Downtown Squamish 2031 Transport Plan

Prepared for
The District of Squamish

Prepared by

CREATIVE TRANSPORTATION SOLUTIONS

In association with

ISL Engineering and Land Services

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MAY 2009

DOWNTOWN SQUAMISH
2031 TRANSPORT PLAN

FINAL REPORT

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District of Squamish

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14 May 2009

File no: 3581

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EXECUTIVE SUMMARY

Creative Transportation Solutions Ltd. (CTS) in association with ISL Engineering & Land Services Ltd. and PTV America were retained by the District of Squamish in August 2007 to develop a multi-modal transport plan for downtown Squamish. The study was initiated by the District of Squamish in order to define the transportation network required to support the proposed redevelopment of downtown Squamish and the Lower Peninsula while adhering to Smart Growth principles.

BACKGROUND

The population of Squamish is forecast to more than double from 14,950 in the year 2006 to 33,100 by the year 2031 with the majority of future residents to be housed in new developments in the vicinity of downtown Squamish. One of the largest areas of potential residential development is an area known as the "lower peninsula" located immediately south of downtown Squamish on former industrial lands. Currently, this area is served by one vehicle access on Galbraith Avenue which connects to downtown Squamish at the intersection of Loggers Lane & Vancouver Street. In an effort to create a more sustainable community and to guide the future development of Squamish, the community has embraced Smart Growth principles for the redevelopment of downtown.

Employment for Squamish-based residents is expected to only increase by only 40% between the year 2006 (8,335 jobs) and the year 2031 (11,700 jobs). Therefore with a larger population but smaller percentage of jobs, the majority of the Squamish based population is forecast to either not be employed or have a job located outside of Squamish. If this trend of turning Squamish into a "bedroom community" continues, it will have significant impacts on the future transportation network requirement for Squamish as the majority of travel demand will be between the various neighbourhoods of Squamish and Highway 99. As well, this would conflict with Smart Growth principles which encourages the development of good jobs close to home for future residents.

The current transportation plan for Squamish identified two future major transportation roadways into downtown Squamish. The "7th Avenue Connector" would be located on the west side of downtown Squamish along the railway corridor and link both downtown and the harbour to the south with the railway yards and industrial park to the north, as well as provide an indirect connection to Highway 99 along Government Road. The second corridor in the transportation plan is a new crossing of the Mamquam Blind Channel which would link downtown Squamish to the west with Highway 99 to the east.

KEY STUDY FINDINGS

A review of traffic patterns on Highway 99 concluded that the summer Friday afternoon peak hour continues to be the dominant hour of the week and time of year for which to further assess both existing and future transportation requirements of Squamish. This peak hour was subsequently selected as the design hour to develop the updated transport plan for downtown Squamish.

A comprehensive transport mode survey was undertaken on a typical Friday in both summer and winter conditions between 7 am and 6 pm in order to document where people enter and exit downtown Squamish, and by what mode of transport. Almost 40,000 people movements were observed on the two survey days entering and exiting downtown Squamish. A total of 21,890 person movements were

recorded during the 11 hour summer survey and 17,643 person movements during the 11 hour winter survey. Therefore, summer travel demand was 24% higher than the winter survey day.

The use of either a car or truck to enter and exit downtown Squamish is overwhelmingly the preferred transport for the majority of the almost 40,000 persons observed as 92.7% used this mode in the summer and 90.4% in the winter. Public transport, which for most urban communities is the next most viable and effective mode of transport for moving people, is clearly not well used in Squamish at only 1.5% in the summer and 3.8% in the winter.

Intersection capacity analysis of existing conditions at 6 key municipal intersections in the study area during the peak summer afternoon peak hour determined that 5 of the 6 were operating at Level of Service A (excellent) and one at Level of Service C (fair), the latter being Cleveland Avenue & Pemberton Street. However, this intersection has been scheduled for signalization in 2009 which is expected to improve the level of service back to A (excellent). Therefore, all key intersections in downtown Squamish are currently operating at good levels of service and have varying amounts of spare capacity to accommodate additional traffic volume growth.

A review was also conducted of the signalized intersections of Highway 99 & Cleveland Avenue and that of Highway 99 & Clark Drive as they too are located within the study area. Although both of these intersections are currently operating at an overall LOS C (fair) during the summer afternoon peak hour, both have a left turn movement experiencing significant delays. As both of these intersections are being rebuilt as part of the Sea to Sky Highway Improvement project, the noted operational problems are expected to be minimized after the highway is widened and improved.

A parking inventory survey of all public on and off-street parking facilities in downtown Squamish was also conducted as part of this project in order to document the availability of public parking. A total of forty municipal blocks were surveyed and 2,290 parking spaces were counted of which 1,167 were on street (51%) and were 1,123 parking spaces are off-street (49%).

A new transportation model using the VISUM software was developed for Squamish in order to test various future transport scenarios. The model included 15 “macro” traffic zones for outside of downtown so that regional traffic patterns could be modeled while for downtown Squamish, it was modeled at a much more detailed level with the use of 21 traffic zones and the boundaries of the downtown traffic zones were designed to match the boundaries of all the distinct precincts in the Downtown Neighbourhood Plan.

Significant effort was expended in meetings with planning staff, property owners and other stakeholders in order to quantify the expected changes between existing and future conditions for each of the traffic zones by the year 2031 for the base case. The following are the major changes projected:

- Housing supply to increase by 8,800 homes of which 1,209 are single family homes and 7,591 multi-family homes;
- Local based employment to increase by 2,390 jobs;
- Commercial accommodation to increase by 510 rooms; and
- College and university student population to increase by 3,230 students

One of the primary objectives of this study was to develop a transport plan that is more sustainable for the community and adheres Smart Growth Principles including #6 “*Good jobs are close to home*”. As well, by testing various “do-something” and “do-something sustainable” options, the positive impacts of

having a more sustainable transport plan could be better understood by the community, stakeholders and other decision makers. Therefore, in consultation with municipal staff, a more sustainable future employment model was developed for further testing which included the following:

- The number of jobs were projected to almost double between 2006 and 2031, which was in keeping with the projected doubling of the population;
- 75% of the new jobs were forecast to be based in Squamish;
- The number of Squamish based residents who are forecast to be employed by the year 2031 increased from 11,700 to 16,328 (+39%); and
- The number of locally based jobs for the year 2031 increased from 8,310 to 11,915 (+43%); and
- The number of housing units to be constructed by the year 2031 was scaled back from 8,800 to 7,480 homes in order to provide for a more sustainable balance between population and jobs.

For this project, consultation with Council, District staff, stakeholders and the public has been extensive and included the following major components:

- The development of a project website to facilitate communication with the public;
- Presentations to Council;
- The hosting of 2 public information meetings; and
- Direct consultation by the project team with almost 25 stakeholders.

The initial work on developing the first draft of the 2031 transport plan was undertaken with the testing of the "Do Nothing" scenario in order to define baseline conditions and to determine whether the existing transportation network could accommodate the projected level of development with no accompanying change in travel mode, projected population or projected employment levels. The analysis determined that there was very strong travel demand between the Lower Peninsula and Highway 99 linking the new local housing with the future jobs outside of Squamish, and that the "Do Nothing" scenario would only work if:

- There was major new capital works at the north end of downtown significantly widening intersections and streets;
- The on-street parking on Cleveland Avenue would be removed to double the roadway capacity; and
- The redevelopment of the lower peninsula would require a minimum of two vehicle access points.

For the calibrated model, approximately 5,200 vehicles were simulated to replicate existing traffic volumes and congestion for the summer Friday afternoon peak hour in all of Squamish. However this is projected to increase to close to 12,000 vehicles per hour by the year 2031, which represents a 130% increase in traffic volumes for the "do-nothing" scenario.

Five "Do Something" scenarios (numbered from 1 to 5) were then examined which tested various network improvements to address projected year 2031 congestion levels but still assumed that there would be no accompanying change in travel mode (i.e. 92.7% of all person trips were still by car, only

1.5% by public transit, etc.), and that projected population and employment levels would remain constant. This assessment determined that:

- The projected volumes warranted one new 2 lane crossing (i.e. 1 lane in each direction) over the Mamquam Blind Channel;
- That the Westminster bridge option would carry double the traffic of the Pemberton bridge option because it provided a more direct link between the lower peninsula, downtown Squamish and Highway 99 but because of that would be close to capacity by the year 2031;
- That a second crossing would likely be required beyond 2031 if current trends continue; and
- That there was a was a strong desire to use Government Road via the 7th Avenue connector, 3rd Avenue or Bailey link to connect downtown with the rest of the community and key employment nodes to the north.

From the assessment of the "Do Nothing" and five "Do Something" scenarios, two "Do Something Sustainable" scenarios were developed and tested known as #6 and #7. Scenarios #6 and #7 included various combinations of a new crossing over the Mamquam Blind Channel with a new or improved road link to Government Road to the north while at the same time reducing auto use from 92.7 to 85%, increasing transit use from 1.5 to 5%, increasing local jobs by 43% and a small reduction in the estimated 2031 population. The use of sustainable initiatives for these scenarios demonstrated how travel demand can be altered to create a more balanced transport system. At the same time, it reduced vehicle congestion (e.g. Westminster bridge) and increased the longevity of the transportation system to absorb future traffic volumes.

The results of the technical work on the base case scenario and the seven alternative scenarios resulted in the development and release to the public of the first draft of the transport plan in October 2009. This transport plan was the preferred "technical" solution by the consultant team for the community and included the following key features:

- Embraced Smart Growth principles (e.g. options to the car were emphasized, minimized construction of new roads, encourage more local employment, etc.);
- Included the Pemberton bridge and the new link to Highway 99 at Clark Drive;
- Recommended that the downtown grid network be extended into the lower peninsula;
- Recommended that Loggers Lane to be the primary vehicle route and Cleveland Avenue be the secondary route to and from the lower peninsula;
- Recommended that Bailey Street be upgraded to an arterial to link the lower peninsula with the future employment to the north;
- That a major roundabout be constructed at the north end of downtown to provide a better connection between major approach roads and to ensure good vehicle access to and from the new Pemberton bridge;
- That the Westminster right of way, the Westminster crossing and the 7th Avenue Connector be protected as potential future port roadways so that the harbour can be linked with Highway 99 and/or the rail lands to the north should the demand develop and/or the sustainable initiatives contained in the transport plan are not met (e.g. reduce vehicle use as a percentage of all person trips)

- That a new multi-modal transportation centre be constructed at the north end of downtown by the main CN railway corridor in order to facilitate transfers between various alternative modes of transport while at the same time providing a higher level of service to the public; and
- That a new commuter pathway be constructed alongside Loggers Lane to link the multi-modal transportation centre to the north with the lower peninsula and possible passenger ferry docks to the south.

Two months of extensive consultation with Council, District staff, the public and stakeholders followed the release of the first draft of the multi-modal transport plan. In summary, the majority of communication and concern from stakeholders and the public was about the proposed "port" roads and the continued protection of right of way for both the 7th Avenue Connector and the Westminster corridor and crossing of the Mamquam Blind Channel. Interestingly, both of these dominant concerns were about plan components that are not even required to address year 2031 projected travel demand, but are included in the plan should the various sustainable initiatives not be achieved.

Between December 2008 and March 2009, a second draft of the multi-modal transport plan was developed which attempted to incorporate requested changes, additions and deletions resulting from the two month consultation phase. The key changes to the transport plan were as follows:

- The port roads have been replaced with "transportation corridors to be protected" in case they are needed in the future or if the sustainable initiatives embedded in the transport plan to reduce private vehicle use are not achieved;
- A section of Bailey has been added to complete the new arterial route to Government linking the future housing in the lower peninsula with the future employment to the north;
- The truck route linking 3rd Avenue with Loggers Lane has been relocated from Westminster Street to Vancouver Street to where it exists today;
- The existing intersections of 3rd Avenue & Vancouver Street, and that of Loggers Lane & Vancouver Street will require geometrical improvements as part of the truck route in order to safely accommodate both existing and future truck turning movements; and
- The roadway classification for the new Pemberton crossing and link between downtown Squamish and Highway 99 has been changed from a collector to an arterial roadway classification based on the projected volumes and level of importance.

In order to maintain the designated truck route along Vancouver Street connecting 3rd Avenue with Loggers Lane, the following intersection improvements will be required for both intersections to safely accommodate both existing and future truck volumes:

- At the intersection of 3rd Avenue & Vancouver Street, both the south approach (for northbound traffic) and the east approach (for westbound traffic) will require widening to properly accommodate the northbound right turn and the westbound left turn truck movements; and
- At the intersection of Loggers Lane & Vancouver Street, both the north approach (for southbound traffic) and the west approach (for eastbound traffic) will require widening to properly accommodate the southbound right turn and the eastbound left turn truck movements.

The protection of rights-of-way for potential transportation corridors is a critical element of a transport plan for any community, and especially so for Squamish, because they are a contingency plan for any of the following scenarios:

- To accommodate future travel demand beyond 2031 so that the transport plan is expandable if required;
- To accommodate more vehicle traffic should the community not embrace the ambitious transport mode targets designed to reduce private vehicle use in downtown Squamish;
- To accommodate more vehicle traffic to and from outside of Squamish should the growth in the local employment not keep pace with the expected future population levels;
- To accommodate unforeseen major changes in land use and/or economic activity that may significantly alter travel demand (e.g. port activity); and
- To provide for potential solutions to reduce truck traffic / community interface conflicts.

STUDY RECOMMENDATIONS

1. That the multi-modal transport plan be adopted by the District of Squamish as the final transport plan for Downtown Squamish;

2. That the District of Squamish adopt the following transport mode targets for the year 2031 for person trips entering and exiting downtown Squamish so that the proposed transport plan for downtown remains viable and that no further network additions are required to accommodate the projected demand:

    - Reduced auto trips from 92.7% to 75%
    - Increased transit trips from 1.5% to 10%
    - Increased motorcycle trips from 0.7% to 1%
    - Increased bicycle trips from 1.6% to 5%
    - Increased walk trips from 3.4% to 7%
    - Increased other trips (e.g. ferry) from 0.1% to 2%

3. That by the year 2031 and in conjunction with the transport mode targets, the District of Squamish increase the number of expected locally based jobs from 8,310 to 11,915 (+43%) and scale back the number of expected residential units from 8,800 to 7,480 homes (-10%) in order to reduce the demand for additional transportation infrastructure by providing a more sustainable balance between population and local jobs;

4. That the District of Squamish develop an annual transportation monitoring program in order to monitor both future traffic volumes and increased use of alternative transport modes to ensure that the goals and objectives of the recommendation transport plan are being achieved in a staged fashion;

5. That the District of Squamish commission a conceptual design study of the proposed major roundabout at the north end of downtown in order to refine the conceptual sketch prepared for this project and to identify the estimated property requirements and determine the associated cost estimate; and

6. That the District of Squamish complete a District-wide Transport Plan and that the findings of the Downtown and District-wide Plans be integrated into the Official Community Plan.

SECTION 1 INTRODUCTION

1.1 Introduction

Creative Transportation Solutions Ltd. (CTS) in association with ISL Engineering & Land Services Ltd. and PTV America were retained by the District of Squamish in August 2007 to develop a multi-modal transport plan for downtown Squamish. The study was initiated by the District of Squamish in order to define the transportation network required to support the proposed redevelopment of downtown Squamish and the lower peninsula while adhering to the following Smart Growth principles:

1. Each community is complete
2. Options to the car are emphasized
3. Work in harmony with natural systems
4. Buildings and infrastructure are greener, smarter and cheaper
5. Housing meets the needs of the whole community
6. Good jobs are close to home
7. The spirit of each community is honoured
8. Everyone has a voice

1.2 Background

Although the future population of Squamish is expected to more than double by the year 2031, the majority of the future growth is expected to occur in downtown Squamish and the immediate area thereby concentrating development and the associated growth pressures. A previous transportation study in 1997 for the District of Squamish identified the long term need for two new major roadways to downtown Squamish and they included the 7th Avenue Connector, which linked downtown and the port with the former BC Rail yards and industrial lands to the north, and a new crossing over the Mamquam Blind Channel in order to provide a new link between Highway 99 and downtown. These potential links were then incorporated into the 1998 Official

Community Plan (OCP) Schedule H1 – Major Road Network, Schedule H2 – Truck Routes and Schedule H3 – Commuter Bicycle Network.

The Mamquam Blind Channel crossing concept was the focus of a follow up and more detailed study in 2006 which examined various potential alignments and crossing locations. The following two crossing locations were shortlisted:

- A "low level" crossing just downstream of the railway bridge connecting Pemberton Avenue in downtown with the former Interfor lands and a new roadway to Highway 99 at Clark Drive.
- A "high level" crossing along the Westminster right-of-way linking Cleveland / Loggers Lane in downtown with Squamish First Nations lands and Highway 99 to the east.

However, the travel demand projections in the 2006 study were not at a detailed enough level in order for the community to make an informed decision on the preferred location for any crossings.

Traffic impact assessments for various proposed developments to be located immediately south of downtown Squamish had already identified the need for 2 roadways to access the lower peninsula to service the expected future population. However, the location for the two access points had not yet been determined. As well, Mamquam Blind Channel is a navigable waterway administered by Transport Canada and includes both recreational and industrial shipping activity. Therefore, maintaining navigable clearance was critical but that this clearance varied depending on the location of any potential crossing.

Squamish is also a deep sea port with the operation of Squamish Terminals and its two berths at the southern end of 3rd Avenue. Squamish Terminals operates as a break bulk facility and both sends and receives cargo. Ground transportation for Squamish Terminals includes both a rail spur from the CN main rail line and a dedicated truck route through downtown Squamish. Of note, Schedule H2 of the OCP shows the designated truck route through downtown to be on 3rd Avenue, Pemberton Avenue and Cleveland Avenue. However, the truck route has evolved to be on 3rd Avenue, Vancouver Street, Loggers Lane and Cleveland Avenue over time instead. Because the port currently has about 3,500 truck shipments a year and this is expected to

increase to approximately 7,000 truck shipments a year in the future, it is critical that the future transport plan include dedicated truck routes.

The planning horizon selected for the Downtown Squamish Transport Plan was the year 2031 in order to coincide with the 2031 OCP planning horizon and the expectation that the transport study recommendations will be considered for inclusion in the OCP in a future amendment.

1.3 Mission Statement and Study Overview

The following mission statement was developed at the beginning of the project to guide the consultant team, the stakeholders and the public on the primary:

> *"To develop an updated Transport Plan for the Downtown peninsula that takes into account both the latest projections in development activity and regional traffic patterns in Squamish Valley while adhering to Smart Growth principles that ensure that the focus is on moving people and not vehicles"*

To accomplish the primary objective, the following key tasks were undertaken for this study:

1. Assess existing summer and winter peak conditions in order to quantify baseline conditions (***i.e. where are we today***);
2. Seek input from stakeholders and the general public on existing and future planned transportation facilities that are currently embedded in the Official Community Plan;
3. Update the District of Squamish's transportation computer model with new information;
4. Project travel demand for the year 2031 in order to assess the "Do-Nothing" baseline scenario (***i.e. where are we tomorrow if we do nothing but keep growing***);
5. Develop and test various "Do-Something" scenarios in order to determine what additional transportation network elements would be required to support the future development needs of greater Downtown Squamish but there would be no

change in the community's travel behaviours (***i.e. what would we have to add just to maintain the current traffic congestion status***);

6. Develop and test various "Do-Something-Sustainable" scenarios in order to determine what combination of new transportation network elements and sustainable initiatives would reduce the additional transportation infrastructure requirements for the year 2031 as part of adhering to Smart Growth principles (***i.e. how can we adjust the community's driving habits in order to minimize or defer building more roads***);
7. Assess the need for additional crossings of the Mamquam Blind Channel (***i.e. how many do we need and if warranted where should they be located***);
8. Develop a first draft of the 2031 multi-modal Transport Plan and present this to Council, District staff, stakeholders and the public for comments;
9. Develop a second draft of the 2031 multi-modal Transport Plan by incorporating as many comments as possible from Council, District staff, stakeholders and the public;
10. Document the study process in a draft report.
11. Finalize the 2031 multi-modal Transport Plan after a final round of consultation on the second draft of the plan; and
12. Issue the final report.

1.4 Study Area

FIGURE 1.1 illustrates the study. In summary, the:

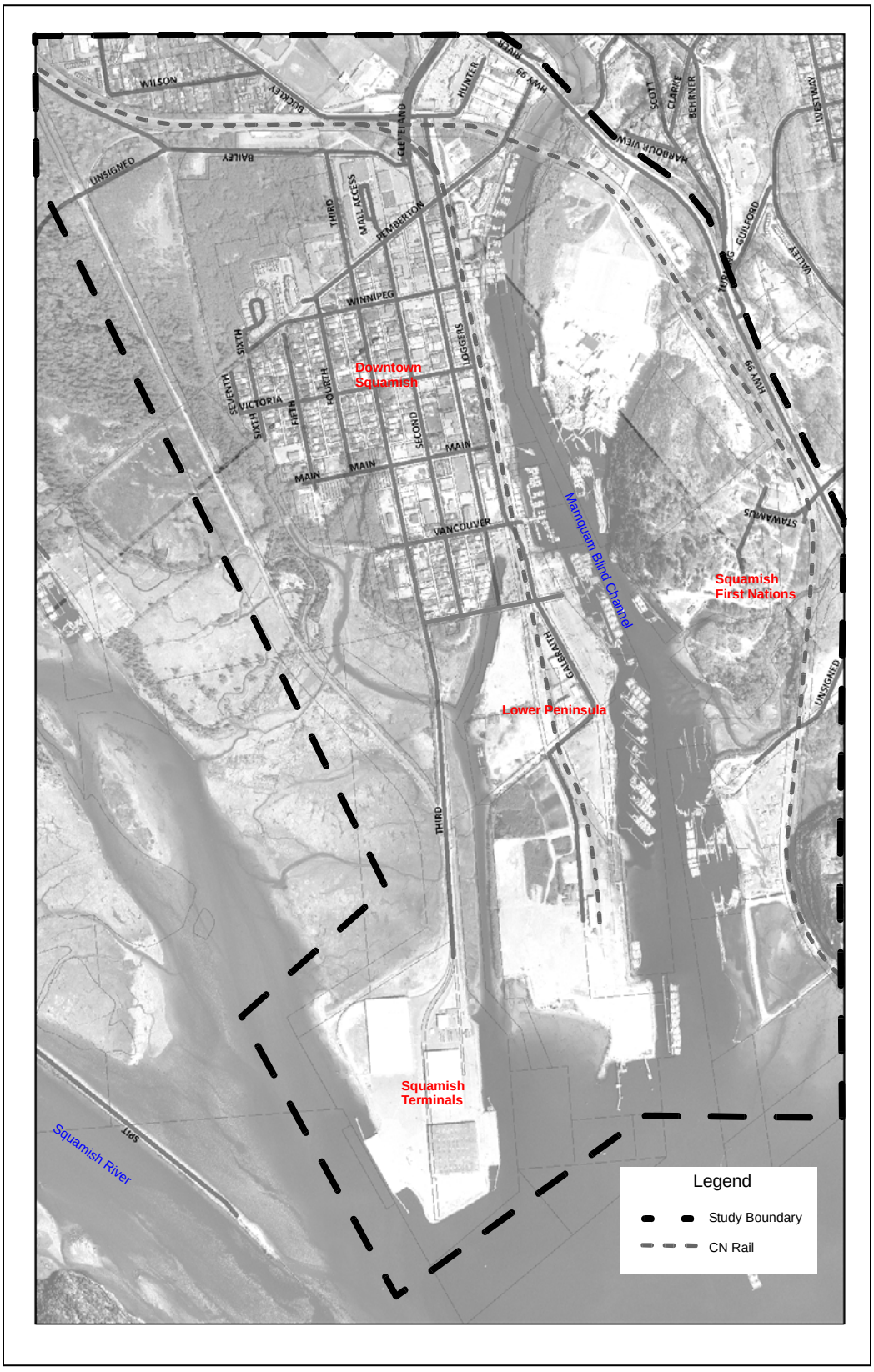
- NORTHERN boundary was the CN main rail line
- SOUTHERN boundary was Howe Sound
- EASTERN boundary was Highway 99
- WESTERN boundary was the Squamish River

All major roadways including District collectors and arterials roads, as well as Highway 99, located within the study area were examined in detail. However, all local roadways within the study area were not included in the analysis as they are typically are excluded from major

transportation studies since they typically carry traffic volumes that are not critical to defining the network requirements for a community.

Of note, the major road network outside of downtown Squamish was also included in the study but only at a macro level to ensure that regional travel patterns were accurately considered.

FIGURE 1.1 - STUDY AREA



SECTION 2 EXISTING CONDITIONS

2.1 Objectives

The development of a future transport plan first requires a solid understanding of existing conditions so that potential future changes have something to be measured up against. In order to do that for this project, the following key transportation surveys were conducted:

- To document existing traffic volume demand;
- To determine the percentage of Squamish based traffic on Highway 99 north and south of the community;
- To document existing travel behavior by transport mode entering and exiting downtown Squamish; and
- To document the existing parking supply available to the public in downtown Squamish.

In addition to documenting existing conditions, this information was also critical for updating the District's transportation computer model so that various future scenarios could be tested.

2.2 Regional Travel Patterns on Highway 99

The only source of an entire year's worth of traffic volume data in the Greater Squamish area are the permanent traffic count stations maintained by the Ministry of Transportation (MoT). MoT has these installed on key sections of their numbered highway system throughout British Columbia so that they can monitor traffic volumes on critical links 365 days a year. On Highway 99 near Squamish, MoT maintains permanent traffic count stations at the following locations:

- Station P-15-3 which is located 10.0 km north of Squamish on Highway 99; and
- Station P-15-8, which is located 6.2 km south of Cleveland Avenue.

The available data from both count stations was reviewed and analyzed in order to better understand the traffic patterns on Highway 99 entering and exiting Squamish by time of year and time of day.

2.2.1 Highway 99 Just North of Squamish

FIGURE 2.1 illustrates the Average Annual Daily Traffic (AADT) volume variation on Highway 99 just north of Squamish between the years 1999 and 2007. This data was obtained from MoT's permanent count station P-15-3, which is located 10.0 km north of Squamish. A review of the collected data from the past nine years has determined that the AADT volume has been fluctuating between the years 1999 and 2007 with no noticeable long term trend as illustrated in **FIGURE 2.1**. However, it is noted that the volumes have been increasing since 2006 with the year 2007 being the highest year recorded by the count station.

FIGURE 2.2 illustrates the monthly traffic volume variation on Highway 99 just north of Squamish between the years 2004 and 2008. This data was obtained from MoT's permanent count station P-15-3, which is located 10.0 km north of Squamish on Highway 99. From **FIGURE 2.2**, the peak monthly volume on Highway 99 consistently occurs in the summer months with August being the highest in 3 of the 4 years of data reviewed. There is a secondary peak that consistently occurs in March but it does not supersede the summer volumes on Highway 99.

A more detailed review of the July and August historical traffic volumes from 2007 was then undertaken to determine the variation by day of week and this is illustrated in **FIGURE 2.3**. From **FIGURE 2.3**, the peak weekday consistently occurred on a Friday while Sunday carried the highest weekend day volumes. The weekend traffic volume patterns on Highway 99 can also be readily seen in **FIGURE 2.3** as northbound traffic to Whistler and destinations further north are dominant on Fridays while southbound traffic from Whistler and elsewhere peaks on Sundays when traffic is returning to Greater Vancouver.

FIGURE 2.4 illustrates the hourly traffic volume profiles on Highway 99 for every Friday in August 2007. From **FIGURE 2.4**, it can be seen that there are three distinct peak hours each Friday, one during the morning, one at lunch and one in the afternoon. However, the afternoon peak hour is consistently the dominant hour of the day.

FIGURE 2.1
AVERAGE ANNUAL DAILY TRAFFIC VOLUME ON HIGHWAY 99 - NORTH OF SQUAMISH

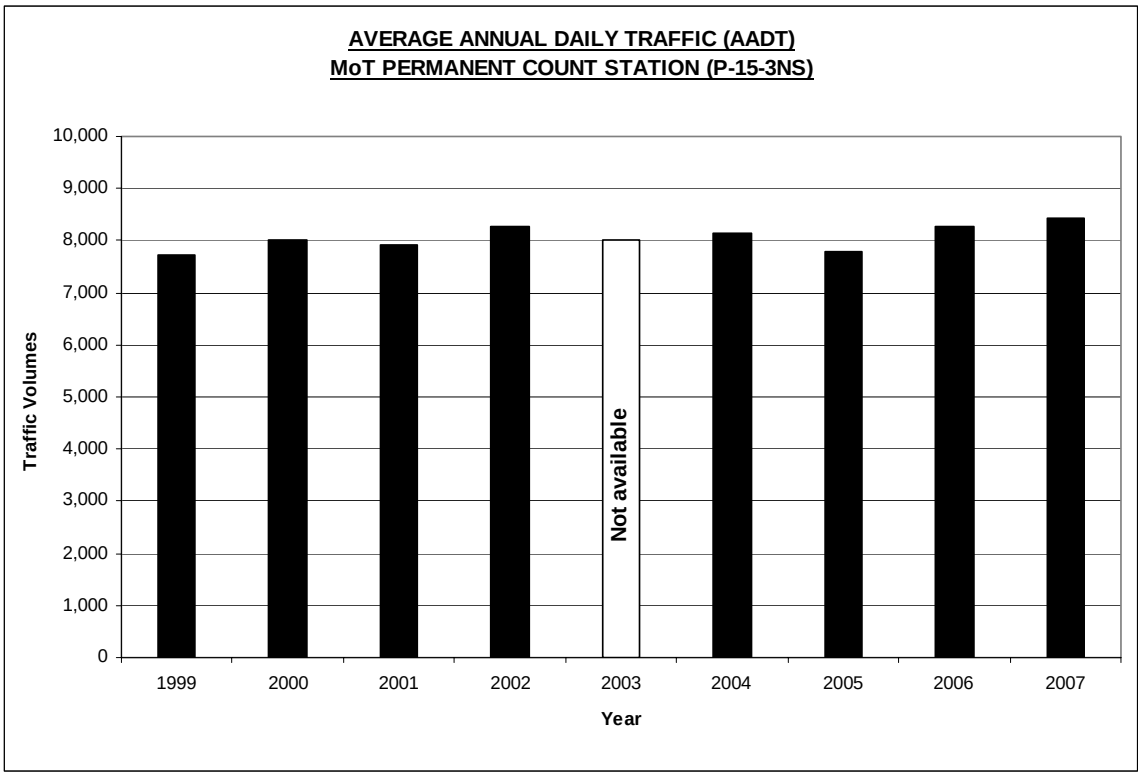


FIGURE 2.2
MONTHLY TRAFFIC VOLUME ON HIGHWAY 99 - NORTH OF SQUAMISH

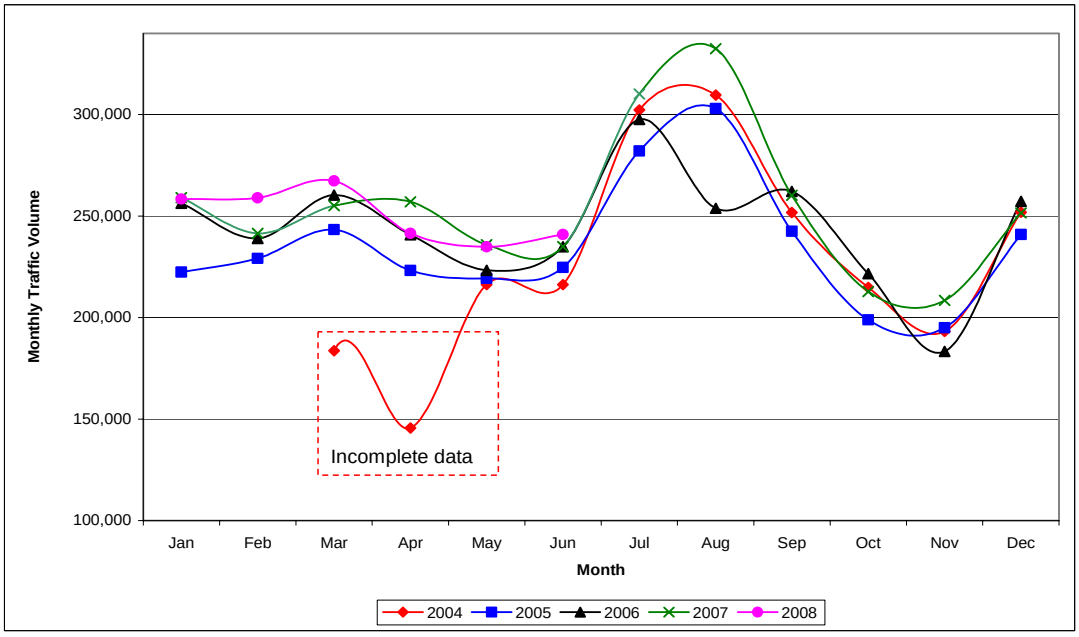


FIGURE 2.3
AVERAGE DAILY TRAFFIC VOLUME IN SUMMER ON HIGHWAY 99 - NORTH OF SQUAMISH

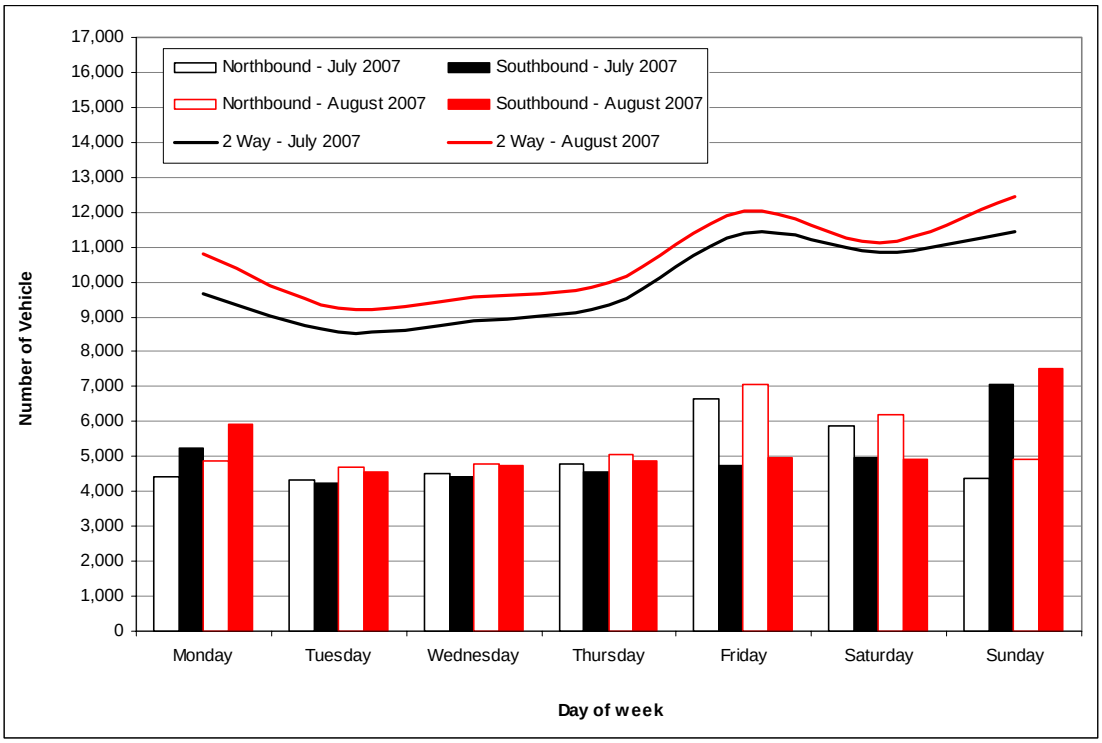
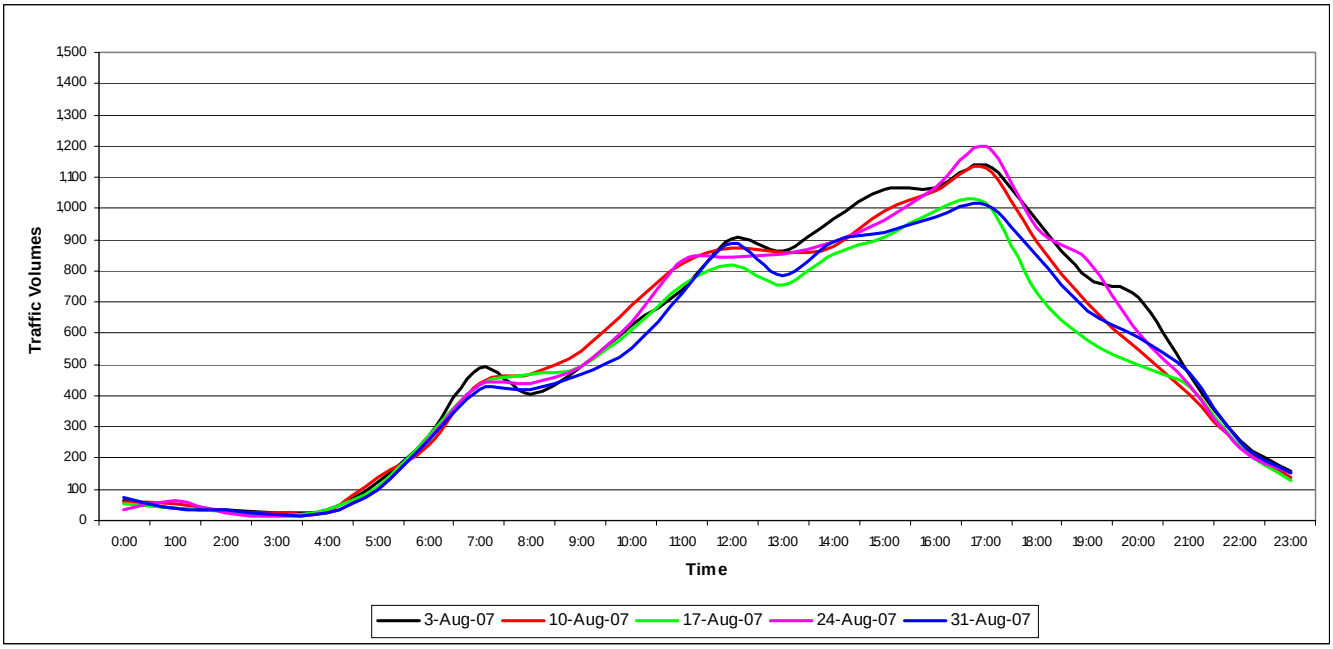


FIGURE 2.4
HIGHWAY 99 HOURLY TRAFFIC VOLUMES FOR SUMMER FRIDAYS - NORTH OF SQUAMISH



2.2.2 Highway 99 Just South of Squamish

FIGURE 2.5 illustrates the AADT traffic volume variation on Highway 99 just south of Squamish between the years 1999 and 2007. This data was obtained from MoT's permanent count station P-15-8, which is located 6.2 km south of Squamish. A review of the collected data from the past nine years has determined that the AADT volume has also been fluctuating between the years 1997 and 2007 with no noticeable long term trend. Of note, there is less more recent data available from MoT for this count station than the one north of Squamish, and that this disruption in continuous data is likely caused by the construction impacts of the Sea to Sky highway improvement project. The traffic data for this location is on average 40% higher than for the station north of Squamish and that is because of the increased trip making between Metro Vancouver and the District of Squamish (e.g. Squamish residents that work in downtown Vancouver, deliveries from Metro Vancouver distribution centres, etc.

FIGURE 2.6 illustrates the monthly traffic volume variation on Highway 99 just south of Squamish between the years 2004 and 2008. This data was obtained from MoT's permanent count station P-15-8, which is located 6.2 km south of Squamish. Of note, there is less more recent data available from MoT for this count station than the one north of Squamish, and that this disruption in continuous data is likely caused by the construction impacts of the Sea to Sky highway improvement project. From **FIGURE 2.6**, August is the dominant month of traffic volumes as well for the section of Highway 99 south of Squamish.

FIGURE 2.7 illustrates the daily variation in traffic volumes on Highway 99 for the months of July and August 2005. Similar to the section of Highway 99 north of Squamish, Fridays is the dominant weekday and Sundays is the dominant weekend day.

FIGURE 2.8 illustrates the hourly traffic volume profiles on Highway 99 for every Friday in August 2007. From **FIGURE 2.8**, it can be seen that there are two distinct peak hours each Friday, one during lunch and one in the late afternoon. However, the afternoon peak hour is consistently the dominant hour of the day.

FIGURE 2.5
AADT TRAFFIC VOLUME ON HIGHWAY 99 – SOUTH OF SQUAMISH

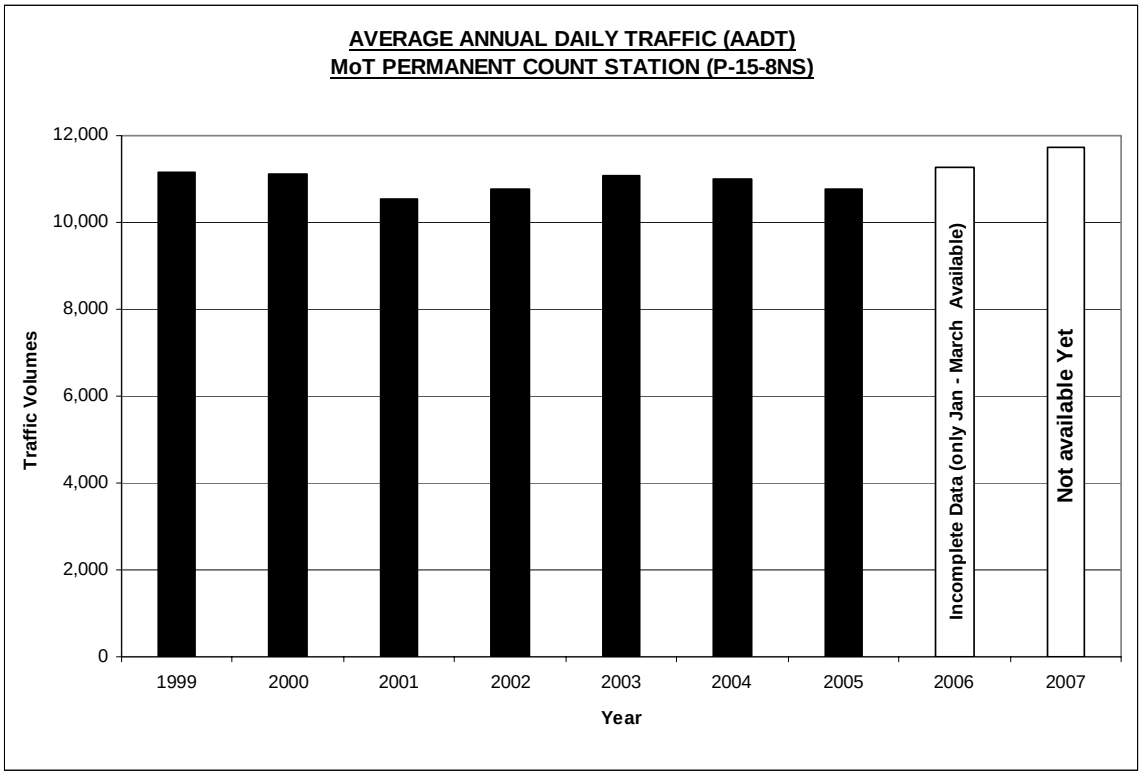


FIGURE 2.6
MONTHLY TRAFFIC VOLUME ON HIGHWAY 99 – SOUTH OF SQUAMISH

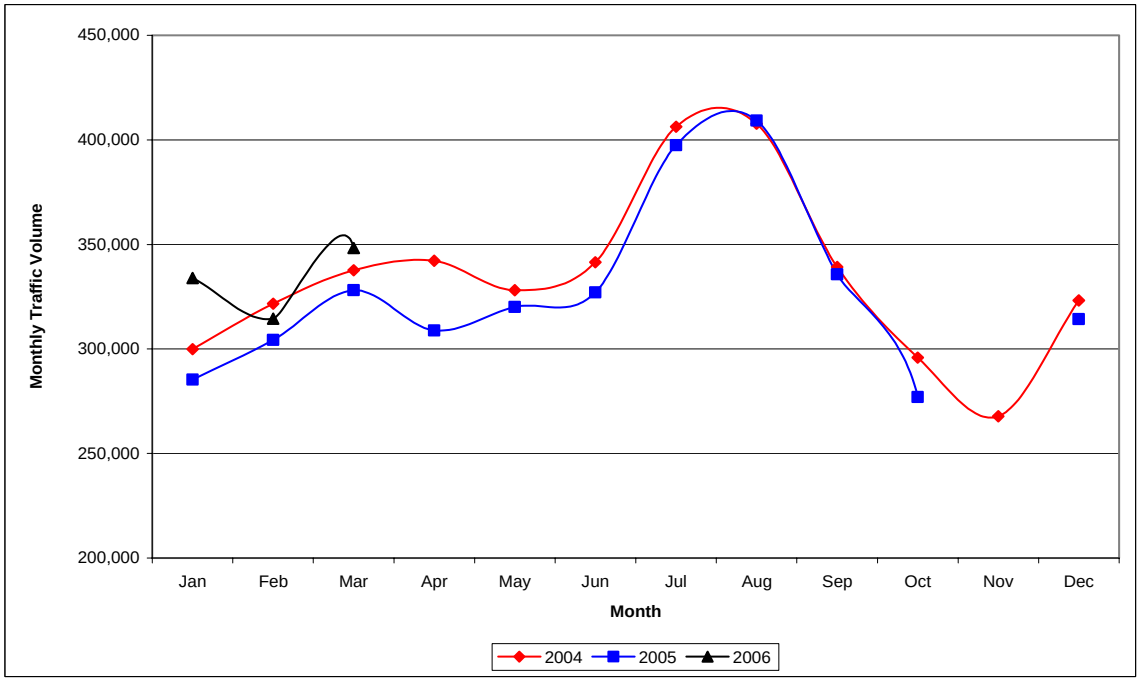


FIGURE 2.7
AVERAGE DAILY TRAFFIC VOLUME IN SUMMER ON HIGHWAY 99 - SOUTH OF SQUAMISH

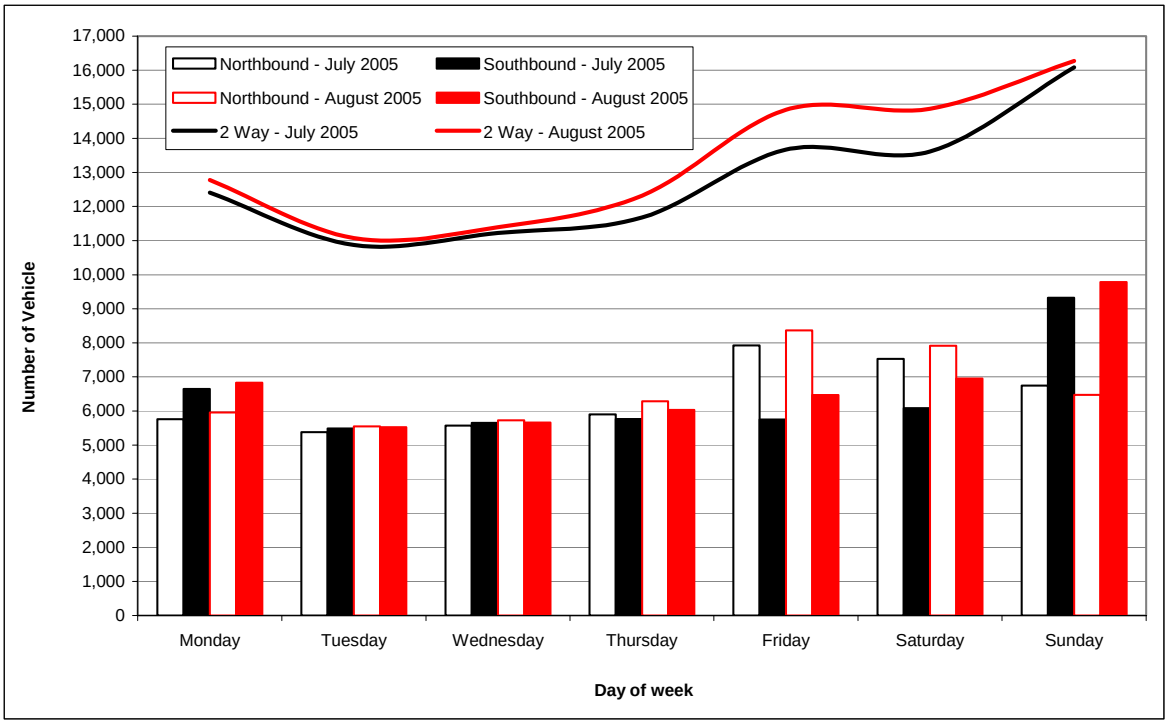
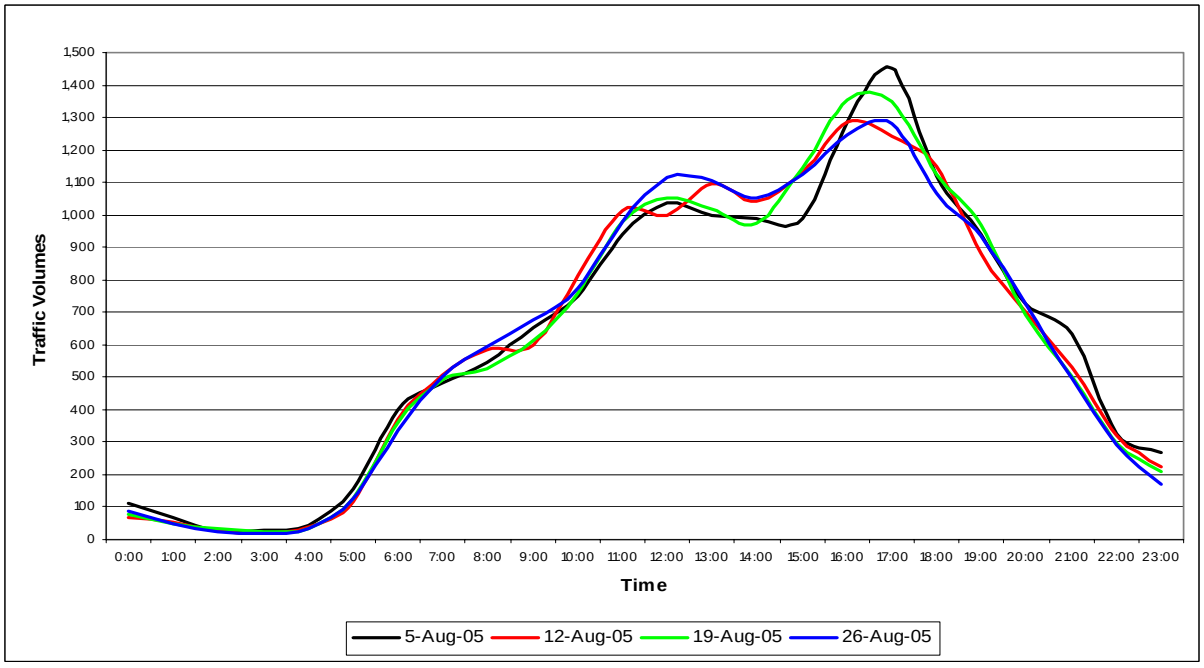


FIGURE 2.8
HIGHWAY 99 HOURLY TRAFFIC VOLUMES FOR SUMMER FRIDAYS - SOUTH OF SQUAMISH



2.2.3 Summary

From this review of regional traffic patterns on Highway 99, it was concluded that the summer Friday afternoon peak hour should be the dominant hour of the week for which to further assess both the existing and future transportation requirements of downtown Squamish.

2.3 Squamish Based Traffic on Highway 99

2.3.1 Overview

Many communities in British Columbia have a numbered Provincial Highway within their jurisdiction that not only provides the main vehicle access to and from neighbouring communities, but also forms an important part of the local road network, and Squamish is no different with the existence of Highway 99. However, as Squamish is located between Greater Vancouver and Whistler, both of which are major traffic generators, it was critical to the success of this study to better understand the traffic volume mix of local and non-local based traffic on Highway 99. In order to determine this ratio, a vehicle license plate survey was conducted on Highway 99 in order to survey the Friday afternoon peak hour.

A license plate survey records the entering and exiting vehicle license plates, along with a time stamp, at every entry and exit point of a community, during an entire survey period. The collected data is then transcribed into a database and then the peak hour is determined based on the recorded entering and exiting traffic volumes. Then, all the recorded license plates within the peak hour are then reviewed to look for matches (e.g. a northbound vehicle with plate #123 ABC entered Squamish on Hwy 99 at 16:30 and was again observed exiting the community still heading north on Hwy 99 at 16:40). In addition to finding a license plate match, the travel time it took that matched vehicle to both enter and exit a community is just as critical as it determines whether the vehicle was just “passing through” the community and not stopping or in fact had an origin or destination within the community and thus constituted a “local trip”. In the previous example given of the vehicle with license plate # 123 ABC, that vehicle would be classified as an “external” trip with no origin or destination within Squamish and that it was just “passing through” the community.

2.3.2 Methodology

A 3-hour license plate survey was conducted on Friday, August 24, 2007 from 15:00 to 18:00 in order to quantify the regional travel patterns on Highway 99. To capture the majority of trips entering and exiting the study area, the following survey stations were setup:

- *STATION 1:* North of Squamish on Highway 99 just north of Alice Lake Provincial Campground access road; and
- *STATION 2:* South of Squamish on Highway 99 just south of Shannon Falls Provincial Park access road.

The recorded digits of each license plate and the corresponding time observed to the nearest minute were recorded by direction using digital Dictaphones, which allow for the accurate reading and recording of vehicle license plates travelling at speed past a survey station. Every effort was made to establish a precise population by recording all missed plates with a "dash" (i.e. those that could not be read). Recorded license plates with less than four digits were considered a missed plate and excluded from the sample. The observed sample for the afternoon peak hour was then normalized with the population to reflect 100% traffic sample. All data presented in the analyses and exhibits was based on normalized numbers.

2.3.3 Findings

The license plate data at the two stations was combined and then summarized for the entire three hours. Each direction was examined separately to maximize the precision of the analysis. This is common practice to use the sample (observed license plate only) and the population (all vehicle observed) to develop the adjustment factor. Depending on the desire line, the applicable movements' factor are then averaged and applied to the actual license plate matches to reflect a sample of 100%. The collective sample rates are summarized in **TABLE 2.1**.

TABLE 2.1
SAMPLE RATE CALCULATION

STATION	RECORDED PLATE (vehicle / 3 hours)		TOTAL TRAFFIC (vehicle / 3 hours)		SAMPLE RATE		
	NB	SB	NB	SB	NB	SB	AVERAGE
1. Shannon Falls	2,315	1,504	2,478	1,617	93.4%	93.0%	93.2%
2. Alice Lake	1,417	1,347	1,723	1,474	82.2%	91.4%	86.8%

From **TABLE 2.1**, a total of 3,662 vehicles were recorded entering Squamish over a three hour period. Similarly, 2,921 vehicles were recorded exiting Squamish during the same time period. Therefore, more vehicles were recorded entering Squamish than leaving during the Friday afternoon period, and that it is hypothesized that this is due to a combination of local residents returning home from their jobs located outside of Squamish and the beginning of the influx of weekend and recreational traffic that has stopped in Squamish.

The Manual of Transportation Engineering Studies (*ITE, 1994)* states that sample sizes for license plate traces rarely exceed 60% and that a minimum of 10% should be strived for in order to obtain a database that is statistically valid. Because the average sample size was 90% for the Squamish license plate survey, the sample size was considered excellent and that the data was considered to be statistically valid.

The license plate data was then reviewed in detail in order to quantify the amount of traffic for the following desire lines during the afternoon peak hour:

<u>Southbound traffic that had either:</u>

- a destination within Squamish or
- exited past Shannon Falls.

<u>Northbound traffic that had either:</u>

- a destination within Squamish or
- exited past at Alice Lake.

Regarding the ”destination within Squamish”, the only information that could be extracted from the license plate database was that a vehicle’s trip origin or destination was within the community. However, using information on turning movement volumes

at critical Highway 99 intersections within Squamish, further observations on travel patterns within the community could be estimated. As well, the collected information was of sufficient detail to permit for the accurate updating of Squamish's transportation computer model at a "macro" level outside of downtown Squamish.

The vehicular traffic volumes associated with each of the above stations are summarized in **TABLE 2.2** and illustrated in **FIGURE 2.9** and **FIGURE 2.10.**

TABLE 2.2
LICENSE PLATE SURVEY RESULTS
(vehicle volumes and percentages)

AFTERNOON PEAK HOUR (15:00 - 16:00)				DESTINATION					
				Shannon Falls		Alice Lake		Within Squamish	
ORIGIN	Alice Lake	491	100%	289	59%			202	41%
	Shannnon Falls	826	100%			395	48%	431	52%

From **TABLE 2.2**, the following key observations can be made:

1. 826 northbound vehicles were observed on Highway 99 entering at Shannon Falls while 491 southbound vehicles were observed entering at Alice Lake during the Friday afternoon peak hour.
2. For the northbound traffic, 52% had a destination within Squamish while the remaining 48% of the traffic flow was external traffic and just "passing through" Squamish.
3. For the southbound traffic, 41% had a destination within Squamish while the remaining 59% of the traffic flow was external traffic and just "passing through" Squamish.

FIGURE 2.9
FRIDAY AFTERNOON PEAK HOUR
SUMMER 2007 NORTHBOUND TRAFFIC VOLUMES

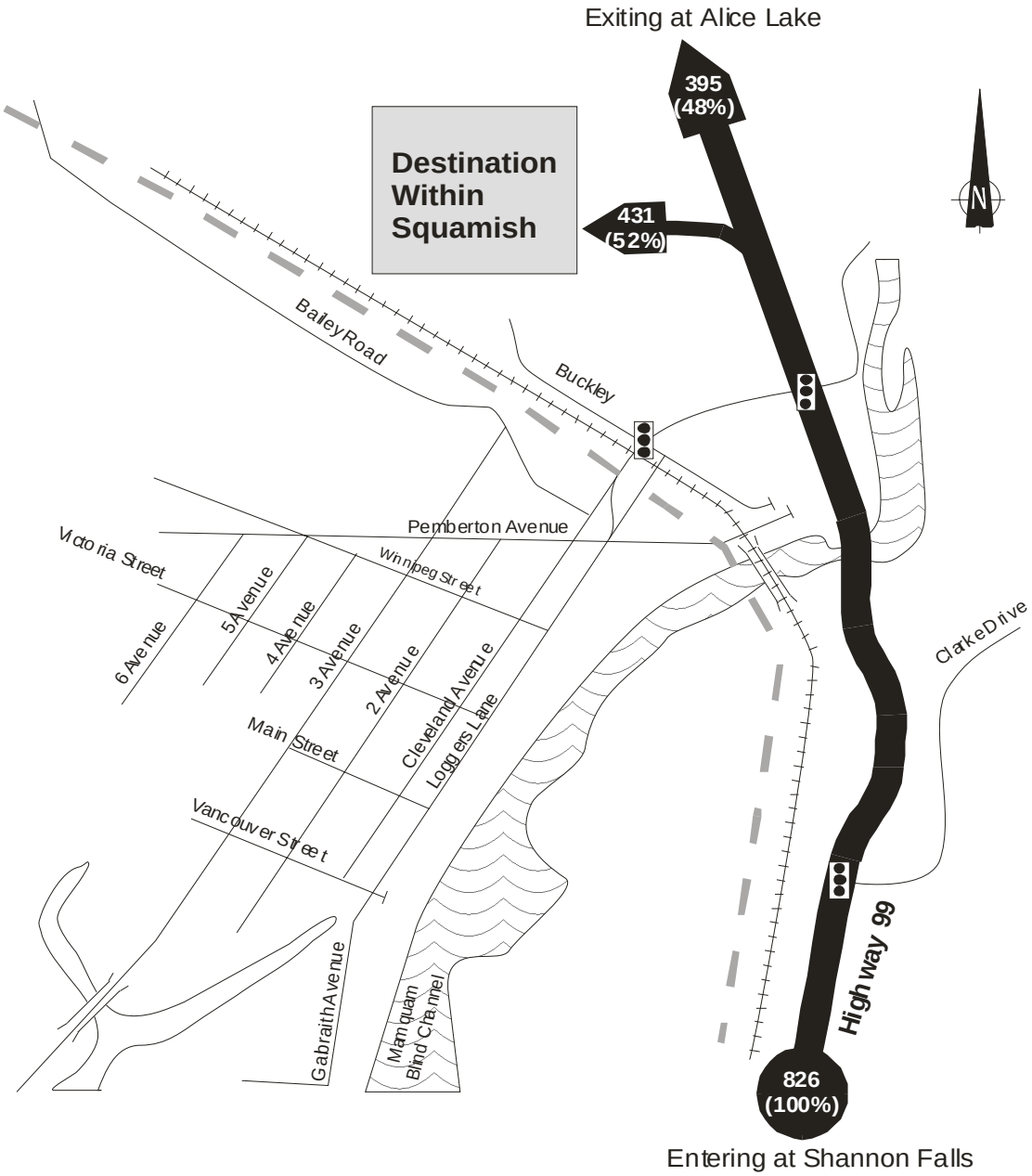
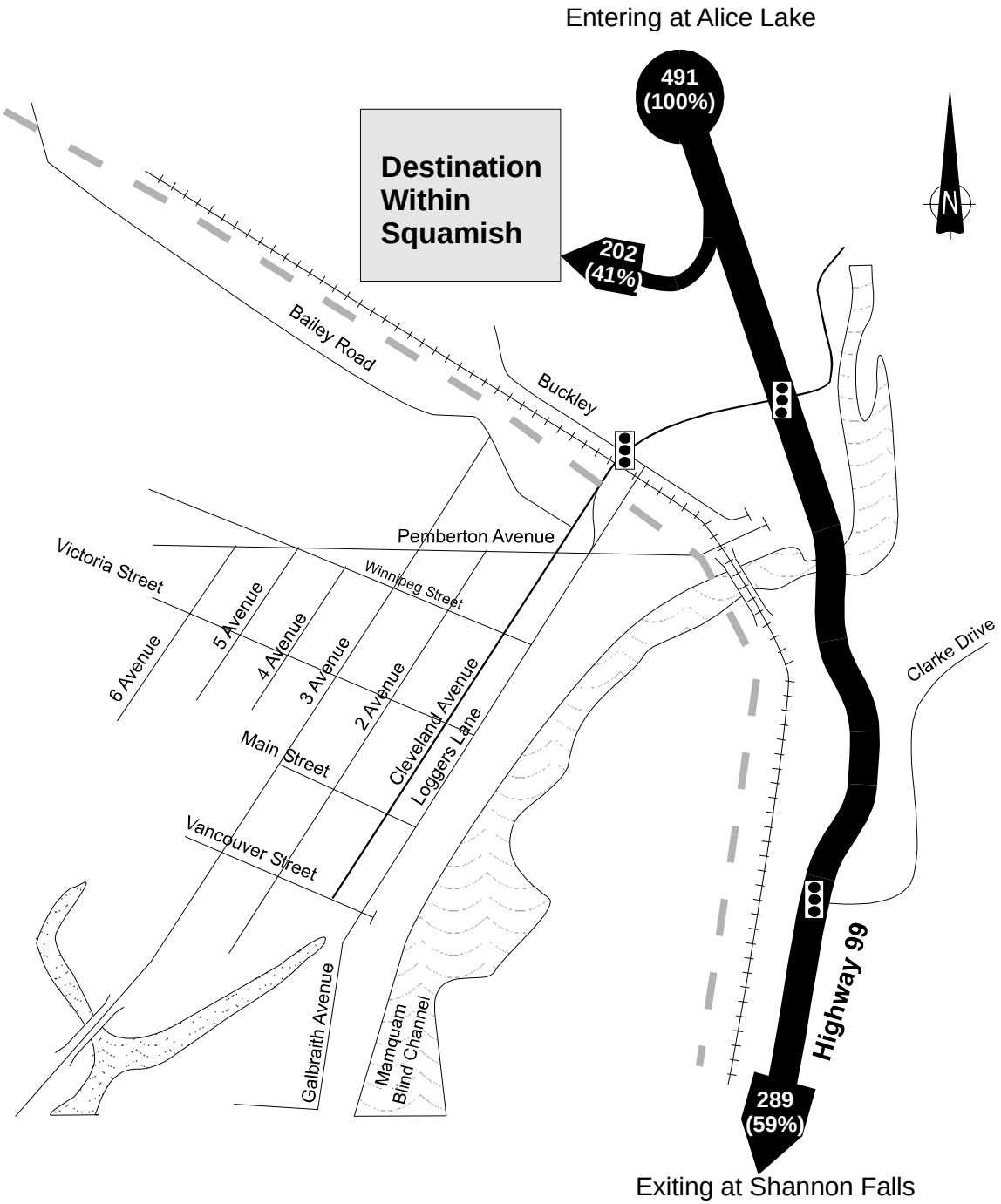


FIGURE 2.10
FRIDAY AFTERNOON PEAK HOUR
SUMMER 2007 SOUTHBOUND TRAFFIC VOLUMES



Of note, the determination of whether a matched license plate was an external or local trip was based on the average travel time it took for various trial runs conducted between the north and south survey stations. The trial runs of "external traffic" ranged from 12 to 15 minutes depending on the level of traffic congestion and number of red traffic signals encountered by the survey vehicles. Therefore for this survey, a travel time of 15 minutes or less was used to determine if the vehicle was external traffic on Highway 99 and just "passing through" Squamish. It is recognized that there is likely a significant percentage of Highway 99 traffic that briefly stops in Squamish for fuel or food but from a modeling point of view, are considered local traffic as they have generated additional trips by having stopped within the community.

2.4 Transport Mode Survey Study

2.4.1 Overview

Because one of the primary objectives of this study was to develop a multi-modal transport study for downtown Squamish, it was critical to understand where people currently enter and exit the study area and by what mode of transport. In order to do this, a comprehensive one day survey was undertaken on a typical Friday in both summer and winter conditions so that benchmarks could be established from which to develop the future transport plan.

2.4.2 Methodology

The summer survey was conducted on Friday, August 23, 2007 and the winter one on Friday, January 18, 2008. Both surveys collected data continuously from 7:00 am to 6:00 pm with information being recorded on every person's movement entering and exiting downtown Squamish at the following entry points:

- Bailey Road at northwest end of downtown Squamish;
- Pedestrian rail crossing from Buckley to Bailey Road;
- Cleveland Avenue at rail crossing;
- Loggers Lane at rail crossing; and
- Pemberton Avenue by the railway crossing and rail bridge

These locations are illustrated in **FIGURE 2.11**. At each location, the following modes of transport were recorded that was associated with each person's movement:

- Passenger car;
- Truck;
- Bus;
- Motorcycle;
- Bicycle;
- Walk; and
- Other

2.4.3 Summer Person Trip Volumes

FIGURE 2.12 illustrates the inbound and outbound demand profile of all person trips during the summer survey between 07:00 and 18:00. The summer inbound flow peaked at 13:00 while the outbound peak flow occurred at 16:15.

FIGURE 2.12
INBOUND AND OUTBOUND PERSON TRIP VOLUMES FROM SUMMER SURVEY ENTERING AND EXITING DOWNTOWN SQUAMISH

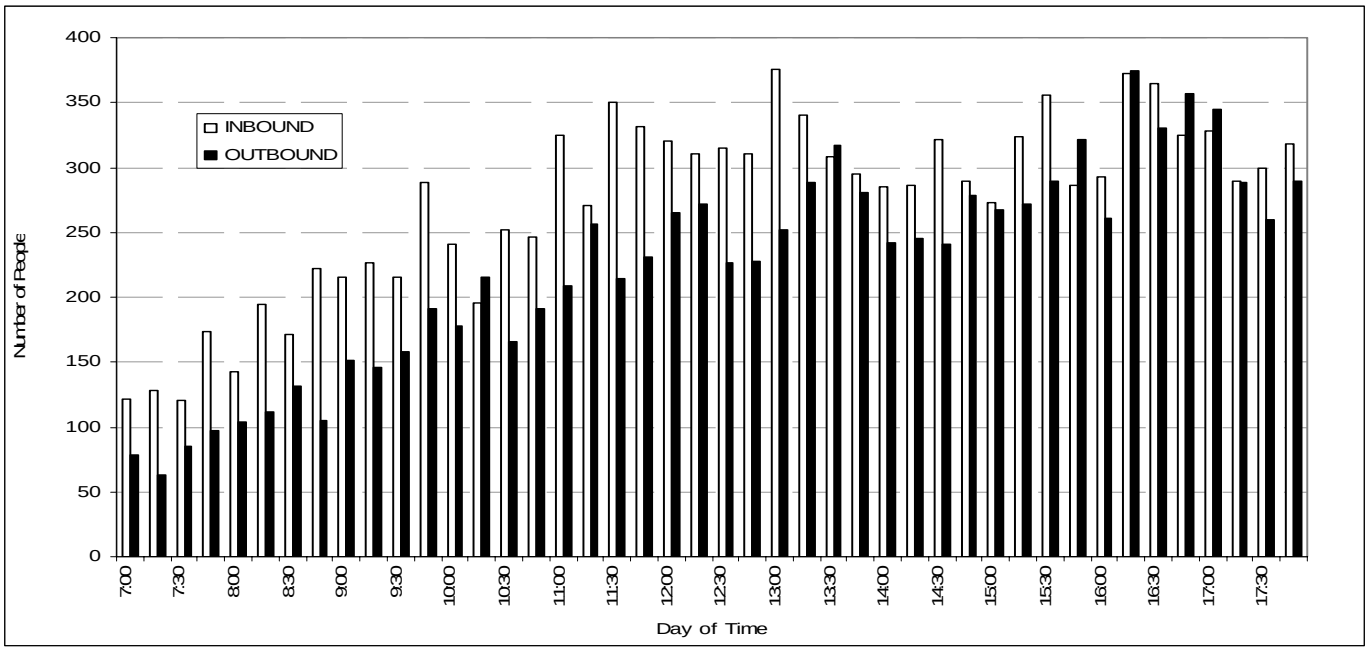


FIGURE 2.11
LOCATIONS OF PERSON TRIP SURVEY STATIONS

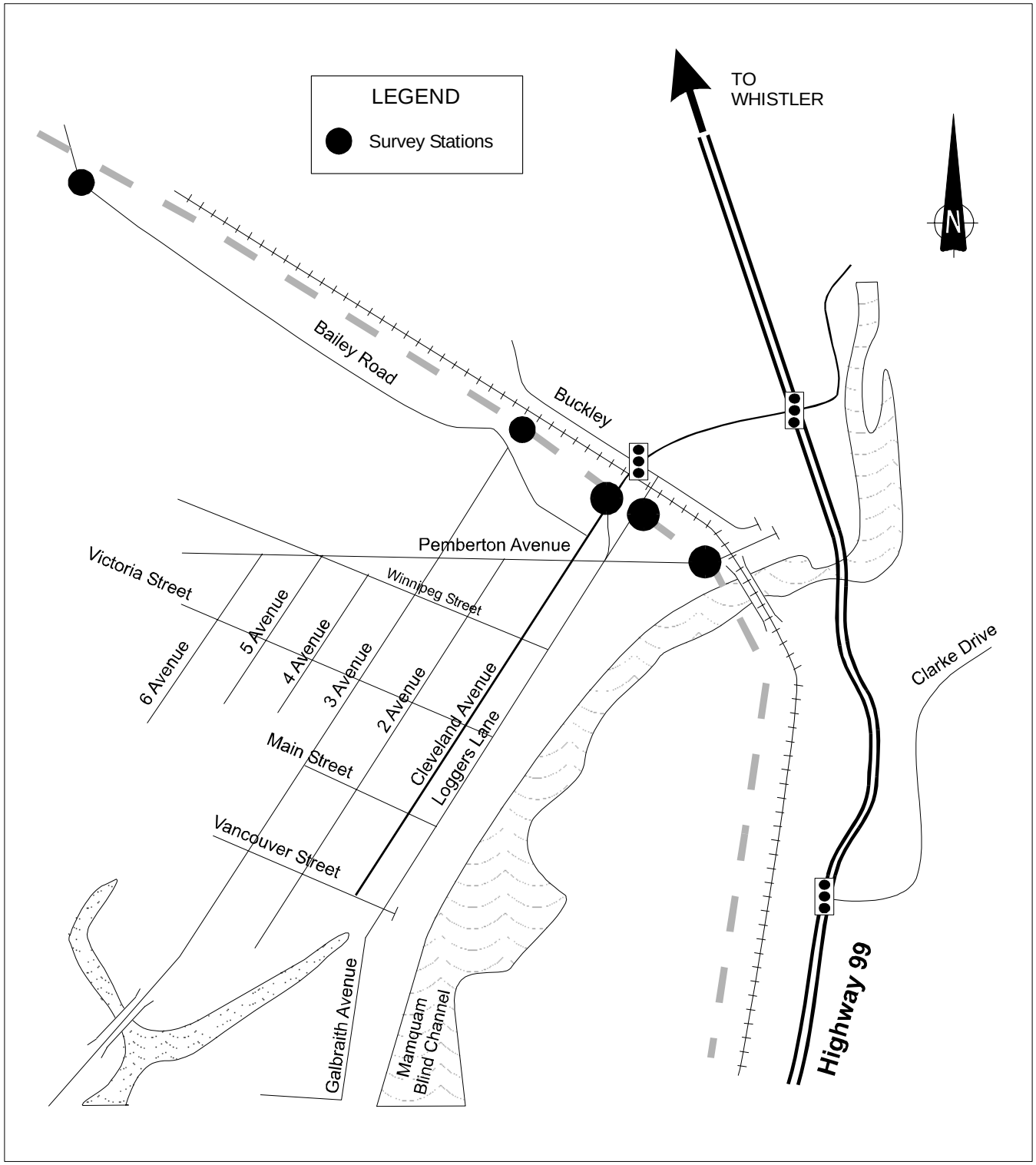
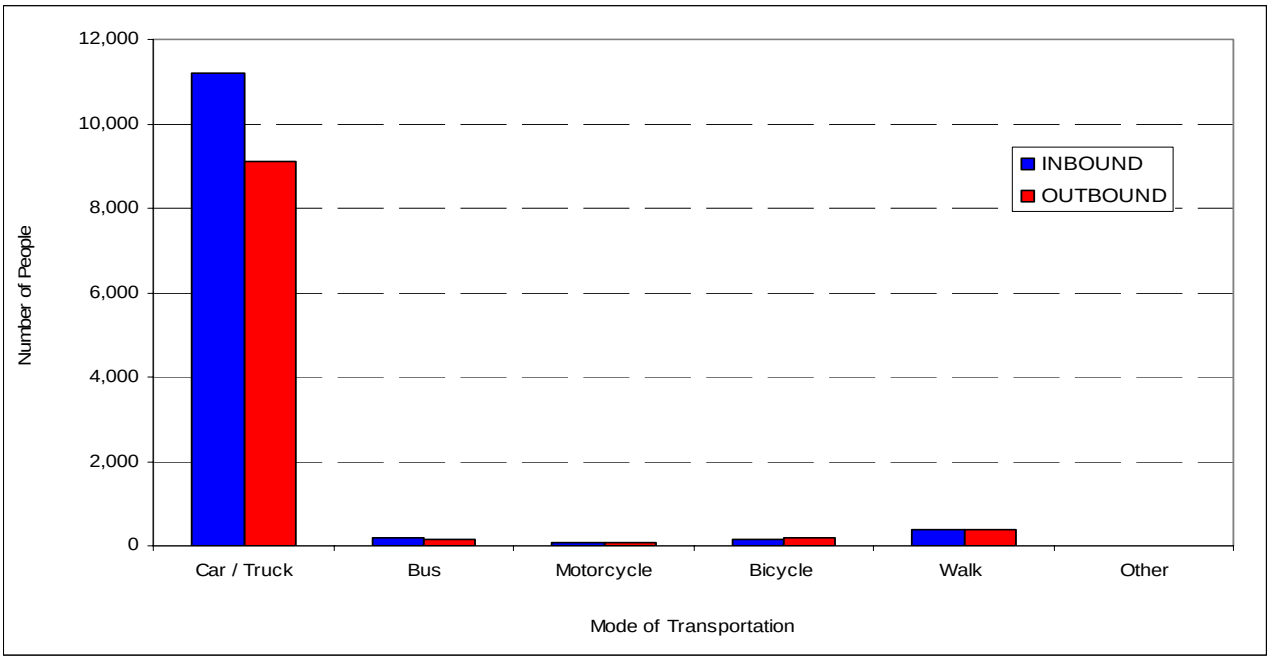


FIGURE 2.13 illustrates the summer transport mode choice used by persons entering and exiting downtown Squamish and it is clear, that car and truck are the dominant mode of transport (at almost 93%) of all observed person trips and walking a distance second place. Public transport, which for most urban communities is the next most viable and effective mode of transport for moving people, is clearly not well used in Squamish (at only 1.5%).

FIGURE 2.13
SUMMER PERSON TRIP TRANSPORT MODE CHOICE
ENTERING AND EXITING DOWNTOWN SQUAMISH



2.4.4 Winter Person Trip Volumes

FIGURE 2.14 illustrates the inbound and outbound demand profile of all person trips during the winter survey between 07:00 and 18:00. The winter inbound flow peaked at 14:30 while the outbound peak flow occurred at 17:00.

FIGURE 2.14
INBOUND AND OUTBOUND PERSON TRIP VOLUMES FROM WINTER SURVEY ENTERING AND EXITING DOWNTOWN SQUAMISH

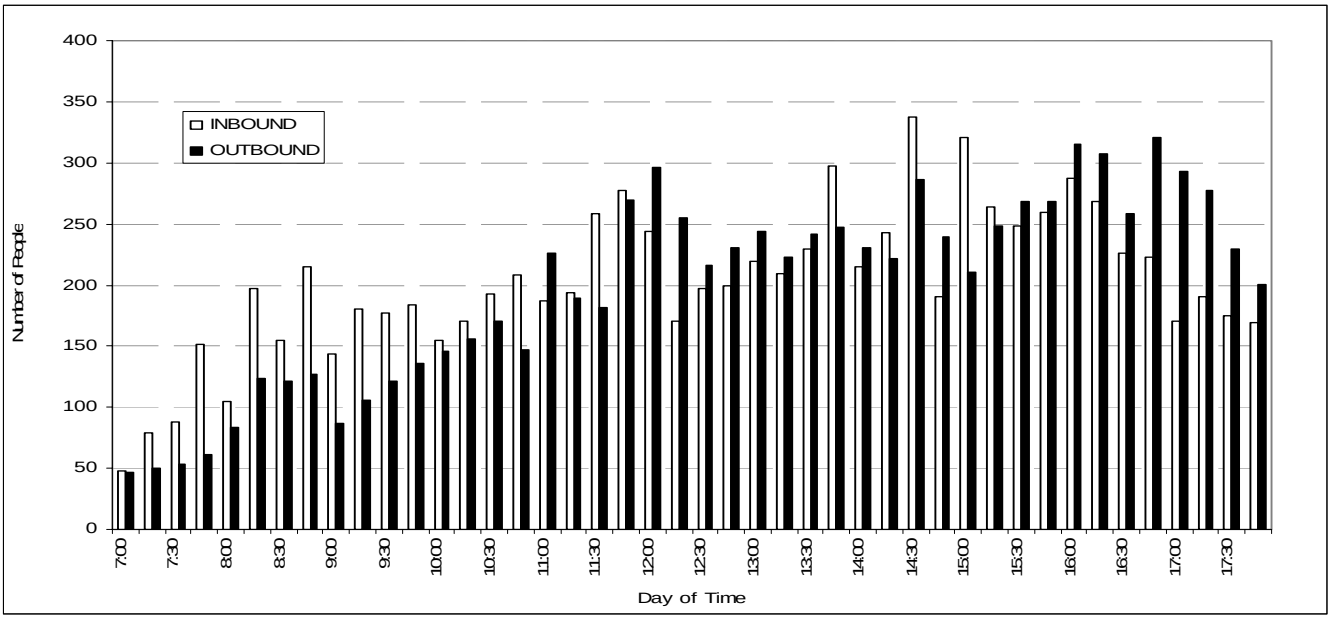
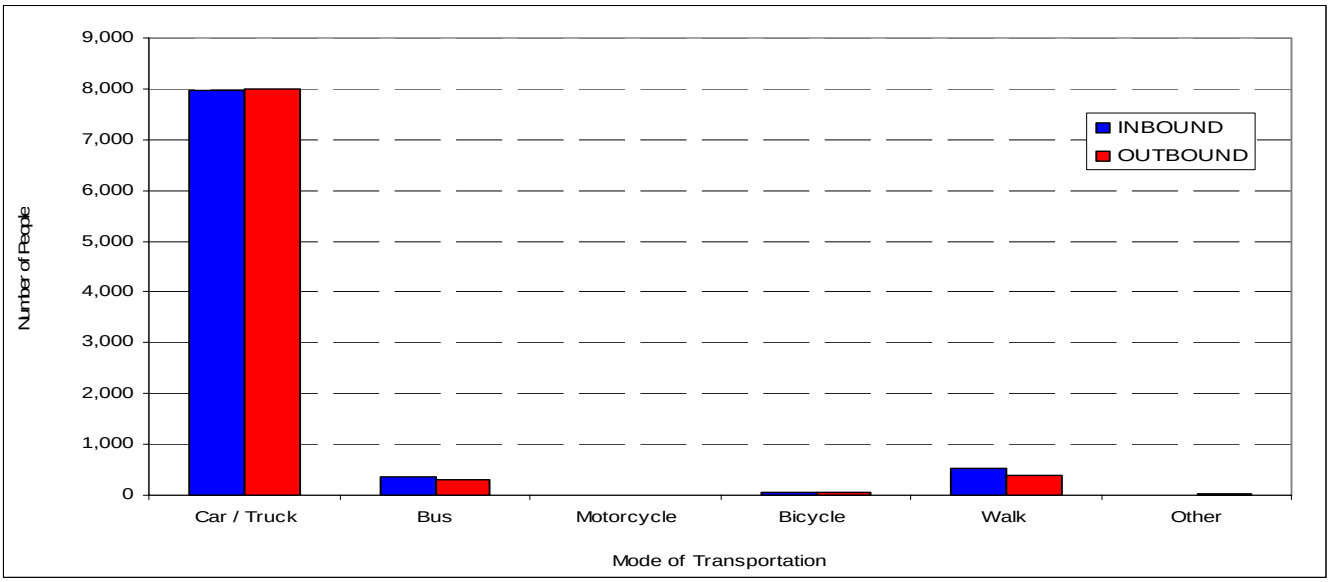


FIGURE 2.15 illustrates the winter transport mode choice used by persons entering and exiting downtown Squamish and it is clear, that car and truck are still the dominant mode of transport (at 92%) of all observed person trips and walking a distance second place. Public transport, which although was higher in the winter survey, was still not well used in Squamish (at only 1.8%).

FIGURE 2.15
WINTER PERSON TRIP TRANSPORT MODE CHOICE
ENTERING AND EXITING DOWNTOWN SQUAMISH



2.4.5 Seasonal Patterns

Almost 40,000 people movements were observed on the two survey days entering and exiting downtown Squamish. A total of 21,890 person movements were recorded during the 11 hour summer survey and 17,643 person movements during the 11 hour winter survey. Therefore, summer travel demand was 24% higher than the winter survey day.

FIGURE 2.16 illustrates the comparison in person trip volumes entering and exiting downtown Squamish volumes for the August 2007 and January 2008 surveys. **FIGURE 2.16** shows that the summer person trip volumes were consistently higher than winter volumes for the majority of the 10 hour survey and that the summer peak hour occurred between 16:00 and 17:00.

FIGURE 2.16
TOTAL PERSON TRIP VOLUMES ENTERING AND EXITING DOWNTOWN

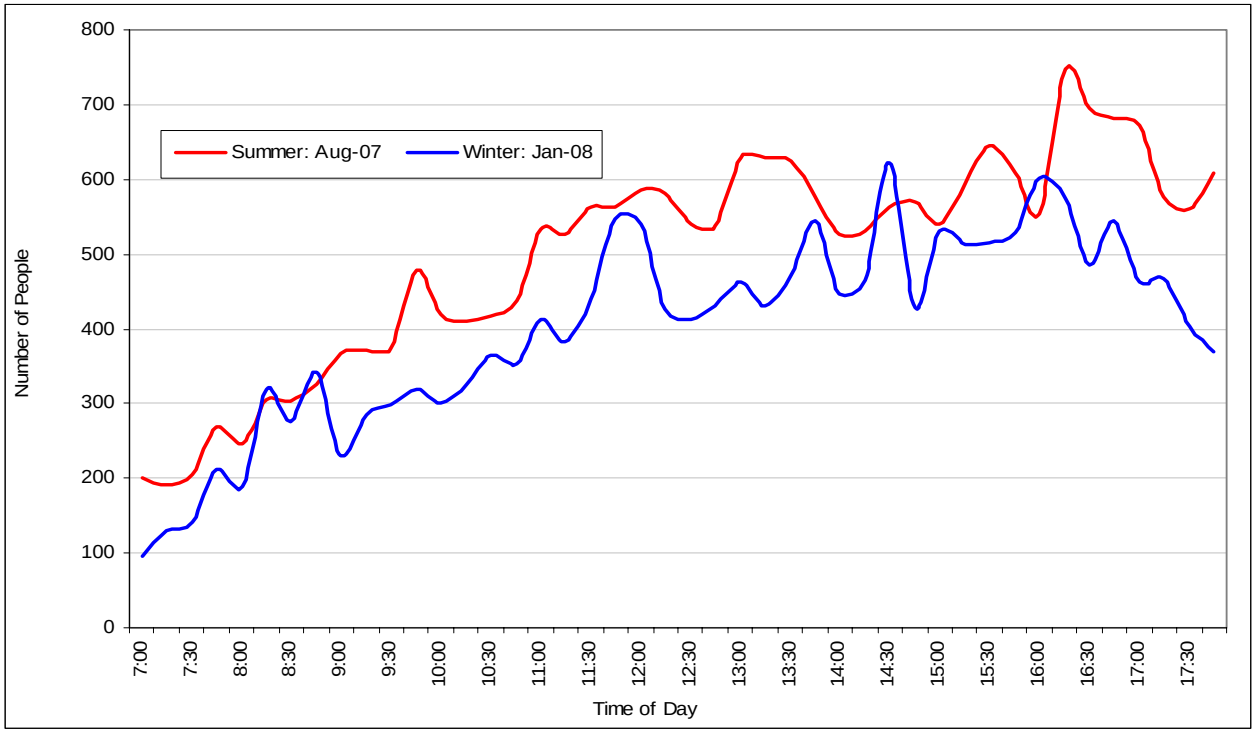


TABLE 2.3 summarizes the person trip volumes recorded for both 11 hour surveys with the data being classified by transport mode. This summary of the the data illustrates that seasonal variations by transport mode type were minor and that a motorized vehicle was the dominant mode of transport for the majority of people entering or exiting downtown Squamish.

TABLE 2.3
COMPARISON OF PERSON TRANSPORT MODE CHOICE
ENTERING AND EXITING DOWNTOWN SQUAMISH
FOR BOTH SUMMER AND WINTER CONDITIONS

YEAR	Car/Truck	Public Transit	Motorcycle	Bicycle	Walk	Other	*Total*
Summer 2007	20,294	328	154	350	738	26	21,890
	92.7%	*1.5%*	*0.7%*	*1.6%*	*3.4%*	*0.1%*	*100.0%*
Winter 2008	15,965	663	7	95	902	25	17,657
	90.4%	*3.8%*	*0.1%*	*0.5%*	*5.1%*	*0.1%*	*100.0%*

2.4.6 Comparison with Other Communities in B.C.

In order to determine how the existing transport mode splits for downtown Squamish compare with other communities in B.C. transport mode wise, **TABLE 2.4** was prepared with available information from the following:

- The City of Revelstoke (from a community wide telephone survey in 2007)
- The City of Vancouver (2004 Translink Trip Diary Survey)
- Metro Vancouver (2004 Translink Trip Diary Survey)
- Future Metro Vancouver (From 2008 B.C. Transit Plan)

TABLE 2.4
COMPARING SQUAMISH'S TRANSPORT MODE CHOICES TO OTHER COMMUNITIES

LOCATION		MODE OF TRANSPORTATION						
		Car / Truck	Bus	Motor-cycle	Bicycle	Walk	Other	*Total*
Squamish	Summer 2007	92.7%	1.5%	0.7%	1.6%	3.4%	0.1%	*100.00%*
	Winter 2008	90.4%	3.8%	0.1%	0.5%	5.1%	0.1%	*100.00%*
Revelstoke	Summer	51.8%	1.2%		19.8%	27.2%	0.0%	*100.00%*
	Winter	73.8%	1.8%		3.3%	21.1%	0.0%	*100.00%*
City of Vancouver	Fall 2004	60.5%	20.1%		2.6%	16.8%	0.0%	*100.00%*
Metro Vancouver	Fall 2004	76.5%	10.8%		1.7%	11.0%	0.0%	*100.00%*
	BC Gov't Plan for 2020		17.0%					
	BC Gov't Plan for 2030		22.0%					

The City of Revelstoke was selected because it actually had transport mode data available and it has the following similar attributes to Squamish:

1. It is also located on a major rail corridor (CP Rail vs. CN);

2. It is also located on a major provincial highway (Trans Canada Hwy vs. Hwy 99) which also carryies significant volumes of external traffic;
3. Downtown Revelstoke is located off Highway 1 just like Squamish;
4. There is a major ski resort nearby;
5. The population of Revelstoke was 7,500 in 2006 which although is almost half of Squamish's, has more in common than say Vancouver.

From **TABLE 2.4**, it is clear that Squamish is a vehicle orientated community and that public transit, walking and cycling have significant opportunities for improvement in order to provide for a more balanced transport system.

2.5 Traffic Counts

2.5.1 Overview

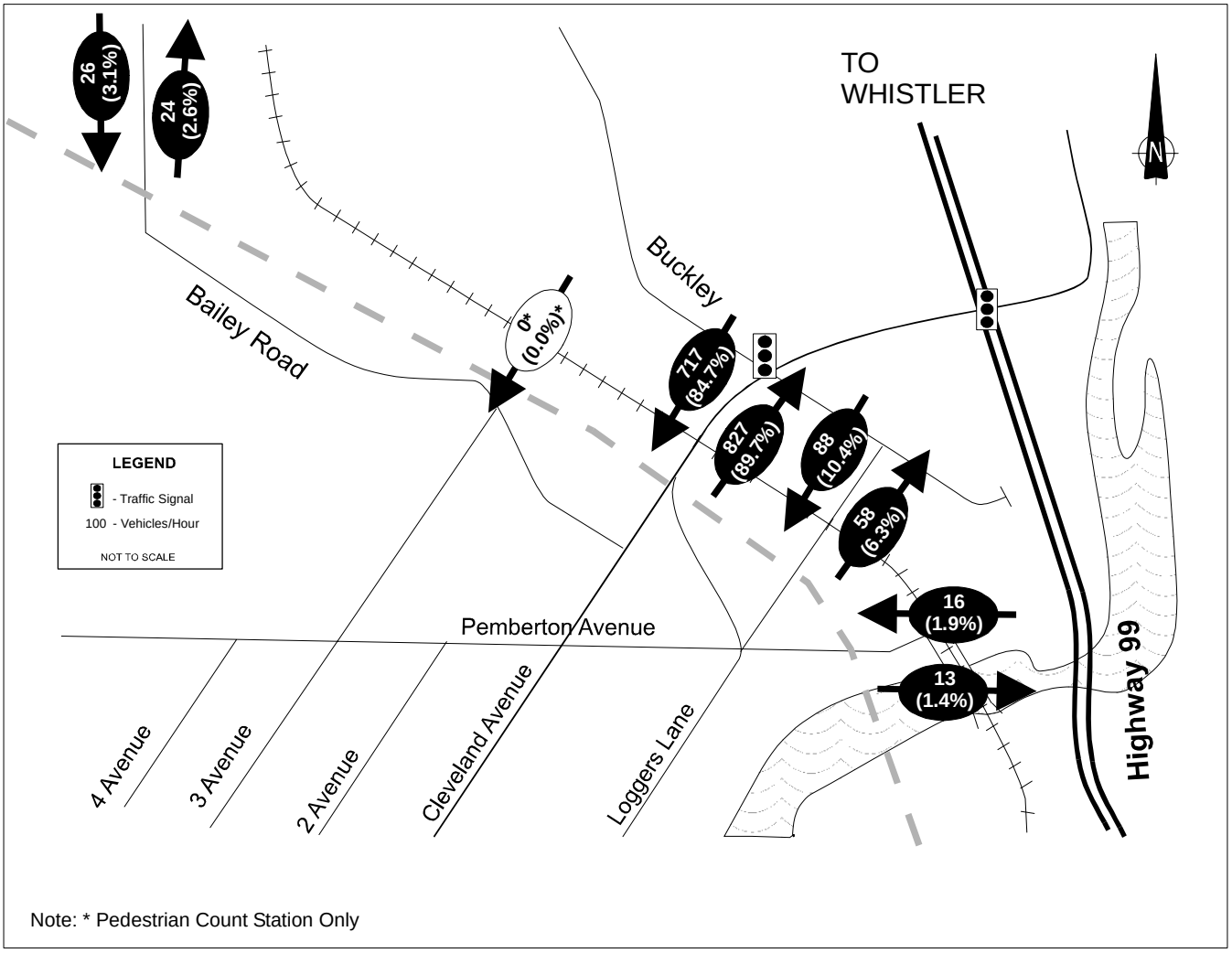
A comprehensive traffic volume data collection program was undertaken in August 2007 in order to document base line conditions and to provide sufficient traffic data to calibrate the transportation model.

2.5.2 Screenline Survey Methodology

A screenline survey was undertaken along the CN main railway corridor to record the inbound and outbound vehicle volumes at the five survey stations illustrated previously in **FIGURE 2.11**. The data was collected from 07:00 to 18:00 on both Friday, August 23, 2007 and Friday, January 18, 2008. **FIGURE 2.17** and **FIGURE 2.18** illustrate the screenline volumes for Summer and Winter conditions respectively. In reviewing the collected traffic volume data, the following observations can be made:

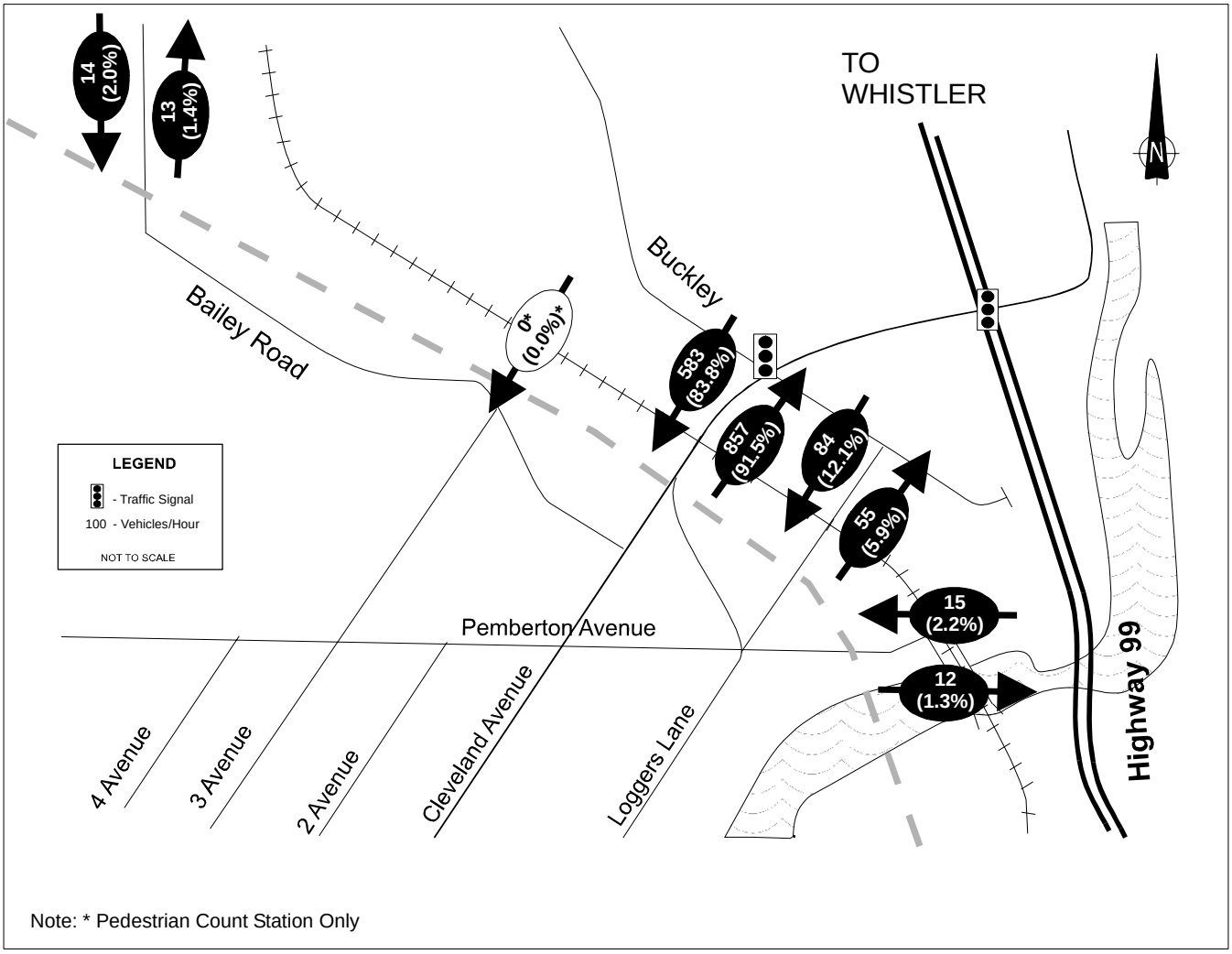
1. The majority of municipal roads surveyed carry volumes less than 200 vehicles per direction during the peak hour (16:00 – 17:00). This level of traffic demand can easily be handled by one lane of traffic;
2. During the 2007 Summer afternoon peak hour, a total of 1,769 vehicles were observed crossing the CN main railway corridor (i.e. 847 vehicles towards downtown and 922 vehicles leaving downtown); and
3. Cleveland Avenue carried 89.4% of all vehicle traffic entering or exiting downtown Squamish.

FIGURE 2.17
ENTERING AND EXITING SCREENLNE VEHICLE VOLUMES
FOR THE AUGUST 2007 SUMMER FRIDAY AFTERNOON PEAK HOUR



1. During the 2008 Winter afternoon peak hour, a total of 1,633 vehicles were observed crossing the CN main railway corridor (i.e. 696 vehicles towards downtown and 937 vehicles leaving downtown); and
2. Cleveland Avenue carried a minimum of 84% of all vehicle traffic entering or exiting downtown Squamish.

FIGURE 2.18
ENTERING AND EXITING SCREENLNE VEHICLE VOLUMES
FOR THE JANUARY 2008 WINTER FRIDAY AFTERNOON PEAK HOUR



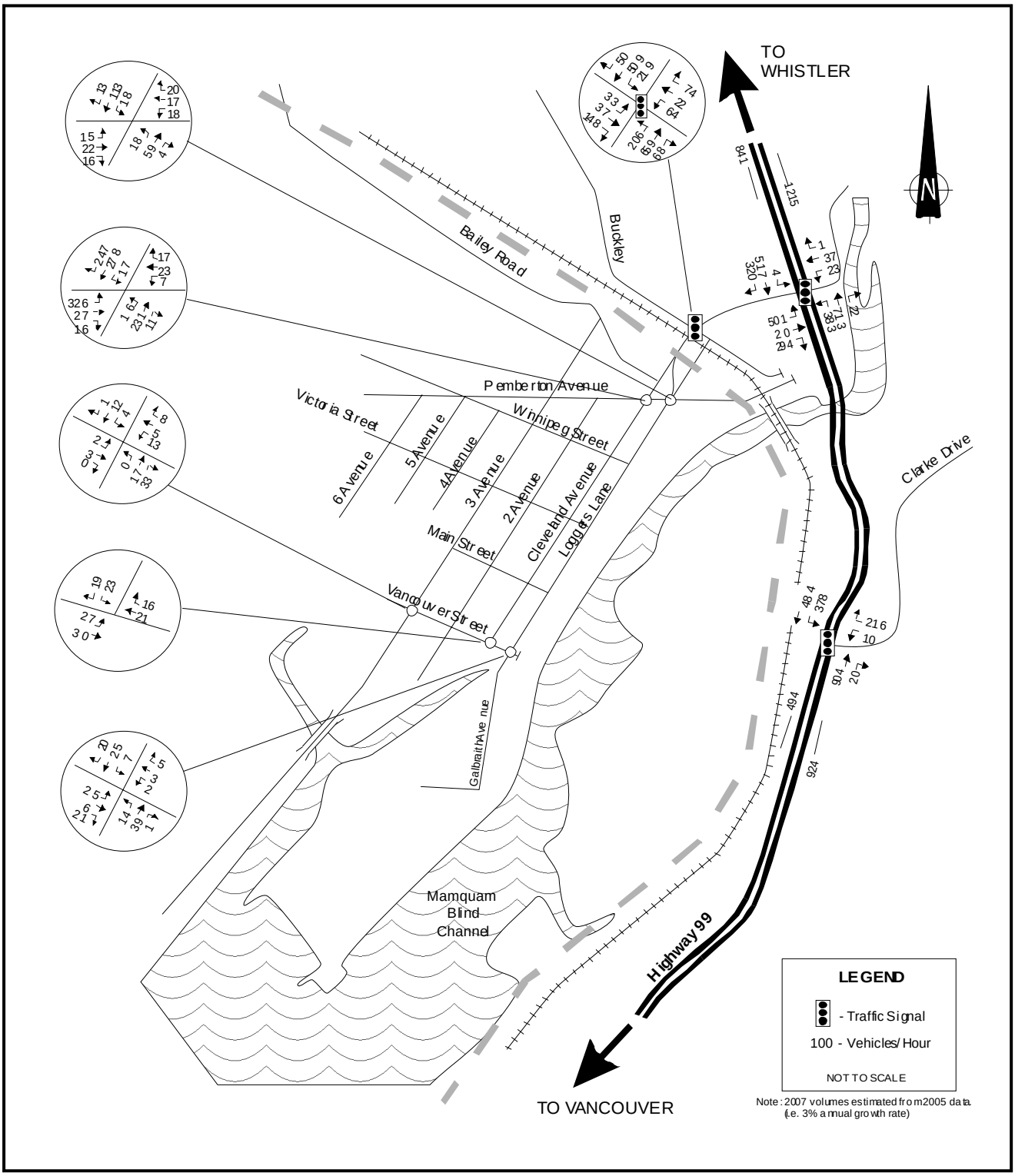
2.5.3 Intersection Traffic Count Methodology

On Friday, July 22, 2005, CTS conducted a full scale intersection traffic count program in downtown Squamish at eight key intersections which are listed in **TABLE 2.5**. Although the traffic count data was two years old, the turning movement percentages were still considered to be accurate for downtown Squamish given the lack of major new development activity since then. Therefore, the 2005 data was factored up using a 3.0% traffic volume growth rate (linear, non-compounded) to estimate August 2007 traffic volumes. This growth rate was developed by comparing the 2005 count data with the August 2007 screenline traffic volume data presented previously. The estimated intersection turning movement volumes for 2007 are illustrated in **FIGURE 2.19**.

TABLE 2.5
SURVEYED INTERSECTIONS AND DATE OF SURVEY

INTERSECTION	SURVEY DATE	DAY OF WEEK	SURVEY PERIOD
Highway 99 & Cleveland Avenue	22 July 2005	Friday	15:00 – 18:00
Highway 99 & Clarke Drive	22 July 2005	Friday	15:00 – 18:00
Cleveland Avenue & Buckley Avenue	22 July 2005	Friday	15:00 – 18:00
Cleveland Avenue & Pemberton Avenue	22 July 2005	Friday	15:00 – 18:00
Cleveland Avenue & Vancouver Street	22 July 2005	Friday	15:00 – 18:00
3 Avenue & Vancouver Street	22 July 2005	Friday	15:00 – 18:00
Loggers Lane & Pemberton Avenue	22 July 2005	Friday	15:00 – 18:00
Loggers Lane & Vancouver Street	22 July 2005	Friday	15:00 – 18:00

FIGURE 2.19
2007 SUMMER FRIDAY AFTERNOON PEAK HOUR TRAFFIC VOLUMES



2.6 Intersection Performance

Capacity analysis was performed at eight key intersections in the study area in order to determine the intersection levels of service (LOS) that is provided to motorists. The Level of Service (LOS) for intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption and travel time. LOS range from "A" (excellent) to "F" (failing). A LOS of "D" (poor) during the critical peak hours is considered acceptable by many public agencies in large urban areas for overall intersection operation and a LOS of "E" (which is approaching capacity) or better is considered acceptable for left turn movements at signalized intersections. However, for a community like the District of Squamish where motorists typically have a lower level of tolerance to traffic congestion, a LOS of "C" or better during the critical peak hours is considered acceptable for overall intersection operation and a LOS of "D" or better is considered acceptable for left turn movements at signalized intersections.

For unsignalized intersections, LOS criteria are stated in terms of total delay, where total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. This time includes the time required to travel from the last-in-queue position to the first-in-queue position. The criteria for unsignalized intersections are given in **TABLE 2.6**.

TABLE 2.6
LEVEL OF SERVICE AND DELAY CRITERIA
FOR UNSIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	CONTROL DELAY* (seconds per vehicle)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤ 25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	> 50.0

** Highway Capacity Manual 2000 (HCM)*

For signalized intersections, LOS criteria are stated in terms of the control delay per vehicle for a 15-minute analysis period. The criteria for signalized intersections are given in **TABLE 2.7**. The LOS thresholds for signalized intersections are somewhat different from the criteria used in **TABLE 2.6** because drivers generally tolerate less delay at an unsignalized intersection than at a signalized one.

TABLE 2.7
LEVEL OF SERVICE AND DELAY CRITERIA FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE* (seconds/veh)	DESCRIPTION
A	$\leq$ 10.0	This LOS occurs when traffic progression is extremely favourable and most vehicles arrive during the green phase. Most vehicles do not stop at all.
B	$>$ 10.0 and $\leq$ 20.0	This LOS generally occurs with good traffic progression, short cycle lengths or both. More vehicles stop than LOS A, causing higher level of average delay.
C	$>$ 20.0 and $\leq$ 35.0	This LOS generally occurs with fair traffic progression, longer cycle lengths or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.
D	$>$ 35.0 and $\leq$ 55.0	At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavourable traffic progression, long cycle lengths, or high volume to capacity ratios. Many vehicles stop and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	$>$ 55.0 and $\leq$ 80.0	LOS E is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor traffic progression, long cycle lengths and high volume to capacity ratios. Individual cycle failures are frequent occurrences.
F	$>$ 80.0	LOS F is considered to be unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high volume to capacity ratios below 1.0 with many individual cycle failures. Poor traffic progression and long cycle lengths may also be major contributing causes to such delay levels.

** Highway Capacity Manual 2000 (HCM)*

Intersection capacity analysis was performed at each of the intersections using the methods and procedures outlined in the Highway Capacity Manual (HCM) (Transportation Research Board Special Report 209, Millennium Edition). The Highway Capacity Software (HCS2000, Version 4.1f), which incorporates the HCM methodologies, was used for the unsignalized analysis. Synchro 6 was used for the signalized analysis. Synchro also evaluates the intersection based on actuated green times as opposed to maximum green time, yielding a more accurate result.

The following assumptions were made with respect to the intersection capacity analysis of the Summer Friday afternoon peak hour volumes:

- Saturation flow rate = 1,800 passenger cars per hour
- Heavy vehicle percentage = 2%

TABLE 2.8 summarizes the results of the intersection capacity analysis for the unsignalized intersections. From **TABLE 2.8** it can be seen that overall, all the intersections and movements analyzed are operating at excellent levels of service with the estimated 2007 traffic volumes

TABLE 2.9 summarizes the results of the intersection capacity analysis for the signalized intersections. From **TABLE 2.9** it can be seen that overall, all three signalized intersections are operating at acceptable levels of service as well with the estimated 2007 traffic volumes. However, the following movements are experiencing significant delays:

1. The southbound left turn movement on Hwy 99 @ Clark Drive (which is failing); and
2. The northbound left turn movement on Hwy 99 @ Cleveland (which is approaching capacity).

As both of these intersections are being rebuilt as part of the Sea to Sky Highway Improvement project, the noted operational problems are expected to be minimized after the highway is widened and improved.

TABLE 2.8
VEHICLE DELAY BY INDIVIDUAL MOVEMENTS FOR UNSIGNALIZED INTERSECTION
2007 SUMMER WEEKDAY PM PEAK HOUR

UNSIGNALIZED INTERSECTION	PERIOD	SCENARIO	IMPROVEMENTS	DELAY (seconds per vehicle)												OVER-ALL	OVER-ALL LOS	STATUS
				EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND					
				LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT			
Cleveland Ave & Pemberton Ave	Friday Afternoon Peak Hour	2005	None	21.5	9.6		10.8	20.3		14.6			15.4		11.7	15.8	C	Okay
		2007	None	25.1	9.9		11.1	10.9		16.1			17.2		12.6	17.6	C	Okay
Loggers Lane & Pemberton Ave		2005	None	11.3			10.9			7.6			7.4			8.6	A	Okay
		2007	None	11.5			11.1			7.6			7.4			8.7	A	Okay
3 Ave & Vancouver St		2005	None	7.3			7.3			7			7.3			7.2	A	Okay
		2007	None	9.6			9.3			7.3			7.4			8.0	A	Okay
Cleveland Ave & Vancouver St		2005	None	7.3			7.3			-			9.0			7.8	A	Okay
		2007	None	7.4			7.3			-			9.3			8.0	A	Okay
Loggers Lane & Vancouver St		2005	None	7.3			7.3			9.2			9.4			8.1	A	Okay
		2007	None	9.5			9.3			7.4			7.3			8.1	A	Okay

Intersection having excess capacity (LOS 'A', 'B' or 'C'); or delays (< 45sec)

Intersection approaching capacity (LOS 'D' or 'E'); or delays (45sec to <54sec)

Intersection equals or exceeds capacity (LOS 'F'); or delays (=> 55sec)

TABLE 2.9
VOLUME TO CAPACITY RATIO BY INDIVIDUAL MOVEMENTS FOR SIGNALIZED INTERSECTION
2007 SUMMER WEEKDAY PM PEAK HOUR

INTERSECTION	PERIOD	YEAR	IMPROVEMENTS	v/c ratio (volume to capacity ratio)												Over-All Delay (s/veh)	OVER-ALL LOS	STATUS
				EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND					
				LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT			
Clarke Dr & Hwy 99	Friday Afternoon Peak Hour	2005	None				0.65		0.65		0.84	0.84	0.84	0.84		17.8	B	Okay
		2007	None				0.62		0.62		0.68	0.02	1.18	0.36		29.5	C	Okay
Cleveland Ave & Hwy 99		2005	None	0.78	0.63	0.49	0.08	0.08	0.08	0.86	0.40		0.01	0.28	0.34	14.3	B	Okay
		2007	None	0.76	0.84	0.48	0.08	0.08	0.08	0.92	0.41		0.01	0.29	0.34	17.5	B	Okay
Cleveland Ave & Buckley Ave		2005	None	0.37	0.37		0.59	0.18		0.24		0.17	0.18		0.30	7.5	A	Okay
		2007	None	0.67	0.29		0.46	0.46		0.24		0.17	0.18		0.30	9.6	A	Okay

v/c ratio =

Intersection having excess capacity (LOS 'A', 'B' or 'C'); or v/c ratio (< 0.85)

Intersection approaching capacity (LOS 'D' or 'E'); or v/c ratio (0.85 to < 1.00)

Intersection equals or exceeds capacity (LOS 'F'); or v/c ratio (=> 1.00)

2.7 Public Parking Inventory

As part of this project, CTS conducted a parking inventory survey of all public on and off-street parking facilities in order to determine the availability of public parking in the study area. The data was collected for each of the 40 municipal blocks illustrated in **FIGURE 2.20** with the detailed survey data included in APPENDIX A. The summary findings are presented in **TABLE 2.10** where a total of 2,290 parking spaces were counted of which 1,167 are on street (51%) and are 1,123 parking spaces are off-street (49%).

TABLE 2.10
SUMMARY OF PUBLIC PARKING IN DOWNTOWN SQUAMISH (AUGUST 2007)

On-Street Parking		Off-Street Parking			**Total**
No Restriction	Restriction	Standard	Disable	Other	
1160 spaces	7 spaces	1065 spaces	25 space	33 space	**2,290**
50.7 %	*0.3 %*	*46.5 %*	*1.1 %*	*1.4 %*	***100.00%***

FIGURE 2.20
MUNICIPAL BLOCK NUMBERING SYSTEM USED
FOR PUBLIC PARKING INVENTORY IN DOWNTOWN SQUAMISH

SECTION 3 TRANSPORTATION MODEL DEVELOPMENT

3.1 Background

In 1997, the QRS 2 software was used to develop a transportation model for the District of Squamish as part of the Official Community Plan update. Discussions with the developers of the 1997 model for Squamish confirmed that the model was not MS Windows based as it used a DOS platform and it had not been updated since then. After reviewing the available digital files and the documentation on the 1997 model, the project team decided to develop a brand new transportation computer model using the latest modeling software VISUM rather than try and retrofit an old model using outdated software, and which software for the most part is no longer used in the industry.

However, before the VISUM model could be setup and calibrated, a traffic zone system had to be setup that took into account land use zoning, geographical boundaries, topographical features and jurisdictional borders for the entire District of Squamish. Traffic zones are used by computer transportation models to describe the traffic generation characteristics and attributes of a defined area.

3.2 Traffic Zones

A total of 15 “macro” traffic zones were developed for outside of downtown so that regional traffic patterns **could be modeled as well and these are** illustrated on **FIGURE 3.1**. For downtown Squamish, this was modelled at a much more detailed level with the use of 21 traffic zones as illustrated on **FIGURE 3.2**. Of note, the boundaries of the downtown traffic zones were designed to match the boundaries of all the distinct precincts in the Downtown Neighbourhool Plan.

TABLE 3.1 summarizes the land use info that was coded into each of the traffic zones for the 2007 baseline conditions. This information was developed from field work, communication with major stakeholders and consultation with the District of Squamish Planning Department staff.

FIGURE 3.1
MACRO TRAFFIC ZONES – DISTRICT OF SQUAMISH

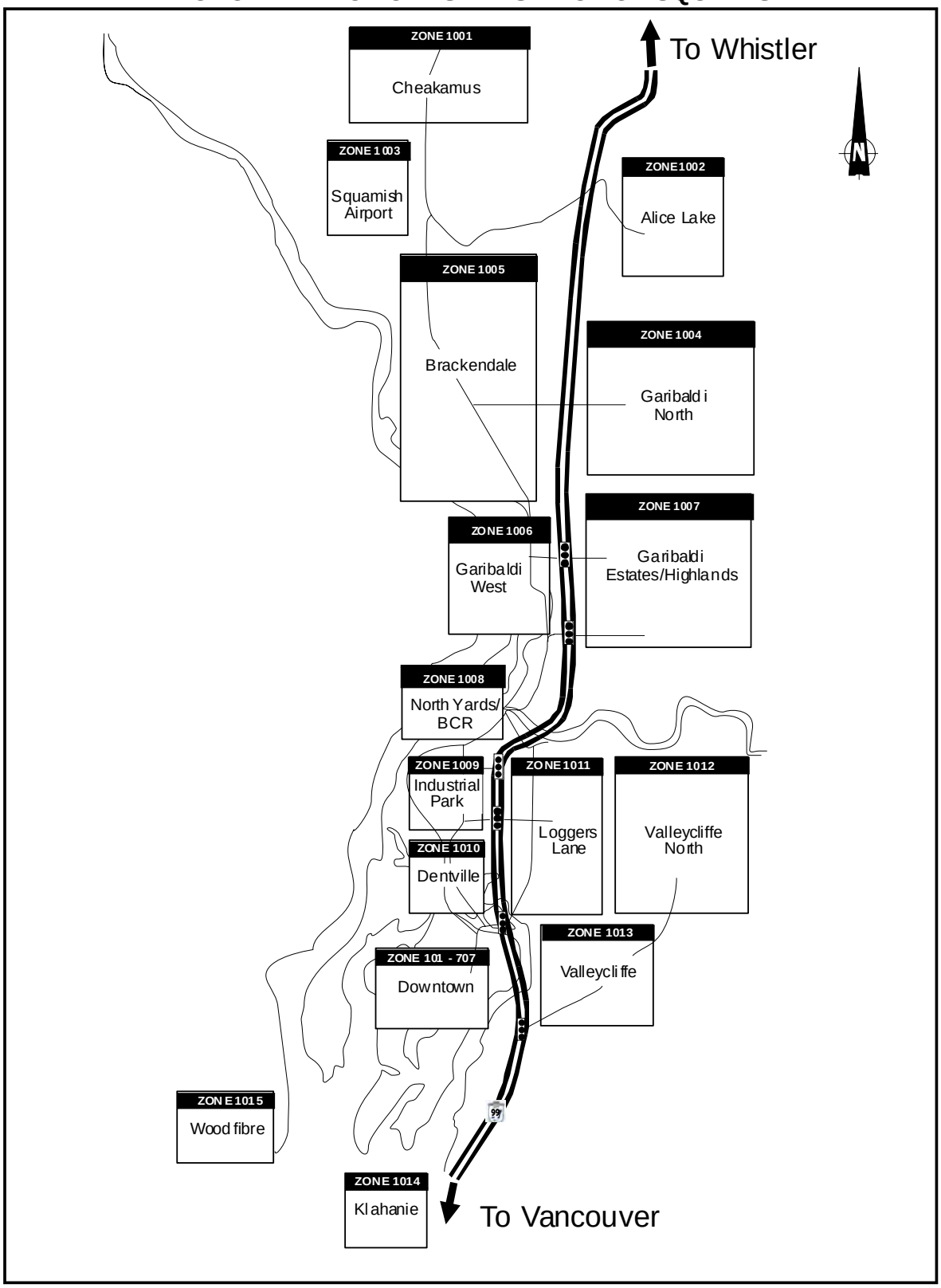


FIGURE 3.2
DOWNTOWN SQUAMISH TRAFFIC ZONES

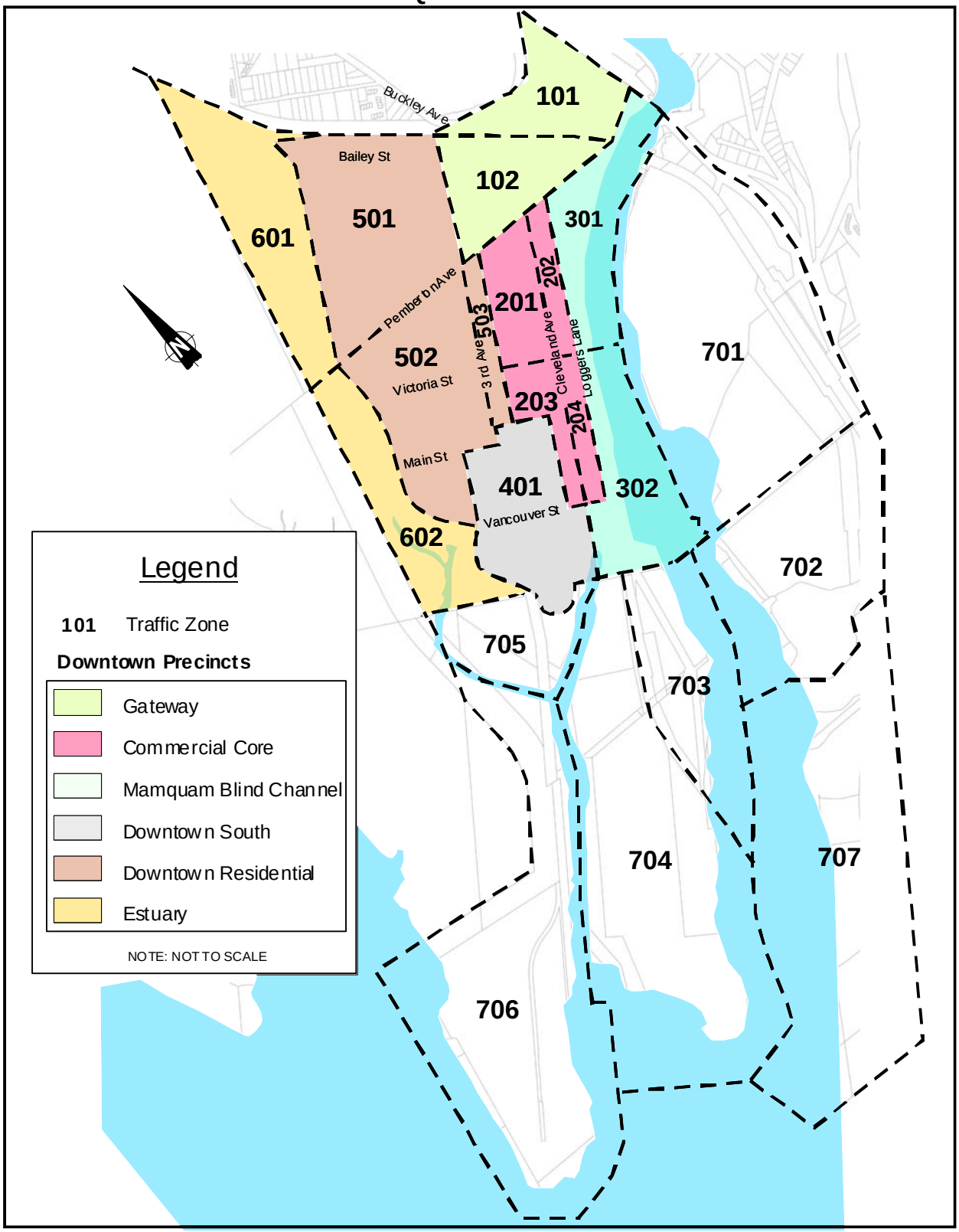


TABLE 3.1
TRAFFIC ZONE DATA FOR 2007 BASELINE CONDITIONS

ZONE	YEAR 2007 BASE CONDITIONS (NOT PRORATED)									
	TRAFFIC ZONE NAME / PRECINCT	Single-family House	Multi-family House	Retail Store	Service / Office / Home Based	Hotel / Motel / Inn	Highway Commercial	Government / Institutional	Industrial	University
		(Units)	(Units)	(Employees)	(Employees)	(Rooms)	(Employees)	(Employees)	(Employees)	(Students)
101	Gateway North	0	0	39	0	0	48	5	0	0
102	Gateway South	0	0	56	0	0	41	0	0	0
201	Commercial Core Northwest	0	39	64	109	44	0	5	0	0
202	Commercial Core Northeast	0	0	27	16		0	5	0	0
203	Commercial Core Southwest	1	0	9	31	98	0	50	0	0
204	Commercial Core Southeast	0	0	0	5		0	0	0	0
301	Mamquam Blind Channel Northwest	3	90	0	12		0	0	0	0
302	Mamquam Blind Channel Southwest	0	0	0	1		0	0	5	0
401	Downtown South	23	12	32	35		0	9	19	0
501	Downtown Residential North	0	243	0	0		0	0	0	0
502	Downtown Residential South	117	29	20	3		0	0	0	0
503	Downtown Residential East	18	0	0	1	30	0	0	0	0
601	Estuary North	0	0	0	0		0	0	0	0
602	Estuary West	0	0	0	0		0	0	0	0
701	Mamquam Blind Channel Northeast	0	0	0	10		0	0	5	0
702	Mamquam Blind Channel Southeast	27	0	0	6		0	0	0	0
703	Lower Peninsula East	0	0	0	0		0	0	0	0
704	Lower Peninsula South	0	0	0	0		0	0	15	0
705	Estuary South	0	0	0	0		0	0	0	0
706	Port	0	0	0	0		0	0	75	0
707	Klahanie North (NEW!!!!)									
1001	Cheakamus	50	0	0	16	20	0	0	0	
1002	Alice Lake	0	0	0	0		0	0	0	
1003	Airport	0	0	0	0		0	0	36	
1004	Garibaldi North	21	10	0	46	116	0	0	0	
1005	Brackendale	1160	0	0	408		0	50	0	
1006	Garibaldi West	321	209	50	312		0	25	0	
1007	Garibaldi Estates/Highlands	1607	0	200	800	52	0	25	0	70
1008	North Yards/BCR	278	12	25	93		0	0	1422	
1009	Industrial Park	0	0	50	142	87	0	0	355	
1010	Dentville	411	29	0	212		0	89	0	400
1011	Loggers Lane	123	7	0	77	27	0	0	36	
1012	Valleycliffe North	0	0	0	14		0	0	14	
1013	Valleycliffe	1034	16	0	352		0	250	14	
1014	Klahanie	0	10	0	39		10	0	0	
GRAND TOTAL		**5194**	**707**	**572**	**2740**	**474**	**99**	**513**	**1996**	**470**

From **TABLE 3.1**, the following are the totals for the key attributes that were used to describe 2007 baseline (or existing) conditions for the District of Squamish:

1. 5,900 residential units
2. 5,920 employees
3. 474 hotel and motel rooms
4. 470 students

3.3 VISUM Software

VISUM is a comprehensive, state of the art flexible software system for transportation planning, travel demand modeling and network data management. VISUM is used on all continents for metropolitan, regional, statewide and national planning applications. Designed for multimodal analysis, VISUM integrates all relevant modes of transportation (i.e., car, car passenger, truck, bus, train, pedestrians and bicyclists) into one consistent network model. VISUM provides a variety of assignment procedures and 4-stage modeling components which include trip-end based as well as activity based approaches.

VISUM is a PC-based program using MS Windows and offers data and image exchange in the Windows environment via clipboard or interfaces to industry standard formats. In addition, VISUM has an open object-oriented concept that enables users to program their own applications using Visual Basic or the programming language of their choice.

VISUM is used to build conventional four-step models for regional and province / state-wide planning while also serving as a powerful analysis and data management tool for traffic engineers and transportation planners. A unique strength is detailed public transportation service planning, with a data model for routes and schedules that goes far beyond traditional demand models.

One of the most exciting feature of VISUM is its ability to merge GIS-data and transportation data into a common database with several layers including: Traffic Analysis Zones and jurisdiction boundaries; transportation network with connectivity, street centerlines, intersection turns and transit routes; user defined attributes and user defined object classes; and back-ground maps. In addition the linkage to the personal

geo database of ESRI or shape files can be used to populate additional geography layers in VISUM which then can be intersected and buffered with the transportation network of VISUM.

This GIS integration enables networks to be coded in a geographically accurate way. Network links are not simple straight lines but can have a specific shape described by a polyline. Another advantage of the GIS integration is that users do not need other GIS software for post-processing and presentations. VISUM alone is sufficient to design powerful maps including flexible legends. Only a few steps are necessary to make use of the many visual options. To enrich the graphical capabilities all standard vector formats as well as image and bitmap formats can be imported.

3.4 Squamish VISUM Model

The Squamish model that was developed for this project used VISUM Version 10.03-00 and the transportation network was coded using NAVTEQ coordinates.

3.4.1 Model Structure

Trip generation was modelled for the following trip types:

- Home to Work;
- Work to Home;
- Home to Other;
- Other to Home; and
- Non Home Based

Other key model characteristics were as follows:

- Trip distribution → a simple gravity model was used with smoothed feedback skims
- Auto mode split → was initially set at 0.93 to replicate existing conditions but was then adjusted downwards later on to test various sustainable initiatives
- Trip assignment → was equilibrium based
- Transit trip assignment → was headway based

3.4.2 Model Calibration

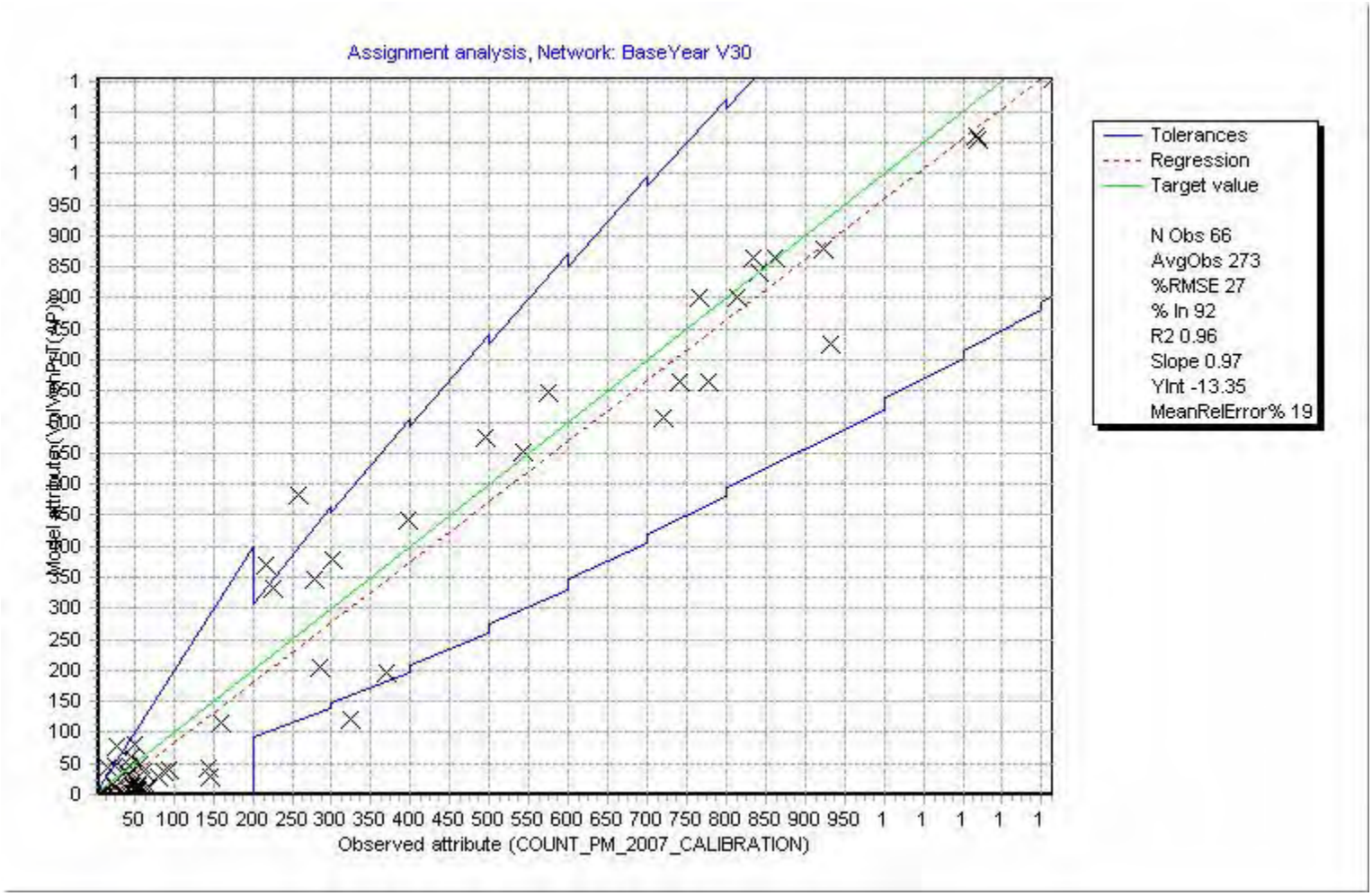
Screenlines were established to calibrate the model with existing conditions. The model's projections were then compared with field counts obtained from a variety of sources. The model's projected volumes on each of the links across the screenlines were then compared against the available traffic counts and any discrepancies noted. Any significant discrepancies were investigated and the model further refined until the discrepancies were found to be within the allowable deviation percentage.

The calibration exercise for the Squamish model resulted in a very accurate model because:

1. The correlation coefficient of the linear regression line comparing actual to simulated volumes was 0.96 and the recommended industry standard is 0.88 or higher (up to a maximum of 1.0);
2. The slope of the linear regression line comparing actual to simulated volumes was 0.97 which is very close to the ideal value of 1.0;
3. The y-intercept was -13.35 which is very close to the ideal value of 0; and
4. The %in statistic was 92% and the recommended Caltrans standard is that 75% of the assigned volumes on principal arterial streets and higher classification roadways are within these standards.

FIGURE 3.3 illustrates the results of the calibration exercise including the 66 data points that were used to compare actual traffic volumes with those simulated from the model.

FIGURE 3.3
VISUM MODEL CALIBRATION RESULTS



SECTION 4 LAND USE

4.1 Population Projections

The population of Squamish is projected to increase from 14,950 in the year 2006 to 33,100 by the year 2031 according to the Growth Management Strategy that was prepared for the District of Squamish in July 2005. This doubling of the population is equivalent to an annual increase of 3.2% per year compounded. In general, this level of population growth rate is considered to be aggressive but is indicative of the amount of development that is proposed for the community, the majority of it to be located in downtown Squamish.

4.2 Employment Projections Using Existing Trend Lines

In the same Growth Management Strategy report, employment for Squamish-based residents is expected to increase by only 40% over the 25 years, which translates into a slower growth rate of 1.4% per year compounded between 2006 (8,335 jobs) and 2031 (11,700 jobs). Therefore with a larger population but smaller percentage of jobs, the majority of the Squamish based population is forecast to either not be employed or have a job located outside of Squamish. If this trend continues, it has been noted that Squamish may turn into more of a "bedroom community", that is a community where people have their homes there but the majority of residents work in other communities. Such a trend would have significant transportation ramifications on both the existing and future municipal connections with Highway 99.

Further analysis was conducted of the employment data for Squamish using the 2006 census data in order to better understand where the existing jobs were located and to assist in calibrating the transportation model. **TABLE 4.1** summarizes the employment locations for Squamish residents that participated in the 2006 census with the "No Fixed Workplace Address" describing contractors and transportation based employment (e.g. couriers). Of the 8,335 existing jobs that Squamish residents have, 71% of them (or 5,920) are based in Squamish while the remaining 29% (or 2,415) are located outside the community. **TABLE 4.1** also summarizes the projected employment levels by category using existing trend lines and that 8,310 jobs are forecast for within Squamish.

TABLE 4.1
SUMMARY OF EXISTING AND PROJECTED EMPLOYMENT
USING EXISTING TREND LINES

LOCATION	2006*		2031 with same %		NET INCREASE	
	# of Jobs	%	# of Jobs	%	# of Jobs	%
Squamish	3880	46.6%	5446	46.5%	1566	40.4%
Other Municipalities	1365	16.4%	1916	16.4%	551	40.4%
Outside SLRD	985	11.8%	1383	11.8%	398	40.4%
At Home	465	5.6%	653	5.6%	188	40.4%
Outside B.C.	45	0.5%	63	0.5%	18	40.0%
Outside Canada	20	0.2%	28	0.2%	8	40.0%
No Fixed Workplace Address	1575	18.9%	2211	18.9%	636	40.4%
Jobs Within Squamish	*5920*	*71.0%*	*8310*	*71.0%*	*2390*	*40.4%*
Jobs Outside Squamish	*2415*	*29.0%*	*3390*	*29.0%*	*975*	*40.4%*
TOTAL	**8335**	**100.0%**	**11700**	**100.0%**	**3365**	**40.4%**

** From 2006 Census data*

4.3 Future Land Use Changes for 2031 Base Case

Significant effort was expended in meetings with planning staff, property owners and other stakeholders in order to quantify the expected changes between existing and future conditions for each of the traffic zones by the year 2031 for the base case. **TABLE 4.2** provides a detailed summary of the expected changes by traffic zone for the base case using existing trend lines and known information. From **TABLE 4.2**, the following are the major changes projected:

1. Housing supply to increase by 8,800 homes of which 1,209 are single family homes and 7,591 multi-family homes;
2. Local based employment to increase by 2,390 jobs;
3. Commercial accommodation to increase by 510 rooms; and
4. College and university student population to increase by 3,230 students

TABLE 4.2 - SUMMARY OF NET CHANGES BY TRAFFIC ZONE FOR BASE CASE USING EXISTING TREND LINES AND KNOWN INFORMATION FOR THE YEAR 2031

ZONE	NET CHANGES FOR YEAR 2031 (PRORATED)									
	TRAFFIC ZONE NAME / PRECINCT	Single-family House	Multi-family House	Retail Store	Service / Office / Home Based	Hotel / Motel / Inn	Highway Commercial	Government / Institutional	Industrial	University
		(Units)	(Units)	(Employees)	(Employees)	(Rooms)	(Employees)	(Employees)	(Employees)	(Students)
101	Gateway North									
102	Gateway South			50	50					
201	Commercial Core Northwest		81	50	50					
202	Commercial Core Northeast			50	50					
203	Commercial Core Southwest		60	50	50					
204	Commercial Core Southeast		82	50	50					
301	Mamquam Blind Channel Northwest		198	50	25					
302	Mamquam Blind Channel Southwest		225	50	25					
401	Downtown South		119	50	50			20		2500
501	Downtown Residential North		450		50					
502	Downtown Residential South		218		50					
503	Downtown Residential East		150	100	25					
601	Estuary North									
602	Estuary West									
701	Mamquam Blind Channel Northeast		1375	150	50					
702	Mamquam Blind Channel Southeast	50	50	250		100	25			
703	Lower Peninsula East		1300	50	50					
704	Lower Peninsula South		2500	150	100	150				
705	Estuary South									
706	Port								75	
707	Klahanie North (NEW!!!!)								50	
1001	Cheakamus									
1002	Alice Lake									
1003	Airport	16								
1004	Garibaldi North									
1005	Brackendale	49	27							
1006	Garibaldi West									
1007	Garibaldi Estates/Highlands	880	695		25			180		1130
1008	North Yards/BCR				29				50	
1009	Industrial Park				50				100	
1010	Dentville	7	16					-14		-400
1011	Loggers Lane	51	14							
1012	Valleycliffe North	156	31							
1013	Valleycliffe									
1014	Klahanie					260	25			
GRAND TOTAL		**1209**	**7591**	**1100**	**779**	**510**	**50**	**186**	**275**	**3230**

TABLE 4.3 provides a detailed summary of the total projections by traffic zone. From **TABLE 4.3**, the following are the major changes projected:

1. Single family housing to increase from 5,194 to 6,403 homes (+ 23%)
2. Multi-family housing to increase from 707 to 8,298 homes (+ 1074%)
3. Employment to increase from 5,920 to 8,310 new jobs (+ 40%)
4. Commercial accommodation to increase from 474 to 984 rooms (+ 108%)
5. College and university student population to increase from 470 to 3,700 students (+ 687%)

4.4 Employment Projections Using A More Sustainable Approach

One of the primary objectives of this study was to develop a transport plan that is more sustainable for the community and adheres Smart Growth Principles including #6 "*Good jobs are close to home*". As well, by testing various "do-something" and "do-something sustainable" options, the positive impacts of having a more sustainable transport plan can be better understood by the community, stakeholders and other decision makers. Therefore, in consultation with municipal staff, a more sustainable future employment model was developed for further testing and this is illustrated in **TABLE 4.4**.

TABLE 4.4
SUMMARY OF EXISTING AND PROJECTED EMPLOYMENT
USING A MORE SUSTAINABLE APPROACH

LOCATION	2006*		TOTAL 2031 JOBS		New jobs new targets	
	# of Jobs	%	# of Jobs	%	# of Jobs	%
Squamish	3880	46.6%	7809	47.8%	3929	49.2%
Other Municipalities	1365	16.4%	2494	15.3%	1129	14.1%
Outside SLRD	985	11.8%	1800	11.0%	815	10.2%
At Home	465	5.6%	936	5.7%	471	5.9%
Outside B.C.	45	0.5%	82	0.5%	37	0.5%
Outside Canada	20	0.2%	37	0.2%	17	0.2%
No Fixed Workplace Address	1575	18.9%	3170	19.4%	1595	20.0%
Jobs Within Squamish	*5920*	*71.0%*	*11915*	73.0%	*5995*	*75.0%*
Jobs Outside Squamish	*2415*	*29.0%*	*4413*	27.0%	*1998*	*25.0%*
TOTAL	**8335**	**100.0%**	**16328**	**195.9%**	**7993**	**100.0%**

** From 2006 Census data*

TABLE 4.3 – TOTAL PROJECTIONS BY TRAFFIC ZONE FOR BASE CASE USING EXISTING TREND LINES AND KNOWN INFORMATION FOR THE YEAR 2031

ZONE	TRAFFIC ZONE NAME / PRECINCT	TOTAL PROJECTIONS FOR YEAR 2031 (PRORATED)								
		Single-family House	Multi-family House	Retail Store	Service / Office / Home Based	Hotel / Motel / Inn	Highway Commercial	Government / Institutional	Industrial	University
		(Units)	(Units)	(Employees)	(Employees)	(Rooms)	(Employees)	(Employees)	(Employees)	(Students)
101	Gateway North			39			48	5		
102	Gateway South			106	50		41			
201	Commercial Core Northwest		120	114	159	44		5		
202	Commercial Core Northeast			77	66			5		
203	Commercial Core Southwest	1	60	59	81	98		50		
204	Commercial Core Southeast		82	50	55					
301	Mamquam Blind Channel Northwest	3	288	50	37					
302	Mamquam Blind Channel Southwest		225	50	26				5	
401	Downtown South	23	131	82	85			29	19	2500
501	Downtown Residential North		693		50					
502	Downtown Residential South	117	247	20	53					
503	Downtown Residential East	18	150	100	26	30				
601	Estuary North									
602	Estuary West									
701	Mamquam Blind Channel Northeast		1375	150	60				5	
702	Mamquam Blind Channel Southeast	77	50	250	6	100	25			
703	Lower Peninsula East		1300	50	50					
704	Lower Peninsula South		2500	150	100	150			15	
705	Estuary South									
706	Port								150	
707	Klahanie North (NEW!!!!)								50	
1001	Cheakamus	50			16	20				
1002	Alice Lake									
1003	Airport	16							36	
1004	Garibaldi North	21	10		46	116				
1005	Brackendale	1209	27		408			50		
1006	Garibaldi West	321	209	50	312			25		
1007	Garibaldi Estates/Highlands	2487	695	200	825	52		205		1200
1008	North Yards/BCR	278	12	25	122				1472	
1009	Industrial Park			50	192	87			455	
1010	Dentville	418	45		212			75		
1011	Loggers Lane	174	21		77	27			36	
1012	Valleycliffe North	156	31		14				14	
1013	Valleycliffe	1034	16		352			250	14	
1014	Klahanie		10		39	260	35			
GRAND TOTAL		**6403**	**8298**	**1672**	**3519**	**984**	**149**	**699**	**2271**	**3700**
Net Change (value)		**1209**	**7591**	**1100**	**779**	**510**	**50**	**186**	**275**	**3230**
Net Change (%)		**23%**	**1074%**	**192%**	**28%**	**108%**	**51%**	**36%**	**14%**	**687%**

The key changes made were as follows:

1. The number of jobs are projected to almost double between 2006 and 2031, which is in keeping with the projected doubling of the population;
2. 75% of the new jobs are forecast to be based in Squamish;
3. The number of Squamish based residents who are forecast to be employed by the year 2031 increased from 11,700 to 16,328 (+39%); and
4. The number of locally based jobs for the year 2031 increased from 8,310 to 11,915 (+43%).

In addition to the increase in locally based employment, municipal staff have also scaled back the number of housing units to be constructed by the year 2031 (i.e. from 8,800 to 7,480 homes) in order to provide for a more sustainable balance between population and jobs.

4.5 Expected Changes in Land Use Using a More Sustainable Approach

TABLE 4.5 provides a detailed summary of the expected changes by traffic zone for the base case using existing trend lines and known information. From **TABLE 4.5**, the following are the major changes projected:

1. Housing supply to increase by 7,480 homes of which 1,209 are single family homes (no change) and 6,271 multi-family homes (lower) to reflect a lower population forecast;
2. Local based employment to increase by 6,101 jobs (higher);
3. Commercial accommodation to increase by 510 rooms (no change); and
4. College and university student population to increase by 3,230 students (no change).

TABLE 4.6 provides a detailed summary of the total projections by traffic zone.

TABLE 4.5 - SUMMARY OF NET CHANGES BY TRAFFIC ZONE FOR SUSTAINABLE APPROACH FOR THE YEAR 2031

ZONE	TRAFFIC ZONE NAME / PRECINCT	NET CHANGES FOR YEAR 2031 (PRORATED)								
		Single-family House	Multi-family House	Retail Store	Service / Office / Home Based	Hotel / Motel / Inn	Highway Commercial	Government / Institutional	Industrial	University
		(Units)	(Units)	(Employees)	(Employees)	(Rooms)	(Employees)	(Employees)	(Employees)	(Students)
101	Gateway North	0		0	0	0	0	0	0	0
102	Gateway South	0		89	89	0	0	0	0	0
201	Commercial Core Northwest	0	67	89	89	0	0	0	0	0
202	Commercial Core Northeast	0		89	89	0	0	0	0	0
203	Commercial Core Southwest	0	50	89	89	0	0	0	0	0
204	Commercial Core Southeast	0	68	89	89	0	0	0	0	0
301	Mamquam Blind Channel Northwest	0	164	89	44	0	0	0	0	0
302	Mamquam Blind Channel Southwest	0	186	89	44	0	0	0	0	0
401	Downtown South	0	98	89	89	0	0	35	0	2500
501	Downtown Residential North	0	372	0	89	0	0	0	0	0
502	Downtown Residential South	0	180	0	89	0	0	0	0	0
503	Downtown Residential East	0	124	177	44	0	0	0	0	0
601	Estuary North	0		0	0	0	0	0	0	0
602	Estuary West	0		0	0	0	0	0	0	0
701	Mamquam Blind Channel Northeast	0	1136	266	89	0	0	0	0	0
702	Mamquam Blind Channel Southeast	50	41	444	0	100	44	0	0	0
703	Lower Peninsula East	0	1074	89	89	0	0	0	0	0
704	Lower Peninsula South	0	2065	266	177	150	0	0	0	0
705	Estuary South	0		0	0	0	0	0	0	
706	Port	0		0	0	0	0	0	339	0
707	Klahanie North (NEW!!!!)			0	0		0	0	226	
1001	Cheakamus			0	0		0	0	0	
1002	Alice Lake			0	0		0	0	0	
1003	Airport	16		0	0		0	0	0	
1004	Garibaldi North	0		0	0		0	0	0	
1005	Brackendale	49	22	0	0		0	0	0	
1006	Garibaldi West	0		0	0		0	0	0	
1007	Garibaldi Estates/Highlands	880	574	0	44		0	319	0	1130
1008	North Yards/BCR	0		0	51		0	0	1226	
1009	Industrial Park	0		0	89		0	0	533	
1010	Dentville	7	13	0	0		0	-25	0	-400
1011	Loggers Lane	51	12	0	0		0	0	0	
1012	Valleycliffe North	156	26	0	0		0	0	0	
1013	Valleycliffe			0	0		0	0	0	
1014	Klahanie			0	0	260	44	0	0	
GRAND TOTAL		**1209**	**6271**	**1951**	**1382**	**510**	**89**	**330**	**2324**	**3230**

TABLE 4.6 – TOTAL PROJECTIONS BY TRAFFIC ZONE FOR SUSTAINABLE APPROACH FOR THE YEAR 2031

ZONE	TRAFFIC ZONE NAME / PRECINCT	TOTAL PROJECTIONS FOR YEAR 2031 (PRORATED)								
		Single-family House	Multi-family House	Retail Store	Service / Office / Home Based	Hotel / Motel / Inn	Highway Commercial	Government / Institutional	Industrial	University
		(Units)	(Units)	(Employees)	(Employees)	(Rooms)	(Employees)	(Employees)	(Employees)	(Students)
101	Gateway North	0	0	39	0	0	48	5	0	0
102	Gateway South	0	0	145	89	0	41	0	0	0
201	Commercial Core Northwest	0	106	153	198	44	0	5	0	0
202	Commercial Core Northeast	0	0	116	105	0	0	5	0	0
203	Commercial Core Southwest	1	50	98	120	98	0	50	0	0
204	Commercial Core Southeast	0	68	89	94	0	0	0	0	0
301	Mamquam Blind Channel Northwest	3	254	89	56	0	0	0	0	0
302	Mamquam Blind Channel Southwest	0	186	89	45	0	0	0	5	0
401	Downtown South	23	110	121	124	0	0	44	19	2500
501	Downtown Residential North	0	615	0	89	0	0	0	0	0
502	Downtown Residential South	117	209	20	92	0	0	0	0	0
503	Downtown Residential East	18	124	177	45	30	0	0	0	0
601	Estuary North	0	0	0	0	0	0	0	0	0
602	Estuary West	0	0	0	0	0	0	0	0	0
701	Mamquam Blind Channel Northeast	0	1136	266	99	0	0	0	5	0
702	Mamquam Blind Channel Southeast	77	41	444	6	100	44	0	0	0
703	Lower Peninsula East	0	1074	89	89	0	0	0	0	0
704	Lower Peninsula South	0	2065	266	177	150	0	0	15	0
705	Estuary South	0	0	0	0	0	0	0	0	0
706	Port	0	0	0	0	0	0	0	414	0
707	Klahanie North (NEW!!!!)	0	0	0	0	0	0	0	226	0
1001	Cheakamus	50	0	0	16	20	0	0	0	0
1002	Alice Lake	0	0	0	0	0	0	0	0	0
1003	Airport	16	0	0	0	0	0	0	36	0
1004	Garibaldi North	21	10	0	46	116	0	0	0	0
1005	Brackendale	1209	22	0	408	0	0	50	0	0
1006	Garibaldi West	321	209	50	312	0	0	25	0	0
1007	Garibaldi Estates/Highlands	2487	574	200	844	52	0	344	0	1200
1008	North Yards/BCR	278	12	25	144	0	0	0	2648	0
1009	Industrial Park	0	0	50	231	87	0	0	888	0
1010	Dentville	418	43	0	212	0	0	64	0	0
1011	Loggers Lane	174	19	0	77	27	0	0	36	0
1012	Valleycliffe North	156	26	0	14	0	0	0	14	0
1013	Valleycliffe	1034	16	0	352	0	0	250	14	0
1014	Klahanie	0	10	0	39	260	54	0	0	0
GRAND TOTAL		**6403**	**6978**	**2523**	**4122**	**984**	**188**	**843**	**4320**	**3700**
Net Change (value)		**1209**	**6271**	**1951**	**1382**	**510**	**89**	**330**	**2324**	**3230**
Net Change (%)		**23%**	**887%**	**341%**	**50%**	**108%**	**90%**	**64%**	**116%**	**687%**

From **TABLE 4.6**, the following are the major changes projected:

1. Single family housing to increase from 5,194 to 6,403 homes (+ 23%)
2. Multi-family housing to increase from 707 to 6,978 homes (+ 887%)
3. Employment to increase from 5,920 to 11,915 new jobs (+ 101%)
4. Commercial accommodation to increase from 474 to 984 rooms (+ 108%)
5. College and university student population to increase from 470 to 3,700 students (+ 687%)

5 PUBLIC AND STAKEHOLDER CONSULTATION

Planning for a future transportation system in order to accommodate projected population and employment level is a vital task of any municipal organization. It must be done in a controlled and staged manner in order to ensure that future traffic volumes do not destroy the livability of the community that the roads are attempting to serve. In addition, the staging for new facilities must be undertaken in a cost-effective manner during these times of fiscal constraint. Of utmost importance is public awareness and support for future municipal transportation facilities, as the public is the primary beneficiary. Therefore, local public support is often the most critical component for any proposed municipal transportation facility.

For this project, public and stakeholder consultation has been extensive and included the following major components:

- The development of a project website to facilitate communication with the public;
- The hosting of 2 public information meetings; and
- Direct consultation by the project team with almost 25 stakeholders.

5.1 Project Website

A project website was setup (www.squamishtrans2031.com) at the beginning of the project in order to allow the public to review the progress of the project and download key information packages for their review. The website includes important information for the public including the following:

- A summary of what the study objectives and key tasks are;
- Who to contact at municipal hall or the project team for more information;
- Downloadable survey forms for the public to fill out at key phases of the work program;
- A summary of past public information meetings for this project for those members of the public that could not attend including photos; and
- Downloadable copies of draft transport plans for the public to review and comment on (currently Draft #1 of the transport plan is posted on the website)

5.2 Public Information Meeting #1

The first public meeting on the Downtown Squamish 2031Transportation Plan was held on Wednesday, 30 January 2008 from 16:00 to 20:00 at the public library in downtown Squamish. District and consultant staff were in attendance to host the Open House and solicit public participation and input. At this meeting, information panels were also displayed presenting both the current major road network and the potential development for downtown Squamish that triggered the need for updating the transport plan. Advertising included announcements in the Squamish Chief newspaper in the week before and Mountain FM radio on the day of the public meeting.

A presentation was also given where key conclusions and recommendations from previous studies were summarized to those in attendance. One of the key previous study recommendations was that the amount of redevelopment proposed for downtown Squamish required two vehicle access points in order to accommodate both the expected volume of traffic while providing for a more balanced and reasonably sized transportation system. As well, it was critical that for the expected population levels in the lower peninsula, that more than one access for emergency vehicles be provided should the primary one be blocked.

The estimated attendance was over 30 (excluding municipal staff and the consultant team) during the course of the four hour event and 32 comment sheets were received. Key comments and concerns received included the following:

1. There appeared to be strong support for a new crossing over the Mamquam Blind Channel;
2. The potential impacts on the Squamish River Estuary from future transportation corridors were of great concern; and
3. A link between the lower peninsula and downtown Squamish was critical to the future vitality of the commercial downtown area.

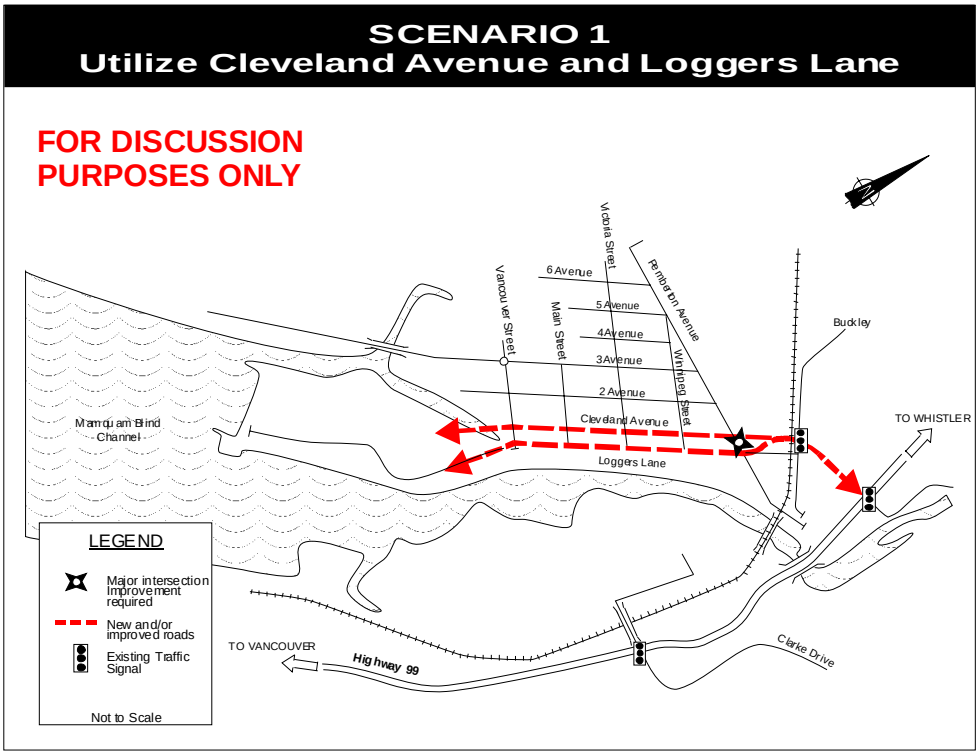
5.2.1 Initial Transport Plan Scenarios

At the first public meeting, 5 future road network plans were presented that had previously been suggested by others as potential future access scenarios to the redevelopment of downtown Squamish. These 5 scenarios are described below and illustrated in the following five figures.

SCENARIO 1 → Utilize Cleveland Avenue and Loggers Lane

Scenario 1, which is illustrated in **FIGURE 5.1**, involves the extension of the existing grid road network to the lower peninsula from downtown Squamish with both Cleveland Avenue and Loggers Lane as the vehicle access points.

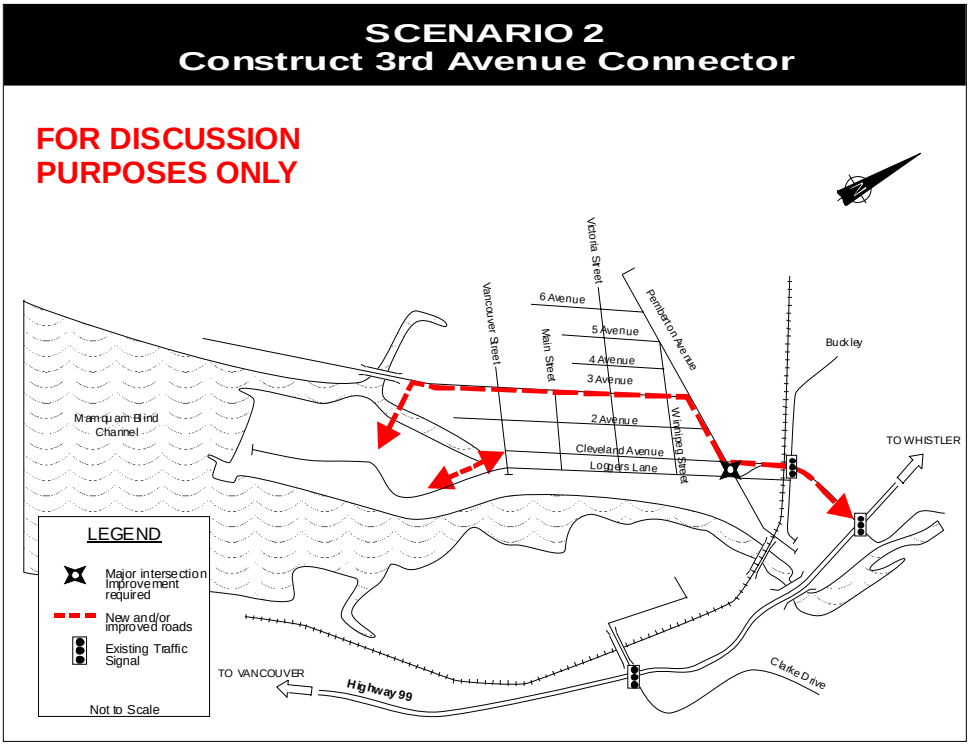
FIGURE 5.1
TRANSPORT PLAN SCENARIO 1



SCENARIO 2 → Construct 3rd Avenue Connector

Scenario 2, which is illustrated in **FIGURE 5.2**, involves the reconfiguration of Pemberton Avenue from Cleveland to 3rd Avenue, and along 3rd Avenue from Pemberton to the Cattermole Slough with a crossing over Cattermole Slough linking the existing 3rd Avenue with the lower peninsula. This connector would be reconfigured with intersection and traffic control operational changes to ensure that northbound and southbound vehicle volumes on 3rd Avenue have priority. Cleveland Avenue or Loggers Lane would provide the second access to the redeveloped lands.

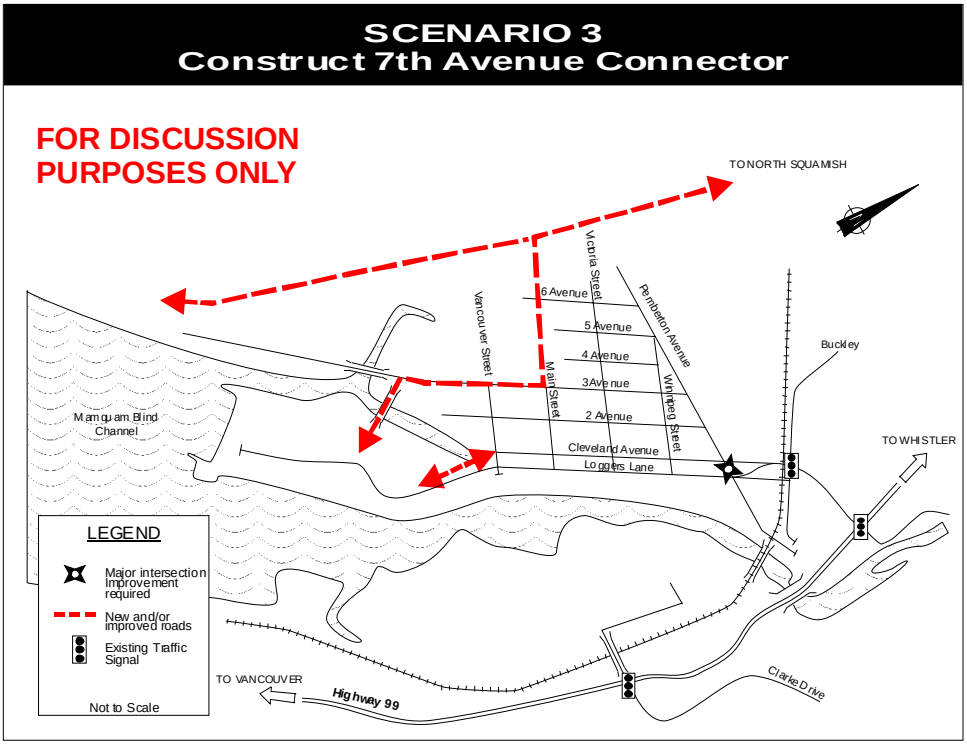
FIGURE 5.2
TRANSPORT PLAN SCENARIO 2



SCENARIO 3 → Construct 7th Avenue Connector

Scenario 3, which is illustrated in **FIGURE 5.3**, involves the construction of the 7th Avenue connector linking 3rd Avenue near Squamish Terminals to the south with Government Road and the industrial lands surrounding the main rail yards and the rest of Squamish to the north. This new link would also connect to the downtown road network via the extension of Main Street to the west. Access to the lower peninsula would be via 3rd Avenue and the new crossing over the Cattermole Slough, while Cleveland Avenue or Loggers Lane would provide the second access to the redeveloped lands.

FIGURE 5.3
TRANSPORT PLAN SCENARIO 3

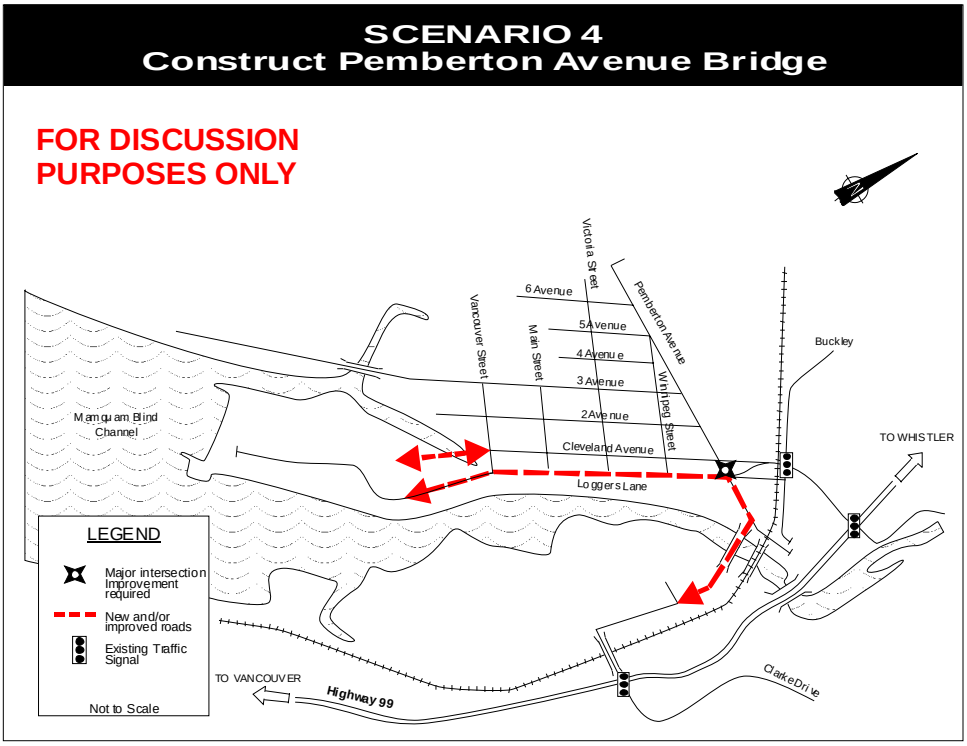


SCENARIO 4 → Construct Pemberton Avenue Bridge

Scenario 4, which is illustrated in **FIGURE 5.4**, involves the construction of a new crossing of the Mamquam Blind Channel just downstream of the rail bridge

linking Pemberton Avenue with the new development under construction on the east of the channel. This connection would also provide a new access to Highway 99 at the signalized intersection of Clark Drive. Loggers Lane would be the primary vehicle access to the lower peninsula with Cleveland Avenue providing the secondary access.

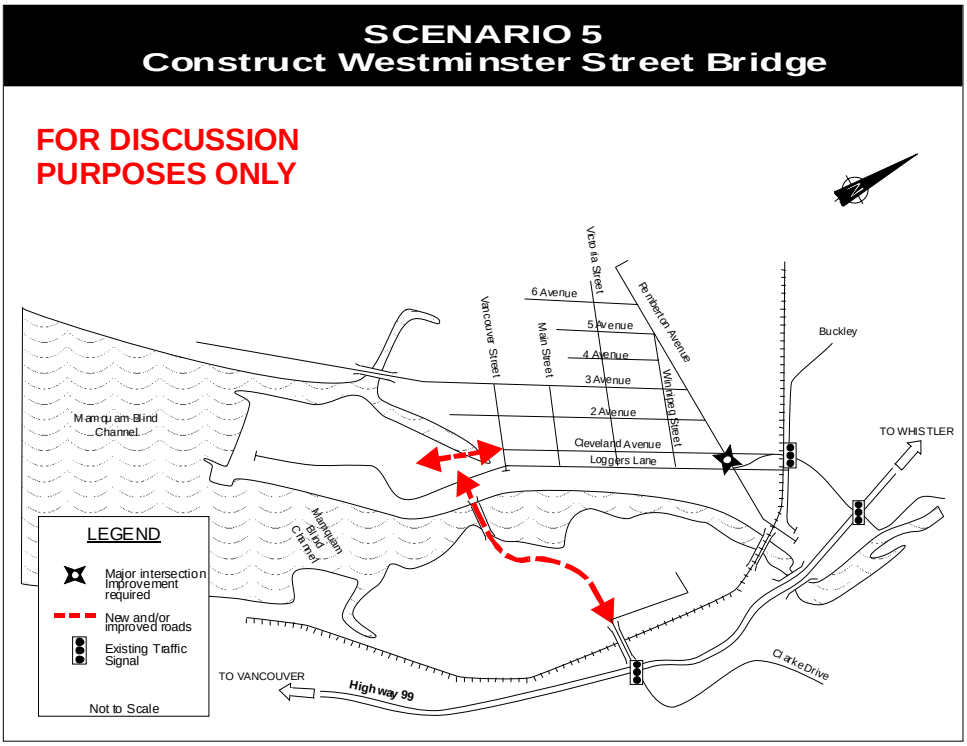
FIGURE 5.4
TRANSPORT PLAN SCENARIO 4



SCENARIO 5 → Construct Westminster Street Bridge

Scenario 5, which is illustrated in **FIGURE 5.5**, involves the construction of a new crossing of the Mamquam Blind Channel along the Westminster right of way linking Loggers Lane / Gailbraith Avenue to the west with Highway 99 at the signalized intersection of Clark Drive to the east. Cleveland Avenue would provide the second access to the lower peninsula.

FIGURE 5.5
TRANSPORT PLAN SCENARIO 5



5.2.2 Initial Feedback on First Five Scenarios

At the first public meeting, the public was also invited to rank the first five scenarios on a scale of 1 to 10 before the technical assessment was done in order to provide the consultant team with an indication of the level of support for each of the scenarios. The ranking ranged from 1 to 3 (dislike), 4 to 7 (neutral) and 8 to 10 (like). From the 32 comment sheets received, the feedback was tabulated and the results are summarized below for the pre-technical assessment:

- Scenario 1 (Grid network) → Score = 4.2
- Scenario 2 (3rd Ave Connector) → Score = 3.1
- Scenario 3 (7th Ave Connector) → Score = 2.3
- Scenario 4 (Pemberton bridge) → Score = 4.7
- Scenario 5 (Westminster bridge) → Score = 7.6

Therefore, Scenario 5, which involved a new crossing of the Mamquam Blind Channel in the vicinity of the Westminster right of way, received more support than other scenarios from those members of the public that participated in the pre-study survey.

5.3 Stakeholder Consultation

The District of Squamish provided the consultant team with a list of stakeholders to communicate with and to seek their input during the course of this project. This consultation consisted of meetings, phone calls, discussions with representatives at the two public open houses, emails and/or letters. As well, each of the stakeholders was provided with a copy of the first draft of the transport plan to further solicit their feedback.

The following is the list of stakeholders who were contacted as part of this project (in alphabetical order):

1. BC Rail Properties
2. BC Transit
3. CN Rail
4. Capilano College
5. Chamber of Commerce
6. Downtown Business Improvement Association
7. Downtown Residents Association Ministry of Transportation & Infrastructure
8. Emergency Service Providers (Fire, Ambulance, Police)
9. School District #48
10. Squamish Estuary Management Committee
11. Squamish First Nations
12. Squamish Oceanfront Development Corporation
13. Squamish Sustainable Corporation
14. Squamish Harbour Authority
15. Squamish Terminals
16. Squamish Trails Society
17. Squamish Yacht Club
18. Transport Canada (Navigable Waters)
19. Westmana Development Corporation

5.4 Public Information Meeting #2

The second public information meeting was held on Thursday, 9 October 2008 at the Squamish Adventure Centre in Squamish with 41 members of the public signing in at the check-in table. The primary objectives of this second public information meeting were to:

1. Present the first draft of the transport plan to the public;
2. Explain the technical rationale for how the first draft of the transport plan was developed by the consultant team; and
3. To solicit input from the public and stakeholders on the first draft.

Advertising included announcements in the Squamish Chief newspaper in the week before and Mountain FM radio on the day of the public meeting. At this meeting, display boards were presented summarizing the work completed to date, the assessment of seven (7) transport plan scenarios and the first draft of the recommended transport plan. In addition to the display boards, a presentation was also given followed by a question and answer session.

Initially, the period for receiving comments from the public was to end on November 1st so that work could begin on the second draft of the transport plan in the month of November. However, feedback from the public and the stakeholders continued until early December, so the development and refinement of the second draft of the plan was delayed till mid December 2008.

Further information on the material presented at the second public information meeting including the scenarios tested and the technical findings are described in the following chapter.

SECTION 6 DEVELOPMENT OF THE 2031 TRANSPORT PLAN

Planning for a future transportation system in order to accommodate projected population and employment level is a vital task of any municipal organization. It must be done in a controlled and staged manner in order to ensure that future traffic volumes do not destroy the livability of a community.

6.1 Development of the 1st Draft of the Transport Plan

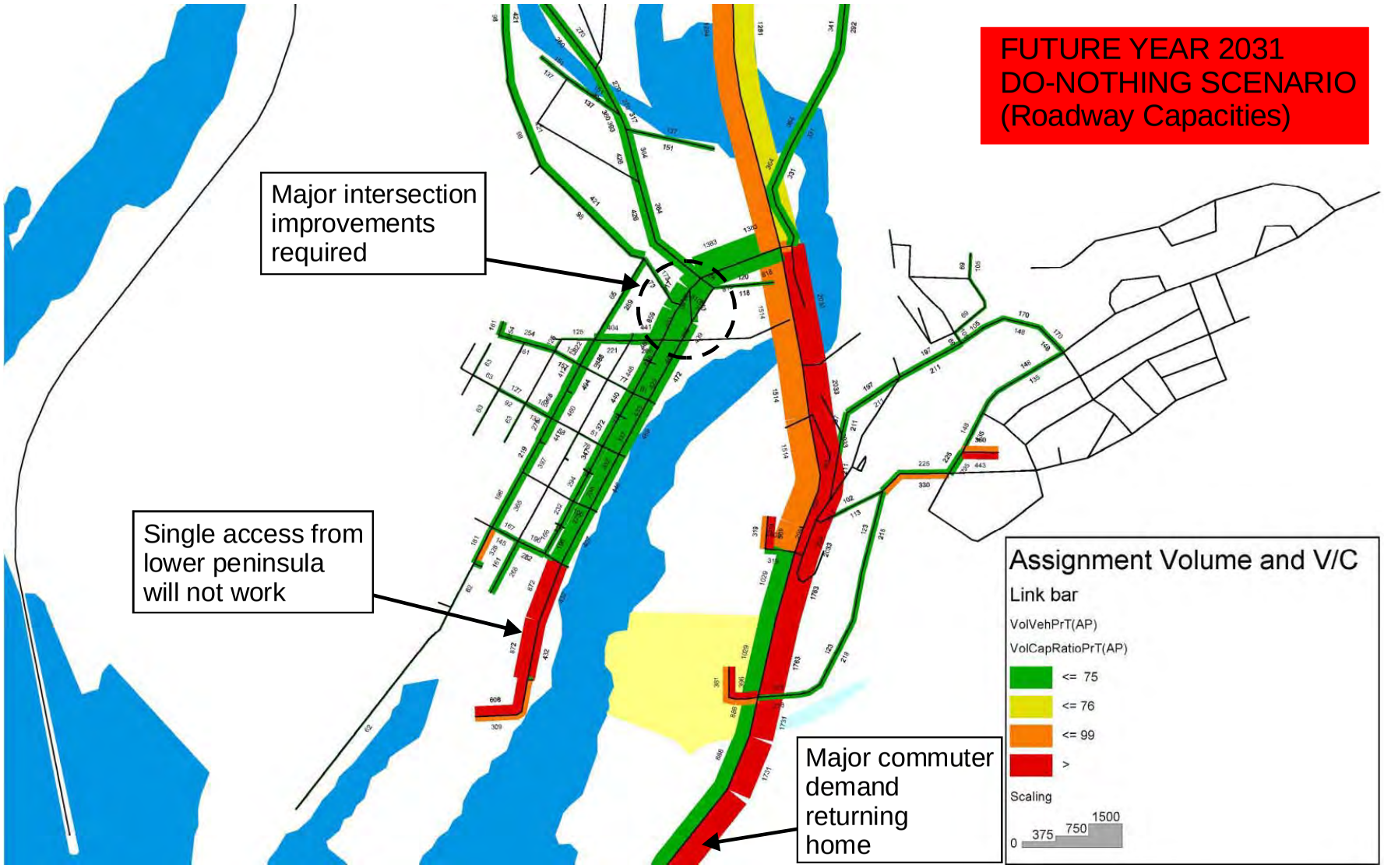
6.1.1 Projected Volumes

The VISUM model developed for this project was used to project design hour volumes for the year 2031 for various road network and transport mode split scenarios. Under existing conditions and for the calibrated model, a total of 5,200 vehicles were modeled for the Summer Friday afternoon peak hour for all of Squamish. However, this is projected to increase to close to 12,000 vehicles per hour by the year 2031 which represents an increase of 130% in background volumes. **FIGURE 6.1** illustrates the projected link volumes for the study area for the "do-nothing" scenario. The link traffic volumes are coloured coded depending on the volume to capacity ration (v/c) which describes how much (or little) spare capacity a roadway segment has to accommodate additional traffic volume growth.

From **FIGURE 6.1**, the following observations can be made:

1) Highway 99 is projected to be at or over capacity in the northbound direction despite the improvements currently being made to the highway as part of the Sea to Sky improvement project;
2) The combination of the commuter demand returning to Squamish and the beginning of the influx of weekend traffic to the Highway 99 corridor is clearly visible;
3) The modelling of a single access to the lower peninsula will not work as the demand will exceed the capacity of the Loggers Lane corridor or Cleveland Avenue corridor without major capacity improvements.
4) Although the link volumes are below the theoretical capacity, the intersections on Cleveland Avenue and Loggers Lane between Pemberton Avenue and Buckley will all be over capacity and have major perational problems.

FIGURE 6.1
LINK VOLUME PROJECTIONS USING THE VISUM MODEL FOR THE DO-NOTHING SCENARIO, 2031 SUMMER FRIDAY AFTERNOON PEAK HOUR



The analysis also determined that there was very strong travel demand between the lower peninsula and Highway 99 linking the new local housing with the future jobs outside of Squamish, and that the "Do Nothing" scenario would only work if:

- There was major new capital works at the north end of downtown significantly widening intersections and streets;
- The on-street parking on Cleveland Avenue would be removed to double the roadway capacity; and
- The redevelopment of the lower peninsula would require a minimum of two vehicle access points.

6.1.2 Testing of Do-Something Scenarios

The results of the "do-nothing" scenario clearly identified key congestion segments and bottlenecks if the existing trend lines and transport mode splits continued, while at the same time the lower peninsula developed as expected. Five "Do Something" scenarios (numbered from 1 to 5) were then examined which tested various network improvements to address projected year 2031 congestion levels but still assumed that there would be no accompanying change in travel mode (i.e. 92.7% of all person trips were still by car, only 1.5% by public transit, etc.) and the projected population and employment levels remained as is. The following five (5) scenarios, which were first presented and illustrated in Chapter 5 of this report, were tested:

Scenario 1 – Utilize Cleveland Avenue & Loggers Lane;

Scenario 2 - Construct 3rd Avenue Connector

Scenario 3 - Construct 7th Avenue Connector

Scenario 4 - Construct Pemberton Avenue Bridge

Scenario 5 - Construct Westminster Street Bridge

The assessment of the above five scenarios determined that:

- The projected volumes warranted one new 2 lane crossing (i.e. 1 lane in each direction) over the Mamquam Blind Channel;
- That the Westminster bridge option would carry double the traffic of the Pemberton bridge option because it provided a more direct link between the

lower peninsula, downtown Squamish and Highway 99 but because of that would be close to capacity by the year 2031;

- That a second crossing would likely be required beyond 2031 if current trends continue; and
- That there was a was a strong desire to use Government Road via the 7th Avenue connector, 3rd Avenue or Bailey link to connect downtown with the rest of the community and key employment nodes to the north.

6.1.3 Testing of Do-Something Sustainable Scenarios

From the assessment of the "Do Nothing" and five "Do Something" scenarios, two "Do Something Sustainable" scenarios were developed and tested where transport mode splits, population and employment projections were adjusted as described below:

- Reduced auto trips to 85%
- Increased transit trips to 5%
- Increased motorcycle trips to 1%
- Increased bicycle trips to 3%
- Increased walk trips to 5%
- Increased other trips (e.g. ferry) to 1%
- Reduced # of new homes (from 8,800 to 7,500)
- Added more local jobs (from 3,400 to 8,000)

SCENARIO 6 → Construct 7th Avenue Connector & Pemberton Avenue Bridge

Scenario 6, which is a hybrid of Scenarios 3 and 4 is illustrated in **FIGURE 6.2**. This scenario involves the combination of both the 7th Avenue connector and the Pemberton Avenue bridge while at the same time increasing the use of alternative modes of transport at the expense of the private automobile.

SCENARIO 7 → Construct Westminster Street Bridge

Scenario 5, which is a hybrid of Scenarios 3 and 5, is illustrated in FIGURE 6.3,. This scenario involves the combination of both the 7th Avenue connector and the Westminster bridge while at the same time increasing the use of alternative modes of transport at the expense of the private automobile.

FIGURE 6.2 - TRANSPORT PLAN SCENARIO 6

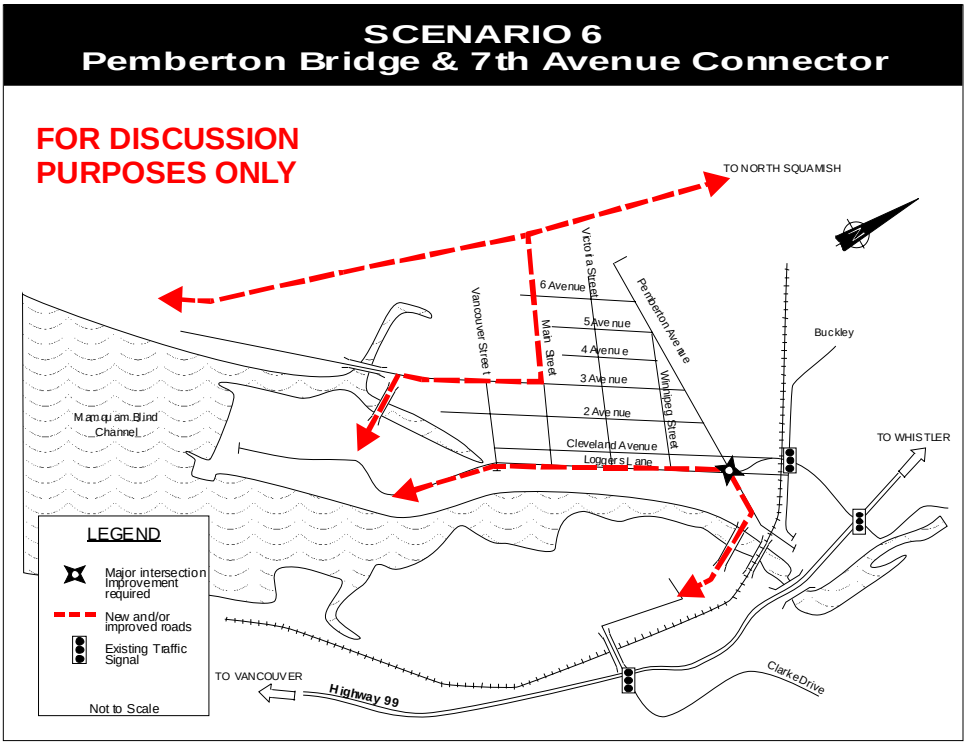
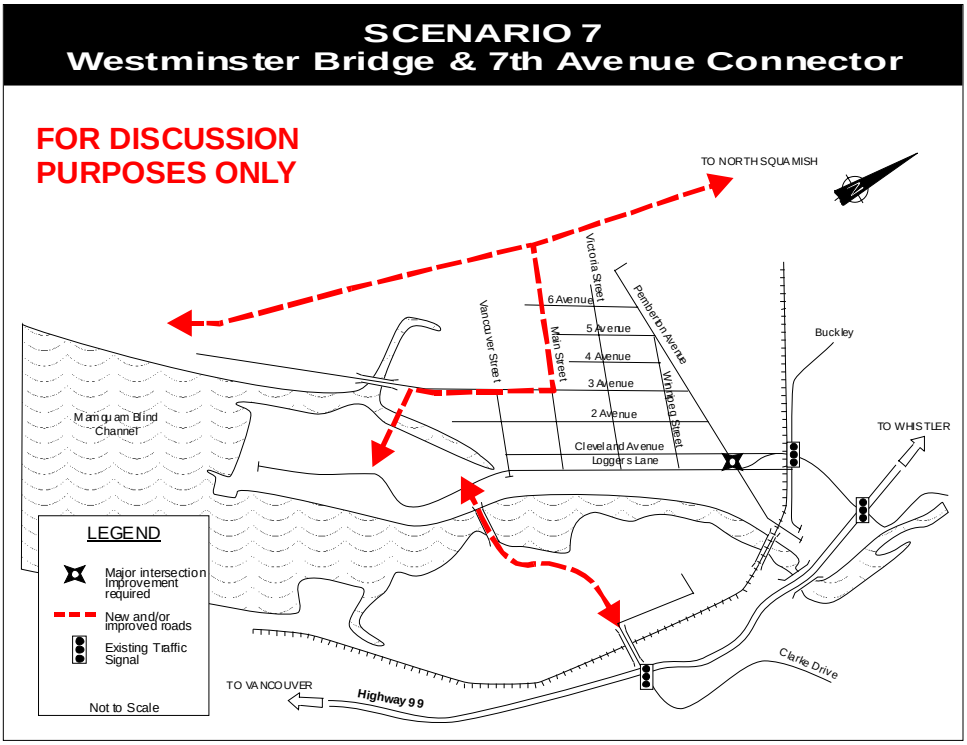


FIGURE 6.3 - ROAD NETWORK – SCENARIO 7



Scenarios #6 and #7 included various combinations of a new crossing over the Mamquam Blind Channel with a new or improved road link to Government Road to the north to access the future employment while at the same time changing transport mode splits to reduce auto use. The modeling of sustainable initiatives for these scenarios demonstrated how travel demand can be altered to create a more balanced transport system. At the same time, it reduced vehicle congestion (e.g. Westminster bridge) and increased the longevity of the transportation system to absorb future traffic volumes.

6.1.4 First Draft of the Transport Plan

The results of the technical work on the base case scenario and the seven alternative scenarios resulted in the development and release to the public of the first draft of the transport plan in October 2009. This transport plan was the preferred "technical" solution by the consultant team for the community and included the following key features:

- Embraced Smart Growth principles (e.g. options to the car were emphasized, minimized construction of new roads, encourage more local employment, etc.);
- Included the Pemberton bridge and the new link to Highway 99 at Clark Drive;
- Recommended that the downtown grid network be extended into the lower peninsula;
- Recommended that Loggers Lane to be the primary vehicle route and Cleveland Avenue be the secondary route to and from the lower peninsula;
- Recommended that Bailey Street be upgraded to an arterial to link the lower peninsula with the future employment to the north;
- That a major roundabout be constructed at the north end of downtown to provide a better connection between major approach roads and to ensure good vehicle access to and from the new Pemberton bridge;
- That the Westminster right of way, the Westminster crossing and the 7th Avenue Connector be protected as potential future port roadways so that the harbour can be linked with Highway 99 and/or the rail lands to the north should the demand develop and/or the sustainable initiatives contained in the transport plan are not met (e.g. reduce vehicle use as a percentage of all person trips)
- That a new multi-modal transportation centre be constructed at the north end of downtown by the main CN railway corridor in order to facilitate transfers between

various alternative modes of transport while at the same time providing a higher level of service to the public;

- That a new commuter pathway be constructed alongside Loggers Lane to link the multi-modal transportation centre to the north with the lower peninsula and possible passenger ferry docks to the south;
- That the Westminster right of way should be expanded to 25 metres to protect for possible future port road;
- Roadway classifications have been developed at a more detailed level to match existing and expected future demand.
- Truck routes have been defined based on existing and expected future requirements.
- Truck route on Loggers Lane can be eliminated when alternate routes become available.
- Potential truck route via 3rd and Main is only if the northern portion of the 7th Avenue connector is constructed.
- Major objective of plan is to significantly increase public transit service, facilities and comfort for passengers (e.g. more bus shelters).
- New major multi-modal transport centre to combine public transit, Greyhound, taxi and future passenger rail transfers under one roof.
  Construct park & ride lot for transport centre
- Proposed plan minimizes the construction of new roads except in new development areas
- Proposed plan minimizes costs where possible

In addition to the network changes, there were also the following changes in transport modes to achieve a more balanced transportation system for downtown Squamish:

- Reduced auto trips from 92.7% to 75%
- Increased transit trips from 1.5% to 10%
- Increased motorcycle/scooter trips from 0.7% to 1%
- Increased bicycle trips from 1.6% to 5%
- Increased walk trips from 3.4% to 7%
- Increased other trips (e.g. ferry) from 0.1% to 2%

FIGURE 6.4 illustrates the projected link volumes for the first draft of the transport plan where the reduction in expected congestion levels resulting from sustainable initiatives can be readily seen with the virtual elimination of road links that are at or over capacity.

FIGURE 6.5 to **FIGURE 6.8** illustrate the components of the first draft of the transport plan.

FIGURE 6.4
LINK VOLUME PROJECTIONS USING THE VISUM MODEL FOR THE FIRST DRAFT OF THE TRANSPORT PLAN, 2031 SUMMER FRIDAY AFTERNOON PEAK HOUR

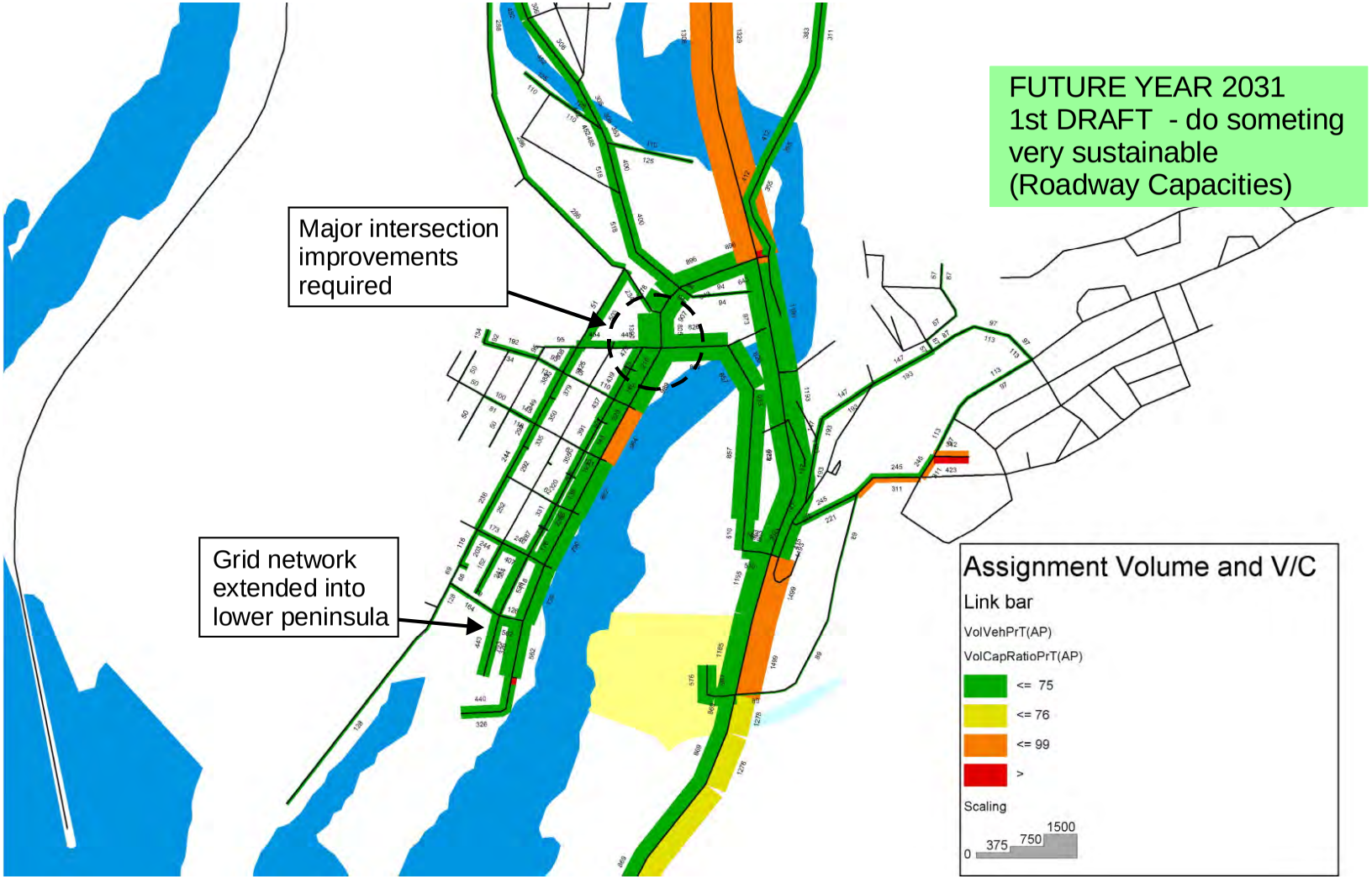


FIGURE 6.5
DRAFT 1 – LONG TERM ROAD NETWORK

FIGURE 6.6
DRAFT 1 – TRUCK ROUTE NETWORK & ROADWAY CLASSIFICATION

FIGURE 6.7
DRAFT 1 – TRANSIT NETWORK

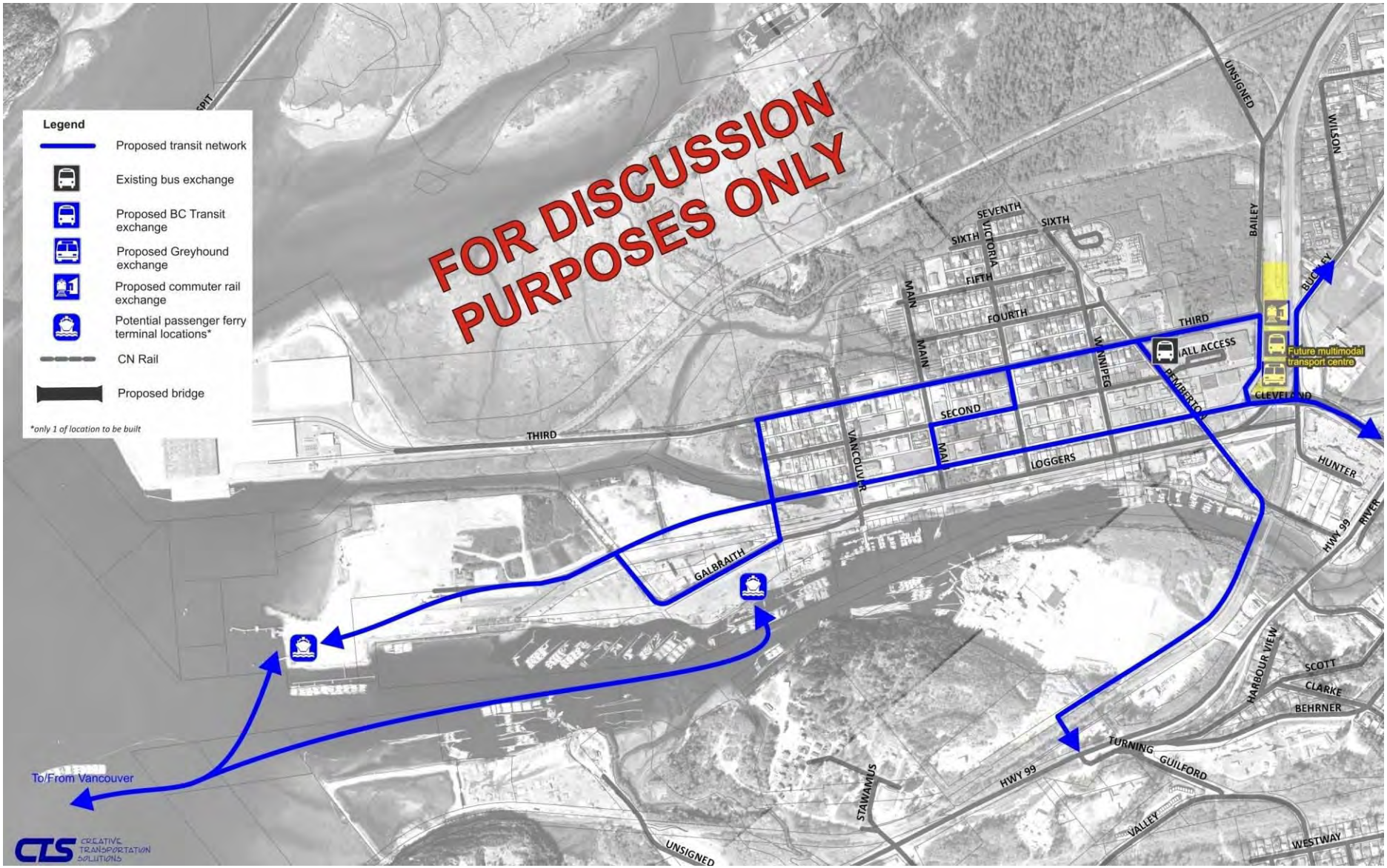
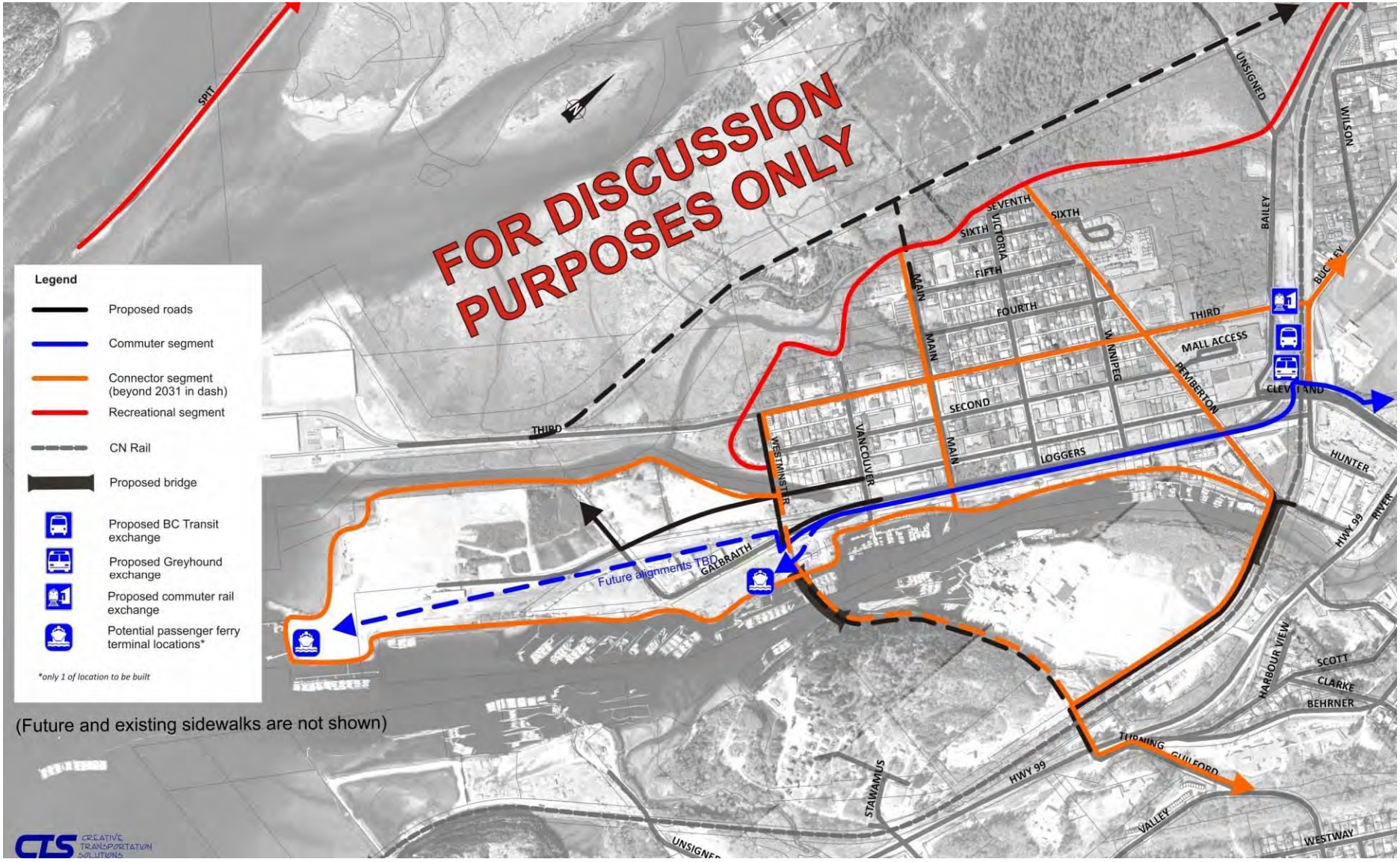


FIGURE 6.8
DRAFT 1 – PEDESTRIAN AND BICYCLE NETWORK



6.2 Consultation on the First Draft of the Transport Plan

Two months of extensive consultation with District staff, stakeholders and the public followed the release of the first draft of the multi-modal transport plan, including a presentation to Council on 7 October 2008. In summary, the majority of communication and concern was about the proposed port roads and the continued protection of right of way for both the 7th Avenue Connector and the Westminster corridor and crossing of the Mamquam Blind Channel. Interestingly, both of these dominant concerns were about plan components that are not even required to address year 2031 projected travel demand, but are included in the plan should the various sustainable initiatives not be achieved.

6.3 Development of the Second Draft of the Transport Plan

In December 2008, a second draft of the multi-modal transport plan was developed which attempted to incorporate requested changes, additions and deletions resulting from the two month consultation phase. The key changes to the transport plan were as follows:

- The port roads have been replaced with "transportation corridors to be protected" in case they are needed in the future or if the sustainable initiatives embedded in the transport plan to reduce private vehicle use are not achieved;
- A section of Bailey has been added to complete the new arterial route to Government linking the future housing in the lower peninsula with the future employment to the north;
- The truck route linking 3rd Avenue with Loggers Lane has been relocated from Westminster Street to Vancouver Street to where it exists today;
- The existing intersections of 3rd Avenue & Vancouver Street, and that of Loggers Lane & Vancouver Street will require geometrical improvements as part of the truck route in order to safely accommodate both existing and future truck turning movements; and
- The roadway classification for the new Pemberton crossing and link between downtown Squamish and Highway 99 has been changed from a collector to an arterial roadway classification based on the projected volumes and level of importance.

FIGURE 6.9 to **FIGURE 6.12** illustrate the second draft of the transport plan. **FIGURE 6.13** illustrates the projected volumes at key intersections within the study area.

In order to maintain the designated truck route along Vancouver Street connecting 3rd Avenue with Loggers Lane, the following intersection improvements will be required for both intersections to safely accommodate both existing and future truck volumes:

1. At the intersection of 3rd Avenue & Vancouver Street, both the south approach (for northbound traffic) and the east approach (for westbound traffic) will require widening to properly accommodate the northbound right turn and the westbound left turn truck movements; and

2. At the intersection of Loggers Lane & Vancouver Street, both the north approach (for southbound traffic) and the west approach (for eastbound traffic) will require widening to properly accommodate the southbound right turn and the eastbound left turn truck movements.

FIGURE 6.9
DRAFT 2 – LONG TERM ROAD NETWORK

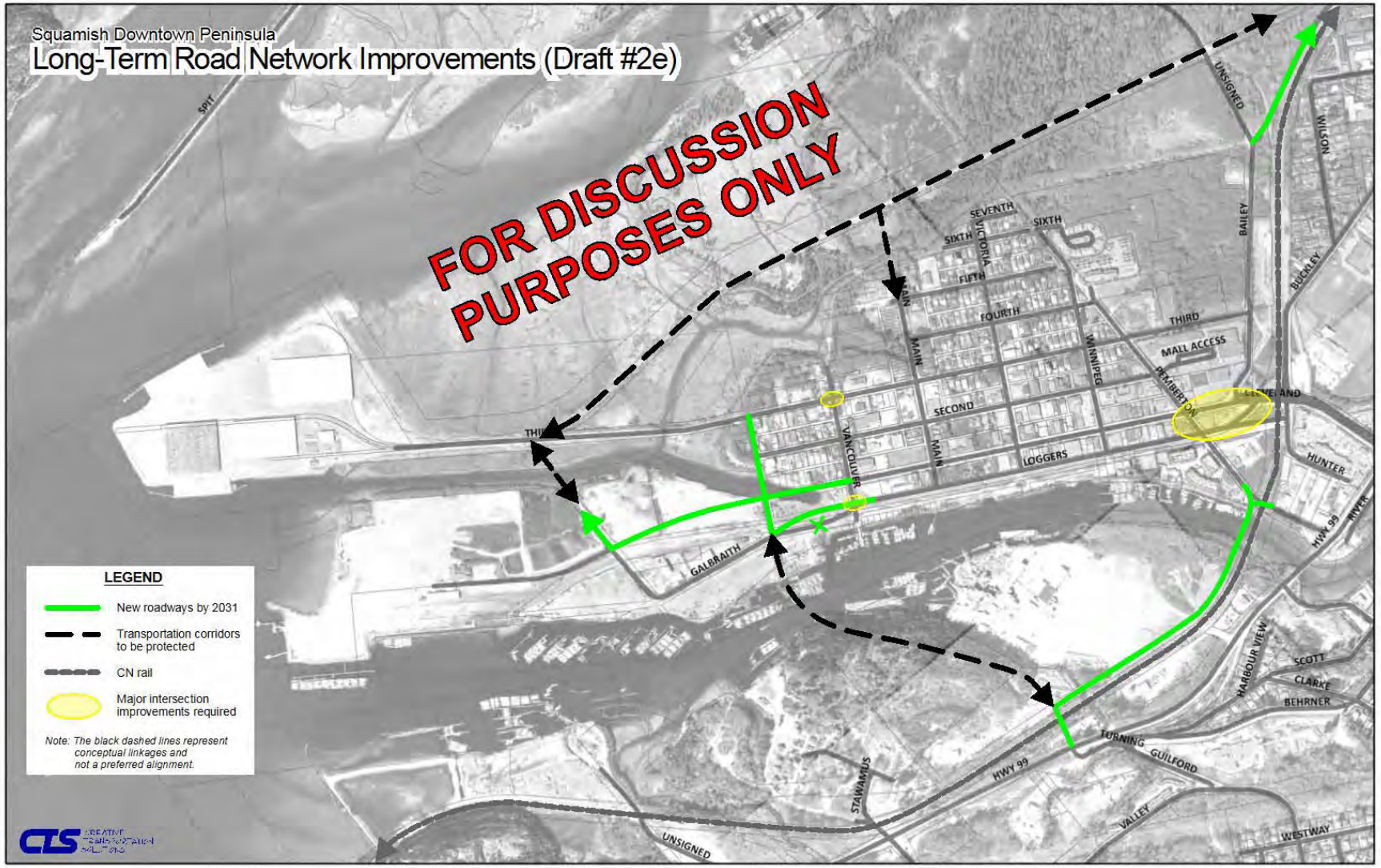


FIGURE 6.10
DRAFT 2 – TRUCK ROUTE NETWORK AND ROAD CLASSIFICATION

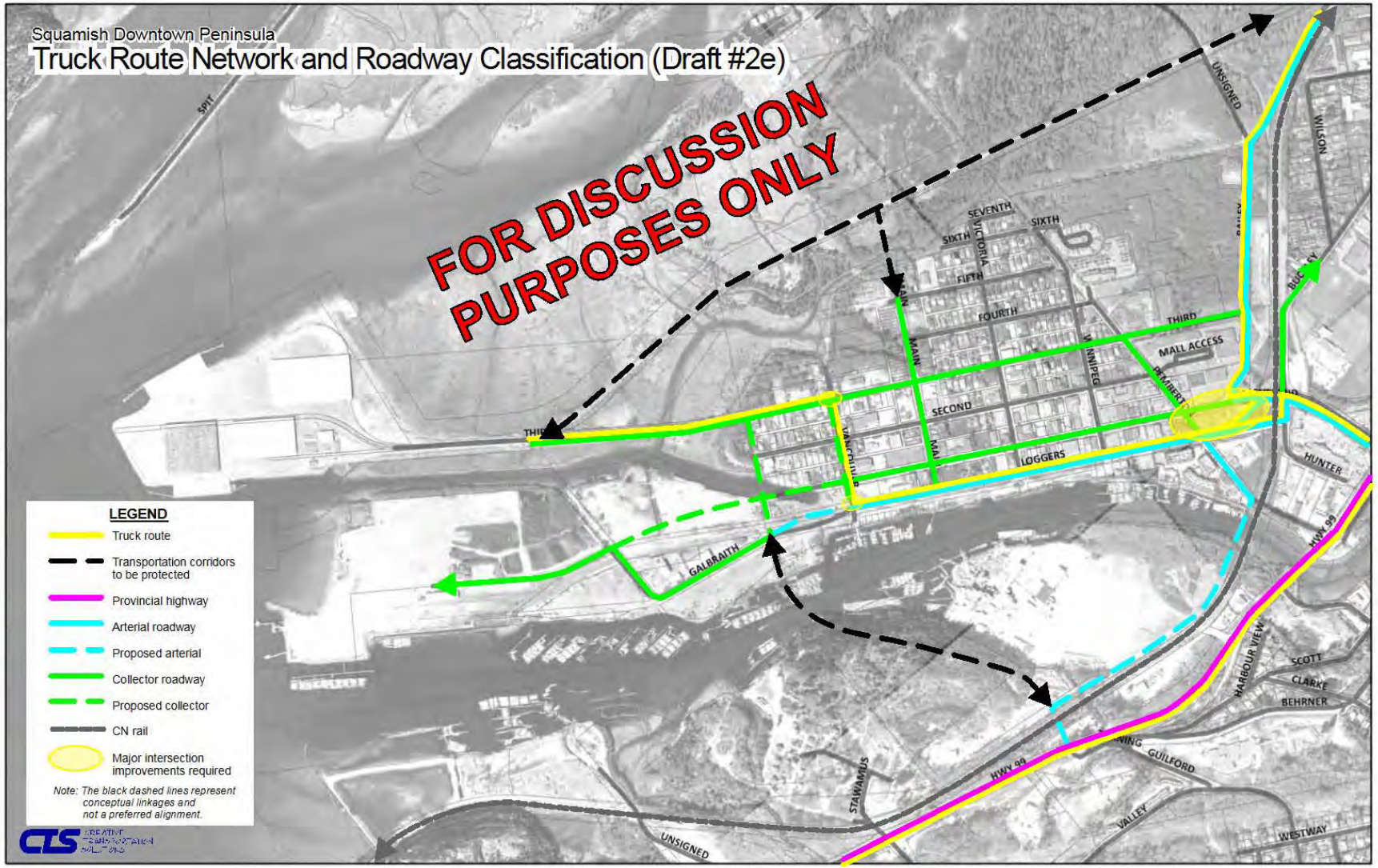


FIGURE 6.11
DRAFT 2 – TRANSIT NETWORK

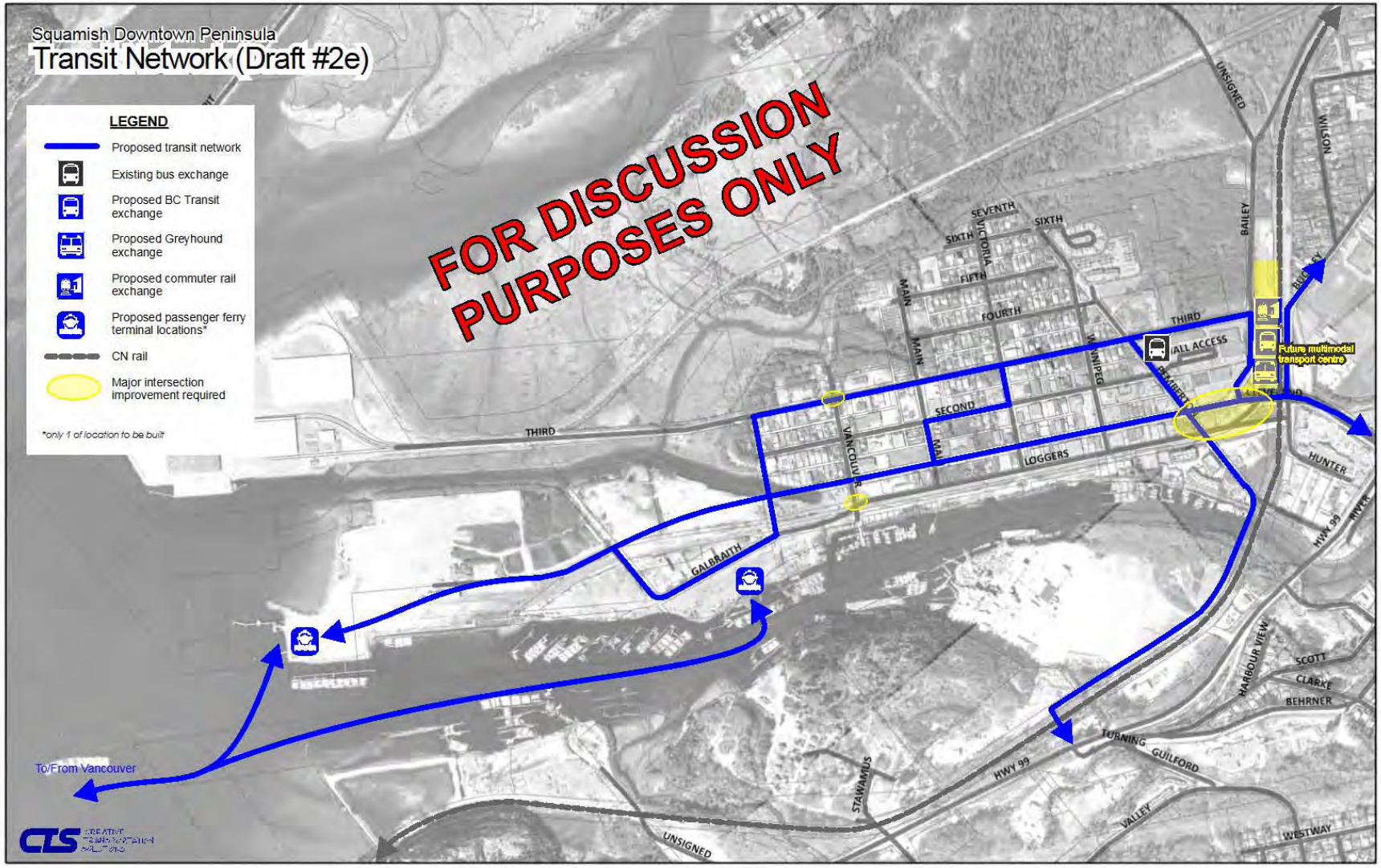


FIGURE 6.12
DRAFT 2 - PEDESTRIAN AND BICYCLE NETWORK

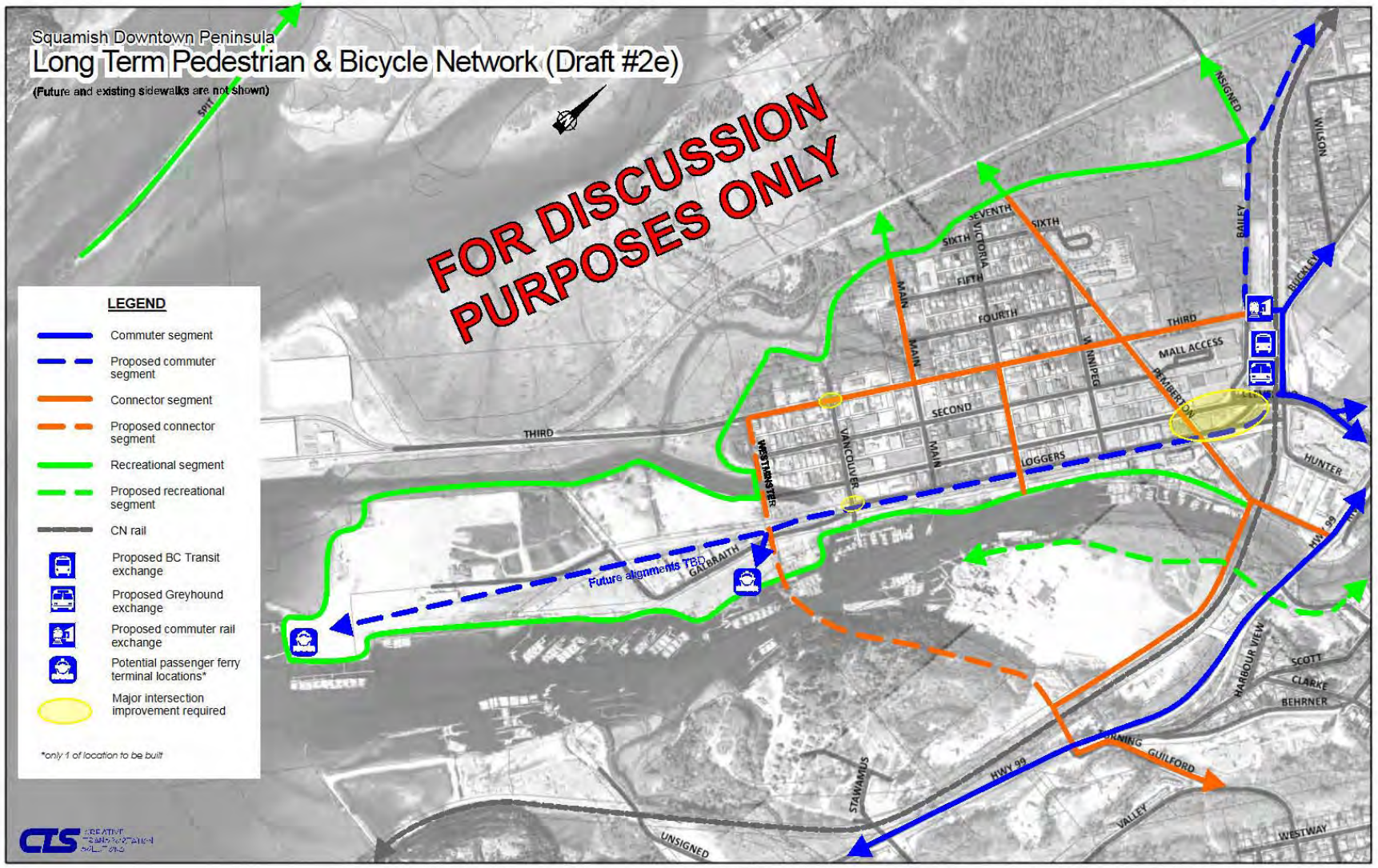
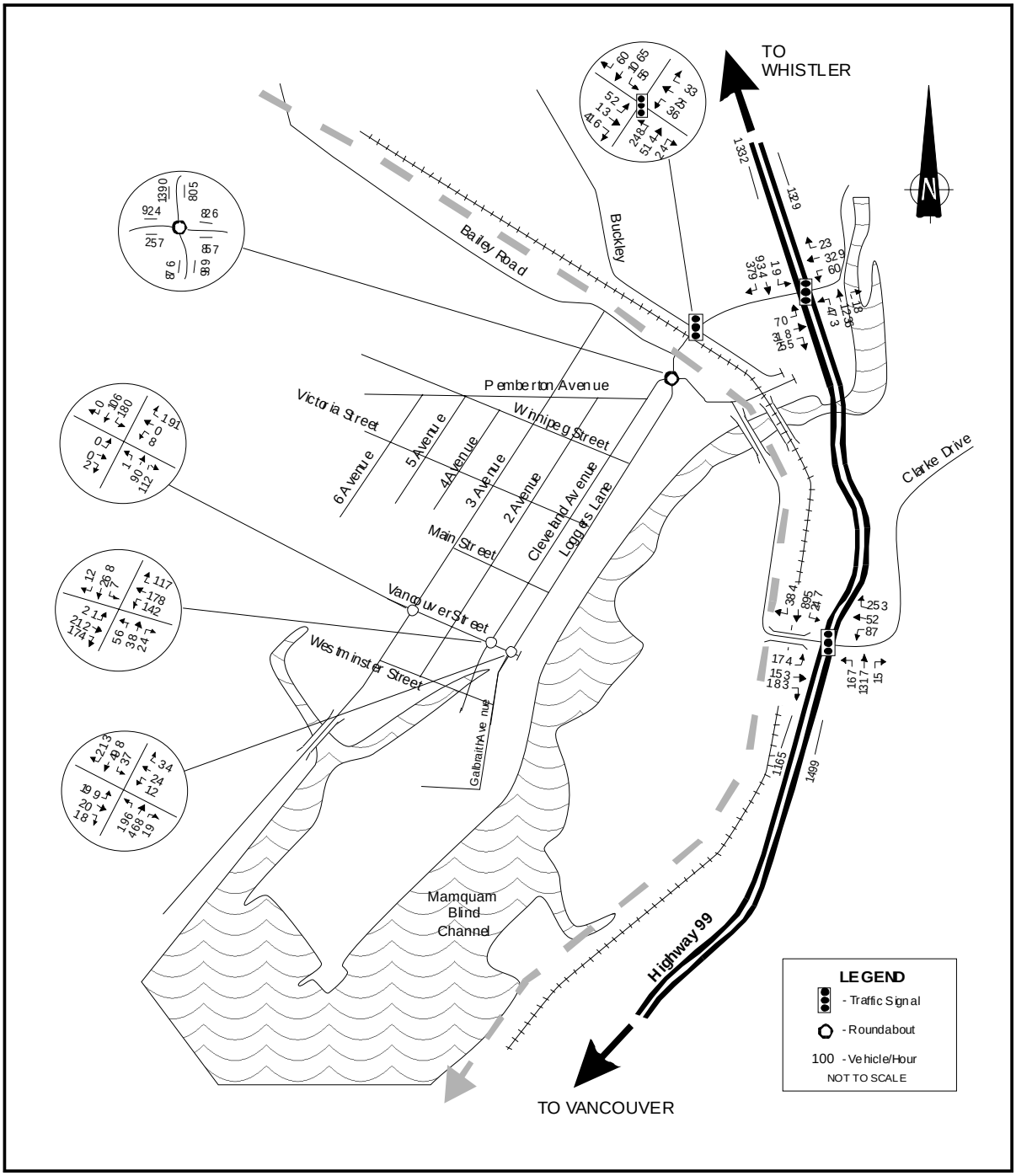


FIGURE 6.13
PROJECTED FRIDAY AFTERNOON PEAK HOUR
SUMMER 2031 TRAFFIC VOLUMES



6.4 Summary of Transport Mode Splits Used

TABLE 6.1 below summarizes the various transport mode splits used in the "do-nothing" and the nine "do-something" scenarios.

TABLE 6.1
SUMMARY OF TRANSPORT MODE SPLITS USED IN EACH SCENARIO

SCENARIO	DESCRIPTION	Car / Truck	Bus	Motorcycle	Bicycle	Walk	Other	*Total*
August 2007*	Base Case	92.7%	1.5%	0.7%	1.6%	3.4%	0.1%	*100.0%*
Scenario 0	Do Nothing	92.7%	1.5%	0.7%	1.6%	3.4%	0.1%	*100.0%*
Scenarios 1 to 5	Do something but no change in travel behaviour	92.7%	1.5%	0.7%	1.6%	3.4%	0.1%	*100.0%*
Scenarios 6 to 7	Do something sustainable (change travel mode and jobs)	85%	5%	1%	3%	5%	1%	*100%*
Scenario 8 (1st draft of plan)	Do something very sustainable (further change travel mode)	75%	10%	1%	5%	7%	2%	*100%*
Scenario 9 (2nd draft of plan)	Do something very sustainable (further change travel mode)	75%	10%	1%	5%	7%	2%	*100%*

6.5 2031 Final Transport Plan

Comments received from Council, District Staff, stakeholders and the public on the 2nd draft of the Transport Plan were reviewed and then the final transport plan for 2031 was prepared and this is illustrated in **FIGURE 6.14** to **FIGURE 6.17.** The key change from the 2nd draft of the transport plan was the recognition that future linkages to the north of downtown require further work as part of a District-wide transport plan as their impacts outside of downtown could not be assessed at this time.

FIGURE 6.14
FINAL – LONG TERM ROAD NETWORK

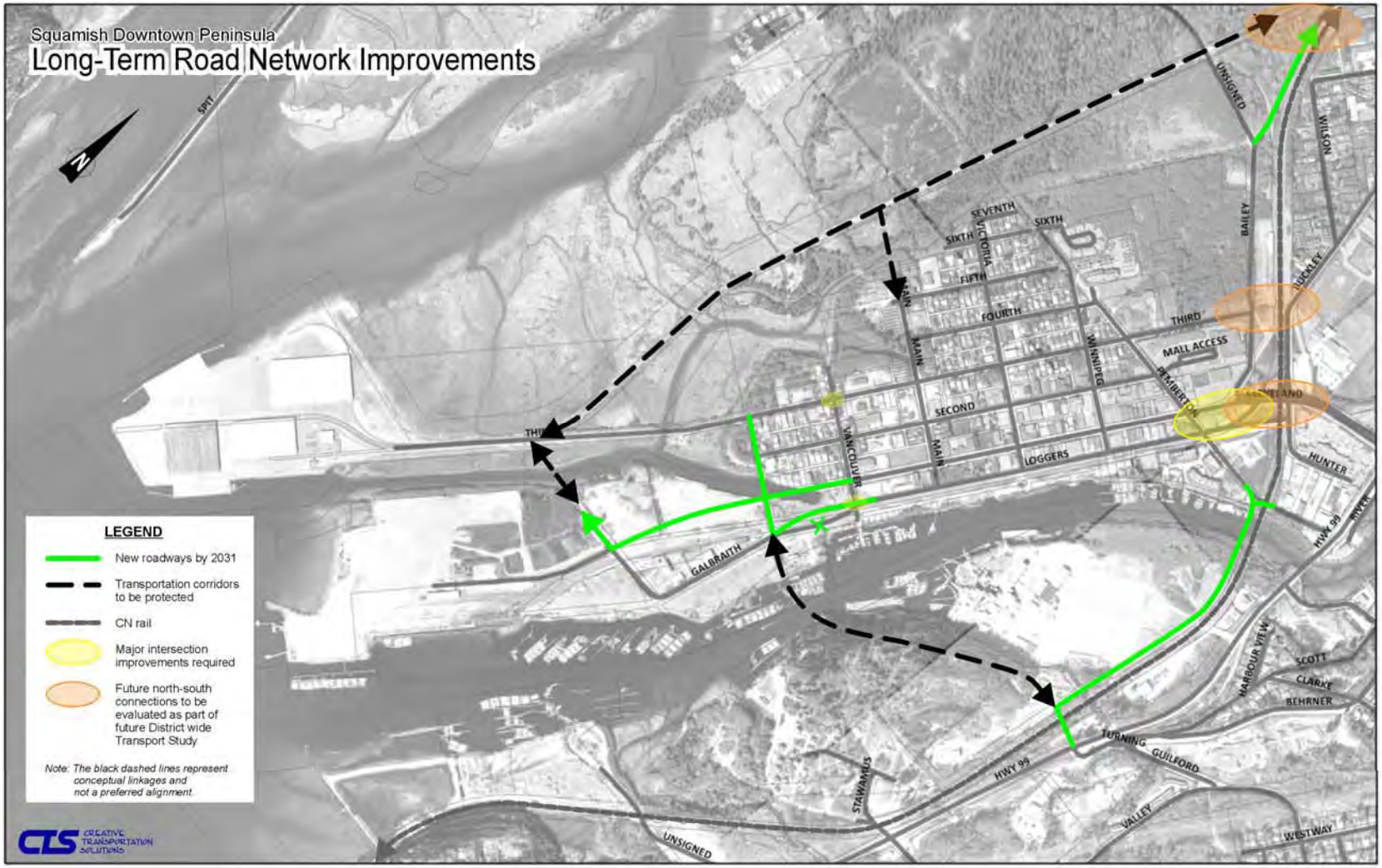


FIGURE 6.15
FINAL – TRUCK ROUTE NETWORK AND ROAD CLASSIFICATION

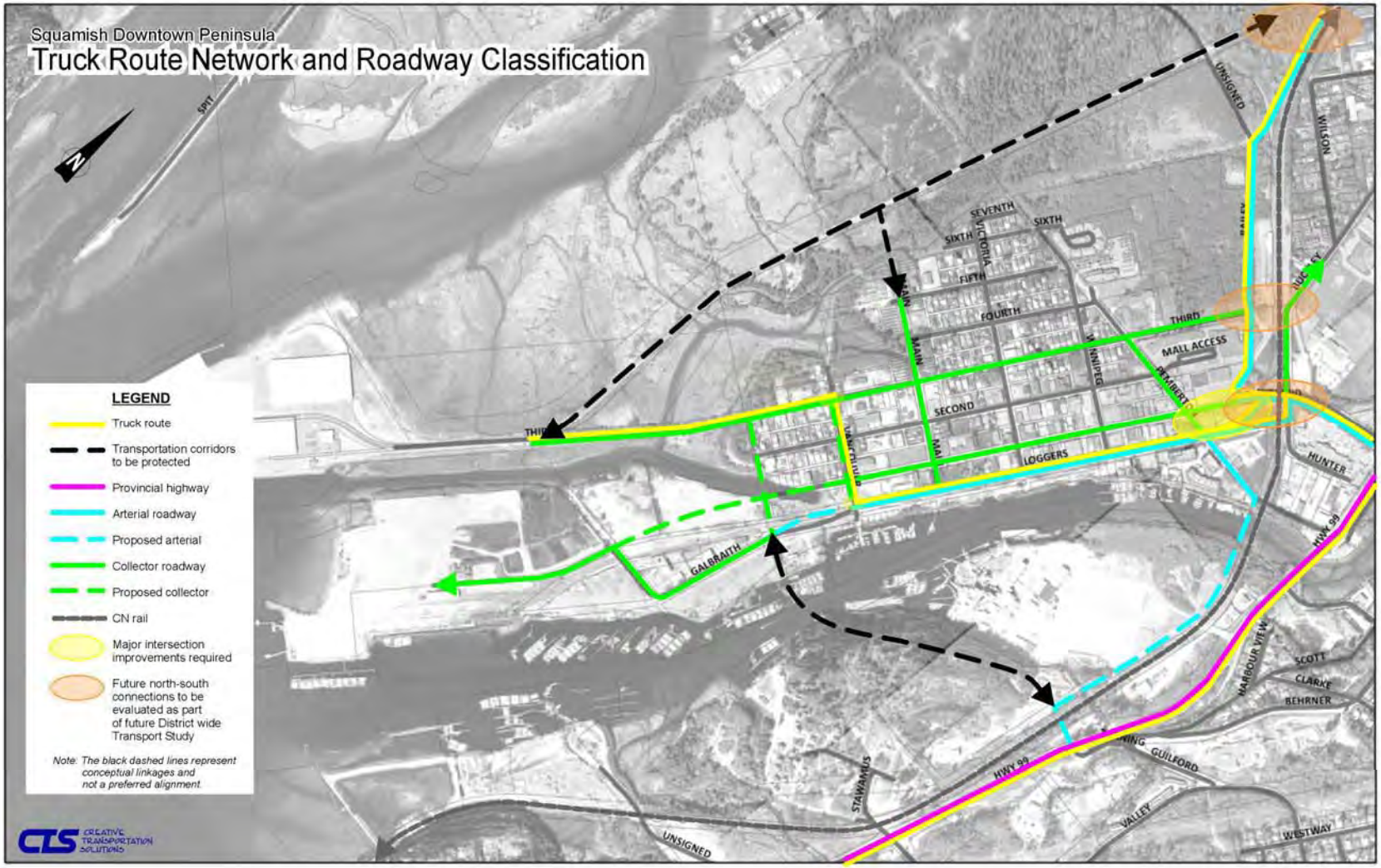


FIGURE 6.16
FINAL – TRANSIT NETWORK

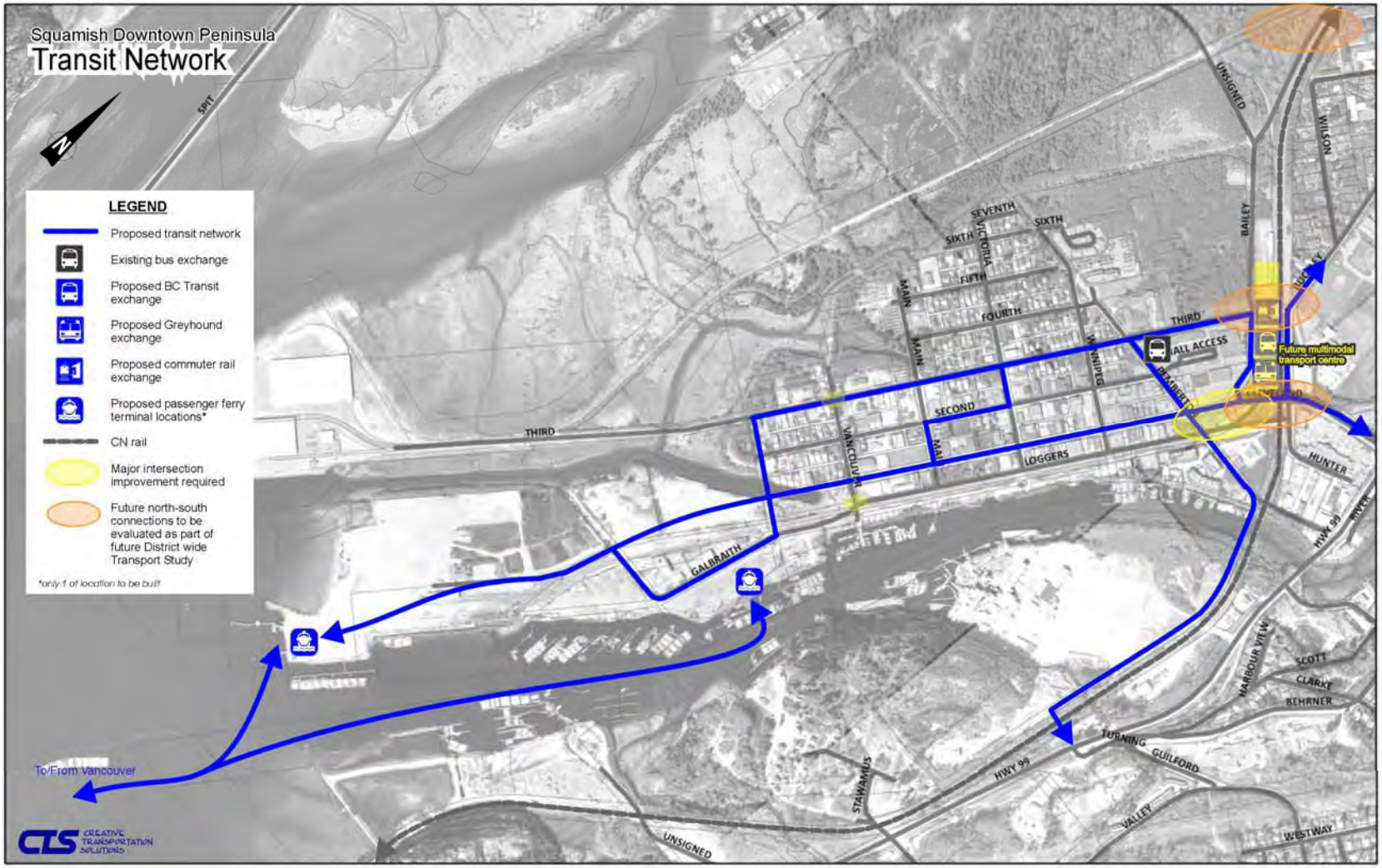
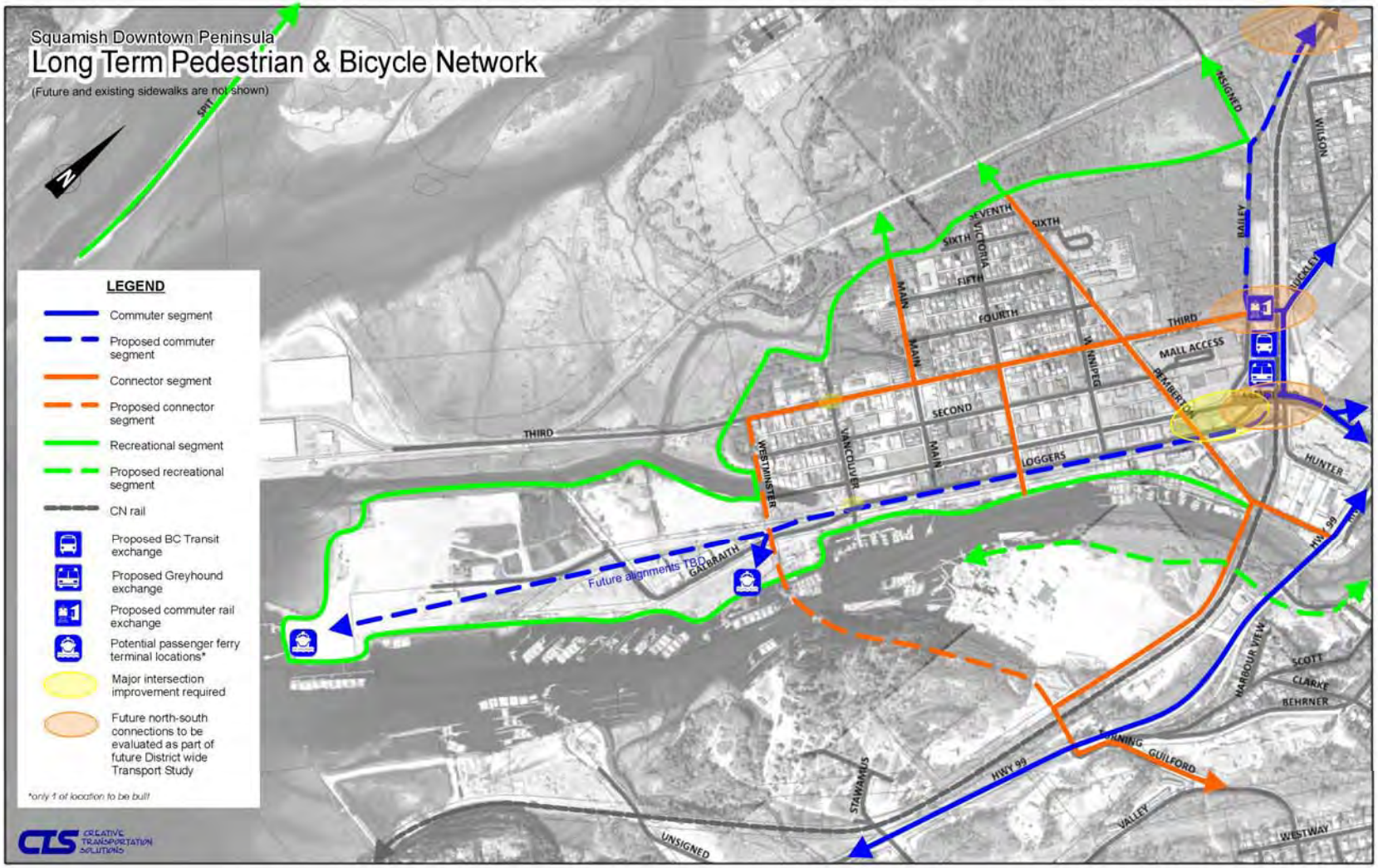


FIGURE 6.17
FINAL - PEDESTRIAN AND BICYCLE NETWORK



SECTION 7 CONCLUSIONS AND RECOMMENDATIONS

This study examined the existing transportation conditions in downtown Squamish and expected future growth patterns in both population and employment to the year 2031 in order to develop a multi-modal transport plan for downtown Squamish that embraces Smart Growth principles.

7.1 CONCLUSIONS

1. The population of Squamish is forecast to more than double from 14,950 in the year 2006 to 33,100 by the year 2031 with the majority of future residents to be housed in new developments in the vicinity of downtown Squamish.

2. One of the largest areas of potential residential development is an area known as the "lower peninsula" located immediately south of downtown Squamish on former industrial lands. Currently, this area is served by one vehicle access on Galbraith Avenue which connects to downtown Squamish at the intersection of Loggers Lane & Vancouver Street. In an effort to create a more sustainable community and to guide the future development of Squamish, the community has embraced Smart Growth principles for the redevelopment of downtown.

3. Employment for Squamish-based residents is expected to only increase by only 40% between the year 2006 (8,335 jobs) and the year 2031 (11,700 jobs). Therefore with a larger population but smaller percentage of jobs, the majority of the Squamish based population is forecast to either not be employed or have a job located outside of Squamish. If this trend of turning Squamish into a "bedroom community" continues, it will have significant impacts on the future transportation network requirement for Squamish as the majority of travel demand will be between the various neighbourhoods of Squamish and Highway 99. As well, this would conflict with Smart Growth principles which encourages the development of good jobs close to home for future residents.

4. The current transportation plan for Squamish identified two future major transportation roadways into downtown Squamish. The "7th Avenue Connector" would be located on the west side of downtown Squamish along the railway corridor and link both downtown and the harbour to the south with the railway

yards and industrial park to the north, as well as provide an indirect connection to Highway 99 along Government Road. The second corridor in the transportation plan is a new crossing of the Mamquam Blind Channel which would link downtown Squamish to the west with Highway 99 to the east.

5. In 2006, a bridge study was conducted that reviewed various potential crossing locations of the Mamquam Blind Channel. From the results of that study, two potential crossing locations were selected for further review. These were known as the "Pemberton bridge" and "Westminster bridge" options. The Pemberton bridge option would be located just south of the existing railway bridge and link Pemberton Avenue to the west with the new Waterfront Landing development and Highway 99 to the east at the Clark Drive intersection. The Westminster bridge option would connect Cleveland Avenue near Vancouver Street in downtown Squamish with Highway 99 to the east, again at the Clark Drive intersection.

6. In 2007, the District of Squamish commissioned this study to develop an updated multi-modal transport plan for downtown Squamish with the primary objective being to develop a plan for the Downtown peninsula that takes into account both the latest projections in development activity and regional traffic patterns in Squamish Valley while adhering to Smart Growth principles that ensure that the focus is on moving people and not vehicles.

7. A review of traffic patterns on Highway 99 concluded that the summer Friday afternoon peak hour continues to be the dominant hour of the week and time of year for which to further assess both existing and future transportation requirements of Squamish. This peak hour was subsequently selected as the design hour to develop the updated transport plan for downtown Squamish.

8. In August 2007, traffic surveys were conducted of vehicles entering and exiting Squamish on Highway 99. The surveys determined that 52% of the northbound traffic at Shannon Falls and 41% of the southbound traffic at Alice Lake had a destination within Squamish during the design hour.

9. A comprehensive transport mode survey was undertaken on a typical Friday in both summer and winter conditions between 7 am and 6 pm in order to document where people enter and exit downtown Squamish, and by what mode of transport. Almost 40,000 people movements were observed on the two

survey days entering and exiting downtown Squamish. A total of 21,890 person movements were recorded during the 11 hour summer survey and 17,643 person movements during the 11 hour winter survey. Therefore, summer travel demand was 24% higher than the winter survey day.

10. The use of either a car or truck to enter and exit downtown Squamish is overwhelmingly the preferred transport for the majority of the almost 40,000 persons observed as 92.7% used this mode in the summer and 90.4% in the winter. Public transport, which for most urban communities is the next most viable and effective mode of transport for moving people, is clearly not well used in Squamish at only 1.5% in the summer and 3.8% in the winter.

11. A comprehensive traffic count program in August 2007 was also undertaken to document existing conditions and to provide sufficient ground data to calibrate the transportation model. From the collected data, it was determined that the majority of municipal roads surveyed carry volumes less than 200 vehicles per direction during the peak hour (i.e. 16:00 – 17:00). This level of traffic demand can easily be handled by one lane of traffic. As well, a total of 1,769 vehicles were observed crossing the CN main railway corridor (i.e. 847 vehicles towards downtown and 922 vehicles leaving downtown) during the summer afternoon peak hour of which Cleveland Avenue carried the majority at 89.4% of all vehicle traffic.

12. The Level of Service (LOS) for intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption and travel time. LOS range from “A” (excellent) to “F” (failing). During the critical peak hours, LOS D (poor) is considered acceptable by many public agencies in large urban areas for overall intersection operation and LOS E (which is approaching capacity) or better is considered acceptable for left turn movements at signalized intersections. However, for a community like the District of Squamish, where motorists typically have a lower level of tolerance to traffic congestion, LOS C (fair) or better during the critical peak hours was considered acceptable for overall intersection operation and LOS D (poor) or better was considered acceptable for left turn movements at signalized intersections.

13. Intersection capacity analysis of existing conditions at 6 key municipal intersections in the study area during the peak summer afternoon peak hour

determined that 5 of the 6 were operating at LOS A (excellent) and one at LOS C (fair), the latter being Cleveland Avenue & Pemberton Street. However, this intersection has been scheduled for signalization in 2009 which is expected to improve the LOS back to A (excellent). Therefore, all key intersections in downtown Squamish are currently operating at good levels of service and have varying amounts of spare capacity to accommodate additional traffic volume growth.

14. A review was also conducted of the signalized intersections of Highway 99 & Cleveland Avenue and that of Highway 99 & Clark Drive as they too are located within the study area. Although both of these intersections are currently operating at an overall LOS C (fair) during the summer afternoon peak hour, both have a left turn movement experiencing significant delays. The southbound left turn movement on Highway 99 at Clark Drive is at LOS F (failing) and the northbound left turn movement on Highway 99 at Cleveland is at LOS E (approaching capacity). As both of these intersections are being rebuilt as part of the Sea to Sky Highway Improvement project, the noted operational problems are expected to be minimized after the highway is widened and improved.

15. A parking inventory survey of all public on and off-street parking facilities in downtown Squamish was also conducted as part of this project in order to document the availability of public parking. A total of forty municipal blocks were surveyed and 2,290 parking spaces were counted of which 1,167 were on street (51%) and were 1,123 parking spaces are off-street (49%).

16. A new transportation model using the VISUM software was developed for Squamish in order to test various future transport scenarios. The model included 15 “macro” traffic zones for outside of downtown so that regional traffic patterns could be modeled while for downtown Squamish, it was modeled at a much more detailed level with the use of 21 traffic zones. Of note, the boundaries of the downtown traffic zones were designed to match the boundaries of all the distinct precincts in the Downtown Neighbourhood Plan. The calibration exercise for the Squamish model resulted in a very accurate model because the correlation coefficient of the linear regression line comparing “actual” to “simulated” volumes was 0.96 and the recommended industry standard is 0.88 or higher (up to a maximum of 1.0).

17. Significant effort was expended in meetings with planning staff, property owners and other stakeholders in order to quantify the expected changes between existing and future conditions for each of the traffic zones by the year 2031 for the base case. The following are the major changes projected:

- Housing supply to increase by 8,800 homes of which 1,209 are single family homes and 7,591 multi-family homes;
- Local based employment to increase by 2,390 jobs;
- Commercial accommodation to increase by 510 rooms; and
- College and university student population to increase by 3,230 students

18. One of the primary objectives of this study was to develop a transport plan that is more sustainable for the community and adheres Smart Growth Principles including #6 "*Good jobs are close to home*". As well, by testing various "do-something" and "do-something sustainable" options, the positive impacts of having a more sustainable transport plan could be better understood by the community, stakeholders and other decision makers. Therefore, in consultation with municipal staff, a more sustainable future employment model was developed for further testing which included the following:

- The number of jobs were projected to almost double between 2006 and 2031, which was in keeping with the projected doubling of the population;
- 75% of the new jobs were forecast to be based in Squamish;
- The number of Squamish based residents who are forecast to be employed by the year 2031 increased from 11,700 to 16,328 (+39%); and
- The number of locally based jobs for the year 2031 increased from 8,310 to 11,915 (+43%); and
- The number of housing units to be constructed by the year 2031 was scaled back from 8,800 to 7,480 homes in order to provide for a more sustainable balance between population and jobs.

19. For this project, consultation with Council, District staff, stakeholders and the public has been extensive and included the following major components:
- The development of a project website to facilitate communication with the public;
- Council presentations

- The hosting of 2 public information meetings; and
- Direct consultation by the project team with almost 25 stakeholders.

20. The initial work on developing the first draft of the 2031 transport plan was undertaken with the testing of the "Do Nothing" scenario in order to define baseline conditions and to determine whether the existing transportation network could accommodate the projected level of development with no accompanying change in travel mode, projected population or projected employment levels. The analysis determined that there was very strong travel demand between the lower peninsula and Highway 99 linking the new local housing with the future jobs outside of Squamish, and that the "Do Nothing" scenario would only work if:
    - There was major new capital works at the north end of downtown significantly widening intersections and streets;
    - The on-street parking on Cleveland Avenue would be removed to double the roadway capacity; and
    - The redevelopment of the lower peninsula would require a minimum of two vehicle access points.

21. For the calibrated model, approximately 5,200 vehicles were simulated to replicate existing traffic volumes and congestion for the summer Friday afternoon peak hour in all of Squamish. However this is projected to increase to close to 12,000 vehicles per hour by the year 2031, which represents a 130% increase in traffic volumes for the "do-nothing" scenario.

22. Five "Do Something" scenarios (numbered from 1 to 5) were then examined which tested various network improvements to address projected year 2031 congestion levels but still assumed that there would be no accompanying change in travel mode (i.e. 92.7% of all person trips were still by car, only 1.5% by public transit, etc.), and that projected population and employment levels would remain constant. This assessment determined that:
    - The projected volumes warranted one new 2 lane crossing (i.e. 1 lane in each direction) over the Mamquam Blind Channel;
    - That the Westminster bridge option would carry double the traffic of the Pemberton bridge option because it provided a more direct link between the

lower peninsula, downtown Squamish and Highway 99 but because of that would be close to capacity by the year 2031;

- That a second crossing would likely be required beyond 2031 if current trends continue; and
- That there was a was a strong desire to use Government Road via the 7th Avenue connector, 3rd Avenue or Bailey link to connect downtown with the rest of the community and key employment nodes to the north.

23. From the assessment of the "Do Nothing" and five "Do Something" scenarios, two "Do Something Sustainable" scenarios were developed and tested known as #6 and #7. Scenarios #6 and #7 included various combinations of a new crossing over the Mamquam Blind Channel with a new or improved road link to Government Road to the north while at the same time reducing auto use from 92.7 to 85%, increasing transit use from 1.5 to 5%, increasing local jobs by 43% and a small reduction in the estimated 2031 population. The use of sustainable initiatives for these scenarios demonstrated how travel demand can be altered to create a more balanced transport system. At the same time, it reduced vehicle congestion (e.g. Westminster bridge) and increased the longevity of the transportation system to absorb future traffic volumes.

24. The results of the technical work on the base case scenario and the seven alternative scenarios resulted in the development and release to the public of the first draft of the transport plan in October 2009. This transport plan was the preferred "technical" solution by the consultant team for the community and included the following key features:

- Embraced Smart Growth principles (e.g. options to the car were emphasized, minimized construction of new roads, encourage more local employment, etc.);
- Included the Pemberton bridge and the new link to Highway 99 at Clark Drive;
- Recommended that the downtown grid network be extended into the lower peninsula;
- Recommended that Loggers Lane to be the primary vehicle route and Cleveland Avenue be the secondary route to and from the lower peninsula;
- Recommended that Bailey Street be upgraded to an arterial to link the lower peninsula with the future employment to the north;

- That a major roundabout be constructed at the north end of downtown to provide a better connection between major approach roads and to ensure good vehicle access to and from the new Pemberton bridge;
- That the Westminster right of way, the Westminster crossing and the 7th Avenue Connector be protected as potential future port roadways so that the harbour can be linked with Highway 99 and/or the rail lands to the north should the demand develop and/or the sustainable initiatives contained in the transport plan are not met (e.g. reduce vehicle use as a percentage of all person trips)
- That a new multi-modal transportation centre be constructed at the north end of downtown by the main CN railway corridor in order to facilitate transfers between various alternative modes of transport while at the same time providing a higher level of service to the public; and
- That a new commuter pathway be constructed alongside Loggers Lane to link the multi-modal transportation centre to the north with the lower peninsula and possible passenger ferry docks to the south.

25. Two months of extensive consultation with Council, District staff, stakeholders and the public followed the release of the first draft of the multi-modal transport plan. In summary, the majority of communication and concern from stakeholders and the public was about the proposed "port" roads and the continued protection of right of way for both the 7th Avenue Connector and the Westminster corridor and crossing of the Mamquam Blind Channel. Interestingly, both of these dominant concerns were about plan components that are not even required to address year 2031 projected travel demand, but are included in the plan should the various sustainable initiatives not be achieved.

26. Between December 2008 and March 2009, a second draft of the multi-modal transport plan was developed which attempted to incorporate requested changes, additions and deletions resulting from the two month consultation phase. The key changes to the transport plan were as follows:

- The port roads have been replaced with "transportation corridors to be protected" in case they are needed in the future or if the sustainable initiatives embedded in the transport plan to reduce private vehicle use are not achieved;

- A section of Bailey has been added to complete the new arterial route to Government linking the future housing in the lower peninsula with the future employment to the north;
- The truck route linking 3rd Avenue with Loggers Lane has been relocated from Westminster Street to Vancouver Street to where it exists today;
- The existing intersections of 3rd Avenue & Vancouver Street, and that of Loggers Lane & Vancouver Street will require geometrical improvements as part of the truck route in order to safely accommodate both existing and future truck turning movements; and
- The roadway classification for the new Pemberton crossing and link between downtown Squamish and Highway 99 has been changed from a collector to an arterial roadway classification based on the projected volumes and level of importance.

27. In order to maintain the designated truck route along Vancouver Street connecting 3rd Avenue with Loggers Lane, the following intersection improvements will be required for both intersections to safely accommodate both existing and future truck volumes:

    1. At the intersection of 3rd Avenue & Vancouver Street, both the south approach (for northbound traffic) and the east approach (for westbound traffic) will require widening to properly accommodate the northbound right turn and the westbound left turn truck movements; and

    2. At the intersection of Loggers Lane & Vancouver Street, both the north approach (for southbound traffic) and the west approach (for eastbound traffic) will require widening to properly accommodate the southbound right turn and the eastbound left turn truck movements.

28. The protection of rights-of-way for potential transportation corridors is a critical element of a transport plan for any community, and especially so for Squamish, because they are a contingency plan for any of the following scenarios:

    - To accommodate future travel demand beyond 2031 so that the transport plan is expandable if required;

- To accommodate more vehicle traffic should the community not embrace the ambitious transport mode targets designed to reduce private vehicle use in downtown Squamish;
- To accommodate more vehicle traffic to and from outside of Squamish should the growth in the local employment not keep pace with the expected future population levels;
- To accommodate unforeseen major changes in land use and/or economic activity that may significantly alter travel demand (e.g. port activity); and
- To provide for potential solutions to reduce truck traffic / community interface conflicts.

7.2 RECOMMENDATIONS

1. That the 2nd draft of the multi-modal transport plan be adopted by the District of Squamish as the final transport plan because:

    - The transport plan embraces Smart Growth principles;

    - The transport plan encourages significant increase in the use of alternative modes of transport, including the supporting infrastructure, in order to reduce reliance on the use of the private automobile;

    - The transport plan saves money by requiring less transportation infrastructure to be constructed to accommodate the projected increases in population and employment;

    - The transport plan encourages a significant increase in the amount of future locally based employment in order to make the District of Squamish more sustainable and thereby reducing the travel demand to and from Highway 99, which in turn reduces and/or defers the demand for future connections to Highway 99; and

    - The transport plan includes contingency plans with the protection of potential transportation corridors to deal with future travel demand beyond 2031 and/or if the community does not embrace both the recommended

transport mode targets to reduce private vehicle use and the creation of more locally based employment.

2. That the District of Squamish adopt the following transport mode targets for the year 2031 for person trips entering and exiting downtown Squamish so that the proposed transport plan for downtown remains viable and that no further network additions are required to accommodate the projected demand:

    - Reduced auto trips from 92.7% to 75%
    - Increased transit trips from 1.5% to 10%
    - Increased motorcycle trips from 0.7% to 1%
    - Increased bicycle trips from 1.6% to 5%
    - Increased walk trips from 3.4% to 7%
    - Increased other trips (e.g. ferry) from 0.1% to 2%

3. That by the year 2031 and in conjunction with the transport mode targets, the District of Squamish increase the number of expected locally based jobs from 8,310 to 11,915 (+43%) and scale back the number of expected residential units from 8,800 to 7,480 homes (-10%) in order to reduce the demand for additional transportation infrastructure by providing a more sustainable balance between population and local jobs.

4. That the District of Squamish develop an annual transportation monitoring program in order to monitor both future traffic volumes and increased use of alternative transport modes to ensure that the goals and objectives of the recommendation transport plan are being achieved in a staged fashion.

5. That the District of Squamish commission a conceptual design study of the proposed major roundabout at the north end of downtown in order to refine the conceptual sketch prepared for this project and to identify the estimated property requirements and determine the associated cost estimate.

6. That the District of Squamish complete a District-wide Transport Plan and that the findings of the Downtown and District-wide Plans be integrated into the Official Community Plan.