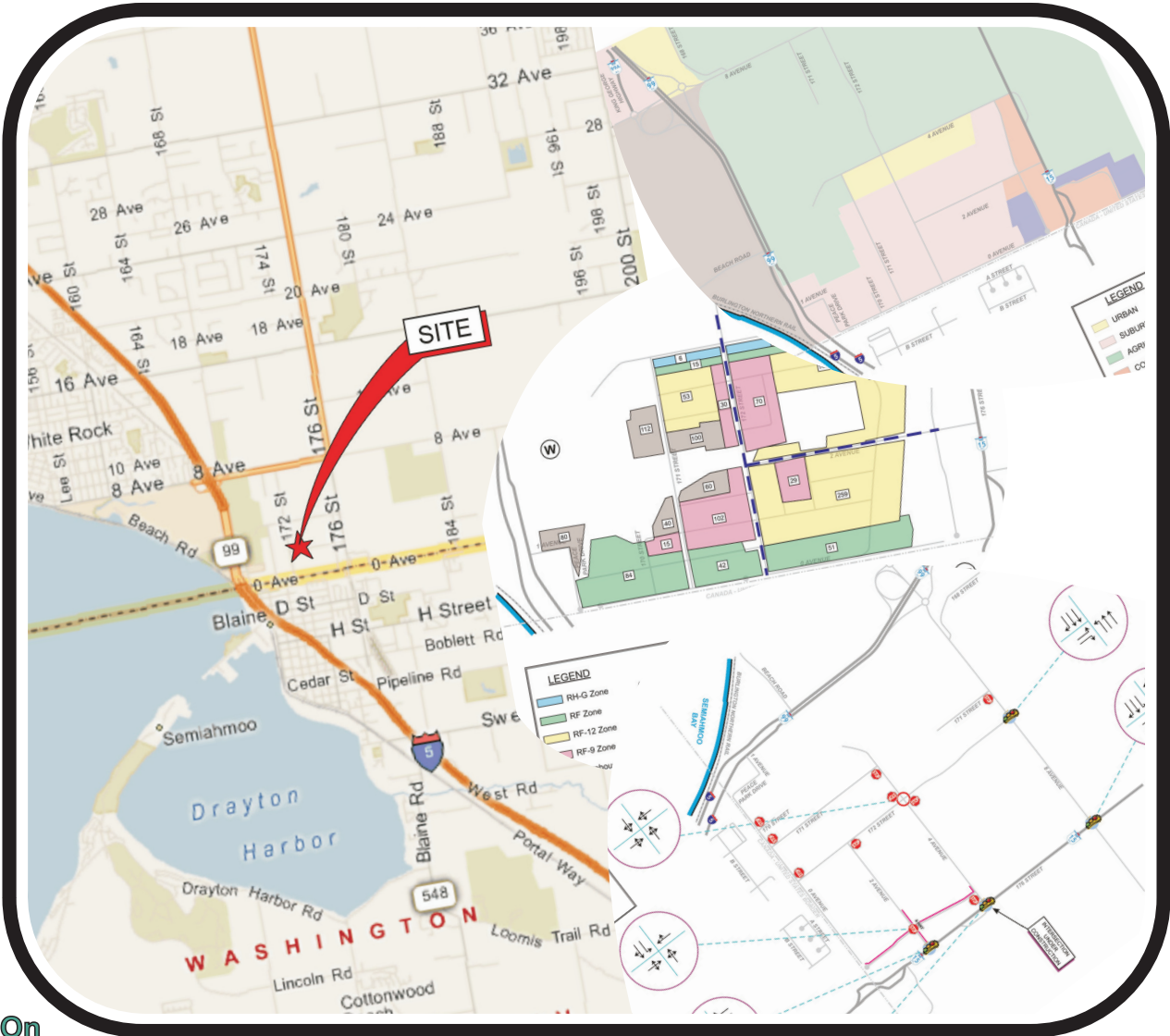


Report to
CITY OF SURREY



On

**TRANSPORTATION REQUIREMENTS
FOR DOUGLAS NEIGHBORHOOD**



- *Traffic Impact*
- *Parking*
- *Transportation Planning*
- *Corridor Studies*
- *Traffic Operations*
- *Transit*
- *Trucking*
- *Network Modelling*
- *Bicycles/Pedestrians*

Email: JABoan@surrey.ca

June 12, 2007

City of Surrey
14245 – 56th Avenue
Surrey, BC V3X 3A2

Attention: Mr. Jaime Boan, P. Eng.

Dear Jaime:


Re: Douglas Area NCP – Traffic

In response to the request of both the City of Surrey and Equitas Developments, we have now undertaken a study to establish the transportation network requirements of the updated land use plan proposed for the Douglas Community south of 4 Avenue between 176 Street/Highway 15 and Highway 99. The attached report documents the work undertaken together with the findings and conclusions. It also includes responses to the additional issues raised by the Ministry of Transportation at the conclusion of the original NCP traffic study over the future requirements of intersections under their jurisdiction.

I trust that this provides a suitable framework that allows the developments in this area to proceed in an orderly manner. Please do not hesitate to call if you have any questions or need additional information.

Yours truly,

T. J. WARD CONSULTING GROUP INC.


Trevor J. Ward, P. Eng., M.B.A.
President

cc: James Evans, Equitas, jaevans@equitas.ca
Bob Ambardar, P.Eng., Cressey Developments, bobambardar@cressey.com
Patrick Hill, Ministry of Transportation, New Westminster, Patrick.Hill@gov.bc.ca

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1.0 INTRODUCTION

This document presents the results of a review of the transportation component of the Douglas Community which for the purpose of this study extends from 0 Avenue on the U.S. border to 4 Avenue on the north side and from 176 Street/Highway 15 on the east side to Highway 99 on the west side in the City of Surrey. The extent of this area in the context of the broader area is shown in Exhibit 1.1 and an aerial photo is shown in Exhibit 1.2.

It is expected that this area will see a significant increase in its population from less than 1,000 in 2006 to over 4,200 in 2021. The purpose of the review was to confirm the form of the road network required in the area to accommodate the generated traffic. The study was undertaken at the request of the City of Surrey, based on a Terms of Reference agreed to by the City.

2.0 EXISTING CONDITIONS

This section describes the existing transportation system in the Douglas area and serves as the base on which future traffic conditions are forecasted and on which the recommendations are based.

2.1 Road Network

The City of Surrey, in their *Road Classification Plan R91*, have a number of different classifications ranging from “provincial highway” through “arterials” and “collector” roads to “local” streets. In the study area, Highway 99, which is a controlled access freeway, and Highway 15/176 Street, which is a controlled access highway, are both under the jurisdiction of the Ministry of Transportation and are generally intended to connect primary areas of traffic generation, whether these be residential, industrial, or commercial concentrations, and to accommodate high volumes of traffic moving at higher speeds and, for freeways, under free-flowing conditions. In this case, both facilities connect to Canada/U.S.A. border crossing points at the south ends.

All other roads in the study area are under the jurisdiction of the City of Surrey. The function of arterial roads in the municipality is to carry through traffic from one area of a municipality to another minimizing interference from and to adjacent land uses. Collector roads in Surrey can be either major or limited and typically collect traffic from local areas and carry this traffic to arterial roads. Local roads provide direct access to adjacent lands.

The existing road network in the Douglas area showing their classification is illustrated in Exhibit 2.1. The key roads relevant to this study are as follows:

- (a) Highway 99: This is a divided four lane controlled access freeway which connects Interstate 5 at the U.S. border with the Trans Canada Highway on the North Shore of Vancouver. It is the primary route for many residents of South Surrey and White Rock

travelling to Vancouver, Richmond (including the airport), South Delta, and the ferry terminals. It has all-movement interchanges at 8 Avenue, Highway 91, Ladner Trunk Road and Highway 17, and limited movement interchanges at 32 Avenue/152 Street and King George Highway. It has a rural cross-section with ditches and no provision for pedestrians.

- (b) 172 Street: This is a two lane road running in a north-south orientation connecting 0 Avenue in the south to 8 Avenue in the north. It is classified by the City as a major collector road from 4 Avenue to the north and is unclassified and therefore a local road to the south. The existing pavement varies in width from 6.1 to 7.0 metres and it has shoulders and ditches on both sides with no sidewalks. The posted speed is 50 km/h.
- (c) 175A Street: This is also a two lane road, albeit classified as a local road, running in a north-south direction between 4 Avenue and 2 Avenue. It has a pavement width of approximately 7.5 metres, an urban cross-section on the west side, i.e., with a curb, gutter, and a sidewalk in front of the developed parcels, but a rural cross section on the east side where there has been no development.
- (d) 176 Street/Highway 15: This road is designated as a Provincial Highway and is under the jurisdiction of the Ministry of Transportation. It is a major route into the US with a border crossing at the south end. It is four lanes from the border north up to 32 Avenue and is currently in the process of being upgraded to a four lane facility all the way north to the Trans-Canada Hwy. The segment between 8 Avenue and the border carries a high volume of trucks as it is the designated truck crossing to the US. It is often congested in the southbound direction by vehicles lined up to cross the border. Trucks are often a major contributor to this congestion and the Ministry is proposing to construct an auxiliary truck lane for these vehicles.
- (e) 0 Avenue: This local road runs in an east-west direction along the Canadian side of the Canada/US border between 168 Street in the west and 175 Street in the east. It does have a connection to Highway 99 for traffic wishing to travel north on the highway towards Vancouver. It is a two lane road for its entire length, with shoulders and ditches on both sides, and no sidewalk.
- (f) 2 Avenue: This is another two lane local road running in an east-west direction, this time between 172 Street and 176 Street (Highway 15). It has a pavement width of approximately 6.3m with shoulders on both sides and a ditch on the south side.
- (g) 4 Avenue: This is another two lane road running in an east-west direction between 171 Street and 176 Street (Highway 15). It is classified by the City as a major collector from 172 Street to the east and as a local road to the west of 172 Street. It has a pavement width of 5.7m with shoulders and ditches on both sides.
- (h) 8 Avenue: This arterial road is designated as a Provincial Highway and runs in an east-west direction a short distance to the north of the NCP area. It is under the jurisdiction of the Ministry of Transportation. It has recently been upgraded to a four lane facility since

it serves as the major connection for trucks between Highway 99 and the border crossing on Highway 15/176 Street.

All of the above roads, with the exception of segments of 176 Street/Highway 15, are of a rural nature with gravel shoulders beyond the paved travel portion of the road and ditches typically on both sides. A summary of the various roads in each classification is provided in Table 2.1.

**Table 2.1
Study Area Roads By Classification**

Road Classification	Road Section
Provincial Hwy	Highway #99 176 Street/Highway 15 8 Avenue
Arterial Roads	none
Major Collector Roads	172 Street – 4 Ave to 8 Ave 4 Avenue – 172 St to 176 St

2.2 Intersection Channelization and Controls

A summary of the laning configuration at each of the intersections of interest in this study is given in Table 2.2. The only roads which currently have two lanes in each direction are Highway 99, 176 Street/Highway 15 and 8 Avenue, all of which are under the Ministry's jurisdiction. There are left turn lanes on all four legs of the intersection of 8 Avenue/176 Street with dual left turn lanes for the northbound to westbound traffic turning onto 8 Avenue at this intersection, and separate right turn lanes on all four legs. There are also left turn lanes on the east and south legs of the 8 Avenue/172 Street intersection.

**Table 2.2
Existing Intersection Laning Configuration**

E-W Street	N-S Street	Eastbound			Westbound			Northbound			Southbound			Sig- nal?	Prior -ity
		L	T	R	L	T	R	L	T	R	L	T	R		
8 Avenue	172 Street	n/a	2	1	1	2	n/a	1	n/a	1	n/a	n/a	n/a	Y	--
8 Avenue	176 Street	1	1	1	1	1	1	2	2	1	1	2	1	Y	--
4 Avenue	172 Street	>	1	<	>	1	<	>	1	<	>	1	<	N	N/S
4 Avenue	175A Street	n/a	1	<	>	1	n/a	>	n/a	<	n/a	n/a	n/a	N	E/W
4 Avenue	176 Street	1	1	<	1	1	<	1	2	<	1	3*	1	Y	--
2 Avenue	172 Street	n/a	n/a	n/a	>	n/a	<	n/a	1	<	>	1	n/a	N	N/S
2 Avenue	175A Street	1	1	<	>	1	<	>	1	<	**	1	<	4-way	--
2 Avenue	176 Street	>	n/a	<	n/a	n/a	n/a	1	2	n/a	n/a	2	1	Y	--

Note: > or < - means no dedicated left or right turn lane but shared with the adjacent through lane; n/a - means movement not appropriate; 4 Ave/176 St intersection is still under construction (Oct 2006), and traffic signals are not ready yet; * 2 lanes for commercial vehicles and 1 lane for general purpose vehicles; ** southbound left turn is prohibited

The traffic controls at each of these intersections are also included in Table 2.2. It is noted that the signalized intersections are on 8 Avenue at 172 Street and 176 Street (Highway 15), and on 176 Street (Highway 15) at 4 Avenue. There is another signal on 176 Street/(Highway 15) at 2 Avenue but this is primarily related to truck movements and traffic in and out of the duty free shop and is not so much related to the traffic generated by the area of development covered by this study.

The laning configuration and traffic controls are illustrated in Exhibit 2.2.

2.3 Existing Traffic Volumes

Intersection turning movement counts were undertaken at all the intersections to be addressed in this City's study by Ward Consulting Group, some in August 2005 and some in August 2006 which was the year the network study was undertaken for the City. These surveys were undertaken in both the a.m. and p.m. peak periods as well as Saturdays at some locations and from this the peak hour volumes were established. Where necessary, 2005 volumes were factored up to represent 2006 volumes. As traffic volumes in August are very close to the highest over the year, no seasonal adjustments were applied. A summary of traffic volumes on key legs of the road network are given in Table 2.3. These link volumes are illustrated in Exhibit 2.3 whilst the intersection turning movements in both the a.m. and p.m. peak hours are illustrated in Exhibit 2.4.

Table 2.3
Existing Traffic Volumes

		2006 AM		2006 PM		2006 SAT	
		EB/NB	WB/SB	EB/NB	WB/SB	EB/NB	WB/SB
8 Avenue	(west of 172 St)	430 (15%)	560 (10%)	<u>840 (6%)</u>	<u>670 (10%)</u>	n/a	n/a
	(east of 176 St)	150 (16%)	<u>290 (11%)</u>	<u>420 (6%)</u>	210 (11%)	n/a	n/a
176 Street	(north of 8 Ave)	180 (24%)	<u>300 (25%)</u>	<u>390 (10%)</u>	220 (14%)	n/a	n/a
	(south of 4 Ave)	300 (18%)	<u>330 (24%)</u>	<u>470 (14%)</u>	320 (18%)	n/a	n/a
172 Street	(south of 8 Ave)	60	60	<u>100</u>	120	90	<u>170</u>
	(south of 4 Ave)	30	30	30	70	<u>55</u>	<u>110</u>
4 Avenue	(west of 176 St)	<u>15</u>	15	10	<u>20</u>	n/a	n/a
	(east of 172 St)	5	<u>15</u>	15	10	<u>25</u>	10
	(west of 172 St)	20	<u>50</u>	<u>45</u>	25	35	40
2 Avenue	(east of 172 St)	10	15	35	20	<u>75</u>	<u>20</u>
0 Avenue	(west of 172 St)	15	10	<u>20</u>	<u>10</u>	n/a	n/a

Note: underlined figures are the highest among the three peak hours by direction
(figures in brackets) are percentage of truck traffic

This data indicates that the highest traffic volumes is the 840 vehicles eastbound on 8 Avenue just west of 176 Street, with this occurring in the p.m. peak hour. Since the capacity of a four lane arterial road is approximately 2,000 vehicles per direction, this road is obviously operating well below its capacity and is very acceptable. Two-way traffic volumes on 176 Street (Highway 15) are between 500 and 650 vehicles in the peak hours which is very low for a four

lane divided highway. Table 2.3 also includes the percentage of truck traffic and it will be noted that this is particularly high on Highway 15 in the a.m. peak hour at 24%.

The highest directional traffic volume in the Douglas neighbourhood south of 4 Avenue is only 70 vehicles and this is southbound on 172 Street. It is noted that on the Saturday, southbound traffic volumes on 172 Street and eastbound volumes on 2 Avenue are significantly higher than the weekday volumes. Based on a review of these volumes, it is likely that 50 to 80 vehicles are shortcutting through the neighbourhood from 8 Avenue via 172 Street and 2 Avenue to 176 Street/Highway 15 when travelling towards the U.S. border, thereby jumping the queue.

Based on a review of all the count data, it is estimated that the existing development in the area generates approximately 180 two-way trips with 54% of these being inbound in the morning peak hour, and 240 vehicle trips with 52% inbound in the afternoon peak hour.

2.4 Transit

There is currently no transit service in the general area. In fact, there is currently no transit service on the east side of Highway 99 anywhere in South Surrey. Transit service is therefore not a consideration in this study.

In a 1999 report undertaken on behalf of the City, it was indicated that transit service was not expected to be provided to service the Douglas NCP area within the build-out horizon since TransLink had concluded that the total population will remain below levels that would support direct bus service. Furthermore, because of the relatively isolated nature of the Douglas area from the rest of the City, buses will have to travel across extensive ALR or non-developed lands with little potential for ridership and revenues.

The closest transit services are therefore those in White Rock, all of which are linked to the South Surrey Park-n-Ride facility in the vicinity of the Highway 99/King George Highway interchange.

2.5 Pedestrians

The only sidewalk on any of the existing roads is the west side of 175A Street since this section has been urbanized in conjunction with the construction of new homes along the west side of this road.

2.6 Bicycles

TransLink's bicycle network for the South Surrey area designates the following routes within the Douglas Neighbourhood as bike routes.

- 0 Avenue – Highway 99 to Highway 15

- 4 Avenue – 172 Street to 175A Street
- 8 Avenue – 172 Street west into White Rock’s Marine Drive
- 175A Street – 0 Avenue to 4 Avenue
- 2 Avenue – 175A Street to Highway 15
- 172 Street – 4 Avenue to 8 Avenue

These routes are shown in Exhibit 2.5.

2.7 Land Use

Based on the current land use plan for the broader area as taken from the City’s website and shown in Exhibit 2.6, the lands are primarily agricultural north of 4 Avenue and designated urban south of here. There is a strip of land designated suburban between 171 Street and the line of 175 Street in the east-west direction and between 3 Avenue and 4 Avenue in the north-south direction with commercial land to the east of 175A Street between 0 Avenue and 4 Avenue.

There are single-family homes on large lots fronting onto most of the existing roads in the Douglas Neighbourhood. Between 0 Avenue and 4 Avenue there are approximately 90 homes west of 172 Street whilst on the east side of 172 Street over to the line of 175A Street there are a further 55 homes – this does not include the new development immediately west of 175A Street. Between 175A Street and 176 Street and south of 2 Avenue there is a significant amount of commercial activity primarily related to the Canada/U.S.A. border crossing.

At the present time, there are some industrial facilities within the neighbourhood and it is assumed that these will be eliminated in conjunction with the development of the area. In particular, these are located on the east side of 172 Street north of 2 Avenue and on the south side of 4 Avenue approximately mid-way between 172 Street and 175A Street. To the west of 172 Street and beyond to Highway 99 is the Peace Portal Golf Course which extends from approximately the line of 1A Avenue north to 8 Avenue.

3.0 FUTURE CONDITIONS

3.1 Future Road Network

Highway 15 between 8 Avenue and 4 Avenue has recently been upgraded with a new FAST truck lane added on Highway 15 in the southbound direction and a physical median down the centre of the highway. In conjunction with this, new traffic signals were installed at the 4 Avenue intersection. No other network improvements outside of the Douglas neighbourhood have been identified and/or approved at this time.

The City indicated that their desire was to see 171 Street as a continuous local through road between 4 Avenue and 0 Avenue within the neighbourhood and this has therefore been included as a base condition in the network. In addition, they also indicated a desire to have 0A Avenue

as being continuous between the line of 174 Street and Peace Arch Drive. Whilst this was initially included in the plan, the segment between 170 Street and 171 Street was subsequently removed as this was deemed impossible to achieve. In the previous network included in the 1999 Douglas Land Use Plan shown in Exhibit 3.1, 0A Avenue was a series of short local roads and cul-de-sacs.

3.2 Future Background Traffic Volumes

Future year traffic volumes for 2021 on 176 Street/Highway 15 and 8 Avenue were established in the study undertaken in conjunction with the design of the Highway 15 truck lane by Ward Consulting Group as sub-consultants to Associated Engineering on behalf of the Ministry of Transportation and documented in Section 1.6 of the report *Highway 15 Truck Lane* dated March 28, 2006. These projections, which were prepared in early 2006, were acceptable to the Ministry at that time and were assumed to be still acceptable. The report notes that the projections took into account future border crossing truck traffic volume projections as provided by TSi Consultants as well as the work undertaken by Ward Consulting Group for Highway 13 on behalf of the Ministry – this study looked at future growth in total border crossing traffic at all three of the border crossings in Surrey and Langley and was documented in the report *Highway 13 Corridor Study* dated September 12, 2005. The 2006 projections were therefore used as the foundation for this current study. Given that border crossing traffic has been very erratic when viewed over the last 10 years with a general downward trend and yet a growth was applied in the study, the projections in this current study were considered optimistic. Based on this information, traffic volumes on these two roads are expected to increase by up to 100%, i.e., double, over the next 15 years with even larger increases in truck volumes. A summary of these projections are given in Table 3.1.

**Table 3.1
Future 2021 Traffic Volumes**

		2006 AM		2006 PM		2021AM		2021 PM	
		EB/NB	WB/SB	EB/NB	WB/SB	EB/NB	WB/SB	EB/NB	WB/SB
8 Avenue	(west of 172 St)	430 (15%)	560 (10%)	840 (6%)	670 (10%)	950 (26%)	1230 (18%)	1250 (18%)	1180 (19%)
	(east of 176 St)	150 (16%)	290 (11%)	420 (6%)	210 (11%)	510 (13%)	400 (7%)	730 (4%)	560 (6%)
176 Street	(north of 8 Ave)	180 (24%)	300 (25%)	390 (10%)	220 (14%)	500 (25%)	620 (29%)	830 (11%)	570 (22%)
	(south of 4 Ave)	300 (2%)	330 (24%)	470 (2%)	320 (18%)	1010 (24%)	930 (30%)	1500 (16%)	880 (32%)

Note: (figures in brackets) are percentage of truck traffic

3.3 Future Land Use

The previous Douglas NCP had planned for a total population of approximately 2,900 persons in 950 dwelling units in the area, together with approximately 4,000 m² of commercial development. A summary of the projected land use at that time is given in Table 3.2.

Table 3.2
Previous Douglas Neighbourhood Concept Plan
Land Use Statistics (July 1999)

Land Use	Area in Hectares (acres)	Projected Number of New Dwelling Units	Projected floor Area Commercial in sq. m. (in sq.ft.)
Suburban	4.35 (10.75)	21	N/A
Single Family	27.4 (67.8)	407	N/A
Single Family Small Lot	9.05 (22.4)	224	N/A
Townhouse (15 upa max)	7.3 (18.1)	272	N/A
Apartments (Above Comm.)	0.7 (1.72)	30	N/A
Commercial	0.7 (1.72)	N/A	3,500 (37,600)
Joint School/ Park Site	5.35 (13.2)	N/A	N/A
Detention Ponds	1.4 (3.4)	N/A	N/A
Parks and Open Space	5.3 (13.1)	N/A	N/A
TOTALS	61.6 (152.2)	954	3,500 (37,600)

The City provided their most up-to-date projections for population and employment in not only the Douglas area but also for the entire City. A summary of the projected population in South Surrey by area including the Douglas area as well as the equivalent employment projections are given in Table 3.3. It is noted that the population in the Douglas area is expected to increase from less than 1,000 in 2006 to over 4,200 by 2021 with the employment also increasing from 60 in 2006 to 140 in 2021.

Table 3.3
Projected Population and Employment in South Surrey

Year	-----Population-----				-----Employment-----			
	2006	2011	2021	2031	2006	2011	2021	2031
<i>Douglas</i>	967	2,070	4,274	4,284	60	84	142	152
Hwy 99 Corridor	228	152	0	0	651	1,507	3,605	3,615
KGH Corridor	12,480	18,435	30,345	30,355	3,694	4,643	5,341	5,351
Morgan Heights NCP #1	1,269	3,102	6,778	6,778	263	605	1,012	1,022
NCP #2	2,298	5,104	10,715	10,725	219	358	693	703
NCP #3	1,311	2,748	5,624	5,634	84	108	164	174
NCP #4	2,105	5,130	11,180	11,190	25	29	37	47
NCP #5	2,181	3,545	6,273	6,283	230	272	374	384
North Grandview Heights Area X1a	785	857	1,003	1,013	117	141	198	208
North Grandview Heights Area X1b	1,087	2,349	4,873	4,883	63	106	124	134

Year	Population				Employment			
	2006	2011	2021	2031	2006	2011	2021	2031
Rosemary Heights Business park	123	259	530	540	154	397	473	483
Rosemary Heights Central	2,812	3,734	5,580	5,590	47	51	61	71
Rosemary Heights West	523	1,362	3,040	3,050	39	86	200	210
Semiahmoo Town Centre	4,947	8,651	16,059	16,069	798	917	1,023	1,033
Total Within NCP Areas	33,114	57,497	106,264	106,274	6,442	9,303	13,448	13,588
Outside NCP Area	47,699	50,783	56,131	74,900	19,317	20,880	40,163	59,600
Surrey Total	80,813	108,280	162,395	181,294	25,759	30,182	53,611	73,188

A preliminary land use plan for the area has been prepared for use in this study and is attached as Exhibit 3.2. This indicates that townhouse developments are to be located on the west side of the area with low density half acre single-family lots along the south side of 4 Avenue and other single-family housing between 0 Avenue and 0A Avenue. Higher density housing is proposed in other areas. There is also to be an elementary school located on this north side of 2 Avenue east of the line of 173 Street. A breakdown of the projections for the Douglas area by sector and by housing type is given in Table 3.4 and included in Exhibit 3.2.

**Table 3.4
Proposed Land Use**

	Half-acre Resid. RH-G (2 upa)	Family Resid. RF (6 upa)	Family Resid. RF-12 (8 upa)	Family Resid. RF-9 (10 upa)	Townhouse T/H (22 upa)	School	Golf Course
NE	12 DU	27 DU	148 DU	125 DU	0 DU	**	
SE	0 DU	51 DU	259 DU	29 DU	0 DU		
W	6 DU	141 DU	53 DU	147 DU	392 DU		***
Total	18 DU	219 DU	460 DU	301 DU	392 DU	**	***
Total: 1390 DU							
Population#	58	701	1,472	963	1,254		
Total population: 4,448							
Note:	NE: northeast quadrant – east of 172 nd Street and between 2 nd Avenue and 4 th Avenue						
	SE: southeast quadrant – east of 172 nd Street and between 0 Avenue and 2 nd Avenue						
	W: west of 172 nd Street – between 0 Avenue/Peace Park Drive and 4 th Avenue						
	** elementary school (assumed enrollment of 350 students)						
	*** existing 18 holes golf course						
	# assumed 3.2 pop/unit						

**Table 3.5
Trip Generation**

Area	Land Use	Size	Rate	AM Peak Hour				PM Peak Hour				
				% In	Total	In	Out	Rate	% In	Total	In	Out
NE	Single Family	187 DU	1.0	26%	187	49	138	1.2	64%	224	144	81
	Townhouse	125 DU	0.49	17%	61	10	51	0.68	66%	85	56	29
	School	350 Students	0.42	55%	147	81	66	0.28	45%	98	44	54
	Sub-total				395	140	255			407	244	164
SE	Single Family	310 DU	1.0	26%	310	81	229	1.2	64%	372	238	134
	Townhouse	29 DU	0.49	17%	14	2	12	0.68	66%	20	13	7

Area	Land Use	Size	AM Peak Hour					PM Peak Hour				
			Rate	% In	Total	In	Out	Rate	% In	Total	In	Out
<i>Sub-total</i>					324	83	241			392	251	141
W	Single Family	200 DU	1.0	26%	200	52	148	1.2	64%	340	154	86
	Townhouse	539 DU	0.49	17%	264	45	219	0.68	66%	367	242	125
	Golf Course	18 Holes	2.8	83%	50	42	9	2.2	52%	40	32	8
<i>Sub-total</i>					515	139	376			646	416	230
Grand Total					1234	362	872			1445	911	534

Note: (1) Trip rates Single Family – MoT’s guideline; Townhouse – MoT’s guideline; School – ITE Code 520; and Golf Course – ITE Code 430
(2) High density “family residential” at 10 units per acre considered equivalent to townhouses

3.4 Development Trip Generation

The amount of traffic expected to be generated by the development of the Douglas Community was calculated based on the trip rates provided from the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (7th Edition) for the school and golf course and from the Ministry’s own *Trip Generation and Parking Rates Manual* for all of the residential units. A summary of these calculations by sector and by land use category is provided in Table 3.5. It should be noted that the higher density family residential of 10 units per acre was considered to be low density multi-family and therefore the townhouse rates were used on this category when calculating the trip generation. Table 3.5 indicates that the area will generate a total of 1,235 trips in the morning peak hour of which 872 are outbound increasing slightly to 1,445 in the afternoon peak hour of which 534 are outbound. It is noted that these trip generation numbers are six to seven times higher than the traffic generated by the existing developments in the area.

3.5 Trip Distribution

A select link analysis using the City’s transportation planning model was able to provide information on the distribution of trips generated by the residents of the three study area zones. A summary of this information is given in Table 3.6. This indicates that there is a different distribution in the inbound and outbound trips in both the morning and afternoon peak hours, and this is to be expected. The highest orientation is towards the west on 8 Avenue, no doubt oriented to Highway 99 with 64% to 72% in this direction.

Table 3.6
Site Traffic Distribution Patterns
Full Development

	AM		PM	
	In	Out	In	Out
8 Ave (West)	64% (137)	72% (522)	68% (562)	68% (305)
Border (South)	1% (2)	2% (15)	4% (33)	6% (27)
Hwy 15 (North)	18% (39)	10% (73)	16% (132)	10% (45)
8 Ave (East)	17% (36)	16% (116)	12% (99)	16% (72)
Total	100% (215)	100% (725)	100% (827)	100% (449)

Figures in brackets represent projected site traffic volumes; Trips to and from the school are considered to be internal trips within the neighbourhood

3.6 Development Traffic Volumes

Traffic volumes on the road network with the Douglas neighbourhood area fully developed in 2021 were established by applying the distribution pattern given in Table 3.6 to the proposed road network. In undertaking this, the three sectors referenced in Tables 3.4 and 3.5 were disaggregated even further in order to assign trips on a more micro level, in and out of the individual parcels. All of the individual trips were then aggregated in order to establish the overall traffic volumes in the area. The resultant future traffic volumes generated by a full development of the Douglas neighbourhood on individual roads are summarized in Table 3.7 and illustrated in Exhibit 3.3.

It is understood that the currently vacant land bounded by Highway 15, 175A Street, 2 Avenue, and 4 Avenue will potentially develop into a commercial site. For this traffic study, a total of approximately 20,000 m² of commercial development was assumed in the analysis with a total trip generation of over 500 veh/h in the peak hours. This traffic was then added to the background traffic together with the Douglas Neighbourhood traffic shown in Exhibit 3.3. The resultant 2021 traffic volumes on the study area roads are shown in Exhibit 3.4.

Table 3.7
Projected Future Traffic Volumes
Full Development

		AM		PM	
		EB/NB	WB/SB	EB/NB	WB/SB
172 Street	(north of 4 Ave)	<u>550</u>	165	325	<u>650</u>
	(south of 4 Ave)	<u>480</u>	120	275	<u>545</u>
	(south of 2 Ave)	<u>325</u>	95	190	<u>375</u>
171 Street	(south of 4 Ave)	<u>65</u>	20	40	<u>95</u>
	(south of 2 Ave)	<u>30</u>	15	15	<u>55</u>
4 Avenue	(east of 172 St)	65	60	<u>90</u>	<u>95</u>
	(west of 172 St)	<u>90</u>	65	80	<u>145</u>
	(east of 174 St)	<u>125</u>	45	95	<u>170</u>
2 Avenue	(east of 172 St)	60	<u>110</u>	<u>110</u>	75
0A Avenue	(east of 172 St)	10	<u>45</u>	<u>40</u>	25
	(west of 172 St)	<u>105</u>	40	60	<u>135</u>

Note: underlined figures are the highest among the three peak hours by direction

3.7 Intersection Analysis

The level of service at the key intersections were analyzed using the Highway Capacity Manual methods. For signalized intersections, the operational analysis methodology gives three indicators for the overall performance of an intersection and for the individual turning movements. The first is the volume to capacity ratio (v/c) where the volume is the number of vehicles wishing to make a certain movement, and capacity is the maximum number of vehicles that can be accommodated in an hour. This takes into account the number of lanes available for the movement, whether the movement is protected or permitted, conflicting traffic, the cycle length, and the amount of green time the movement receives. The higher the v/c ratio, the more

congested the intersection becomes. When the v/c ratio is greater than 1.00, this indicates that more vehicles wish to make a given movement than are able to, due to the limited capacity. The second measure, the average delay per vehicle, is based on the cycle length, the green time for each movement and the v/c ratios. The third measure is the level of service which is established from the average delay. The larger the average delay - and the higher the v/c ratio - the worse is the level of service. Table 3.8 shows the relationship between level of service and delay.

The generally accepted guidelines for determining whether or not a signalized intersection needs to be upgraded is that all individual movements should operate with a v/c ratio of 0.90 or less. If this threshold is not achieved, any signal changes required to achieve these levels should be identified. These cover changes to signal timings and phasing, for example adding advanced phases for left turn movements and possible elimination of certain turning movements, but not the provision of additional capacity with extra through or turn lanes. When traffic generated by a development is added to an intersection and the v/c ratio of a specific movement that was less than 0.90 under background conditions is now greater than 0.90, then improvements must be identified to allow the intersection to operate at the 0.90 value. If the intersection was above 0.90 under background conditions, then the original v/c ratios must not be exceeded, i.e., the operation of the intersection must be no worse as a result of the development.

Table 3.8
Level of Service vs. Delay

LoS	Signalized Intersection		Unsignalized Intersection	
	Control Delay/Vehicle (s/veh)	Delays	Control Delay/Vehicle	
A	≤ 10.0	Little or no delay	≤ 10.0	
B	> 10.0 and ≤ 20.0	Short traffic delays	> 10 and ≤ 15	
C	> 20.0 and ≤ 35.0	Average traffic delays	> 15 and ≤ 25	
D	> 35.0 and ≤ 55.0	Long traffic delays	> 25 and ≤ 35	
E	> 55.0 and ≤ 80.0	Very long traffic delays	> 35 and ≤ 50	
F	> 80.0	Failure	> 50	

The performance of unsignalized intersections was also reviewed using the methodology for such intersections in the *Highway Capacity Manual*. While the overall level of service and delay for an unsignalized intersection provide a measure of overall performance, it is commonly turning movements at such intersections which are the primary focus of interest. With only low turning volumes to or from the minor road and high through volumes on the main road, delays to turning vehicles can become excessive. As delays increase, turning vehicles will attempt to turn across unacceptable gaps which can present safety concerns.

A number of the key intersections in the study area were analyzed, four of these being unsignalized and three being signalized. The detailed results are provided in Table 3.9 and 3.10 whilst a summary of the performance is given in Table 3.11. The analysis indicates that all internal unsignalized intersections as well as two of the three signalized intersections will operate adequately through to 2021 in both the a.m. and p.m. peak hours. The only exception is the 176

Street (Highway 15)/4 Avenue intersection in the p.m. peak hour when the northbound movement on the highway operates at Level of Service F with a v/c ratio of 1.14.

Table 3.9
Douglas NCP - Intersection Performance
- Un-signalized Intersection

		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
AM Peak Hour													
4 Ave / 172 St	LoS	C	C	C	B	B	B	A	A	A	A	A	A
	v/c	0.25	0.25	0.25	0.08	0.08	0.08	0.00	0.00	0.00	0.01	0.01	0.01
	Delay	16.1	16.1	16.1	11.7	11.7	11.7	0.1	0.1	0.1	0.5	0.5	0.5
	Queue		7m			2m			0m			0m	
2 Ave / 172 St	LoS	n/a	n/a	n/a	B	n/a	B	n/a	A	A	A	A	n/a
	v/c	n/a	n/a	n/a	0.13	n/a	0.13	n/a	--	--	0.02	0.02	n/a
	Delay	n/a	n/a	n/a	10.2	n/a	10.2	n/a	--	--	3.5	3.5	n/a
	Queue				3m						1m		
0A Ave / 172 St	LoS	A	A	A	A	A	A	B	B	B	A	A	A
	v/c	0.06	0.06	0.06	0.00	0.00	0.00	0.01	0.01	0.01	0.05	0.05	0.05
	Delay	7.4	7.4	7.4	0.0	0.0	0.0	10.8	10.8	10.8	8.9	8.9	8.9
	Queue		2m			0m			0m			1m	
2 Ave / 174St	LoS	A	A	A	A	A	A	A	A	A	A	A	A
	v/c	0.04	0.04	0.04	0.00	0.00	0.00	0.02	0.02	0.02	0.00	0.00	0.00
	Delay	9.0	9.0	9.0	9.8	9.8	9.8	4.2	4.2	4.2	0.0	0.0	0.0
	Queue		1m			0m			1m			0m	
PM Peak Hour													
4 Ave / 172 St	LoS	C	C	C	C	C	C	A	A	A	A	A	A
	v/c	0.18	0.18	0.18	0.24	0.24	0.24	0.00	0.00	0.00	0.00	0.00	0.00
	Delay	20.8	20.8	20.8	18.6	18.6	18.6	0.0	0.0	0.0	0.8	0.8	0.8
	Queue		5m			7m			0m			1m	
2 Ave / 172 St	LoS	n/a	n/a	n/a	B	n/a	B	n/a	A	A	A	A	n/a
	v/c	n/a	n/a	n/a	0.09	n/a	0.09	n/a	--	--	0.06	0.06	n/a
	Delay	n/a	n/a	n/a	10.2	n/a	10.2	n/a	--	--	2.4	2.4	n/a
	Queue				2m						1m		
0A Ave / 172 St	LoS	A	A	A	A	A	A	A	A	A	A	A	A
	v/c	0.03	0.03	0.03	0.00	0.00	0.00	0.01	0.01	0.01	0.17	0.17	0.17
	Delay	7.2	7.2	7.2	0.0	0.0	0.0	10.0	10.0	10.0	9.4	9.4	9.4
	Queue		1m			0m			0m			5m	
2 Ave / 174St	LoS	A	A	A	A	A	A	A	A	A	A	A	A
	v/c	0.05	0.05	0.05	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
	Delay	9.0	9.0	9.0	9.8	9.8	9.8	3.7	3.7	3.7	0.0	0.0	0.0
	Queue		1m			0m			0m			0m	

Table 3.10
Douglas NCP - Intersection Performance
- Signalized Intersections

		Eastbound			Westbound			Northbound			Southbound			Over-all
		L	T	R	L	T	R	L	T	R	L	T	R	
2021 AM														
Hwy 15 / 4 Ave	LoS	C	B	B	C	C	B	D	C	C	D	B	D	C
	v/c	0.42	0.04	0.04	0.00	0.00	0.04	0.07	0.77	0.77	0.07	0.62	0.72	0.77*
	Delay	25.5	19.7	19.7	31.0	31.0	16.4	46.3	21.4	21.4	46.8	19.0	51.0	22.9
	Queue	42m	7m			2m	4m	9m	215m		9m	231m	103m	
Hwy 15 / 2 Ave	LoS	B	n/a	B	n/a	n/a	n/a	C	A	n/a	n/a	A	A	A

		Eastbound			Westbound			Northbound			Southbound			Over-all
		L	T	R	L	T	R	L	T	R	L	T	R	
8 Ave / 172 St	v/c	0.30	n/a	0.30	n/a	n/a	n/a	0.14	0.43	n/a	n/a	0.41	0.02	0.43*
	Delay	13.9	n/a	13.9	n/a	n/a	n/a	20.2	4.8	n/a	n/a	7.6	4.5	6.6
	Queue	15m						7m	39m			62m	3m	
	LoS	n/a	B	A	B	B	n/a	C	n/a	A	n/a	n/a	n/a	B
	v/c	n/a	0.59	0.20	0.13	0.73	n/a	0.73	n/a	0.11	n/a	n/a	n/a	0.73*
	Delay	n/a	11.8	2.4	11.1	14.2	n/a	23.8	n/a	5.5	n/a	n/a	n/a	13.8
	Queue		61m	8m	5m	83m		65m		7m				
2021 PM														
Hwy 15 / 4 Ave	LoS	C	C	C	C	C	C	D	F	F	D	C	F	E
	v/c	0.40	0.09	0.09	0.00	0.00	0.04	0.24	1.14	1.14	0.07	0.64	0.99	1.14*
	Delay	25.9	21.6	21.6	33.0	32.0	16.8	45.4	90.9	90.9	48.0	23.3	87.7	64.3
	Queue	40m	12m			2m	4m	21m	361m		8m	205m	150m	
Hwy 15 / 2 Ave	LoS	B	n/a	B	n/a	n/a	n/a	C	A	n/a	n/a	A	A	A
	v/c	0.32	n/a	0.32	n/a	n/a	n/a	0.23	0.59	n/a	n/a	0.37	0.04	0.59*
	Delay	16.6	n/a	16.6	n/a	n/a	n/a	24.7	4.9	n/a	n/a	6.7	3.2	6.1
	Queue	15m						11m	61m			49m	4m	
8 Ave / 172 St	LoS	n/a	B	A	C	B	n/a	C	n/a	A	n/a	n/a	n/a	B
	v/c	n/a	0.67	0.48	0.53	0.63	n/a	0.58	n/a	0.08	n/a	n/a	n/a	0.67*
	Delay	n/a	11.0	2.5	28.3	10.4	n/a	21.0	n/a	7.8	n/a	n/a	n/a	10.6
	Queue		79m	12m	24m	72m		41m		6m				

Table 3.11
Summary of Intersection Performance

Intersection	2021 AM			2021 PM			Remark
	LoS	v/c	Crit. Mvmt.	LoS	v/c	Crit. Mvmt.	
4 Ave / 176 St	C	0.77	--	E	1.14	NBT,SBR	
2 Ave / 176 St	A	0.43	--	A	0.59	--	
8 Ave / 172 St	B	0.73	--	B	0.67	--	

Note: LoS = Overall Level of Service; v/c = maximum v/c ratio for individual movement or the highest v/c ratio of the minor legs of unsignalized intersection; Crit. Mvmt.= LoS for approach is E or F

3.8 Sensitivity to Results of Trip Generation

- (a) Trip Generation: As the study area was within the Ministry’s 800 metre sphere of influence, the trip generation rates used in this study were taken from the Ministry’s own *Parking and Trip Generation Rates Manual*. These rates were established by the Ministry for use on BC developments. This manual states very clearly that “single-family housing is defined as detached houses located on individual lots” and that “multi-family housing is typically represented by townhouse or condominium developments, in which a series of ownership residences are attached to each other...” Many of the family residential lots are 10 units per acre which produce relatively small homes no larger than many townhouses. It is the Ministry rates for these two uses that were used.

There are two factors which are likely to result in lower rather than higher rates for the housing stock in the study area. Firstly, our experience is that single-family homes in more rural areas further away from the “CBD” or commercial core make fewer trips as they try to combine trips because of the longer distance necessary to travel and the higher travel costs. Secondly, many South Surrey

residents work north of the Fraser River and consequently leave earlier and arrive home later than would typically be found elsewhere in the region. Based on this, it would seem completely inappropriate to apply single-family trip generation rates to townhouse developments in the Douglas area.

Nevertheless, the trip generation calculations undertaken were also done in response to the Ministry's very unusual request to use the single-family rates for the townhouse component as well and a summary of these calculations are provided in Table 3.12. This indicates that the total trip generation increases from 1,234 to 1,587 in the a.m. peak hour and from 1,445 to 1,806 in the p.m. peak hour based on these artificial rates. The distribution pattern established previously was then applied to these revised trip generation numbers.

Table 3.12
Trip Generation – Revised Residential Trip Rates

Area	Land Use	Size	Rate	AM Peak Hour				PM Peak Hour				
				% In	Total	In	Out	Rate	% In	Total	In	Out
NE	Single Family	187 DU	1.0	26%	187	49	138	1.2	64%	224	144	81
	Townhouse	125 DU	1.0	26%	125	33	93	1.2	64%	150	96	54
	School	350 Students	0.42	55%	147	81	66	0.28	45%	98	44	54
<i>Sub-total</i>					<i>459</i>	<i>162</i>	<i>297</i>			<i>472</i>	<i>284</i>	<i>189</i>
SE	Single Family	310 DU	1.0	26%	310	81	229	1.2	64%	372	238	134
	Townhouse	29 DU	1.0	26%	29	8	21	1.2	64%	35	22	13
	<i>Sub-total</i>					<i>339</i>	<i>88</i>	<i>251</i>			<i>407</i>	<i>260</i>
W	Single Family	200 DU	1.0	26%	200	52	148	1.2	64%	240	154	86
	Townhouse	539 DU	1.0	26%	539	140	399	1.2	64%	647	414	233
	Golf Course	18 Holes	2.8	83%	50	42	9	2.2	52%	40	32	8
<i>Sub-total</i>					<i>789</i>	<i>234</i>	<i>555</i>			<i>927</i>	<i>599</i>	<i>328</i>
Grand Total					1587	484	1103			1806	1143	663

Note: Trip rates based on ITE Trip Generation Manual (7th Edition) and the MoT's guidelines
 Single Family – MoT's guideline; Townhouse – MoT's guideline; School – ITE Code 520; and Golf Course – ITE Code 430
 Applied the same Trip rates for single-family housings to townhouses

- (b) Impact on Analysis Results: The two key signalized intersections previously analyzed, viz., Highway 15/4 Avenue and 8 Avenue/172 Street were reanalyzed using the revised trip generation rates to determine the sensitivity and the results of this are presented in Table 3.13.

For the 2021 a.m. peak hour, the higher theoretical trip generation rates result in a slightly higher v/c ratio for the two intersections previously analyzed: Highway 15/4 Avenue increases from a maximum value of 0.77 to 0.80, albeit still at Level of Service C, whilst for 8 Avenue/172 Street it increases from 0.73 to 0.90 with the level of service increasing from B to C. These results are still considered to be acceptable.

Table 3.13
Douglas NCP - Intersection Performance
 - Signalized Intersections – Higher Trip Rates

		Eastbound			Westbound			Northbound			Southbound			Over
		L	T	R	L	T	R	L	T	R	L	T	R	-all
2021 AM														
Hwy 15 / 4 Ave	LoS	C	B	B	C	C	B	D	C	C	D	B	E	C
	v/c	0.52	0.05	0.05	0.00	0.00	0.04	0.01	0.78	0.78	0.07	0.64	0.80	0.80*
	Delay	26.9	19.3	19.3	31.0	31.0	16.4	46.5	22.5	22.5	46.8	19.9	55.4	24.7
	Queue	54m	8m			2m	4m	3m	217m		9m	235m	123m	
Hwy 15 / 8 Ave	LoS	D	D	A	D	C	A	D	C	C	D	D	B	C
	v/c	0.62	0.73	0.64	0.52	0.64	0.08	0.75	0.44	0.44	0.49	0.59	0.47	0.75*
	Delay	43.6	36.3	5.9	40.9	32.9	8.0	35.8	20.2	20.2	49.6	36.2	14.5	27.7
	Queue	44m	119m	24m	32m	103m	7m	103m	74m		44m	77m	37m	
8 Ave / 172 St	LoS	n/a	C	A	D	C	n/a	D	n/a	B	n/a	n/a	n/a	C
	v/c	n/a	0.65	0.42	0.45	0.84	n/a	0.90	n/a	0.16	n/a	n/a	n/a	0.90*
	Delay	n/a	25.9	3.7	38.3	32.8	n/a	39.3	n/a	10.9	n/a	n/a	n/a	28.5
	Queue		121m	17m	23m	175m		212m		19m				
2021 PM														
Hwy 15 / 4 Ave	LoS	C	C	C	C	C	B	D	F	F	D	C	F	E
	v/c	0.43	0.11	0.11	0.01	0.00	0.04	0.30	1.19	1.19	0.07	0.68	1.07	1.19*
	Delay	25.0	20.8	20.8	32.0	32.0	16.6	45.5	115	115	47.8	26.2	104	78.4
	Queue	45m	14m		2m	2m	4m	26m	366m		8m	216m	180m	
Sensitivity Test (NBT reduce 600 veh)	LoS	C	B	B	C	C	B	D	C	C	D	C	E	C
	v/c	0.38	0.10	0.10	0.01	0.00	0.05	0.35	0.75	0.75	0.08	0.70	0.90	0.90*
	Delay	22.5	19.0	19.0	33.0	33.0	17.1	50.3	24.5	24.5	49.8	28.1	61.7	30.9
	Queue	44m	14m		2m	2m	4m	27m	197m		9m	222m	170m	
Hwy 15 / 8 Ave	LoS	C	C	A	F	B	A	F	E	E	F	D	A	E
	v/c	0.48	0.59	0.49	1.30	0.36	0.06	1.26	0.97	0.97	0.96	0.73	0.49	1.30*
	Delay	21.4	21.5	6.8	184	17.0	3.5	169	65.7	65.7	115	54.6	9.3	70.2
	Queue	53m	127m	64m	169m	69m	6m	159m	154m		78m	72m	21m	
(add Adv WBLT)	LoS	D	F	B	F	B	A	F	D	D	F	E	A	E
	v/c	0.70	1.03	0.64	1.01	0.39	0.07	1.02	0.89	0.89	0.91	0.78	0.51	1.03*
	Delay	50.3	86.7	19.5	85.6	19.4	4.1	82.8	50.9	50.9	102	58.4	9.8	56.8
	Queue	78m	221m	122m	135m	74m	7m	141m	141m		75m	76m	21m	
8 Ave / 172 St	LoS	n/a	B	A	E	B	n/a	E	n/a	B	n/a	n/a	n/a	C
	v/c	n/a	0.60	0.71	0.87	0.56	n/a	0.94	n/a	0.15	n/a	n/a	n/a	0.84*
	Delay	n/a	15.5	4.0	67.4	14.8	n/a	65.4	n/a	11.4	n/a	n/a	n/a	20.6
	Queue		114m	15m	68m	104m		186m		15m				
(add Adv WBLT)	LoS	n/a	C	B	C	B	n/a	D	n/a	A	n/a	n/a	n/a	D
	v/c	n/a	0.78	0.80	0.63	0.61	n/a	0.85	n/a	0.14	n/a	n/a	n/a	0.85*
	Delay	n/a	29.2	10.0	33.5	17.0	n/a	47.9	n/a	6.5	n/a	n/a	n/a	23.4
	Queue		167m	85m	39m	117m		168m		11m				

In the 2021 p.m. peak hour, the Highway 15/4 Avenue intersection experiences an increase in the v/c ratio from 1.14 to 1.19, still at Level of Service E – a problem before and still a problem. The City had previously questioned the exceptionally high increase in the northbound volume on Highway 15 to the 2021 horizon year in the January traffic impact study report. This was the result of using the data from the Regional EMME/2 model, and still adding on the projected increase in border crossing traffic. It is acknowledged that there may be some double counting here. The City’s particular concern centered on whether or not the border could handle the total projected volumes. In response, we looked at

reducing this volume. If it is reduced by 600 vehicles – this does not appear to be an unreasonable reduction given the high increase – then the maximum v/c ratio drops to 0.90.

The 8 Avenue/172 Street intersection continues to operate at an acceptable level in the p.m. peak hour – this intersection performs better at this time than in the a.m. peak hour and this is understandable given the higher volume of traffic exiting the area in the a.m. peak hour.

The intersection of Highway 5/2 Avenue was not reanalyzed since the maximum v/c ratio established in the earlier Table 3.11 was very low with a maximum of only 0.43. Clearly a 25% increase in trip generation from the NCP area will not now create a problem at this intersection.

3.9 Analysis of Additional Intersections

The Ministry also requested that additional intersections be analyzed. The results of this are as follows:

- (a) Highway 15/8 Avenue: The results from analyzing the intersection of Highway 15/8 Avenue are included in Table 3.13. The maximum v/c ratio is 0.75 in the 2021 a.m. peak hour even with the higher trip generation rates and this is clearly very acceptable. In the p.m. peak hour, the maximum v/c ratio is 1.30 this being for the westbound left turn movement, i.e., traffic arriving from the east and turning towards the border. If an advanced green phase is added then the maximum v/c ratio drops to 1.03. To reduce this to the 0.90 threshold, a second eastbound through lane needs to be added to accommodate the projected 550 vehicles making this movement.
- (b) 8 Avenue Roundabouts: New counts were taken at the 8 Avenue roundabouts in March 2007. Traffic travelling between Highway 99 and the 8 Avenue/Highway 15 intersection was factored up to mirror the growth in volumes at this intersection whilst other movements through the two roundabouts were factored at a 1% annual rate to reflect the slower growth in the City of White Rock. The two roundabouts were then analyzed using the Sidra software under existing conditions, 2021 background conditions, and 2021 combined conditions for both the a.m. and p.m. peak hours and the results of this are given in Table 3.14.

This analysis indicates that, based on the projected background volumes, the east roundabout will fail in the 2021 background conditions for both the a.m. and p.m. peak hour. However, if one of the westbound lanes is converted to become a free-flow westbound right turn lane onto the highway northbound, then the roundabout will operate adequately in both peak hours at this horizon year. With this improvement in place and the addition of the site generated traffic, it will continue to operate adequately.

The analysis shows that the west roundabout operates at an acceptable v/c ratio for all three scenarios.

Table 3.14
Analysis of 8 Avenue East Roundabout

	AM Peak Hour			PM Peak Hour			Remark
	LoS	v/c	Crit. Mvmt.	LoS	v/c	Crit. Mvmt.	
<u>(a) East Roundabout</u>							
2007 (Extg)	B	0.68	--	A	0.41	--	
2021 (Bkgd)	F	1.67	WBRT	D	1.23	WBRT	
	A	0.60	--	A	0.54	--	Convert 1 lane to be a free flow WBRT lane
2021 (Comb)	F	1.92	WBRT	E	1.37	WBRT	
	A	0.63	--	A	0.67	--	Convert 1 lane to be a free flow WBRT lane
<u>(b) West Roundabout</u>							
2007 (Extg)	A	0.47	--	A	0.43	--	
2021 (Bkgd)	B	0.59	--	A	0.55	--	
2021 (Comb)	B	0.63	--	B	0.63	--	

The new counts undertaken at 176 Street/8 Avenue and the 8 Avenue roundabouts were taken in March 2007. Although not adjusted at this point, they could easily be adjusted and the conclusions from the results would not change, in that improvements are needed at the eastern roundabout regardless of the development, and with the improvements in place it operates adequately with the Douglas area built out. The west roundabout will continue to operate in an acceptable manner.

3.10 Highway 15/4 Avenue Capacity

As was noted above, it has previously been pointed out that the growth in traffic volumes Highway 15 is very high even though these volumes were used in the Highway 15 Truck Lane analysis. It should be noted that this study also had high maximum v/c ratios exceeding 0.90 for this same intersection which are documented in Table 1.3 of the truck lane report. These results were accepted by the Ministry at that time with no mitigation measures being required of the Ministry's designers. Furthermore, the truck lane study did include approximately 50% of the growth expected in the Douglas area. So not all trips given in Table 3.5 earlier are "new" trips over and above background traffic. The volumes used in the analysis in this current study are based on the same distribution used for the earlier Truck Lane study. Both studies assigned all Douglas generated traffic oriented to Highway 15 to the 4 Avenue access route as the City indicated that 2 Avenue was to be closed to residential traffic. Whilst eastbound exiting traffic could use 2 Avenue, this eastbound left turn is not the critical movement at 4 Avenue. The southbound right turn traffic is more problematic and this traffic cannot be reassigned to 2 Avenue.

In reality, the majority of the traffic entering or exiting the Douglas NCP area will be local residents. After facing lengthy delays at this 4 Avenue intersection when making a left turn exit or a right turn entrance, they will quickly learn there are sometimes more convenient routes and

no doubt take the 172 Street route to 8 Avenue when exiting and then east to Highway 15 instead – this assumes that the border traffic is not backed up onto and along 8 Avenue. The analysis uses the resultant volumes based on the initial projections – it has not adjusted the distributed traffic after the initial analysis to “make it work.”

3.11 Turn Lane Lengths

The predicted queue lengths for the various movements at each of the Ministry’s intersections for the 2021 a.m. and p.m. peak hours are included in Tables 3.9, 3.10, and 3.13. A summary of these queue lengths considered necessary to accommodate projected increases in traffic on Highway 15 and the adjacent areas and the existing lengths provided are given in Table 3.15. The only queue on Highway 15 that the development traffic will impact on is the southbound right turn movement at 4 Avenue. It was pointed out to the Ministry during the design phase that the length proposed was not sufficient to accommodate the projected volumes (see Table 1.3 in Truck Lane report) and the Ministry made a decision to not provide for the calculated length. Once again, in reality, the new Douglas residents will likely tire of the delays and difficulty entering the area via Highway 15/4 Avenue and will use 8 Avenue and 172 Street instead – the analysis is therefore considered to be a worse case scenario.

**Table 3.15
Intersection Queue Lengths on Ministry Roads – 2021**

	-----Actual-----				-----Projected-----			
	EB	NB	NB	SB	EB	WB	NB	SB
176 St/2 Ave LT	-	-	28 m	-	15 m	n/a	15 m	n/a
176 St/4 Ave LT	42 m	10 m	30 m	30 m	40 m	10 m	20 m	10 m
176 St/4 Ave RT	-	-	-	55 m	n/a	n/a	n/a	150 m
176 St/8 Ave LT	47 m	56 m	48 m*	97 m	75 m	135 m	140 m	75 m
72 St/8 Ave LT	-	70 m	32 m	-	n/a	25 m	65 m	n/a

* Duel northbound left turn lanes

3.12 Restricting Access to 176 Street/Highway 15

The Ministry identified some concerns over access from the Douglas neighbourhood to 176 Street/Highway 15 and requested that some options be considered. These concerns are addressed as follows:

- (a) Option A: No Access to 176 Street/Highway 15: For a residential area with an ultimate population of approximately 4,500 persons, two permanent access routes into the area are considered essential. The Ministry’s March 15 memorandum requested that the study should look at closing off direct access to the neighbourhood from Highway 15” and that “traffic should access the neighbourhood via 172 Street exclusively.” It is understood that this concept of no access to or from 176 Street/Highway 15 is contrary to the agreement reached between the City and Ministry over access to the Douglas Neighbourhood. This option is considered to be a non-starter for a second reason and that is that two access routes into and out of a development of this size are essential for safety reasons – even if the intersection of 8 Avenue/172 Street could accommodate the

traffic from a capacity perspective. It is therefore recommended that if access to 176 Street/Highway 15 is closed off, an alternative signalized access be provided on Highway 99 with a dedicated southbound lane on the highway for traffic travelling south and turning left into the development.

The 8 Avenue/172 Street intersection was reanalyzed under this scenario of no access to 176 Street/Highway 15 in accordance with the Ministry's request and these results are given in Table 3.16. Whilst this intersection will operate at an acceptable level of service in the a.m. peak hour, it will fail in the p.m. peak hour and will require an advance green phase to be added for the westbound left turn movement. However, as already noted, this scenario is considered to be a non-starter. The Highway 15/8 Avenue intersection also operates in an acceptable manner in the a.m. peak hour but similarly needs an advance green phase for the westbound left turn in the p.m. peak hour.

- (b) Option B: 2 Avenue Closed to Residential Traffic: The analysis undertaken in our earlier study assumed any Douglas traffic entering and exiting the neighbourhood via Highway 15 did so via 4 Avenue. The analysis therefore reflects the condition with 2 Avenue closed to all residential traffic but continuing open for traffic oriented to the business along the highway corridor. As was noted earlier, this was the condition requested by the City. If this route was open to residential traffic exiting the area, the conditions reflected in the analysis of the Highway 15/4 Avenue intersection would be slightly better than that documented. As this intersection is projected to operate beyond its capacity, based on the growth in traffic volumes assumed for 176 Street/Highway 15 through to 2021, any relief such as allowing local traffic to use 2 Avenue, would be beneficial.

Table 3.16
Douglas NCP - Intersection Performance – No Highway 15 Access
- Signalized Intersections

		Eastbound			Westbound			Northbound			Southbound			Over-all
		L	T	R	L	T	R	L	T	R	L	T	R	
2021 AM														
Hwy 15 / 8 Ave	LoS	D	D	A	C	C	A	D	C	C	D	D	B	C
	v/c	0.64	0.74	0.63	0.29	0.61	0.07	0.76	0.34	0.34	0.51	0.57	0.47	0.76*
	Delay	42.3	35.5	5.5	29.8	30.7	7.5	37.3	20.9	20.9	51.8	37.6	13.3	27.9
	Queue	49m	126m	23m	18m	100m	7m	104m	59m		44m	73m	34m	
8 Ave / 172 St	LoS	n/a	B	A	C	B	n/a	D	n/a	B	n/a	n/a	n/a	B
	v/c	n/a	0.51	0.26	0.32	0.67	n/a	0.80	n/a	0.30	n/a	n/a	n/a	0.80*
	Delay	n/a	15.1	2.6	20.3	17.9	n/a	37.5	n/a	15.5	n/a	n/a	n/a	18.7
	Queue		100m	13m	20m	145m		127m		31m				
2021 PM														
Hwy 15 / 8 Ave	LoS	C	C	A	F	B	A	F	D	D	F	D	A	D
	v/c	0.57	0.63	0.50	1.19	0.41	0.07	1.13	0.83	0.83	0.90	0.59	0.56	1.19*
	Delay	26.6	24.1	6.2	148	19.1	4.0	118	47.6	47.6	101	50.1	9.7	53.2
	Queue	65m	141m	62m	135m	80m	6m	155m	118m		75m	55m	23m	
(add Adv WBLT)	LoS	D	E	B	E	C	A	E	D	D	E	D	B	D
	v/c	0.72	1.00	0.63	0.97	0.44	0.07	1.00	0.80	0.80	0.76	0.58	0.56	1.00*
	Delay	49.6	77.3	16.2	77.6	21.5	4.5	77.2	44.8	44.8	74.5	49.5	10.6	50.1
	Queue	86m	224m	115m	107m	86m	7m	144m	116m		66m	55m	25m	
8 Ave / 172 St	LoS	n/a	A	A	F	A	n/a	F	n/a	B	n/a	n/a	n/a	C
	v/c	n/a	0.51	0.50	1.04	0.47	n/a	1.05	n/a	0.33	n/a	n/a	n/a	1.05*

		Eastbound			Westbound			Northbound			Southbound			Over -all
		L	T	R	L	T	R	L	T	R	L	T	R	
(add Adv WBLT)	Delay	n/a	8.0	1.8	91.3	7.6	n/a	107	n/a	16.0	n/a	n/a	n/a	21.9
	Queue		75m	9m	57m	68m		161m		25m				
	LoS	n/a	C	A	D	B	n/a	D	n/a	A	n/a	n/a	n/a	C
	v/c	n/a	0.81	0.65	0.71	0.53	n/a	0.82	n/a	0.26	n/a	n/a	n/a	0.82*
	Delay	n/a	30.1	7.1	38.4	11.1	n/a	51.4	n/a	6.8	n/a	n/a	n/a	22.1
	Queue		170m	49m	65m	94m		121m		14m				

- (c) Option C: 4 Avenue for Eastbound Residential: Having 4 Avenue open to eastbound traffic only, i.e., traffic exiting the neighbourhood but not to entering traffic, would lead to confusion for many visitors since most maps do not reflect one-way streets. Visitors would therefore still travel southbound on Highway 15 and make the right turn in at 4 Avenue. It is acknowledged that the performance of the intersection would improve as the residential component of the southbound right turn traffic on Highway 15 at 4 Avenue is now eliminated. The maximum v/c ratio in the p.m. peak hour reduces from 1.14 as given in Table 3.11 in the report to 1.03 as shown in Table 3.17. But what happens to vehicles destined to the area that do enter via 4 Avenue? They would have three options: to turn around on 4 Avenue and exit back onto Highway 15; turn south and exit via 2 Avenue; or just go the wrong way through the one-way eastbound “gate.” This wrong way use of the gate may even be used by visitors. This option is not considered a desirable option either.
- (d) Commuter vs. Truck Traffic: In a subsequent email memo of March 21, 2007, the Ministry expanded their request and added some additional options to be considered, noting that the Ministry “has concerns that residential traffic will unnecessarily be mixing with heavy truck traffic in their daily commutes.” It should be noted that the majority of the commuter traffic generated by the Douglas neighbourhood exiting the Highway 15/4 Avenue intersection will be doing so in the morning peak hour to travel northbound on Highway 15 whereas the concentration of the trucks are travelling southbound at this time. In the afternoon peak hour when this commuter traffic is returning southbound, the volume of truck traffic is relatively low and therefore once again there will be a minimal mixing.

Table 3.17
Douglas NCP - Intersection Performance
With No 4 Avenue Access to Residential

		Eastbound			Westbound			Northbound			Southbound			Over -all
		L	T	R	L	T	R	L	T	R	L	T	R	
2021 AM														
Hwy 15 / 4 Ave	LoS	C	C	C	C	C	B	D	B	B	D	B	D	B
	v/c	0.55	0.05	0.05	0.00	0.00	0.04	0.07	0.70	0.70	0.07	0.57	0.16	0.70*
	Delay	31.9	22.8	22.8	31.0	31.0	16.3	45.6	16.9	16.9	46.1	15.3	41.9	17.7
2021 PM														
Hwy 15 / 4 Ave	LoS	C	C	C	C	C	B	D	D	D	D	B	D	D
	v/c	0.54	0.12	0.12	0.00	0.00	0.04	0.23	1.03	1.03	0.07	0.57	0.43	1.03*
	Delay	32.6	24.7	24.7	32.0	31.0	16.4	43.9	48.7	48.7	46.7	18.8	47.4	37.3

Based on this review of the three options considered for access to the Douglas neighbourhood to and from 176 Street/Highway 15, it is concluded that 4 Avenue should remain open to use by residents of the Douglas neighbourhood and that 2 Avenue could be closed.

3.13 Safety

The Ministry requested that the safety of their intersections be considered. All five of the signalized intersections and roundabouts analyzed in this study have been constructed within the last two years by Ministry contractors based on Ministry designs. It is assumed that the Ministry undertook safety audits of the designs of these intersections prior to them being constructed – it is known that such a safety review was undertaken by CH2M Hill for the Highway 15/4 Avenue intersection. The Ministry subsequently indicated that, given the short time frame that these intersections and roundabouts have been in operation, there is insufficient data available to undertake such a review and it was agreed that this issue should not be investigated any further.

4.0 RECOMMENDED TRANSPORTATION NETWORK

4.1 Road Network

The road network for the Douglas neighbourhood was defined by the City at the commencement of this study and then modified to reflect the elimination of 0A Avenue between 170 Street and 171 Street. Based on the analysis undertaken in this study, there is no need to change the City's desired network.

Recommendation: The recommended road network, which can serve as the base for future development in the area, showing both existing and proposed future roads, is illustrated in Exhibit 4.1. This network includes the continued use of the existing access to 176 Street/Highway 15 at 4 Avenue by the existing and future residents of the Douglas area but closing 2 Avenue as requested by the City. No improvements are required to these intersections as a result of the development of the Douglas neighbourhood.

It is acknowledged that some of the development applications being considered envisage relatively minor changes to this road network. The City has suggested that these changes will be addressed in conjunction with consideration of the individual development applications.

4.2 Road Classification

As referenced earlier, road networks typically consist of a mixture of arterial, collector, and local roads and Surrey's road network is no exception. The City's stated guidelines for the different road classifications relevant to the study area are as follows:

- (a) Collectors
- Carry through, slower speed traffic
 - Accommodate vehicles, bicycles, pedestrians, and on street parking
 - Are preferred for transit routes
 - Collect the local roads' traffic and direct it to the arterial road network
 - Intersection spacing a minimum of 100m and preferably 200m
- (b) Through Local
- Provide direct access to individual lots
 - Accommodate residential vehicular, bike and pedestrian traffic
 - Carry internal traffic and direct it to collectors and arterials
 - Provide for internal circulation
 - Intersection spacing along through local should be a minimum of 100m maximum 200m
- (c) Limited Local
- Provide direct access to individual lots
 - Do not provide internal circulation
 - Create closed neighbourhoods, with safety concerns for pedestrian connections

Recommendations: The recommended classifications were established based on a review of these definitions, the role of each road within the study area, and the projected volumes on them as well as the existing classifications and local circumstances, and this is given in Table 4.1 and shown in Exhibit 4.2

**Table 4.1
Proposed Road Classification**

Roadway	Existing Classification	Proposed Classification
Highway 99	Provincial highway	Provincial highway
Highway 15 (176 St)	Provincial highway	Provincial highway
172 Street	Major Collector – 4 Ave to 8 Ave Local Road – 0 Ave to 4 Ave	Special Through Local – 0A Ave to 4 Ave Major Collector 4 Ave to 8 Ave Through Local – 0 Ave to 0A Ave
171 Street	Local Road – 0 Ave to 4 Ave	Through Local – 0 Ave to 4 Ave
8 Avenue	Provincial highway	Provincial highway
4 Avenue	Major Collector – 172 St to 176 St Local Road – 171 St to 172 St	Major Collector – 172 St to 176 St Through Local – 171 St to 172 St
2 Avenue	Local Road – 172 St to 176 St	Through Local – 172 St to 176 St
0A Avenue	--	Through Local – Peace Park Dr to 170 St Through Local – 171 St to 174 St
0 Avenue	Local Road	Unique Through Local

The only change of any significance is that whereas the existing classification has all local roads as simply local, the new classification has subdivided these into limited local and through local.

4.3 Intersection Improvements

The treatment proposed for the key intersections are discussed as follows:

- (a) 4 Avenue/175A Street: In the previous NCP it was recommended that this intersection be configured so that eastbound 4 Avenue traffic is controlled by a stop sign, i.e., the east leg of 4 Avenue would flow directly into the south leg of 175A Street. This was intended to discourage traffic from using 4 Avenue to exit to Highway 15, thereby discouraging traffic shortcutting through the neighbourhood, and to confine the commercial traffic exiting from Highway 15 to 175A Street. Whilst it is confirmed that this principle is acceptable, it should be cautioned that traffic exiting from the neighbourhood segment of 4 Avenue to Highway 15 could in fact face extensive delays as they will have to give way to traffic travelling westbound on 4 Avenue turning south on 175A Street.

Recommendation: Given that 4 Avenue is a collector road, the recommended configuration is to leave it as a 'T' with a left turn lane on the east leg of 4 Avenue and prohibit left turn movements from the south leg of 175A Street.

- (b) 2 Avenue/174 Street: The 2 Avenue route appears to be used as a shortcutting route by traffic travelling between 8 Avenue and the border. At one time there was a recommendation to close the segment of 2 Avenue west of 175A Street. In the previous NCP, traffic calming measures were recommended at this location – these included speed humps and a chicane, with the purpose of the chicane being to permit passenger vehicles to pass through it but not commercial traffic. Furthermore, the chicane restricts the number of vehicles since only one vehicle can pass through it at any one time.

It is noted that 2 Avenue is in a direct line between 172 Street and 176 Street/Highway 15 with no visual obstructions. Traffic arriving at 2 Avenue on 172 Street therefore can see the trucks and other vehicles on Highway 15.

Recommendation: Some form of curvilinear alignment on a segment of 2 Avenue as this would certainly eliminate the attraction of this route between 172 Street and Highway 15 with respect to its visibility.

Ideally, the east leg of this 2 Avenue should connect directly into 175A Street. However, it appears to be too late to achieve this configuration. It is noted that 2 Avenue is to be classified as a “through local”, meaning that it connects to other roads at either end.

Recommendations: It is recommended that some form of alignment shift be considered to discourage such traffic. In addition, traffic calming measures, including a chicane on the west side of 175A Avenue should be introduced on 2 Avenue.

- (c) 4 Avenue/172 Street and 2 Avenue/172 Street: The three key roads within this neighbourhood will be 172 Street, 4 Avenue, and 2 Avenue. The first of these is a special through local with the second a major collector and the third a through local. All three lead to signalized access points on the highways outside of the neighbourhood. Traffic

volumes through these two intersections are relatively low and traffic circles could accommodate such traffic.

Recommendation: Consideration should be given to the use of traffic circles at the intersections of 4 Avenue/172 Street and 2 Avenue/172 Street.

4.4 Other Road Network Issues

- (a) 172 Street: This will be one of the primary access routes into the area and traffic volumes will be relatively high.

Recommendation: Given the number of developments along the length of 172 Street particularly between 1 Avenue and 4 Avenue, it is recommended that a centre left turn lane be added to reduce unnecessary delays to through traffic.

However, if traffic circles are installed on 172 Street at the two intersections at either end of this length, i.e., 1 Avenue and 4 Avenue, then a centre left turn lane is not required since vehicles can be restricted to right-in/right-out movements only and use the traffic circle to make the equivalent left turn movement. This road would then be an ideal candidate for a centre median.

Concern has been expressed over the speed of traffic on 172 Street. Certainly the traffic circle proposed at the 4 Avenue intersection will tend to slow traffic down; however, other traffic circles are also recommended at 3A Avenue and 2 Avenue. Further measures such as curb extensions may also be necessary. It should also be noted that as there is very little development along these roads at the present time; development will increase and this does tend to reduce traffic speeds.

- (b) 0A Avenue: This has been deemed a “unique through local” road continuous between 171A Street and Peace Park Drive. It is not perceived that this road would be used for any form of shortcutting traffic by vehicles external to the neighbourhood – just traffic generated by the Douglas neighbourhood. Whereas the 1999 plan had 0A Avenue as a series of short streets and/or cul-de-sacs thereby ensuring a relatively circuitous route for those wishing to exit to Highway 99 northbound, the current plan now has just one missing segment.

4.5 Traffic Controls

As noted above, traffic volumes on roads within the neighbourhood are projected to be relatively low. At all other intersections, stop sign controls on the minor legs are considered adequate.

Recommendations: The four key intersections of 1 Avenue, 2 Avenue, 3A Avenue, and 4 Avenue with 172 Street should be controlled through traffic circles. Another candidate for a traffic circle is 2 Avenue/174 Street. The recommended traffic control plan is provided in Exhibit 4.3.

4.6 Proposed Pedestrian Network

In order to enhance the opportunities for pedestrians, sidewalks should be provided on both sides of the major collectors and also the through local roads within the neighbourhood. The primary exception to this would be the north side of 4 Avenue between 172 Street and 175A Street since the lands on this north side are not included in this neighbourhood plan. For all other local roads, sidewalks should be provided on one side only.

Any traffic circles proposed within the neighbourhood should incorporate pedestrian crosswalks on all four legs. These crosswalks could be raised in order to firstly slow traffic down and secondly to make it very obvious to pedestrians that they are crosswalks.

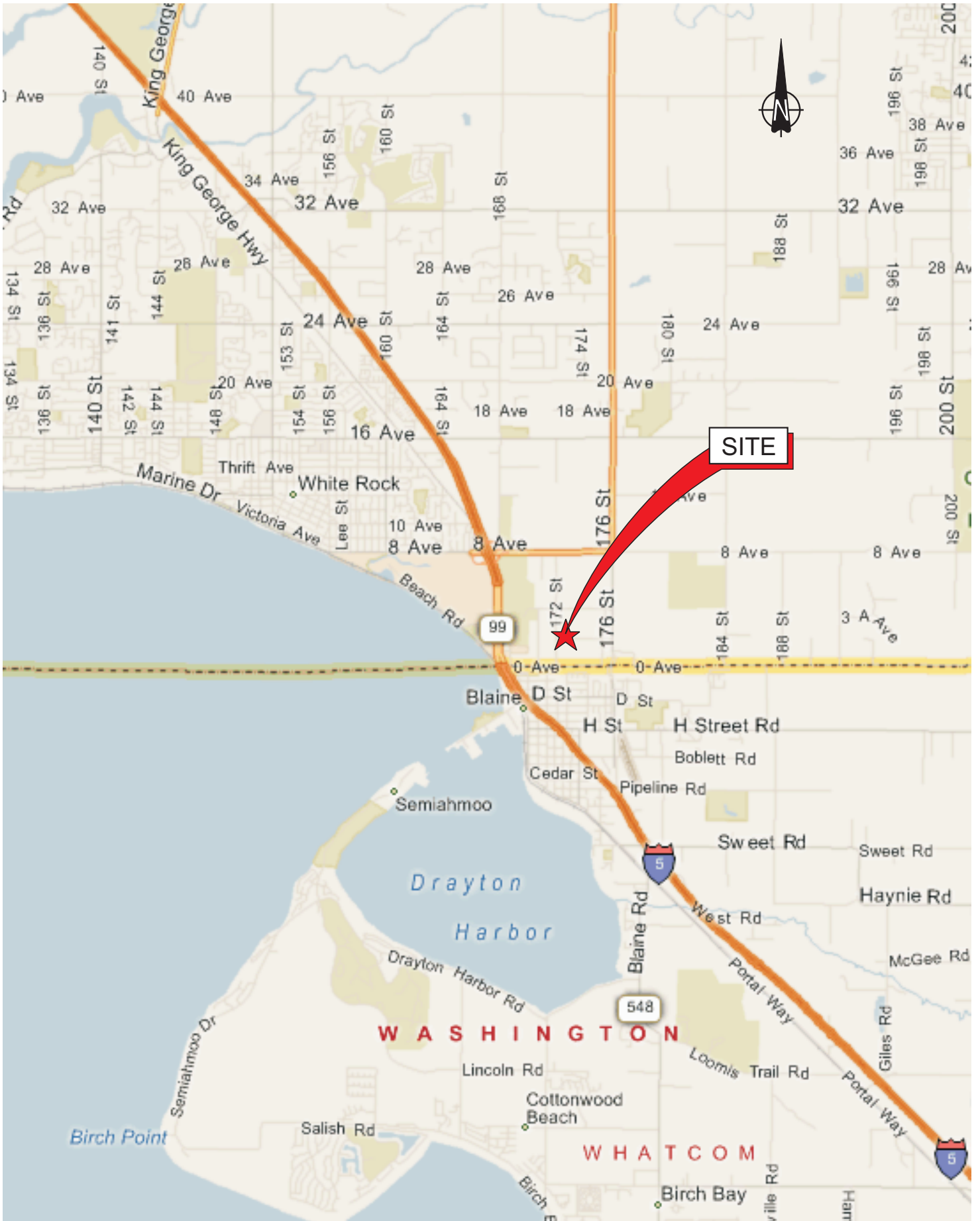
The City has indicated that there is also the potential for a pedestrian link connecting 4 Avenue to 3A Avenue.

Recommendations: The recommended pedestrian network is shown in Exhibit 4.4.

4.7 Recommended Bicycle Routes

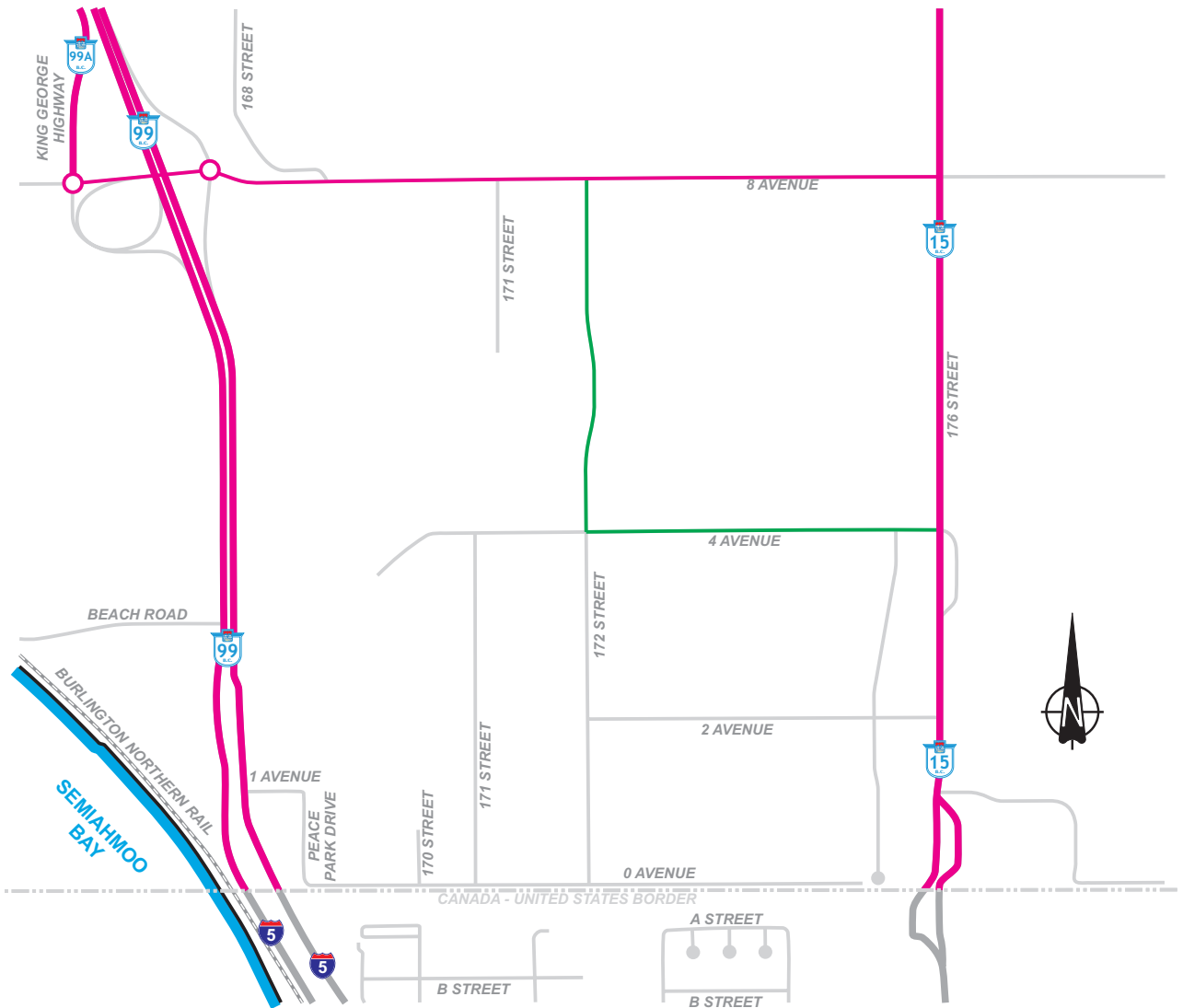
Whilst these TransLink routes serve the regional recreational public, they do not fully address the needs of the local residents. For this reason, 172 Street between 0 Avenue and 4 Avenue as well as 2 Avenue between 172 Street and 175A Street should also be designated as bicycle routes.

Recommendations: The recommended network is shown in Exhibit 4.5.



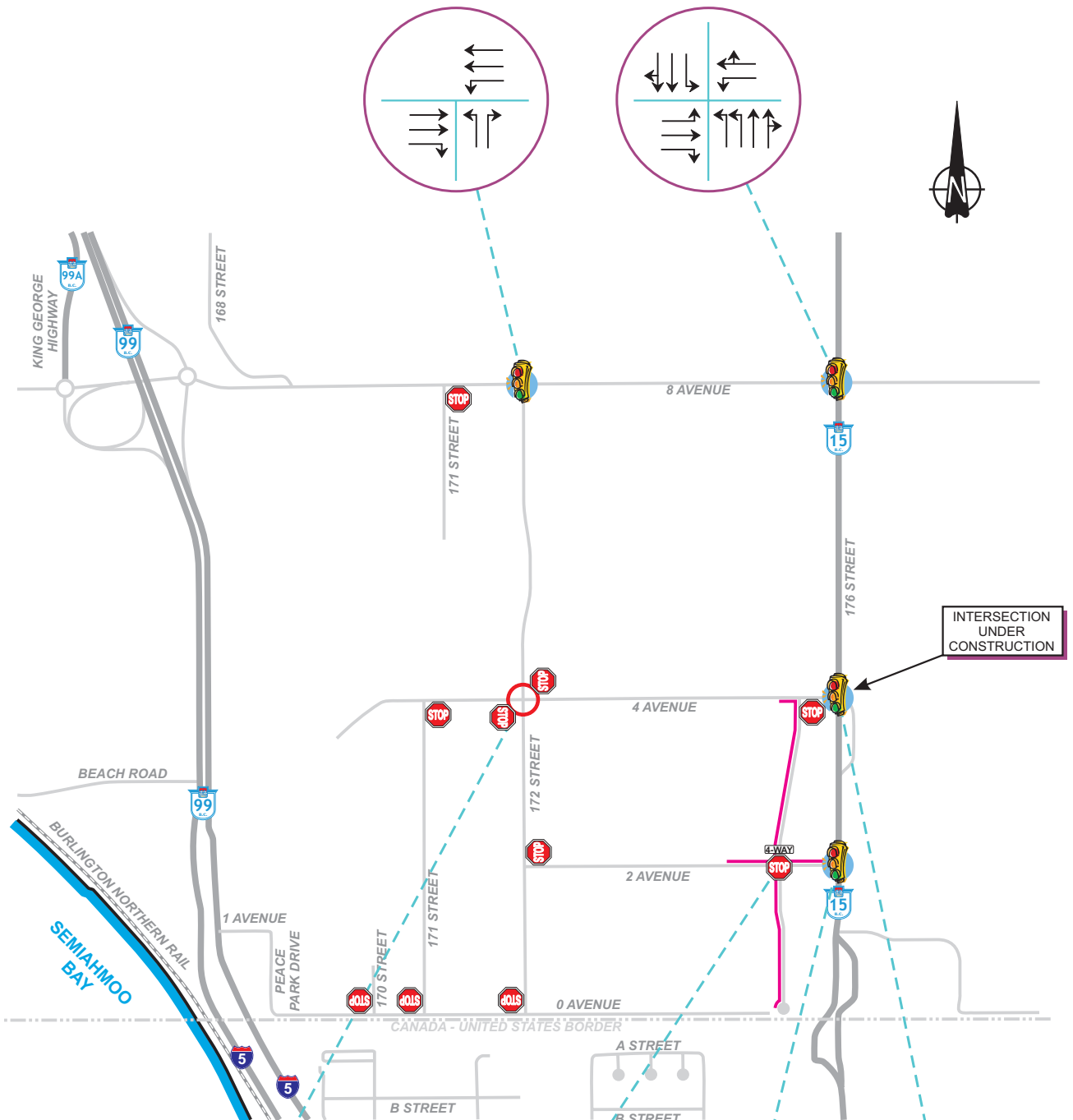


2006 EXISTING ROAD NETWORK AND CLASSIFICATIONS






LEGEND	
—	PROVINCIAL HIGHWAY
—	COLLECTOR ROAD

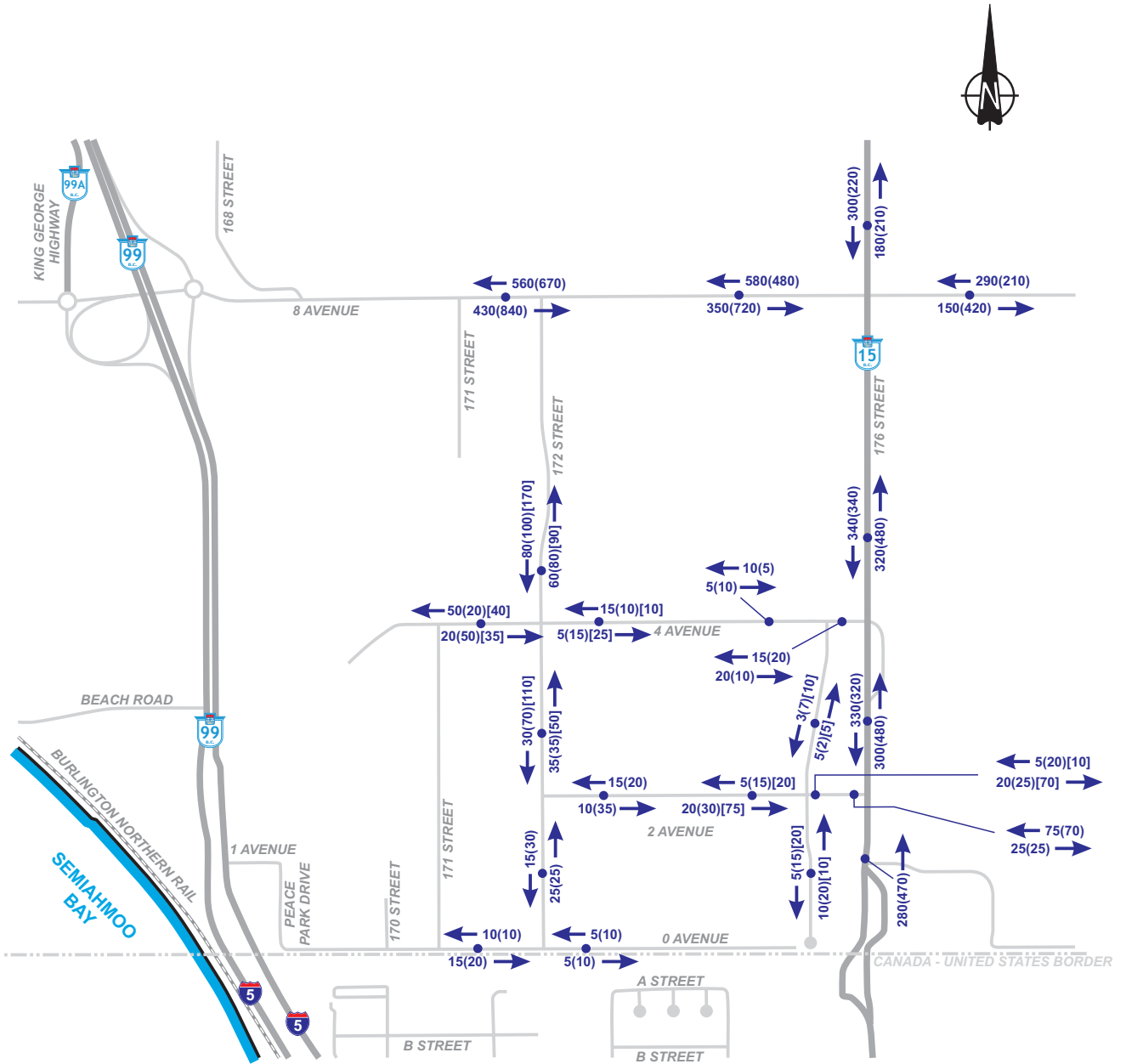
EXISTING INTERSECTION CONFIGURATION AND CONTROLS



LEGEND

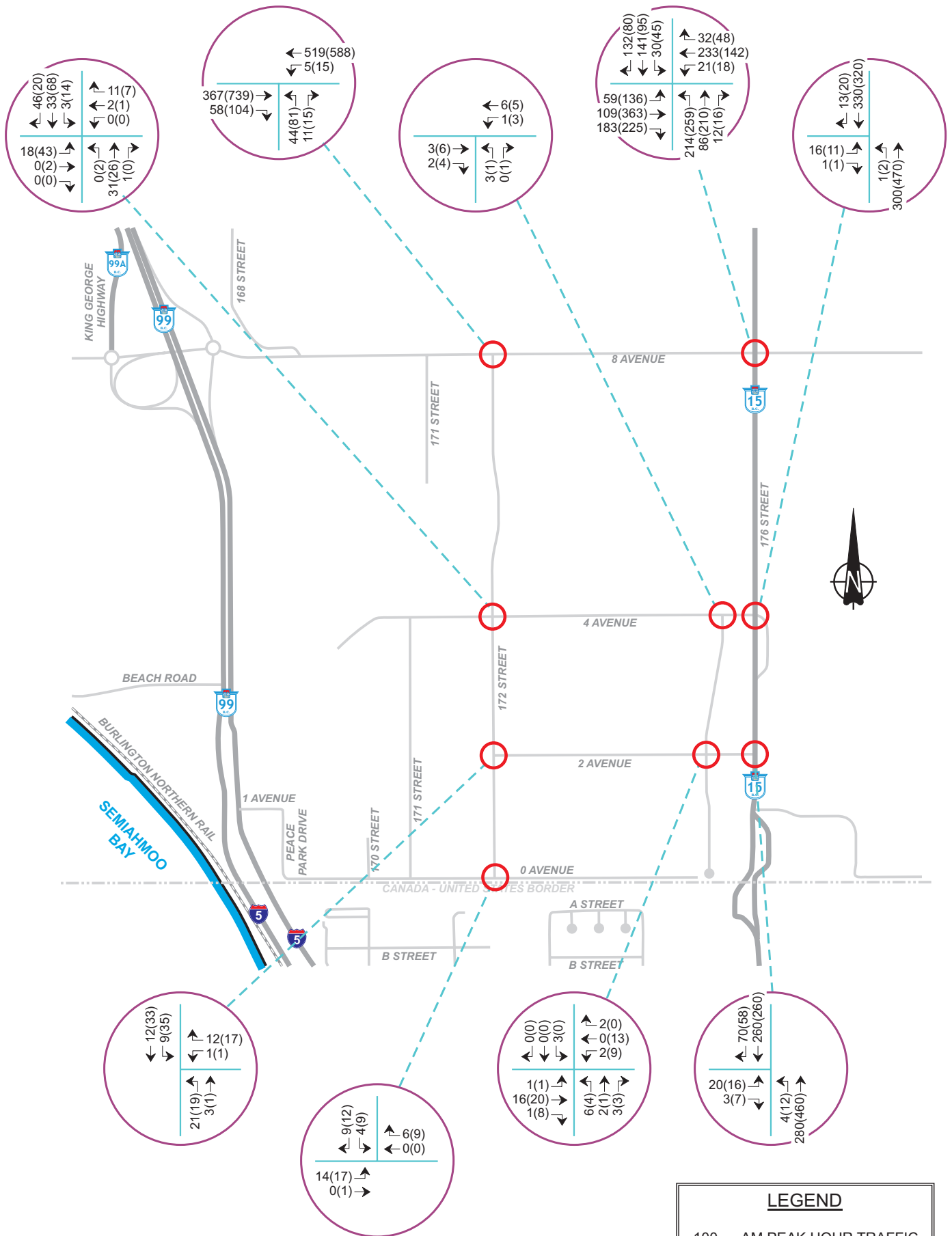
-  SIGNALIZED INTERSECTION
-  STOP CONTROLLED INTERSECTION
-  CONCRETE SIDE-WALL

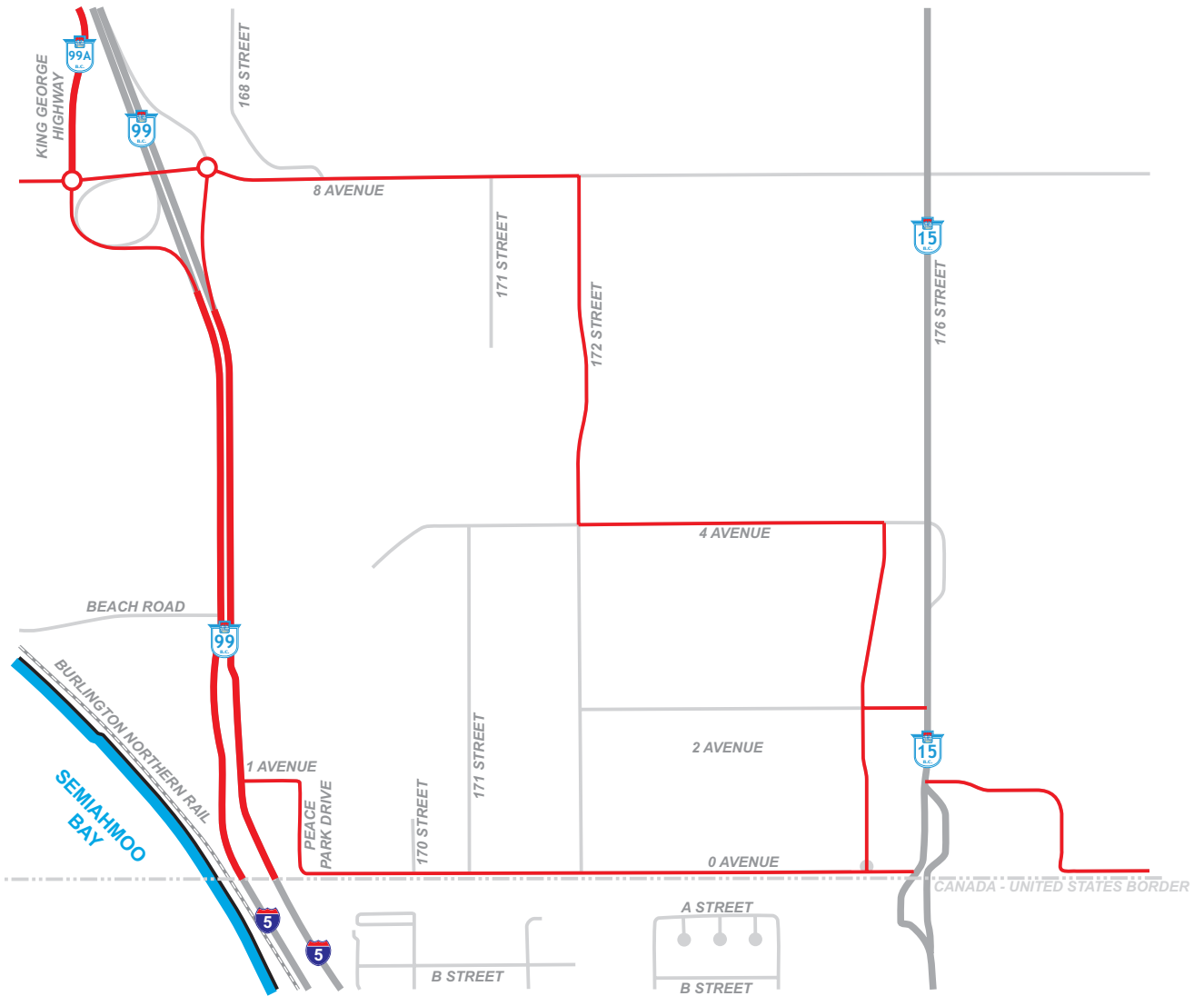
2006 EXISTING TRAFFIC VOLUMES

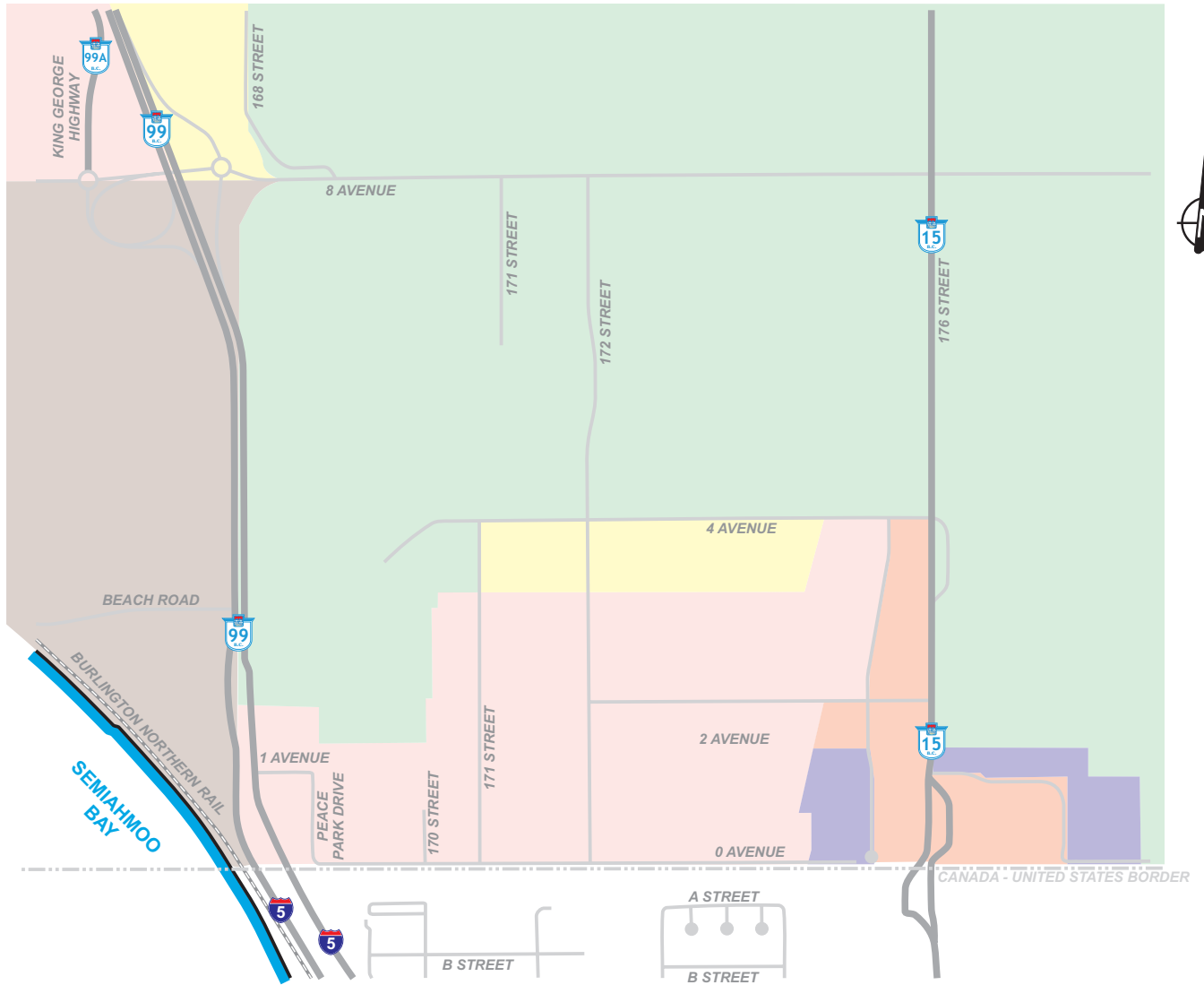


LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC
[200]	SATURDAY PEAK HOUR TRAFFIC

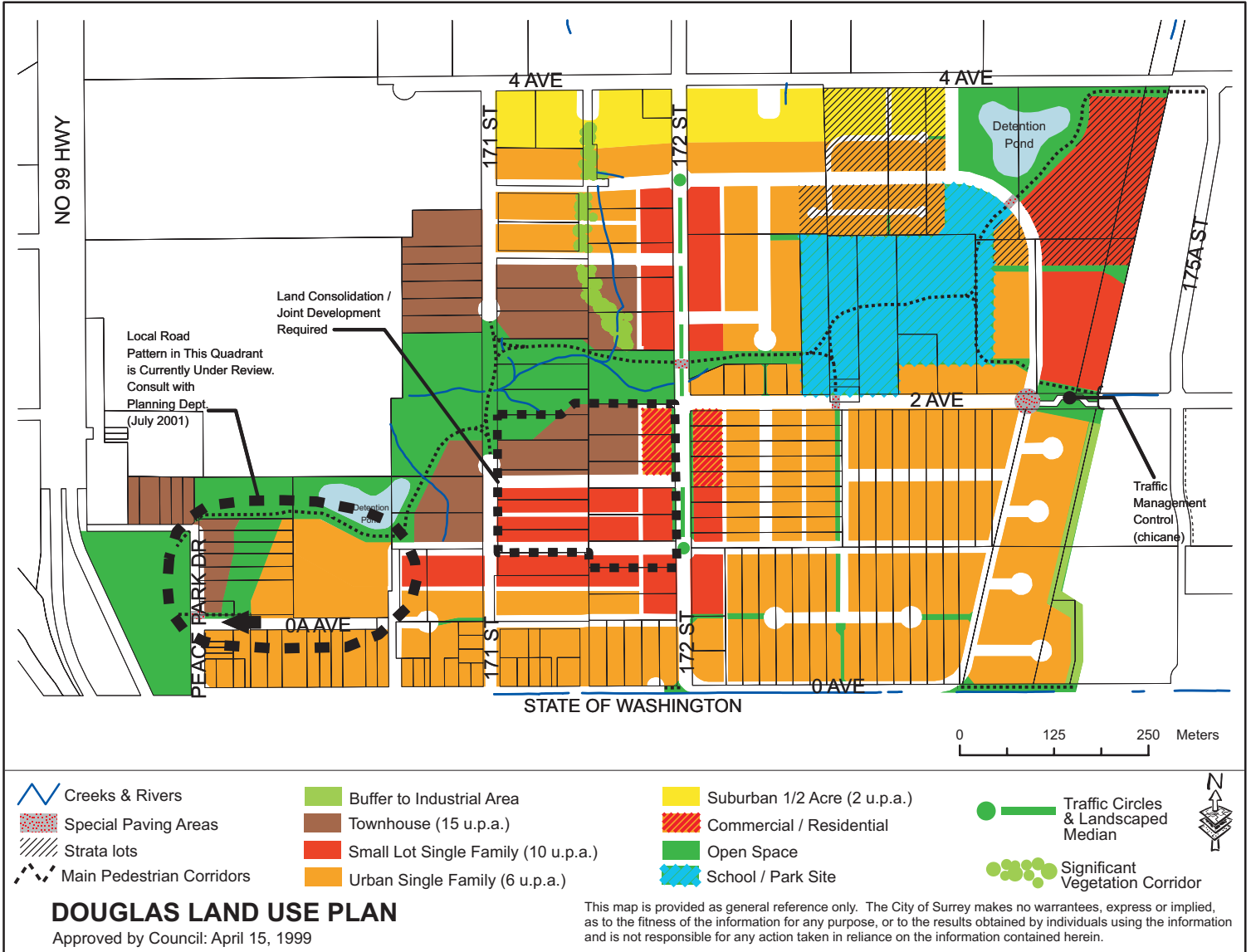
2006 EXISTING TRAFFIC VOLUMES

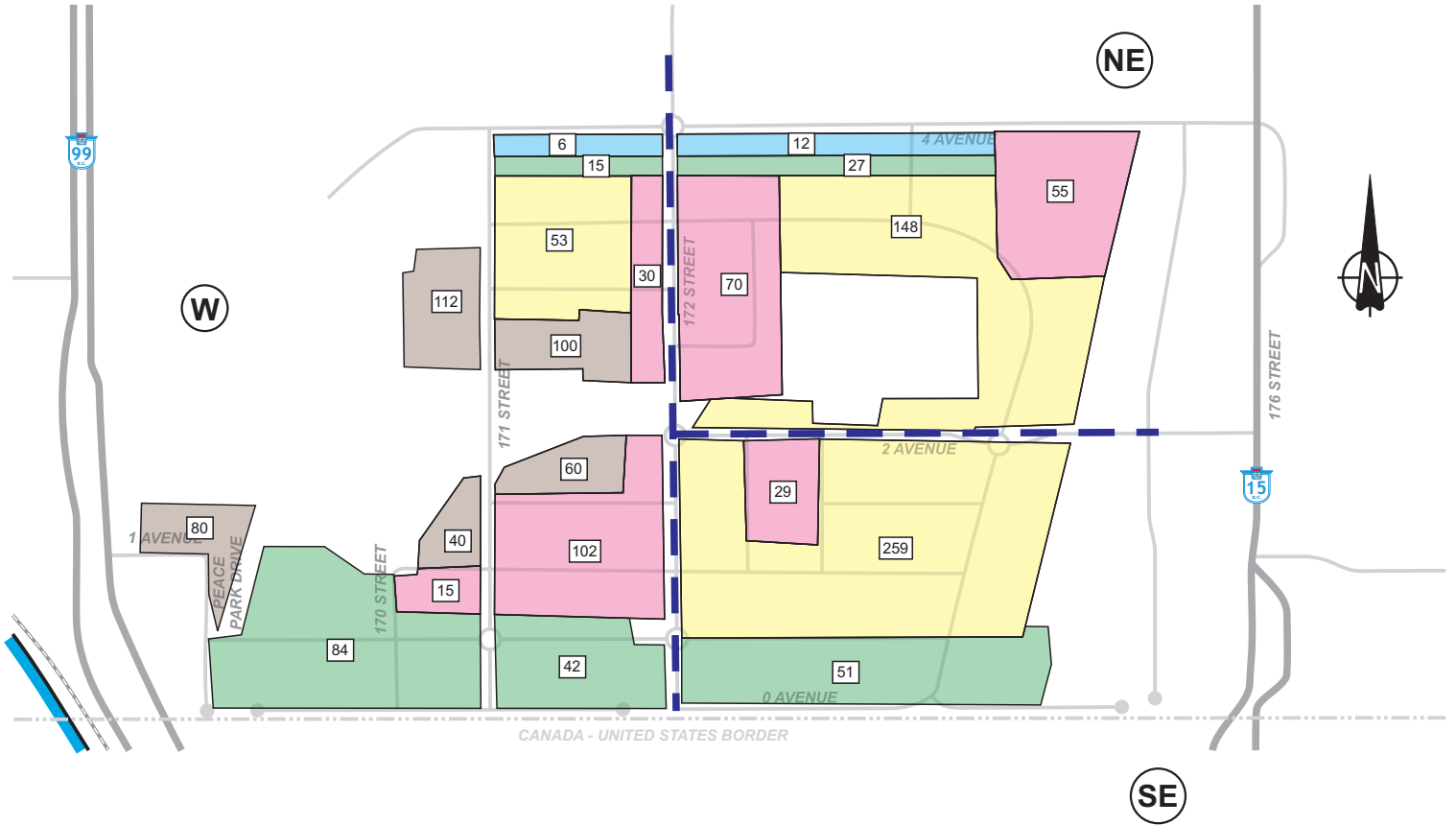











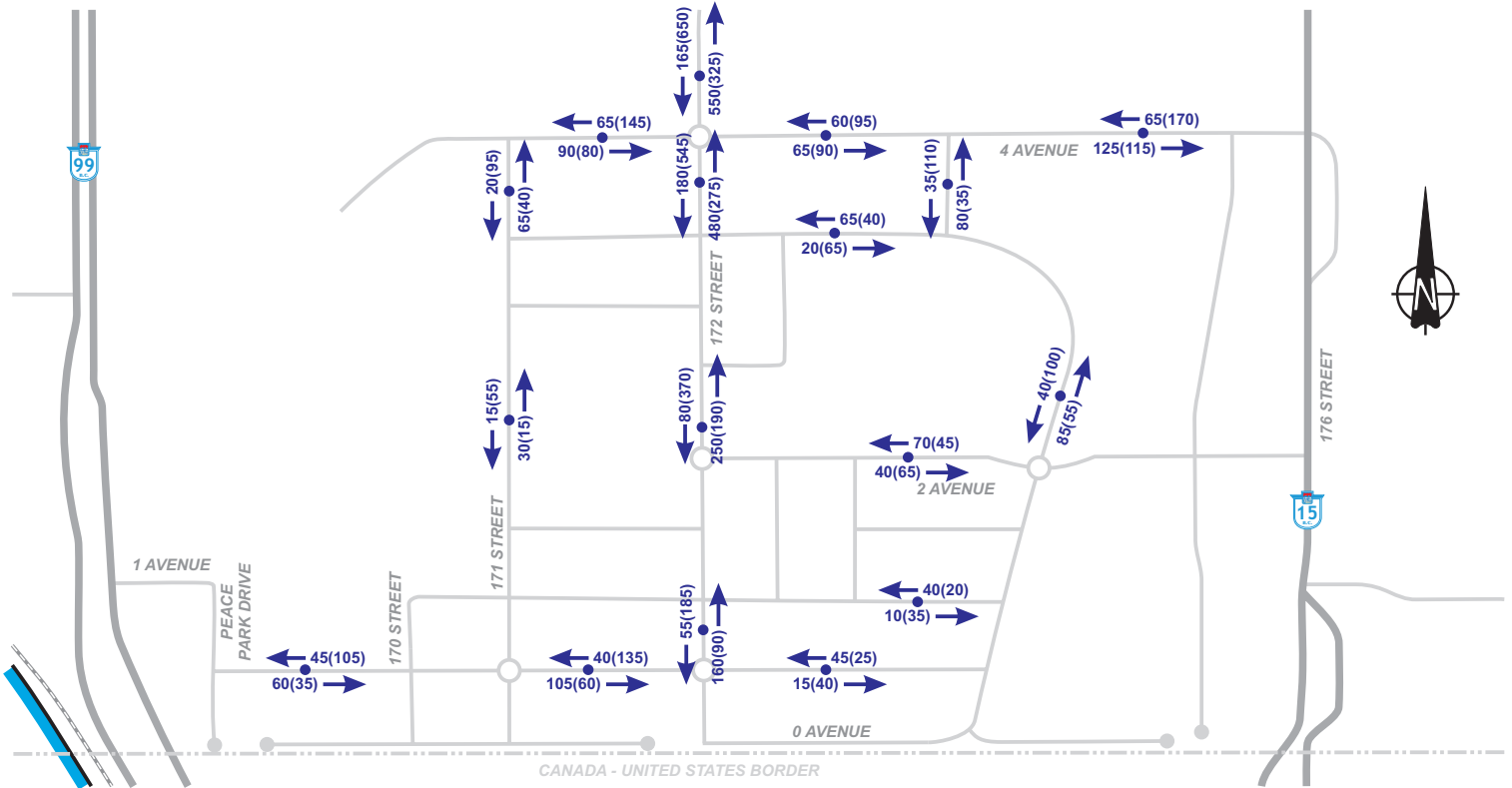
LEGEND	
	URBAN
	SUBURBAN
	AGRICULTURAL
	COMMERCIAL
	INDUSTRIAL
	INDIAN RESERVE



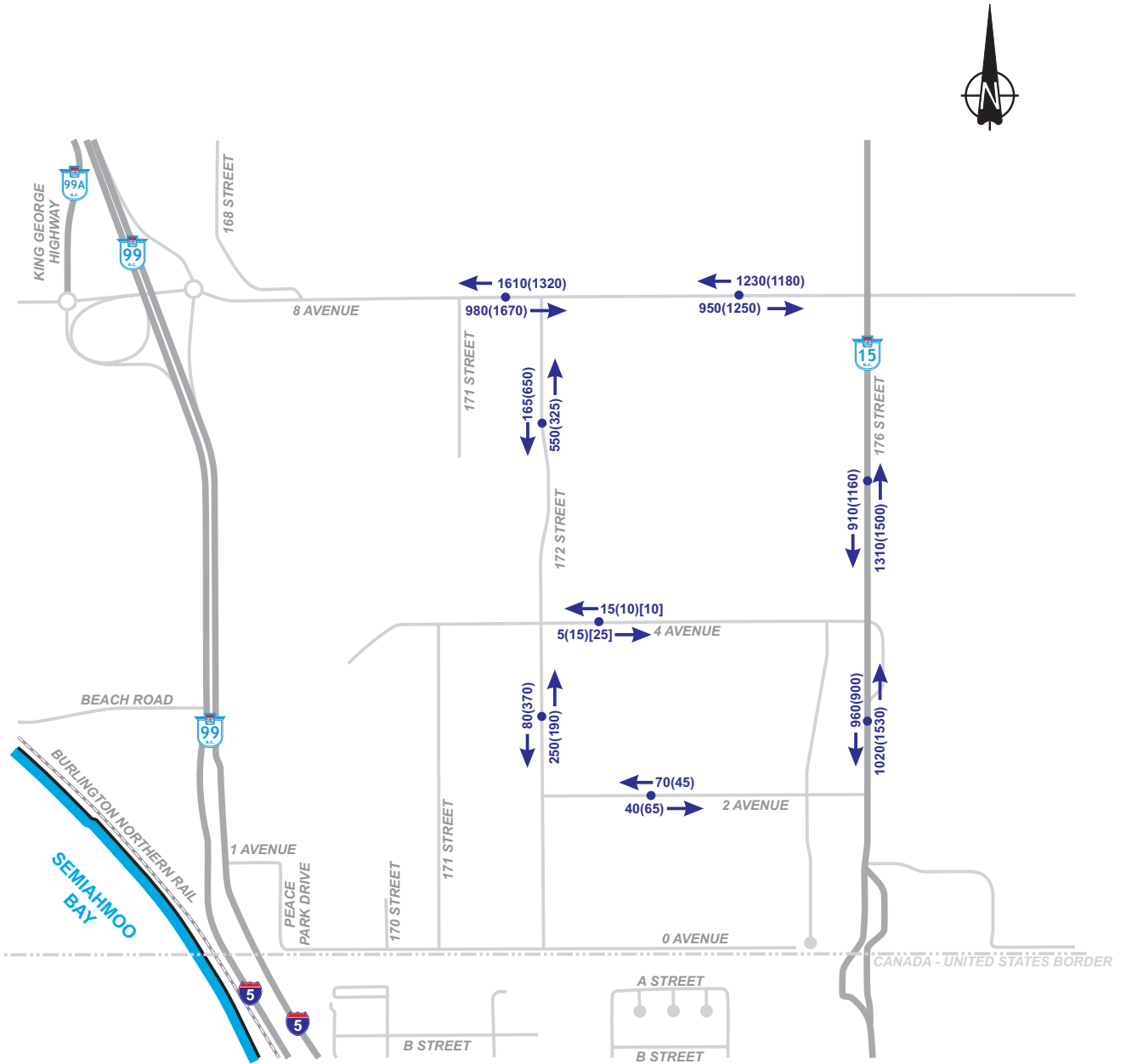


LEGEND		NZ	SZ	W	Total
	RH-G Zone (2 upa)	12	0	6	18
	RF Zone (6 upa)	27	51	141	219
	RF-12 Zone (8 upa)	148	259	53	460
	RF-9 Zone (10 upa)	125	29	147	301
	Townhouse Zone (22 upa)	0	0	392	392
		312	339	739	1390

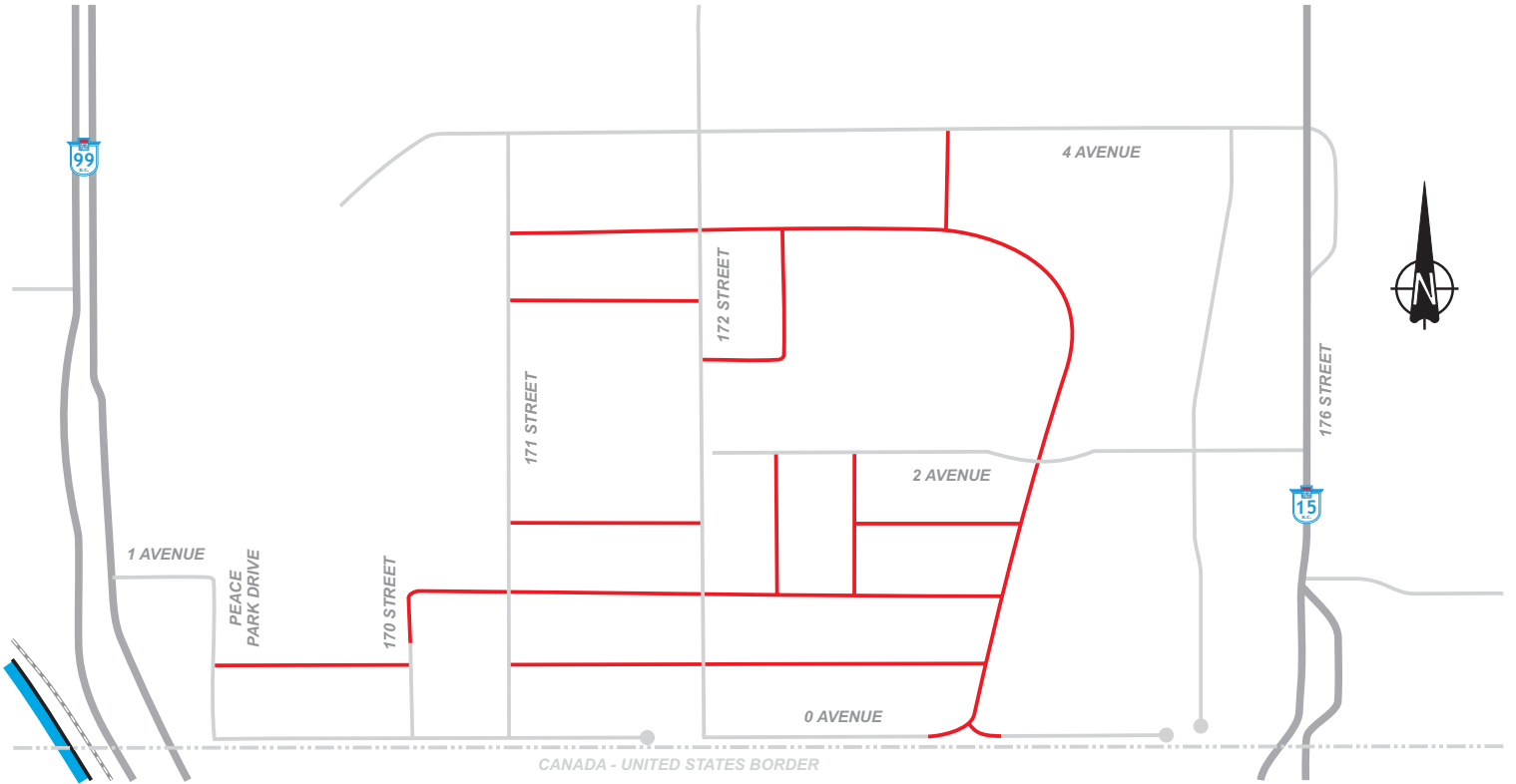
FUTURE DEVELOPMENT TRAFFIC




LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC



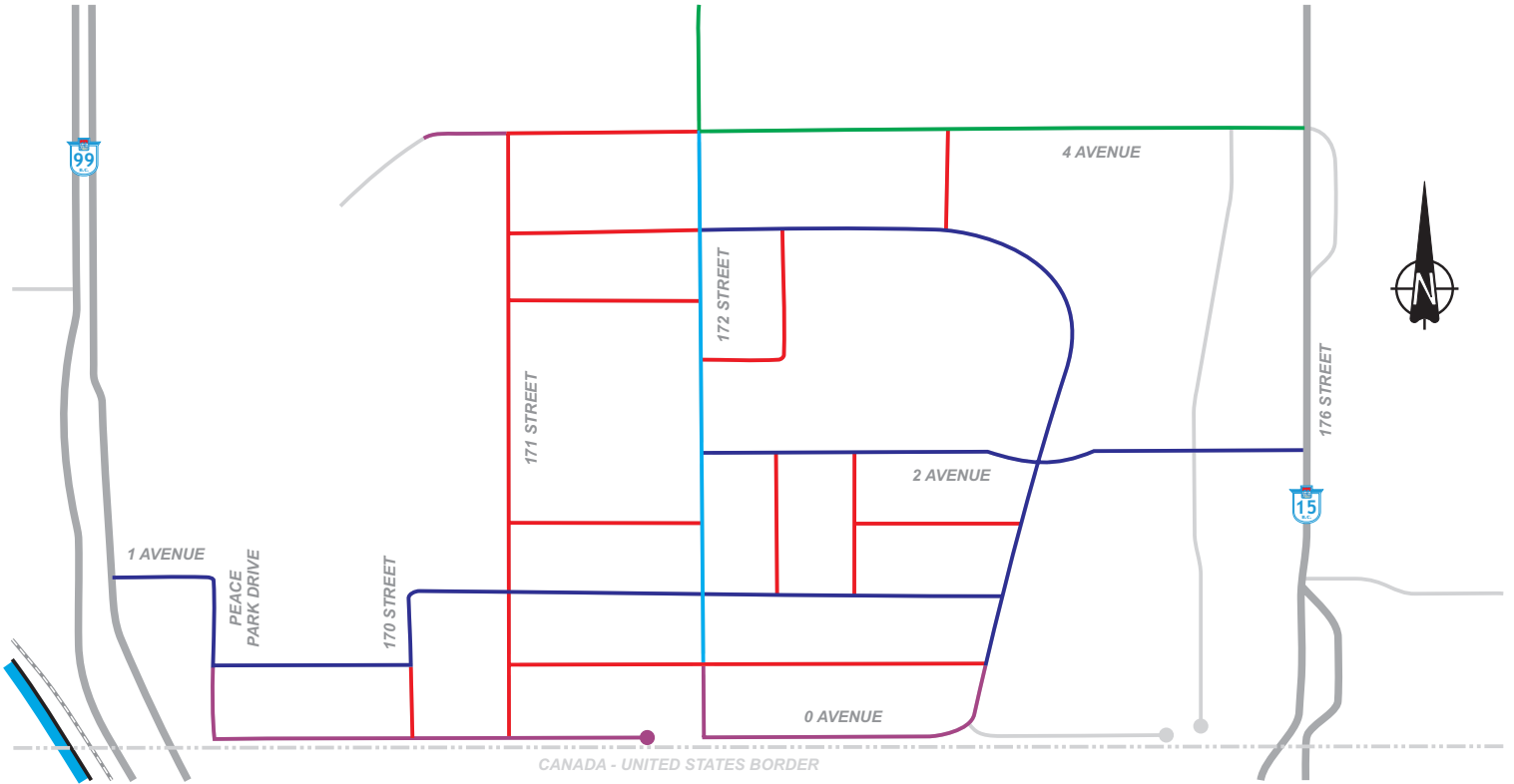
LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC
[200]	SATURDAY PEAK HOUR TRAFFIC








LEGEND

-  EXISTING ROAD
-  NEW ROAD

RECOMMENDED ROAD CLASSIFICATIONS







LEGEND	
	COLLECTOR ROAD
	SPECIAL THROUGH LOCAL ROAD - "MAIN" STREET <i>(14m pavement)</i>
	THROUGH LOCAL ROAD <i>(11m pavement)</i>
	THROUGH LOCAL ROAD <i>(8.5m pavement)</i>
	UNIQUE LOCAL ROAD <i>(6.6m pavement)</i>

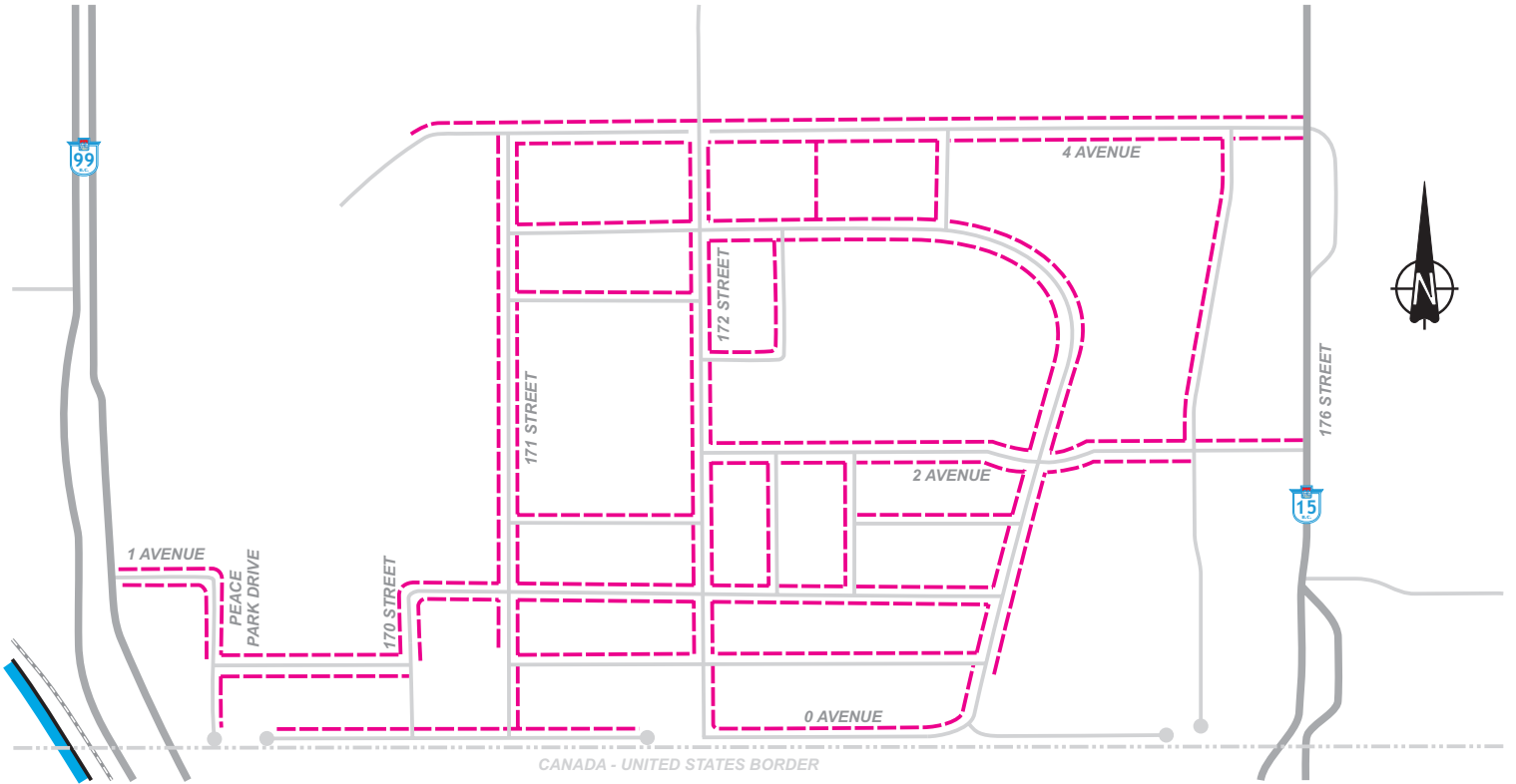
RECOMMENDED TRAFFIC CONTROL PLAN

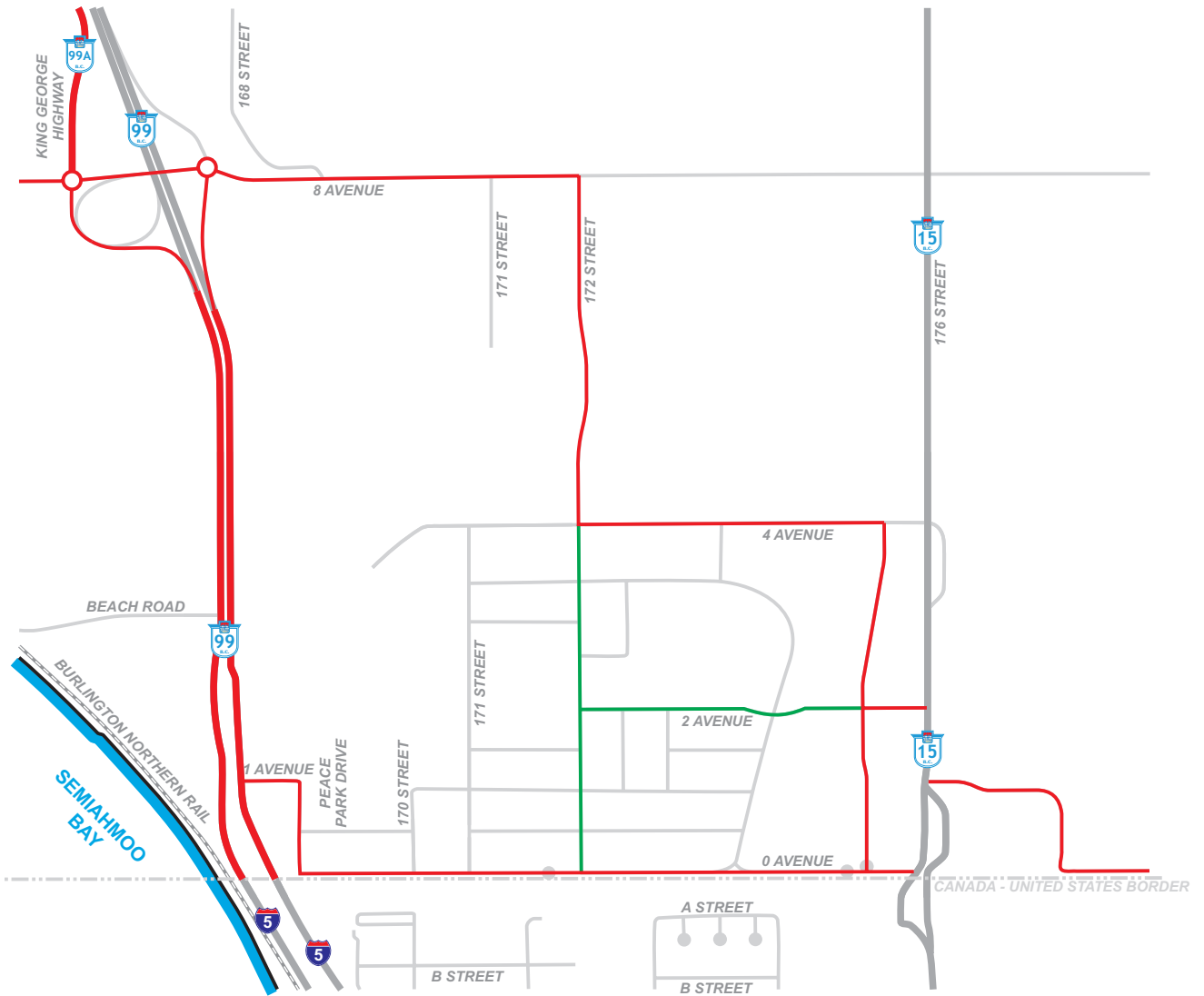


LEGEND

-  SIGNALIZED INTERSECTION
-  STOP CONTROLLED INTERSECTION
-  FOUR-WAY STOP
-  NO LEFT TURNS

RECOMMENDED SIDEWALK NETWORK





LEGEND

- EXISTING BICYCLE NETWORK
- RECOMMENDED BICYCLE NETWORK