

# 1999 Lower Mainland Truck Freight Study

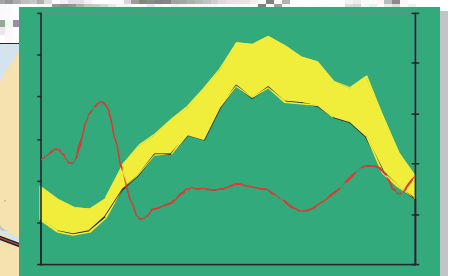
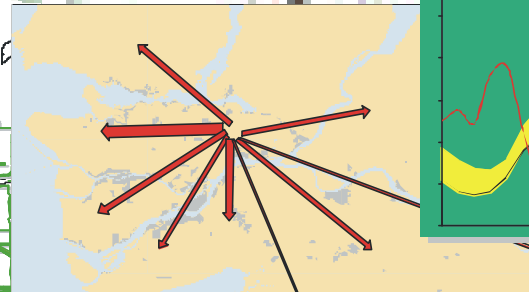
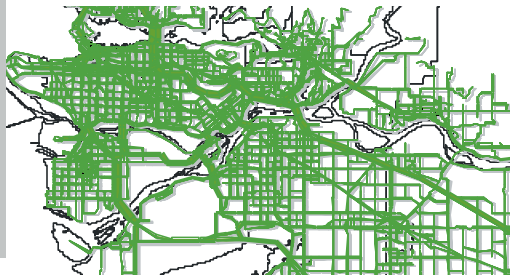
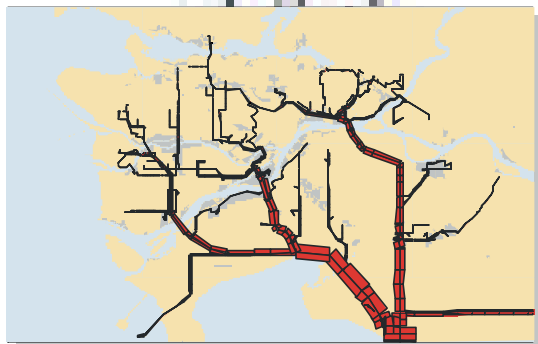
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**Fraser River Port Authority**

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## Summary of Findings





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# PREFACE

The Lower Mainland Truck Freight Study is a comprehensive study of the trucking industry and goods movement in the Greater Vancouver/Fraser Valley Region. This study incorporated a number of major data collection activities to facilitate a thorough understanding of the current situation, as well as the development of a truck demand forecasting model that would permit this understanding to be applied in future truck movement analyses.

The current study expanded on the base established in the 1988 Truck Study, conducted by the City of Vancouver and the Greater Vancouver Regional District, by increasing the geographic scope to include a large portion of the Fraser Valley Regional District, including more types of truck trips such as those generated by ports, airports and inter-modal yards, and through development of a sophisticated truck demand forecasting model.

The study was jointly commissioned in the fall of 1999 by TransLink, Transport Canada, British Columbia Transportation Financing Authority, British Columbia Ministry of Transportation and Highways, Insurance Corporation of British Columbia, Vancouver Port Authority, Vancouver International Airport Authority and the Fraser River Port Authority. The study was completed in mid-2000.

The results of this study are presented in 5 volumes. This summary report presents an overview of the study, together with a summary of major insights gained from analysis of the data. It is designed to be accessible by a broad audience. Reports 1 through 4 provide a more detailed technical description of the methodology, data, and results of the technical study tasks, broken down as follows:

## *Report 1: Internal Trip Diary Survey*

This report documents a mail-out survey of truck drivers who made trips within the Lower Mainland, regarding information such as the number of trips made, their origin and destination and trip times.

## *Report 2: Vehicle Volume and Classification Survey*

This report documents the results of vehicle counts at 266 locations. Light and heavy trucks were counted at 75 of these locations.

## *Report 3: Special Generator/External Surveys*

This report documents a survey of truck drivers who served special generators such as the ports, airports and inter-modal yards. Special surveys were also conducted for trips that had an origin or destination outside the Lower Mainland.

## *Report 4: Truck Demand Forecasting Model Development*

This report documents the development of a truck demand forecasting model that was developed using the data from the surveys and screenline classification counts.

To obtain any of the above reports or additional copies of this report please contact:

### **TransLink - Strategic Planning Department**

1700 – 4720 Kingsway  
Burnaby, B.C. V5H 4N2  
Telephone: (604) 453-4572





# ACKNOWLEDGEMENTS

Given the rapid changes to the trucking industry since the last similar effort in 1988, preparing a comprehensive overview of truck movements in the Lower Mainland was a challenging task. This study reflected the current trends within the Lower Mainland toward stronger inter-agency co-operation on a wide range of transportation issues, and involved sustained constructive effort from a large team of individuals that represented goods movement stakeholders.

This report was jointly produced by a project team consisting of Technical Committee members from TransLink and the Ministry of Transportation and Highways, and staff from Reid Crowther and Partners Ltd. The project team acknowledges the contribution of the study partners, the steering and technical committees, and the project consultants.

## PARTNERS

The following organizations jointly funded the Lower Mainland Truck Freight Study:

- Greater Vancouver Transportation Authority (TransLink); project manager
- Transport Canada
- British Columbia Transportation Financing Authority
- British Columbia Ministry of Transportation and Highways (MoTH)
- Insurance Corporation of British Columbia (ICBC)
- Vancouver Port Authority
- Vancouver International Airport Authority
- Fraser River Port Authority

The BC Trucking Association, as well as numerous terminal operators and trucking carriers, also provided useful advice, resources, and information.

## STEERING AND TECHNICAL COMMITTEES

The Steering and Technical committees were comprised of representatives of the Partners. The following committee members provided invaluable guidance towards the execution of this study:

- John Mills, Transport Canada, Project Director
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- Garland Chow, UBC, Project Advisor
- Robert Hodgins, Mobility Solutions, Project Advisor

## **CONSULTING TEAM**

The following consultants were engaged to execute this study:

### **Reid Crowther and Partners Ltd (Prime Consultant)**

- Ian Rokeby, Project Director
- Jim Hnatiuk, Project Manager
- Steve Brown

### **Jack Faucett & Associates**

- Michael Lawrence
- Jeff Olsen

### **Cambridge Systematics**

- Michael Fischer

### **TSi Consultants**

- Karoly Krajczar

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- Marina Gilson

### **Interprovincial Traffic Services Ltd**

- Chris Agnew
- Warren Cook

# 1 INTRODUCTION

Trucks are the dominant mode of transport for the movement of urban freight in the Lower Mainland. The following statistics give some indication of the economic importance of this industry to the region:

- The trucking industry in the Lower Mainland accounts for over \$1 billion in revenue per year. This represents approximately 8% of the Lower Mainland economy.
- The trucking industry in British Columbia is expected to grow by 37% between 1994 and 2005, most of which can be expected to take place in the Lower Mainland.
- The estimated value of goods moved through the Greater Vancouver Gateway now totals \$25 billion per year.
- The majority of goods consumed in the Lower Mainland have at some time been transported by truck.

## 1.1 FACTORS THAT INFLUENCE THE TRUCKING INDUSTRY

Truck movements are derived from the need to transport goods. As such, the level and type of truck activity is dependent upon the vitality and structure of the economy. Likewise, a factor in the efficiency of the economy is the ability of the trucking industry to adapt to its dynamic requirements. This section highlights changes to the economy within the last 10 to 15 years that have fundamentally altered the nature of trucking in the Lower Mainland.

## International Trade

Under the influence of the Canada-United States Free Trade Agreement (FTA), the North American Free Trade Agreement (NAFTA), and the Open Skies Agreement with the United States (1995), and due to the increasing trade bond between British Columbia and the rest of Canada with Asia, the demand for international goods movement has increased dramatically. For example, in 1996 bilateral trade between Canada and the United States was valued at \$366 billion. Between 1996 and 1999 trade grew 37%, or 11% per year, to \$502 billion. Over 80% of these goods were carried by truck.

- There has been a significant increase in cross-border truck movements. In 1999, there were close to 1.2 million truck trips between the Lower Mainland and United States. The Pacific Border Crossing at Highway 15 is the fourth busiest commercial truck crossing along the Canada-United States border.
- In 1999 Port Vancouver's three container terminals handled over 1 million TEUs (twenty foot equivalents – the standard measurement of containers). This represents an increase in business of 257% since 1989 and 100% since 1996, or 14% annually. Currently, 57% of Port Vancouver's container business moves by truck.
- Air cargo movements at Vancouver International Airport grew by 201% since 1992, or approximately 10% per year.

## **Regional Economy**

The Lower Mainland has been one of the fastest growing urban regions in North America over the past two decades. During this time, the economic base has expanded and diversified.

- Employment growth has been heavily concentrated on the services sector.
- The wholesale and retail trade, finance/ insurance/ real estate and construction sectors grew at rates similar to the overall rate of population growth.
- The primary and manufacturing sectors have added only a few jobs to the regional economy. Stagnation in forestry related businesses offset growth in agriculture and other manufacturing sectors.
- The Lower Mainland has maintained and expanded the gateway function through the continued development of the ports, the airport and rail inter-modal yards.

Although the economy of British Columbia is currently experiencing a period of turbulence in which some sectors are suffering decline or adjustment while others are growing rapidly, the Lower Mainland continues to attract people, businesses and investment.

## **Regional Distribution of Employment**

Employment can be used as an indicator of truck activity. Vancouver remains the main employment node in the region, but a growing share of employment growth between 1981 and 1996 has occurred in the central part of the region (Burnaby, Delta, Richmond, Surrey and Langley). Generally, this area has the key attributes of vacant land availability at a reasonable cost, centrality, good vehicular accessibility and proximity to a large labour pool. This shift of employment

growth in the Lower Mainland indicates a regional shift in trucking activity.

## **Regional Infrastructure**

There have been significant additions to the region's infrastructure over the last decade that have affected the demand for trucks:

- The Alex Fraser Bridge permits easier access between Burrard Peninsula and Surrey/ Delta/ Richmond and United States. It has supported the rapid growth of industry in Annacis and Tilbury Islands in Richmond and Delta.
- Capacities at the Port Vancouver and Fraser Port were expanded. Significant additional port capacity was added through the development of Deltaport Container Terminal. Furthermore, Seaspam Coastal Inter-modal moved from Vancouver to Tilbury Island in Delta.
- The CP Rail Inter-modal terminal in Pitt Meadows opened in 1999, and the Thornton Yards CN Rail Inter-modal Terminal in Surrey opened in 1992.

## **Storage and Handling**

Changes to the storage and handling of commodities has also altered the nature of demand for trucking:

- Containers are fast becoming the dominant mode of transporting manufactured and consumer goods. In addition to marine shipping, the warehousing and distribution functions for many commercial activities are increasingly reliant on containerization. At the same time, the forest product and agricultural product industries have commenced exporting value-added product using containers.

- In an effort to minimize warehouse space and capital invested in stock, many manufacturing and retail businesses require 'just-in-time delivery', which demands a high level of regularity and reliability from the trucking industry.
- Although it is difficult to quantify the impact at this point, internet shopping and e-commerce have changed the nature of delivery of retail goods. In general, goods are being delivered to consumers in smaller quantities and at a finer level, namely households.
- Intelligent Transportation System (ITS) applications can be expected to expedite truck movements through pre-clearance at weigh scales and pre-arrival notification at border crossings and container terminal gates. It is anticipated that these programs will be active in the near future.

### **Truck Industry Regulations**

The trucking industry was de-regulated in 1998, meaning that trucking companies were no longer required to prove demand for their service before being granted a license to operate. This has likely resulted in an increase in total trucks/capacity and therefore an intensification of pressure to improve efficiency.

## **1.2 A FRESH LOOK AT TRUCKING**

It is evident that trucking plays a significant role in the regional economy, and has the potential to continue to grow rapidly. However, with this growth are concerns that the road network will be unable to efficiently accommodate this demand; and more localized concerns from residents who wish to relieve their roads of truck movements.

In response to these issues, the TransLink Strategic Transportation Plan expresses the desire to facilitate truck demand on the regional transportation system through selective implementation of road improvements that will benefit goods movement, road priority measures and implementation of ITS technology. Efficient goods movement is also a stated priority of Transport Canada and the Ministry of Transportation and Highways.

Hence, the analysis of truck movements is a priority of all agencies involved in providing transportation services. However, much of the information on truck movements was collected in 1988 and therefore preceded most of the changes described in the previous section.

In order to provide a more relevant and current basis for addressing truck movement issues and investment priorities, a consortium of regional transportation agencies commissioned the Lower Mainland Truck Freight Study. The study objectives were to:

- develop a 'snapshot' of trucking movements for a typical day during October/November 1999;
- quantify the changes in truck movements since 1988; and
- develop a computer model that can be used to forecast future truck demand.

The deliverables of this study will be used by a range of organizations and professionals in the field. Specific applications of the deliverables include major infrastructure planning, traffic monitoring, traffic impact assessments of major developments, cross border freight movement, inter-modal freight planning, pavement management systems, and air quality modelling.

### 1.3 HOW THIS STUDY WAS DONE

The Lower Mainland Truck Freight Study investigated trucking movements in the geographic area bounded by the U.S. border to the south, the Strait of Georgia to the west, the Coast Range mountains to the north of the Fraser Valley, and the town of Hope to the east. The study area is illustrated in **Exhibit 1**.

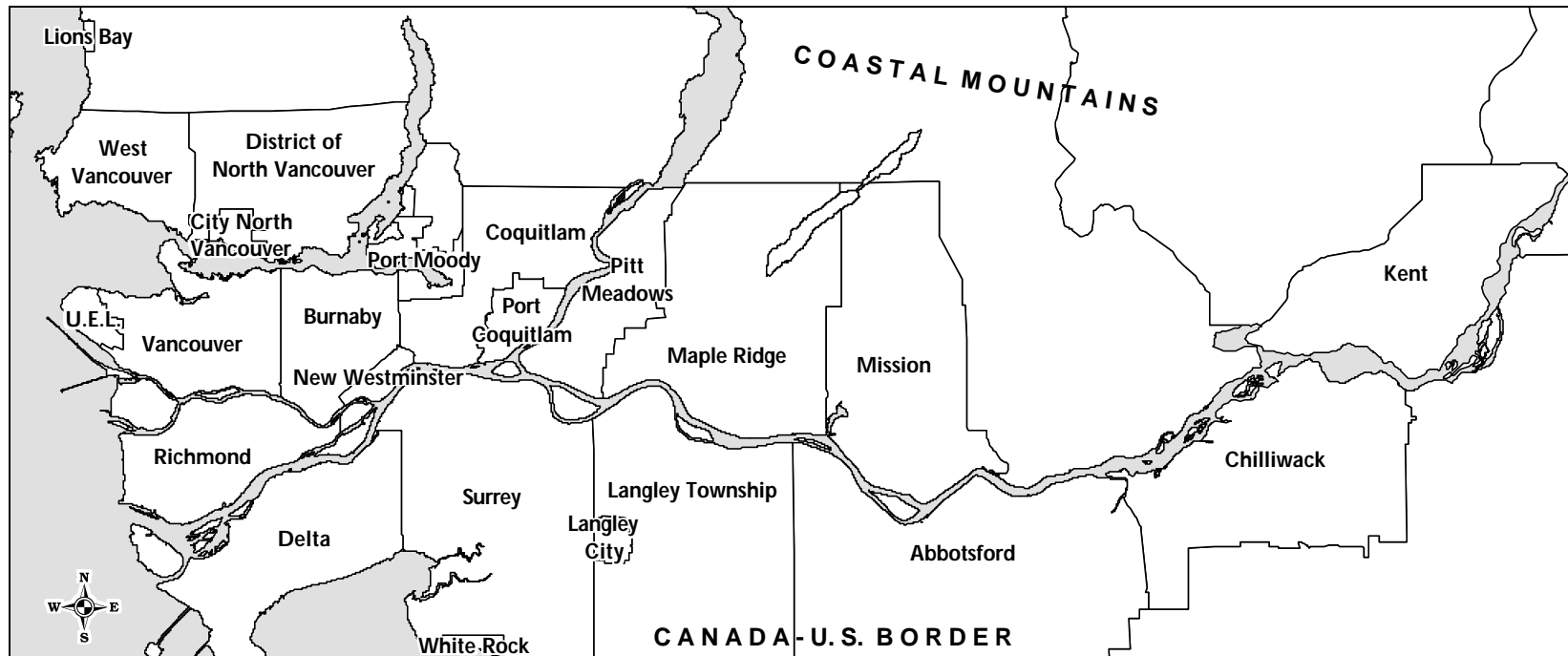
Light and heavy trucks were considered separately. Generally, trucks with only two axles, such as cube vans, were considered to be light trucks.

Trucks with three or more axles, either as a single unit or in combination with a trailer, were considered to be heavy trucks.

The study was divided into three main components:

- origin/destination surveys;
- vehicle volumes and classification survey; and
- development of truck demand forecasting model.

**Exhibit 1 – Lower Mainland Truck Freight Study Area**



### **Origin/Destination Surveys**

In order to produce an understanding of truck demand, surveys of three types of truck trips were conducted:

- Internal Trips – truck trips originating and terminating at points within the Lower Mainland.
- External Trips – truck trips originating or terminating at points outside of the Lower Mainland. The surveys also captured trips originating outside the Lower Mainland and passing through the region.
- Special Generator Trips - truck trips originating or terminating at discrete truck traffic generators, such as port terminals, the airport, and inter-modal rail facilities.

### **Vehicle Volumes and Classification Survey**

A major vehicle classification count program was undertaken throughout the region, incorporating 266 separate traffic counting/classification activities. Vehicles were classified into 10 different categories including light and heavy trucks at 75 of these locations. This count program also served as an update to the last major survey of traffic volumes, carried out in 1996.

### **Truck Demand Forecasting Model**

A computer model that is able to forecast truck demand was developed using the surveys and vehicle classification counts. By specifically addressing major traffic sources as discrete “special generators”, and by linking truck demand to demographic variables which will change over time, a flexible, state-of-the-art tool has been created. The truck demand forecasting model was integrated into the regional EMME/2 travel demand forecasting model, and is able to forecast truck demand for future horizon years such as 2006, 2011 and 2021.

## **1.4 REPORT STRUCTURE**

Chapter 2 of this report presents an overview of regional trucking characteristics, and a discussion of findings from the origin/destination surveys. The vehicle classification counts are described in Chapter 3. The truck demand forecasting model and its future applications are discussed in Chapter 4. Using a combination of the model and vehicle classification counts, major truck corridors in the Lower Mainland are identified and discussed in Chapter 5. Chapter 6 provides salient conclusions and lessons learned from the study, as well as suggestions for future studies.





## 2 REGIONAL TRUCK ACTIVITY SURVEYS

The objective of the regional truck activity surveys was to obtain quantitative information regarding demand for light and heavy truck trips in the Lower Mainland. The type of information collected included the number of trips made in a day, origins and destinations of these trips, and land use at the trip end. The purpose of this chapter is to summarize the data gathered in the surveys, and to provide a 'snapshot' of truck demand for a typical day in November 1999.

### Definition of Truck Types

Light and heavy trucks display distinctly different operating characteristics. As a result, they were considered separately for the purposes of this study. Truck classification for this survey was based upon gross vehicle weight (GVW), where trucks under a GVW of 20,000 kg were considered to be light, and trucks over a GVW of 20,000 kg were considered to be heavy. As gross vehicle weight can be difficult to visually observe in the field during the vehicle volume and classification survey, the number of axles on a truck was also used to distinguish between light and heavy trucks. Trucks with only two axles, such as cube vans or panel vans, were considered to be light trucks. **Exhibit 2** illustrates two examples of light trucks<sup>1</sup>.

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<sup>1</sup> Small vans and pickup trucks that may be used for commercial purposes were not classified as trucks, but considered as part of the regular traffic stream.

### Exhibit 2 – Examples of Light Trucks



*Panel Van*

*Cube Van*

Trucks that had three or more axles were considered to be heavy trucks. This includes single unit trucks and combination vehicles. Two examples of heavy trucks are illustrated in **Exhibit 3**.

### Exhibit 3 – Examples of Heavy Trucks



*Single Unit*

*Combination Vehicle*

### Types of Truck Trips and Surveys

Surveys were conducted for three types of truck trips:

- **Internal Trips** - truck trips originating and terminating at points within the study area. Trip diary surveys were mailed out to fleet managers of 13,600 trucks in the Lower Mainland, based on a random sample of heavy and light trucks generated from the ICBC vehicle registry database. A total of 1,740 surveys were completed and these surveys described a total of 8,100 truck trips. This 13% response rate is considered high when compared to

similar efforts elsewhere (typically response rates of 1% to 10% have been achieved in U.S. jurisdictions for similar surveys).

- **Special Generator Trips** - truck trips originating or terminating at facilities that are major discrete truck traffic generators and possess truck trip generation characteristics that are distinct from other types of trip generators in the Lower Mainland. They include port terminals, the airport, and inter-modal rail facilities. Truck demand information for these facilities was gathered using roadside interviews and supplemented by input from facility operators.
- **External Trips** - truck trips originating or terminating at points outside of the Lower Mainland such as the British Columbia Interior, Vancouver Island and the United States. This survey also captured 'through trips', or truck trips that originate outside the Lower Mainland and then pass through the region without making freight stops. Data on truck movements for external trips were assembled from a variety of sources including roadside interviews and co-ordination with the National Roadside Survey (NRS).

The rest of this chapter summarizes the product of the surveys and is divided into four sections:

- **Regional Trucking Characteristics** – indicators of the trucking industry as a whole and general characteristics of truck trips;
- **Origin-Destination Information** – total trips to and from sub-areas of the region;
- **Special Generators** – a summary of the contribution of special generators to total truck trips within the region and a discussion of each special generator surveyed; and

- **External Gateways** – a summary of the contribution of external trips to total truck trips within the region and a discussion of each external gateway.

## 2.1 REGIONAL TRUCKING CHARACTERISTICS

Information on truck trips obtained from the surveys was expanded to represent the entire truck population as well as observations of trucks obtained during the vehicle classification counts. For the purposes of this report all values presented are from the expanded survey data<sup>2</sup>. Please refer to Report #4, Truck Demand Forecasting Model Development, for a detailed explanation of these expansion procedures.

There were approximately 187,000 truck trips made in the Lower Mainland on a typical day in November, 1999. Approximately 68% of these trips are made using light trucks and 32% using heavy trucks. A breakdown of the total trips by light and heavy trucks, as well as trip type is provided in **Exhibit 4**.

**Exhibit 4 – Light and Heavy Truck Trips by Trip Type**

Trip Type	Total		Light		Heavy	
	Sum	%	Sum	%	Sum	%
<i>Internal</i>	170,200	91%	122,300	96%	47,900	79%
<i>External</i>	9,900	5%	2,200	2%	7,700	13%
<i>Special Generator</i>	7,200	4%	2,500	2%	4,700	8%
<b>Total</b>	<b>187,300</b>		<b>127,000</b>	<b>68%</b>	<b>60,300</b>	<b>32%</b>

Light truck trips are mostly (96%) composed of internal trips, or in other words trips that have an origin and destination within the Lower Mainland. The majority of the light truck trips attributed to special generators (2%) are related to

<sup>2</sup> These values represent the expanded estimates produced during calibration of the EMME/2 truck demand forecasting model.

integrators and food service providers in the area of Vancouver International Airport.

Internal trips also constitute the majority of heavy truck trips (79%). However, external and special generator trips are also significant components of heavy truck trips. Approximately 7,700 heavy truck trips (13%) have an origin or destination outside of the Lower Mainland. Approximately 8% of heavy truck trips are related to special generators.

### Operating Status

Recipients of the internal mail-out survey were asked to indicate the status of their truck on the day of the survey. The choices were: active on the survey day; inactive on the survey day; or operating entirely outside the region on the survey day. Responses are summarized in **Exhibit 5**.

**Exhibit 5 – Truck Operating Status**

Operating Status	Light	Heavy
<i>Active in Lower Mainland</i>	63%	60%
<i>Not Active on Survey Day</i>	35%	30%
<i>Operated Outside Lower Mainland</i>	2%	10%
<b>Total</b>	<b>100%</b>	<b>100%</b>

**Exhibit 5** indicates that approximately 60% of the trucks registered in the Lower Mainland are active on any given day. Approximately 10% of heavy trucks operated outside of the region.

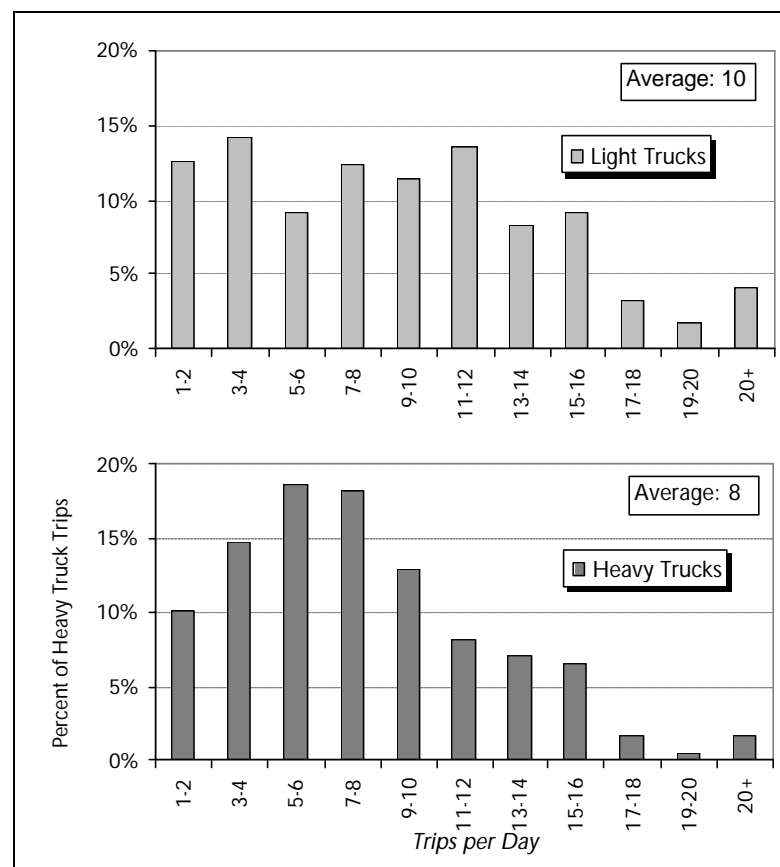
### Trip Frequency

Of the trucks that were active on the survey day, light and heavy trucks were used for, on average, 10 and 8 trips per day, respectively. The frequency of trips per day for light and

heavy trucks is illustrated in **Exhibit 6**. For example, close to 15% of light trucks were used for between three and four trips per day. Approximately 40% of light trucks were used for more than 10 trips per day.

Generally, heavy trucks were used for fewer trips per day than light trucks. This bias is illustrated at the bottom part of **Exhibit 6**. Approximately 25% of heavy trucks were used for more than 10 trips per day.

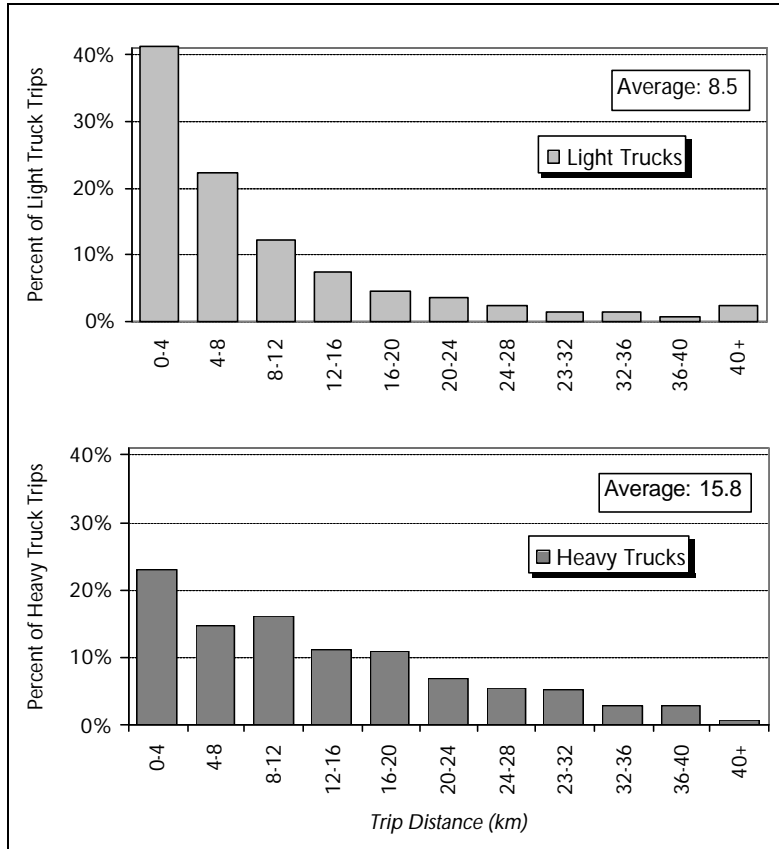
**Exhibit 6 – Trip Frequency Distribution**



### Trip Length

The length of trips was derived from the stated origins and destinations in the internal survey. The trip length distribution for light and heavy trucks is displayed in **Exhibit 7**.

**Exhibit 7 – Trip Length Frequency Distribution**



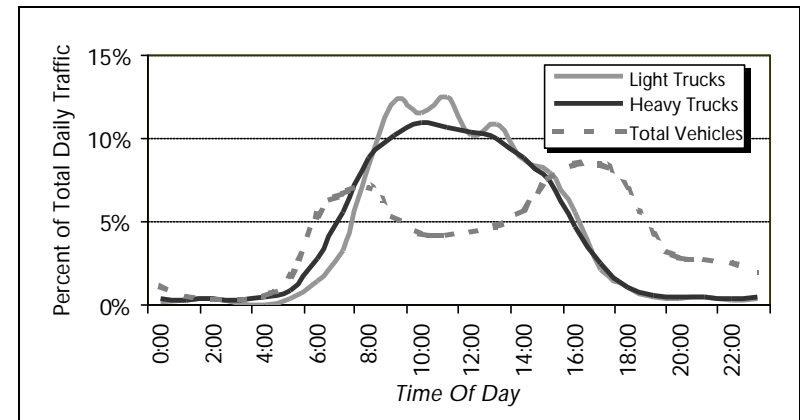
The average trip length for light and heavy trucks is 8.5 and 15.8 kilometres, respectively. The number of truck trips decreases with distance much more rapidly for light trucks

than for heavy indicating that light trucks predominately make more short trips, and fewer longer haul trips than heavy trucks. This trip length does not include truck trips to and from external gateways.

### Time of Day Profiles

A profile that describes when truck trips were made throughout the day was developed from the reported arrival time for the trip diary surveys. This profile is illustrated in **Exhibit 8**, and was validated with observations of trucks obtained during the vehicle classification counts. For the purposes of comparison, a typical profile for total traffic including trucks is also provided.

**Exhibit 8 – Time of Day Profile (Light & Heavy Truck Trips)**



The time of day profile for light and heavy truck trips are very similar, with both peaking during the midday period, and decreasing prior to the afternoon rush period. The only notable difference appears that heavy truck trips start approximately one hour earlier (6-7 a.m.) than light truck trips (7-8 a.m.). Approximately 70% of trucks arrive at their destination during the period of 9:00 AM – 4:00 PM. The

time of day profile for trucks is notably different from total traffic which experiences peaks during the AM and PM peak periods.

### Land Use at Trip Destination

To an extent, light and heavy trucks serve different purposes and different sectors of the economy. For the purpose of this study, this distinction was made through identification of the type of land use where truck trips terminated.

**Exhibit 9** provides land use at the trip destinations for light and heavy trucks respectively, as a percentage of total trips by each truck type. Land uses where light trucks were used more than heavy trucks included retail, residential and office/professional services. Land uses where heavy trucks were used more than light trucks included manufacturing, transportation/communication/utilities, construction sites and agriculture/mining/forestry.

**Exhibit 9 – Land Use at Trip Destination**

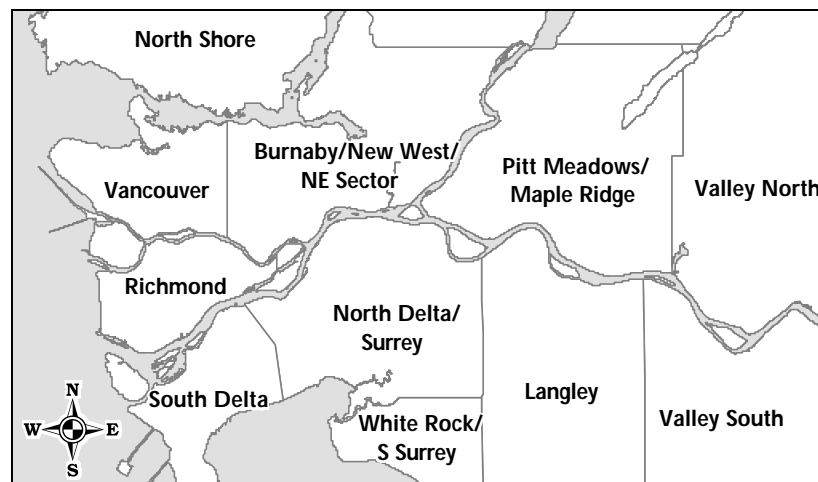
Land Use Category	Destination by Truck Type	
	Light	Heavy
<i>Retail</i>	17%	11%
<i>Residential</i>	15%	3%
<i>Warehouse/Wholesale</i>	14%	17%
<i>Transportation/Communication/Utilities</i>	10%	14%
<i>Restaurant/Pub/Hotel</i>	10%	9%
<i>Manufacturing</i>	6%	14%
<i>Offices/Professional Services</i>	5%	1%
<i>Construction Site</i>	5%	11%
<i>Port/Rail/Airport</i>	5%	5%
<i>School/Hospital/Institutional</i>	5%	2%
<i>Agriculture/Mining/Forestry</i>	1%	7%
<i>Dump/Landfill</i>	1%	4%
<i>Other</i>	7%	2%
<i>Total</i>	100%	100%

## 2.2 ORIGIN-DESTINATION INFORMATION

The previous section described some general characteristics of truck trips in the Lower Mainland, and noted that there are an estimated 187,000 truck trips in the Lower Mainland every weekday. Of these trips, 127,000 are made using light trucks and 60,000 using heavy trucks. The purpose of this section is to further describe total truck demand by relating it to specific sub-areas in the region. The truck demand described in this section includes trips attributed to special generators and external gateways. Detailed discussion of these unique locations can be found in the proceeding sections.

In order to present the data the region was divided into eleven sub-areas that are generally aggregations of municipalities. They are illustrated in **Exhibit 10**.

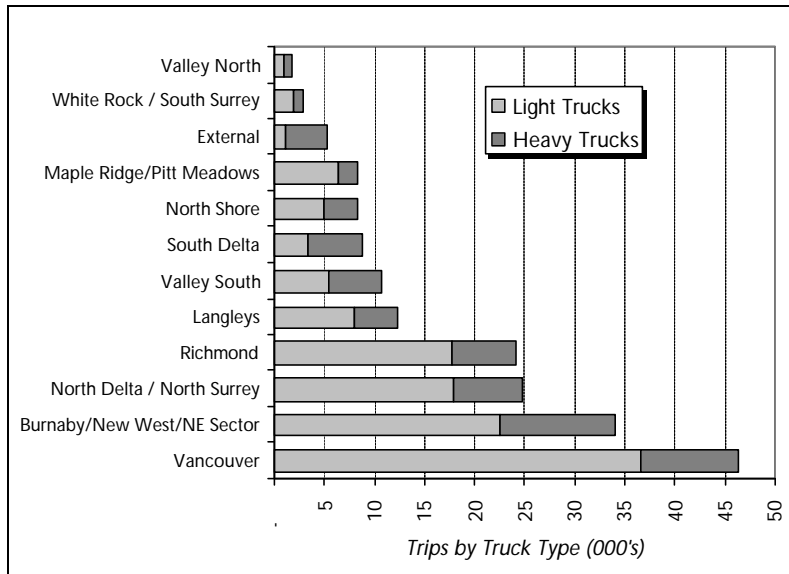
**Exhibit 10 – Regional Sub-Areas**



### Truck Trip Generation by Sub-Area

**Exhibit 11** shows the total number of light and heavy trucks generated from each of these sub-areas. The grey and black parts of the bar represent light and heavy trucks respectively. Over 40% of truck trips in the Lower Mainland are generated on the Burrard Peninsula. The City of Vancouver generates the largest amount of truck trips with over 46,000. Burnaby/New Westminister /NE Sector generates over 34,000. North Delta/North Surrey and Richmond generate close to 25,000 truck trips every day. Most other sub-areas generate between 5,000–12,000 truck trips every day. Approximately 5,000 truck trips generated in the Lower Mainland leave the region via external gateways.

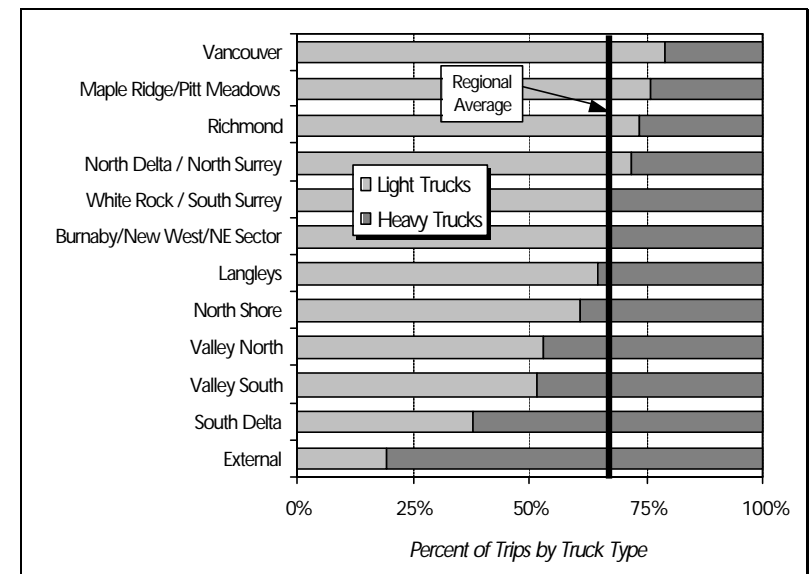
**Exhibit 11 – 24 Hour Light and Heavy Truck Trip Generation by Sub-Area**



**Exhibit 12** shows the percent of light and heavy trucks generated by each sub-area. It should be noted that, on average, light and heavy trucks contribute 68% and 32% of truck trips, respectively. At 80%, the City of Vancouver generates well above the regional average of light truck trips. This converts to 30% of all light truck trips generated in the Lower Mainland. Close to 50% of all light truck trips are generated on the Burrard Peninsula.

In some areas the percentage share of the light and heavy truck trips is similar to that of the regional average. This occurs in North Delta/North Surrey, Richmond, Burnaby/New West/NE Sector, White Rock/South Surrey and the Langleys.

**Exhibit 12 – Percent of Light and Heavy Trucks Generated by Sub-Area**



Close to 40% of all heavy truck trips are generated in the area south of the Fraser River which includes Delta, Surrey, Langley, White Rock, Abbotsford and Chilliwack. Abbotsford, Chilliwack and Mission generate close to a 50/50 split between light and heavy trucks. The split between light and heavy trucks in South Delta is the reciprocal of the regional average, where 68% of truck trips are attributed to heavy trucks and 32% to light trucks.

### **Origin-Destination Trip Tables**

The estimated origins and destination of light and heavy truck trips by sub-area are presented as trip tables<sup>3</sup> in **Exhibit 13**. The rows represent trip origins where, for example, the total number of light trucks generated in Vancouver was 36,711. The columns represent destinations where, for example, 36,707 light trucks were destined to Vancouver. The individual cells within the matrix represent both origins and destinations. For example, there were 972 light truck trips from Vancouver destined to Richmond.

### **Truck Trip Destinations**

In general, truck trips leaving a sub-area to other sub-areas have a similar overall pattern to trucks entering the sub-area from other sub-areas. For example, there were 203 light truck trips originating in South Delta and destined to Burnaby/New Westminster/NE Sector.

Conversely, there were 131 light truck trips originating in Burnaby/New Westminster/NE Sector and destined to South Delta. Because these patterns are similar, only trips originating from a sub-area and destined to other sub-areas are discussed in this section.

Using a geographic information system, the trip tables can be illustrated on a map. The following **Exhibits 14-24** display the truck destinations by each geographic sub-area and include a commentary on some of the notable truck trip characteristics for each region.

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<sup>3</sup> Typically referred to as the origin-destination matrix. It represents travel between and within sub-areas.

### Exhibit 13 – 24 Hour Origin-Destination Trip Tables for Light and Heavy Trucks

#### Light Trucks

To/From	NSHORE	VANCOU	BURNESEC	RICHMOND	SDELTA	ND/NSUR	WR/SSUR	MR/PM	LANGLEYS	VALLEY N	VALLEY S	EXTERN	Total
NSHORE	4,005	51	725	24	5	64	1	7	84	1	15	65	5,047
VANCOU	124	29,088	5,005	972	352	606	36	41	338	5	59	85	36,711
BURNESEC	691	4,986	12,537	897	131	1,515	35	776	697	38	133	193	22,629
RICHMOND	24	925	1,160	13,146	1,064	916	112	10	221	4	35	101	17,718
SDELTA	8	441	203	1,045	919	448	57	1	85	-	8	112	3,327
ND/NSUR	44	531	1,321	932	538	10,783	550	40	2,571	25	353	166	17,854
WR/SSUR	1	56	39	141	64	517	724	1	326	1	29	10	1,909
MR/PM	4	29	661	7	1	21	-	4,884	83	277	301	41	6,309
LANGLEYS	63	436	625	387	126	2,418	341	85	2,867	36	498	92	7,974
VALLEY N	1	8	33	6	1	30	3	223	47	286	292	42	972
VALLEY S	13	76	129	59	14	371	39	201	565	256	3,591	201	5,515
EXTERN	60	80	185	99	107	158	10	26	69	22	124	75	1,015
<b>Total</b>	<b>5,038</b>	<b>36,707</b>	<b>22,623</b>	<b>17,715</b>	<b>3,322</b>	<b>17,847</b>	<b>1,908</b>	<b>6,295</b>	<b>7,953</b>	<b>951</b>	<b>5,438</b>	<b>1,183</b>	<b>126,980</b>

#### Heavy Trucks

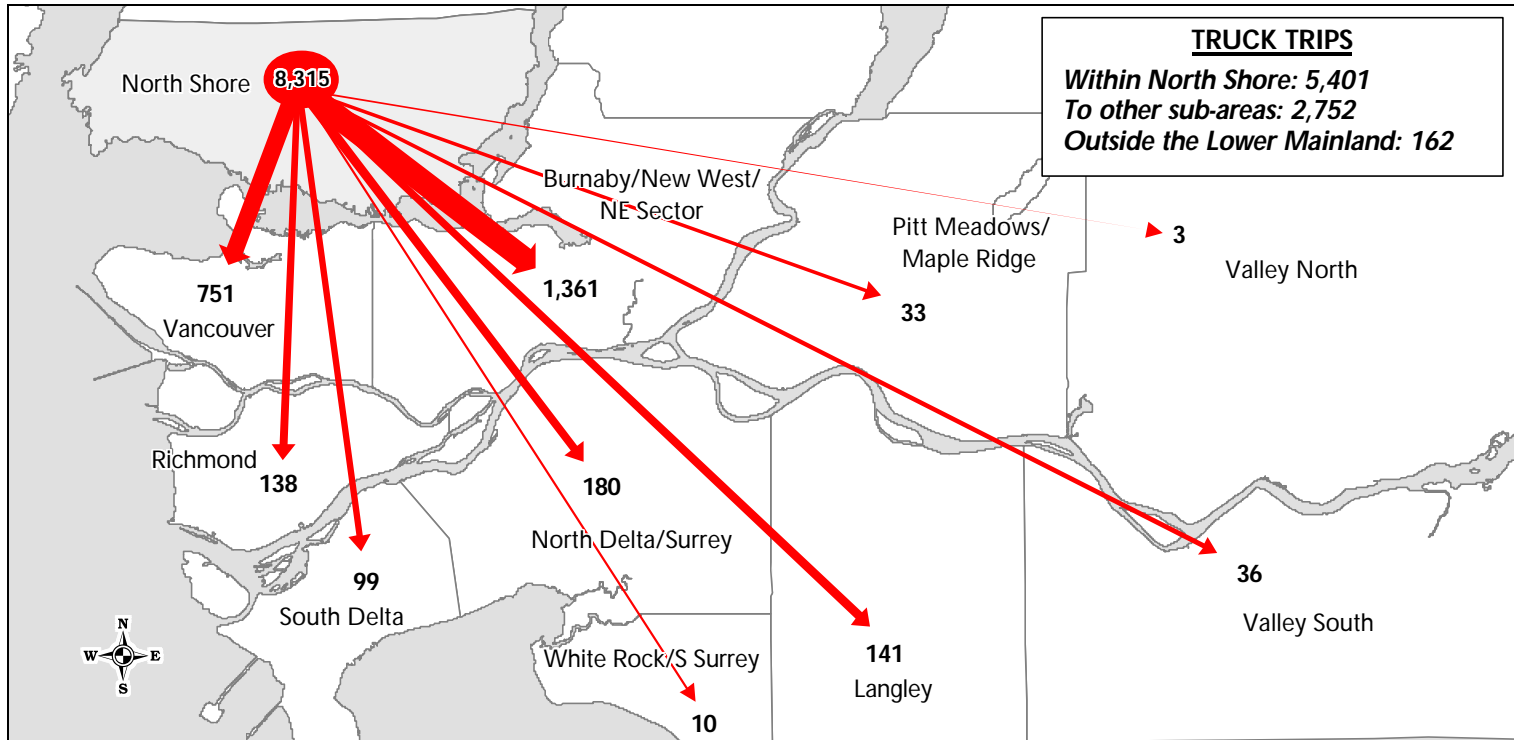
To/From	NSHORE	VANCOU	BURNESEC	RICHMOND	SDELTA	ND/NSUR	WR/SSUR	MR/PM	LANGLEYS	VALLEY N	VALLEY S	EXTERN	Total
NSHORE	1,396	700	636	114	94	116	9	26	57	2	21	97	3,268
VANCOU	663	4,653	1,479	1,289	564	435	38	73	122	5	40	284	9,645
BURNESEC	656	1,460	5,082	524	612	1,109	84	526	458	40	178	669	11,398
RICHMOND	120	1,241	600	2,331	906	426	74	69	95	2	23	426	6,313
SDELTA	107	545	690	937	1,609	748	119	69	175	3	47	400	5,449
ND/NSUR	99	462	1,065	457	830	1,971	234	92	827	21	255	644	6,957
WR/SSUR	8	47	87	92	131	224	149	5	137	3	32	45	960
MR/PM	25	71	543	71	78	87	4	651	55	103	163	125	1,976
LANGLEYS	43	126	415	122	204	853	157	60	1,487	46	540	308	4,361
VALLEY N	1	4	33	3	4	26	4	95	49	235	312	108	874
VALLEY S	17	32	162	34	57	265	44	135	560	301	2,968	593	5,168
EXTERN	81	261	618	405	371	594	43	115	274	94	525	595	3,976
<b>Total</b>	<b>3,216</b>	<b>9,602</b>	<b>11,410</b>	<b>6,379</b>	<b>5,460</b>	<b>6,854</b>	<b>959</b>	<b>1,916</b>	<b>4,296</b>	<b>855</b>	<b>5,104</b>	<b>4,294</b>	<b>60,345</b>

#### Total Trucks

To/From	NSHORE	VANCOU	BURNESEC	RICHMOND	SDELTA	ND/NSUR	WR/SSUR	MR/PM	LANGLEYS	VALLEY N	VALLEY S	EXTERN	Total
NSHORE	5,401	751	1,361	138	99	180	10	33	141	3	36	162	8,315
VANCOU	787	33,741	6,484	2,261	916	1,041	74	114	460	10	99	369	46,356
BURNESEC	1,347	6,446	17,619	1,421	743	2,624	119	1,302	1,155	78	311	862	34,027
RICHMOND	144	2,166	1,760	15,477	1,970	1,342	186	79	316	6	58	527	24,031
SDELTA	115	986	893	1,982	2,528	1,196	176	70	260	3	55	512	8,776
ND/NSUR	143	993	2,386	1,389	1,368	12,754	784	132	3,398	46	608	810	24,811
WR/SSUR	9	103	126	233	195	741	873	6	463	4	61	55	2,869
MR/PM	29	100	1,204	78	79	108	4	5,535	138	380	464	166	8,285
LANGLEYS	106	562	1,040	509	330	3,271	498	145	4,354	82	1,038	400	12,335
VALLEY N	2	12	66	9	5	56	7	318	96	521	604	150	1,846
VALLEY S	30	108	291	93	71	636	83	336	1,125	557	6,559	794	10,683
EXTERN	141	341	803	504	478	752	53	141	343	116	649	670	4,991
<b>Total</b>	<b>8,254</b>	<b>46,309</b>	<b>34,033</b>	<b>24,094</b>	<b>8,782</b>	<b>24,701</b>	<b>2,867</b>	<b>8,211</b>	<b>12,249</b>	<b>1,806</b>	<b>10,542</b>	<b>5,477</b>	<b>187,325</b>

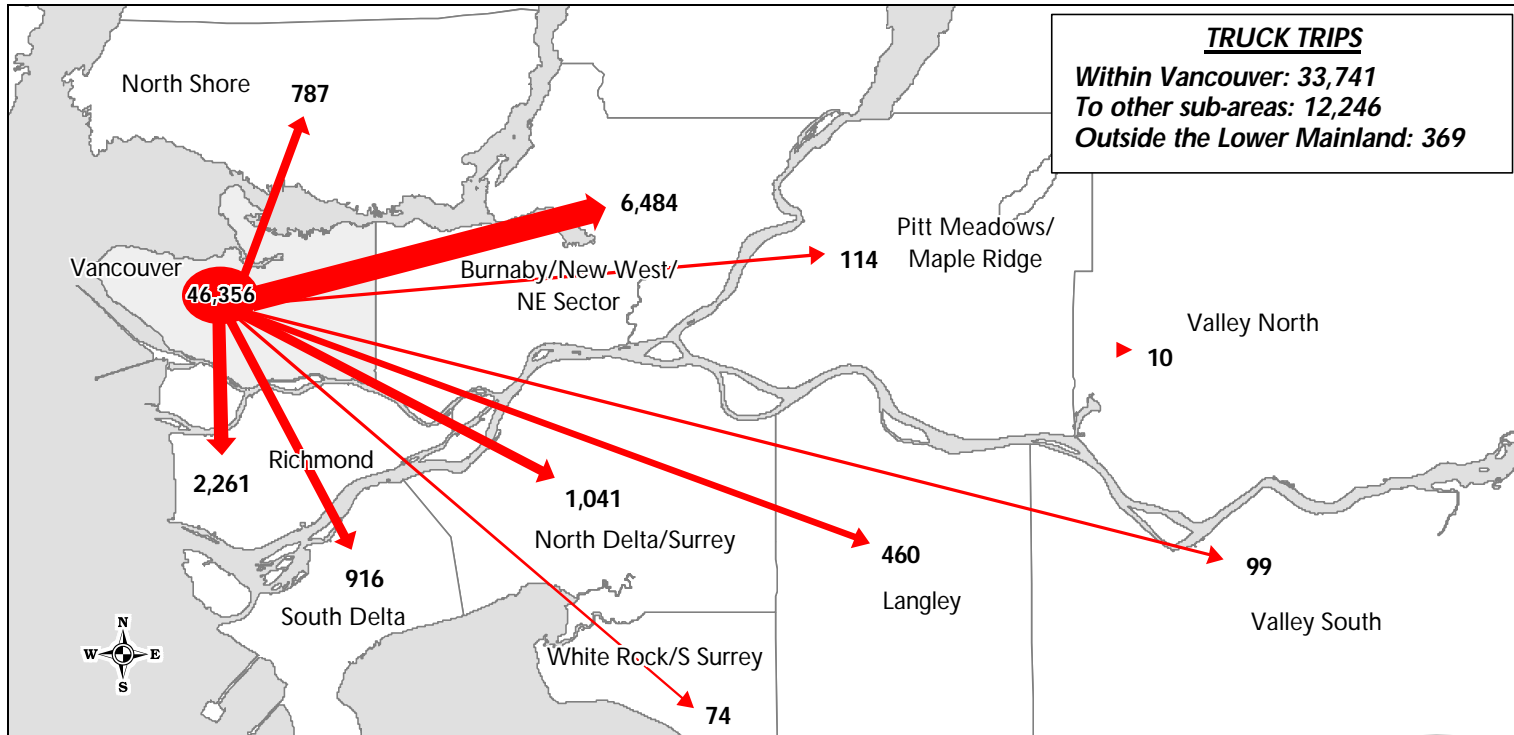


Exhibit 14 – 24 Hour Total Truck Trips Generated from the North Shore



NORTH SHORE SUB-AREA	Destination of Trips Originating in the North Shore				
<p>The North Shore generates approximately 8,300 truck trips, or 4.5% of all truck trips in the Lower Mainland. The Trans-Canada Highway serves as the major east-west connector and the Lion’s Gate and the Second Narrows bridges link the North Shore to the rest of the Lower Mainland. Heavy trucks are prohibited on the Lion’s Gate Bridge. The North Shore also serves as a gateway to the region for trucks travelling through to the Sea to Sky Highway and the Horseshoe Bay Ferry Terminal. The North Shore also hosts a number of Port Vancouver’s bulk and general cargo terminals.</p>	Destined to:	<b>Light</b>	<b>Heavy</b>	<b>Total</b>	<b>Percent</b>
	<i>Within sub-area</i>	4,005	1,396	5,401	65
	<i>Other sub-areas</i>	977	1,775	2,752	33
	<i>Outside the region</i>	65	97	162	2
	<i>Total</i>	<b>5,047</b>	<b>3,268</b>	<b>8,315</b>	<b>100</b>
<p>Approximately 65% of truck trips originating from the North Shore travel to destinations within the North Shore sub-area. Most of the trips that leave the North Shore are destined to Vancouver and Burnaby/ New Westminster/ NE Sector. The remaining trips are relatively evenly spread throughout the other sub-areas.</p>					

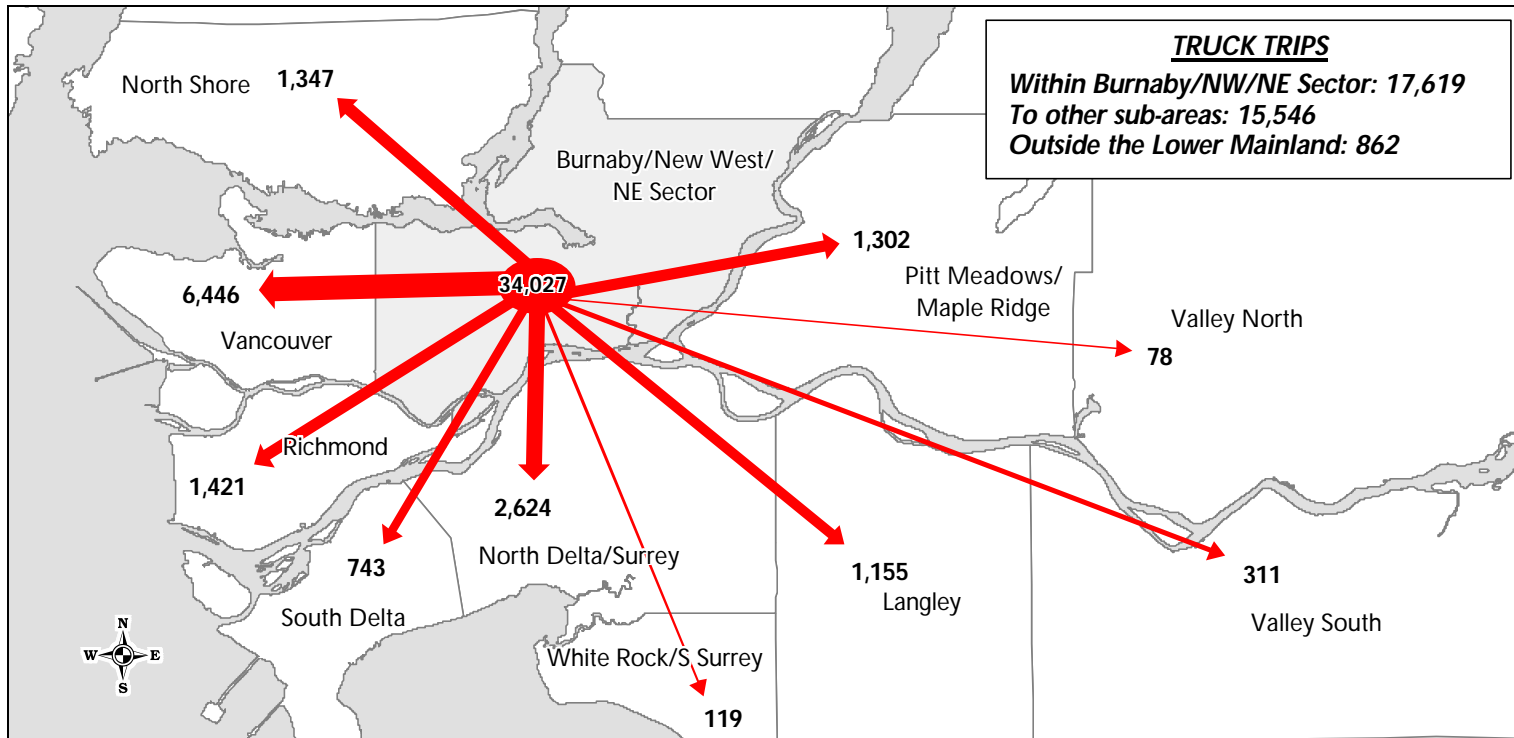
**Exhibit 15 – 24 Hour Total Truck Trips Generated from Vancouver**



VANCOUVER SUB-AREA	Destination of Trips Originating in Vancouver				
<p>Vancouver generates over 46,000 truck trips, or 25% of all truck trips in the Lower Mainland. This includes close to 30% of all light truck trips, but only 16% of all heavy truck trips. Major truck routes in Vancouver include the Trans-Canada Highway, Knight Street, Marine Drive, Grandview Highway and Boundary Road. Vancouver is also host to the Port of Vancouver container terminals, Centerm and Vanterm. Combined, these two terminals produce a large portion of heavy truck traffic for this sub-area.</p>	Destined to:	<b>Light</b>	<b>Heavy</b>	<b>Total</b>	<b>Percent</b>
	<i>Within sub-area</i>	29,088	4,653	33,741	73
	<i>Other sub-areas</i>	7,538	4,708	12,246	26
	<i>Outside the region</i>	85	284	369	1
	<i>Total</i>	<b>36,711</b>	<b>9,645</b>	<b>46,356</b>	<b>100</b>

At 73%, Vancouver has a high percentage of trucks that remain within the sub-area. The majority of truck trips that exit Vancouver are destined to Burnaby/New Westminister/NE Sector and Richmond.

Exhibit 16 – 24 Hour Total Truck Trips Generated from Burnaby/New Westminister/NE Sector



**BURNABY/NEW WESTMINSTER/NE SECTOR SUB-AREA**

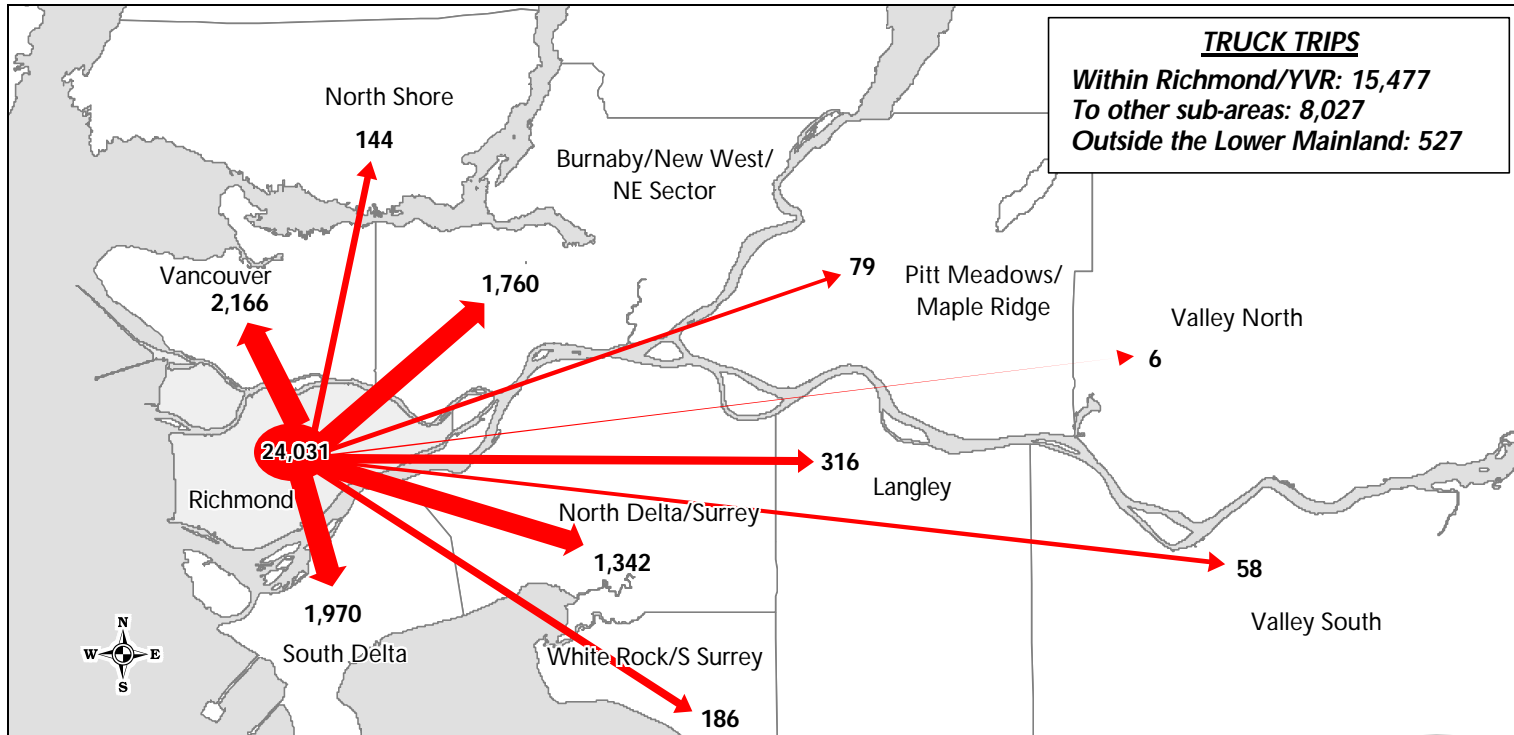
The Burnaby/New Westminster/NE Sector Sub-area generates approximately 34,000 truck trips. This contribution is approximately 18% of all light and heavy truck trips in the Lower Mainland. As the area is centrally located, truck routes in the sub-area region are used for through trips between other sub-areas in the region. Important corridors for these trips include the Marine Drive/ Stewardson Way/ Front Street /Brunette Ave corridor, Highway 1 and Highway 7. In total absolute terms, the number of trucks travelling to the rest of the region is higher than other sub-areas.

**Destination of Trips Originating in Burn/NW/NE Sector**

Destined to:	Light	Heavy	Total	Percent
<i>Within sub-area</i>	12,537	5,082	17,619	52
<i>Other sub-areas</i>	9,899	5,647	15,546	46
<i>Outside the region</i>	193	669	862	2
<b>Total</b>	<b>22,692</b>	<b>11,398</b>	<b>34,027</b>	<b>100</b>

The destinations of trips exiting this sub-area are relatively diffuse throughout the Lower Mainland, but concentrated on Vancouver, Richmond, Surrey and Delta. Close to 900 trips from this sub-area have a destination outside the Lower Mainland.

**Exhibit 17 – 24 Hour Total Truck Trips Generated from Richmond/YVR**



**RICHMOND/YVR SUB-AREA**

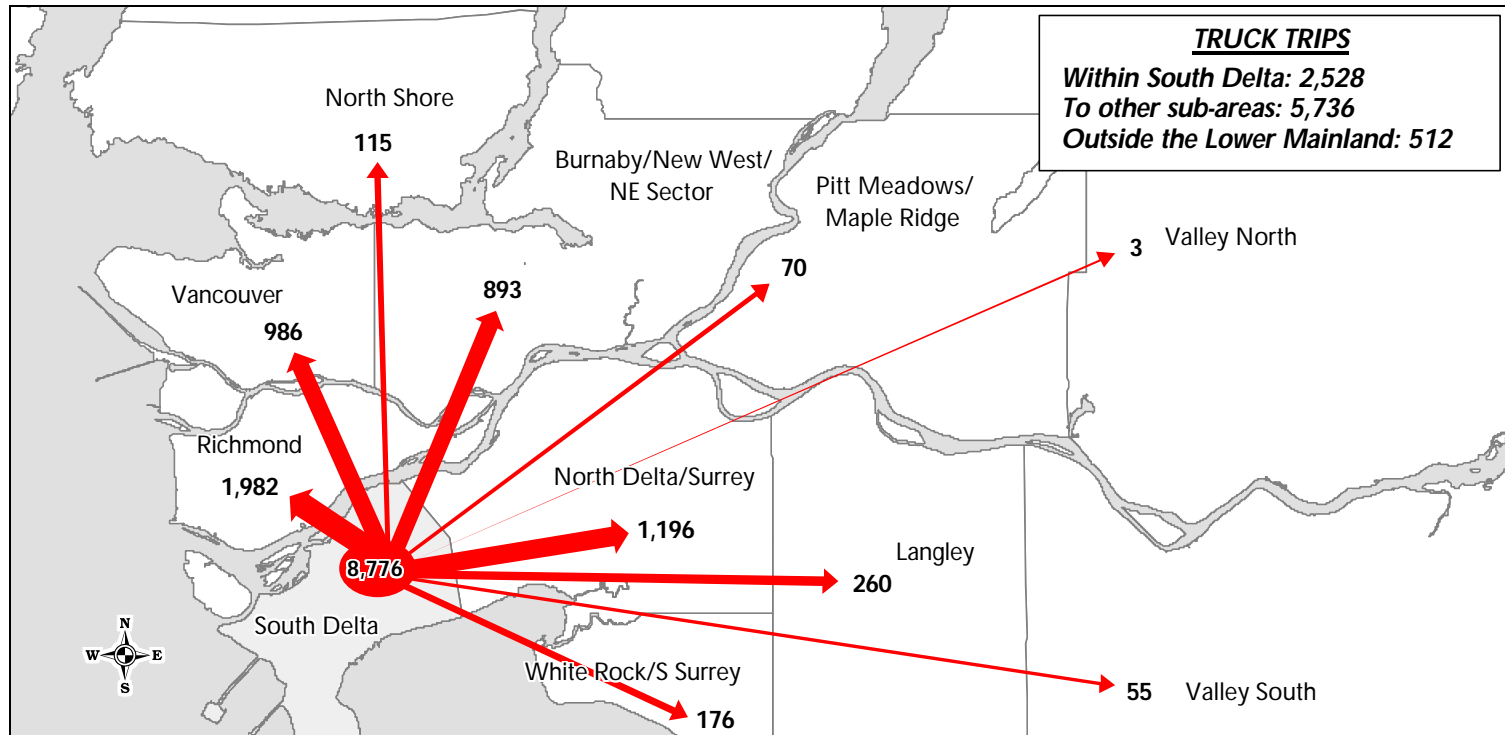
The Richmond/ Vancouver International Airport sub-area generates approximately 24,000 truck trips. This contribution is approximately 13% of all light and heavy truck trips in the Lower Mainland. Truck routes in this sub-region are also used for trips between other sub-areas. Highways 91 and 99, Knight Street and Russ Baker Way are major truck corridors in the sub-area and also carry the majority of through traffic.

**Destination of Trips Originating in Richmond/YVR**

Destined to:	Light	Heavy	Total	Percent
<i>Within sub-area</i>	13,146	2,331	15,477	64
<i>Other sub-areas</i>	4,471	3,556	8,027	33
<i>Outside the region</i>	101	426	527	3
<b>Total</b>	<b>17,718</b>	<b>6,313</b>	<b>24,031</b>	<b>100</b>

The Vancouver International Airport and associated integrators produce approximately 8% of the total truck traffic and 6% of the light truck traffic in this sub-area. Of the trips going to the other sub-areas, most are destined to Vancouver and South Delta.

**Exhibit 18 – 24 Hour Total Truck Trips Generated from South Delta**



**SOUTH DELTA SUB-AREA**

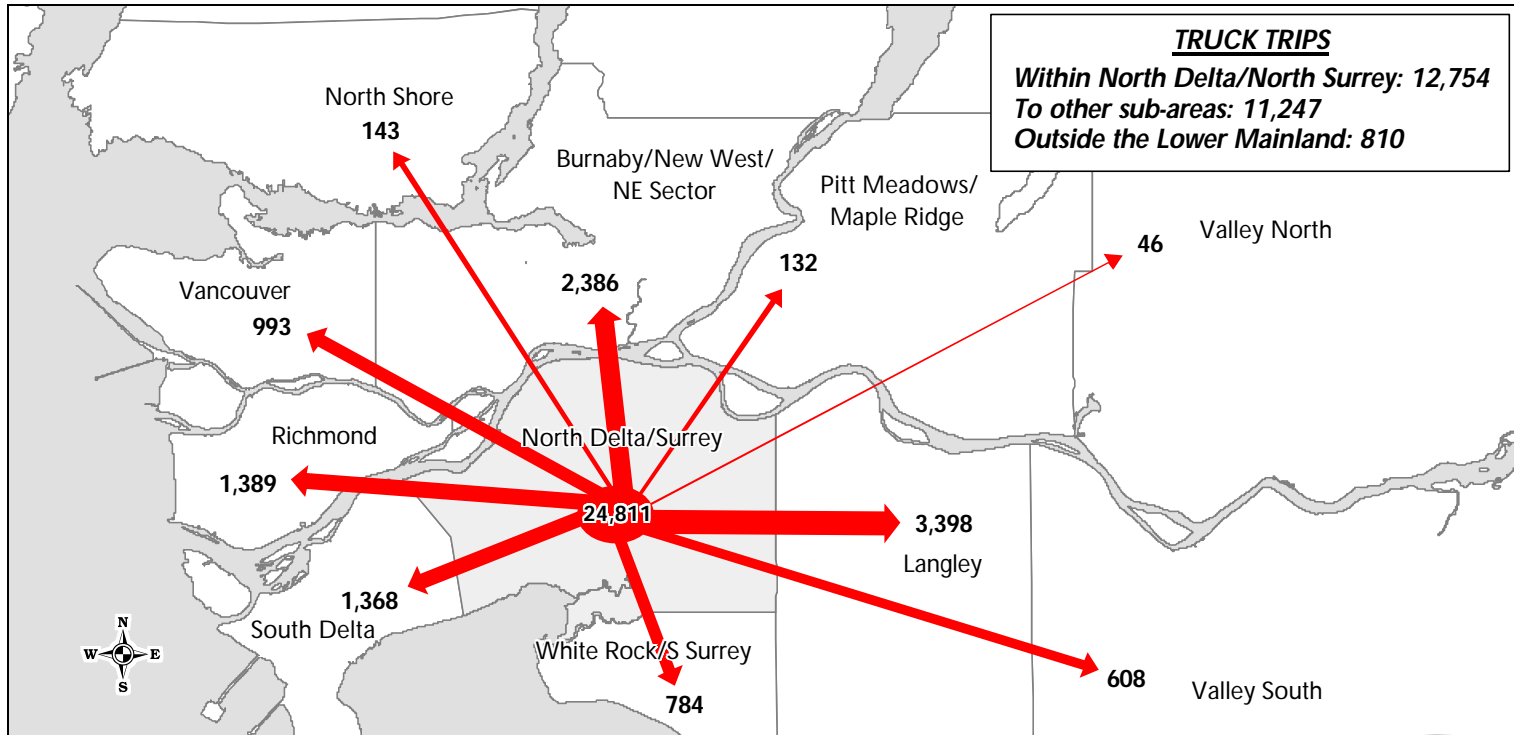
The South Delta sub-area generates approximately 8,800 truck trips. This contribution is approximately 3% of all light truck trips and 9% of all heavy truck trips produced in the Lower Mainland. This area is host to the special generators Deltaport, and Seaspan Coastal Marine. It also provides a gateway to Vancouver Island through the Tsawwassen Ferry Terminal. Furthermore it contains significant industrial areas in Tilbury Island and Annacis Island. Major truck routes include Highways 17, 91 and 99 and River Road.

**Destination of Trips Originating in South Delta**

Destined to:	Light	Heavy	Total	Percent
<i>Within sub-area</i>	919	1,609	2,528	29
<i>Other sub-areas</i>	2,296	3,440	5,736	65
<i>Outside the region</i>	112	400	512	4
<b>Total</b>	<b>3,327</b>	<b>5,449</b>	<b>8,776</b>	<b>100</b>

Compared with other sub-areas, South Delta has a relatively low percentage of trips that stay within the sub-area. Trips that leave the sub-area are relatively evenly distributed throughout the Lower Mainland.

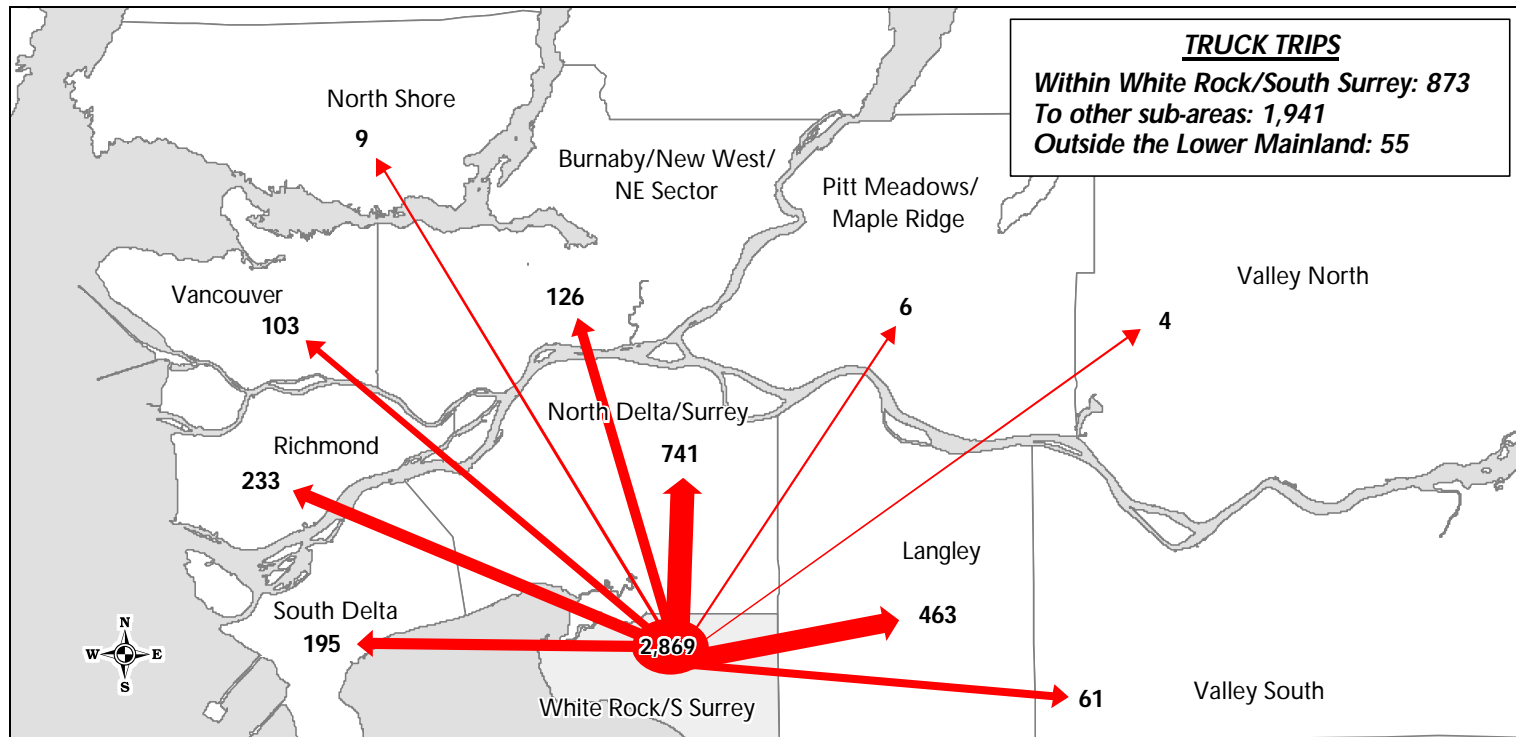
Exhibit 19 – 24 Hour Total Truck Trips Generated from North Delta/North Surrey



NORTH DELTA/NORTH SURREY SUB-AREA	Destination of Trips Originating in N Delta/N Surrey				
	Destined to:	Light	Heavy	Total	Percent
North Delta/North Surrey generates approximately 25,000 truck trips, or 13% of all truck trips in the Lower Mainland. Some of these trips are related to the special generators Fraser Surrey Docks (Fraser River Port Authority) and the CN Thornton Rail Inter-modal Yard. Major truck corridors in this sub-area include Highways 1, 10 and 15. Truck trips from this sub-area are distributed throughout the Lower Mainland, where the primary destinations are the Langleys and Burnaby/New Westminister / NE Sector.	<i>Within sub-area</i>	10,783	1,971	12,754	51
	<i>Other sub-areas</i>	6,905	4,342	11,247	45
	<i>Outside the region</i>	166	644	810	4
	<b>Total</b>	<b>17,854</b>	<b>6,957</b>	<b>24,811</b>	<b>100</b>

Destinations of truck trips are fairly evenly balanced between destinations within the sub-area and destinations outside the sub-area. Approximately 800 truck trips that originate in North Delta / North Surrey exit the Lower Mainland.

**Exhibit 20 – 24 Hour Total Truck Trips Generated from White Rock/South Surrey**



**WHITE ROCK/SOUTH SURREY SUB-AREA**

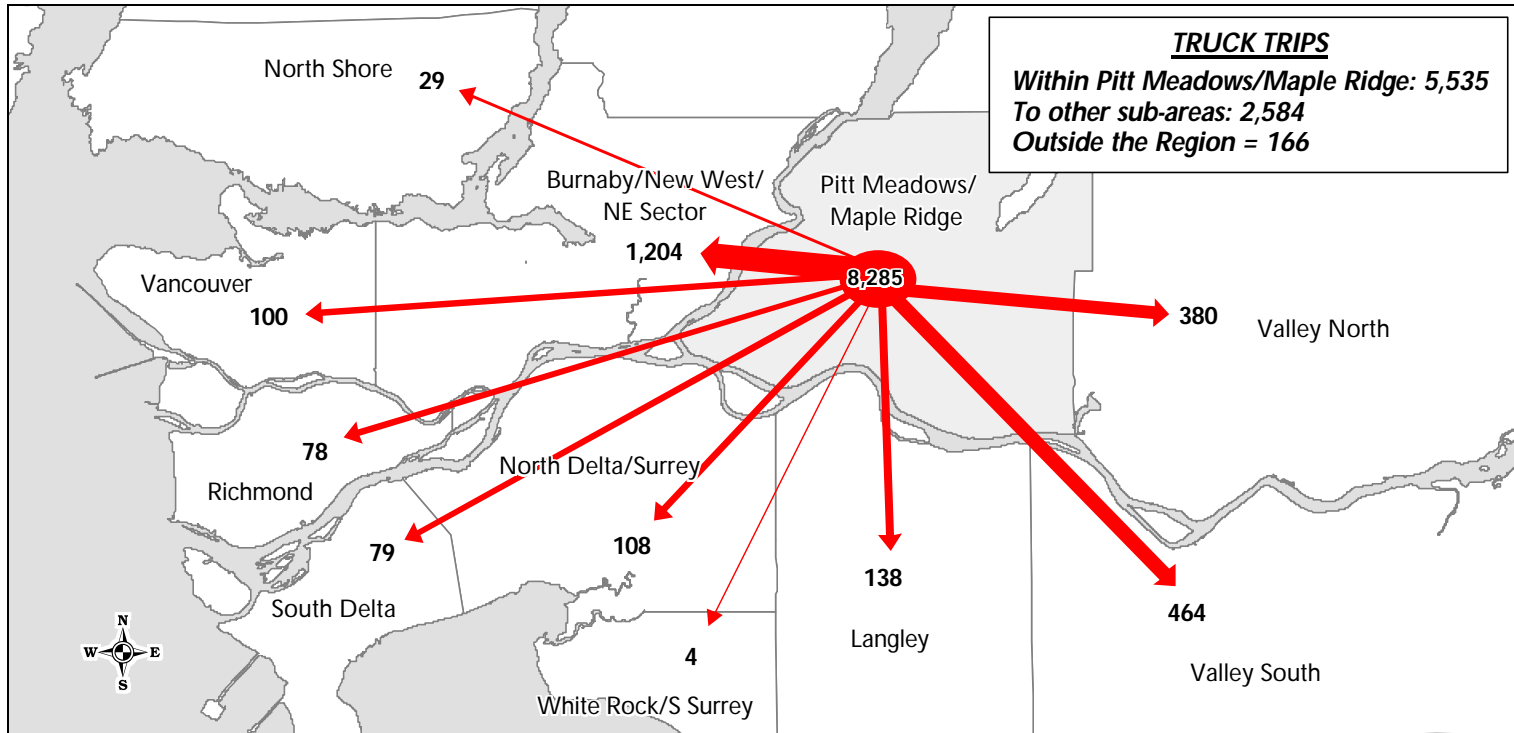
The White Rock / South Surrey sub-area contributes close to 3,000 truck trips daily. This constitutes approximately 1.5% of all truck trips generated in the Lower Mainland. Due to the Pacific Border Crossing at Hwy 15, this sub-area is also a major gateway to the United States. Only truck trips from White Rock / South Surrey to external locations are included in the 'outside of region' part of this figure. A high proportion of truck trips that are generated within this sub-area are destined for other sub-areas.

**Destination of Trips Originating in WR/S Surrey**

Destined to:	Light	Heavy	Total	Percent
<i>Within sub-area</i>	724	149	873	30
<i>Other sub-areas</i>	1,175	766	1,941	68
<i>Outside the region</i>	10	45	55	2
<b>Total</b>	<b>1,909</b>	<b>960</b>	<b>2,869</b>	<b>100</b>

The majority of truck traffic exiting South Surrey/White Rock are destined to North Delta/Surrey and the Langleys.

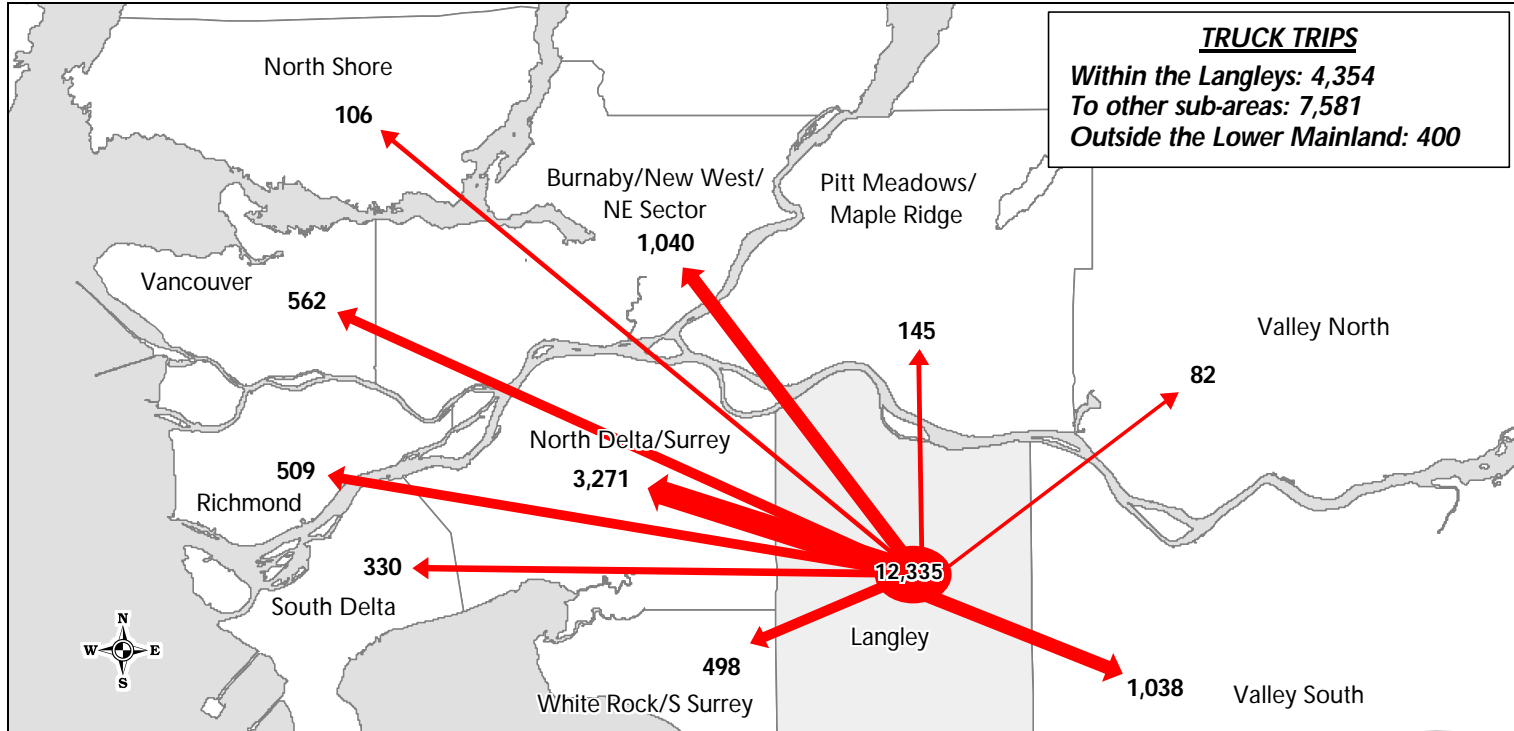
**Exhibit 21 – 24 Hour Total Truck Trips Generated from Pitt Meadows/Maple Ridge**



PITT MEADOWS/MAPLE RIDGE SUB-AREA		Destination of Trips Originating in PM/MR			
The Pitt Meadows/Maple Ridge sub-area generates approximately 8,300 truck trips per day. This constitutes approximately 4.5% of all truck trips in the Lower Mainland. This sub-area is host to the CP Inter-modal Yard. Highway 7 (including the Pitt River Bridge) provides the only direct link between this sub-area and the rest of the Lower Mainland. A relatively low percentage of trucks generated in this sub-area exit to other sub-areas.	Destined to:	<b>Light</b>	<b>Heavy</b>	<b>Total</b>	<b>Percent</b>
	<i>Within sub-area</i>	4,884	651	5,535	67
	<i>Other sub-areas</i>	365	662	2,584	31
	<i>Outside the region</i>	41	125	166	2
	<i>Total</i>	<b>6,309</b>	<b>1,976</b>	<b>8,285</b>	<b>100</b>
		The primary destination for trucks leaving this sub-area is Burnaby / New Westminster / NE Sector.			



**Exhibit 22 – 24 Hour Total Truck Trips Generated from The Langleys**



**THE LANGLEYS SUB-AREA**

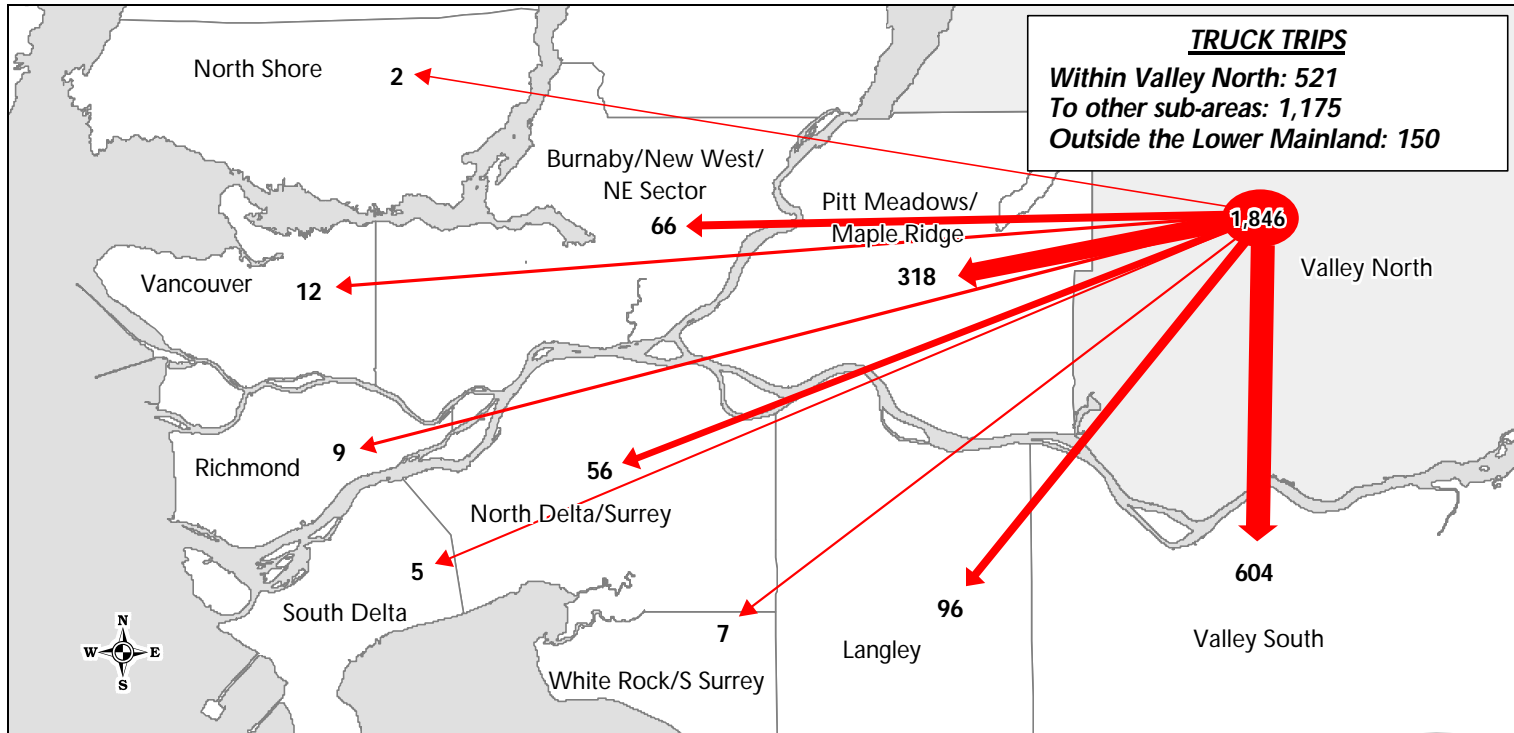
The Langleys produce over 12,000 truck trips per day, or approximately 6.5% of all truck trips in the Lower Mainland. Major truck routes in this sub-area include Highways 1 and 10, Fraser Highway and 200<sup>th</sup> Street. The Highway 13 border crossing at Aldergrove is also in this sub-area. A large proportion of truck trips generated in this area are destined to sub-areas south of the Fraser River. These include Surrey, Delta, Abbotsford and Chilliwack.

**Destination of Trips Originating in The Langleys**

Destined to:	Light	Heavy	Total	Percent
<i>Within sub-area</i>	2,867	1,487	4,354	35
<i>Other sub-areas</i>	5,015	2,566	7,581	61
<i>Outside the region</i>	92	308	400	4
<i>Total</i>	<b>7,974</b>	<b>4,361</b>	<b>12,335</b>	<b>100</b>

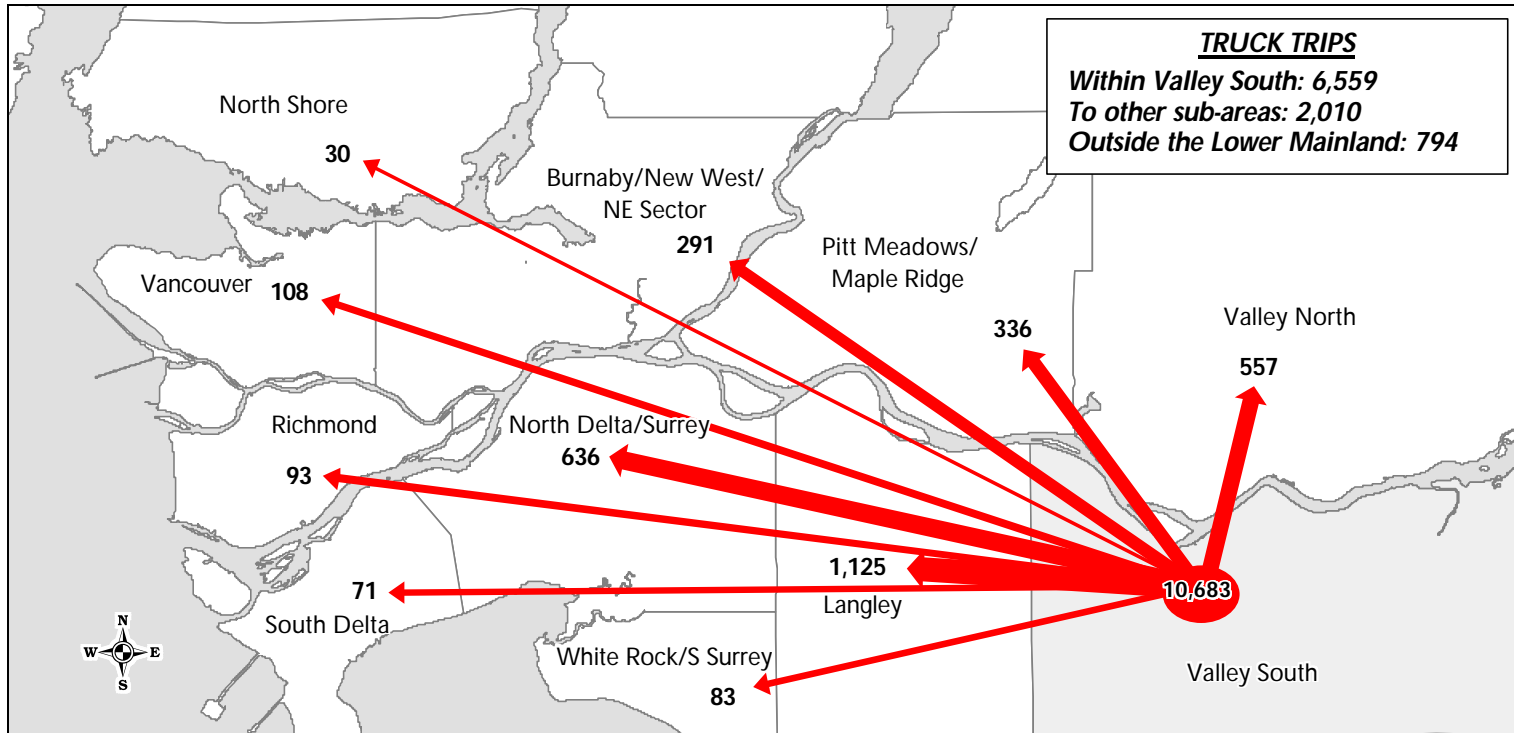
Approximately 35% of truck trips generated in the Langleys have a destination within this sub-area.

**Exhibit 23 – 24 Hour Total Truck Trips Generated from Valley North**



VALLEY NORTH SUB-AREA	Destination of Trips Originating in Valley North				
<p>This sub-area includes Mission and Kent. It produces close to 2,000 truck trips per day, or 1% of all truck trips in the Lower Mainland. Highways 7 and 11 link this sub-area with the rest of the Lower Mainland. This sub-area generates a similar number of light and heavy truck trips. The primary destinations of truck trips that leave this sub-area are Valley South (Abbotsford/Chilliwack) and Pitt Meadows / Maple Ridge</p>	Destined to:	<b>Light</b>	<b>Heavy</b>	<b>Total</b>	<b>Percent</b>
	<i>Within sub-area</i>	286	235	521	28
	<i>Other sub-areas</i>	644	531	1,175	64
	<i>Outside the region</i>	42	108	150	8
	<i>Total</i>	<b>972</b>	<b>874</b>	<b>1,846</b>	<b>100</b>
		<p>This area produces a high percentage of truck tips that have a destination outside the Lower Mainland.</p>			

**Exhibit 24 – 24 Hour Total Truck Trips Generated from Valley South**



VALLEY SOUTH SUB-AREA	Destination of Trips Originating in Valley South				
The Valley South sub-area includes Abbotsford and Chilliwack. It generates over 10,500 truck trips per day, or 5.5% of all truck trips generated in the Lower Mainland. Highways 1 and 11 and the Fraser Highway are major truck corridors in this sub-area. Highway 1 also carries a significant number of trips destined for the British Columbia Interior through this sub-area. This sub-area generates approximately an equal number of heavy and light truck trips.	Destined to:	<b>Light</b>	<b>Heavy</b>	<b>Total</b>	<b>Percent</b>
	<i>Within sub-area</i>	3,591	2,968	6,559	61
	<i>Other sub-areas</i>	911	1,099	2,010	19
	<i>Outside the region</i>	201	593	794	20
	<i>Total</i>	<b>5,515</b>	<b>5,168</b>	<b>10,683</b>	<b>100</b>
	Close to 20% of truck trips leaving Valley South have a destination outside the Lower Mainland. Other significant destinations include the Langleys, North Delta/North Surrey and Burnaby/New Westminster/NE Sector.				

## 2.3 SPECIAL GENERATORS

Special generator truck trips are those that originate at or are destined to major discrete traffic generators such as port terminals, the international airport and inter-modal rail facilities. Demand for these types of truck trips is related to economic forces within and outside of the Lower Mainland, as well as trends within industry regarding containerization of goods. As such, truck trips from special generators are considered to be a distinct sub-set of all truck trips. The figures presented in the previous section include truck trips from special generators. The purpose of this section is to describe the contribution of special generators to total truck trips in the Lower Mainland.

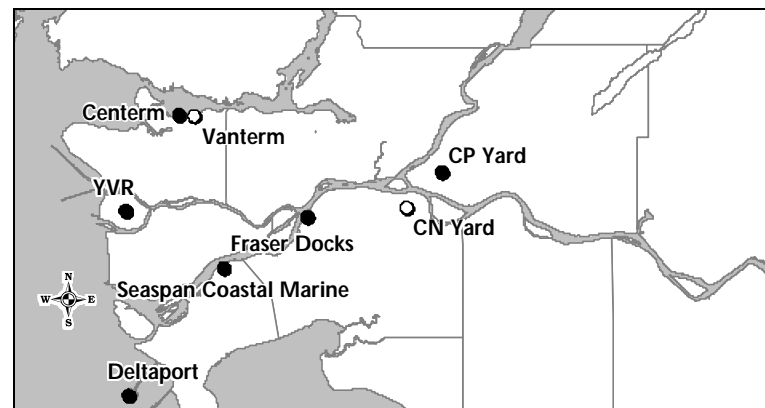
In order to capture the unique nature of special generator truck trips, roadside interviews were conducted at six sites that are shown in **Exhibit 25**. They are:

- Centerm Container Terminal (Centerm)
- Deltaport Container Terminal (Deltaport)
- Seaspan Coastal Inter-modal Terminal (Seaspan)
- Fraser Surrey Docks (Fraser Docks)
- Vancouver International Airport Area (YVR)
- CP Rail Inter-modal Yards (CP Yard)

The selection of the special generator sites was based upon survey cost, and the requirement to have all major types of special generators represented. Furthermore, it was assumed that similar sites would have similar commodity types and origin-destination patterns. For the above reasons, roadside interviews were not conducted at the following sites:

- CN Rail Inter-modal Yard (CN Yard)
- Vanterm Container Terminal (Vanterm)

**Exhibit 25 – Special Generators**



The results of the roadside interviews were expanded to include the two sites that were not surveyed. Therefore the following values represent the sum of all eight special generator sites. There were approximately 7,200 truck trips attributed to special generators on a typical day in November, 1999. This constituted approximately 4% of all truck trips in the Lower Mainland. The composition of special generator truck trips as part of total truck trips in the Lower Mainland is provided in **Exhibit 26**. Special generators account for 2% of all light truck trips and 8% of all heavy truck trips.

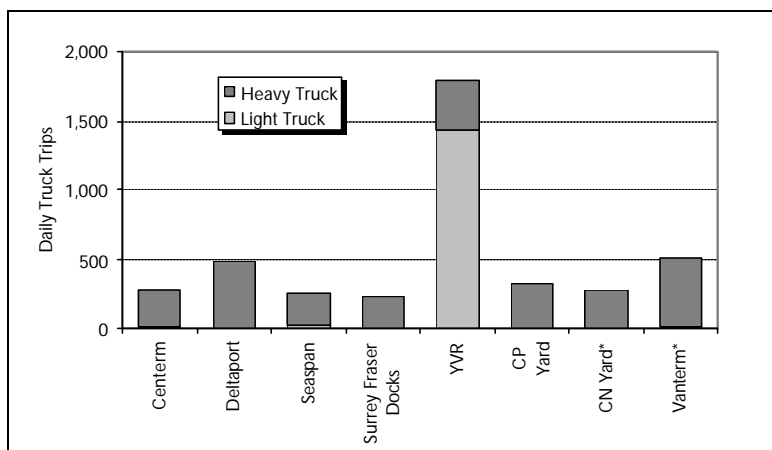
**Exhibit 26 – Special Generator Truck Trips in Context**

Trip Type	Total	Light	Heavy
<i>Special Generators</i>	7,200	2,500	4,700
<i>Total</i>	187,300	127,000	60,300
<i>Percent Special Generator</i>	4%	2%	8%

It is important to remember that the information presented in this section is the product of surveys conducted in November, 1999. The level of activity, commodity being handled, and the origins and destinations of truck trips can be expected to vary due to a number of factors including the shipping lines being serviced at the ports and seasonal variation in activity and commodity. The information presented in this section provides valuable context regarding the contribution of special generators to total truck movements in the Lower Mainland, but should not be considered a comprehensive analysis that accounts for variation throughout the year.

The total truck trips produced by each of the eight special generators are shown in **Exhibit 27**. With the exception of Vancouver International Airport (YVR), special generators produce almost entirely heavy truck trips. The significant number of light truck trips at the airport is largely due to integrators and food service providers located on Sea Island.

**Exhibit 27 – Total Daily Truck Trips Originating From Special Generators**



\* an origin/destination survey was not conducted at these sites

While the above provided an overview on the contribution of special generators to the total truck trips in the Lower Mainland, the rest of this section presents a brief overview of each special generator that was surveyed. It includes information on the trips generated, the light/heavy truck trip split and the destinations of truck trips produced by the special generators.

### Centerm Container Terminal

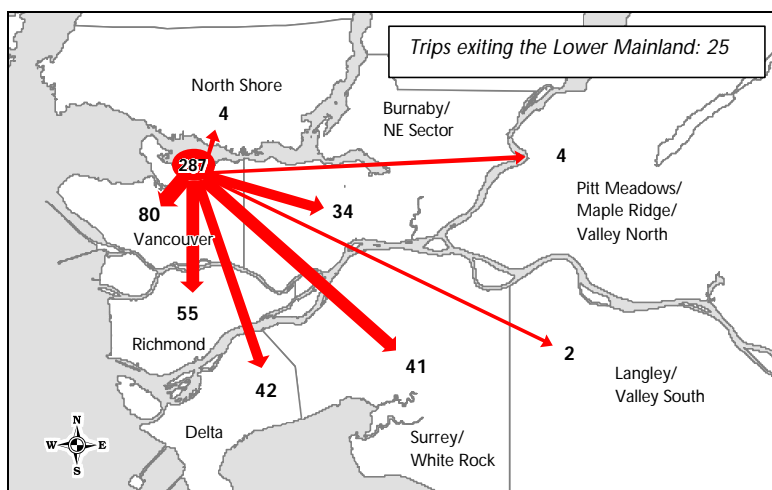
Centerm is one of two container terminals located on the southern shore of the Burrard Inlet. The other container terminal, Vanterm, is located east of Centerm. Both terminals are under the jurisdiction of the Vancouver Port Authority and are open from Monday to Friday 7:00 am to 4:00 pm.

Port Vancouver's container business has grown by 257% since 1989, and 100% since 1996. Presently, 57% of Port Vancouver's container business moves by truck. The total number of trucks accessing the terminals every day is relatively stable throughout the year, with peaks generally coinciding with the pre-Christmas retail period in August and September. Together, Centerm and Vanterm generated approximately 1,600 truck trips per day in November, 1999, or approximately 800 trips in each direction. This represents approaching 10% of all heavy truck trips produced in Vancouver. Centerm generated 35% of these trips.

As the roadside interview was only conducted at Centerm, the following information is for Centerm only. On the survey day, Centerm generated approximately 570 truck trips per day, or approximately 285 in each direction. The truck traffic is comprised of almost completely heavy trucks. The exception was less than 20 light truck trips per day that were recorded between the terminal and Vancouver International Airport.

The destinations of truck trips originating from Centerm are presented in **Exhibit 28**. The primary destinations were Vancouver and Richmond, which captured 28% and 20% of all truck trips respectively. Other areas that captured over 10% of the truck trips were Burnaby/ New Westminister/ NE Sector, Surrey, and Delta. Close to 10% of all truck trips had a destination outside the Lower Mainland.

**Exhibit 28 – Destinations of Daily Truck Trips Originating from Centerm**



The sub-areas represented in **Exhibit 28** and other like figures include truck trips from the special generator in question to other special generators. Close to 40% of all truck trips produced by Centerm were destined to other special generators (See **Exhibit 29**). For example, Vanterm received 73 trips (25%) from Centerm. This may be largely due to trucks that drop off a container at one terminal and then pick up the container from the other. This may also be due to frequent re-handling of empty containers between the two terminals and the nearby empty container depots.

**Exhibit 29 – Daily Truck Trips from Centerm to Other Special Generators**

Special Generators	Trips	%
<i>Vanterm</i>	73	65%
<i>Deltaport</i>	11	10%
<i>Seaspan</i>	8	7%
<i>Surrey Fraser Docks</i>	2	2%
<i>YVR</i>	7	6%
<i>CP and CN Yards</i>	12	11%
<b>Total</b>	<b>113</b>	<b>100%</b>

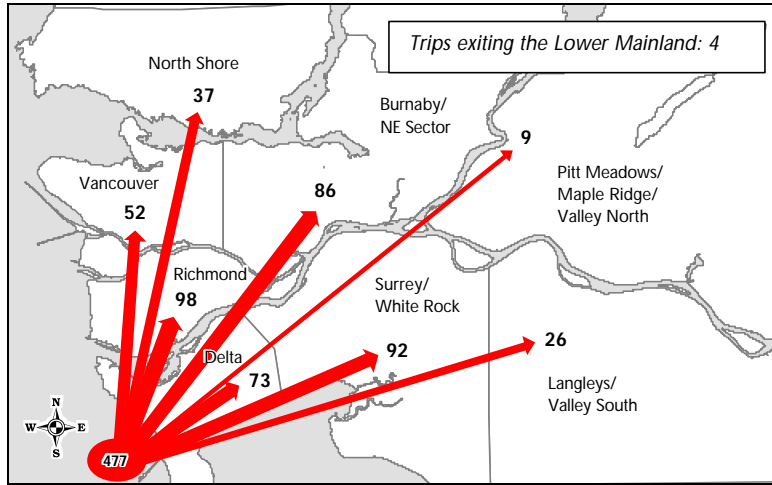
### Deltaport Container Terminal

Deltaport is a relatively new container terminal located near the Tsawwassen Ferry Terminal in Delta. It is under the jurisdiction of the Vancouver Port Authority. It has been experiencing significant growth in container throughput over the past few years due to its reserve capacity, and generates from 1,000 to 1,200 truck trips per day, or 500 to 600 truck trips per direction. Deltaport is presently being expanded to substantially increase its current capacity.

The operating hours are from 7:00am to 4:30pm from Monday to Friday. The majority of the truck traffic accessing this facility is in the off-peak direction. The truck traffic is almost entirely heavy trucks except for a few light trucks that perform maintenance and other operation-related activities.

Approximately 10% of all heavy truck trips produced in Delta can be attributed to Deltaport. The destinations of truck trips originating from Deltaport are presented in **Exhibit 30**. The primary trip destinations were Richmond, Surrey, and Burnaby/ New Westminister / NE Sector.

**Exhibit 30 – Destinations of Daily Truck Trips Originating from Deltaport**



A large portion of the truck traffic from Deltaport (16%) is related to the other special generators. This relationship is shown in Exhibit 31.

**Exhibit 31 – Daily Truck Trips from Deltaport to Other Special Generators**

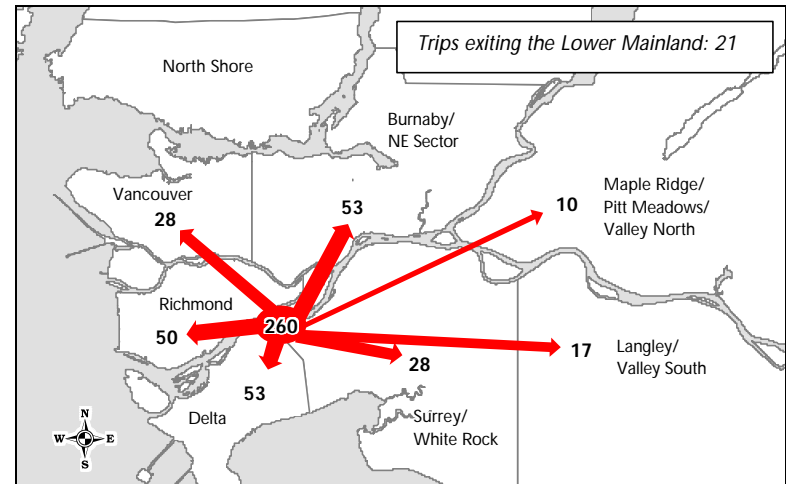
Special Generators	Trips	%
Centerm	6	8%
Vanterm	21	28%
Seaspan	24	32%
Surrey Fraser Docks	9	12%
YVR	12	16%
CP and CN Yards	4	5%
<b>Total</b>	<b>76</b>	<b>100%</b>

**Seaspan Coastal Inter-modal Terminal**

Seaspan Coastal Inter-modal Terminal provides commercial truck and rail ferry service between the British Columbia Mainland and Vancouver Island. Formerly Canadian Pacific Railway Coastal Marine Operations, the company became a member of the Washington Marine Group in November 1998. The facility is based in Delta on Tilbury Island.

Seaspan operates 24 hours per day, with the majority of the trucking activity occurring in the evening. Seaspan generates between 200 to 300 truck trips on the average weekday in each direction. In general, weekend traffic tends to be lighter than weekdays. Approximately 230 heavy trucks and 55 light trucks were recorded on the survey days. Most of the light truck trips were related with YVR. Exhibit 32 shows the destinations of truck trips originating from Seaspan.

**Exhibit 32 – Destinations of Daily Truck Trips Originating from Seaspan**



The primary destinations were the Delta, Richmond / YVR and Burnaby / New Westminister / N. E. Sector sub-areas, with each sub-area attracting approximately 50 trips per day. Close to 40% of truck trips produced by Seaspan were destined to other special generators. These trips are shown in **Exhibit 33**. Deltaport and YVR were the primary recipients of these truck trips.

**Exhibit 33 – Daily Truck Trips from Seaspan to Other Special Generators**

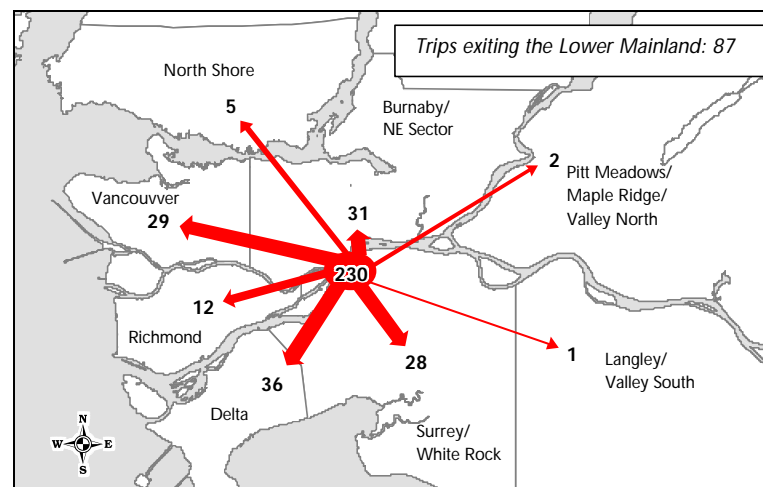
Special Generators	Trips	%
<i>Centerm</i>	4	4%
<i>Vanterm</i>	7	7%
<i>Deltaport</i>	28	27%
<i>Fraser Surrey Docks</i>	15	14%
<i>YVR</i>	39	37%
<i>CP and CN Yards</i>	12	11%
<b>Total</b>	<b>105</b>	<b>100%</b>

### Fraser Surrey Docks

Fraser Surrey Docks is under the jurisdiction of the Fraser River Port Authority. It handles three main commodity types, with a separate gate for each, including lumber, steel and containers. Fraser Surrey Docks produces approximately 230 truck trips per day in each direction. The majority of these trips were made using heavy trucks. The destinations of the outbound truck trips are illustrated in **Exhibit 34**.

Close to 40% of all truck trips originating at Fraser Surrey Docks were destined to locations outside the Lower Mainland. Approximately 80% of these external trips (70% steel and 10% container) were destined to Alberta. The other portion was destined for the United States.

**Exhibit 34 – Destinations of Daily Truck Trips Originating from Fraser Surrey Docks**



**Exhibit 35** provides the daily heavy truck trips from Fraser Surrey Docks to other special generators. The truck trips to Deltaport, Centerm and Vanterm may be attributed to Fraser Surrey Docks' ability to stuff containers.

**Exhibit 35 – Daily Truck Trips from Fraser Surrey Docks to Other Special Generators**

Special Generators	Trips	%
<i>Centerm</i>	9	20%
<i>Vanterm</i>	7	16%
<i>Deltaport</i>	10	23%
<i>Seaspan</i>	14	32%
<i>YVR</i>	0	0%
<i>CP and CN Yards</i>	4	9%
<b>Total</b>	<b>44</b>	<b>100%</b>

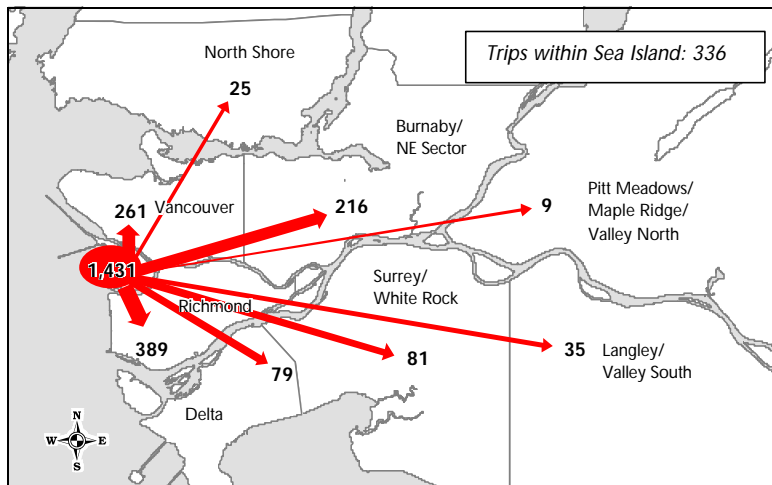


### Vancouver International Airport

The main areas of interest on the Vancouver International Airport (YVR) in terms of truck trips are the cargo village, courier companies, and the food services areas. During the survey approximately 3,200 truck trips per day were produced and attracted by YVR. This includes approximately 360 truck trips that stayed internally within the YVR area. Of these truck trips, close to 80% were made using light trucks. As mentioned earlier in this section, the high number of light truck trips is likely due to courier companies in the area that use light trucks for pick-up and delivery operations.

**Exhibit 36** shows the destinations of light truck trips that originate at YVR. Of these 1,431 light truck trips, 336 (or 23%) were made within the area. This is related to the catering businesses that deliver goods to the planes and food service areas. Other major light truck destinations include Richmond, Vancouver and Burnaby / New Westminister / NE Sector.

**Exhibit 36 – Destinations of Daily Light Truck Trips Originating from YVR**



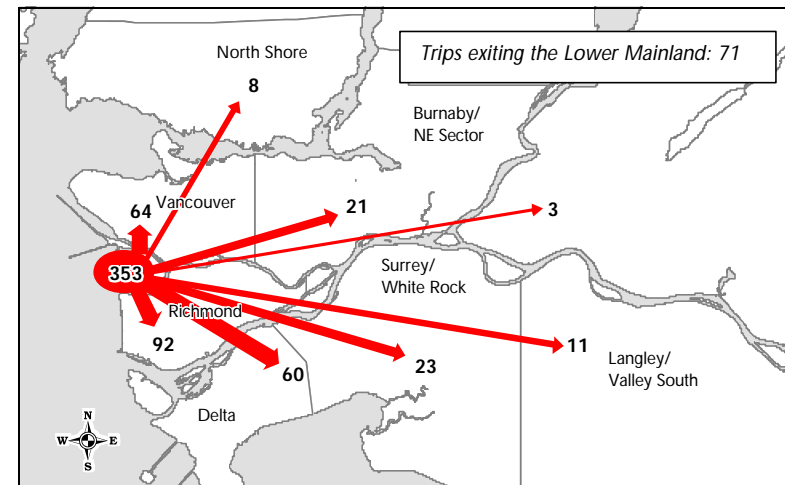
**Exhibit 37** provides the destinations of the 3% of light trucks trips that were destined for other special generators.

**Exhibit 37 – Daily Light Truck Trips from YVR to Other Special Generators**

Special Generators	Trips	%
<i>Centerm</i>	7	14%
<i>Vanterm</i>	13	27%
<i>Deltaport</i>	0	0%
<i>Seaspan</i>	28	57%
<i>Fraser Surrey Docks</i>	0	0%
<i>CP and CN Yards</i>	1	2%
<b>Total</b>	<b>49</b>	<b>100%</b>

The YVR area generates approximately 350 heavy truck trips per day in each direction. The destinations of these truck trips are illustrated in **Exhibit 38**.

**Exhibit 38 – Destinations of Daily Heavy Truck Trips Originating from YVR**



The majority of the heavy trucks were destined for Richmond, Vancouver and Delta. Approximately 20% exit the Lower Mainland, most of which were destined to the United States. Furthermore, there were 34 trips (10%) destined to locations within Sea Island. YVR also generates approximately 30 heavy truck trips destined to other special generators. **Exhibit 39** shows the trip distribution.

**Exhibit 39 – Daily Heavy Truck Trips from YVR to Other Special Generators**

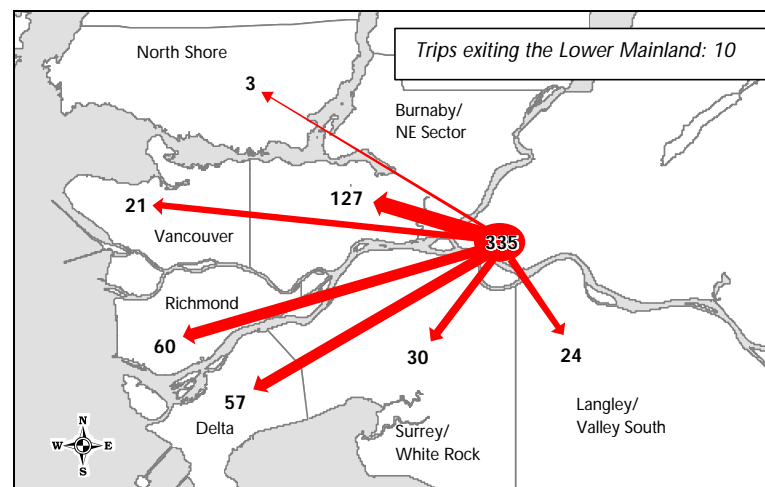
Special Generators	Trips	%
<i>Centerm</i>	0	0%
<i>Vanterm</i>	6	21%
<i>Deltaport</i>	13	46%
<i>Seaspan</i>	8	29%
<i>Fraser Surrey Docks</i>	0	0%
<i>CP and CN Yards</i>	1	4%
<b>Total</b>	<b>28</b>	<b>100%</b>

### CP Rail Inter-modal Yard

Canadian Pacific (CP) Railway Inter-modal Yard was recently relocated to Pitt Meadows on the east side of the Pitt River Bridge. The site is open 24 hours a day, seven days a week. Truck traffic consists mostly of container trucks. However, some truck trailers are loaded onto trains as well. The rail containers are significantly larger than the containers loaded on the ocean liners, with an overall length of 48 feet instead of 40 feet.

The CP Yard produces approximately 650 heavy truck trips per day, or 330 in each direction. No light truck trips recorded on the survey day. **Exhibit 40** illustrates the destinations of trips that originate from the CP Yard.

**Exhibit 40 – Destinations of Daily Truck Trips Originating from the CP Yard**



The primary destination for these trips was Burnaby/ New Westminster/ NE Sector (38%). Other sub-areas that captured more than 15% of these trips were Delta and Richmond. None of these trips were destined to Pitt Meadows/Maple Ridge. **Exhibit 41** presents the truck trips destined to other special generators.

**Exhibit 41 – Daily Truck Trips from CP Yard to Other Special Generators**

Special Generators	Trips	%
<i>Centerm</i>	0	0%
<i>Vanterm</i>	8	32%
<i>Deltaport</i>	0	0%
<i>Seaspan</i>	13	52%
<i>Fraser Surrey Docks</i>	3	12%
<i>YVR</i>	1	4%
<b>Total</b>	<b>25</b>	<b>100%</b>

## 2.4 EXTERNAL GATEWAYS

External truck trips are those that originate or terminate outside of the Lower Mainland. Because demand for external trips is partly driven by economic forces outside the region, external truck trips bear different trip making characteristics from trips internal to the region. Furthermore, many of the trucks using external gateways were not registered in British Columbia and were therefore not eligible for the mailout survey. Consequently roadside interviews were conducted at seven entry/exit points. The purpose of this section is to describe the locations that were surveyed, and the demand that these entry points into the region serve.

The external gateways that were surveyed are illustrated in **Exhibit 42**. They represent four general entry/exit points and are:

### **British Columbia Interior**

- Highway 7 (near Haig)
- Highway 1 (near Laidlaw)

### **Canada-United States Border**

- Highway 15 (Pacific Highway Border Crossing)
- Highway 13 (Aldergrove Border Crossing)
- Highway 11 (Huntington Border Crossing)

### **Squamish/Whistler**

- Highway 99 North (Sea to Sky Highway)

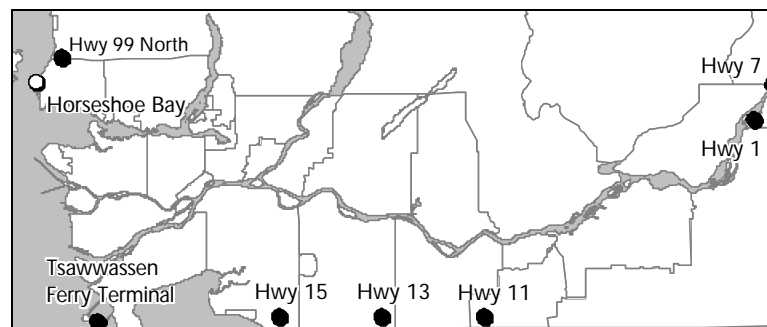
### **Gulf/Vancouver Islands**

- Tsawwassen Ferry Terminal

Trucks were not surveyed at the Highway 99 (Peace Arch) Border Crossing and the Tsawwassen Border Crossing at Point Roberts because of truck prohibitions and low truck volume, respectively. The Horseshoe Bay Ferry Terminal was

not surveyed as trucks were being diverted towards the Tsawwassen Ferry Terminal at that time.

**Exhibit 42 – External Gateways**



External trips constitute approximately 5% of the total truck trips in the Lower Mainland. The composition of external trips as part of the total truck trips in the Lower Mainland is provided in **Exhibit 43**.

**Exhibit 43 – External Truck Trips in Context**

Trip Type	Total	Light	Heavy
<i>External Trips</i>	9,900	2,200	7,700
<i>Total Trips</i>	187,300	127,000	60,300
<i>Percent External</i>	5%	2%	13%

External truck trips account for approximately 2% of total light truck trips and 13% of total heavy truck trips. Approximately 6% of external trips are through trips, or in other words, trips that pass through the region without making a freight stop.

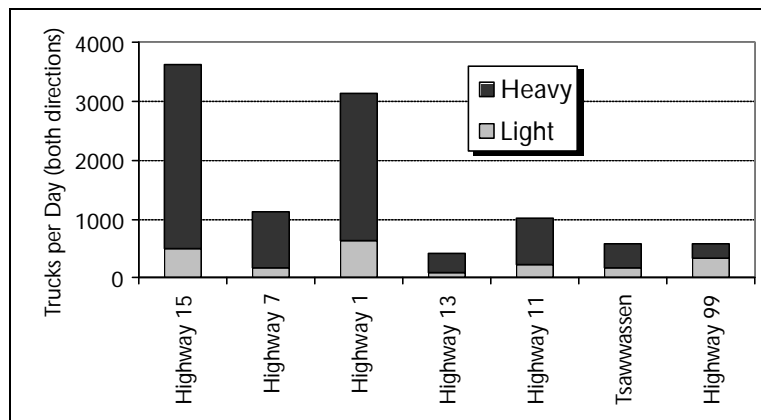
**Exhibit 44** provides the percentage of trips generated through each of the four major entry/exit points previously described. Approximately 50% of external trips cross the Canada-United States border. The British Columbia interior accounts for a further 40% of external truck trips. The Vancouver/Gulf Islands and Highway 99 each account for 5% of external trips.

**Exhibit 44 – General Direction of Truck Volumes at External Gateways**

Direction	Percent of External Trips
Canada - US Border	50
British Columbia Interior	40
Vancouver / Gulf Islands	5
Squamish/Whistler	5
<b>Percent External</b>	<b>100</b>

The magnitude of truck trips at each external gateway as the sum of both directions is shown in **Exhibit 45**.

**Exhibit 45 – Truck Volumes at External Gateways**



Two gateways dominate in terms of total truck traffic. Highway 15 is the primary border crossing connecting the Lower Mainland to the United States. Specifically, it connects to Interstate 5, the major north-south highway that serves the American west coast. Highway 1 is the primary highway connection between the Lower Mainland and the rest of Canada, including the British Columbia Interior. Combined, these two gateways constitute 65% of all external truck trips. Light and heavy trucks account for approximately 20% and 80% of trips using external gateways, respectively.

A review of the origin and destination pairs reported in the surveys showed that, in general, the number of truck trips destined to a particular sub-area from an external gateway is similar to the number of truck trips destined to the same external gateway from the same particular sub-area. It should be noted that these are not necessarily the same trucks entering and exiting via the same gateway. Some trucks make a triangular route i.e. entering through the Canada-United States border, making a freight stop, and then exiting the Lower Mainland into the British Columbia Interior before eventually returning to the United States. For the purposes of simplicity, only inbound trips at each external gateway are discussed for the duration of this section.

This survey did not capture trucks that are external in the sense that they are registered outside of the Lower Mainland, but used for intra-regional trips. There are anecdotal suggestions that this may be increasing within the last 5 years, and this may be attributed to two factors: deregulation and transfers of transportation companies, or their fleets, to surrounding jurisdictions such as Alberta and Washington state. It is illegal to use vehicles registered outside the province for strictly local trips. Due to deregulation of motor carriers, these vehicles are less visible to enforcement agencies. This may warrant further study.

## Highway 15 (Pacific Border Crossing)

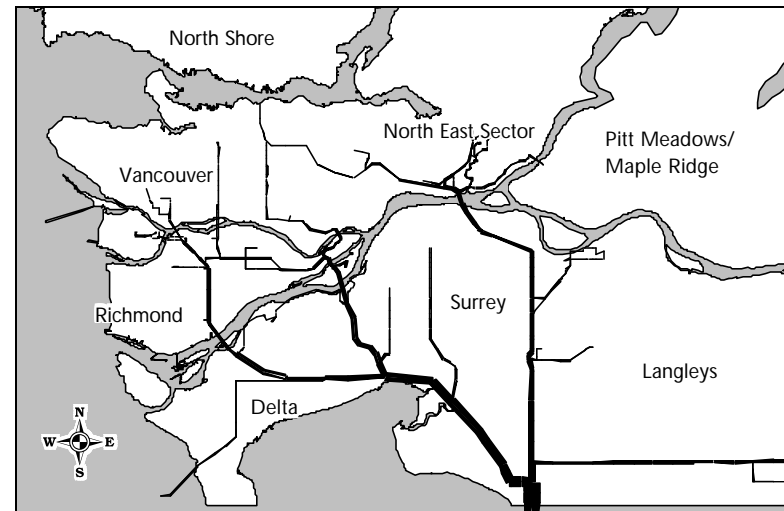
Highway 15 is the fourth busiest commercial border crossing in Canada. Each day, approximately 3,600 two-way truck trips pass through this gateway entering and/or exiting the Lower Mainland, or 1,800 in each direction. The origins and destinations of truck trips using the crossing are provided in **Exhibit 46**. The areas attracting the most trips from this gateway are Richmond, Burnaby/New West/NE Sector and North Delta/Surrey at 18%, 16% and 16% respectively. Through trips account for 14% of total trips, where the interior gateways capture 10% of through traffic and 4% is destined for the Vancouver/Gulf Islands.

**Exhibit 46 – Destinations of Trucks Entering the Lower Mainland Via Highway 15 (Pacific)**

Sub-Area	Destinations
<i>Burnaby / New Westminster / NE Sector</i>	18%
<i>Richmond</i>	16%
<i>North Delta / North Surrey</i>	16%
<i>South Delta</i>	11%
<i>Eastern Externals</i>	10%
<i>Vancouver</i>	7%
<i>The Langleys</i>	7%
<i>Fraser Valley South</i>	5%
<i>Vancouver / Gulf Islands</i>	4%
<i>Pitt Meadows / Maple Ridge</i>	3%
<i>White Rock / South Surrey</i>	2%
<i>North Shore</i>	1%
<i>Fraser Valley North</i>	0%
<i>Highway 99 North</i>	0%
<b>Total</b>	<b>100%</b>

Using the truck demand forecasting model, **Exhibit 47** illustrates the origins and destination of truck trips that use the Highway 15 (Pacific Highway) border crossing, and the routes that they can be expected to take between these points. **Exhibit 47** suggests that current truck trips from the NE Sector and parts of Burnaby and New Westminster would use the full route of Highway 15, and cross into the Burrard Peninsula via the Port Mann bridge. Truck trips originating or destined to Richmond would be expected to use Highway 99 and the George Massey tunnel.

**Exhibit 47 – Origins and Destinations of Trucks Trips that use Highway 15 Border Crossing (1999)**



Forecasts of truck trips through the Highway 15 Border Crossing for future years would incorporate regional land use plans, changes in the highway network and economic growth scenarios to portray the growth in truck travel demand that would be assigned to the network (see Chapter 4.3).

### Highway 13 (Aldergrove Border Crossing)

The destination of truck trips from the Highway 13 border crossing at Aldergrove show a very high bias to areas in the Fraser Valley, south of the Fraser River. Approximately 400 two-way truck trips pass through this gateway in one day, or 200 trucks in each direction. More than half of the trucks crossing northbound into Canada is destined to points in Langley City and Langley Township. A further 19% of trips are destined to Abbotsford and Chilliwack. Approximately 10% of the trips are destined to the Burrard Peninsula and a further 6% to Richmond. Through trips account for 2% of all trips, all of which are destined to the Eastern gateways at Highway 1 and 7. The origin and destination of trucks using the Aldergrove border crossing is provided in **Exhibit 48**.

**Exhibit 48 – Destinations of Trucks Entering the Lower Mainland Via Highway 13 (Aldergrove)**

Sub-Area	Destinations
<i>The Langleys</i>	56%
<i>Fraser Valley South</i>	20%
<i>Vancouver</i>	7%
<i>Richmond</i>	6%
<i>South Delta</i>	2%
<i>North Delta / North Surrey</i>	2%
<i>Eastern Externals</i>	2%
<i>White Rock / South Surrey</i>	2%
<i>Burnaby / New Westminster / NE Sector</i>	0%
<i>Vancouver / Gulf Islands</i>	0%
<i>Pitt Meadows / Maple Ridge</i>	0%
<i>North Shore</i>	0%
<i>Fraser Valley North</i>	0%
<i>Highway 99 North</i>	0%
<b>Total</b>	<b>100%</b>

### Highway 11 (Huntingdon Border Crossing)

Approximately 1,000 two-way trips pass through the Highway 11 border crossing daily, or 500 trucks in each direction. Of these, over half, or 52%, are destined to Abbotsford and Chilliwack. The other primary destinations include Mission and Pitt Meadows/Maple Ridge, which are served by the Highway 11 crossing of the Fraser River at Mission. Another characteristic of this gateway is the high number of through trips. The survey results indicate that 21% of the trucks passing this border crossing leave the Lower Mainland via its eastern gateways. Examples of the ultimate destinations of through trips include Kamloops, Williams Lake, Prince George, Edmonton and Anchorage. The destinations of truck trips using the Huntingdon border crossing are given in **Exhibit 49**.

**Exhibit 49 – Destinations of Trucks Entering the Lower Mainland Via Highway 11 (Huntingdon)**

Sub-Area	Destinations
<i>Fraser Valley South</i>	52%
<i>Eastern Externals</i>	21%
<i>Fraser Valley North</i>	15%
<i>Pitt Meadows / Maple Ridge</i>	12%
<i>Burnaby / New Westminster / NE Sector</i>	0%
<i>Richmond</i>	0%
<i>North Delta / North Surrey</i>	0%
<i>South Delta</i>	0%
<i>Vancouver</i>	0%
<i>The Langleys</i>	0%
<i>Vancouver / Gulf Islands</i>	0%
<i>White Rock / South Surrey</i>	0%
<i>North Shore</i>	0%
<i>Highway 99 North</i>	0%
<b>Total</b>	<b>100%</b>

## Highway 1

Located at the eastern end of the region, approximately 3,100 two-way truck trips pass through the Highway 1 gateway into the region. Most of these trips originated in the British Columbia Interior or Alberta. The primary destinations are provided in **Exhibit 50**. Nearly 50% of these truck trips are destined for south of the Fraser River, with emphasis on Surrey, Delta, and Abbotsford/Chilliwack. Approximately 18% of these trucks are destined for the Burnaby/New Westminister/NE Sector sub-area. A large portion of trips that enter the Lower Mainland through this gateway have a destination outside the Lower Mainland. These include 12% of trips destined to the United States and 2% to the Vancouver / Gulf islands. Other destinations receive less than 10% of trucks that enter the Lower Mainland at this gateway.

**Exhibit 50 – Destinations of External Trucks Entering the Lower Mainland Via Highway 1**

Sub-Area	Destinations
<i>North Delta / North Surrey</i>	20%
<i>Burnaby / New Westminister / NE Sector</i>	18%
<i>Fraser Valley South</i>	13%
<i>United States</i>	12%
<i>South Delta</i>	10%
<i>Vancouver</i>	7%
<i>Richmond</i>	7%
<i>The Langleys</i>	5%
<i>North Shore</i>	2%
<i>Fraser Valley North</i>	2%
<i>Vancouver / Gulf Islands</i>	2%
<i>Pitt Meadows / Maple Ridge</i>	2%
<i>White Rock / South Surrey</i>	1%
<i>Highway 99 North</i>	0%
<b>Total</b>	<b>100%</b>

## Highway 7

This gateway is located north of the Fraser River at the eastern end of the study area. Approximately 1,100 truck trips pass through this gateway daily, or approximately 500-550 in each direction. The primary destinations of truck trips entering the region represent two-thirds of the truck traffic from this gateway, and are North Delta/Surrey, Burnaby/New West/NE Sector, Fraser Valley South and South Delta. The distribution of destinations is provided in **Exhibit 51**. The remaining 30% are distributed throughout every sub-area within the region, but primarily consists of Vancouver, Richmond and The Langleys. Through trips represent 3% of the total traffic, all of which are destined for the United States.

**Exhibit 51 – Destinations of External Trucks Entering Lower Mainland Via Highway 7**

Sub-Area	Destinations
<i>North Delta / North Surrey</i>	22%
<i>Burnaby / New Westminister / NE Sector</i>	20%
<i>Fraser Valley South</i>	15%
<i>South Delta</i>	11%
<i>Vancouver</i>	8%
<i>Richmond</i>	8%
<i>The Langleys</i>	5%
<i>United States</i>	3%
<i>North Shore</i>	3%
<i>Fraser Valley North</i>	3%
<i>Pitt Meadows / Maple Ridge</i>	2%
<i>White Rock / South Surrey</i>	1%
<i>Highway 99 North</i>	0%
<i>Vancouver / Gulf Islands</i>	0%
<b>Total</b>	<b>100%</b>

### Highway 99 North (Squamish/Whistler)

The Highway 99 corridor serves the interior of British Columbia as well as Squamish, Whistler and Lilloet. Each day, approximately 600 two-way truck trips pass through this gateway, or 300 in each direction. The majority of truck trips entering the region from this gateway are destined to the North Shore (27%) and Burrard Peninsula (38%). Other destinations attracting more than 10% of the trucks are Vancouver, South Delta and North Delta/Surrey. The destinations of truck trips entering the Lower Mainland via Highway 99 North are given in **Exhibit 52**.

**Exhibit 52 – Destinations of Trucks Entering the Lower Mainland Via Highway 99 North**

Sub-Area	Destinations
North Shore	27%
Burnaby / New Westminster / NE Sector	25%
South Delta	13%
Vancouver	12%
North Delta / North Surrey	10%
Richmond	5%
The Langleys	4%
United States	3%
Fraser Valley South	1%
Pitt Meadows / Maple Ridge	0%
Eastern Externals	0%
Vancouver / Gulf Islands	0%
White Rock / South Surrey	0%
Fraser Valley North	0%
<b>Total</b>	<b>100%</b>

### Tsawwassen Ferry Terminal

Each day, 600 two-way truck trips pass through this gateway, or 300 truck trips in each direction. Truck traffic from Tsawwassen is destined roughly equally to North Delta/Surrey, Burnaby/New West/NE Sector, and Richmond (approximately 15% each). As shown in **Exhibit 53**, a further 10% of trips are destined to South Delta and 6% to The Langleys and Vancouver. Tsawwassen has the highest percentage of through trips of any external gateway at 23%. External truck trips from the Tsawwassen Ferry Terminal are primarily destined for the United States (19%) with another 4% destined to the eastern gateways.

**Exhibit 53 – Destinations of Trucks Entering the Lower Mainland Via Tsawwassen Terminal**

Sub-Area	Destinations
United States	19%
Burnaby / New Westminster / NE Sector	15%
Richmond	14%
North Delta / North Surrey	13%
South Delta	10%
The Langleys	6%
Vancouver	6%
Fraser Valley South	4%
Highway 99 North	4%
Eastern Externals	4%
Pitt Meadows / Maple Ridge	2%
White Rock / South Surrey	1%
North Shore	1%
Fraser Valley North	0%
<b>Total</b>	<b>100%</b>



## Through Trips

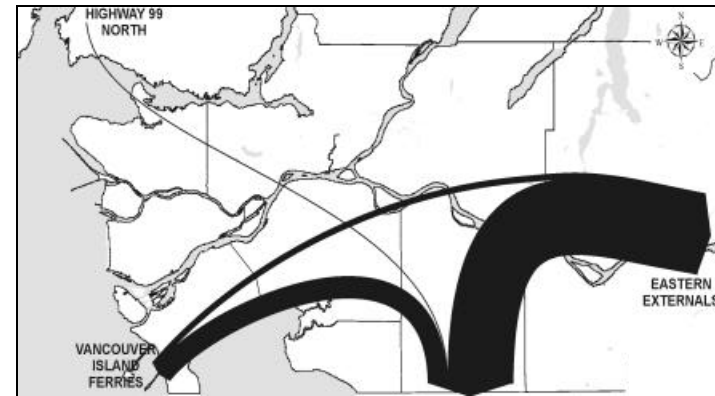
Through trips are trips that enter the region at one gateway and leave the region at another gateway on the same trip. They are a subset of external trips because the trip origins and destinations are outside the region. Of the 9,900 total external truck trips, 670 trips, or 6.8%, are through trips. The break down by light and heavy trucks is shown in **Exhibit 54**. The majority of through trips (89%) are made using heavy trucks.

**Exhibit 54 – Through Trips**

Truck Type	External	Through	Percent
<i>Light</i>	2,200	75	3.4%
<i>Heavy</i>	7,700	596	7.7%
<i>Total</i>	9,900	671	6.8%

**Exhibit 55** shows the origin destination patterns of the through trips. The most pronounced demand line for through trips is between the United States border and the British Columbia Interior / rest of Canada, accounting for 72% of all through trips. Trucks trips from the US border to the Tsawwassen Ferry Terminal is the second most popular demand line at 21%. Six percent of all through trips are between the Vancouver/Gulf Islands and the British Columbia Interior gateways. Approximately 1% of through trips was between Highway 99 north and the US border. Through trips were not observed between Highway 99 North to the British Columbia interior, or from Highway 99 North to the Vancouver/Gulf Islands.

**Exhibit 55 – Through Trip Origin Destination Patterns**



## 2.5 SUMMARY

This chapter provided a snapshot of truck demand by two truck types (light and heavy) and 3 trips types (internal, special generator and external). On a typical day in November 1999, there was demand for approximately 187,000 truck trips, of which 68% were made using light trucks and 62% using heavy trucks. The average trip length for light and heavy trucks is 8.5 and 15.8 kilometres, respectively. The peak period for truck activity is during the mid-day in between commuter peak periods.

Internal truck trips constituted 91% of all trucks trips, where the largest quantity of trips was generated by the Vancouver sub-area. Vancouver generated 30% of all light truck trips in the Lower Mainland. A high percentage of truck trips generated in South Delta were made using heavy trucks. Special generators and external gateways contributed approximately 4% and 5% of all Lower Mainland truck trips, respectively.



### 3 VEHICLE VOLUME AND CLASSIFICATION SURVEY

Chapter 2 presented the results of the Regional Truck Activity Surveys, and showed the demand lines for truck trips between sub-areas within the Lower Mainland. This understanding of truck demand was supplemented with an extensive vehicle volume and classification survey. The objective of this survey was to collect 24 hour vehicle count and classification information throughout the region. This element of the Lower Mainland Truck Freight Study:

- Completes the 'snapshot' of truck activity on a typical day in autumn 1999;
- Establishes a reference point for comparison to historic counts, and to support monitoring truck movements in the future;
- Presents insight into route selection and identification of major truck routes; and
- Provides a basis for calibration and validation of the truck demand forecasting model. In other words, this data provides the vital link between the estimated (model) and observed truck traffic.

Total vehicle volume was counted at 266 locations in the Lower Mainland. Total vehicles were divided into 10 classifications including light and heavy trucks at 75 of these locations.

**Exhibit 56** shows the count stations (locations) where vehicles were counted. Note that many of the stations follow physical barriers (rivers), municipal boundaries and/or major roads. These artificial boundaries are called screenlines, and the object is to count all movements crossing the screenline

such that the quantity of trips from these sub-areas can be monitored. This survey built on the screenlines initially established in 1985, and now includes screenlines that capture some intra-municipal travel as well as special trucking movements throughout the region.

The purpose of this section is to highlight some of the results of the vehicle volume and classification survey, with specific emphasis on truck movements.

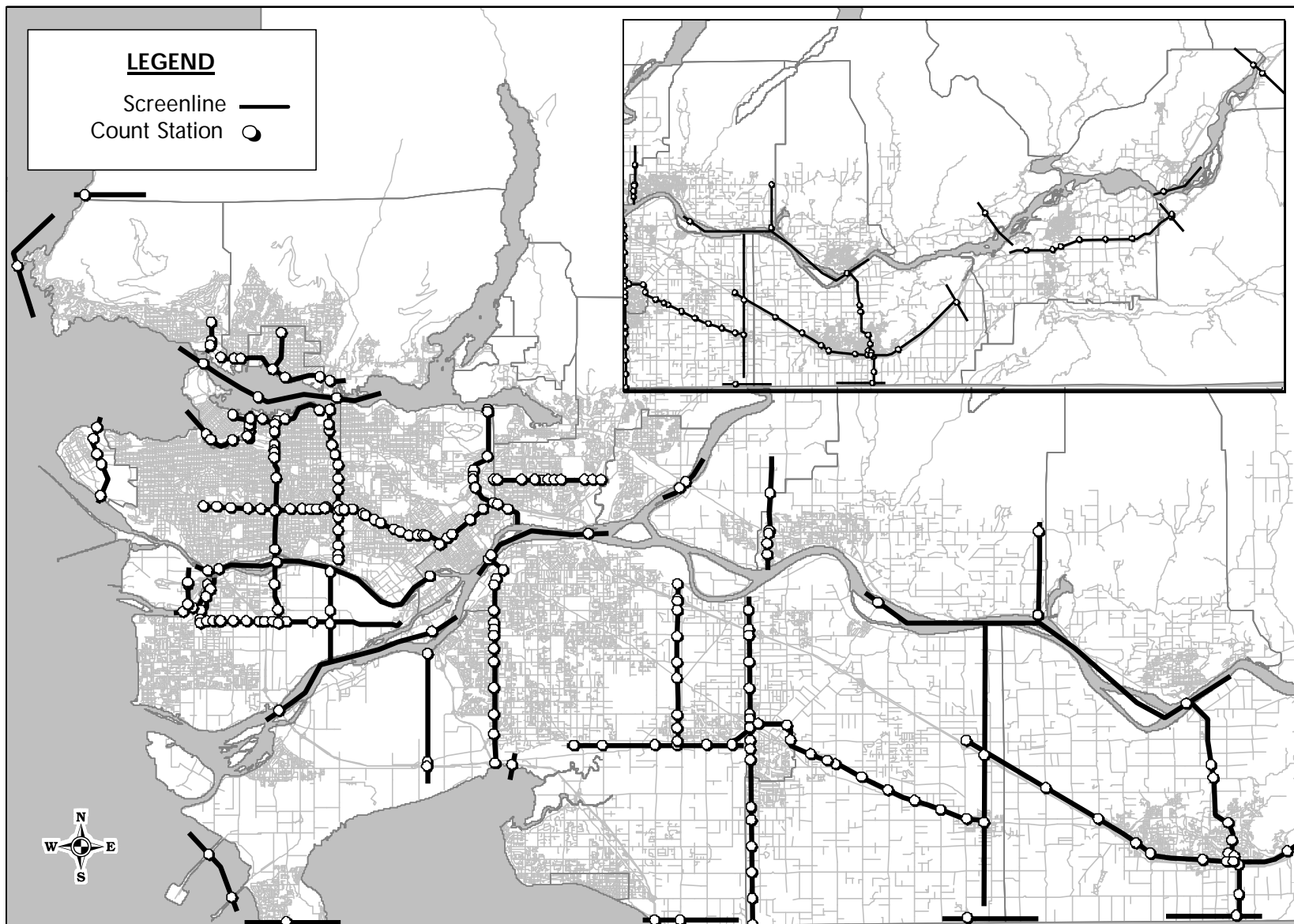
#### Daily Variation in Traffic Counts

It is important to note that the traffic data provided in the following section represents an average value for a typical autumn weekday in 1999. The purpose of the averaging was to smooth out the day to day variation in vehicle traffic.

In order to assess the range of day to day variation, the Ministry of Transportation and Highways (MoTH) conducted an analysis of weekday traffic at a number of stations that are equipped with permanent automatic counters. These count stations collect information about traffic movements and classification information continuously throughout the year. This enables MoTH to provide important information regarding annual, seasonal, monthly, daily and hourly variations at these count stations.

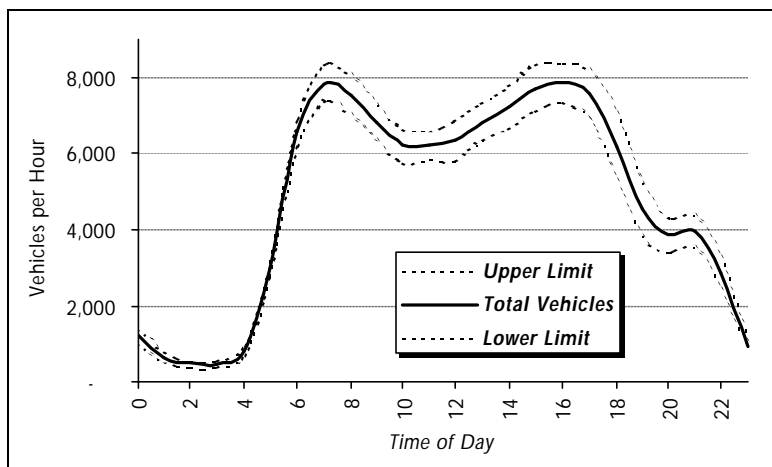
Analysis of this data revealed that it is reasonable to expect total 24 hour volume on any weekday day to vary from the average by up to 10%. Light and heavy truck volume can vary by as much as 20%.

Exhibit 56 – Screenline Locations



An example of day to day variation in traffic volume is provided in **Exhibit 57**. This exhibit shows the representative hourly variation in combined two-way traffic volumes at the Port Mann Bridge on the Trans Canada Highway for the fall of 1999.

**Exhibit 57 – Variation in Fall Weekday Total Two-Way Traffic on the Port Mann Bridge**



**Exhibit 57** shows that total vehicle volume can be expected to vary by up to approximately 600 vehicles during the peak period of the day. This represents up to 10% of the total two-way volume and is typical of many of the major locations throughout the Lower Mainland. In order to dampen day to day variation in the values provided, all total vehicle volumes presented are the average of a minimum of three days. The truck volumes presented range from one-day counts to monthly averages (as collected by MoTH permanent count stations).

### 3.1 VEHICLE MOVEMENTS AT MAJOR REGIONAL SCREENLINES

Total vehicle volume over a 24 hour period at representative screenlines throughout the region is presented in **Exhibit 58**. The percentage growth of overall traffic volumes relative to the screenline survey conducted in 1996, as well as a summary of total light and heavy truck traffic as a percentage of total 24 hour traffic volume are also shown.

**Exhibit 58 – 24 Hour Total Vehicle Volumes**

Location	1985 Vehicle Volume	1996 Vehicle Volume	1999 Vehicle Volume	Change from '96 to '99	1999 Percent Trucks
Vancouver CBD	424,800	420,200	430,700	4%	2%
North Arm	247,200	339,100	366,900	8%	5%
Burrard Inlet	154,900	186,700	191,900	3%	3%
Boundary Road	335,700	397,100	458,800	16%	3%
North Road	226,200	293,600	350,200	19%	6%
South/Main Arm	226,000	369,700	386,700	5%	7%
Pitt River	26,700	63,900	66,700	4%	6%
200th Street	n.a.	232,500	243,900	5%	7%
Eastern Gateways	n.a.	14,700	13,800	-6%	25%
Highway 99 North	6,400	10,600	11,200	6%	8%
U.S. Truck Crossings	18,500	28,000	22,200	-20%	26%

\* estimate based upon major truck routes through screenlines

Annual growth rates for the 24 hour and AM and PM peak hours are presented graphically in **Exhibits 59** and **60**. Furthermore, **Exhibits 61** and **62** provide truck volume as a percentage of total 24 hour traffic volume at each major regional screenline. Through the use of a stacked bar chart, the split between light and heavy trucks is also displayed. A detailed discussion of each screenline is provided following these exhibits.

Exhibit 59 – Annual Growth in Total Traffic (1985-1996 & 1996-1999)

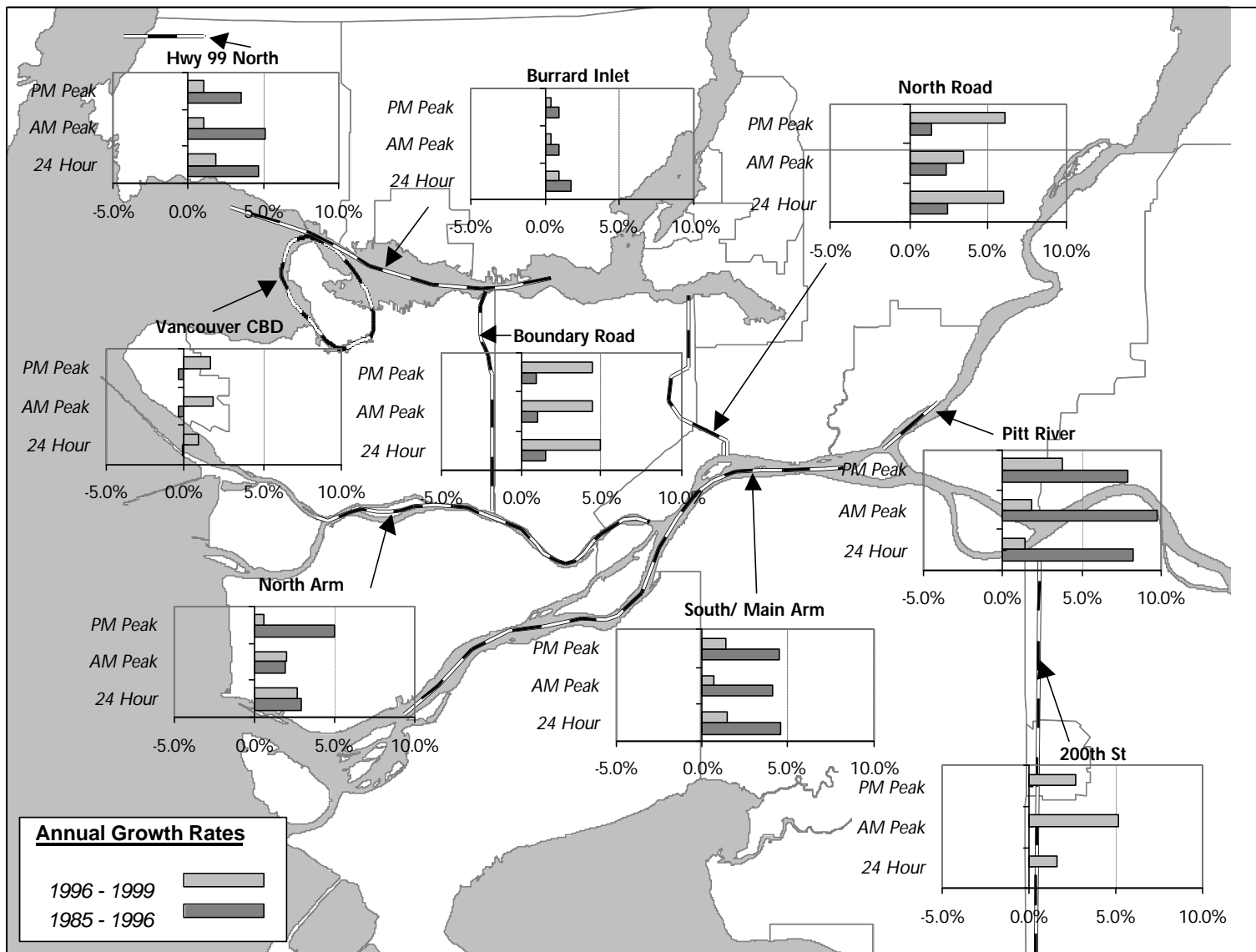


Exhibit 60 – Annual Growth in Total Traffic (1985-1996 & 1996-1999)

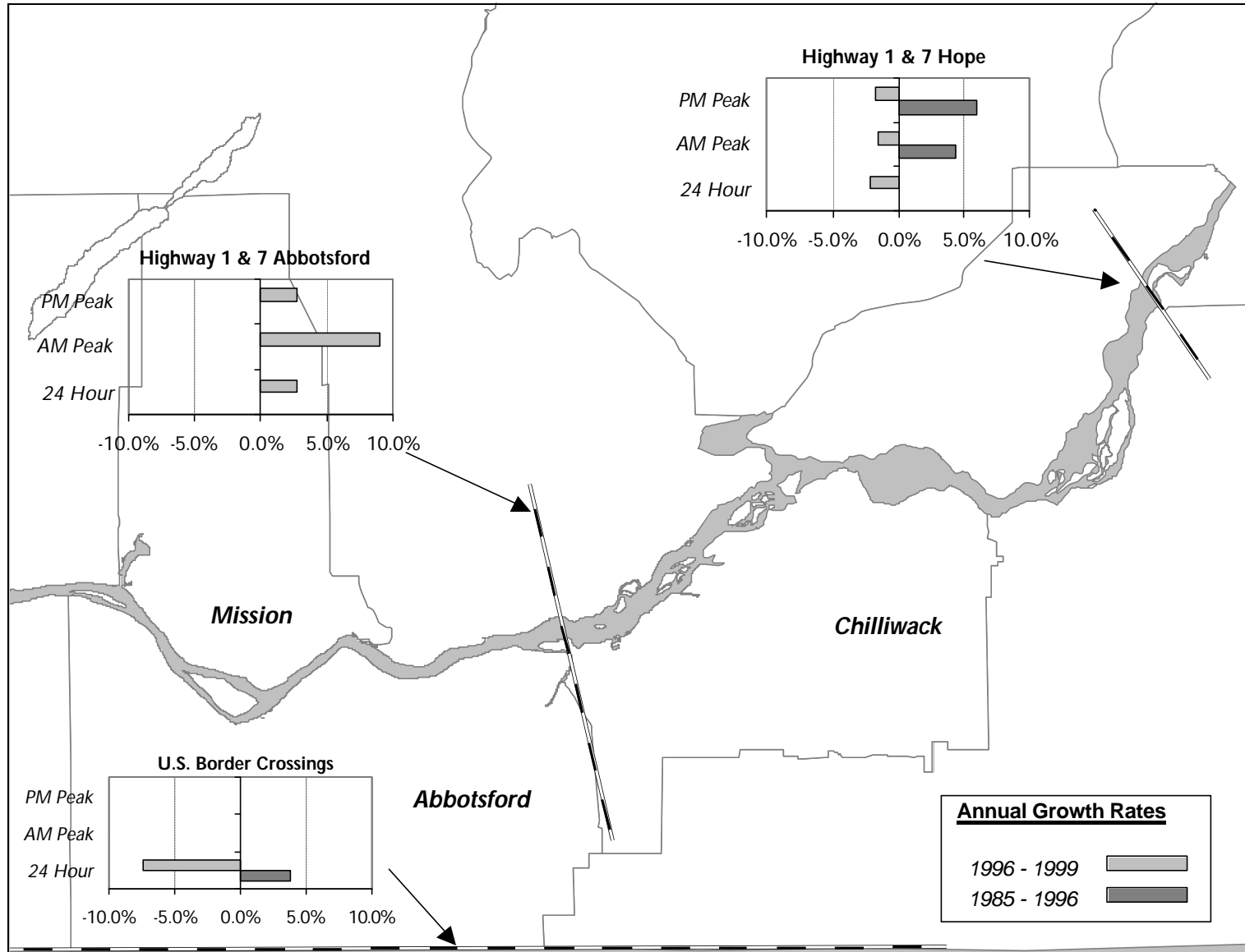
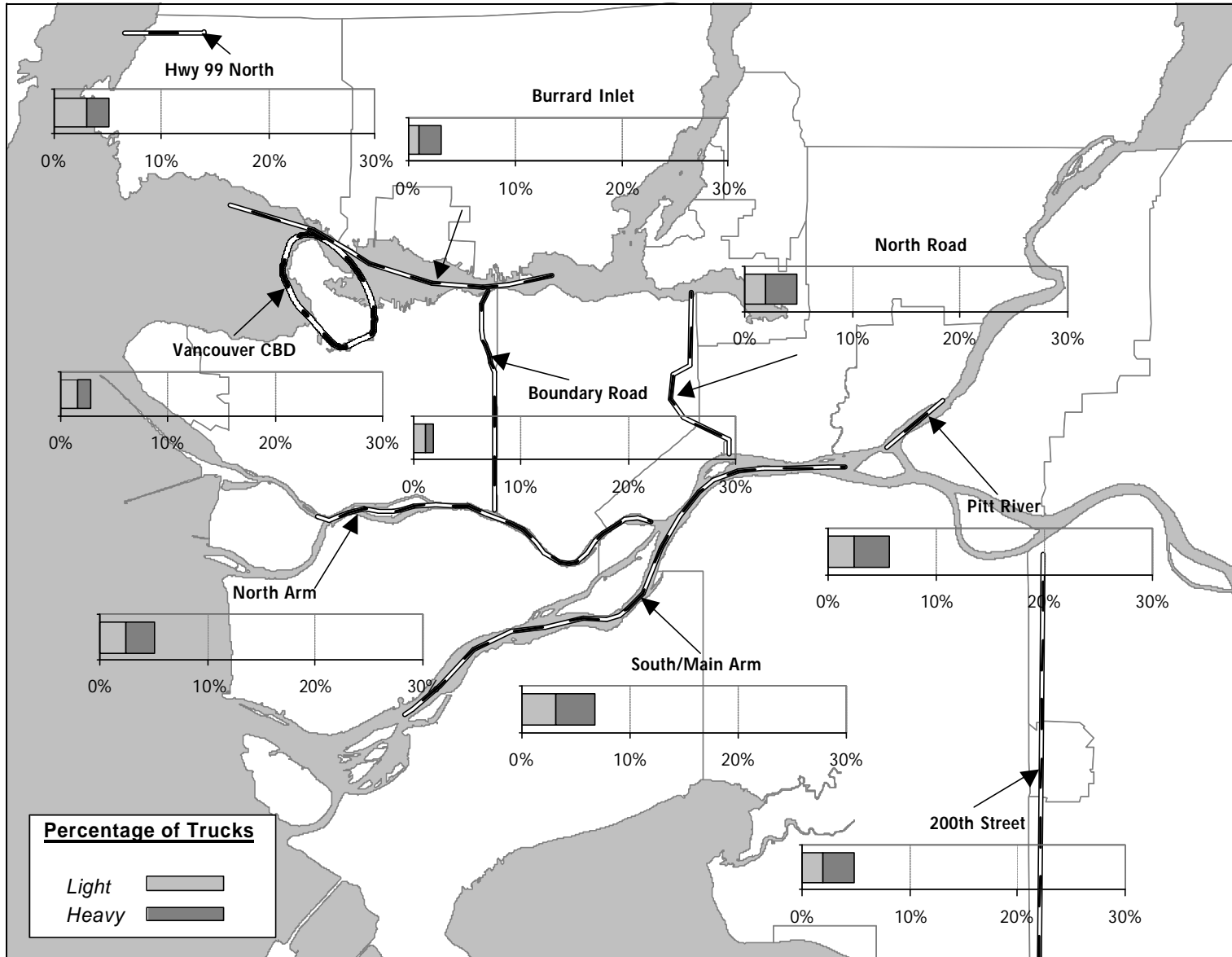
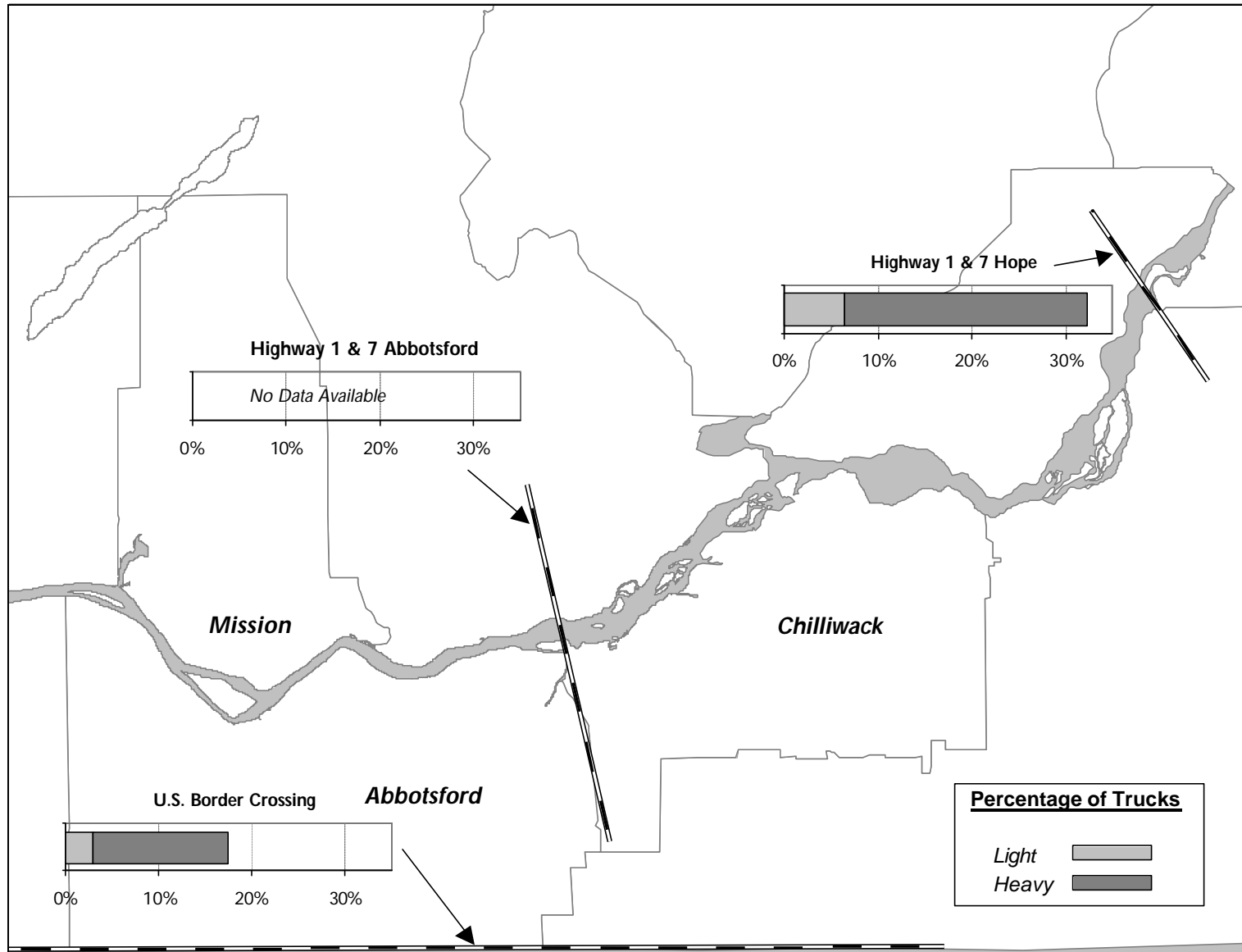


Exhibit 61 – Light and Heavy Trucks as a Percentage of Total Traffic (Cumulative)





**Exhibit 62 – Light and Heavy Trucks as a Percentage of Total Traffic (Cumulative)**



### 3.2 SCREENLINE SUMMARIES

The following sub-sections describe each screenline and their associated properties. Each section provides a 24 hour bi-directional traffic profile for major facilities where vehicles were classified.

The traffic phenomenon of “peak spreading” is mentioned during the discussion in this section. Peak spreading refers to the horizontal expansion of the peak period into other parts of the day. An example of peak spreading is noted during the PM peak period in **Exhibit 63**. It is evident that the traffic demand remains higher into the later PM peak hours in 1999 than 1985.

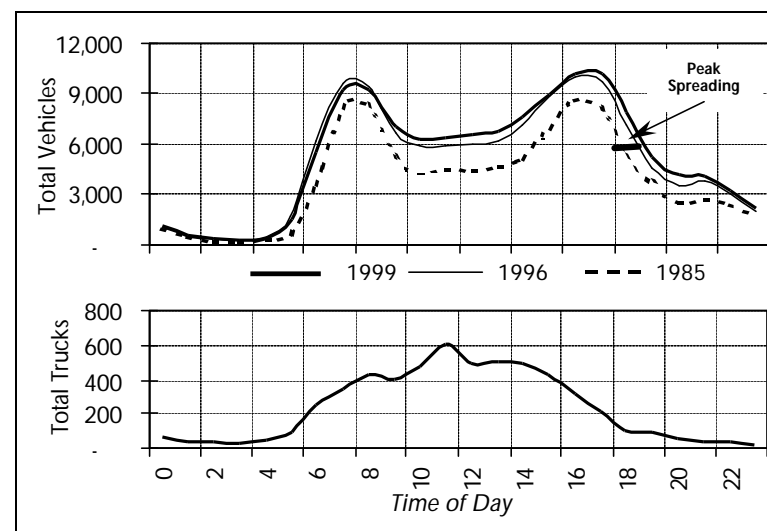
#### Burrard Inlet Screenline

The Burrard Inlet Screenline separates the North Shore from the Burrard Peninsula and is comprised of two bridges: the Lion’s Gate and the Second Narrows. Of these, heavy trucks are only permitted on the Second Narrows Bridge, thereby creating a unique access constraint for heavy trucks destined to the CBD. This screenline exhibited modest annual growth of roughly 2% over a 24 hour period between 1985 and 1996. Between 1996 and 1999, traffic volume grew by less than 1% per annum. As shown in **Exhibit 61**, truck traffic represents 3% of total daily traffic across this screenline. Light and heavy trucks constitute 34% and 66% of this truck demand, respectively. Total 24 hour traffic on Lion’s Gate Bridge has increased by a total of roughly 4% since 1985, or less than 1% per year. Traffic volume on Lion’s Gate Bridge decreased by 3% between 1996 and 1999.

**Exhibit 63** displays the daily profile for total traffic and truck traffic for the Second Narrows Bridge. As stated above this crossing is the only major connection to the North Shore for heavy trucks, and is the primary crossing for light trucks. As

noted, this facility has experienced peak spreading. The Second Narrows Bridge carries approximately 5,500 truck trips per day, or 4.5% of total traffic. The daily profile for trucks is typical, with a single peak dominant in the mid-day.

**Exhibit 63 – Daily Traffic Profile of Second Narrows Bridge**  
(24 Hour Bi-Directional Traffic Profile)



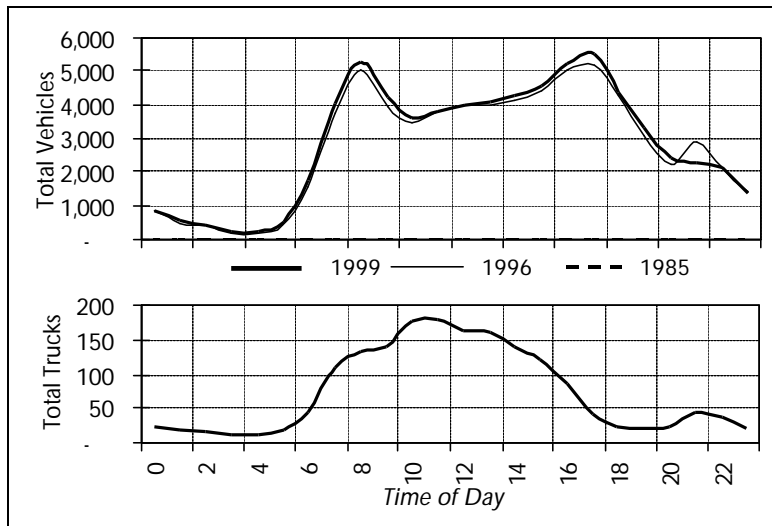
#### Vancouver CBD Cordon

Between 1985 to 1996 the Vancouver CBD Cordon experienced virtually no growth. This may be due to the introduction of Skytrain in 1986. Between 1996 and 1999, total traffic volume grew at a rate of just under 1% annually. The Vancouver CBD Cordon is one of the only major regional screenlines where the growth in peak hour traffic volumes exceeded the 24 hour growth. The Vancouver CBD Cordon also has the lowest percentage of truck traffic of all major regional screenlines at 2%. Of this, 53% were light trucks and 47% heavy trucks.

The daily traffic profile for Cambie Street Bridge, one of four bridges in the CBD Cordon is shown in **Exhibit 64**. A profile of 1985 traffic is not available. The Cambie Street Bridge carries approximately 1,500 two-way truck trips per day. This constitutes slightly more than 2% of total traffic volume.

It can be seen from **Exhibit 64** that there are two distinct peaks in the total traffic that will coincide with the commuter traffic flow into the downtown. Sports and special events often create a third peak around ten or eleven in the evening when they are typically over. These peaks were not included in the 1999 data, and therefore not portrayed in the average traffic profile shown below.

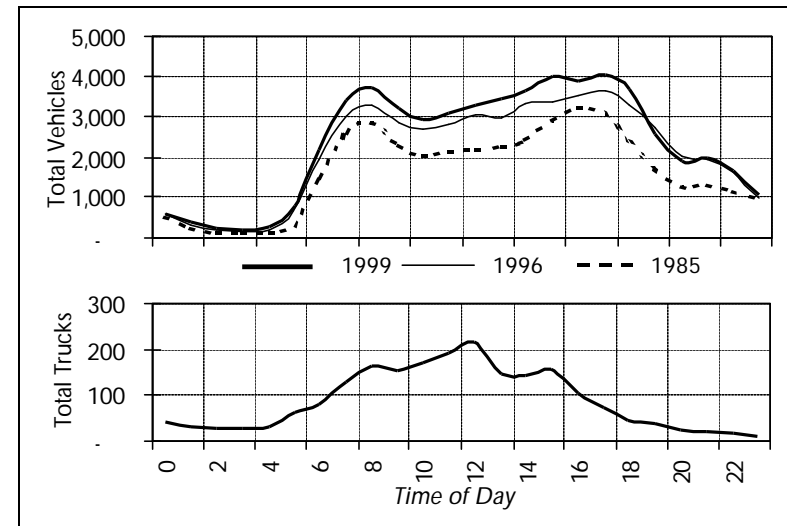
**Exhibit 64 – Daily Traffic Profile of Cambie Bridge**  
(24 Hour Bi-Directional Traffic Profile)



### Boundary Road Screenline

The Boundary Road screenline separates the municipalities of Vancouver and Burnaby and captures major east-west flows across the Burrard Peninsula. From 1985 to 1996, the growth of vehicular traffic across this screenline was roughly 2% per annum. From 1996 to 1999 however, this screenline experienced the highest growth of any of the major regional screenlines at 5% per annum. PM peak hour volumes have grown by 5% per annum while the AM peak hour has grown by 4%. As shown in **Exhibit 61**, truck traffic represents 3% of total daily traffic across this screenline. 60% of this traffic are light trucks and 40% are heavy trucks. The daily traffic profile for Grandview Highway is shown in **Exhibit 65**. Grandview Highway carries approximately 2,100 two-way trucks per day. This is close to 4% of total traffic.

**Exhibit 65 – Daily Traffic Profile of Grandview Highway**  
(24 Hour Bi-Directional Traffic Profile)

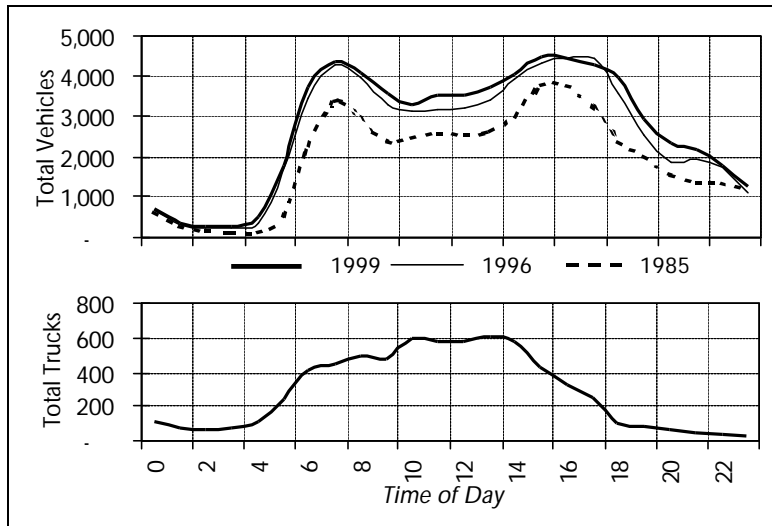


### North Road Screenline

This screenline runs from the Fraser River in the south to the Burrard Inlet in the north, separating the N.E. Sector communities of Coquitlam, Port Coquitlam and Port Moody from the rest of the Burrard Peninsula. The North Road screenline grew by approximately 2% from 1985 to 1996. However, this growth appears to have accelerated considerably from 1996 to 1999 to approximately 6% annually. As shown in **Exhibit 61** trucks represent 6% of total daily traffic across this screenline. Of this traffic, 39% are light truck and 61% are heavy trucks. The daily traffic profile for Brunette Avenue south of Highway 1 is provided in **Exhibit 66**. Approximately 6,800 two-way truck trips, or 10% of total traffic use this section of Brunette Avenue daily 70% of which are heavy trucks.

**Exhibit 66 – Daily Traffic Profile of Brunette Avenue South of Highway 1**

*(24 Hour Bi-Directional Traffic Profile)*



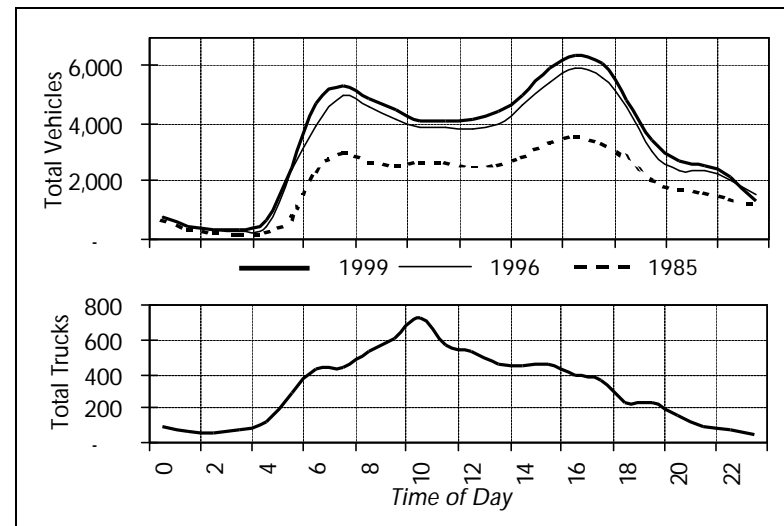
### 200th Street Screenline

This screenline captures major east and west traffic flow south of the Fraser River. Between 1996 and 1999, this screenline exhibited daily growth of just under 2% per annum and AM and PM peak hour growth of 5% and 3% per annum respectively. As shown in **Exhibit 62** truck traffic represents 7% of total daily traffic across this screenline. 39% of this traffic is light trucks and 61% is heavy trucks.

**Exhibit 67** displays the daily profile for Highway 1 west of 200th Street. This section of Highway 1 has experienced relatively even growth throughout the entire day. At this location Highway 1 carries approximately 7,500 two-way truck trips per day constituting over 9% of all traffic. The 24 hour truck profile is similar to a typical daily truck profile.

**Exhibit 67 – Daily Traffic Profile of Highway 1 West of 200th Street**

*(24 Hour Bi-Directional Traffic Profile)*



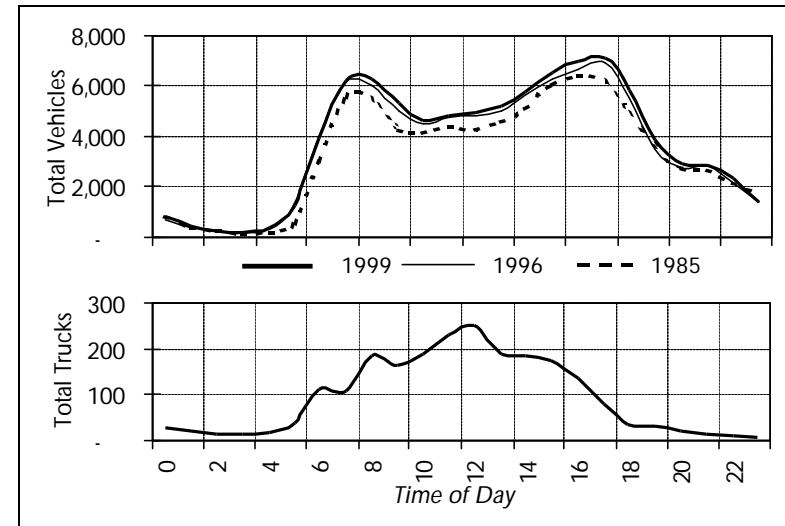
### North Arm Fraser River Screenline

The North Arm Screenline follows the North Arm of the Fraser River and separates Vancouver and Burnaby /New Westminster from Richmond. This screenline is comprised of the following bridges: Arthur Laing, Oak, Knight and Queensborough. From 1985 to 1996 this screenline experienced the highest peak hour growth of all major regional screenlines and one of the highest 24 hour growths. As shown in **Exhibit 59**, per annum growth from 1996 to 1999 has slowed, especially in the PM peak hour. Between 1996 and 1999, 24 hour growth was 3% per annum while the rate of AM and PM peak hour growth was 2% and 1% respectively. As shown in **Exhibit 61** truck traffic represents 5% of total daily traffic across this screenline. 48% of this traffic is light trucks and 52% is heavy trucks.

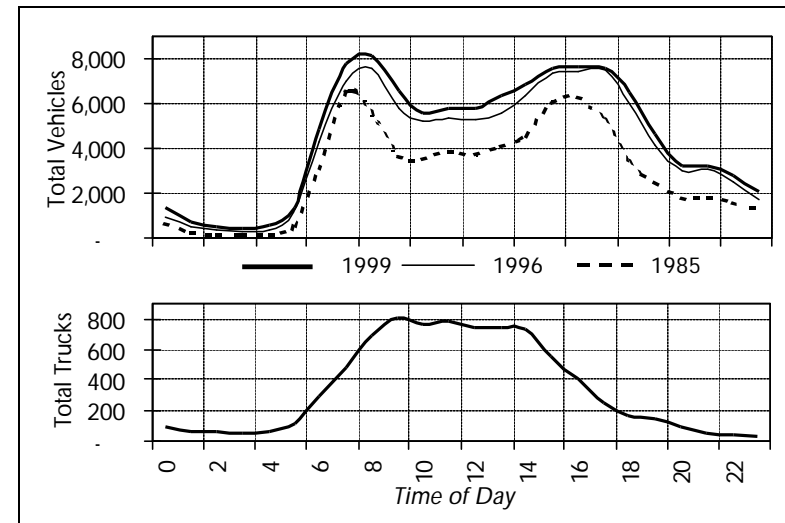
**Exhibits 68** and **Exhibit 69** display daily profiles for two major river crossings on the North Arm screenline; the Oak Street and the Knight Street Bridges. The 24 hour profile for the Oak Street Bridge has remained relatively stable since 1985, with traffic growth offsetting the traffic that was diverted upon the opening of the Alex Fraser Bridge in 1986. The Knight Street Bridge experienced considerable growth in traffic after the addition of the Alex Fraser Bridge and experienced moderate growth from 1996 to 1999. The peak periods at both bridges appear to be experiencing slight peak spreading, with a slightly larger affect at Knight Street.

The smaller amount of growth on the Oak Street Bridge may be due to the heavy constraint from the signal on the main approach near the north end, whereas the Knight Street Bridge allows for slightly more growth with access from both Marine Drive and Knight Street. The Oak Street Bridge carries approximately 2,300 two-way truck trips per day or 3% of traffic. Approximately 8,600 trucks use the Knight Street Bridge daily constituting close to 8% of all traffic.

**Exhibit 68 – Daily Traffic Profile of Oak Street Bridge  
(24 Hour Bi-Directional Traffic Profile)**



**Exhibit 69 – Daily Traffic Profile of Knight Street Bridge  
(24 Hour Bi-Directional Traffic Profile)**



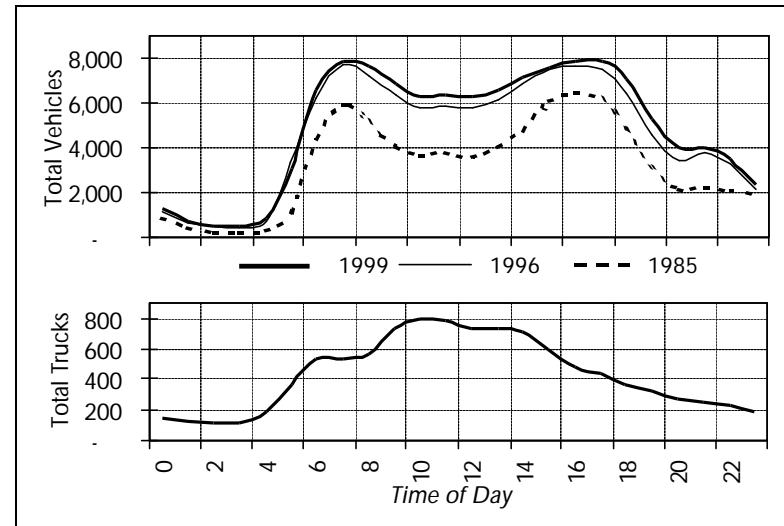
### South/Main Arm Fraser River Screenline

The South/Main Arm Screenline follows the Fraser River and separates Delta, Surrey, Langley and the southern Fraser Valley from the Burrard Peninsula. This screenline includes the George Massey Tunnel as well as the Alex Fraser, Pattullo and Port Mann Bridges - four of the region's most critical river crossings. The South/Main Arm Screenline showed the highest 24 hour per annum growth and the second highest peak period growth from 1985 to 1996 of all major regional screenlines. However, this growth appears to have slowed considerably from 1996 to 1999. During this period, traffic volume across the screenline grew by less roughly 1% in all cases. 24 hour growth from 1996 to 1999 was higher than peak hour growth suggesting that growth in peak hour volumes may be constrained by roadway capacity. The likely consequence of this condition is peak spreading as can be observed in the daily profiles at the Port Mann Bridge. As shown in **Exhibit 61**, truck traffic represents 6.8% of total daily traffic across this screenline. 47% of this traffic are light trucks and 53% are heavy trucks.

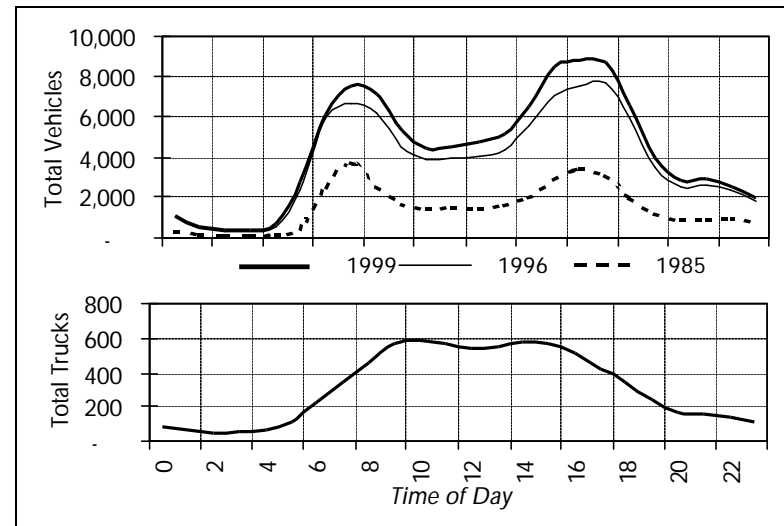
There are three main facilities that cross the South/ Main Arm of the Fraser River; the Port Mann Bridge, the Alex Fraser Bridge, and the George Massey Tunnel. The total traffic and truck profiles for these three facilities are displayed in **Exhibits 70-72**.

At the Port Mann Bridge, the AM peak appears to be extending to the late morning. Approximately 10,700 trucks travel over the Port Mann Bridge daily, representing over 9% of the total traffic. Close to 8,600 trucks use the Alex Fraser Bridge on a typical weekday. This constitutes over 7% of total traffic. The profile for the George Massey Tunnel has remained stable since 1996, which is similar to the Oak Street Bridge to the north. The tunnel carries approximately 4,700 trucks per day, or 6% of total traffic volume.

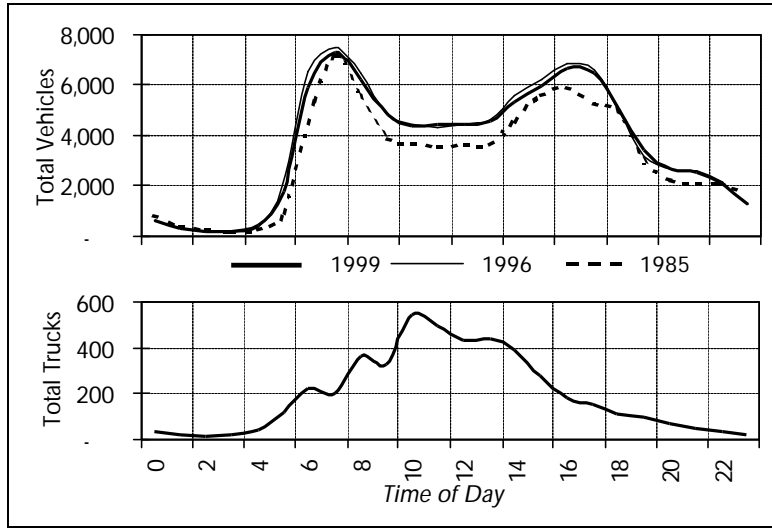
**Exhibit 70 – Daily Traffic Profile of Port Mann Bridge  
(24 Hour Bi-Directional Traffic Profile)**



**Exhibit 71 – Daily Traffic Profile of Alex Fraser Bridge  
(24 Hour Bi-Directional Traffic Profile)**



**Exhibit 72 – Daily Traffic Profile of George Massey Tunnel  
(24 Hour Bi-Directional Traffic Profile)**



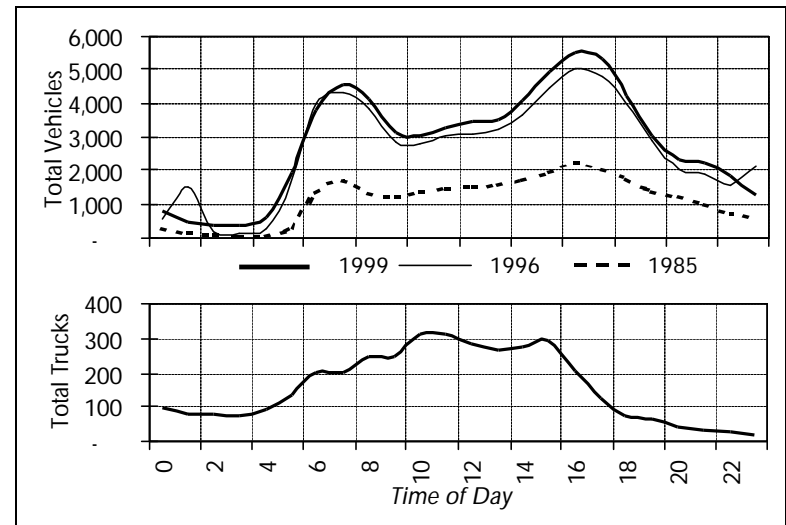
**Highway 99 North Screenline**

This screenline serves as an external gateway. It is located at the north-west end of the region, where the Sea-to-Sky Highway enters the study area. Per annum growth from 1985 to 1996 on a typical weekday was consistent across all time periods at approximately 5%. Between 1996 and 1999, growth slowed to less than half that, ranging from 1% per annum in the peak hours to 2% during the 24 hour period. Approximately 900 trucks use this gateway daily representing 5% of total traffic. 60% are light trucks and 40% are heavy trucks.

**Pitt River Bridge Screenline**

The Pitt River Bridge is the primary gateway into the rest of the Lower Mainland for the Pitt Meadows/Maple Ridge sub-area. Alternatives to the Pitt River Bridge are the Mission Bridge and the Albion Ferry. Traffic volume on this bridge grew by 140% between 1985 and 1996, or 8% per year. The bridge was converted from two lanes in each direction to counterflow operation of 3 lanes in the peak direction and 1 lane in the off-peak direction in October, 1997. Between 1996 and 1999 total volume on Pitt River Bridge grew by 4%. Trucks constitute approximately 6% of total volume crossing this bridge. The daily profile of traffic using Pitt River Bridge is provided in **Exhibit 73**.

**Exhibit 73 – Daily Traffic Profile of Pitt River Bridge  
(24 Hour Bi-Directional Traffic Profile)**



### U.S. Truck Crossings Screenline

This screenline represents all the US border crossings in the study area that carry significant volumes of truck traffic, namely:

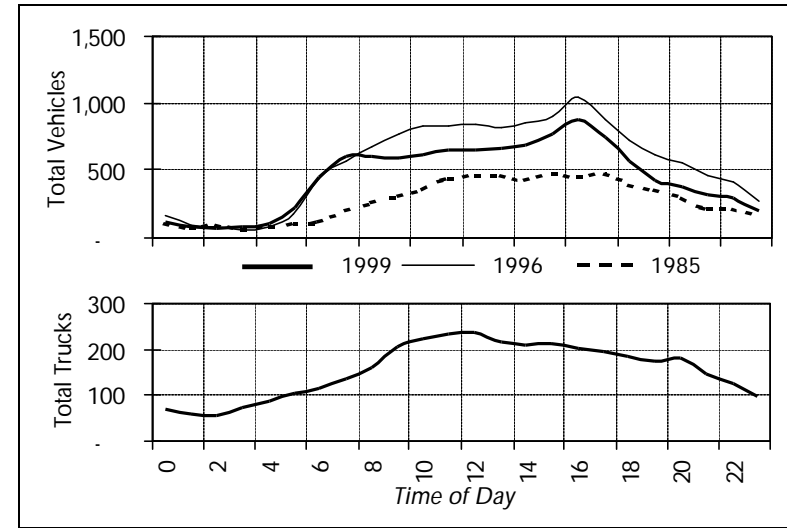
- Highway 15 (Pacific Border Crossing);
- Highway 13 (Aldergrove Border Crossing); and
- Highway 11 (Huntingdon Border Crossing).

Trucks were not surveyed at Highway 99 (Peace Arch Border Crossing) because they are not permitted, and at the Point Roberts Border Crossing because they are not significant.

During the period 1985 to 1996, daily and PM peak hour total traffic volumes across this screenline grew by approximately 4% per year. From 1996 to 1999, daily traffic growth actually decreased by 7% per year. This may be due in part by the low value of the Canadian dollar relative to the United States dollar. It is important to note that this decrease can be attributed to passenger vehicles. The number of truck movements through this screenline, especially at the Highway 15 border crossing, has been increasing dramatically. For example, over 1.2 million trucks traversed the border in 1999. This represents an increase in total truck volume at these three crossings of 92% between 1991 and 1999, or 9% per year. At this screenline, trucks represent 26% of all traffic of which 16% are light trucks and 84% are heavy trucks.

Annual truck traffic at the Highway 15 Border Crossing increased by 106% between 1991 and 1998, or 11% per year. The 24 hour traffic profile is displayed for the Pacific Highway Border crossing in **Exhibit 74**. The truck profile is slightly different from a typical profile with truck trips tending to start earlier in the morning and carrying on later into the evening.

**Exhibit 74 – Daily Traffic Profile of Pacific Border Crossing at Highway 15**  
(24 Hour Bi-Directional Traffic Profile)



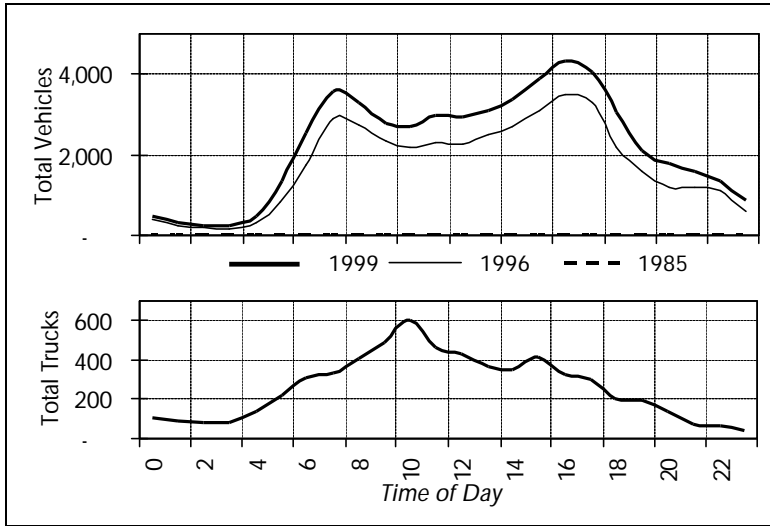
### Eastern Gateways Screenline

This screenline is at the eastern end of the study area and consists of two stations: Highway 1 west of Hope and Highway 7 west of Hope. This screenline has experienced a drop in traffic volumes of approximately 2% from 1996 to 1999. The Highway 1 and 7 screenline west of Hope has the second highest percentage of truck traffic of all major regional screenlines at 25%.

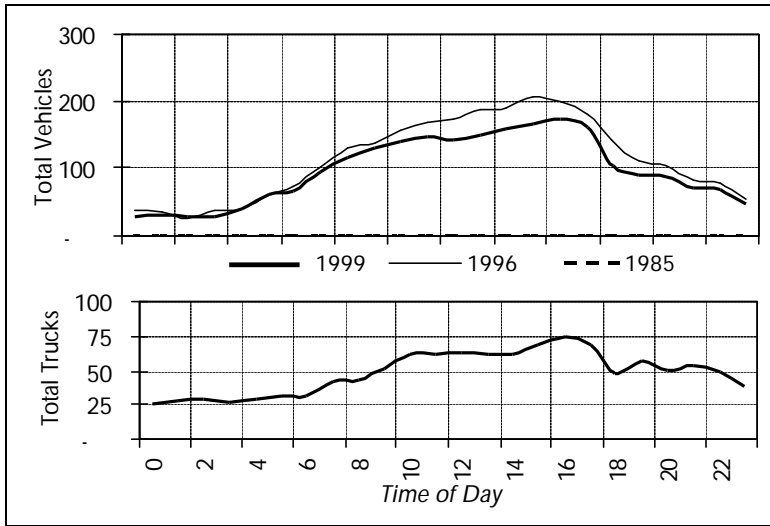
Highway 1 and Highway 7 west of Hope are two locations that are highly influenced by long range trips. As shown in **Exhibit 75** and **76** the total traffic profiles have a single peak and are highly influenced by truck traffic. Also the total truck traffic profiles portray characteristics of longer range trips with volumes remaining more consistent throughout the day and extending into the late evening time periods.



**Exhibit 75 – Daily Traffic Profile of Hwy 1 West of Hope  
(24 Hour Bi-Directional Traffic Profile)**



**Exhibit 76 – Daily Traffic Profile of Hwy 7 West of Hope  
(24 Hour Bi-Directional Traffic Profile)**



### 3.3 SUMMARY

The vehicle volume and classification survey at major screenlines revealed that traffic growth between 1996 and 1999 seemed to be strongest on the Burrard Peninsula. The Boundary Road screenline grew by 62,800 vehicles or 5% per annum over a 24 hour period. Similarly the North Road screenline grew by close to 40,000 vehicles or 6% per year over a 24 hour period. The North Arm screenline which divides Richmond and the Burrard Peninsula also showed reasonably strong growth at 3% per annum (27,100 vehicles). The South/Main Arm, which includes the Port Mann, Pattullo, Alex Fraser and George Massey water crossings, grew by 11,300 vehicles, or 2% per year between 1996 and 1999.

Of the major screenlines, the 200th Street, South/Main Arm and North Road screenlines had the highest proportion of trucks in the traffic stream. Although total vehicles at border crossings decreased during the last few years, truck traffic at has increased by 92% since 1991. Trucks constituted 25-30% of total volume at entry/exit point to the British Columbia Interior and the United States.



# 4 TRUCK DEMAND FORECASTING MODEL

The previous chapters described data that was collected regarding light and heavy trucks and their trip characteristics. This data is useful to support analytical work related to truck issues in three ways:

- Develop an understanding of the contribution of truck movements to the overall transportation demand. The data is also useful in addressing more immediate and localized trucking concerns.
- Provide a 1999 reference point for assessing the changes since the last truck study in 1988, and for tracking truck movements into the future.
- Provide an analytical basis for planning of goods movement and prioritization of investments. Planning for goods movement will be enhanced with the development of analytical truck demand forecasting tools.

The purpose of this chapter is to introduce the truck demand forecasting model and its future applications.

## 4.1 TRUCK DEMAND FORECASTING MODEL

A travel demand forecasting model is based upon a series of mathematical equations that attempt to emulate travel behaviour on a regional scale. Because it attempts to replicate transportation related behaviour and represents average conditions or behaviour, and because of the large scale of the model, the model is not able to replicate the real world in finite detail. However, the model does produce remarkably accurate estimates of travel over the system in general, and reasonable comparisons with observed counts

on many individual road and transit links. For detailed discussion pertaining to the EMME/2 travel demand forecasting model please refer to the TransLink EMME/2 Transportation Planning Manual.

The regional EMME/2 Travel Demand Forecasting Model is typically used to produce forecasts of single occupant and high occupant vehicles and transit users for system, corridor and project level studies, and for focus on specific issues within municipalities. This powerful tool has been enhanced with development of the truck demand forecasting model. that operates as a component, or sub-model, of the regional EMME/2 Travel Demand Forecasting Model. The new truck demand forecasting model is able to forecast the quantity of light and heavy truck trips, the origins and destinations of these truck trips, and the most likely route taken between these origins and destinations. The truck demand forecasting model can also be used for explicit analysis of special generators such as ports and external gateways.

### Forecasting

The ability to forecast truck trip demand requires definition of the future years under consideration, and certain assumptions about those future years. In order to be consistent with the regional EMME/2 Travel Demand Forecasting Model, the truck demand forecasting model was developed to estimate truck trips for the AM peak hour or a full 24 hour period for the years 2006, 2011 and 2021.

Forecasts of truck activity are based upon certain assumptions regarding the future years. These include:

- Forecasts of population and employment and their distribution throughout the Lower Mainland.
- Forecasts of containers at port terminals and rail inter-modal yards.
- Estimates of future air cargo tonnes for both integrators and non-integrators at Vancouver International Airport.
- Forecasts of employment by industrial sector for external gateways.
- Configuration of the future road network.
- Economic charges such as tolling.

Various scenarios regarding the future can be tested by altering the assumptions listed above i.e. the benefits of changing the future road network to include a proposed major truck route can be assessed.

#### **4.2 APPLICATIONS OF THE TRUCK DEMAND FORECASTING MODEL**

The truck demand forecasting model can be used to support the following types of initiatives:

- Corridor/route analysis and major infrastructure planning, including economic analyses.
- Truck route planning such as truck priority lanes, definition of Major Commercial Road Network (MCRN), traffic management during road construction.
- Tolling analysis and revenue forecasting.
- Cross-border studies.
- Examining the transportation impact of industrial development.

- Inter-modal freight planning including rail, seaport and airports.
- Pavement deterioration and management analysis.
- Air quality modelling and analysis.
- Weigh scale planning including strategic planning of locations and enforcement/compliance.
- General transportation planning.

#### **4.3 EXAMPLE OF MODEL FORECAST FOR YEAR 2021**

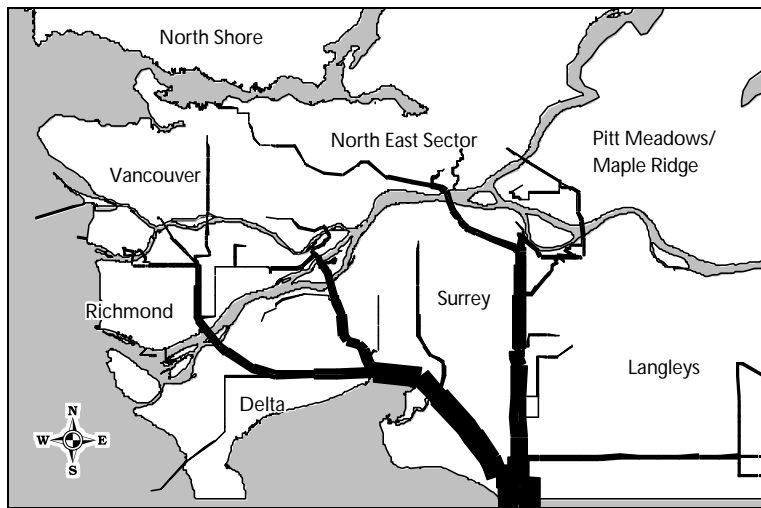
The purpose of this section is to provide an example of a typical model forecast for the horizon year 2021. **Exhibit 77** illustrates the forecast 2021 origins and destinations of truck trips that use the Highway 15 (Pacific Highway) border crossing, and the routes that they can be expected to take between these points. The volumes represent a full 24 hour period. This forecast was produced assuming that:

- the Growth Management Strategy forecast for 2021 has been realized;
- a crossing between Maple Ridge / Pitt Meadows and Surrey/Langley has been constructed following the 200th Street alignment, and a \$1 toll applied for each trip across the bridge;
- an additional EB HOV lane has been added to Port Mann Bridge (for a total of 5 lanes);
- George Massey Tunnel has been widened to accommodate counter-flow HOV lanes; and

It is important to note that none of these assumptions presuppose provincial, TransLink or municipal policy. These assumptions were selected solely to demonstrate an example application of the truck demand forecasting model for the horizon year 2021.

A companion base year (1999) model estimate is provided in Chapter 2.4. Both exhibits were produced with the identical scale.

**Exhibit 77 – Forecast of 2021 Origins and Destinations of 24 Hour Truck Trips that use Highway 15 Border Crossing**



The 1999 observed truck movements using the Highway 15 border crossing was approximately 1,800 per day in each direction, or 3,600 per day in total. The 2021 estimate is approximately 5,000 per day in each direction, or 10,000 per day in total. Many of the forecast trucks follow similar paths to the 1999 pattern, with the following exceptions:

- a number of trucks can be expected to use the crossing between Maple Ridge/Pitt Meadows and Surrey/Langley.
- the number of trips that use the Highway 15 (Pacific) border crossing **and** have either an origin or destination in Richmond or Burrard Peninsula has increased, thereby increasing the volume of traffic on the Port Mann, Alex Fraser and George Massey water crossings. However, the George Massey Tunnel captured the approximately 60% of this growth.

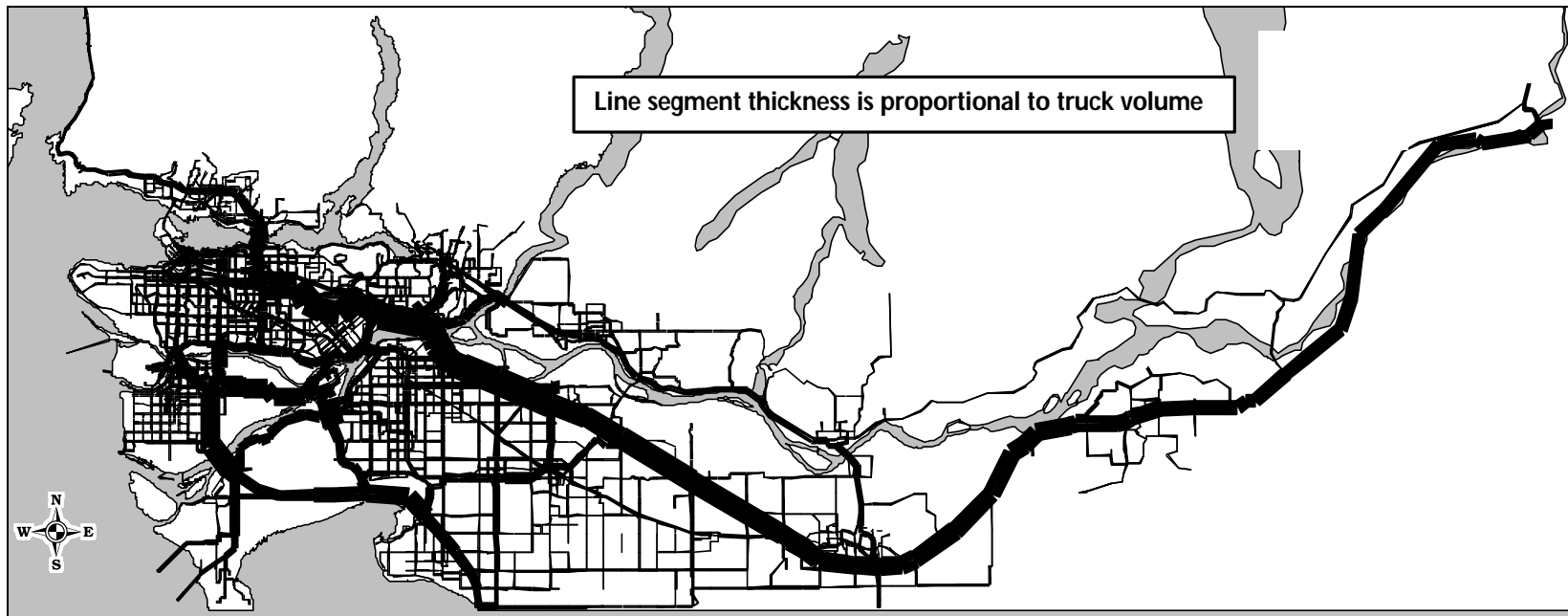


## 5 TRUCK CORRIDORS

The previous chapters described the data collection efforts that led to the development and calibration of the light and heavy truck demand forecasting model. The purpose of this chapter is to identify major truck corridors in the Lower Mainland through application of the model<sup>4</sup> and observations of trucks obtained during the vehicle volume and classification survey.

**Exhibit 78** illustrates 1999 truck traffic over a 24 hour period in the Greater Vancouver and Fraser Valley Regional Districts. These volumes were produced using the regular traffic assignment procedure in the EMME/2 travel demand forecasting model. This illustration highlights the relative magnitude of truck volume on the road system.

**Exhibit 78 – 24 Hour Light and Heavy Truck Traffic Volume in the Lower Mainland**



<sup>4</sup> Application of select link analysis in EMME/2. That is, a partial equilibrium assignment of only those trips that use a particular part of the network. For a detailed explanation of this type of analysis, refer to INRO Consultants EMME/2 User's Manual or the TransLink EMME/2 Transportation Planning Manual available from TransLink, Strategic Planning Department.

## 5.1 MAJOR TRUCK CORRIDORS

It is evident from **Exhibit 78** on the preceding page that the three dominant truck routes within the Lower Mainland are:

- Highway 1 (Trans-Canada Highway);
- Highway 91; and
- Highway 99.

### Highway 1 (Trans-Canada Highway)

The Trans-Canada Highway provides an important continuous linkage that connects most municipalities in the Lower Mainland with each other, the British Columbia Interior and the rest of Canada. Truck volumes are highest on the portions of the Trans Canada Highway through Surrey, Coquitlam and Burnaby. Highway 1 is also the major truck route through the North Shore and the Fraser Valley.

**Exhibit 79** provides total truck volumes along Highway 1 as observed at four locations in the vehicle volume and classification survey.

**Exhibit 79 – Total Observed 24 Hour Truck Volumes on Highway 1**

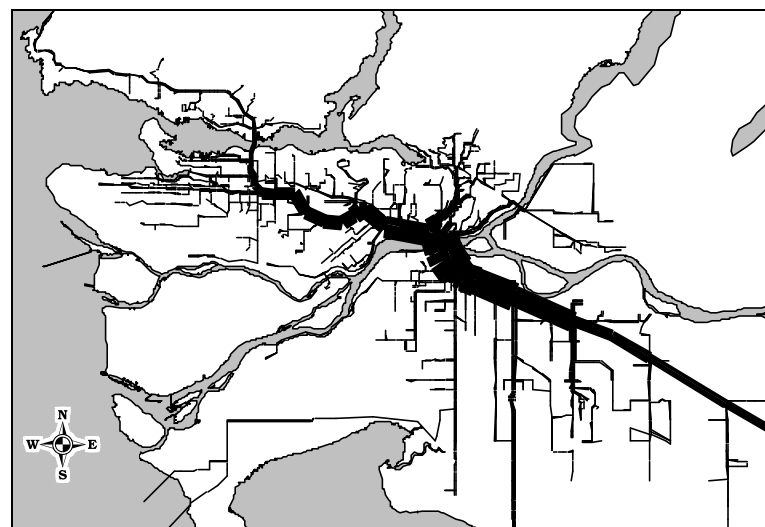
Location	24-Hour Trucks - Both Directions		
	Total	Light	Heavy
Hope	3,100	650	2,450
West of Abbotsford	7,700	2,600	5,100
Port Mann Bridge	10,700	4,600	6,100
Second Narrows Bridge	5,500	1,700	3,800

Over 10,000 trucks were observed crossing the Port Mann Bridge over a 24 hour period. This was the highest observed truck count in the Lower Mainland.

**Exhibit 80** illustrates the general catchment area for trucks using the Port Mann Bridge over a 24 hour period. The catchment area represents the collector roads that feed and disperse truck traffic for this particular facility. The catchment area for the Port Mann Bridge covers the majority of the Greater Vancouver region.

Port Mann Bridge serves as an important connector between the Burrard Peninsula and Surrey, Langley and the Fraser Valley Regional District. It provides limited service to Richmond, Delta and Pitt Meadows/Maple Ridge.

**Exhibit 80 – General Catchment Area of Trucks Using Port Mann Bridge (24 Hours)**



*\*line segment thickness is proportional to truck volume*



### Highway 99 & Knight/Oak Street Corridors

The Highway 99 corridor links Vancouver, Richmond, Delta, Surrey and Vancouver International Airport. It also connects with the United States border. The north-south section through Richmond experiences the highest heavy truck volume with the maximum load occurring at the George Massey Tunnel. Other key load points are at the intersections of Highway 99 with Highway 91 (south of Alex Fraser Bridge), Highway 17 (Tsawwassen Ferry Terminal and Deltaport) and the East-West Connector. Observed 1999 truck volumes at major screenline locations along the Highway 99 corridor are presented in **Exhibit 81**.

**Exhibit 81 – Total Observed 24 Hour Truck Volumes Along the Highway 99 Corridor**

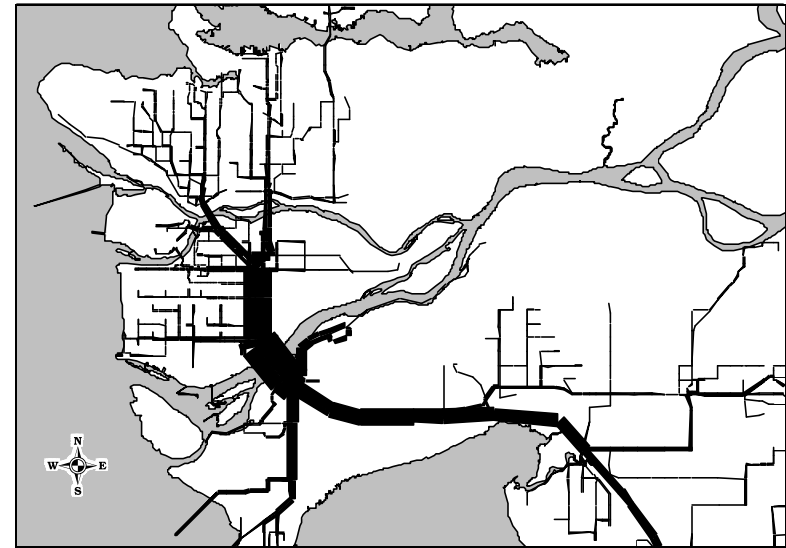
Location	24 Hour Trucks - Both Directions		
	Total	Light	Heavy
Pacific Crossing	3,600	500	3,100
West of Highway 91	2,700	1,000	1,700
George Massey Tunnel	4,700	1,600	3,100
Knight Street Bridge	8,600	3,900	4,700
Oak Street Bridge	2,300	900	1,400

Highway 99 feeds the City of Vancouver via the Oak Street and Knight Street bridges. The Knight Street Bridge carries a similar quantity of truck traffic as Alex Fraser Bridge, and provides an important connection between the East-West Connector in Richmond and Marine Drive in Vancouver. North of Marine Drive, Knight Street continues north through the City of Vancouver as a vital link for trucks serving the Port Vancouver's terminals on the Burrard Inlet.

**Exhibit 82** shows the general catchment area for trucks using the George Massey tunnel. This exhibit shows that the tunnel primarily serves truck trips between Surrey, Delta, Richmond and Vancouver. Specific areas being served include Tilbury Island, Vancouver International Airport,

Deltaport Container Terminal, Tsawwassen Ferry Terminal and the Pacific Highway Border Crossing.

**Exhibit 82 – General Catchment Area of Trucks Using George Massey Tunnel (24 Hours)**



*\*line segment thickness is proportional to truck volume*

### Highway 91 (Annacis) Network

The third corridor of regional importance is Highway 91 (Annacis System). This network consists of the north-south Annacis system including Highway 91A (Queensborough Bridge) and the East-West Connector. It serves as an important connector between the Burrard Peninsula, Richmond and Surrey/Delta including the industrial areas of Annacis Island and Tilbury Island. It also connects the special generators Seaspac Coastal Inter-modal and Fraser River Port Authority with the rest of the Lower Mainland. The maximum load point on this corridor is in the vicinity of the Alex Fraser Bridge and Annacis Island. 24 hour two-way volumes at

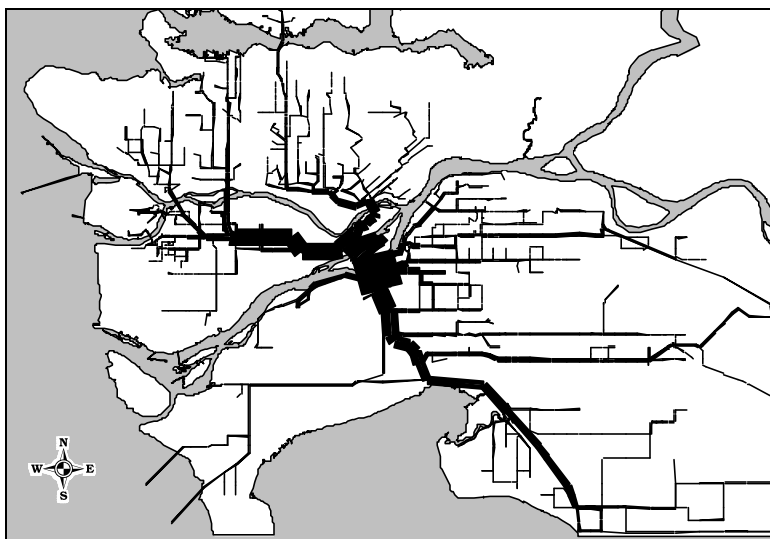
locations where Highway 91 crosses major regional screenlines are provided in **Exhibit 83**.

**Exhibit 83 – Total Observed 24 Hour Truck Volumes on Highway 91 Corridor**

Location	24 Hour Trucks - Both Directions		
	Total	Light	Heavy
Alex Fraser Bridge	8,600	3,700	4,900
Queensborough Bridge	6,100	3,000	3,100
East of Knight Street	7,200	3,100	4,100

**Exhibit 84** shows the general catchment area for trucks using the Alex Fraser Bridge. This figure shows that the Alex Fraser Bridge serves northwest trips between Surrey, Delta, Langley and the Burrard Peninsula. Specific areas being served include Tilbury Island, Annacis Island, Seaspam Inter-modal and Fraser River Port Authority.

**Exhibit 84 – General Catchment Area of Trucks Using Alex Fraser Bridge (24 Hours)**



*\*line segment thickness is proportional to truck volume*

## 5.2 OTHER TRUCK CORRIDORS

In addition to the Highway 1, Highway 99 and Highway 91 corridors, other truck routes of key importance include the following:

- **Marine/Stewardson/Front/Brunette** – This series of roads provides an east-west route along the north bank of the Fraser River through New Westminister linking Vancouver, Richmond and Burnaby to New Westminister and Coquitlam. It directly connects the Arthur Laing Bridge, Oak Street Bridge, Knight Street Bridge, Boundary Road, the Alex Fraser Bridge (via Queensborough) and Highways 1 and 7. Approximately 6,800 trucks travel on Brunette Avenue just south of Highway 1 and 2,800 trucks travel on Marine Way just west of Boundary over a 24 hour period.
- **Grandview Highway** – This highway provides an important link between Vancouver and Highway 1 while serving the Grandview and False Creek/Clark Drive industrial areas. The manual count at Grandview Highway indicates that it carries roughly 2,100 two-way truck trips per day west of Boundary road.
- **Lougheed Highway/Mary Hill Bypass** - Both Highway 7 and the Mary Hill Bypass provide a connection from Highway 1 to the North East Sector and, via the Pitt River Bridge, to Pitt Meadows and Maple Ridge. The relocation of the CP Inter-modal Facility from Mayfair Industrial park in Port Coquitlam to Pitt Meadows has increased the importance of the Pitt River Bridge which carries roughly 3,800 trucks per day. The Lougheed Highway sees approximately 2,600 trucks per day north of Colony Farm Road.

- **North Fraser Corridor ( Highways 7 & 11)** – Highway 7 and Highway 11 provide an important linkage between the north and south areas of the Fraser River. It also connects the Fraser North communities of Pitt Meadows, Maple Ridge and Mission to the U.S. Border. According to the manual classification counts, the Mission Bridge carries 2,600 trucks per day.
- **Boundary Road** - This route provides a north-south connection between Highway 1 and the Marine/ Stewardson/ Front/ Brunette corridor. Despite its steep grade at the southern end at the Fraserwood Industrial area, Boundary Road carries approximately 2,200 trucks per day just North of Kingsway.
- **Highway 17** - Highway 17 through Delta provides an important link for the Tsawwassen Ferry Terminal and the Deltaport Container Terminal to the rest of the region. More specifically this highway connects to Highway 10, the George Massey Tunnel, Highway 99 South and River Road. The volume of heavy trucks is particularly pronounced north of Deltaport Way which is the direct link to the Deltaport Container terminal.
- **Deltaport Way** - This road connects the Deltaport Container Terminal to Highway 17 and thus, the rest of the region. Truck traffic on this route is almost exclusively heavy trucks and amounts to approximately 1,000- 1,200 trucks per day.
- **River Road** - West of the Alex Fraser Bridge, River Road provides a connection between Highway 17 and the Highway 91 corridor. It also serves the Tilbury Industrial area in North Delta which includes the Seaspan Ferry service. East of the Alex Fraser Bridge, River Road and the partially constructed portion of the South Fraser Perimeter Road in Surrey provide a connection from Highway 91 to the Pattullo Bridge and also serves Fraser Port and the adjacent industrial area. River Road carries approximately 4,200 trucks per day west of Nordel Way.
- **Highway 10** - This route provides a direct connection between Highway 1 and Highway 99 through Langley, Surrey and Delta. It also connects the interior of British Columbia to the Tsawwassen Ferry Terminal and the Deltaport Container Terminal. The section most heavily used by trucks is between Langley City and the King George Highway. Highway 10 carries roughly 3,600 trucks per day west of Highway 15 and 1,200 trucks per day West of Highway 91.
- **Highway 15 (176th Street)** - This is an important north-south corridor through Surrey. It directly links the Pacific Highway Border Crossing to Highway 1 and the CN Thornton Inter-modal Yard at the north end of Surrey. It also provides access for trips crossing the U.S. Border via Highways 91 and 99. Highway 15 carries roughly 3,600 trucks per day north of the U.S. border crossing and 1,300 truck trips per day south of Highway 10.
- **Highway 13 (264th Street)** – The primary function of Highway 13 is to serve as a gateway to the United States. It provides localized services to the Langley and Abbotsford areas. Highway 13 carries roughly 400 trucks per day north of the U.S. border crossing and 1,400 trucks per day north of Fraser Highway.
- **Highway 11** – Highway 11 has a dual function of serving the local Abbotsford and Mission areas as well as external trips from east of Hope and the Sumas border crossing. Highway 11 carries roughly 1,000 trucks per day north of the U.S. border crossing and 2,600 trucks per day across the Mission bridge.



## 6 CONCLUSIONS

The Lower Mainland Truck Freight Study has provided reliable and comprehensive data that establishes a 1999 baseline of truck movements in the Lower Mainland. As a result of the study, a new truck demand forecasting model will enable the estimation of future truck demand and activities. The products of this study will assist the participating agencies to better address goods movement issues. This section presents the conclusions of the study.

### **INTER-AGENCY COLLABORATION**

The study was funded by eight agencies ranging from the federal government to port authorities. A trademark of this study was the successful inter-agency collaboration throughout the project, funding negotiations to project delivery. Useful input was also obtained from non-funding stakeholders such as the British Columbia Trucking Association. This can serve as an example for future large scale transportation studies.

### **RELIABLE AND COMPREHENSIVE BASELINE**

Based upon study results, there were close to 188,000 truck trips made on a typical day in the Autumn of 1999. Of these truck trips, approximately 127,000 (68%) were made using light trucks and 61,000 (32%) using heavy trucks. The results of the surveys further indicated that the peak period for trucks is generally during the mid-day period. Approximately 70% of light and heavy truck trips arrive at their destination during the time period of 9:00 AM and 4:00 PM.

### **Light Trucks**

On average, light trucks were used for 10 trips per day, and had a average trip length of 8.5 kilometres. Close to 30% of all light truck trips generated in the Lower Mainland were made within the City of Vancouver. Approximately 2% of light truck trips are linked to special generators and external locations. A large portion of these trips is captured by the Vancouver International Airport and the integrator (couriers) caterers etc.... located there. Close to 50% of all light truck trips are destined to retail, residential and warehouse/wholesale land uses.

### **Heavy Trucks**

On average, heavy trucks were used for 8 trips per day, and had a average trip length of 15.8 kilometres. Sub-areas of the region that produced more than the regional average of heavy trucks are generally south of the Fraser River, and include South Delta, Abbotsford, Chilliwack and Mission. The largest absolute number of heavy trucks was produced in the Burnaby / New Westminster / NE Sector sub-area.

Approximately 20% of all heavy truck trips in the Lower Mainland are related to special generators (8%) and external locations (11%). Highway 1 and Highway 15 (Pacific Border Crossing) were the most heavily used gateways into the Lower Mainland. Close to 50% of all heavy truck trips are destined to warehouse/wholesale, transportation/communication/ utilities and manufacturing land uses.

### **Vehicle Volume and Classification**

The strongest growth in total traffic between 1996 and 1999 was on the Burrard Peninsula. For example, total traffic crossing the Boundary Road screenline between Burnaby and Vancouver, as well as between Burnaby / New Westminster and the NE Sector, grew by approximately 5-6% per year. Screenlines within the study area that displayed a high proportion of trucks in the traffic stream were 200th Street, South Main Arm (Port Mann, Pattullo, Alex Fraser and George Massey Water crossings) and North Road (separating Burnaby / New Westminster from the NE Sector). Major truck corridors include Highways 1, 91 and 99. In addition significant truck traffic utilizes Highway 15 enroute to and from the US border.

### **EFFECTIVE TOOLS FOR TRUCKING ANALYSIS**

The Lower Mainland Truck Freight Study provides comprehensive data that enables a better understanding of truck movements in the Lower Mainland. It also produced a truck demand forecasting model as a sub-model within the EMME/2 travel demand forecasting model. This model will be used to forecast future truck demand.

### **Understanding of Current Truck Movements**

The data collected will be useful for the detailed analysis of truck movements, and provides an indication of the extent that external gateways and special generators contribute to the total truck demand in the Lower Mainland. Observations of total vehicles as well as light and heavy truck movements at main screenlines will assist in the monitoring of regional truck movements in the future. This information will also be useful in providing a context for addressing localized truck and truck route issues.

### **Estimating Future Truck Movements**

Future truck movements can be estimated through application of the new truck demand forecasting model. This model was integrated into the regional EMME/2 travel demand forecasting model, and will be able to forecast truck demand for future horizon years such as 2006, 2011 and 2021. As a result, the regional travel demand forecasting model has the capability to integrate multi-modal attributes into the transportation planning process.

Specific applications of the truck demand forecasting model include major infrastructure planning, traffic monitoring, traffic impact assessments of major developments, cross border freight movement, inter-modal freight planning, pavement management systems, and air quality modelling.

### **LESSONS LEARNED**

A number of lessons from the Lower Mainland Truck Freight Study can be applied to future truck studies or studies of a similar nature in the future.

#### **Timing of Future Studies**

Due to the complexity of the study and multi-agency involvement, sufficient lead time is required to establish the study scope and assign the required funding within the budget of each agency. It is recommended that preparation for a similar study (magnitude and scope) begin two years prior to the anticipated commencement of the study.

#### **ICBC Vehicle Registration Database**

Access to the ICBC vehicle registration database proved to be a valuable source for determination of the truck

population in the Lower Mainland. However, because of the emerging share of leased truck fleets it was difficult to track the ultimate operating entity for the distribution of the survey questionnaires. Future studies need to take this change in ownership / vehicle registration into consideration.

### **Harmonization of Data Sources**

Significant effort was made in this study to obtain data from a number of sources such that efforts were not duplicated. This presented a number of difficulties regarding differing data collection periods, resolutions of data being collected and data formats. It is recommended that such harmonization be investigated in the future. However, it is important to note that the integration of various sources of data is an important consideration in preliminary study design. Also, where possible, collection of data by one study team should be considered. This can be expected to be more efficient and result in improved data integrity.

### **Special Generator Sub-Models**

The truck study sampled a number of special generator locations and applied the results to the broader universe of special generators, including Abbotsford Airport. It is suggested that roadside interviews be conducted at all special generators in future studies. The collaboration of special generator operators has greatly enhanced the explanatory power of the data and truck demand forecasting model compared to a similar truck study in 1988. Due consideration should be given to different forecasting variables when incorporating special generator truck sub-models within the EMME/2 travel demand forecasting model.

### **Expanded Coverage Area**

Understanding of trucking movements in the Lower Mainland was enhanced through expansion of the study area to include a large portion of the Fraser Valley Regional District. Future studies should at minimum maintain the expanded study area, or perhaps consider further expansion in Squamish-Lilloet Regional District.

### **Validation of Data**

The immediate validation of the data collected to ensure integrity is a critical element of the study. The quality assurance aspect of data collection needs to be an integral component of the project management process.

### **FURTHER STUDIES**

The Lower Mainland Truck Freight Study provides valuable insight into trucking movements for a typical day in November, 1999. In addition, the development of the truck demand forecasting model will enhance the region's ability to effectively address goods movements and trucking related issues. However, this understanding can be improved through additional studies that focus on detailed goods movement activities.

### **Future Comprehensive Truck Studies**

The current study has established a baseline understanding of truck movements for November, 1999. As the trucking industry can be expected to continue to undergo significant changes, it is recommended that a similar study be undertaken every five years. This will ensure that the data being used for trucking analysis is up to date, and to monitor changes in trucking movements.

### **Commodity Flow Analysis**

The current study was unable to effectively collect commodity information. Hence, other methodologies for collecting this information require examination. For example, waybill analysis or customs import/export data may provide some better information. The refinement to the model and the ability to more accurately reflect truck impacts based on future economic projections would be enhanced through commodity based analysis.

### **Province-Wide Truck/Freight Model**

Consideration could be given to the development of a province wide truck freight study and development of a demand forecasting model that would incorporate modes such as rail, ferry, air cargo and truck freight with advanced techniques such as commodity flow analysis.

### **Detailed Analysis of External Gateways**

With respect to types of truck trips and commodities, the information in this study regarding entry/exit points into the region represents a few days of data collection in November, 1999. However, the types of truck trips and commodities using entry/exit points into the Lower Mainland can be expected to vary throughout the year. Further study of the variation at external locations is recommended.

### **Detailed Analysis of Special Generators**

Similar to external locations, the types of truck trips and commodities accessing the special generators can be expected to vary throughout the year. Further study of each special generator is recommended. In addition, the type of special generators perhaps needs to be expanded to account for the large warehouse /distribution centres and other major truck trip generators.

### **Analysis of Daily/Seasonal Variation in Truck Traffic**

With the exception of the permanent count stations maintained by the Ministry of Transportation and Highways, truck data was collected for one day in this study. It is noted that truck demand can fluctuate significantly from day to day, and from season to season. Truck counts averaged over a series of days, and in each of the four seasons would provide a more complete picture of year round truck demand, and provide a more robust base for monitoring truck demand into the future. It may be useful to consider including trucks as a component of the regular screenline count program, or establish a more regular cycle to collect truck data.