

TRAFFIC IMPACT STUDY
BRONTE GREEN SUBDIVISION
MERTON TERTIARY PLAN
OAKVILLE

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1. INTRODUCTION

This Traffic Impact Study (TIS) is submitted in support of applications made by Bronte Green Corporation for an OPA and for a draft plan of subdivision for the Bronte Green subdivision within the Merton Tertiary Plan area in the Town of Oakville. Figure 1 shows the Merton Tertiary Plan boundary and the location of the Bronte Green subdivision.

Read, Voorhees was retained to prepare a traffic impact study (TIS) for the Bronte Green applications. The proposed development was the subject of a TIS report prepared by Read Voorhees dated February 2014. This updated report is based on the updated draft plan and addresses the proposed changes to the draft plan layout.

The design hours for the traffic analysis are the weekday morning and afternoon commuter peak hours. A five year horizon period to 2019 has been used for the subdivision analysis. Implementation is anticipated to have initial occupancies by the end of 2017.

The study area includes the two new proposed subdivision access intersections on Bronte Road, and the existing signalized intersections at Bronte Road and Upper Middle Road, Bronte Road and Woodlands Operations Centre, Bronte Road and North Service Road, Bronte Road and the WB QEW off-ramp, and Bronte Road and the EB QEW off-ramp.

2. DRAFT PLAN OF SUBDIVISION

The development is located on the existing Saw Whet golf course lands. The draft plan of subdivision is shown on Figure 2.

The subdivision is primarily residential with a commercial or 'Main Street' area on Street A adjacent to Bronte Road.

The residential lot unit count is 760, made up of 229 townhouse units and 531 detached units. There is also a 0.92 ha. Higher density residential block with commercial at grade on the north side of Street A at Bronte Road, and a 0.70 ha. Main Street mixed use block opposite on the south side of Street A. No specific development is yet proposed on these two blocks, but an assumption of 100 apartment units has been included in the analysis for a total residential unit count of 860. The commercial at grade on the residential block is assumed at 2,275 m² of retail use. The mixed use block on the south side is assumed to have 1,725 m² of retail use and 1,725 m² of office use on the second level for the traffic forecast.

The Fourteen Mile Creek valley is a major geographic feature which precludes any feasible access to the north or east from the Saw Whet property. Connection to the existing Oakville road system will be on Bronte Road at Street A, at Street B, and at the Woodlands Centre/Street C intersection.

The road system within the subdivision has Street A as a major collector running from Bronte Road to the east limit of the subdivision. It has a right-of-way of 22 metres, except at Bronte Road where it is widened to 25 metres to provide both parking lanes and a left turn lane.

There is one minor collector, Street C, which has a right-of-way of 19 metres. Street C is planned to connect with the Woodlands Operations Centre roadway that intersects with Bronte Road to form a portion of a Community Transit Service route that will circulate through the subdivision.

The cross sections for the two collector roads, Street A and Street C, are proposed to be the same as is being built in the North Oakville subdivisions as Avenue/Transit Corridors and Connector/Transit Corridors respectively.

All other public roads are local roads with a 16 metre right-of-way, except Street B which intersects with Bronte Road and then turns south and runs down to the south end of the subdivision. The section of Street B from Bronte Road to the Street V intersection has a right-of-way of 21.5 metres to accommodate a three lane cross section at the intersection with Bronte Road. The section from Street V to Street A has a right-of-way of 18 metres to accommodate sidewalks on both sides, and the remainder of Street B has the regular local road right-of-way of 16 metres.

Provision exists in the plan for a future extension of Street A south into the Deerfield lands, which can continue to North Service Road.

The Street A intersection on Bronte Road will be opposite the location of an access serving the proposed development on the west side of Bronte Road. Interim operation will be as a T intersection until the west side of Bronte Road develops.

At the north end of the subdivision north of Fourteen Mile Creek and west of the hydro corridor the developable frontage on Upper Middle Road is very close to Bronte Road, and therefore provision of a full moves access intersection on Upper Middle Road is not possible. The area will be accessed by Street V which extends north from Street B. There is one condominium block of single family lots that is accessed off Street V by a private road with a 10 metre right-of-way.

Spacing between the new intersections on Bronte Road is 440 metres from Upper Middle Road to Street B, 360 metres between the Street B and Street A intersections, and 400 metres between Street A and the Woodlands Operations Access intersection.

3. EXISTING CONDITIONS

3.1 Road System

Freeway service to the general Merton area is provided by the QEW which is a 6 lane facility plus 2 HOV lanes on this section. The highway provides connection to the east to Toronto and beyond and to the west to Hamilton and beyond. An interchange is located at Bronte Road.

Highway 407 is a 6 lane freeway located further to the north well outside the study area, also providing east-west service. An interchange is provided at Bronte Road.

Bronte Road is a four lane arterial road plus turn lanes at intersections. It provides north-south service through the area, and as noted has interchanges with the QEW to the south, and with Highway 407 to the north. Posted speed limit is 60 km/h. Bronte Road is under Region of Halton jurisdiction. The Region's TMP includes a recommendation for widening of Bronte Road to six lanes in the future from Speers Road to Highway 407. Bronte Road will be designated as a transit corridor with two of the lanes utilized as HOV lanes.

Upper Middle Road is an east-west arterial road north of the site that provides connection to the area further north of the QEW and with other north-south arterials. Upper Middle Road is under Region of Halton jurisdiction.

North Service Road is a major collector that serves the lands immediately north of the QEW. The North Service Road runs from Bronte Road east to Third Line, and continues easterly across Oakville to Dorval Drive and Kerr Street. North Service Road is under Town jurisdiction.

Signalized intersections are located at Bronte Road and Upper Middle Road, at Bronte Road and Woodlands Operations access, at Bronte Road and North Service Road, at North Service Road and Halton Region Access, and at the two QEW Bronte Road interchange off-ramps connecting to Bronte Road.

3.2 Traffic Volumes

Figure 3 shows the existing peak hour traffic volumes in the vicinity of the site. The volumes are from the following counts:

Bronte Road and Upper Middle Road	February 2012 by Halton Region
Bronte Road and Woodlands Entrance	October 2012 by Read Voorhees
Bronte Road and North Service Road	June 2011 by Halton Region
North Service Road and Halton Centre driveways	December 2010 by Read Voorhees
Bronte Road and QEW westbound Off-ramp	June 2011 by Halton Region
Bronte Road and QEW eastbound Off-ramp	November 2013 by Read Voorhees

3.3 Transit Service

There are two Oakville Transit routes serving the Merton Tertiary Plan area and Halton Region Centre. The Upper Middle Route 6 service operates from the Bronte GO station along Bronte Road and across Upper Middle Road to the east end of Oakville at Winston Park. The Westoak Trails Route 13 service also operates from Bronte GO station up to and across West Oak Trails Blvd and connects to the Oakville GO Station at Cross Street. Headways are 20 minutes for the Upper Middle route, and 30 minutes for the Westoak Trails route.

As noted above, a Bronte Road widened to six lanes in the future will be a transit corridor with HOV lanes. However, the widening is not anticipated for the 2019 horizon period.

4. TRAFFIC FORECASTS

4.1 Background Traffic

The Halton Region Transportation Master Plan and the Oakville Transportation Master Plan (TMP) were updated in 2011 to provide traffic forecasts to 2031.

For long term planning in developing the Merton Tertiary Plan, growth rates on the arterial roads in the study area were developed by a comparison of the 2031 assignments for the recommended plan in the TMP and the 2006 existing volumes calibration run. However, for the immediate future five year horizon period for the Bronte Green subdivision the background traffic on Bronte Road has been forecast by application of an annual growth rate of 3% over the intersection turning movements shown on Figure 3 from the dates listed.

A review of turning movement counts over the past five years across the study area indicates very minor change in volume in the off-peak direction in the two peak periods, but nevertheless the 3% annual growth has been applied to all movements.

The Halton Region office complex on Bronte Road is within the Merton Tertiary Plan boundary. However, the existing development is not expected to change, so this segment is accounted for within the existing conditions data. There are no other site development approvals in the immediate vicinity of the Bronte Green proposal.

In the Merton Tertiary Plan traffic analysis allowance was made for possible commercial development as per the zoning on the QEW-Bronte Developments block on the east side of Bronte Road between the QEW Westbound off-ramp and North Service Road. However, there is no development application at present and therefore no forecast is added to the five year horizon background traffic in this TIS.

Figure 4 shows the 2019 background traffic in the study area based on the above described 3% annual growth rate applied to the existing volumes at the intersections.

4.2 Bronte Green Subdivision Traffic

Trip generation rates from the ITE Trip Generation Manual, Eighth Edition have been used as the base for subdivision traffic. For the single family units the rates for land use code 210 have been applied, and for townhouse units the rates for land use code 231 have been applied. For apartment units the rates for land use code 230 have been applied.

The retail commercial space will largely serve the subdivision, but there will also be some trips attracted as passby trips from traffic on Bronte Road. The retail is unlikely to be open in the morning peak hours but employees could be coming to work. The rates used are estimates for this type of small retail area based on ITE land use category 814, specialty retail centre. The office use auto trips will largely come from external zones. The rates from the ITE Manual for land use code 710 Office Building have been applied.

The ITE trip rates do not include a specific allowance for transit use. Since future development in Oakville is being planned with a transit first policy and high quality transit service, the traffic generation forecast incorporates a transit mode split. For the 2019 horizon year a transit mode split of 5% has been applied to the site traffic forecast for the Bronte Green subdivision. The overall Town objective is a 20% transit mode split by 2031.

The subdivision traffic forecast is shown in Table 1.

Table 1 - BRONTE GREEN TRIP GENERATION

USE	UNITS	A.M. PEAK HOUR		P.M. PEAK HOUR	
		In	Out	In	Out
Single family trip rate	Per unit	0.19	0.56	0.64	0.37
Units and Trips	531	101	297	340	196
Townhouse trip rate	Per unit	0.17	0.50	0.45	0.33
Units and Trips	229	39	115	103	76
Apartment trip rate	Per unit	0.07	0.37	0.35	0.17
Units and Trips	100	7	37	35	17
SUB-TOTAL	860	147	449	478	289
Transit trips		7	22	24	14
NET SUB-TOTAL		140	427	454	275
Retail trip rate	Per 100 m ²	1.0	0.5	2.5	2.5
Floor Area and Trips	4000 m ²	40	20	100	100
Office trip rate	Per 100 m ²	1.36	0.19	0.25	1.24
Floor Area and Trips	1725 m ²	26	4	5	23
TOTAL SITE TRIPS		206	451	559	398
INTERNAL SITE TRIPS		44	15	55	74
EXTERNAL SITE TRIPS		162	436	504	324

The residential trips are oriented primarily to and from employment areas in Oakville and the adjacent GTA municipalities. The retail trips are assumed to be oriented 50% to the subdivision, which is already accounted for in the residential trip generation number. A portion of these are linked trips in and out of the subdivision associated with other external purpose trips made by residents. The other 50% of the retail trips is assumed to be passby traffic from Bronte Road through traffic. The office trips are assumed to be almost all externally oriented to and from Bronte Road.

The directional distribution and assignment by roadway is as follows:

	<u>Residential</u>	<u>Retail</u>	<u>Office</u>
Internal to Bronte Green	4%	50%	0%
West on QEW	15	0	15
East on QEW	31	0	15
East on Upper Middle	10	0	15
West on Upper Middle	0	0	5
East on North Service Road	10	0	15
South on Bronte Road	10	25 (passby)	20
North on Bronte Road	<u>20</u>	<u>25 (passby)</u>	<u>15</u>
TOTAL	100%	100%	100%

The site generated traffic assigned to the road system is shown in Figures 5 and 6, for the residential use and for the commercial uses respectively.

4.3 Total Traffic

Figure 7 shows the total 2019 traffic at the study area intersections.

5. TRAFFIC OPERATIONS

5.1 Signalized Intersections

The intersections have been analyzed using the Synchro program. The output data is included in the Appendix. The operating parameters used are a saturation flow rate of 1900 vphg, a cycle length of 120 seconds, and the timing and phasing is optimized. For existing conditions a peak hour factor of 0.92 is applied, and this is also used for the 2019 horizon year scenarios.

In the future Bronte Road is to be widened to six lanes through the study area, from Upper Middle Road south to Speers Road, with the curb lanes to be utilized as HOV lanes. However, this is not anticipated to be in place by 2019. Therefore the analysis has assumed operation on Bronte Road to be as per existing conditions.

Table 4 shows the results of the analysis for existing traffic, for 2019 background traffic and for 2019 total traffic conditions.

Table 2 - Signalized Intersection Analysis (AM Peak Hour)

Intersection / Condition	Existing Traffic			Future Background 2019 Traffic			Future Total 2019 Traffic		
	Delay (sec)	LOS	HCM v/c	Delay (sec)	LOS	HCM v/c	Delay (sec)	LOS	HCM v/c
A.M. Peak Hour									
Bronte & Upper Middle	23.3	C	0.64	29.4	C	0.82	31.0	C	0.81
Bronte & Street B	-	-	-	-	-	-	5.5	A	0.77
Bronte & Street A	-	-	-	-	-	-	10.7	B	0.83
Bronte & Woodlands	2.9	A	0.60	3.8	A	0.69	8.6	A	0.82
Bronte & North Service	3.1	A	0.46	3.4	A	0.57	3.7	A	0.65
NSR & Region Access	18.9	B	0.20	20.6	C	0.21	24.5	C	0.22
Bronte & WB Off-ramp	12.8	B	0.33	12.4	B	0.43	12.4	B	0.48
WB right	48.6	D	0.39	44.7	D	0.22	46.3	D	0.33
WB left	48.1	D	0.42	48.4	D	0.57	48.7	D	0.57
NB thru	3.5	A	0.31	2.2	A	0.40	3.2	A	0.41
Bronte & EB Off-ramp	26.0	C	0.70	46.0	D	0.96	57.9	E	1.02
WB left	52.4	D	0.78	67.7	E	0.98	91.9	F	1.06
WB thru/right	34.7	C	0.36	24.4	C	0.23	26.4	C	0.24
SB left	24.1	C	0.77	72.5	E	0.97	99.5	F	1.10
NB thru	25.8	C	0.51	66.8	E	0.97	92.2	F	1.06

Table 3 - Signalized Intersection Analysis (PM Peak Hour)

Intersection / Condition	Existing Traffic			Future Background 2019 Traffic			Future Total 2019 Traffic		
	Delay (sec)	LOS	HCM v/c	Delay (sec)	LOS	HCM v/c	Delay (sec)	LOS	HCM v/c
P.M. Peak Hour									
Bronte & Upper Middle	15.1	B	0.58	19.8	B	0.75	23.6	C	0.80
Bronte & Street B	-	-	-	-	-	-	4.0	A	0.74
Bronte & Street A	-	-	-	-	-	-	21.8	C	0.87
Bronte and Woodlands	3.1	A	0.56	4.0	A	0.69	8.2	A	0.82
Bronte & North Service	6.9	A	0.59	10.4	B	0.74	21.2	C	0.89
NB thru	3.5	A	0.65	9.7	A	0.83	25.6	C	0.99
NSR & Region Access	13.9	B	0.14	13.9	B	0.14	14.0	B	0.17
Bronte & WB Off-ramp	16.8	B	0.79	17.0	B	0.83	22.1	C	0.93
WB right	51.7	D	0.83	56.0	E	0.78	75.2	E	0.93
WB left	31.7	C	0.24	47.7	D	0.74	48.5	D	0.85
NB thru	9.1	A	0.77	7.5	A	0.85	11.9	B	0.93
Bronte & EB Off-ramp	41.7	D	0.94	36.1	D	0.91	50.6	D	0.99
WB left	36.3	D	0.34	78.8	E	0.95	75.1	E	0.94
WB thru/right	51.4	D	0.89	40.2	D	0.52	44.1	D	0.64
NB thru	54.6	D	0.98	41.5	D	0.95	74.3	E	1.06
SB left	79.5	E	0.95	69.4	E	0.89	87.9	F	1.01

5.1.1 Bronte Road and Upper Middle Road

The Bronte Road and Upper Middle Road intersection is presently operating at a v/c ratio of 0.64 in the a.m. peak hour and 0.58 in the p.m. peak hour. Level of service is at level C in the a.m. peak hour and level B in the p.m. peak hour. The signal phasing for existing conditions includes a southbound left turn phase, a northbound left turn phase, and a westbound left turn phase. A westbound double left turn lane configuration is now in place. These conditions are carried forward for the future traffic analysis.

With the 2019 background volumes level of service remains at level C in the a.m. peak hour and remains at level B in the p.m. peak hour. The v/c ratios are 0.82 in the a.m. peak hour and 0.75 in the p.m. peak hour.

With the Bronte Green traffic added to the road system, the Bronte Road and Upper Middle Road intersection level of service remains at level C in the a.m. peak hour and changes to level C in the p.m. peak hour. The v/c ratio in the a.m. peak hour does not increase, and in the p.m. peak hour increases by 0.05 to 0.80.

No additional mitigation is required to accommodate the subdivision traffic.

5.1.2 Bronte Road and Street B

The Street B access road in the subdivision plan will operate at level of service A in the a.m. peak hour and at level A in the p.m. peak hour. This access will service all the residential uses at the north end of the subdivision and by some of the units in the remainder of the subdivision. Two outbound lanes should be provided on the approach to Bronte Road, and designated as separate left turn and right turn lanes.

A separate southbound left turn lane is required at the intersection, but the volume of left turns during the peak hours does not require a separate signal phase. A northbound right turn lane will be provided to maximize available capacity on Bronte Road.

During the a.m. peak hour the southbound through lanes on Bronte Road are calculated to operate at level of service A based on average vehicle delay, and with a v/c ratio of 0.82. In the p.m. peak hour northbound Bronte Road is calculated to operate at level of service A based on average vehicle delay and with a v/c ratio of 0.78.

5.1.3 Bronte Road and Street A

The Street A access road for the subdivision will be the busier of the three access roadways on Bronte Road since it is more central to the overall development, and it will serve the commercial site. The intersection will in the future have a west leg that serves the lands west of Bronte Road. However, initially it will operate as a T intersection. Two outbound lanes are required at the intersection on the east leg, operating as a left turn lane and a right turn lane. In the future the right lane will also accommodate any through traffic.

Northbound and southbound left turn lanes will be provided at the intersection, as will northbound and southbound right turn lanes to maximize available capacity on Bronte Road.

With the volumes forecast a separate southbound left turn phase is required in the p.m. peak hour. During the a.m. peak hour there is only a small volume of left turns. The intersection will operate in the a.m. peak hour with a v/c ratio of 0.83, and at level of service B. During the p.m. peak hour the v/c ratio is 0.87 and the level of service is level C.

Similar to the condition for Bronte Road noted above for the North Access, during the a.m. peak hour the southbound through traffic is calculated to operate at level of service A, and will have a v/c ratio of 0.86. In the p.m. peak hour the northbound through traffic on Bronte Road will operate at level of service C with a v/c ratio of 0.94.

5.1.4 Bronte Road and Halton Region Woodlands Operations Centre Access

The Bronte Road intersection at the Halton Region Woodlands Operations Centre access driveway is presently operating at a v/c ratio of 0.60 in the a.m. peak hour and 0.56 in the p.m. peak hour. Level of service is at level A in both peak hours. The volumes in and out of the Centre are minor and the signal is required in order to provide safe access out to a busy Bronte Road. Average vehicle delay at the intersection is only 2.9 seconds in the a.m. peak hour and 3.1 seconds in the p.m. peak hour.

For 2019 conditions with the background volumes the level of service remains at level A in both peak hours, and the v/c ratios are 0.69 in the a.m. peak hour and 0.69 in the p.m. peak hour.

With the Bronte Green subdivision connected to the Woodlands Operations access road, site traffic will be added to this intersection. The intersection level of service remains at level A in the a.m. peak hour and remains at level A in the p.m. peak hour. The v/c ratio in the a.m. peak hour increases by 0.13 to 0.82, and in the p.m. peak hour increases by 0.13 to 0.82.

The intersection has adequate capacity and no other improvement is necessary to accommodate the 2019 forecast and the proposed Bronte Green development.

5.1.5 Bronte Road and North Service Road

The Bronte Road and North Service Road intersection is presently operating at a v/c ratio of 0.46 in the a.m. peak hour and 0.59 in the p.m. peak hour. Level of service is at level A in the a.m. peak hour and at level A in the p.m. peak hour.

With the 2019 background volumes level of service remains at level A in the a.m. peak hour and changes to level B in the p.m. peak hour. The intersection v/c ratios are 0.57 in the a.m. peak hour and 0.74 in the p.m. peak hour.

With the Bronte Green traffic added to the road system, the Bronte Road and North Service Road intersection level of service remains at level A in the a.m. peak hour and changes to

level C in the p.m. peak hour. The v/c ratio in the a.m. peak hour increases by 0.08 to 0.65, and in the p.m. peak hour increases by 0.15 to 0.89.

The intersection already operates with two westbound left turn lanes, and no improvements are required to accommodate the proposed subdivision.

5.1.6 North Service Road and Halton Region Access

The North Service Road intersection with the Halton Region Centre access driveways is presently operating at a v/c ratio of 0.20 in the a.m. peak hour and 0.14 in the p.m. peak hour. Level of service is at level B in both peak hours.

Minor change is anticipated for the 2019 background volumes. Level of service changes to level C in the a.m. peak hour and remains at level B in the p.m. peak hour. The intersection v/c ratios are 0.21 in the a.m. peak hour and 0.14 in the p.m. peak hour.

The increase in average vehicle delay is small at 2 seconds in the a.m. peak hour, but because this changes from 18.9 seconds to 20.6 seconds this crosses the dividing line between levels of service B and C. In the p.m. peak hour there is no change in average vehicle delay and therefore no change from level of service B.

A small volume of Bronte Green subdivision traffic is expected to use the North Service Road to travel to and from the east. However, this will have negligible impact on the intersection. With the subdivision traffic added to the road volumes the v/c ratio in the a.m. peak hour increases by 0.01 to 0.22, and in the p.m. peak hour increases by 0.03 to 0.17.

5.1.7 Bronte Road and QEW Westbound Off-ramp

The Bronte Road and QEW Westbound Off-ramp intersection is presently operating at a v/c ratio of 0.33 in the a.m. peak hour and 0.79 in the p.m. peak hour. Level of service is at level B in both peak hours.

The current right turn volume on the Off-ramp is higher than the left turn volume, particularly in the p.m. peak hour. However, the lane designation has two left turn lanes and one right turn lane. With the 2019 background traffic, the right turn volume is getting to a v/c ratio of 0.94 and is approaching the capacity of one lane. Therefore it is recommended that the present lane designation of two left turn lanes and one right turn lane be modified to make the centre lane an optional left/right lane. This requires only revised pavement marking, and does not involve any road construction

With this change the Bronte Road and QEW Westbound Off-ramp intersection level of service for 2019 background traffic remains at level B in both peak hours. The v/c ratio in the a.m. peak hour is 0.43, and in the p.m. peak hour is 0.83.

With the Bronte Green subdivision traffic added, the Bronte Road and QEW Westbound Off-ramp intersection level of service remains at level B in the a.m. peak hour and changes to

level C in the p.m. peak hour. The v/c ratio in the a.m. peak hour increases by 0.05 to 0.48, and in the p.m. peak hour increases by 0.10 to 0.93.

5.1.8 Bronte Road and QEW Eastbound Off-ramp

The Bronte Road and QEW Eastbound Off-ramp intersection is presently operating at a v/c ratio of 0.70 in the a.m. peak hour and 0.94 in the p.m. peak hour. Level of service is at level C in the a.m. peak hour and level D in the p.m. peak hour. The 2013 volumes at this intersection appear to have increased considerably over a previous count in 2010, doubling the volume for some ramp movements. Therefore the intersection is already approaching capacity in the p.m. peak hour if these volumes are representative of regular use.

With the 2019 background volumes and the current ramp geometry the level of service would move into level D in the a.m. peak hour and remains at level D in the p.m. peak hour. The v/c ratios would be 0.96 in the a.m. peak hour and 0.91 in the p.m. peak hour.

With the Bronte Green traffic added to the intersection, the Bronte Road and QEW Eastbound Off-ramp intersection would change to level of service E in the a.m. peak hour, and remains at level D in the p.m. peak hour. The v/c ratio in the a.m. peak hour would increase to 1.02, and in the p.m. peak hour to 0.99.

Therefore with the future background and total 2019 volume increases as forecast, mitigation may be required. The Merton Tertiary Plan traffic analysis recommended that for the long term the improvement that would add capacity to the intersection is a second right turn lane on the eastbound off-ramp on the approach to Bronte Road. This movement is a heavy right turn volume, currently 481 vph in the a.m. and 576 vph in the p.m. peak hour. The 2019 right turn volume is forecast to increase by 87 to 568 vph in the a.m., and increase by 104 to 680 vph in the p.m. peak hour.

However, an interim mitigation measure will also accommodate the 2019 volumes, without having to construct an additional lane. At the QEW Eastbound Off-ramp the current lane designation has two left turn lanes and a through-right lane. The existing volumes of left and right turns on the off-ramp are about equal in the a.m. peak hour, but the right turn is substantially higher than the left turn in the p.m. peak hour. This imbalance in the p.m. peak hour is forecast to be even greater in the future scenarios. Therefore it is recommended that the lane designations on the off ramp be revised to have only one exclusive left turn lane, designate the centre lane as a through/right lane to accommodate the through movement into the carpool lot, and thus create an exclusive right turn lane.

With this revision the Bronte Road and QEW Eastbound Off-ramp intersection will operate for 2019 background traffic in the a.m. peak hour with a v/c ratio of 0.96 and level of service D. In the p.m. peak hour the 2019 background v/c ratio is 0.91 and level of service is D.

For 2019 total traffic in the a.m. peak hour the v/c ratio is 1.02 and level of service is E, and in the p.m. peak hour the v/c ratio is 0.99 and level of service is D.

As noted above, this mitigation does not require any construction, but for the long term traffic forecasts beyond 2019 an additional right turn lane is recommended on the approach to Bronte Road to accommodate higher volumes.

It is also noted that the Synchro analysis has been carried out using a peak hour factor of 0.92. Under capacity conditions the peak hour factor will increase towards 1.0, and the intersection v/c ratios will be lower than the values shown in Tables 2 and 3.

5.2 Internal Roadways

The roadways within Bronte Green subdivision will be constructed to the standard established for each classification of road in the Town's Design Guidelines.

The highest directional volumes are in the order of 300 vph on Street A inbound in the p.m. peak hour at the intersection with Bronte Road. The volumes disperse along Street A eastward into the subdivision. This section of Street A is adjacent to the commercial block, and a wider right-of-way of 25 metres has been provided for a distance of 60 metres from Bronte Road to accommodate parking lanes on each side as well as an outbound left turn lane at Bronte Road. The remainder of Street A has a 22 metre right-of-way, and can have two through lanes and two parking lanes in the cross section.

All other roadways in the subdivision can be constructed with two through lanes and one parking lane. The Street C collector road has a 19 metre right-of-way in order to facilitate operation of transit vehicles. It can have two through lanes of up to 3.75m and one parking lane in the cross section. The local roads will have two through lanes of up to 3.25m and one parking lane.

All intersections within the subdivisions can operate satisfactorily with Stop sign control. It is recommended that all-way Stop sign control be implemented at the intersection of Street A and Street B, and at the intersection of Street B and Street C. Traffic signals are not warranted at any intersection within the Bronte Green subdivision plan.

5.3 Traffic Calming

The primary initial measure for traffic calming is identification of sections of straight roadway that are longer than 300 metres for roads that are expected to operate with a posted speed limit of 50 km/h. This would apply to Street A. For collector Street C which is relatively curvilinear, and for local roads that are posted with speed limits of 40 km/h, the critical length of straight road is 160 metres.

The traffic calming features are to be located to achieve the Town's goals of eliminating the potential for speeding, and creating safe pedestrian and cycling environments. All-way Stop sign control is not used as a traffic calming measure, but where used as the preferred form of traffic control it can influence the location of other traffic calming measures.

Figure 8 shows the location of the proposed traffic calming features. The east section of Street A is a long section of straight road that can be mitigated with a curb extension treatment at the intersection with Street S/Street C.

The traffic calming features can be finalized as part of the detailed road design that will subsequently be prepared for the subdivision.

6. TRANSIT SERVICE

6.1 Existing Oakville Transit Routes

At the present time Oakville Transit operates regular service along Bronte Road on Route 6 and Route 13. A 400 metre walking distance from Bronte Road would cover the area over to the hydro corridor. Service to development east of the hydro corridor would require a route into the subdivision.

6.2 Internal Transit Route and Stops

Transit service for the Merton Tertiary Plan area in the long term would likely be provided by a route through the quadrant on a Street A collector road intersecting Bronte Road and North Service Road.

As the subdivision develops initially the area from Bronte Road to the hydro corridor can be served by the transit service on Bronte Road since it is within a 400 metre coverage zone. The units east of the hydro corridor would require an internal transit route for coverage since that area extends a further 400 metres east of the hydro corridor. This can be provided by a route looping through the subdivision from Bronte Road along Street A and then on Street C down to the Woodlands Operations Centre connection back to Bronte Road.

Figure 9 shows the transit route and transit stop locations along Street A and Street C.

Transit stop locations would be located at the intersections of Street A with Street B, Street G, Street S, and at intersections of Street C with Street K, Street O, and Street B. Average bus stop spacing is in the order of 150 to 200 metres.

7. CONCLUSIONS

The Bronte Green subdivision is located on the east side of Bronte Road, and the lands are presently operating as the Saw Whet golf course.

The residential lot unit count is 760, made up of 229 townhouse units and 531 detached units. There is also a 0.92 ha. higher density residential block with commercial at grade on the north side of Street A at Bronte Road, and a 0.70 ha. mixed use block on the opposite

south side of Street A. An assumption of 100 apartment units and 4,000 m² of retail uses and 1,725 m² of office uses been included in the traffic forecast.

Road access for the subdivision will be three connections to Bronte Road, at Street A, at Street B, and at a connection of Street C to the Woodlands Operations Centre access on Bronte Road. Provision exists for future extension of Street A south into the Deerfield lands, which would continue to North Service Road.

A 5 year horizon period to 2019 has been used for traffic forecasting. The subdivision is expected to be completed and occupied by the end of 2017. The growth rate applied to Bronte Road for traffic forecasting is a 3% annual rate applied to existing volumes. Bronte Road is planned to be widened to six lanes in the future from Upper Middle Road down to Speers Road, but this is not expected to be in place for the 2019 horizon period.

The traffic operations analysis indicates that the existing road system can accommodate the 2019 background forecast plus the Bronte Green traffic within the study area. However, operational changes that modify the lane configurations are recommended at the two QEW off-ramp intersections on Bronte Road.

At the Bronte Road and QEW Westbound Off-ramp it is recommended that the centre lane be designated as an optional left or right turn lane. The future right turn volume in the p.m. peak hour is much higher than the left turn volume. Similarly, at the Bronte Road and QEW Eastbound Off-ramp it is recommended that the existing designations on the three lanes on the ramp be modified to create an exclusive left turn lane, a through/right lane, and an exclusive right turn lane. The future right turn volume in the p.m. peak hour is much higher than the left turn volume. No new construction at the ramp terminals is required for these modifications.

The traffic volumes within the Bronte Green subdivision can be accommodated on two lane roadways throughout the plan, although at the intersections with Bronte Road it is recommended that the pavement be widened to 12 metres to provide two outbound lanes and one inbound lane.

All intersections within the subdivision can operate satisfactorily with Stop sign control, with all-way stop control recommended for some locations.

Traffic calming can be provided within the subdivision with curb extensions along the straight sections of the busiest roads.

Transit service is now being provided along Bronte Road, and in the long term Bronte Road is to be designated as a transit corridor with HOV lanes. Transit service is expected to operate in the longer term future on Street A between Bronte Road and North Service Road. In the interim an internal loop route to and from Bronte Road can be provided along Street A and Street C which is to be linked into the Woodlands Operations Centre connection to Bronte Road.

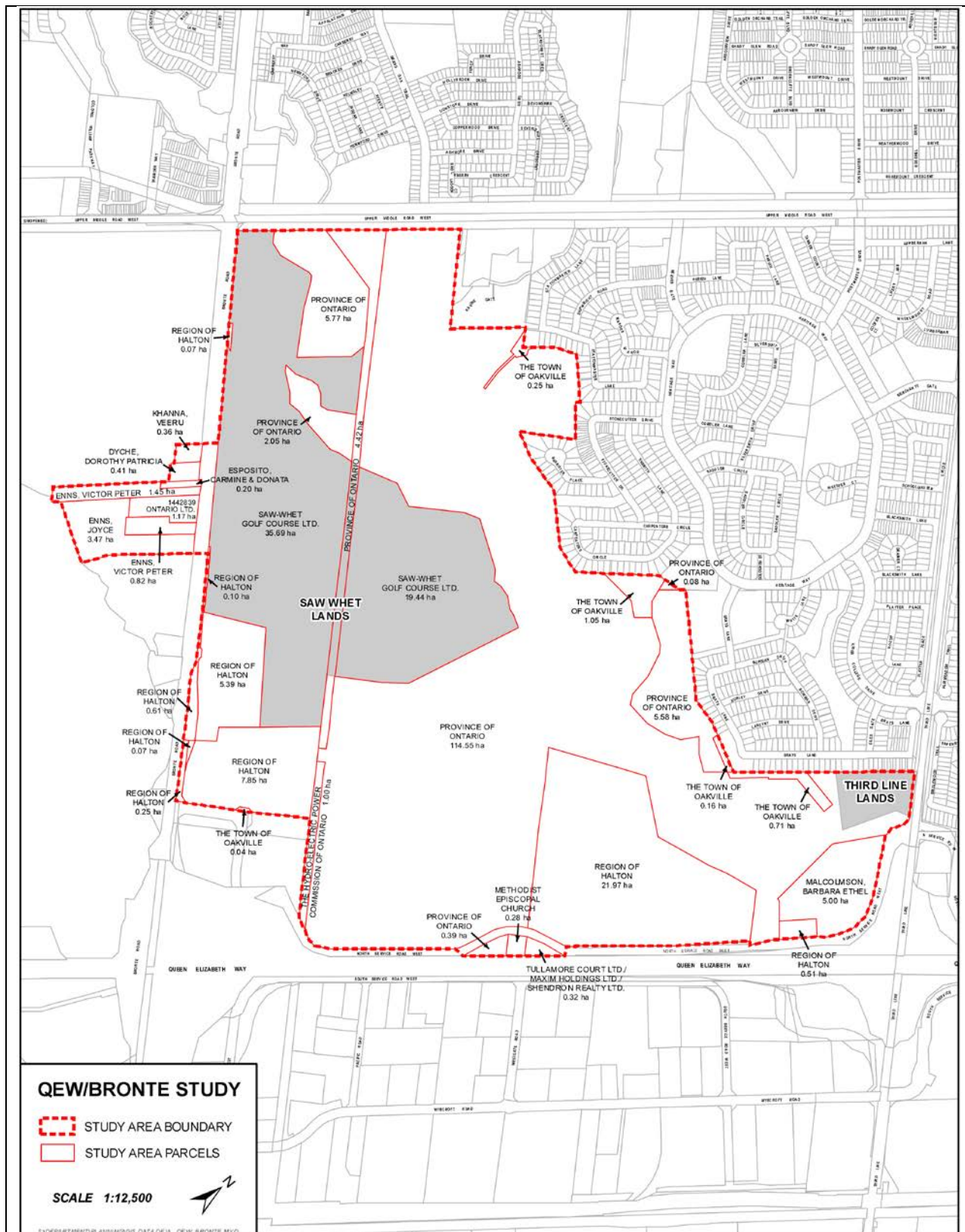
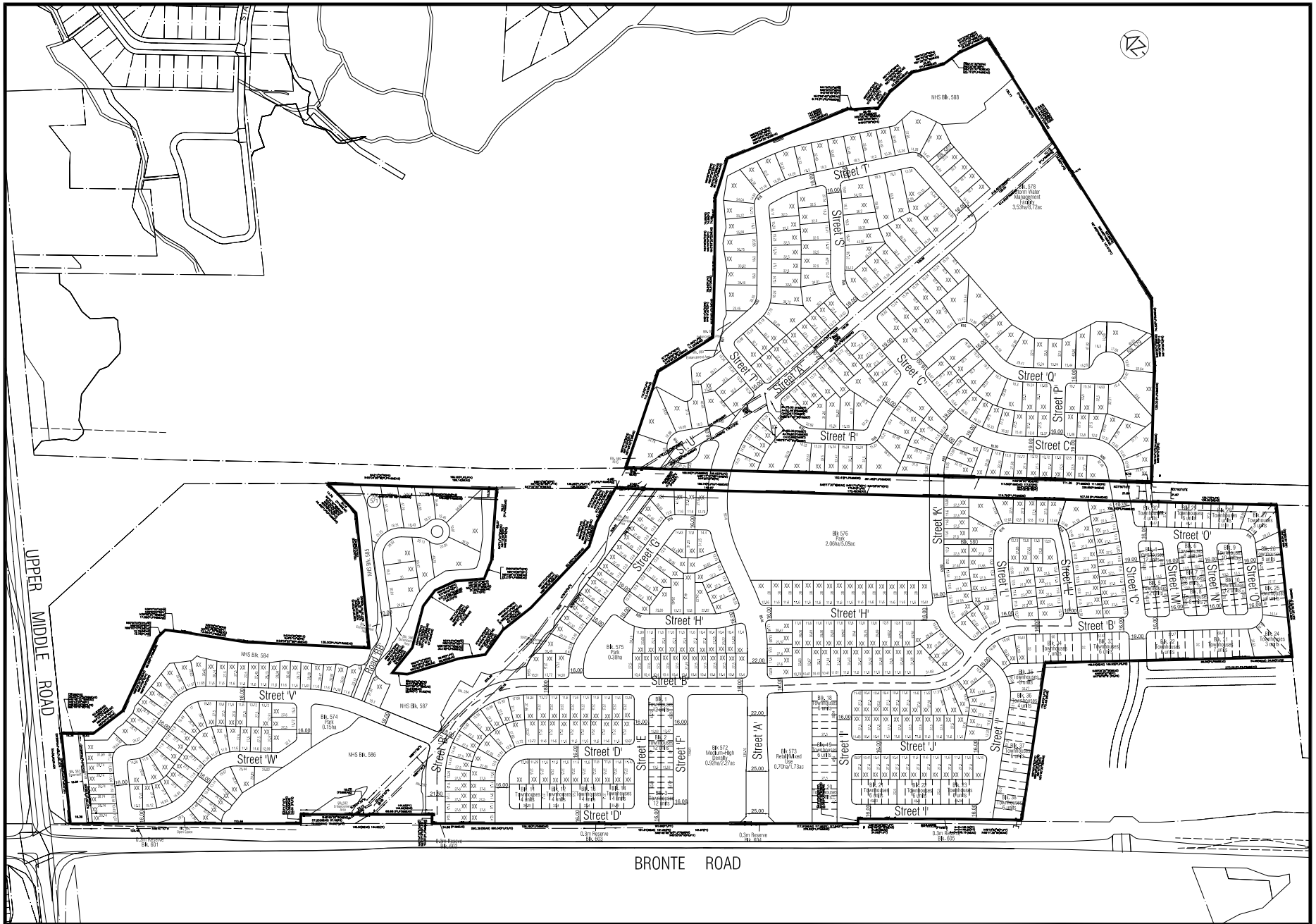
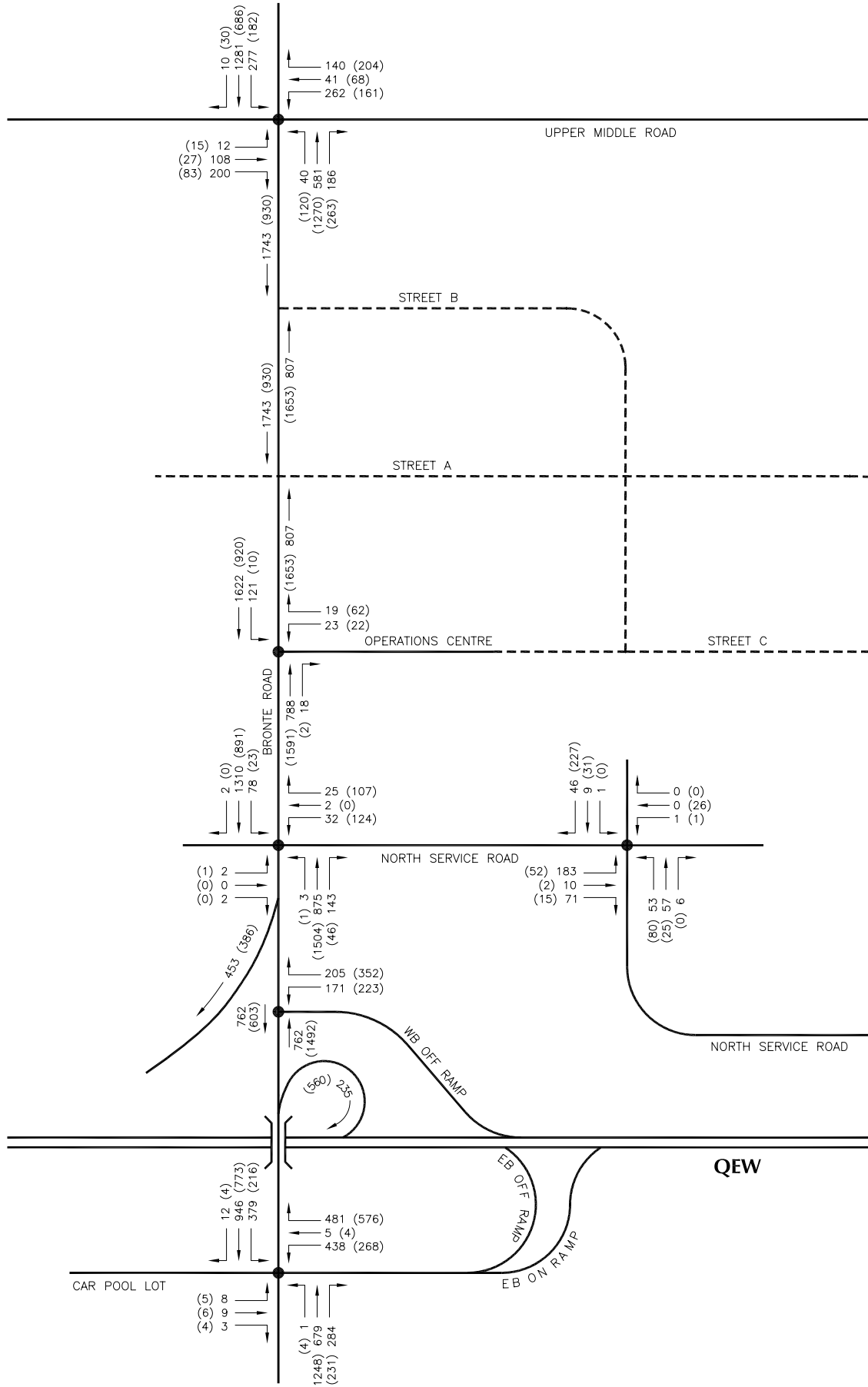


Figure 1 – Merton (QEW Bronte Road) Planning Study Area



DRAFT PLAN OF SUBDIVISION
FIGURE 2

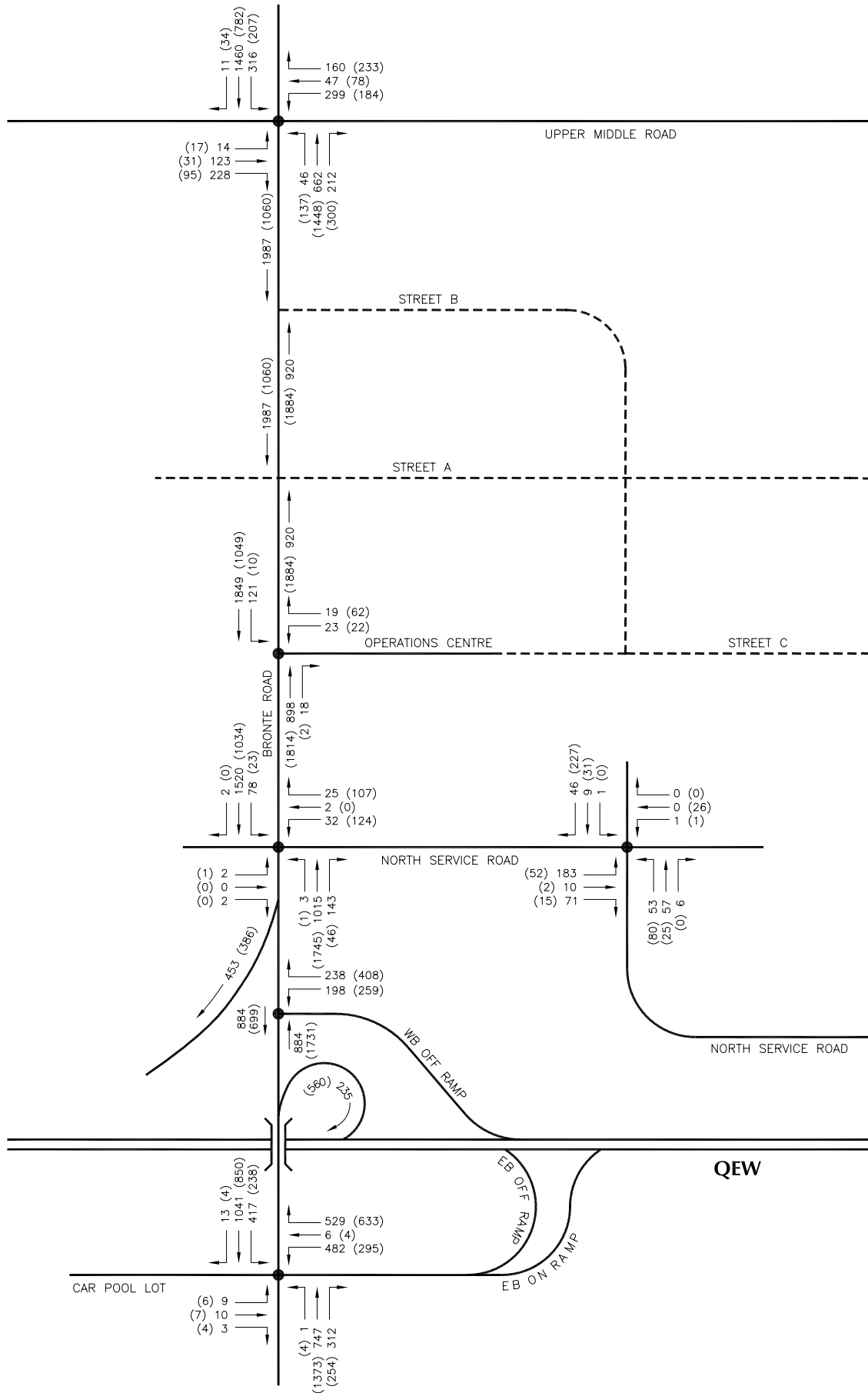


LEGEND

- 48 A.M. PEAK HOUR VOLUME
- (11) P.M. PEAK HOUR VOLUME
- SIGNALIZED INTERSECTION

EXISTING TRAFFIC

FIGURE 3

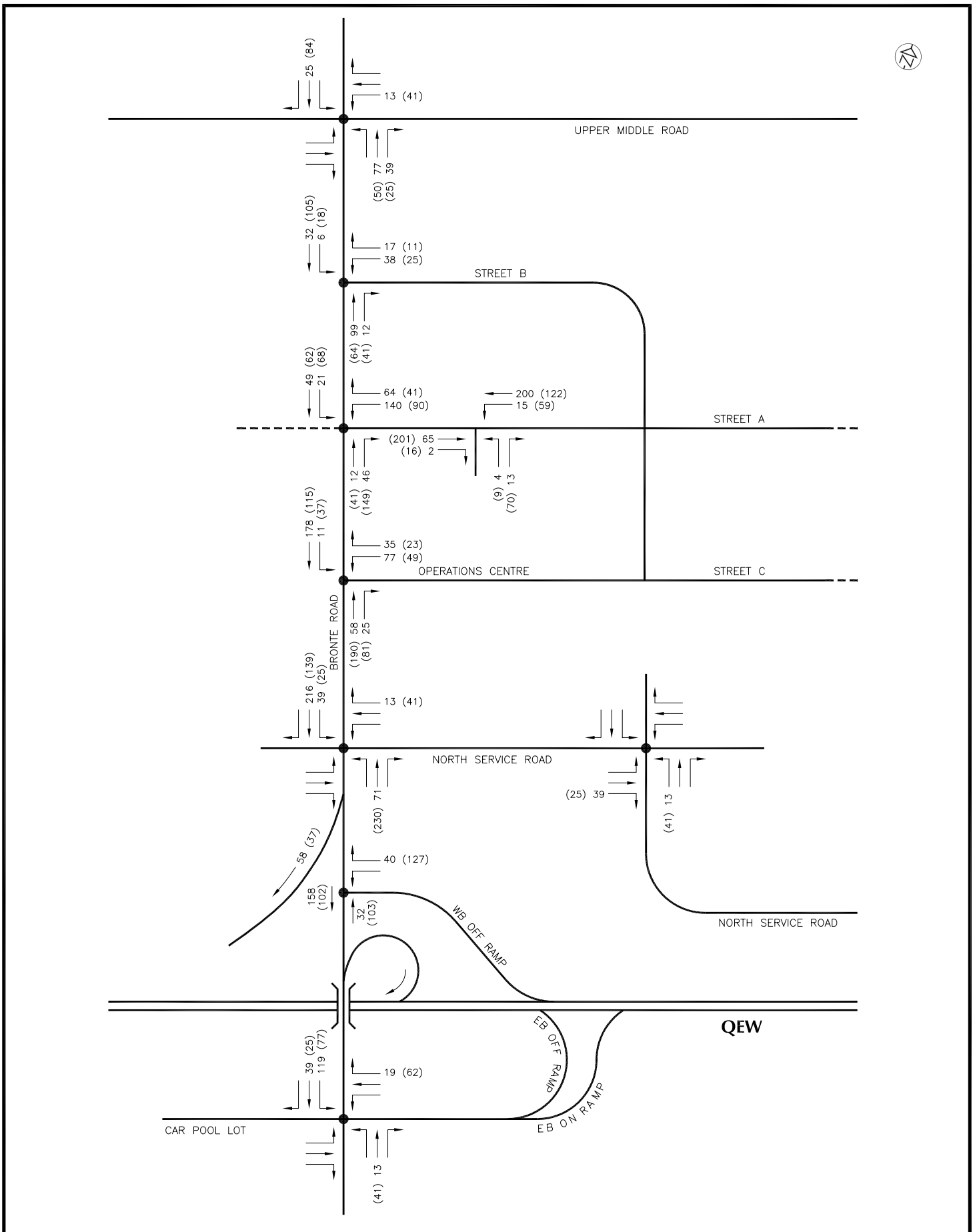


LEGEND

- 48 A.M. PEAK HOUR VOLUME
- (11) P.M. PEAK HOUR VOLUME
- SIGNALIZED INTERSECTION

2019 BACKGROUND TRAFFIC

FIGURE 4

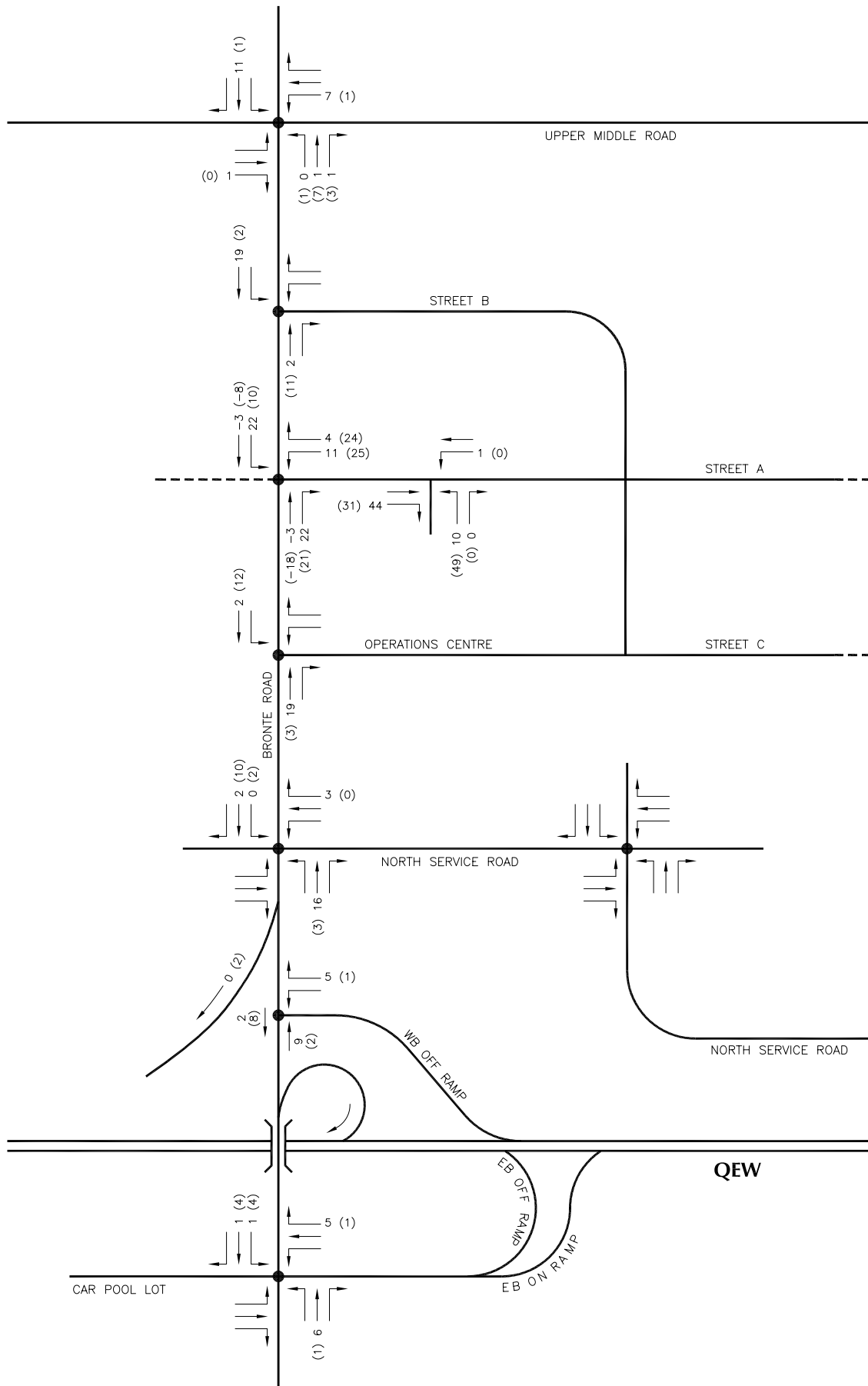


LEGEND

- 48 A.M. PEAK HOUR VOLUME
- (11) P.M. PEAK HOUR VOLUME
- SIGNALIZED INTERSECTION

RESIDENTIAL SITE TRAFFIC

FIGURE 5

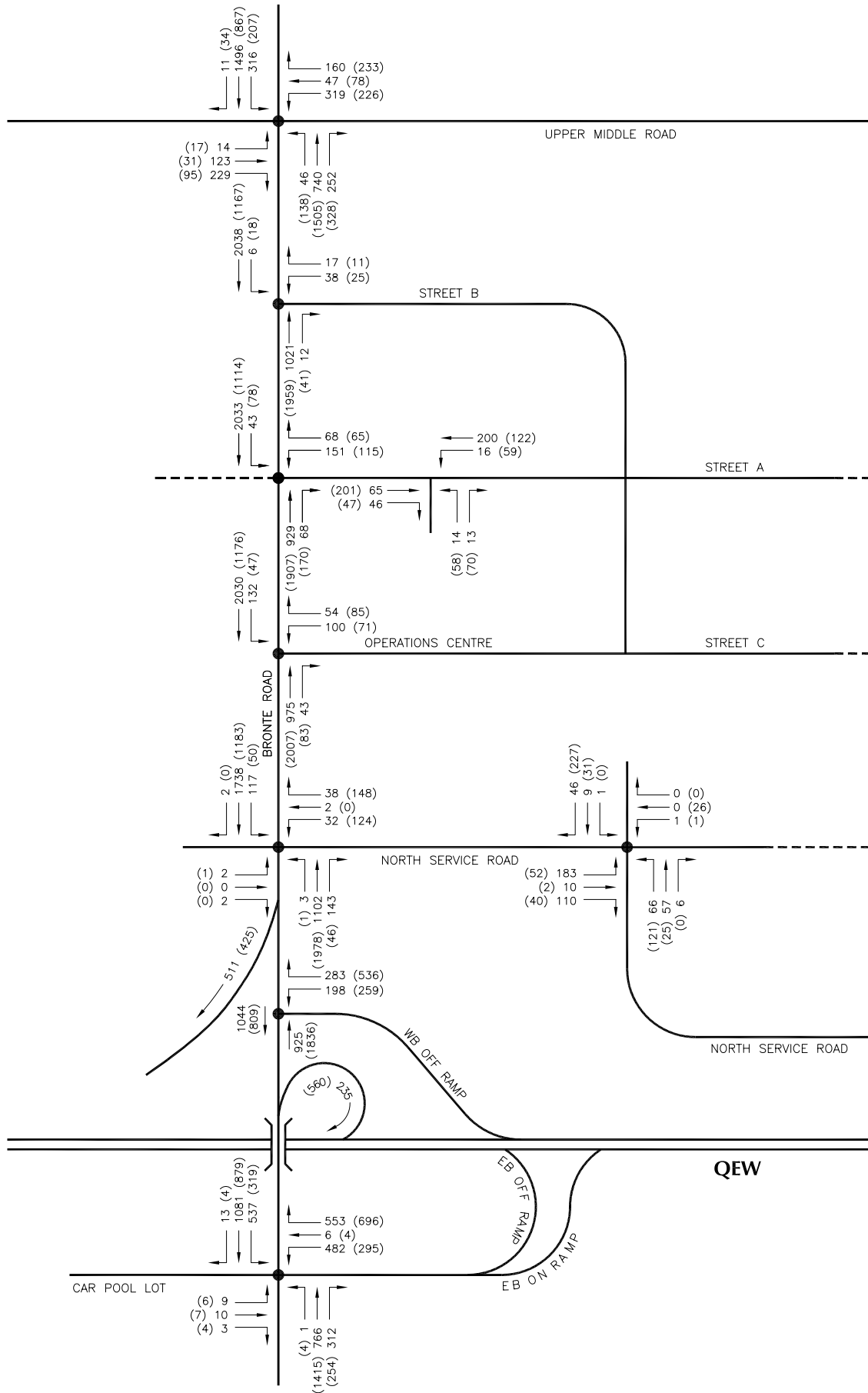


LEGEND

- 48 A.M. PEAK HOUR VOLUME
- (11) P.M. PEAK HOUR VOLUME
- SIGNALIZED INTERSECTION

COMMERCIAL SITE TRAFFIC

FIGURE 6

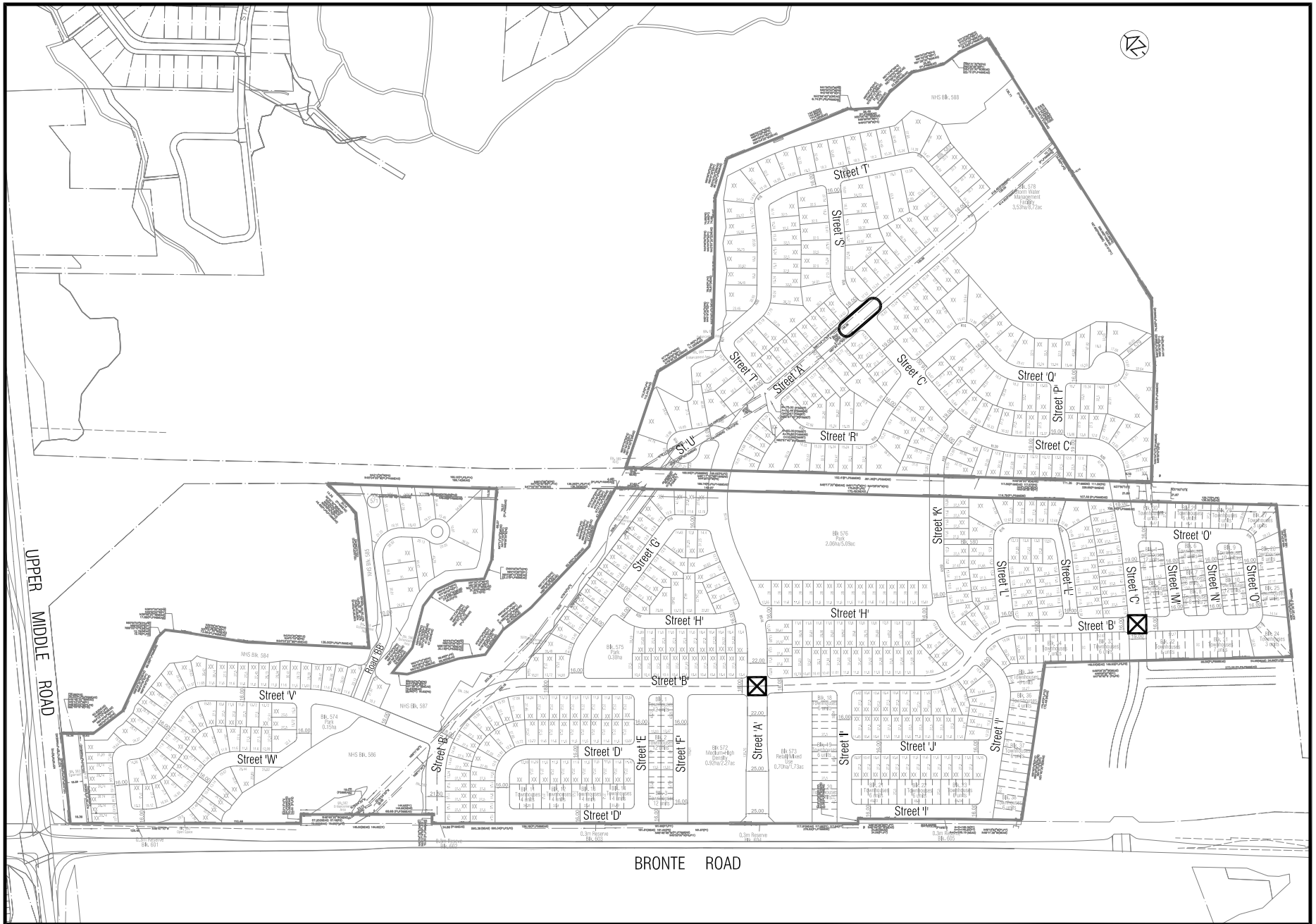




LEGEND

- 48 A.M. PEAK HOUR VOLUME
- (11) P.M. PEAK HOUR VOLUME
- SIGNALIZED INTERSECTION

2019 TOTAL TRAFFIC

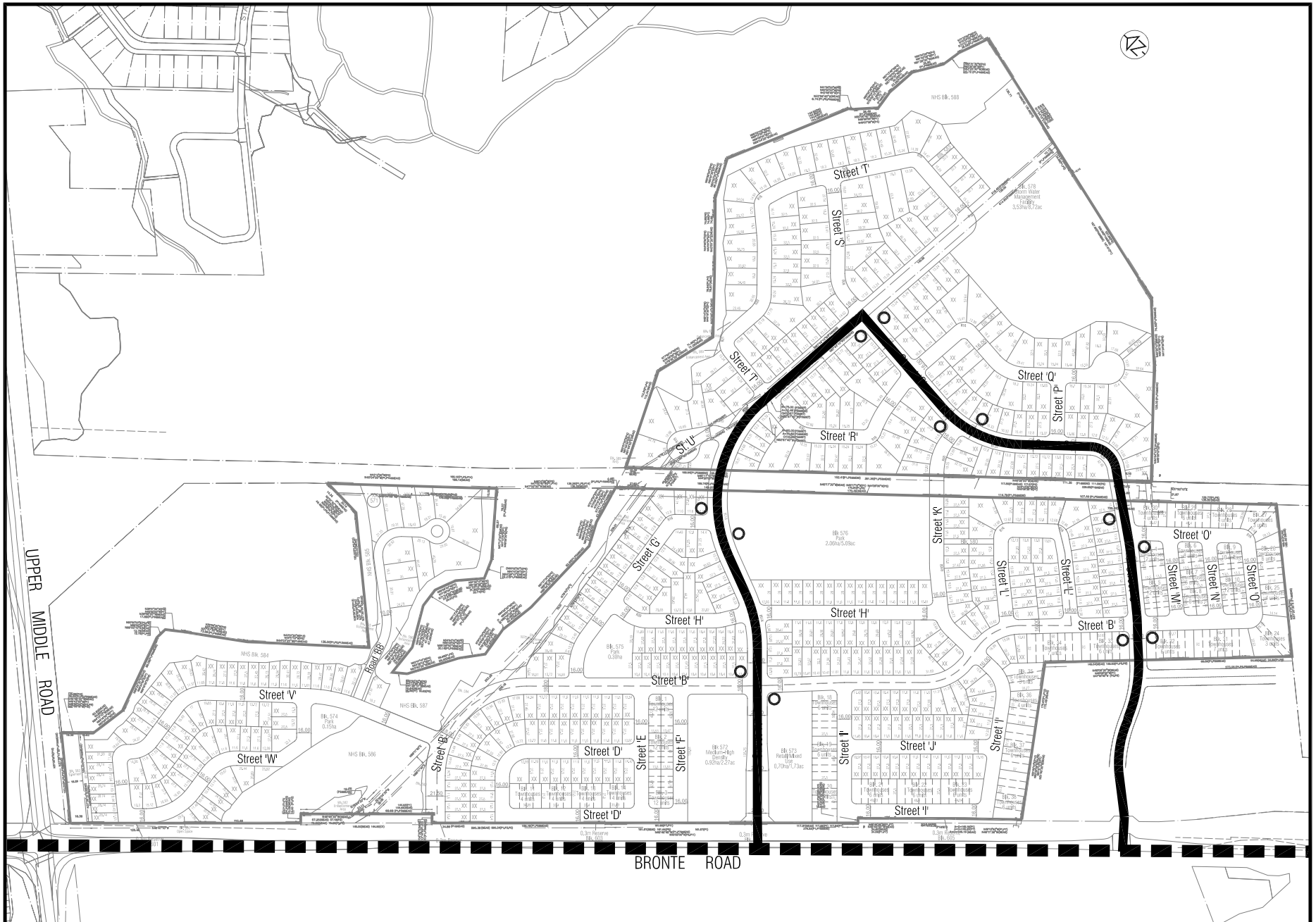
FIGURE 7






-  CURB BUMP OUT
-  FOUR WAY STOP

TRAFFIC CALMING LOCATIONS

FIGURE 8



-  PRIMARY TRANSIT CORRIDOR SERVICE
-  COMMUNITY TRANSIT SERVICE
-  BUS STOP

TRANSIT PLAN AND STOP LOCATIONS

FIGURE 9

APPENDIX
SYNCHRO OUTPUT

HCM Signalized Intersection Capacity Analysis

18: UPPER MIDDLE & BRONTE

EXISTING
AM PEAK HOUR

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	12	108	200	262	41	140	40	581	186	277	1281	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		3.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1785	3222		3395	1879	1566	1785	3336	1536	1750	3433	1597
Flt Permitted	0.73	1.00		0.95	1.00	1.00	0.16	1.00	1.00	0.34	1.00	1.00
Satd. Flow (perm)	1367	3222		3395	1879	1566	298	3336	1536	624	3433	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	13	117	217	285	45	152	43	632	202	301	1392	11
RTOR Reduction (vph)	0	45	0	0	0	104	0	0	106	0	0	4
Lane Group Flow (vph)	13	289	0	285	45	48	43	632	96	301	1392	7
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	7%	4%	2%	4%	0%
Turn Type	Perm			Prot		Perm	Perm		Perm	pm+pt		Perm
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4					8	2		2	6		6
Actuated Green, G (s)	15.3	15.3		14.4	34.7	34.7	54.3	54.3	54.3	71.3	71.3	71.3
Effective Green, g (s)	18.3	18.3		16.4	37.7	37.7	57.3	57.3	57.3	74.3	74.3	74.3
Actuated g/C Ratio	0.15	0.15		0.14	0.31	0.31	0.48	0.48	0.48	0.62	0.62	0.62
Clearance Time (s)	7.0	7.0		5.0	7.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	208	491		464	590	492	142	1593	733	546	2126	989
v/s Ratio Prot		c0.09		c0.08	0.02			0.19		0.08	c0.41	
v/s Ratio Perm	0.01					0.03	0.14		0.06	0.26		0.00
v/c Ratio	0.06	0.59		0.61	0.08	0.10	0.30	0.40	0.13	0.55	0.65	0.01
Uniform Delay, d1	43.5	47.3		48.8	28.9	29.1	19.1	20.2	17.5	11.2	14.6	8.7
Progression Factor	1.00	1.00		0.71	0.72	0.42	1.10	1.04	2.24	1.00	1.00	1.00
Incremental Delay, d2	0.1	1.8		2.4	0.1	0.1	5.3	0.7	0.4	1.2	1.6	0.0
Delay (s)	43.6	49.2		37.0	20.8	12.4	26.3	21.7	39.5	12.4	16.2	8.8
Level of Service	D	D		D	C	B	C	C	D	B	B	A
Approach Delay (s)		48.9			27.7			26.0			15.5	
Approach LOS		D			C			C			B	
Intersection Summary												
HCM Average Control Delay			23.3									C
HCM Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			120.0								11.0	
Intersection Capacity Utilization			69.0%									C
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
15: WOODLANDS & BRONTE

EXISTING
AM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	23	19	794	18	121	1716
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1566	1521	3400	1597	1785	3400
Flt Permitted	0.95	1.00	1.00	1.00	0.32	1.00
Satd. Flow (perm)	1566	1521	3400	1597	608	3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	21	863	20	132	1865
RTOR Reduction (vph)	0	20	0	3	0	0
Lane Group Flow (vph)	25	1	863	17	132	1865
Heavy Vehicles (%)	14%	5%	5%	0%	0%	5%
Turn Type	custom		Perm		Perm	
Protected Phases			2		6	
Permitted Phases	8	8	2		6	
Actuated Green, G (s)	5.1	5.1	100.9	100.9	100.9	100.9
Effective Green, g (s)	8.1	8.1	103.9	103.9	103.9	103.9
Actuated g/C Ratio	0.07	0.07	0.87	0.87	0.87	0.87
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	106	103	2944	1383	526	2944
v/s Ratio Prot			0.25		c0.55	
v/s Ratio Perm	c0.02	0.00	0.01		0.22	
v/c Ratio	0.24	0.01	0.29	0.01	0.25	0.63
Uniform Delay, d1	53.0	52.2	1.4	1.1	1.4	2.4
Progression Factor	1.00	1.00	1.09	1.51	0.67	0.60
Incremental Delay, d2	1.1	0.1	0.2	0.0	0.9	0.8
Delay (s)	54.2	52.3	1.8	1.7	1.8	2.3
Level of Service	D	D	A	A	A	A
Approach Delay (s)	53.3		1.8		2.3	
Approach LOS	D		A		A	























Intersection Summary			
HCM Average Control Delay	2.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: NSR & BRONTE

EXISTING
AM PEAK HOUR

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	0	2	32	2	25	3	875	143	78	1310	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		3.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	
Frt		0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1709		1615	1636	1439	1785	3275	1566	1733	3367	
Flt Permitted		0.83		0.77	0.95	1.00	0.16	1.00	1.00	0.28	1.00	
Satd. Flow (perm)		1458		1301	1618	1439	298	3275	1566	515	3367	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	0	2	35	2	27	3	951	155	85	1424	2
RTOR Reduction (vph)	0	2	0	0	0	23	0	0	22	0	0	0
Lane Group Flow (vph)	0	2	0	19	18	4	3	951	133	85	1426	0
Heavy Vehicles (%)	0%	0%	0%	5%	0%	11%	0%	9%	2%	3%	6%	0%
Turn Type	Perm			pm+pt		Perm	Perm		pm+ov	Perm		
Protected Phases		4		3	8			2	3		6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)		1.3		14.6	14.6	14.6	91.4	91.4	100.7	91.4	91.4	
Effective Green, g (s)		4.3		15.6	17.6	17.6	94.4	94.4	102.7	94.4	94.4	
Actuated g/C Ratio		0.04		0.13	0.15	0.15	0.79	0.79	0.86	0.79	0.79	
Clearance Time (s)		7.0		4.0	7.0	7.0	7.0	7.0	4.0	7.0	7.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		52		196	239	211	234	2576	1340	405	2649	
v/s Ratio Prot				c0.01	c0.01			0.29	0.01		c0.42	
v/s Ratio Perm		0.00		0.00	0.00	0.00	0.01		0.08	0.17		
v/c Ratio		0.04		0.10	0.08	0.02	0.01	0.37	0.10	0.21	0.54	
Uniform Delay, d1		55.9		46.0	44.2	43.8	2.8	3.8	1.4	3.3	4.7	
Progression Factor		1.00		0.71	0.69	0.97	0.54	0.49	0.75	0.27	0.33	
Incremental Delay, d2		0.3		0.2	0.1	0.0	0.1	0.4	0.0	0.9	0.6	
Delay (s)		56.2		33.0	30.7	42.6	1.6	2.3	1.1	1.8	2.2	
Level of Service		E		C	C	D	A	A	A	A	A	
Approach Delay (s)		56.2			36.4			2.1			2.2	
Approach LOS		E			D			A			A	

Intersection Summary

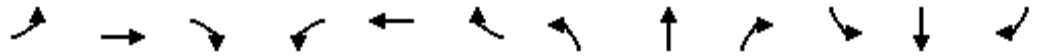
HCM Average Control Delay	3.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

11: NSR-EW & NSR-Halton

EXISTING
AM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	183	10	71	1	0	0	53	57	6	1	9	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0			4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00			1.00	1.00			1.00	1.00
Frt	1.00	0.87		1.00			1.00	0.98			1.00	0.85
Flt Protected	0.95	1.00		0.95			0.95	1.00			1.00	1.00
Satd. Flow (prot)	1785	1618		1785			1716	1850			1870	1597
Flt Permitted	0.76	1.00		0.70			0.75	1.00			0.99	1.00
Satd. Flow (perm)	1423	1618		1315			1356	1850			1857	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	199	11	77	1	0	0	58	62	7	1	10	50
RTOR Reduction (vph)	0	30	0	0	0	0	0	3	0	0	0	34
Lane Group Flow (vph)	199	58	0	1	0	0	58	66	0	0	11	16
Heavy Vehicles (%)	0%	0%	1%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	71.0	71.0		71.0			35.0	35.0			35.0	35.0
Effective Green, g (s)	74.0	74.0		74.0			38.0	38.0			38.0	38.0
Actuated g/C Ratio	0.62	0.62		0.62			0.32	0.32			0.32	0.32
Clearance Time (s)	7.0	7.0		7.0			7.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	878	998		811			429	586			588	506
v/s Ratio Prot		0.04						0.04				
v/s Ratio Perm	c0.14			0.00			c0.04				0.01	0.01
v/c Ratio	0.23	0.06		0.00			0.14	0.11			0.02	0.03
Uniform Delay, d1	10.2	9.1		8.8			29.3	29.0			28.2	28.3
Progression Factor	1.11	1.40		1.00			1.00	1.00			1.00	1.00
Incremental Delay, d2	0.6	0.1		0.0			0.7	0.4			0.1	0.1
Delay (s)	11.9	12.9		8.8			29.9	29.4			28.2	28.4
Level of Service	B	B		A			C	C			C	C
Approach Delay (s)		12.2			8.8			29.7			28.4	
Approach LOS		B			A			C			C	

Intersection Summary

HCM Average Control Delay	18.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	33.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: WB OFF RAMP & BRONTE

EXISTING
AM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖↗	↖	↕↕			↕↕
Volume (vph)	171	205	762	0	0	762
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	0.97	1.00	0.95			0.95
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3298	1452	3336			3400
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3298	1452	3336			3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	186	223	828	0	0	828
RTOR Reduction (vph)	0	146	0	0	0	0
Lane Group Flow (vph)	186	77	828	0	0	828
Heavy Vehicles (%)	5%	10%	7%	2%	2%	5%
Turn Type	Perm					
Protected Phases	8		2			6
Permitted Phases	8					
Actuated Green, G (s)	13.3	13.3	92.7			92.7
Effective Green, g (s)	16.3	16.3	95.7			95.7
Actuated g/C Ratio	0.14	0.14	0.80			0.80
Clearance Time (s)	7.0	7.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	448	197	2660			2712
v/s Ratio Prot	c0.06		c0.25			0.24
v/s Ratio Perm		0.05				
v/c Ratio	0.42	0.39	0.31			0.31
Uniform Delay, d1	47.5	47.3	3.3			3.3
Progression Factor	1.00	1.00	1.00			1.27
Incremental Delay, d2	0.6	1.3	0.3			0.3
Delay (s)	48.1	48.6	3.5			4.4
Level of Service	D	D	A			A
Approach Delay (s)	48.4		3.5			4.4
Approach LOS	D		A			A

Intersection Summary

HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: EB OFF RAMP & BRONTE

EXISTING
AM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖↗	↗		↖	↕	↗	↖	↕↗	
Volume (vph)	8	9	3	438	5	481	1	679	284	379	946	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		4.0	3.0		4.0	4.0	4.0	3.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00		1.00	0.95	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.85		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1785	1814		3236	1482		1785	3305	1529	1750	3428	
Flt Permitted	0.53	1.00		0.95	1.00		0.28	1.00	1.00	0.25	1.00	
Satd. Flow (perm)	989	1814		3236	1482		517	3305	1529	454	3428	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	10	3	476	5	523	1	738	309	412	1028	13
RTOR Reduction (vph)	0	3	0	0	374	0	0	0	174	0	1	0
Lane Group Flow (vph)	9	10	0	476	154	0	1	738	135	412	1040	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	0%	0%	0%	7%	0%	8%	0%	8%	2%	2%	4%	0%
Turn Type	Perm			Prot			Perm		Perm	pm+pt		
Protected Phases		4		3	8			2			1	6
Permitted Phases	4						2		2		6	
Actuated Green, G (s)	4.6	4.6		21.7	31.3		49.4	49.4	49.4	75.7	75.7	
Effective Green, g (s)	7.6	7.6		22.7	34.3		52.4	52.4	52.4	75.7	78.7	
Actuated g/C Ratio	0.06	0.06		0.19	0.29		0.44	0.44	0.44	0.63	0.66	
Clearance Time (s)	6.0	6.0		5.0	6.0		7.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	63	115		612	424		226	1443	668	538	2248	
v/s Ratio Prot		0.01		c0.15	c0.10			0.22		c0.15	0.30	
v/s Ratio Perm	0.01						0.00		0.09	c0.33		
v/c Ratio	0.14	0.09		0.78	0.36		0.00	0.51	0.20	0.77	0.46	
Uniform Delay, d1	53.1	52.9		46.3	34.2		19.1	24.5	20.9	13.9	10.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.27	1.01	
Incremental Delay, d2	1.0	0.3		6.2	0.5		0.0	1.3	0.7	6.4	0.7	
Delay (s)	54.2	53.3		52.4	34.7		19.1	25.8	21.6	24.1	11.0	
Level of Service	D	D		D	C		B	C	C	C	B	
Approach Delay (s)		53.6			43.1			24.6			14.7	
Approach LOS		D			D			C			B	
























Intersection Summary

HCM Average Control Delay	26.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

18: UPPER MIDDLE & BRONTE

EXISTING
PM PEAK HOUR

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	27	83	161	68	204	120	1270	263	182	686	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		3.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.89		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1785	3165		3395	1879	1566	1785	3336	1536	1750	3433	1597
Flt Permitted	0.71	1.00		0.95	1.00	1.00	0.37	1.00	1.00	0.13	1.00	1.00
Satd. Flow (perm)	1332	3165		3395	1879	1566	692	3336	1536	231	3433	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	29	90	175	74	222	130	1380	286	198	746	33
RTOR Reduction (vph)	0	82	0	0	0	177	0	0	74	0	0	9
Lane Group Flow (vph)	16	37	0	175	74	45	130	1380	212	198	746	24
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	7%	4%	2%	4%	0%
Turn Type	Perm			Prot		Perm	Perm		Perm	pm+pt		Perm
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4					8	2		2	6		6
Actuated Green, G (s)	7.1	7.1		8.0	20.1	20.1	71.5	71.5	71.5	85.9	85.9	85.9
Effective Green, g (s)	10.1	10.1		10.0	23.1	23.1	74.5	74.5	74.5	88.9	88.9	88.9
Actuated g/C Ratio	0.08	0.08		0.08	0.19	0.19	0.62	0.62	0.62	0.74	0.74	0.74
Clearance Time (s)	7.0	7.0		5.0	7.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	112	266		283	362	301	430	2071	954	353	2543	1183
v/s Ratio Prot		0.01		c0.05	c0.04			c0.41		c0.07	0.22	
v/s Ratio Perm	0.01					0.03	0.19		0.14	0.35		0.02
v/c Ratio	0.14	0.14		0.62	0.20	0.15	0.30	0.67	0.22	0.56	0.29	0.02
Uniform Delay, d1	50.9	50.9		53.2	40.7	40.3	10.6	14.7	10.0	11.2	5.1	4.1
Progression Factor	1.00	1.00		0.69	0.73	1.74	0.39	0.45	0.22	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.2		3.8	0.3	0.2	1.5	1.4	0.4	2.0	0.3	0.0
Delay (s)	51.5	51.2		40.6	29.9	70.1	5.6	8.0	2.7	13.2	5.4	4.1
Level of Service	D	D		D	C	E	A	A	A	B	A	A
Approach Delay (s)		51.2			52.8			7.0			7.0	
Approach LOS		D			D			A			A	

Intersection Summary

HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: WOODLANDS & BRONTE

EXISTING
PM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	22	62	1591	2	10	920
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1566	1521	3400	1597	1785	3400
Flt Permitted	0.95	1.00	1.00	1.00	0.12	1.00
Satd. Flow (perm)	1566	1521	3400	1597	223	3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	67	1729	2	11	1000
RTOR Reduction (vph)	0	49	0	0	0	0
Lane Group Flow (vph)	24	18	1729	2	11	1000
Heavy Vehicles (%)	14%	5%	5%	0%	0%	5%
Turn Type	custom			Perm	Perm	
Protected Phases			2			6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	6.6	6.6	99.4	99.4	99.4	99.4
Effective Green, g (s)	9.6	9.6	102.4	102.4	102.4	102.4
Actuated g/C Ratio	0.08	0.08	0.85	0.85	0.85	0.85
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	125	122	2901	1363	190	2901
v/s Ratio Prot			c0.51			0.29
v/s Ratio Perm	c0.02	0.01		0.00	0.05	
v/c Ratio	0.19	0.15	0.60	0.00	0.06	0.34
Uniform Delay, d1	51.6	51.4	2.6	1.3	1.4	1.8
Progression Factor	1.00	1.00	0.24	0.27	0.76	0.76
Incremental Delay, d2	0.8	0.6	0.7	0.0	0.6	0.3
Delay (s)	52.3	52.0	1.4	0.3	1.6	1.7
Level of Service	D	D	A	A	A	A
Approach Delay (s)	52.1		1.4			1.7
Approach LOS	D		A			A

Intersection Summary






















HCM Average Control Delay	3.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: NSR & BRONTE

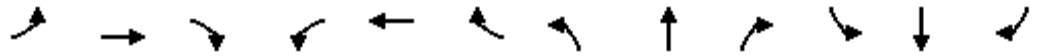
EXISTING
PM PEAK HOUR

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	0	0	124	0	107	1	1504	46	23	891	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		3.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	
Frt		1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.95		0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1785		1615	1615	1439	1785	3275	1566	1733	3368	
Flt Permitted		0.71		0.88	0.76	1.00	0.27	1.00	1.00	0.12	1.00	
Satd. Flow (perm)		1335		1504	1287	1439	514	3275	1566	211	3368	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	0	0	135	0	116	1	1635	50	25	968	0
RTOR Reduction (vph)	0	0	0	0	0	37	0	0	6	0	0	0
Lane Group Flow (vph)	0	1	0	67	68	79	1	1635	44	25	968	0
Heavy Vehicles (%)	0%	0%	0%	5%	0%	11%	0%	9%	2%	3%	6%	0%
Turn Type	Perm			pm+pt		Perm	Perm		pm+ov	Perm		
Protected Phases		4		3	8			2	3		6	
Permitted Phases	4			8		8	2	2		6		
Actuated Green, G (s)		2.7		16.8	16.8	16.8	89.2	89.2	100.3	89.2	89.2	
Effective Green, g (s)		5.7		16.8	19.8	19.8	92.2	92.2	106.3	92.2	92.2	
Actuated g/C Ratio		0.05		0.14	0.16	0.16	0.77	0.77	0.89	0.77	0.77	
Clearance Time (s)		7.0		3.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		63		221	251	237	395	2516	1387	162	2588	
v/s Ratio Prot				0.03	0.03			c0.50	0.00		0.29	
v/s Ratio Perm		0.00		0.01	0.01	c0.06	0.00		0.02	0.12		
v/c Ratio		0.02		0.30	0.27	0.33	0.00	0.65	0.03	0.15	0.37	
Uniform Delay, d1		54.5		46.3	43.8	44.3	3.2	6.4	0.8	3.7	4.5	
Progression Factor		1.00		0.96	0.96	0.94	0.59	0.41	0.07	0.72	0.71	
Incremental Delay, d2		0.1		0.8	0.6	0.8	0.0	0.8	0.0	1.9	0.4	
Delay (s)		54.6		45.3	42.8	42.6	1.9	3.5	0.1	4.6	3.6	
Level of Service		D		D	D	D	A	A	A	A	A	
Approach Delay (s)		54.6			43.4			3.4			3.6	
Approach LOS		D			D			A			A	
Intersection Summary												
HCM Average Control Delay			6.9		HCM Level of Service					A		
HCM Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)					8.0		
Intersection Capacity Utilization			61.5%		ICU Level of Service					B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

11: NSR-EW & NSR-Halton

EXISTING
PM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	52	2	15	1	26	0	80	25	0	0	31	227
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.87		1.00	1.00		1.00	1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	1785	1614		1785	1879		1716	1879			1879	1597
Flt Permitted	0.74	1.00		0.75	1.00		0.73	1.00			1.00	1.00
Satd. Flow (perm)	1388	1614		1401	1879		1328	1879			1879	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	2	16	1	28	0	87	27	0	0	34	247
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	0	0	0	99
Lane Group Flow (vph)	57	7	0	1	28	0	87	27	0	0	34	148
Heavy Vehicles (%)	0%	0%	1%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	37.0	37.0		37.0	37.0		69.0	69.0			69.0	69.0
Effective Green, g (s)	40.0	40.0		40.0	40.0		72.0	72.0			72.0	72.0
Actuated g/C Ratio	0.33	0.33		0.33	0.33		0.60	0.60			0.60	0.60
Clearance Time (s)	7.0	7.0		7.0	7.0		7.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	463	538		467	626		797	1127			1127	958
v/s Ratio Prot		0.00			0.01			0.01			0.02	
v/s Ratio Perm	c0.04			0.00			0.07					c0.09
v/c Ratio	0.12	0.01		0.00	0.04		0.11	0.02			0.03	0.15
Uniform Delay, d1	27.8	26.8		26.7	27.1		10.3	9.7			9.8	10.6
Progression Factor	0.95	0.87		1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	0.5	0.0		0.0	0.1		0.3	0.0			0.0	0.3
Delay (s)	26.8	23.3		26.7	27.2		10.5	9.8			9.8	10.9
Level of Service	C	C		C	C		B	A			A	B
Approach Delay (s)		26.0			27.2			10.4			10.8	
Approach LOS		C			C			B			B	

Intersection Summary

HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: WB OFF RAMP & BRONTE

EXISTING
PM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	223	352	1492	0	0	603
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	0.97	1.00	0.95			0.95
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3298	1452	3336			3400
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3298	1452	3336			3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	242	383	1622	0	0	655
RTOR Reduction (vph)	0	19	0	0	0	0
Lane Group Flow (vph)	242	364	1622	0	0	655
Heavy Vehicles (%)	5%	10%	7%	2%	2%	5%
Turn Type	Perm					
Protected Phases	8		2			6
Permitted Phases	8					
Actuated Green, G (s)	33.2	33.2	72.8			72.8
Effective Green, g (s)	36.2	36.2	75.8			75.8
Actuated g/C Ratio	0.30	0.30	0.63			0.63
Clearance Time (s)	7.0	7.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	995	438	2107			2148
v/s Ratio Prot	0.07		c0.49			0.19
v/s Ratio Perm	c0.25					
v/c Ratio	0.24	0.83	0.77			0.30
Uniform Delay, d1	31.6	39.1	15.8			10.1
Progression Factor	1.00	1.00	0.51			0.96
Incremental Delay, d2	0.1	12.6	0.9			0.4
Delay (s)	31.7	51.7	9.1			10.0
Level of Service	C	D	A			B
Approach Delay (s)	44.0		9.1			10.0
Approach LOS	D		A			B

Intersection Summary

HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: EB OFF RAMP & BRONTE

EXISTING
PM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↘		↗↘	↘		↗	↕	↗	↗	↕	↘↗
Volume (vph)	5	6	4	268	4	576	4	1248	231	216	773	4
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	3.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00		1.00	0.95	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95		1.00	0.85		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1783	1776		3298	1408		1785	3336	1551	1653	3398	
Flt Permitted	0.39	1.00		0.95	1.00		0.33	1.00	1.00	0.08	1.00	
Satd. Flow (perm)	736	1776		3298	1408		629	3336	1551	140	3398	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	7	4	291	4	626	4	1357	251	235	840	4
RTOR Reduction (vph)	0	4	0	0	156	0	0	0	99	0	0	0
Lane Group Flow (vph)	5	7	0	291	474	0	4	1357	152	235	844	0
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	0%	0%	0%	5%	0%	12%	0%	7%	3%	8%	5%	0%
Turn Type	Perm			Prot			Perm		Perm		pm+pt	
Protected Phases	4			3			8		2		1	
Permitted Phases	4						2		2		6	
Actuated Green, G (s)	7.2	7.2		30.2	42.4		46.8	46.8	46.8	63.6	63.6	
Effective Green, g (s)	10.2	10.2		31.2	45.4		49.8	49.8	49.8	63.6	66.6	
Actuated g/C Ratio	0.08	0.08		0.26	0.38		0.42	0.42	0.42	0.53	0.55	
Clearance Time (s)	7.0	7.0		5.0	7.0		7.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	63	151		857	533		261	1384	644	248	1886	
v/s Ratio Prot		0.00		0.09	c0.34			c0.41		c0.11	0.25	
v/s Ratio Perm	0.01						0.01		0.10	0.39		
v/c Ratio	0.08	0.05		0.34	0.89		0.02	0.98	0.24	0.95	0.45	
Uniform Delay, d1	50.6	50.4		36.0	34.9		20.7	34.6	22.8	36.6	15.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.03	0.62	
Incremental Delay, d2	0.5	0.1		0.2	16.5		0.1	20.0	0.9	42.0	0.8	
Delay (s)	51.1	50.6		36.3	51.4		20.8	54.6	23.6	79.5	10.6	
Level of Service	D	D		D	D		C	D	C	E	B	
Approach Delay (s)		50.7			46.6			49.7			25.6	
Approach LOS		D			D			D			C	

Intersection Summary		
HCM Average Control Delay	41.7	HCM Level of Service
HCM Volume to Capacity ratio	0.94	D
Actuated Cycle Length (s)	120.0	Sum of lost time (s)
Intersection Capacity Utilization	92.4%	11.0
Analysis Period (min)	15	ICU Level of Service
c Critical Lane Group		F

HCM Signalized Intersection Capacity Analysis
18: UPPER MIDDLE & BRONTE

2019 BACKGROUND
AM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	131	242	317	50	169	48	703	225	335	1550	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1785	1879	1597	3395	1879	1566	1785	3336	1536	1750	3433	1597
Flt Permitted	0.72	1.00	1.00	0.95	1.00	1.00	0.08	1.00	1.00	0.28	1.00	1.00
Satd. Flow (perm)	1356	1879	1597	3395	1879	1566	152	3336	1536	519	3433	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	142	263	345	54	184	52	764	245	364	1685	13
RTOR Reduction (vph)	0	0	21	0	0	126	0	0	123	0	0	4
Lane Group Flow (vph)	16	142	242	345	54	58	52	764	123	364	1685	9
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	7%	4%	2%	4%	0%
Turn Type	Perm		Perm	Prot		Perm	Perm		Perm	pm+pt		Perm
Protected Phases		4		3	8			2			1	6
Permitted Phases	4		4			8	2		2	6		6
Actuated Green, G (s)	17.8	17.8	17.8	12.0	34.8	34.8	57.0	57.0	57.0	71.2	71.2	71.2
Effective Green, g (s)	20.8	20.8	20.8	14.0	37.8	37.8	60.0	60.0	60.0	74.2	74.2	74.2
Actuated g/C Ratio	0.17	0.17	0.17	0.12	0.32	0.32	0.50	0.50	0.50	0.62	0.62	0.62
Clearance Time (s)	7.0	7.0	7.0	5.0	7.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	235	326	277	396	592	493	76	1668	768	467	2123	987
v/s Ratio Prot		0.08		c0.10	0.03			0.23		0.09	c0.49	
v/s Ratio Perm	0.01		c0.15			0.04	0.34		0.08	0.39		0.01
v/c Ratio	0.07	0.44	0.87	0.87	0.09	0.12	0.68	0.46	0.16	0.78	0.79	0.01
Uniform Delay, d1	41.5	44.4	48.3	52.1	29.0	29.2	22.8	19.5	16.3	12.6	17.2	8.8
Progression Factor	1.00	1.00	1.00	0.76	0.77	0.82	0.99	1.02	2.09	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.9	24.6	18.2	0.1	0.1	39.1	0.9	0.4	8.0	3.2	0.0
Delay (s)	41.6	45.3	72.9	57.8	22.4	24.2	61.7	20.8	34.4	20.7	20.3	8.8
Level of Service	D	D	E	E	C	C	E	C	C	C	C	A
Approach Delay (s)		62.4			43.9			25.9			20.3	
Approach LOS		E			D			C			C	

Intersection Summary

HCM Average Control Delay	29.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: WOODLANDS & BRONTE

2019 BACKGROUND
 AM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	23	19	935	18	121	1963
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1566	1521	3400	1597	1785	3400
Flt Permitted	0.95	1.00	1.00	1.00	0.27	1.00
Satd. Flow (perm)	1566	1521	3400	1597	516	3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	21	1016	20	132	2134
RTOR Reduction (vph)	0	20	0	3	0	0
Lane Group Flow (vph)	25	1	1016	17	132	2134
Heavy Vehicles (%)	14%	5%	5%	0%	0%	5%
Turn Type	custom			Perm	Perm	
Protected Phases			2			6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	5.1	5.1	100.9	100.9	100.9	100.9
Effective Green, g (s)	8.1	8.1	103.9	103.9	103.9	103.9
Actuated g/C Ratio	0.07	0.07	0.87	0.87	0.87	0.87
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	106	103	2944	1383	447	2944
v/s Ratio Prot			0.30			c0.63
v/s Ratio Perm	c0.02	0.00		0.01	0.26	
v/c Ratio	0.24	0.01	0.35	0.01	0.30	0.72
Uniform Delay, d1	53.0	52.2	1.5	1.1	1.5	2.9
Progression Factor	1.00	1.00	1.48	2.21	1.11	0.89
Incremental Delay, d2	1.1	0.1	0.3	0.0	0.9	0.9
Delay (s)	54.2	52.3	2.6	2.4	2.5	3.5
Level of Service	D	D	A	A	A	A
Approach Delay (s)	53.3		2.6			3.4
Approach LOS	D		A			A

Intersection Summary

HCM Average Control Delay	3.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: NSR & BRONTE

2019 BACKGROUND
AM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↖	↖	↖	↖	↕	↖	↖	↕	
Volume (vph)	2	0	2	34	2	27	3	1085	153	83	1624	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		3.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	
Frt		0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1709		1615	1635	1439	1785	3275	1566	1733	3367	
Flt Permitted		0.83		0.77	0.93	1.00	0.10	1.00	1.00	0.22	1.00	
Satd. Flow (perm)		1457		1301	1588	1439	188	3275	1566	394	3367	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	0	2	37	2	29	3	1179	166	90	1765	2
RTOR Reduction (vph)	0	2	0	0	0	25	0	0	24	0	0	0
Lane Group Flow (vph)	0	2	0	20	19	4	3	1179	142	90	1767	0
Heavy Vehicles (%)	0%	0%	0%	5%	0%	11%	0%	9%	2%	3%	6%	0%
Turn Type	Perm			pm+pt		Perm	Perm		pm+ov	Perm		
Protected Phases		4		3	8			2	3		6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)		1.3		14.3	14.3	14.3	91.7	91.7	100.7	91.7	91.7	
Effective Green, g (s)		4.3		15.3	17.3	17.3	94.7	94.7	102.7	94.7	94.7	
Actuated g/C Ratio		0.04		0.13	0.14	0.14	0.79	0.79	0.86	0.79	0.79	
Clearance Time (s)		7.0		4.0	7.0	7.0	7.0	7.0	4.0	7.0	7.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		52		192	234	207	148	2585	1340	311	2657	
v/s Ratio Prot				c0.01	c0.01			0.36	0.01		c0.52	
v/s Ratio Perm		0.00		0.00	0.00	0.00	0.02		0.08	0.23		
v/c Ratio		0.04		0.10	0.08	0.02	0.02	0.46	0.11	0.29	0.67	
Uniform Delay, d1		55.9		46.3	44.5	44.1	2.7	4.2	1.4	3.5	5.6	
Progression Factor		1.00		0.72	0.70	1.12	0.46	0.40	0.50	0.26	0.36	
Incremental Delay, d2		0.3		0.2	0.1	0.0	0.2	0.6	0.0	1.7	1.0	
Delay (s)		56.2		33.4	31.3	49.5	1.5	2.2	0.7	2.6	3.0	
Level of Service		E		C	C	D	A	A	A	A	A	
Approach Delay (s)		56.2			39.7			2.0			3.0	
Approach LOS		E			D			A			A	

Intersection Summary

HCM Average Control Delay	3.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: NSR-EW & NSR-Halton

2019 BACKGROUND
AM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	183	10	90	1	0	0	67	57	6	1	9	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0			4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00			1.00	1.00			1.00	1.00
Frt	1.00	0.87		1.00			1.00	0.98			1.00	0.85
Flt Protected	0.95	1.00		0.95			0.95	1.00			1.00	1.00
Satd. Flow (prot)	1785	1611		1785			1716	1850			1870	1597
Flt Permitted	0.76	1.00		0.69			0.75	1.00			0.99	1.00
Satd. Flow (perm)	1423	1611		1290			1356	1850			1858	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	199	11	98	1	0	0	73	62	7	1	10	50
RTOR Reduction (vph)	0	38	0	0	0	0	0	3	0	0	0	34
Lane Group Flow (vph)	199	71	0	1	0	0	73	66	0	0	11	16
Heavy Vehicles (%)	0%	0%	1%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	70.0	70.0		70.0			36.0	36.0			36.0	36.0
Effective Green, g (s)	73.0	73.0		73.0			39.0	39.0			39.0	39.0
Actuated g/C Ratio	0.61	0.61		0.61			0.32	0.32			0.32	0.32
Clearance Time (s)	7.0	7.0		7.0			7.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	866	980		785			441	601			604	519
v/s Ratio Prot		0.04						0.04				
v/s Ratio Perm	c0.14			0.00			c0.05				0.01	0.01
v/c Ratio	0.23	0.07		0.00			0.17	0.11			0.02	0.03
Uniform Delay, d1	10.7	9.6		9.2			28.9	28.3			27.5	27.6
Progression Factor	1.19	1.94		1.00			1.00	1.00			1.00	1.00
Incremental Delay, d2	0.6	0.1		0.0			0.8	0.4			0.1	0.1
Delay (s)	13.4	18.9		9.2			29.7	28.7			27.6	27.7
Level of Service	B	B		A			C	C			C	C
Approach Delay (s)		15.3			9.2			29.2			27.7	
Approach LOS		B			A			C			C	

Intersection Summary

HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.21		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: WB OFF RAMP & BRONTE

2019 BACKGROUND
AM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	212	254	945	0	0	945
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	0.97	0.91	0.95			0.95
Frt	0.95	0.85	1.00			1.00
Flt Protected	0.97	1.00	1.00			1.00
Satd. Flow (prot)	3141	1321	3336			3400
Flt Permitted	0.97	1.00	1.00			1.00
Satd. Flow (perm)	3141	1321	3336			3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	276	1027	0	0	1027
RTOR Reduction (vph)	66	115	0	0	0	0
Lane Group Flow (vph)	280	45	1027	0	0	1027
Heavy Vehicles (%)	5%	10%	7%	2%	2%	5%
Turn Type	Perm					
Protected Phases	8		2			6
Permitted Phases	8					
Actuated Green, G (s)	15.8	15.8	90.2			90.2
Effective Green, g (s)	18.8	18.8	93.2			93.2
Actuated g/C Ratio	0.16	0.16	0.78			0.78
Clearance Time (s)	7.0	7.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	492	207	2591			2641
v/s Ratio Prot	c0.09		c0.31			0.30
v/s Ratio Perm		0.03				
v/c Ratio	0.57	0.22	0.40			0.39
Uniform Delay, d1	46.9	44.2	4.3			4.3
Progression Factor	1.00	1.00	0.43			1.16
Incremental Delay, d2	1.5	0.5	0.4			0.4
Delay (s)	48.4	44.7	2.2			5.3
Level of Service	D	D	A			A
Approach Delay (s)	47.2		2.2			5.3
Approach LOS	D		A			A
























Intersection Summary

HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: EB OFF RAMP & BRONTE

2019 BACKGROUND
AM PEAK HOUR

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	9	11	4	517	6	568	1	801	335	447	1116	14	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.0	3.0		3.0	3.0	3.0	4.0	4.0	4.0	3.0	4.0		
Lane Util. Factor	1.00	1.00		1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95		
Frbp, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00		
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Frt	1.00	0.96		1.00	0.85	0.85	1.00	1.00	0.85	1.00	1.00		
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	1785	1808		1668	1413	1405	1785	3305	1529	1750	3428		
Flt Permitted	0.56	1.00		0.48	1.00	1.00	0.23	1.00	1.00	0.12	1.00		
Satd. Flow (perm)	1052	1808		843	1413	1405	429	3305	1529	226	3428		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	10	12	4	562	7	617	1	871	364	486	1213	15	
RTOR Reduction (vph)	0	4	0	0	187	186	0	0	221	0	0	0	
Lane Group Flow (vph)	10	12	0	562	129	122	1	871	143	486	1228	0	
Confl. Peds. (#/hr)									1	1			
Heavy Vehicles (%)	0%	0%	0%	7%	0%	8%	0%	8%	2%	2%	4%	0%	
Turn Type	Perm			pm+pt			Perm	Perm		Perm	pm+pt		
Protected Phases		4		3	8			2			1	6	
Permitted Phases	4			8		8	2		2		6		
Actuated Green, G (s)	4.4	4.4		44.4	44.4	44.4	29.6	29.6	29.6	62.6	62.6		
Effective Green, g (s)	7.4	7.4		45.4	47.4	47.4	32.6	32.6	32.6	62.6	65.6		
Actuated g/C Ratio	0.06	0.06		0.38	0.39	0.39	0.27	0.27	0.27	0.52	0.55		
Clearance Time (s)	6.0	6.0		4.0	6.0	6.0	7.0	7.0	7.0	3.0	7.0		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	65	111		573	558	555	117	898	415	499	1874		
v/s Ratio Prot		0.01		c0.30	0.09			c0.26		c0.24	0.36		
v/s Ratio Perm	0.01			c0.07		0.09	0.00		0.09	0.26			
v/c Ratio	0.15	0.11		0.98	0.23	0.22	0.01	0.97	0.35	0.97	0.66		
Uniform Delay, d1	53.3	53.2		35.1	24.2	24.0	31.9	43.2	35.1	35.2	19.2		
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.12	1.18		
Incremental Delay, d2	1.1	0.4		32.6	0.2	0.2	0.1	23.6	2.3	32.9	1.8		
Delay (s)	54.4	53.6		67.7	24.4	24.2	32.0	66.8	37.4	72.5	24.4		
Level of Service	D	D		E	C	C	C	E	D	E	C		
Approach Delay (s)		53.9			44.9			58.1			38.0		
Approach LOS		D			D			E			D		
Intersection Summary													
HCM Average Control Delay			46.0									HCM Level of Service	D
HCM Volume to Capacity ratio			0.96										
Actuated Cycle Length (s)			120.0									Sum of lost time (s)	10.0
Intersection Capacity Utilization			92.2%									ICU Level of Service	F
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: UPPER MIDDLE & BRONTE

2019 BACKGROUND
PM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	33	100	195	82	247	145	1537	318	220	830	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		3.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.89		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1785	3167		3395	1879	1566	1785	3336	1536	1750	3433	1597
Flt Permitted	0.70	1.00		0.95	1.00	1.00	0.32	1.00	1.00	0.06	1.00	1.00
Satd. Flow (perm)	1314	3167		3395	1879	1566	593	3336	1536	105	3433	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	20	36	109	212	89	268	158	1671	346	239	902	39
RTOR Reduction (vph)	0	99	0	0	0	154	0	0	83	0	0	10
Lane Group Flow (vph)	20	46	0	212	89	114	158	1671	263	239	902	29
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	7%	4%	2%	4%	0%
Turn Type	Perm			Prot		Perm	Perm		Perm	pm+pt		Perm
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4					8	2		2	6		6
Actuated Green, G (s)	7.5	7.5		7.0	19.5	19.5	67.5	67.5	67.5	86.5	86.5	86.5
Effective Green, g (s)	10.5	10.5		9.0	22.5	22.5	70.5	70.5	70.5	89.5	89.5	89.5
Actuated g/C Ratio	0.09	0.09		0.08	0.19	0.19	0.59	0.59	0.59	0.75	0.75	0.75
Clearance Time (s)	7.0	7.0		5.0	7.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	115	277		255	352	294	348	1960	902	339	2560	1191
v/s Ratio Prot		0.01		c0.06	0.05			c0.50		c0.11	0.26	
v/s Ratio Perm	0.02					c0.07	0.27		0.17	0.42		0.02
v/c Ratio	0.17	0.16		0.83	0.25	0.39	0.45	0.85	0.29	0.71	0.35	0.02
Uniform Delay, d1	50.7	50.7		54.8	41.6	42.7	13.9	20.5	12.3	34.4	5.3	3.9
Progression Factor	1.00	1.00		0.71	0.76	0.97	0.52	0.63	0.40	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3		19.4	0.4	0.8	3.0	3.6	0.6	6.5	0.4	0.0
Delay (s)	51.5	51.0		58.4	31.8	42.1	10.2	16.5	5.5	41.0	5.6	4.0
Level of Service	D	D		E	C	D	B	B	A	D	A	A
Approach Delay (s)		51.0			46.6			14.3			12.7	
Approach LOS		D			D			B			B	

Intersection Summary

HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: WOODLANDS & BRONTE

2019 BACKGROUND
 PM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	22	62	1925	2	10	1113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1566	1521	3400	1597	1785	3400
Flt Permitted	0.95	1.00	1.00	1.00	0.07	1.00
Satd. Flow (perm)	1566	1521	3400	1597	133	3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	67	2092	2	11	1210
RTOR Reduction (vph)	0	26	0	0	0	0
Lane Group Flow (vph)	24	41	2092	2	11	1210
Heavy Vehicles (%)	14%	5%	5%	0%	0%	5%
Turn Type	custom			Perm	Perm	
Protected Phases			2			6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	7.7	7.7	98.3	98.3	98.3	98.3
Effective Green, g (s)	10.7	10.7	101.3	101.3	101.3	101.3
Actuated g/C Ratio	0.09	0.09	0.84	0.84	0.84	0.84
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	140	136	2870	1348	112	2870
v/s Ratio Prot			c0.62			0.36
v/s Ratio Perm	0.02	c0.03		0.00	0.08	
v/c Ratio	0.17	0.31	0.73	0.00	0.10	0.42
Uniform Delay, d1	50.5	51.2	3.8	1.5	1.6	2.3
Progression Factor	1.00	1.00	0.41	0.72	0.76	0.76
Incremental Delay, d2	0.6	1.3	1.4	0.0	1.6	0.4
Delay (s)	51.1	52.4	2.9	1.0	2.8	2.1
Level of Service	D	D	A	A	A	A
Approach Delay (s)	52.1		2.9			2.1
Approach LOS	D		A			A























Intersection Summary

HCM Average Control Delay	4.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: NSR & BRONTE

2019 BACKGROUND
PM PEAK HOUR

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	0	0	133	0	114	1	1865	49	25	1105	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		3.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	
Frt		1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.95		0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1785		1615	1615	1439	1785	3275	1566	1733	3368	
Flt Permitted		0.71		0.87	0.76	1.00	0.20	1.00	1.00	0.06	1.00	
Satd. Flow (perm)		1328		1478	1287	1439	381	3275	1566	103	3368	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	0	0	145	0	124	1	2027	53	27	1201	0
RTOR Reduction (vph)	0	0	0	0	0	16	0	0	6	0	0	0
Lane Group Flow (vph)	0	1	0	72	73	108	1	2027	47	27	1201	0
Heavy Vehicles (%)	0%	0%	0%	5%	0%	11%	0%	9%	2%	3%	6%	0%
Turn Type	Perm			pm+pt		Perm	Perm		pm+ov	Perm		
Protected Phases		4		3	8			2	3		6	
Permitted Phases	4			8		8	2	2		6		
Actuated Green, G (s)		3.5		19.0	19.0	19.0	87.0	87.0	99.5	87.0	87.0	
Effective Green, g (s)		6.5		19.0	22.0	22.0	90.0	90.0	105.5	90.0	90.0	
Actuated g/C Ratio		0.05		0.16	0.18	0.18	0.75	0.75	0.88	0.75	0.75	
Clearance Time (s)		7.0		3.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		72		248	278	264	286	2456	1377	77	2526	
v/s Ratio Prot				0.03	0.03			c0.62	0.00		0.36	
v/s Ratio Perm		0.00		0.02	0.01	c0.08	0.00		0.03	0.26		
v/c Ratio		0.01		0.29	0.26	0.41	0.00	0.83	0.03	0.35	0.48	
Uniform Delay, d1		53.7		44.5	42.0	43.3	3.8	9.8	0.9	5.1	5.8	
Progression Factor		1.00		0.96	0.96	0.95	0.84	0.81	0.39	0.95	0.70	
Incremental Delay, d2		0.1		0.7	0.5	1.0	0.0	1.8	0.0	11.3	0.6	
Delay (s)		53.8		43.3	40.8	42.3	3.2	9.7	0.4	16.1	4.7	
Level of Service		D		D	D	D	A	A	A	B	A	
Approach Delay (s)		53.8			42.2			9.5			5.0	
Approach LOS		D			D			A			A	

Intersection Summary		
HCM Average Control Delay	10.4	HCM Level of Service
HCM Volume to Capacity ratio	0.74	B
Actuated Cycle Length (s)	120.0	Sum of lost time (s)
Intersection Capacity Utilization	71.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: NSR-EW & NSR-Halton

2019 BACKGROUND
 PM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	52	2	16	1	26	0	102	25	0	0	31	227
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.87		1.00	1.00		1.00	1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	1785	1612		1785	1879		1716	1879			1879	1597
Flt Permitted	0.74	1.00		0.75	1.00		0.73	1.00			1.00	1.00
Satd. Flow (perm)	1388	1612		1400	1879		1328	1879			1879	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	2	17	1	28	0	111	27	0	0	34	247
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	0	0	0	99
Lane Group Flow (vph)	57	8	0	1	28	0	111	27	0	0	34	148
Heavy Vehicles (%)	0%	0%	1%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	37.0	37.0		37.0	37.0		69.0	69.0			69.0	69.0
Effective Green, g (s)	40.0	40.0		40.0	40.0		72.0	72.0			72.0	72.0
Actuated g/C Ratio	0.33	0.33		0.33	0.33		0.60	0.60			0.60	0.60
Clearance Time (s)	7.0	7.0		7.0	7.0		7.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	463	537		467	626		797	1127			1127	958
v/s Ratio Prot		0.00			0.01			0.01			0.02	
v/s Ratio Perm	c0.04			0.00			0.08					c0.09
v/c Ratio	0.12	0.01		0.00	0.04		0.14	0.02			0.03	0.15
Uniform Delay, d1	27.8	26.8		26.7	27.1		10.5	9.7			9.8	10.6
Progression Factor	0.95	0.89		1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	0.5	0.0		0.0	0.1		0.4	0.0			0.0	0.3
Delay (s)	26.9	23.9		26.7	27.2		10.8	9.8			9.8	10.9
Level of Service	C	C		C	C		B	A			A	B
Approach Delay (s)		26.1			27.2			10.6			10.8	
Approach LOS		C			C			B			B	

Intersection Summary	
HCM Average Control Delay	13.9 HCM Level of Service B
HCM Volume to Capacity ratio	0.14
Actuated Cycle Length (s)	120.0 Sum of lost time (s) 8.0
Intersection Capacity Utilization	33.0% ICU Level of Service A
Analysis Period (min)	15

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: WB OFF RAMP & BRONTE

2019 BACKGROUND
PM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	277	436	1850	0	0	748
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	0.97	0.91	0.95			0.95
Frt	0.94	0.85	1.00			1.00
Flt Protected	0.97	1.00	1.00			1.00
Satd. Flow (prot)	3094	1321	3336			3400
Flt Permitted	0.97	1.00	1.00			1.00
Satd. Flow (perm)	3094	1321	3336			3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	474	2011	0	0	813
RTOR Reduction (vph)	16	16	0	0	0	0
Lane Group Flow (vph)	513	230	2011	0	0	813
Heavy Vehicles (%)	5%	10%	7%	2%	2%	5%
Turn Type	Perm					
Protected Phases	8		2			6
Permitted Phases	8					
Actuated Green, G (s)	23.8	23.8	82.2			82.2
Effective Green, g (s)	26.8	26.8	85.2			85.2
Actuated g/C Ratio	0.22	0.22	0.71			0.71
Clearance Time (s)	7.0	7.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	691	295	2369			2414
v/s Ratio Prot	0.17		c0.60			0.24
v/s Ratio Perm	c0.17					
v/c Ratio	0.74	0.78	0.85			0.34
Uniform Delay, d1	43.4	43.8	12.7			6.6
Progression Factor	1.00	1.00	0.41			1.24
Incremental Delay, d2	4.3	12.2	2.3			0.4
Delay (s)	47.7	56.0	7.5			8.6
Level of Service	D	E	A			A
Approach Delay (s)	50.3		7.5			8.6
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: EB OFF RAMP & BRONTE

2019 BACKGROUND
PM PEAK HOUR






























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	7	5	316	5	680	5	1473	273	255	912	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		3.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.94		1.00	0.85	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1783	1770		1700	1341	1335	1785	3336	1551	1653	3398	
Flt Permitted	0.69	1.00		0.59	1.00	1.00	0.29	1.00	1.00	0.07	1.00	
Satd. Flow (perm)	1294	1770		1053	1341	1335	541	3336	1551	115	3398	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	8	5	343	5	739	5	1601	297	277	991	5
RTOR Reduction (vph)	0	5	0	0	199	199	0	0	91	0	0	0
Lane Group Flow (vph)	7	8	0	343	176	170	5	1601	206	277	996	0
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	0%	0%	0%	5%	0%	12%	0%	7%	3%	8%	5%	0%
Turn Type	Perm			pm+pt		Perm	Perm		Perm	pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	2.8	2.8		27.1	27.1	27.1	57.5	57.5	57.5	78.9	78.9	
Effective Green, g (s)	5.8	5.8		28.1	30.1	30.1	60.5	60.5	60.5	78.9	81.9	
Actuated g/C Ratio	0.05	0.05		0.23	0.25	0.25	0.50	0.50	0.50	0.66	0.68	
Clearance Time (s)	7.0	7.0		4.0	7.0	7.0	7.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	63	86		361	336	335	273	1682	782	311	2319	
v/s Ratio Prot		0.00		c0.17	0.13			c0.48		c0.14	0.29	
v/s Ratio Perm	0.01			c0.05		0.13	0.01		0.13	0.45		
v/c Ratio	0.11	0.10		0.95	0.52	0.51	0.02	0.95	0.26	0.89	0.43	
Uniform Delay, d1	54.6	54.6		44.3	38.8	38.6	14.9	28.4	17.0	38.4	8.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.16	0.61	
Incremental Delay, d2	0.8	0.5		34.5	1.5	1.2	0.1	13.2	0.8	24.8	0.6	
Delay (s)	55.4	55.1		78.8	40.2	39.8	15.0	41.5	17.8	69.4	5.8	
Level of Service	E	E		E	D	D	B	D	B	E	A	
Approach Delay (s)		55.2			52.3			37.8			19.6	
Approach LOS		E			D			D			B	

Intersection Summary

HCM Average Control Delay	36.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	89.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: UPPER MIDDLE & BRONTE

2019 TOTAL
AM PEAK HOUR

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				 				 			 	
Volume (vph)	15	131	243	334	50	169	48	789	269	335	1584	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1785	1879	1597	3395	1879	1566	1785	3336	1536	1750	3433	1597
Flt Permitted	0.72	1.00	1.00	0.95	1.00	1.00	0.08	1.00	1.00	0.24	1.00	1.00
Satd. Flow (perm)	1356	1879	1597	3395	1879	1566	144	3336	1536	445	3433	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	142	264	363	54	184	52	858	292	364	1722	13
RTOR Reduction (vph)	0	0	20	0	0	127	0	0	146	0	0	4
Lane Group Flow (vph)	16	142	244	363	54	57	52	858	146	364	1722	9
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	7%	4%	2%	4%	0%
Turn Type	Perm		Perm	Prot		Perm	Perm		Perm	pm+pt		Perm
Protected Phases		4		3	8			2			1	6
Permitted Phases	4		4			8	2		2	6		6
Actuated Green, G (s)	17.0	17.0	17.0	12.0	34.0	34.0	57.0	57.0	57.0	72.0	72.0	72.0
Effective Green, g (s)	20.0	20.0	20.0	14.0	37.0	37.0	60.0	60.0	60.0	75.0	75.0	75.0
Actuated g/C Ratio	0.17	0.17	0.17	0.12	0.31	0.31	0.50	0.50	0.50	0.62	0.62	0.62
Clearance Time (s)	7.0	7.0	7.0	5.0	7.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	226	313	266	396	579	483	72	1668	768	441	2146	998
v/s Ratio Prot		0.08		c0.11	0.03			0.26		c0.10	c0.50	
v/s Ratio Perm	0.01		c0.15			0.04	0.36		0.10	0.41		0.01
v/c Ratio	0.07	0.45	0.92	0.92	0.09	0.12	0.72	0.51	0.19	0.83	0.80	0.01
Uniform Delay, d1	42.2	45.1	49.2	52.4	29.6	29.8	23.5	20.2	16.6	13.3	16.9	8.5
Progression Factor	1.00	1.00	1.00	0.76	0.78	0.84	0.96	0.95	2.07	1.00	1.00	1.00
Incremental Delay, d2	0.1	1.0	33.7	25.1	0.1	0.1	46.2	1.1	0.5	11.9	3.3	0.0
Delay (s)	42.3	46.1	82.9	65.0	23.1	25.2	68.8	20.4	34.9	25.3	20.2	8.5
Level of Service	D	D	F	E	C	C	E	C	C	C	C	A
Approach Delay (s)		69.0			49.0			26.0			21.0	
Approach LOS		E			D			C			C	
Intersection Summary												
HCM Average Control Delay			31.0								HCM Level of Service	C
HCM Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			120.0								Sum of lost time (s)	7.0
Intersection Capacity Utilization			78.4%								ICU Level of Service	D
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
27: NORTH ACCESS & BRONTE

2019 TOTAL
AM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	42	19	1090	13	7	2153
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1750	1566	3368	1566	1750	3368
Flt Permitted	0.95	1.00	1.00	1.00	0.22	1.00
Satd. Flow (perm)	1750	1566	3368	1566	414	3368
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	21	1185	14	8	2340
RTOR Reduction (vph)	0	19	0	2	0	0
Lane Group Flow (vph)	46	2	1185	12	8	2340
Heavy Vehicles (%)	2%	2%	6%	2%	2%	6%
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Actuated Green, G (s)	7.5	7.5	98.5	98.5	98.5	98.5
Effective Green, g (s)	10.5	10.5	101.5	101.5	101.5	101.5
Actuated g/C Ratio	0.09	0.09	0.85	0.85	0.85	0.85
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	153	137	2849	1325	350	2849
v/s Ratio Prot	c0.03		0.35			c0.69
v/s Ratio Perm		0.00		0.01	0.02	
v/c Ratio	0.30	0.01	0.42	0.01	0.02	0.82
Uniform Delay, d1	51.3	50.0	2.2	1.4	1.5	4.7
Progression Factor	1.00	1.00	1.05	1.12	0.60	0.87
Incremental Delay, d2	1.1	0.0	0.4	0.0	0.1	1.5
Delay (s)	52.4	50.1	2.7	1.6	0.9	5.6
Level of Service	D	D	A	A	A	A
Approach Delay (s)	51.7		2.7			5.6
Approach LOS	D		A			A

Intersection Summary

HCM Average Control Delay	5.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 25: SOUTH ACCESS & BRONTE

2019 TOTAL
 AM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	162	78	1019	76	41	2155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1750	1566	3368	1566	1750	3466
Flt Permitted	0.95	1.00	1.00	1.00	0.23	1.00
Satd. Flow (perm)	1750	1566	3368	1566	432	3466
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	176	85	1108	83	45	2342
RTOR Reduction (vph)	0	72	0	18	0	0
Lane Group Flow (vph)	176	13	1108	65	45	2342
Heavy Vehicles (%)	2%	2%	6%	2%	2%	3%
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Actuated Green, G (s)	14.7	14.7	91.3	91.3	91.3	91.3
Effective Green, g (s)	17.7	17.7	94.3	94.3	94.3	94.3
Actuated g/C Ratio	0.15	0.15	0.79	0.79	0.79	0.79
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	258	231	2647	1231	339	2724
v/s Ratio Prot	c0.10		0.33			c0.68
v/s Ratio Perm		0.01		0.04	0.10	
v/c Ratio	0.68	0.05	0.42	0.05	0.13	0.86
Uniform Delay, d1	48.5	44.0	4.1	2.9	3.1	8.5
Progression Factor	1.00	1.00	2.24	4.84	0.95	0.51
Incremental Delay, d2	7.2	0.1	0.5	0.1	0.5	2.3
Delay (s)	55.7	44.1	9.7	14.0	3.4	6.6
Level of Service	E	D	A	B	A	A
Approach Delay (s)	51.9		10.0			6.5
Approach LOS	D		A			A

Intersection Summary

HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: WOODLANDS & BRONTE

2019 TOTAL
AM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	108	58	1031	46	133	2161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1566	1521	3400	1597	1785	3400
Flt Permitted	0.95	1.00	1.00	1.00	0.23	1.00
Satd. Flow (perm)	1566	1521	3400	1597	438	3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	63	1121	50	145	2349
RTOR Reduction (vph)	0	54	0	10	0	0
Lane Group Flow (vph)	117	9	1121	40	145	2349
Heavy Vehicles (%)	14%	5%	5%	0%	0%	5%
Turn Type	custom			Perm	Perm	
Protected Phases			2			6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	13.3	13.3	92.7	92.7	92.7	92.7
Effective Green, g (s)	16.3	16.3	95.7	95.7	95.7	95.7
Actuated g/C Ratio	0.14	0.14	0.80	0.80	0.80	0.80
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	213	207	2712	1274	349	2712
v/s Ratio Prot			0.33			c0.69
v/s Ratio Perm	c0.07	0.01		0.02	0.33	
v/c Ratio	0.55	0.04	0.41	0.03	0.42	0.87
Uniform Delay, d1	48.4	45.1	3.7	2.5	3.7	8.0
Progression Factor	1.00	1.00	1.27	2.69	1.00	0.66
Incremental Delay, d2	2.9	0.1	0.4	0.0	1.8	2.1
Delay (s)	51.3	45.1	5.1	6.8	5.5	7.4
Level of Service	D	D	A	A	A	A
Approach Delay (s)	49.1		5.2			7.3
Approach LOS	D		A			A























Intersection Summary

HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: NSR & BRONTE





















2019 TOTAL
AM PEAK HOUR

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	2	0	2	34	2	44	3	1178	153	126	1864	2	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0		3.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0		
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95		
Frt		0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		
Flt Protected		0.98		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1709		1615	1635	1439	1785	3275	1566	1733	3368		
Flt Permitted		0.83		0.77	0.93	1.00	0.07	1.00	1.00	0.19	1.00		
Satd. Flow (perm)		1457		1301	1588	1439	124	3275	1566	349	3368		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	2	0	2	37	2	48	3	1280	166	137	2026	2	
RTOR Reduction (vph)	0	2	0	0	0	41	0	0	24	0	0	0	
Lane Group Flow (vph)	0	2	0	20	19	7	3	1280	142	137	2028	0	
Heavy Vehicles (%)	0%	0%	0%	5%	0%	11%	0%	9%	2%	3%	6%	0%	
Turn Type	Perm			pm+pt		Perm	Perm		pm+ov	Perm			
Protected Phases		4		3	8			2	3		6		
Permitted Phases	4			8		8	2		2		6		
Actuated Green, G (s)		1.3		14.3	14.3	14.3	91.7	91.7	100.7	91.7	91.7		
Effective Green, g (s)		4.3		15.3	17.3	17.3	94.7	94.7	102.7	94.7	94.7		
Actuated g/C Ratio		0.04		0.13	0.14	0.14	0.79	0.79	0.86	0.79	0.79		
Clearance Time (s)		7.0		4.0	7.0	7.0	7.0	7.0	4.0	7.0	7.0		
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)		52		192	234	207	98	2585	1340	275	2658		
v/s Ratio Prot				c0.01	c0.01			0.39	0.01		c0.60		
v/s Ratio Perm		0.00		0.00	0.00	0.00	0.02		0.08	0.39			
v/c Ratio		0.04		0.10	0.08	0.03	0.03	0.50	0.11	0.50	0.76		
Uniform Delay, d1		55.9		46.3	44.5	44.2	2.7	4.4	1.4	4.4	6.7		
Progression Factor		1.00		0.73	0.73	1.49	0.44	0.40	0.31	0.23	0.22		
Incremental Delay, d2		0.3		0.2	0.1	0.1	0.6	0.6	0.0	3.2	1.1		
Delay (s)		56.2		34.0	32.6	65.8	1.8	2.4	0.5	4.2	2.6		
Level of Service		E		C	C	E	A	A	A	A	A		
Approach Delay (s)		56.2			51.2			2.2			2.7		
Approach LOS		E			D			A			A		
Intersection Summary													
HCM Average Control Delay			3.7									HCM Level of Service	A
HCM Volume to Capacity ratio			0.65										
Actuated Cycle Length (s)			120.0									Sum of lost time (s)	7.0
Intersection Capacity Utilization			68.3%									ICU Level of Service	C
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: NSR-EW & NSR-Halton

2019 TOTAL
AM PEAK HOUR

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	183	10	133	1	0	0	84	57	6	1	9	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0			4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00			1.00	1.00			1.00	1.00
Frt	1.00	0.86		1.00			1.00	0.98			1.00	0.85
Flt Protected	0.95	1.00		0.95			0.95	1.00			1.00	1.00
Satd. Flow (prot)	1785	1602		1785			1716	1850			1870	1597
Flt Permitted	0.76	1.00		0.65			0.75	1.00			0.99	1.00
Satd. Flow (perm)	1423	1602		1221			1356	1850			1859	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	199	11	145	1	0	0	91	62	7	1	10	50
RTOR Reduction (vph)	0	62	0	0	0	0	0	3	0	0	0	32
Lane Group Flow (vph)	199	94	0	1	0	0	91	66	0	0	11	18
Heavy Vehicles (%)	0%	0%	1%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		2			6			8				4
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	66.0	66.0		66.0			40.0	40.0			40.0	40.0
Effective Green, g (s)	69.0	69.0		69.0			43.0	43.0			43.0	43.0
Actuated g/C Ratio	0.57	0.57		0.57			0.36	0.36			0.36	0.36
Clearance Time (s)	7.0	7.0		7.0			7.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	818	921		702			486	663			666	572
v/s Ratio Prot		0.06						0.04				
v/s Ratio Perm	c0.14			0.00			c0.07				0.01	0.01
v/c Ratio	0.24	0.10		0.00			0.19	0.10			0.02	0.03
Uniform Delay, d1	12.6	11.5		10.8			26.5	25.6			24.9	25.0
Progression Factor	1.36	2.63		1.00			1.00	1.00			1.00	1.00
Incremental Delay, d2	0.7	0.2		0.0			0.9	0.3			0.0	0.1
Delay (s)	17.8	30.5		10.9			27.3	25.9			24.9	25.1
Level of Service	B	C		B			C	C			C	C
Approach Delay (s)		23.4			10.9			26.7			25.1	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM Average Control Delay			24.5				HCM Level of Service				C	
HCM Volume to Capacity ratio			0.22									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)				8.0	
Intersection Capacity Utilization			34.8%				ICU Level of Service				A	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: WB OFF RAMP & BRONTE

2019 TOTAL
AM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	212	303	989	0	0	1121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	0.97	0.91	0.95			0.95
Frt	0.94	0.85	1.00			1.00
Flt Protected	0.97	1.00	1.00			1.00
Satd. Flow (prot)	3111	1321	3336			3400
Flt Permitted	0.97	1.00	1.00			1.00
Satd. Flow (perm)	3111	1321	3336			3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	329	1075	0	0	1218
RTOR Reduction (vph)	110	110	0	0	0	0
Lane Group Flow (vph)	271	68	1075	0	0	1218
Heavy Vehicles (%)	5%	10%	7%	2%	2%	5%
Turn Type	Perm					
Protected Phases	8		2			6
Permitted Phases	8					
Actuated Green, G (s)	15.4	15.4	90.6			90.6
Effective Green, g (s)	18.4	18.4	93.6			93.6
Actuated g/C Ratio	0.15	0.15	0.78			0.78
Clearance Time (s)	7.0	7.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	477	203	2602			2652
v/s Ratio Prot	c0.09		0.32			c0.36
v/s Ratio Perm		0.05				
v/c Ratio	0.57	0.33	0.41			0.46
Uniform Delay, d1	47.1	45.3	4.3			4.5
Progression Factor	1.00	1.00	0.66			0.85
Incremental Delay, d2	1.6	1.0	0.4			0.5
Delay (s)	48.7	46.3	3.2			4.3
Level of Service	D	D	A			A
Approach Delay (s)	47.9		3.2			4.3
Approach LOS	D		A			A
























Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
























3: EB OFF RAMP & BRONTE

2019 TOTAL
AM PEAK HOUR

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	11	4	517	6	592	1	821	335	579	1160	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0	3.0	4.0	4.0	4.0	3.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.96		1.00	0.85	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1785	1808		1668	1412	1405	1785	3305	1529	1750	3428	
Flt Permitted	0.55	1.00		0.48	1.00	1.00	0.22	1.00	1.00	0.13	1.00	
Satd. Flow (perm)	1039	1808		843	1412	1405	409	3305	1529	241	3428	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	10	12	4	562	7	643	1	892	364	629	1261	15
RTOR Reduction (vph)	0	4	0	0	203	202	0	0	215	0	0	0
Lane Group Flow (vph)	10	12	0	562	126	119	1	892	149	629	1276	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	0%	0%	0%	7%	0%	8%	0%	8%	2%	2%	4%	0%
Turn Type	Perm			pm+pt			Perm	Perm		Perm	pm+pt	
Protected Phases		4		3	8			2			1	6
Permitted Phases	4			8		8	2		2		6	
Actuated Green, G (s)	4.4	4.4		41.4	41.4	41.4	27.6	27.6	27.6	65.6	65.6	
Effective Green, g (s)	7.4	7.4		42.4	44.4	44.4	30.6	30.6	30.6	65.6	68.6	
Actuated g/C Ratio	0.06	0.06		0.35	0.37	0.37	0.26	0.26	0.26	0.55	0.57	
Clearance Time (s)	6.0	6.0		4.0	6.0	6.0	7.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	64	111		532	522	520	104	843	390	572	1960	
v/s Ratio Prot		0.01		c0.30	0.09			0.27		c0.32	0.37	
v/s Ratio Perm	0.01			c0.07		0.08	0.00		0.10	c0.28		
v/c Ratio	0.16	0.11		1.06	0.24	0.23	0.01	1.06	0.38	1.10	0.65	
Uniform Delay, d1	53.3	53.2		37.1	26.2	26.0	33.4	44.7	36.9	34.6	17.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.03	
Incremental Delay, d2	1.1	0.4		54.8	0.2	0.2	0.2	47.5	2.8	67.0	1.6	
Delay (s)	54.5	53.6		91.9	26.4	26.2	33.6	92.2	39.7	99.5	19.7	
Level of Service	D	D		F	C	C	C	F	D	F	B	
Approach Delay (s)		54.0			56.7			77.0			46.0	
Approach LOS		D			E			E			D	
Intersection Summary												
HCM Average Control Delay			57.9								HCM Level of Service	E
HCM Volume to Capacity ratio			1.02									
Actuated Cycle Length (s)			120.0								Sum of lost time (s)	6.0
Intersection Capacity Utilization			100.1%								ICU Level of Service	G
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
18: UPPER MIDDLE & BRONTE

2019 TOTAL
PM PEAK HOUR

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	18	33	100	241	82	247	146	1597	348	220	922	36	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0		3.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Frt	1.00	0.89		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1785	3167		3395	1879	1566	1785	3336	1536	1750	3433	1597	
Flt Permitted	0.70	1.00		0.95	1.00	1.00	0.29	1.00	1.00	0.06	1.00	1.00	
Satd. Flow (perm)	1314	3167		3395	1879	1566	537	3336	1536	107	3433	1597	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	20	36	109	262	89	268	159	1736	378	239	1002	39	
RTOR Reduction (vph)	0	99	0	0	0	118	0	0	94	0	0	10	
Lane Group Flow (vph)	20	46	0	262	89	150	159	1736	284	239	1002	29	
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	7%	4%	2%	4%	0%	
Turn Type	Perm			Prot		Perm	Perm		Perm	pm+pt		Perm	
Protected Phases		4		3	8			2		1	6		
Permitted Phases	4					8	2		2	6		6	
Actuated Green, G (s)	7.9	7.9		8.0	20.9	20.9	65.6	65.6	65.6	85.1	85.1	85.1	
Effective Green, g (s)	10.9	10.9		10.0	23.9	23.9	68.6	68.6	68.6	88.1	88.1	88.1	
Actuated g/C Ratio	0.09	0.09		0.08	0.20	0.20	0.57	0.57	0.57	0.73	0.73	0.73	
Clearance Time (s)	7.0	7.0		5.0	7.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	119	288		283	374	312	307	1907	878	346	2520	1172	
v/s Ratio Prot		0.01		c0.08	0.05			c0.52		c0.11	0.29		
v/s Ratio Perm	0.02					c0.10	0.30		0.18	0.39		0.02	
v/c Ratio	0.17	0.16		0.93	0.24	0.48	0.52	0.91	0.32	0.69	0.40	0.02	
Uniform Delay, d1	50.4	50.3		54.6	40.4	42.6	15.6	23.0	13.5	34.6	6.0	4.3	
Progression Factor	1.00	1.00		0.74	0.80	0.85	0.81	0.68	0.89	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.3		33.3	0.3	1.1	4.6	6.2	0.7	5.8	0.5	0.0	
Delay (s)	51.0	50.6		74.0	32.6	37.5	17.4	21.7	12.7	40.4	6.5	4.4	
Level of Service	D	D		E	C	D	B	C	B	D	A	A	
Approach Delay (s)		50.6			52.2			19.9			12.7		
Approach LOS		D			D			B			B		
Intersection Summary													
HCM Average Control Delay			23.6		HCM Level of Service					C			
HCM Volume to Capacity ratio			0.80										
Actuated Cycle Length (s)			120.0		Sum of lost time (s)					7.0			
Intersection Capacity Utilization			80.7%		ICU Level of Service					D			
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
27: STREET B & BRONTE

2019 TOTAL
PM PEAK HOUR



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	28	12	2078	45	20	1243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1750	1566	3368	1566	1750	3368
Flt Permitted	0.95	1.00	1.00	1.00	0.06	1.00
Satd. Flow (perm)	1750	1566	3368	1566	107	3368
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	13	2259	49	22	1351
RTOR Reduction (vph)	0	12	0	6	0	0
Lane Group Flow (vph)	30	1	2259	43	22	1351
Heavy Vehicles (%)	2%	2%	6%	2%	2%	6%
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Actuated Green, G (s)	5.2	5.2	100.8	100.8	100.8	100.8
Effective Green, g (s)	8.2	8.2	103.8	103.8	103.8	103.8
Actuated g/C Ratio	0.07	0.07	0.86	0.86	0.86	0.86
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	120	107	2913	1355	93	2913
v/s Ratio Prot	c0.02		c0.67			0.40
v/s Ratio Perm		0.00		0.03	0.21	
v/c Ratio	0.25	0.01	0.78	0.03	0.24	0.46
Uniform Delay, d1	53.0	52.1	3.3	1.1	1.4	1.8
Progression Factor	1.00	1.00	0.91	1.28	0.73	0.73
Incremental Delay, d2	1.1	0.0	1.3	0.0	5.2	0.5
Delay (s)	54.1	52.1	4.3	1.5	6.2	1.8
Level of Service	D	D	A	A	A	A
Approach Delay (s)	53.5		4.3			1.9
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	4.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 25: STREET A & BRONTE

2019 TOTAL
 PM PEAK HOUR

















Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	140	79	2045	193	102	1169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	3.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1750	1566	3368	1566	1750	3466
Flt Permitted	0.95	1.00	1.00	1.00	0.05	1.00
Satd. Flow (perm)	1750	1566	3368	1566	87	3466
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	86	2223	210	111	1271
RTOR Reduction (vph)	0	74	0	32	0	0
Lane Group Flow (vph)	152	12	2223	178	111	1271
Heavy Vehicles (%)	2%	2%	6%	2%	2%	3%
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	14.1	14.1	81.1	81.1	91.9	91.9
Effective Green, g (s)	17.1	17.1	84.1	84.1	92.9	94.9
Actuated g/C Ratio	0.14	0.14	0.70	0.70	0.77	0.79
Clearance Time (s)	7.0	7.0	7.0	7.0	4.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	249	223	2360	1098	175	2741
v/s Ratio Prot	c0.09		c0.66		c0.04	0.37
v/s Ratio Perm		0.01		0.11	0.45	
v/c Ratio	0.61	0.05	0.94	0.16	0.63	0.46
Uniform Delay, d1	48.3	44.5	15.8	6.1	32.7	4.1
Progression Factor	1.00	1.00	1.41	1.24	1.29	0.80
Incremental Delay, d2	4.4	0.1	6.7	0.2	6.7	0.5
Delay (s)	52.7	44.6	29.0	7.7	49.0	3.8
Level of Service	D	D	C	A	D	A
Approach Delay (s)	49.8		27.2			7.5
Approach LOS	D		C			A

Intersection Summary			
HCM Average Control Delay	21.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: WOODLANDS & BRONTE

2019 TOTAL
PM PEAK HOUR

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	76	87	2138	91	51	1255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1566	1521	3400	1597	1785	3400
Flt Permitted	0.95	1.00	1.00	1.00	0.04	1.00
Satd. Flow (perm)	1566	1521	3400	1597	77	3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	95	2324	99	55	1364
RTOR Reduction (vph)	0	16	0	16	0	0
Lane Group Flow (vph)	83	79	2324	83	55	1364
Heavy Vehicles (%)	14%	5%	5%	0%	0%	5%
Turn Type	custom			Perm	Perm	
Protected Phases			2			6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	11.6	11.6	94.4	94.4	94.4	94.4
Effective Green, g (s)	14.6	14.6	97.4	97.4	97.4	97.4
Actuated g/C Ratio	0.12	0.12	0.81	0.81	0.81	0.81
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	191	185	2760	1296	62	2760
v/s Ratio Prot			0.68			0.40
v/s Ratio Perm	c0.05	0.05		0.05	c0.71	
v/c Ratio	0.43	0.43	0.84	0.06	0.89	0.49
Uniform Delay, d1	48.9	48.8	6.7	2.2	7.6	3.6
Progression Factor	1.00	1.00	0.44	1.04	1.60	1.32
Incremental Delay, d2	1.6	1.6	2.0	0.1	79.6	0.6
Delay (s)	50.5	50.4	4.9	2.4	91.7	5.3
Level of Service	D	D	A	A	F	A
Approach Delay (s)	50.4		4.8			8.6
Approach LOS	D		A			A

Intersection Summary























HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: NSR & BRONTE

2019 TOTAL
PM PEAK HOUR

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	1	0	0	133	0	159	1	2122	49	56	1270	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0		3.0	4.0	4.0	4.0	4.0	0.0	4.0	4.0		
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95		
Frt		1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		
Flt Protected		0.95		0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1785		1615	1615	1439	1785	3275	1566	1733	3368		
Flt Permitted		0.71		0.84	0.76	1.00	0.15	1.00	1.00	0.05	1.00		
Satd. Flow (perm)		1328		1436	1287	1439	284	3275	1566	85	3368		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	1	0	0	145	0	173	1	2307	53	61	1380	0	
RTOR Reduction (vph)	0	0	0	0	0	9	0	0	7	0	0	0	
Lane Group Flow (vph)	0	1	0	72	73	164	1	2307	46	61	1380	0	
Heavy Vehicles (%)	0%	0%	0%	5%	0%	11%	0%	9%	2%	3%	6%	0%	
Turn Type	Perm			pm+pt		Perm	Perm		pm+ov	Perm			
Protected Phases		4		3	8			2	3		6		
Permitted Phases	4			8		8	2		2		6		
Actuated Green, G (s)		5.3		23.6	23.6	23.6	82.4	82.4	97.7	82.4	82.4		
Effective Green, g (s)		8.3		23.6	26.6	26.6	85.4	85.4	103.7	85.4	85.4		
Actuated g/C Ratio		0.07		0.20	0.22	0.22	0.71	0.71	0.86	0.71	0.71		
Clearance Time (s)		7.0		3.0	7.0	7.0	7.0	7.0	3.0	7.0	7.0		
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)		92		305	335	319	202	2331	1353	60	2397		
v/s Ratio Prot				0.03	0.03			0.70	0.01		0.41		
v/s Ratio Perm		0.00		0.02	0.02	c0.11	0.00		0.02	c0.71			
v/c Ratio		0.01		0.24	0.22	0.52	0.00	0.99	0.03	1.02	0.58		
Uniform Delay, d1		52.0		40.6	38.2	41.0	5.0	16.9	1.1	17.3	8.5		
Progression Factor		1.00		0.96	0.96	0.96	0.86	0.96	0.57	0.78	0.55		
Incremental Delay, d2		0.0		0.4	0.3	1.4	0.0	9.5	0.0	114.2	0.9		
Delay (s)		52.1		39.4	37.1	40.7	4.3	25.6	0.7	127.7	5.6		
Level of Service		D		D	D	D	A	C	A	F	A		
Approach Delay (s)		52.1			39.6			25.0			10.7		
Approach LOS		D			D			C			B		
Intersection Summary													
HCM Average Control Delay			21.2									HCM Level of Service	C
HCM Volume to Capacity ratio			0.89										
Actuated Cycle Length (s)			120.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			81.8%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

11: NSR-EW & NSR-Halton

2019 TOTAL
PM PEAK HOUR



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	52	2	47	1	26	0	147	25	0	0	31	227
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.86		1.00	1.00		1.00	1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	1785	1592		1785	1879		1716	1879			1879	1597
Flt Permitted	0.74	1.00		0.72	1.00		0.73	1.00			1.00	1.00
Satd. Flow (perm)	1388	1592		1357	1879		1328	1879			1879	1597
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	2	51	1	28	0	160	27	0	0	34	247
RTOR Reduction (vph)	0	34	0	0	0	0	0	0	0	0	0	99
Lane Group Flow (vph)	57	19	0	1	28	0	160	27	0	0	34	148
Heavy Vehicles (%)	0%	0%	1%	0%	0%	0%	4%	0%	0%	0%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		2			6			8				4
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	37.0	37.0		37.0	37.0		69.0	69.0			69.0	69.0
Effective Green, g (s)	40.0	40.0		40.0	40.0		72.0	72.0			72.0	72.0
Actuated g/C Ratio	0.33	0.33		0.33	0.33		0.60	0.60			0.60	0.60
Clearance Time (s)	7.0	7.0		7.0	7.0		7.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	463	531		452	626		797	1127			1127	958
v/s Ratio Prot		0.01			0.01			0.01			0.02	
v/s Ratio Perm	c0.04			0.00			c0.12					0.09
v/c Ratio	0.12	0.04		0.00	0.04		0.20	0.02			0.03	0.15
Uniform Delay, d1	27.8	27.0		26.7	27.1		10.9	9.7			9.8	10.6
Progression Factor	0.91	0.78		1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	0.5	0.1		0.0	0.1		0.6	0.0			0.0	0.3
Delay (s)	25.9	21.2		26.7	27.2		11.5	9.8			9.8	10.9
Level of Service	C	C		C	C		B	A			A	B
Approach Delay (s)		23.6			27.2			11.2			10.8	
Approach LOS		C			C			B			B	














Intersection Summary

HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.17		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	35.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group
























HCM Signalized Intersection Capacity Analysis
6: WB OFF RAMP & BRONTE

2019 TOTAL
PM PEAK HOUR

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 			 
Volume (vph)	277	577	1966	0	0	871
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	0.97	0.91	0.95			0.95
Frt	0.92	0.85	1.00			1.00
Flt Protected	0.98	1.00	1.00			1.00
Satd. Flow (prot)	3055	1321	3336			3400
Flt Permitted	0.98	1.00	1.00			1.00
Satd. Flow (perm)	3055	1321	3336			3400
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	627	2137	0	0	947
RTOR Reduction (vph)	11	11	0	0	0	0
Lane Group Flow (vph)	604	302	2137	0	0	947
Heavy Vehicles (%)	5%	10%	7%	2%	2%	5%
Turn Type	Perm					
Protected Phases	8		2			6
Permitted Phases	8					
Actuated Green, G (s)	26.6	26.6	79.4			79.4
Effective Green, g (s)	29.6	29.6	82.4			82.4
Actuated g/C Ratio	0.25	0.25	0.69			0.69
Clearance Time (s)	7.0	7.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	754	326	2291			2335
v/s Ratio Prot	0.20		c0.64			0.28
v/s Ratio Perm	c0.23					
v/c Ratio	0.85dr	0.93	0.93			0.41
Uniform Delay, d1	42.4	44.1	16.4			8.2
Progression Factor	1.00	1.00	0.43			1.24
Incremental Delay, d2	6.1	31.0	4.9			0.5
Delay (s)	48.5	75.2	11.9			10.6
Level of Service	D	E	B			B
Approach Delay (s)	57.5		11.9			10.6
Approach LOS	E		B			B
Intersection Summary						
HCM Average Control Delay			22.1	HCM Level of Service		C
HCM Volume to Capacity ratio			0.93			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			84.8%	ICU Level of Service		E
Analysis Period (min)	15					
dr Defacto Right Lane. Recode with 1 though lane as a right lane.						
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
3: EB OFF RAMP & BRONTE

2019 TOTAL
PM PEAK HOUR

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	7	5	316	5	749	5	1519	273	345	945	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		3.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.94		1.00	0.85	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1783	1770		1700	1340	1335	1785	3336	1551	1653	3398	
Flt Permitted	0.69	1.00		0.59	1.00	1.00	0.28	1.00	1.00	0.07	1.00	
Satd. Flow (perm)	1294	1770		1053	1340	1335	522	3336	1551	125	3398	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	8	5	343	5	814	5	1651	297	375	1027	5
RTOR Reduction (vph)	0	5	0	0	194	194	0	0	99	0	0	0
Lane Group Flow (vph)	7	8	0	343	218	213	5	1651	198	375	1032	0
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	0%	0%	0%	5%	0%	12%	0%	7%	3%	8%	5%	0%
Turn Type	Perm			pm+pt		Perm	Perm		Perm	pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	2.8	2.8		27.4	27.4	27.4	52.8	52.8	52.8	78.6	78.6	
Effective Green, g (s)	5.8	5.8		28.4	30.4	30.4	55.8	55.8	55.8	78.6	81.6	
Actuated g/C Ratio	0.05	0.05		0.24	0.25	0.25	0.46	0.46	0.46	0.65	0.68	
Clearance Time (s)	7.0	7.0		4.0	7.0	7.0	7.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	63	86		366	339	338	243	1551	721	372	2311	
v/s Ratio Prot		0.00		c0.17	0.16			c0.49		c0.19	0.30	
v/s Ratio Perm	0.01			c0.05		0.16	0.01		0.13	0.47		
v/c Ratio	0.11	0.10		0.94	0.64	0.63	0.02	1.06	0.27	1.01	0.45	
Uniform Delay, d1	54.6	54.6		44.0	40.0	39.8	17.3	32.1	19.7	40.1	8.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.03	0.53	
Incremental Delay, d2	0.8	0.5		31.0	4.1	3.7	0.2	42.2	0.9	46.6	0.6	
Delay (s)	55.4	55.1		75.1	44.1	43.5	17.5	74.3	20.6	87.9	5.2	
Level of Service	E	E		E	D	D	B	E	C	F	A	
Approach Delay (s)		55.2			53.0			66.0			27.3	
Approach LOS		E			D			E			C	
Intersection Summary												
HCM Average Control Delay			50.6								HCM Level of Service	D
HCM Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			120.0								Sum of lost time (s)	10.0
Intersection Capacity Utilization			95.3%								ICU Level of Service	F
Analysis Period (min)			15									
c	Critical Lane Group											