

*A Technical Memo
For:*

GEORGE MASSEY TUNNEL REPLACEMENT
PROJECT
ANALYSIS OF OD SURVEY DATA
FALL 2014

DRAFT

Submitted By:

PARSONS

SW1223
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TABLE OF CONTENTS

1.	Introduction	1
2.	Bluetooth Data Collection and Processing	3
3.	Analysis Limitations	5
4.	GMT Trip Patterns - North Side of the Fraser River	6
5.	GMT Trip Patterns - South Side of the Fraser River.....	10

DRAFT

1. Introduction

The George Massey Tunnel Replacement project team commissioned an Origin Destination (OD) survey along Highway 99 and Highway 91 in October/November 2014.

This survey was conducted using Bluetooth technology. Temporary Bluetooth reader units were stationed at key locations throughout the corridors and collected data for approximately two weeks. This data was supplemented by the Ministry Advanced Traveller Information System (ATIS), which collects similar data. The datasets were analyzed and aggregated to determine regional traffic patterns.

Figure 1.1 illustrates the locations of the Bluetooth reader units.

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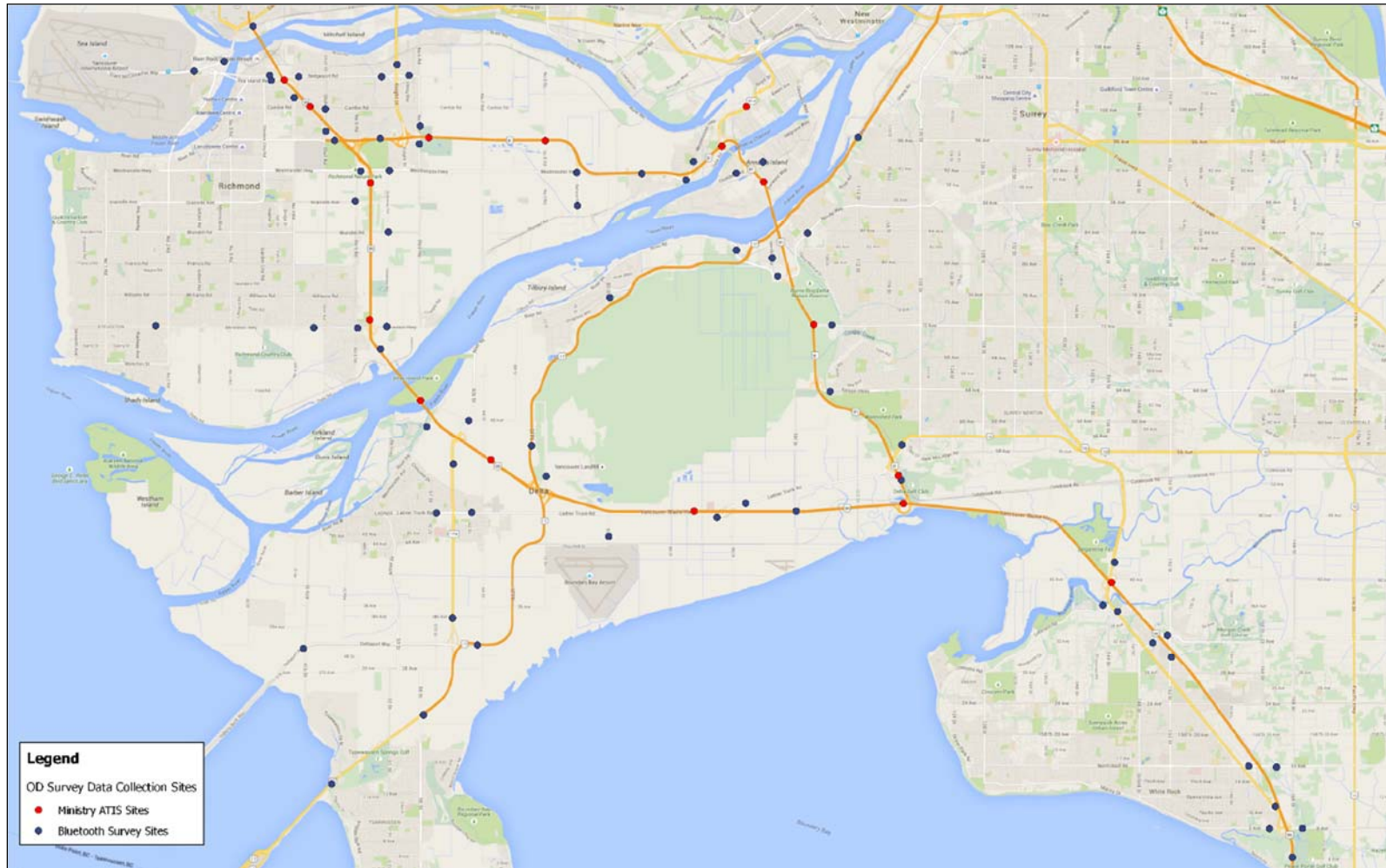


Figure 1.1 - Map of Bluetooth Reader Locations

2. Bluetooth Data Collection and Processing

Key characteristics of the OD datasets were as follows:

- The survey was conducted from October 22 through November 5, 2014;
- Bluetooth reader units were installed at 70 locations to collect Media Access Control (MAC) addresses;
- The data was supplemented with MAC addresses from 16 Ministry ATIS stations;
- Almost 14 million Bluetooth “hits” were captured – yielding 3.6 million events, once duplicate hits at specific stations were removed;
- About 127,000 events were excluded since they were stationary devices;
- A substantial proportion of events occurred at only one station (913,000 or about 25 per cent). These primarily represent cross traffic or traffic that did not use the Highway 99 or 91 corridors. These events are not included in the OD analysis;
- The penetration rate varied at each location, ranging between 7 to 11 per cent.
- The remaining 2.56 million events were converted to 507,000 trips from/to specific station pairs over the period Oct. 22 to Oct. 31

Error checks were performed to identify trips with possible errors including:

- Loop trips with common start and end points;
- Trips that appear to use both crossings;
- Trips with a very low sample size, which limits the potential for consistency checks;
- Trips that were significantly longer in time than the norm for a given OD pair.

The Bluetooth sites were grouped geographically into 17 subareas to assist in the analysis of origin-destination patterns. The subareas are mapped in **Figure 2.1**.

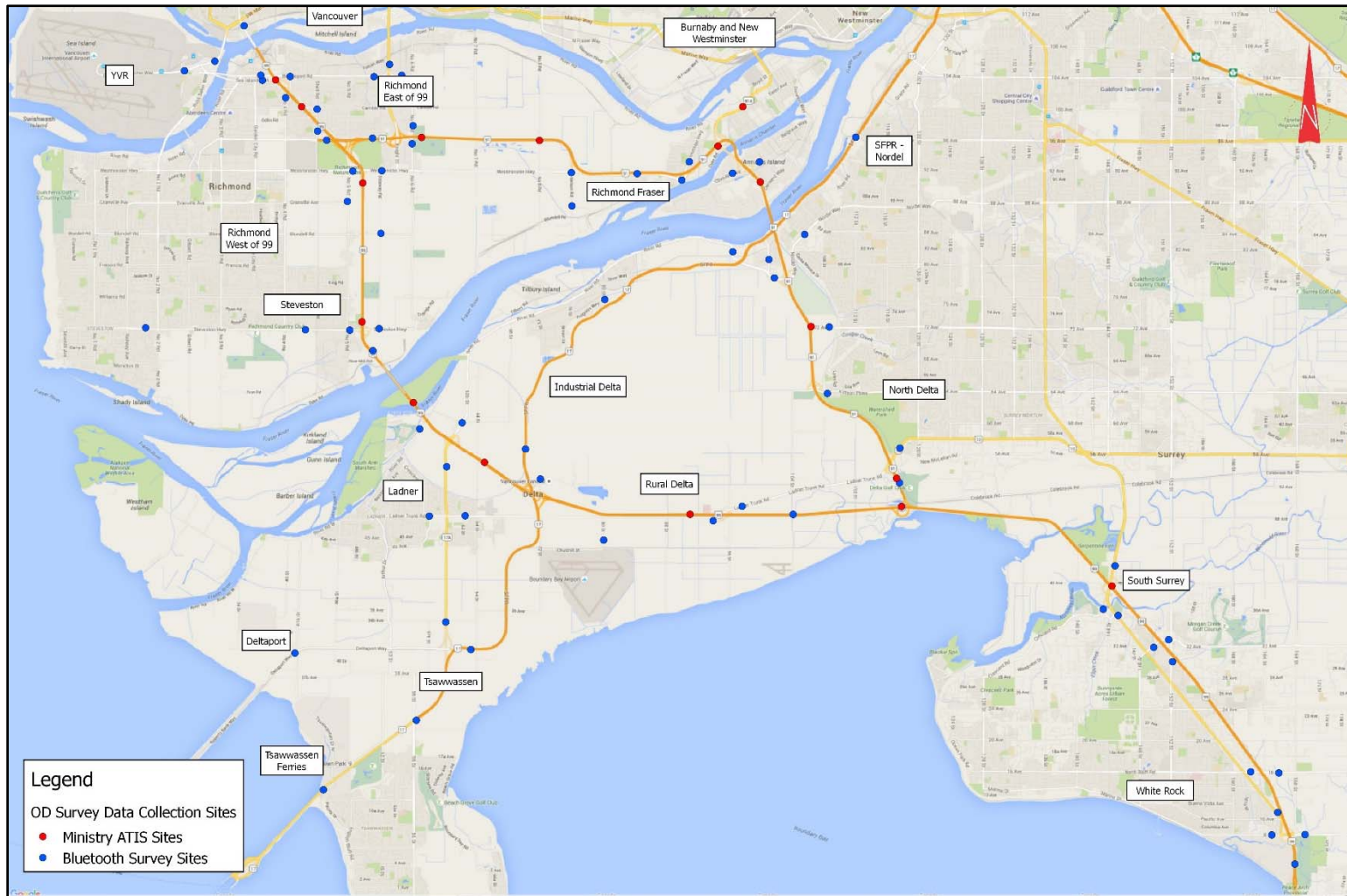


Figure 2.1 - Map of Sub-Area Locations

3. Analysis Limitations

The limitations of the survey methodology must be understood when interpreting the findings presented in this document.

The collected data represents a sample of the total vehicle fleet. Not every vehicle will have a Bluetooth device enabled. Furthermore, although the Bluetooth reader units are fairly reliable, there is a possibility that a device may not be detected.

Traffic patterns are dynamic. While the OD survey was conducted over a period of two weeks, it may be difficult to determine traffic patterns as they can vary on a daily basis.

Therefore, it should be expected that the traffic patterns on any given day will exhibit some deviation from the findings presented in this document.

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4. GMT Trip Patterns - North Side of the Fraser River

The estimated traffic patterns for trips destined to/originating from areas on the north side of the Fraser River are discussed in this section.

Table 4.1 shows the destinations of northbound (NB) trips through the George Massey Tunnel throughout the average weekday, as well as the overall weekday distribution.

Table 4.1 – Weekday NB Destinations

Subarea	AM Period	MD Period	PM Period	EVE Period	ALL DAY
Vancouver	43%	38%	41%	35%	40%
YVR	6%	5%	4%	10%	6%
Richmond West of 99	19%	17%	15%	17%	18%
Richmond East of 99	14%	11%	7%	6%	11%
Richmond Fraser	2%	3%	2%	3%	2%
Steveston	15%	25%	30%	28%	22%
Burnaby/New Westminster	1%	1%	1%	1%	1%

Table 4.2 shows the origins of southbound (SB) trips through the George Massey Tunnel throughout the average weekday, as well as the overall weekday distribution.

Table 4.2 – Weekday SB Origins

Subarea	AM Period	MD Period	PM Period	EVE Period	ALL DAY
Vancouver	35%	33%	35%	35%	34%
YVR	4%	6%	7%	11%	7%
Richmond West of 99	10%	17%	23%	20%	19%
Richmond East of 99	9%	12%	12%	6%	11%
Richmond Fraser	3%	3%	1%	1%	2%
Steveston	38%	28%	21%	26%	26%
Burnaby/New Westminster	1%	1%	1%	1%	1%

The subareas listed in **Table 4.1** and **Table 4.2** were aggregated to Richmond/YVR and Vancouver/Burnaby/New Westminster. **Figure 4.1** and **Figure 4.2** show the distribution of NB and SB trips.

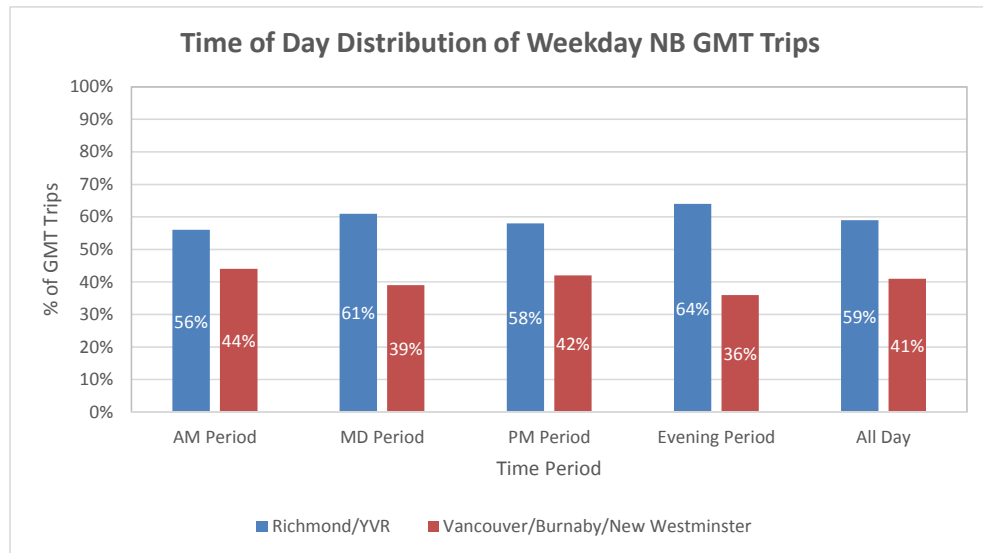


Figure 4.1 – Time of Day Distribution of Weekday NB GMT Trip Destinations

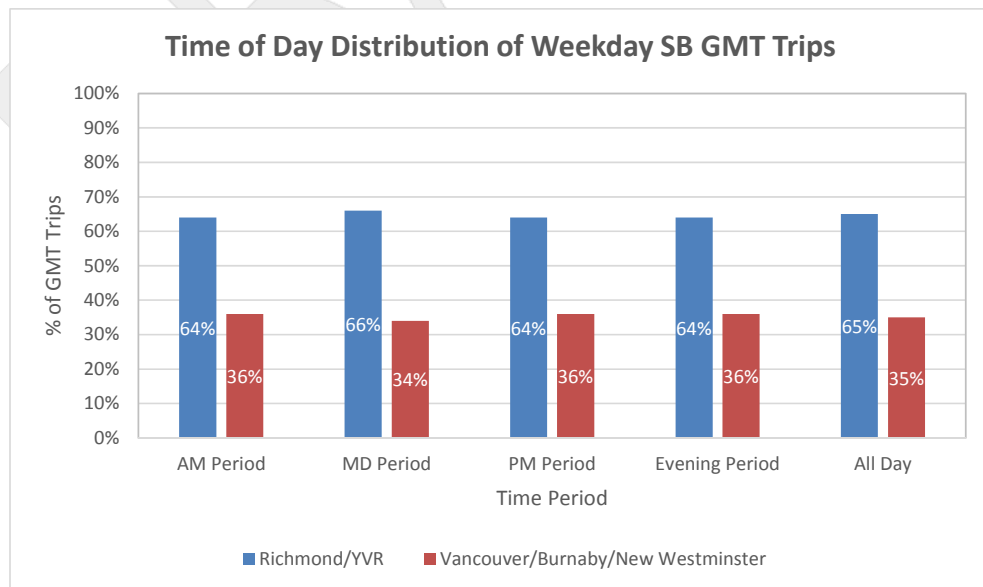


Figure 4.2 – Time of Day Distribution of Weekday SB GMT Trip Origins

As shown in **Figure 4.1** and **Figure 4.2**, Richmond traffic accounts for approximately 60 per cent of all NB traffic from the George Massey Tunnel. Approximately 65 per cent of all SB traffic to the George Massey Tunnel originates from Richmond.

Table 4.3 shows the destinations of NB trips through the George Massey Tunnel on weekends.

Table 4.3 – Weekend NB Destinations

Subarea	ALL DAY
Vancouver	43%
YVR	5%
Richmond West of 99	17%
Richmond East of 99	7%
Richmond Fraser	2%
Steveston	25%
Burnaby/New Westminster	1%

Table 4.4 shows the origins of SB trips through the George Massey Tunnel on weekends.

Table 4.4 – Weekend SB Origins

Subarea	ALL DAY
Vancouver	36%
YVR	6%
Richmond West of 99	18%
Richmond East of 99	9%
Richmond Fraser	1%
Steveston	28%
Burnaby/New Westminster	2%

The subareas listed in **Table 4.3** and **Table 4.4** were aggregated to Richmond/YVR and Vancouver/Burnaby/New Westminster. **Figure 4.3** and **Figure 4.4** show the distribution of NB and SB trips.

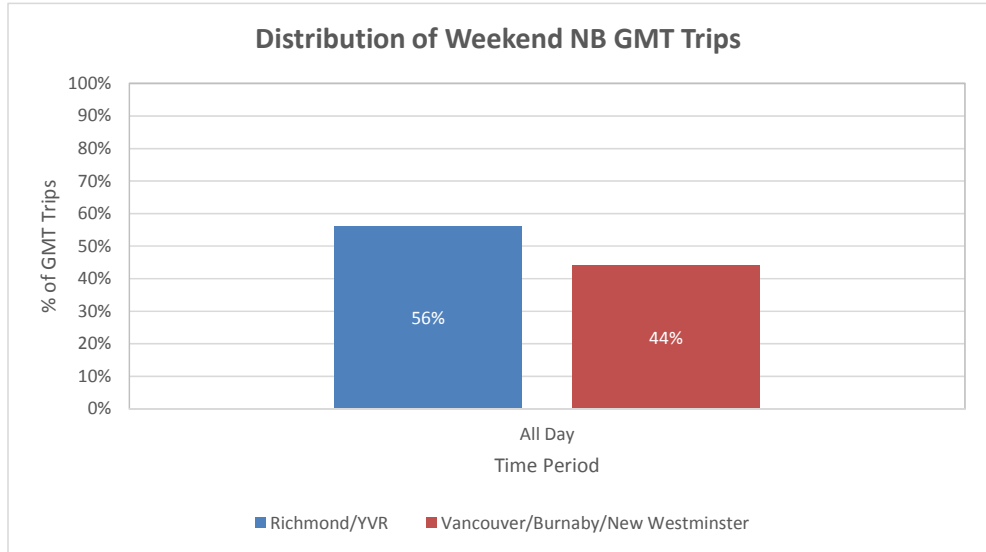


Figure 4.3 –Distribution of Weekend NB GMT Trip Destinations

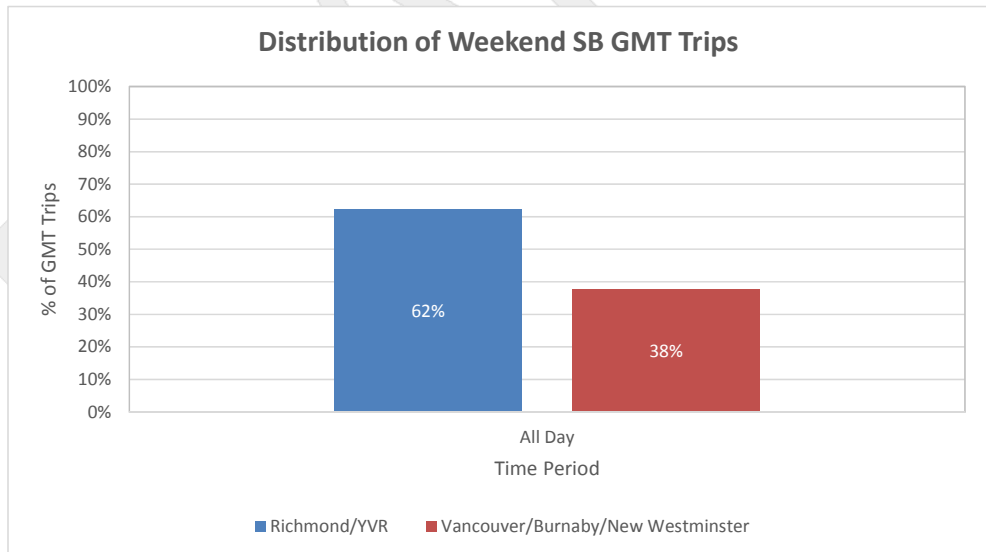


Figure 4.4 –Distribution of Weekend SB GMT Trip Origins

5. GMT Trip Patterns - South Side of the Fraser River

The estimated traffic patterns for trips destined to/originating from areas on the south side of the Fraser River are discussed in this section.

Table 5.1 shows the destinations of SB trips through the George Massey Tunnel throughout the average weekday, as well as the overall weekday distribution.

Table 5.1 – Weekday SB Destinations

Subarea	AM Period	MD Period	PM Period	EVE Period	ALL DAY
Ladner	12%	15%	16%	17%	15%
Deltaport	7%	3%	1%	1%	2%
Tsawwassen	12%	16%	15%	16%	15%
Tsawwassen Ferries	8%	5%	2%	3%	4%
Industrial Delta	17%	9%	3%	3%	7%
Rural Delta	5%	4%	2%	4%	3%
North Delta	10%	9%	16%	14%	13%
SFPR - Nordel	7%	10%	8%	6%	8%
South Surrey	10%	17%	27%	26%	22%
White Rock	12%	12%	10%	10%	11%

Table 5.2 shows the origins of NB trips through the George Massey Tunnel throughout the average weekday, as well as the overall weekday distribution.

Table 5.2 – Weekday NB Origins

Subarea	AM Period	MD Period	PM Period	EVE Period	ALL DAY
Ladner	16%	17%	17%	17%	17%
Deltaport	1%	3%	3%	2%	2%
Tsawwassen	14%	17%	16%	11%	15%
Tsawwassen Ferries	1%	4%	8%	9%	4%
Industrial Delta	5%	11%	15%	5%	8%
Rural Delta	2%	3%	4%	4%	3%
North Delta	15%	9%	7%	12%	10%
SFPR - Nordel	11%	9%	6%	7%	9%
South Surrey	27%	19%	14%	19%	23%
White Rock	8%	8%	10%	14%	9%

The subareas listed in **Table 5.1** and **Table 5.2** were aggregated to Ladner/Tsawwassen/Deltaport; Delta/Nordel/SFPR East; and South Surrey/White Rock. **Figure 5.1** and **Figure 5.2** show the distribution of SB and NB trips.

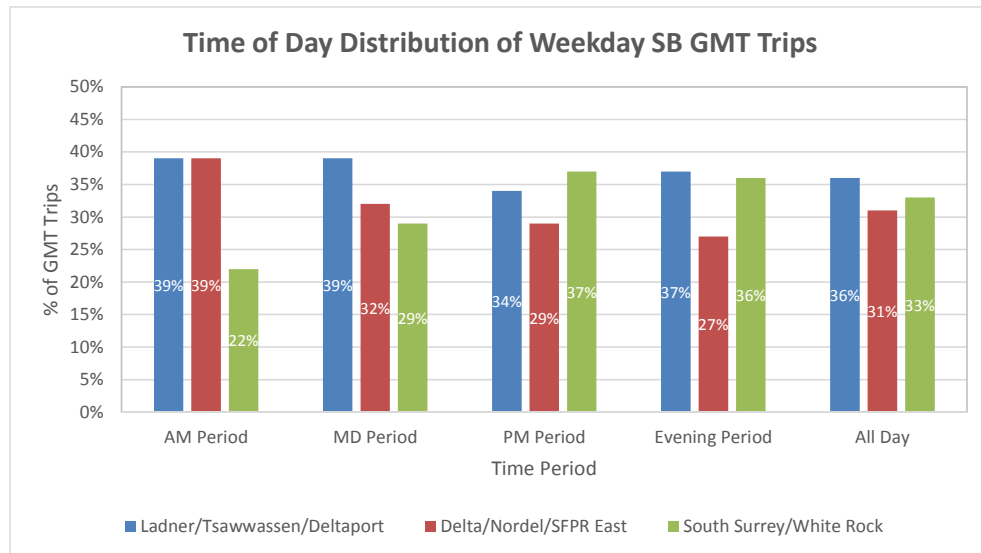


Figure 5.1 – Time of Day Distribution of Weekday SB GMT Trip Destinations

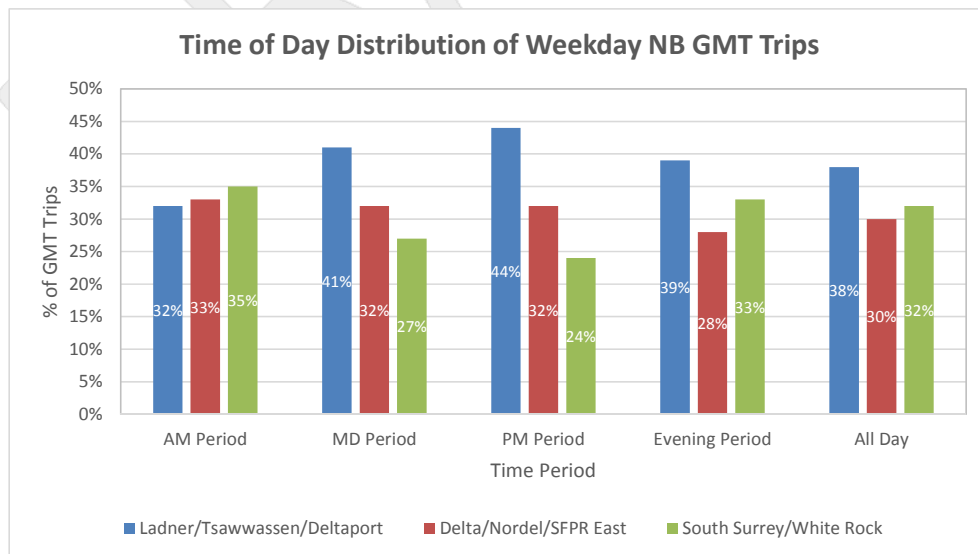


Figure 5.2 – Time of Day Distribution of Weekday NB GMT Trip Origins

As shown in **Figure 5.1** and **Figure 5.2**, the distribution of traffic varies significantly throughout the day for each area.

In the AM period, traffic that is destined to South Surrey and White Rock represent 22 per cent of the total trips. This percentage increases to 37 per cent in the PM period. In the NB direction, traffic that originates from South Surrey and White Rock decreases from 35 per cent in the AM period to 24 per cent in the PM period.

Table 5.3 shows the destinations of SB trips through the George Massey Tunnel on weekends.

Table 5.3 – Weekend SB Destinations

Subarea	ALL DAY
Ladner	16%
Deltaport	2%
Tsawwassen	16%
Tsawwassen Ferries	7%
Industrial Delta	3%
Rural Delta	3%
North Delta	12%
SFPR - Nordel	5%
South Surrey	22%
White Rock	14%

Table 5.4 shows the origins of northbound trips through the George Massey Tunnel on weekends.

Table 5.4 – Weekend NB Origins

Analysis Group	ALL DAY
Ladner	18%
Deltaport	1%
Tsawwassen	17%
Tsawwassen Ferries	6%
Industrial Delta	4%
Rural Delta	2%
North Delta	11%
SFPR - Nordel	6%
South Surrey	22%
White Rock	13%

The subareas listed in **Table 5.3** and **Table 5.4** were aggregated to Ladner/Tsawwassen/Deltaport; Delta/Nordel/SFPR East; and South Surrey/White Rock. **Figure 5.3** and **Figure 5.4** show the distribution of SB and NB trips.

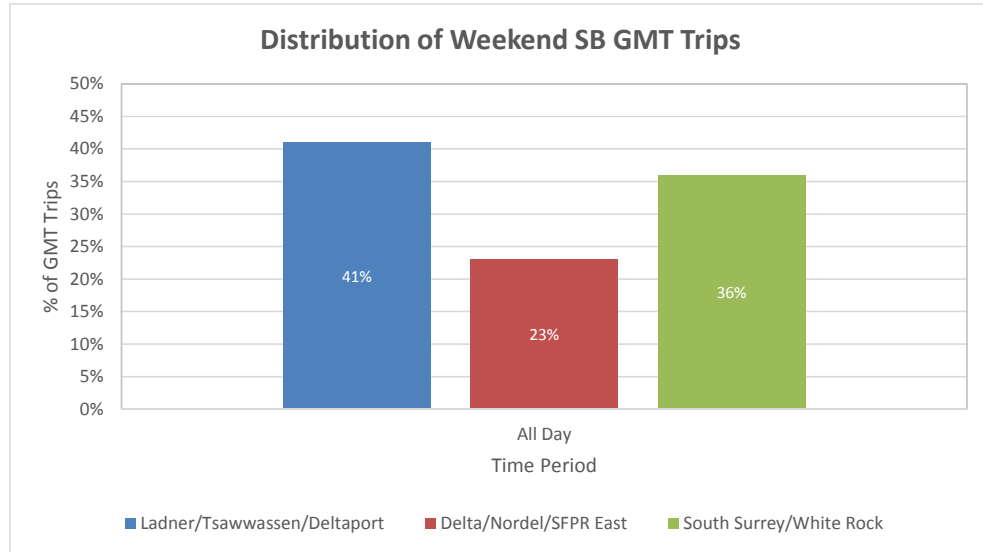


Figure 5.3 – Distribution of Weekend SB GMT Trip Destinations

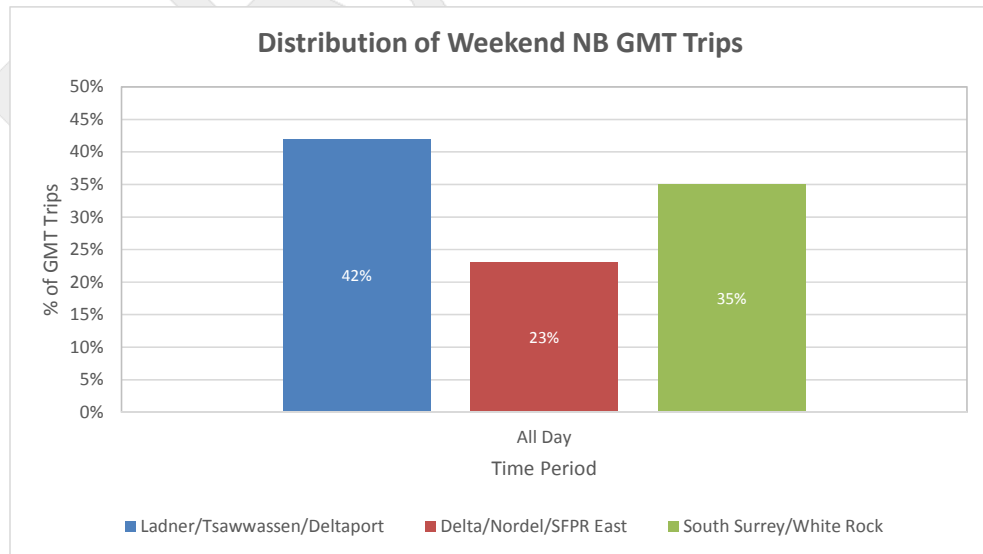


Figure 5.4 – Distribution of Weekend NB GMT Trip Origins