District of Squamish

2031 District Wide Multi-Modal Transportation Study

REPORT #2
FINAL TRANSPORTATION PLAN

District of Squamish

2031 District Wide Multi-Modal Transportation Study

REPORT #2
FINAL TRANSPORTATION PLAN – Rev #4

Opus International Consultants (Canada) Limited

Prepared and Reviewed by:

Robert Lew, EIT
Transportation Engineer

Sarah Rocchi, P.Eng.
Vice President

September 14, 2011

H-90210.00

850 – 1185 West Georgia St.
Vancouver, British Columbia
Canada, V6E 4E6

Tel: 604 684 4488
Fax: 604 684 5908
www.opusinternational.ca

ISO 9001:2001 Registered

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

An integrated transportation plan is a critical element for local government to plan, maintain, and manage connectivity for residents, businesses, and visitors to the community. In July of 2010, Opus International Consultants was commissioned by the District of Squamish to review its long-term transportation needs and to bring forward a Squamish 2031 Multi-Modal Transportation Plan (M-MTP) that would support the Community Vision identified in the District's Official Community Plan Bylaw 2100, 2009 (OCP).

OCP Community Vision

"We are a spectacular seaside mountain community where people come to live, learn, work and play in harmony.

We are multicultural, compassionate, vibrant and diverse.

We are leaders in fostering social integrity, economic development, and environmental sustainability."

2031 M-MTP Study Vision Statement

"Squamish proudly enjoys a fully integrated transportation network that shows respect for its citizens by offering an array of safe travel options and by encouraging practical, healthful and sustainable travel choices."

2031 M-MTP Study Goals

Following from the vision and guiding principles set out for the Squamish 2031 Multi-Modal Transportation Plan, the goals of this study are to:

- Develop a long-term, multimodal transportation strategy for the District of Squamish;
- Support economic growth and new development; and
- Promote a growing, accessible, and connected Squamish that functions as a single community.

Towards these ends public consultation and community involvement were an integral part of the study process and have been accomplished by the following means: forty-seven stakeholders, representing a cross-section of community interests, were identified and were updated at project milestones; a fifteen person Focus Group was established to assist the District in understanding community needs as well as providing advice on network options; on-line Travel Preference and Travel Behaviour Surveys were conducted; a Council Workshop was held; a Public Information Meeting was held; and, a number of meetings were held with specific stakeholders, including the Ministry of Transportation, Howe Sound School District No.48 Parents Advisory Group and the Squamish Estuary Management Committee. In addition, community updates were provided periodically and study materials were made available in a number of ways throughout the course of the study. This broad-based approach to collecting, discussing, and disseminating information has ensured a true community perspective for the study. By combining this information with the consultant's background analysis and theoretical modelling, the District is now well positioned to create a model that will stand the test of time.

The results of the study propose a fundamental shift in transportation behaviours and norms. The MMTP envisions a truly multi-modal strategy which will address the needs of private passenger vehicles, car-pooling, commercial vehicles, public transit, cyclists, and pedestrians, while also considering connectivity of the various communities within Squamish and connectivity with communities beyond the District's borders. This is to be done in a manner that accommodates foreseeable traffic growth and yet uses transportation infrastructure decisions to support the visions of the District. This document is intended to guide transportation related decisions in the District of Squamish for the same planning horizon as the District's new OCP, namely 2031 (20 years).

The report was categorized into three distinct and key study areas: Highway Interface & Regional Transportation; Local Networks; and, Commercial Transport. This report provides the detail of the analysis, comments made, and options available to the District.

Significant findings include:

- The existing level of service for traffic at major intersections is generally good. In 2031, with signal optimization, most intersections are expected to operate at acceptable levels, except for the Friday and Sunday PM peak periods in August and February.
- An additional Mamquam River Crossing will not be required unless the District's population reaches 50,000. This population would exceed current community build-out forecasts. As a cautionary note, under this unexpected scenario highway intersections would fail on a daily basis, unless there was a major change in travel behaviour (mode choice) or existing roads were widened and new roads built.

- With over 30% of the Squamish workforce working outside of the District limits and approximately 90% of trips being by SOV (Single Occupant Vehicle), there is a significant latent demand for commuting options - over 2,000 trips daily. This represents an opportunity for varied commuting services, such as transit, various forms of ridesharing or passenger ferry.
- The local road network is expected to function adequately with few major additions up to 2031. Most new roads will be driven by the needs of development and therefore should be paid for through the DCC structure or in some instances by specific developments when there is a direct causal relationship.
- A Downtown Entrance Study should be completed in the near term to reconcile issues such as community gateway, emergency access and multi-modal network needs.
- Local transit provides a relatively low level of service and experiences low annual ridership. Although surveys indicated that improving local transit service was the top transportation priority, it is clear that the current service is not meeting the community's needs. Furthermore the current net cost is not believed to be sustainable.
- Cycling is relatively under-utilized. This is likely due to limited route coverage and lack of continuity that discourage cycling as a viable transportation alternative. It is recommended that the District allocate $100,000 annually to upgrade and expand cycling infrastructure.
- Downtown Squamish represents a relatively pedestrian friendly environment; the rest of Squamish features few pedestrian amenities. There are few existing policies and practices to encourage pedestrian improvements on established road networks. It is recommended that the District allocate $100,000 annually to upgrade and expand pedestrian infrastructure. Safe routes to school should be a primary consideration when establishing pedestrian and cycling priorities.
- Information will need to be collected on wildlife travel patterns so that human wildlife interaction may be appropriately managed.
- Squamish is a major commercial vehicle destination within the region. Due attention should be given to connectivity of the inter-modal port, rail facilities, industrial lands generally, resource extraction based industries and outlying destinations.
- An alternative commercial route will be required to improve access to the downtown peninsula for long-term development. Once future demand is better understood, a downtown north–south connecting route will need to be selected considering the best overall fit that accommodates economic development while maintaining overall liveability.

Overall, network changes, policy recommendations, strategies and areas for further study were developed based on the issues and opportunities identified in the study. Options were evaluated based on relative cost, benefit, ease of implementation, likelihood of affecting mode shift, and the difficulty associated with coordinating outside parties.

A complete list of recommendations is included in Section 6.6, Summary of Recommendations.

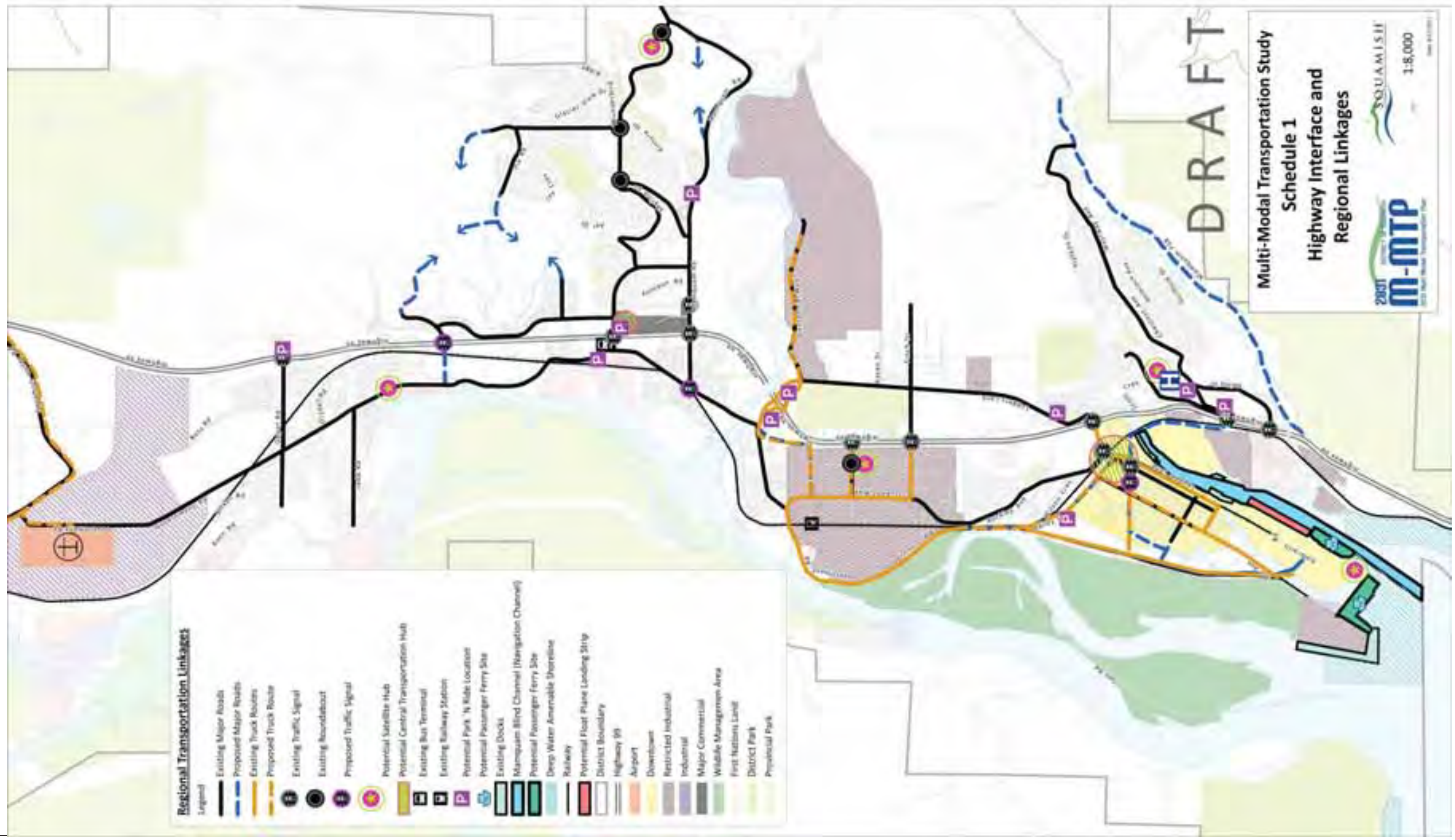
To realize the vision will require a commitment to sustainable transportation values and actions. It will be the sum of many small changes that will create the large change and ultimately determine the District's success in achieving a sustainable transportation future.

The following maps describe the proposed 2031 networks by mode:

- Schedule 1 – Highway Interface and Regional Linkages:
- Schedule 2A – Major Roads,
- Schedule 2B – Cycle Routes
- Schedule 2C – Pedestrian Routes
- Schedule 3 – Commercial Transport Routes.

FIGURE ES-1 Schedule 1 – Highway Interface and Regional Linkages

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)



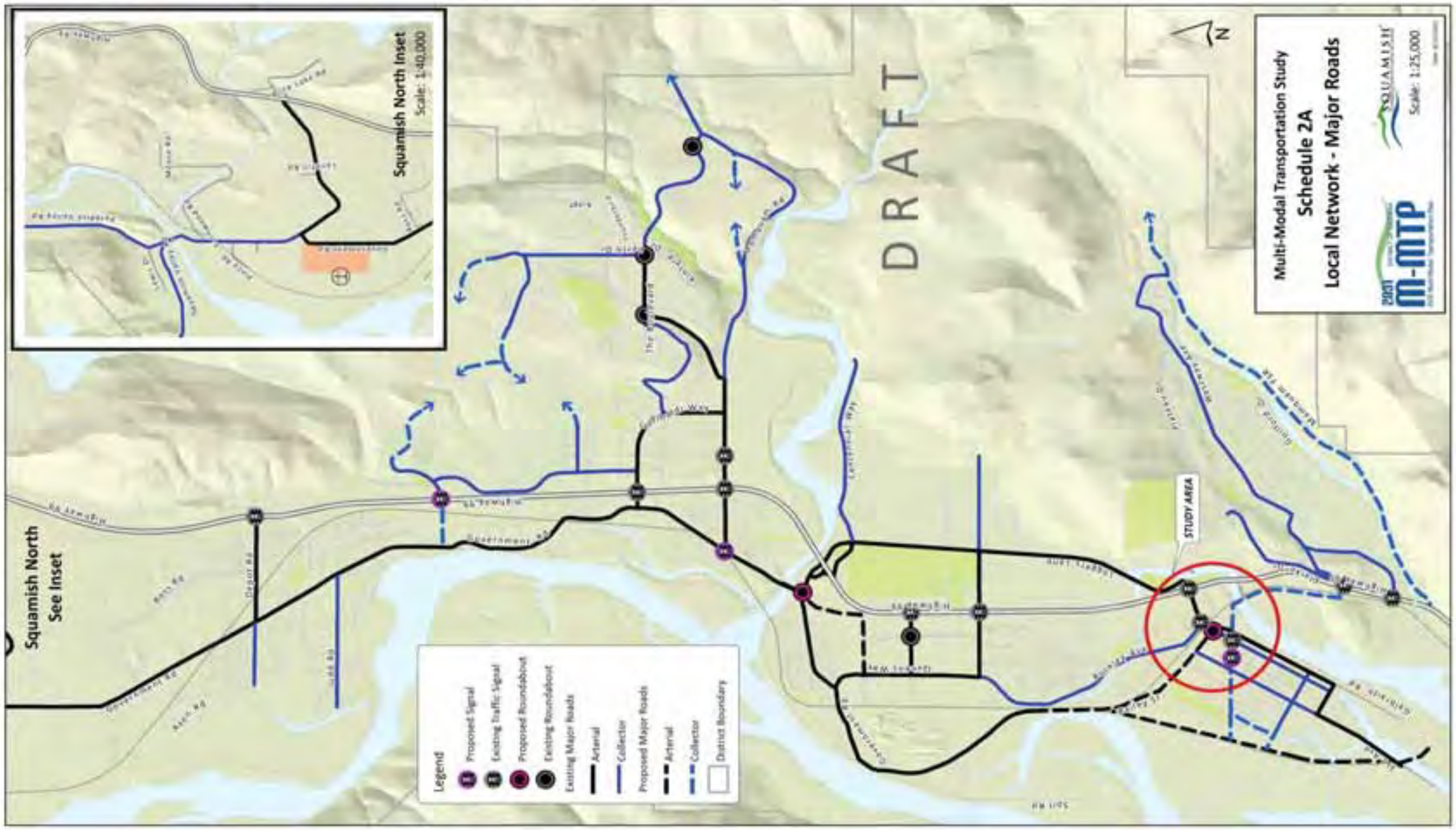


FIGURE ES-2 Schedule 2A - Proposed Major Road Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

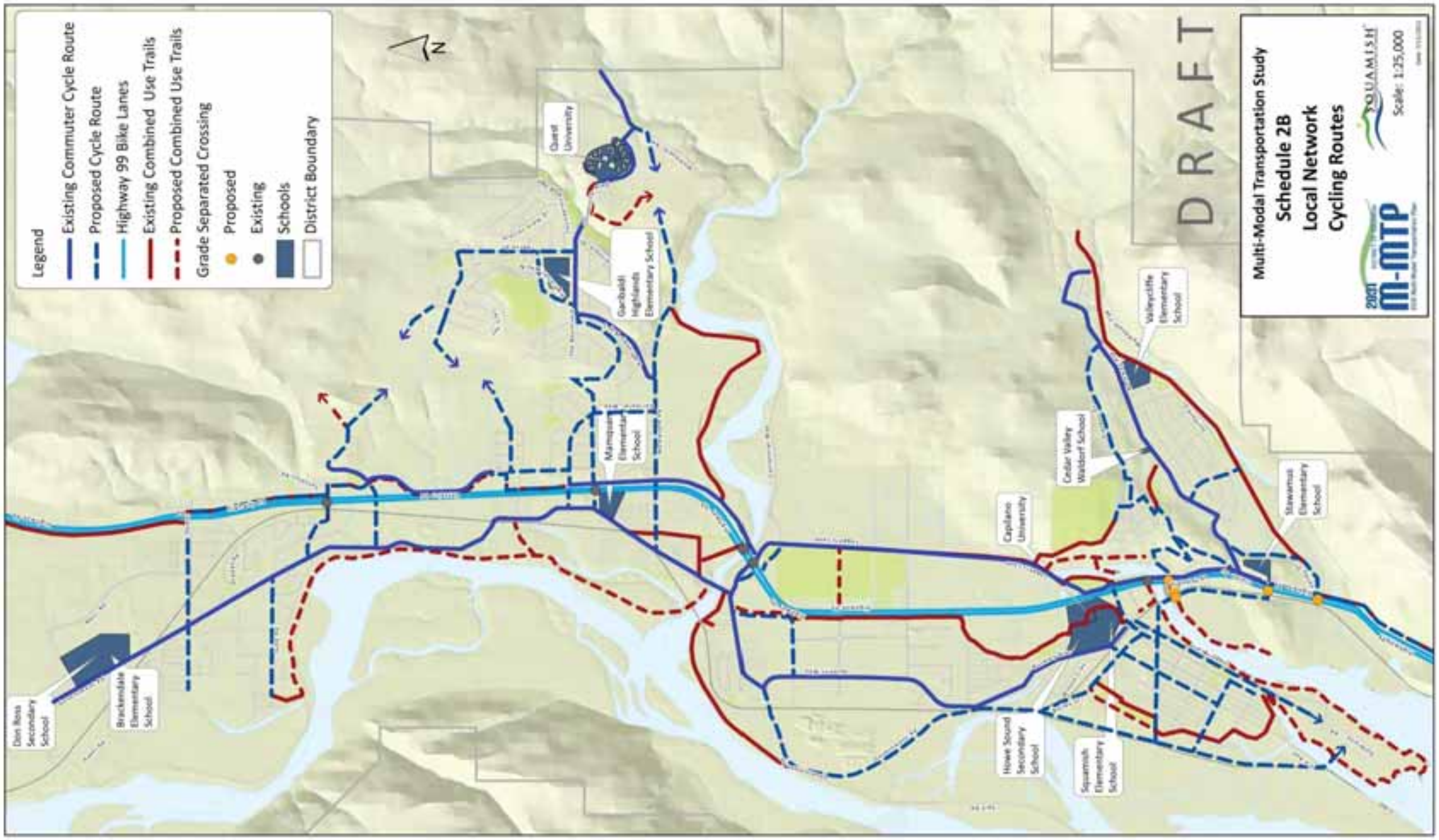


FIGURE ES-3 Schedule 2B - Proposed Cycling Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

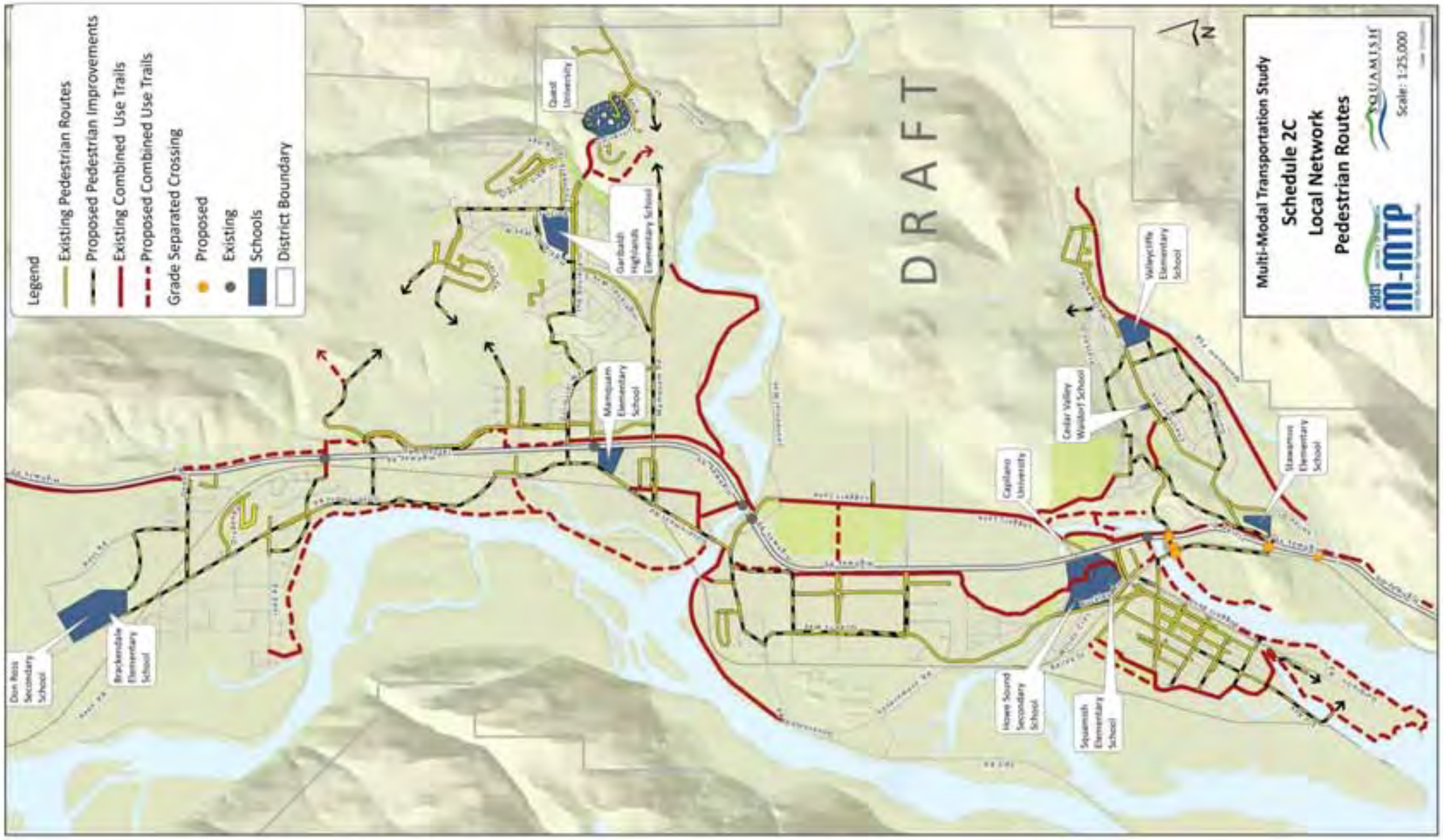
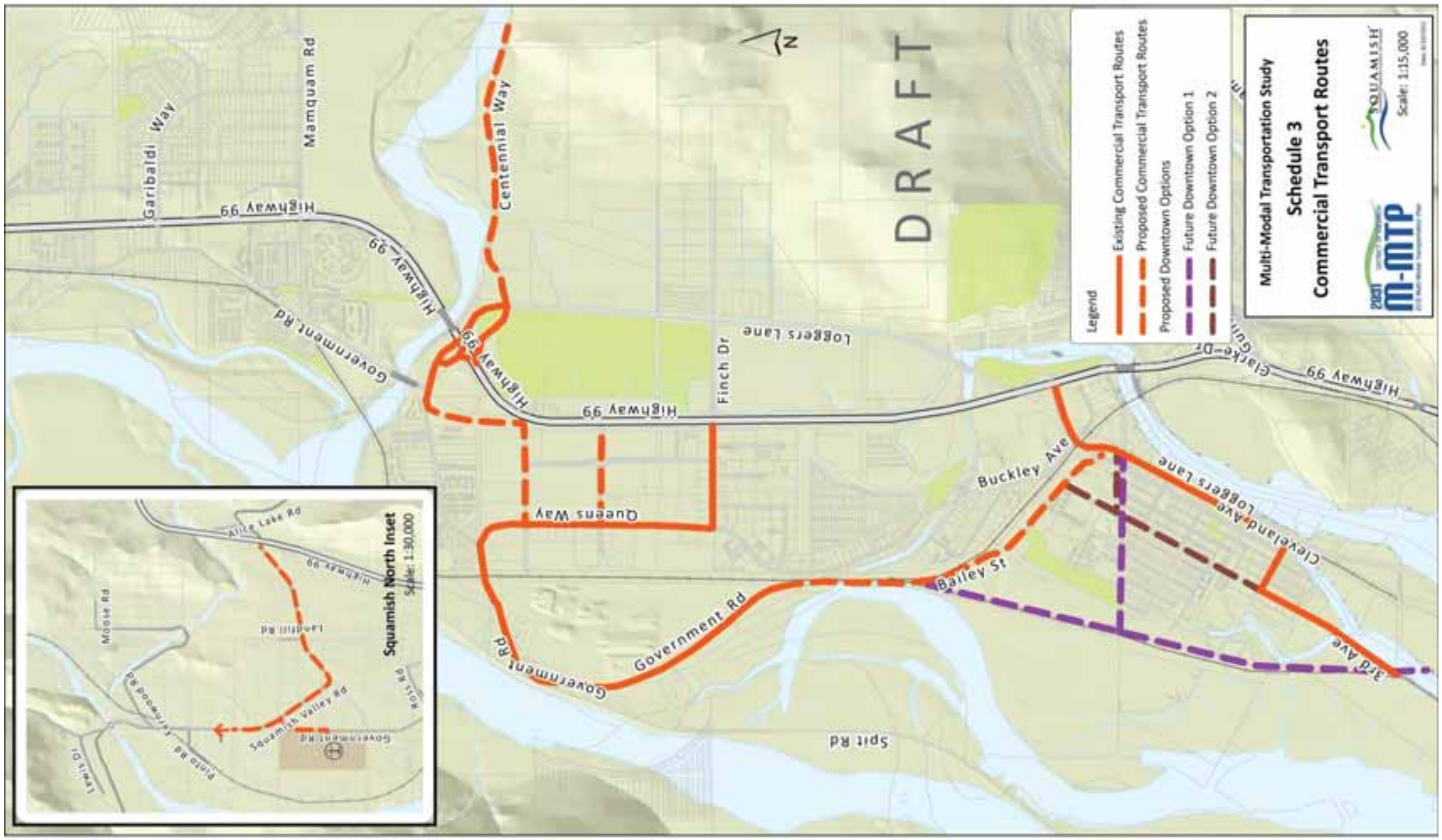


FIGURE ES-4 Schedule 2C - Proposed Pedestrian Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

FIGURE ES-5 Schedule 3 - Proposed Commercial Transport Routes

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)



Tables ES-1, 2 & 3 summarize the estimated costs for roads, bicycle routes and pedestrian routes, respectively, and represent only the network improvements that will be needed by 2031 irrespective of the level of development activity. They have been extracted from the complete list of projects which is included in Appendix 'F' to this report. Major new developments will trigger additional infrastructure costs and will presumably carry the burden of these costs either through the DCC structure or as direct costs.

TABLE ES-1 Local Road Network Improvement Cost Summary

IMPROVEMENT TYPE	ESTIMATED COST	FUNDING SOURCE		
		DCC	General	Reserve
SHORT to MID-TERM PROJECTS (2012 -2021)				
New Major Roads	$5,040,000	$2,880,000	$2,010,000	$150,000
Bridges	$3,000,000	$0	$3,000,000	$0
Intersections	$850,000	$550,000	$300,000	$0
Short to Mid-term Sub-total	$8,890,000	$3,430,000	$5,310,000	$150,000
LONG-TERM PROJECTS (2022 - 2031)				
New Major Roads	$6,840,000	$4,455,000	$2,385,000	$0
Bridges	$7,500,000	$6,250,000	$1,250,000	$0
Intersections	$500,000	$500,000	$0	$0
Long-term Sub-Total	$14,840,000	$11,205,000	$3,635,000	$0
TOTAL	**$23,730,000**	**$14,635,000**	**$8,945,000**	**$150,000**

TABLE ES-2 New Bicycle Route Cost Summary

CLASSIFICATION	AREA	LENGTH (m)	COST	NET DISTRICT COST
Commuter Routes		10300	$1,502,000	$1,152,000
Neighbourhood Routes	Downtown	7000	$720,000	$18,000
	Valleycliffe	1400	$210,000	$210,000
	Estates	400	$60,000	$60,000
	Highlands	1600	$365,000	$240,000
	Brackendale	1300	$195,000	$195,000
	TOTAL	**22000**	**$3,052,000**	**$1,875,000**

TABLE ES-3 New Sidewalks on Existing Roads Cost Summary

NEIGHBOURHOOD	LENGTH (m)	COST ($/m)	COST	NET DISTRICT COST
Downtown	2517	96	$242,200	$117,000
Valleycliffe/ Hospital Hill	4034	367	$1,479,600	$1,067,100
Business Park/ North Yards	3338	132	$440,000	$214,000
Estates	4270	235	$1,002,000	$582,000
Highlands	3990	254	$1,013,500	$456,000
Brackendale	3770	364	$1,374,000	$1,202,750
TOTAL	**21919**		**$5,551,300**	**$3,638,850**

(Note: These lists of improvements have been generated by the District of Squamish, and summarize the results of this study as well as previous OCP documents and other reports). Complete lists of Projects are described in Appendix 'F'.

END OF EXECUTIVE SUMMARY

DISTRICT OF SQUAMISH 2031 MULTI-MODAL TRANSPORTATION PLAN

1.0 INTRODUCTION

1.1 Background, Planning Context, and Study Vision

Opus International Consultants was commissioned by the District of Squamish to review the long term transportation needs of the District of Squamish and to bring forward the Squamish 2031 Multi-Modal Transportation Plan that will support the vision and goals identified in the District's Official Community Plan (OCP), including:

- Establishing and maintaining an effective transportation system within the District;
- Moving people and goods efficiently;
- Improving road connectivity throughout the District when appropriate;
- Developing a connected and integrated network of bikeways & commuter trails connecting major activity areas;
- Improving access to and the viability of public transit;
- Encouraging transit, rail, and marine travel service for regional passenger travel; and
- Supporting a diversity of transportation choices and alternatives.

The following Transportation Vision statement was developed to support the transportation master plan process:

Vision

Squamish proudly enjoys a fully integrated transportation network that shows respect for its citizens by offering an array of safe travel options and by encouraging practical, healthful and sustainable travel choices.

The following guiding principles were developed in support of this vision statement:

1. Transportation and land use planning will be fully integrated.

2. Transportation network alternatives will allow a broad range of modal choices with a preference given to modes that reduce reliance on single

occupant vehicles (SOV's) and minimize GHG impacts, generally in conformance with the following Transportation Hierarchy:

Modal Hierarchy

i. Pedestrians
ii. Cyclists
iii. Public Transit
iv. Commercial Transport
v. High Occupancy Vehicles
vi. Single Occupancy Vehicles

It is understood that public transit could include bus, rail, marine and air travel, that commercial transport could include truck, rail, ship and air, and that high occupancy vehicles could include multiple occupant private vehicles, taxicabs and motorcycles.

3. Transportation network alternatives will consider all aspects of the environment with a goal of protecting green spaces and natural ecosystems.

4. The full costs and benefits of transportation network alternatives will be considered, including affordability.

5. Transportation network alternatives will account for the movement of goods and people in a safe and efficient way.

6. Transportation network alternatives will support economic development and foster the building of a complete and livable community.

7. Improving community connectivity for all modes of transportation will be a fundamental consideration.

8. Regional transportation opportunities that support economic development and reduce reliance on SOV's will be accounted for when considering transportation network alternatives.

9. Emerging transportation technologies will be taken into account.

The plan envisions a truly multi-modal strategy which will address the needs of private passenger vehicles, car-pooling, commercial vehicles, public transit, cyclists, and pedestrians, while also considering connectivity of the various communities within Squamish and connectivity with communities beyond the District's borders. This is to be done in a manner that accommodates foreseeable traffic growth and yet uses transportation infrastructure decisions to support the visions of the District. This document is intended to guide transportation related decisions in the District of Squamish for the same planning horizon as the District's new OCP, namely 2031 (20 years).

1.2 Study Purpose – Goals and Objectives

Following from the vision and guiding principles set out for the Squamish 2031 Multi-Modal Transportation Plan, the goals of this study are to:

- Develop a long-term, multimodal transportation strategy for the District of Squamish;
- Support economic growth and new development; and
- Promote a growing, accessible, and connected Squamish that functions as a single community.

The objectives of this study are to:

- Identify issues and opportunities and develop 2031 network schedules for all transportation modes;
- Recommend short-, medium-, and long-term improvements; and
- Develop a plan that will form the basis of an amendment to the OCP and guide transportation infrastructure development over the next 20 years.

1.3 Method

The following list outlines the major tasks proposed for this study:

Phase I

1) Start up meeting with District Staff
2) Review of background information, previous studies, and plans
3) Origin / Destination phone survey, conducted by Synnovate.

4) Web-based public opinion survey (prepared by the District of Squamish)
5) Data collection, site review.
6) Calibration of a model to represent transportation demand and forecasting traffic for two future land use scenarios
7) Network assessment and identification of issues and opportunities for all modes
8) Prepare Report #1 – Network Issues

<u>Phase II</u>

9) Present findings to Council and the public at an Open House (Public Information Meeting #1)
10) Develop road, safety, active transport and traffic demand management options based on the findings of Report #1.
11) Develop Multiple Account Evaluation parameters and weightings
12) Model some of the options developed in item 10.
13) Evaluate Options using MAE
14) Develop Policy and Network recommendations
15) Prepare Report #2, Draft Transportation Plan
16) Prepare Final Transportation Plan – District staff to lead

<u>Phase III</u>

17) OCP Amendment – District of Squamish Planning Department

This report is Report #2, Final Transportation Plan, and it develops the recommended network and policy changes. Sections 1 and 2 provide introductory and background material, while the remainder of the document deals with issues, opportunities, proposed solution options, and recommended network changes for each mode of transportation. This report contains sections outlining the conditions, opportunities, issues, and recommended solutions for various modes divided into the following categories:

- Highway Interface and Regional Transportation;
- Local Networks; and
- Commercial Transport.

2.0 EXISTING LAND USE

2.1 Background

As part of the Squamish 2031 Multi-Modal Transportation Study, a review of land uses was conducted to analyse the effect they will have on the modes of transportation under evaluation. A general overview of the existing land use information was reviewed and the most relevant documents related to the existing land use are listed in TABLE 2.1.1.

TABLE 2.1.1 Relevant Documents for Existing Land Use Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	District of Squamish Official Community Plan	2009	Document
2	Downtown Squamish 2031 Transport Plan (Creative Transportation Solutions)	2009	Document
3	Growth Management Strategy	2005	Document
4	Squamish Investment & marketing Strategy	2005	Document

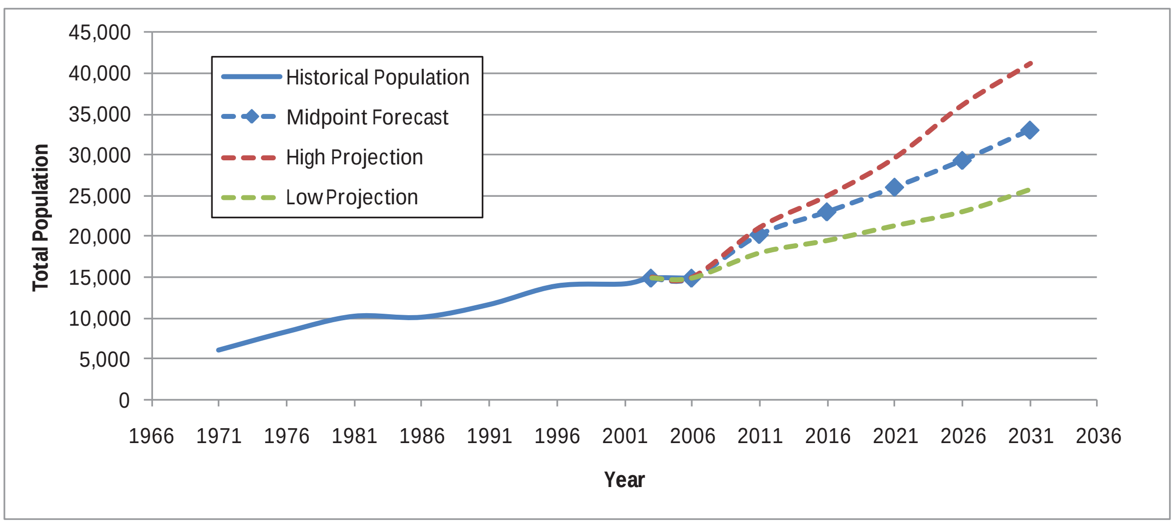


FIGURE 2.1.1 Squamish Historical and Projected Population

2.2 Existing Conditions

Existing land uses are shown in FIGURE 2.2.1. Development patterns in Squamish are influenced by its steep topography, summarized in FIGURE 2.2.2.

2.3 2031 Land Use Forecast

The model was developed using an estimate of 2010 population and employment based on 2006 census data, and building permits approved since 2006. Population and employment data were developed by District of Squamish staff to develop a forecast for the *2031 Base Land Use* Scenario.

In addition to the 2031 Base Land Use Scenario, a 2031 'Hypergrowth' scenario was developed, which assumed that all developable lands identified in the OCP would build-out at current densities. This resulted in a hypothetical population of 50,000 compared with 32,200 for the 2031 Base Case. The hypergrowth scenario was used as a kind of sensitivity analysis to illustrate where transportation pressure points could arise in the future. It is merely a network assessment tool and should not be construed as a population or development forecast.

The household, population and employment forecasts for these scenarios are provided in TABLE 2.3.1. Although the census year was not modelled, it is provided for comparison purposes.

TABLE 2.3.1 Land Use Scenarios

	2006	2010	2031 - Base	2031 - Hypergrowth
Population	15,495	17,628	32,200	>50,000
Households – Single Family & Duplex	n/a	4,170	5,910	10,030
Households – Townhouses	n/a	1,190	3,750	5,670
Households – Apartment and Mobile Home	n/a	1,720	3,165	4,840
Employment	7,805	8,481	11,351	21,173
Students (Post Secondary)	470	710	1,950	1,950

For ease of discussion, individual zones that were used for modelling purposes were grouped into "super-zones" that represented major communities within Squamish; these super-zones are also shown in FIGURE 2.2.3 to give context to discussion in the following sections.

A detailed breakdown of land use by zone is provided in APPENDIX D.

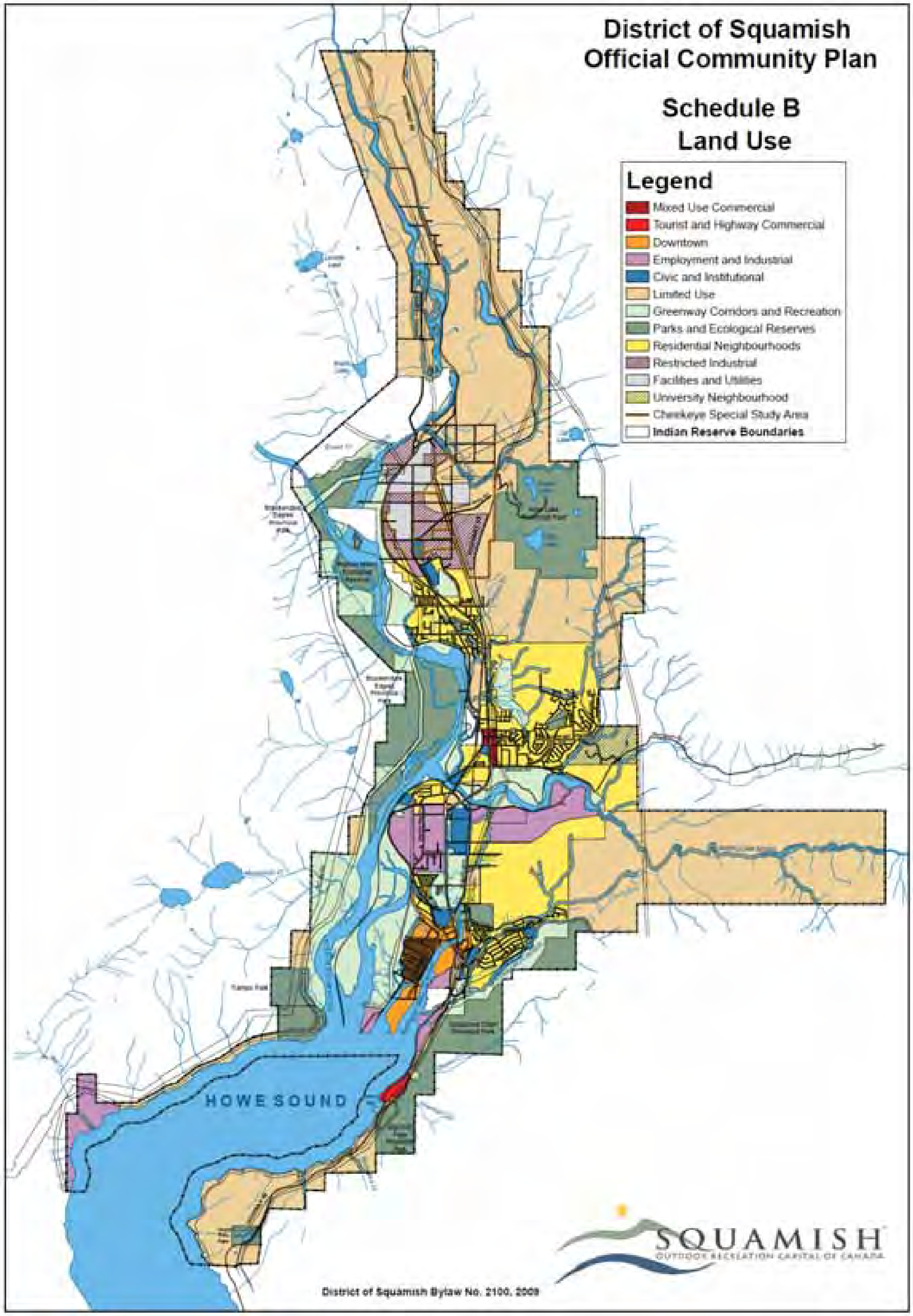


FIGURE 2.2.1 Squamish Land Use Zones – OCP Schedule B

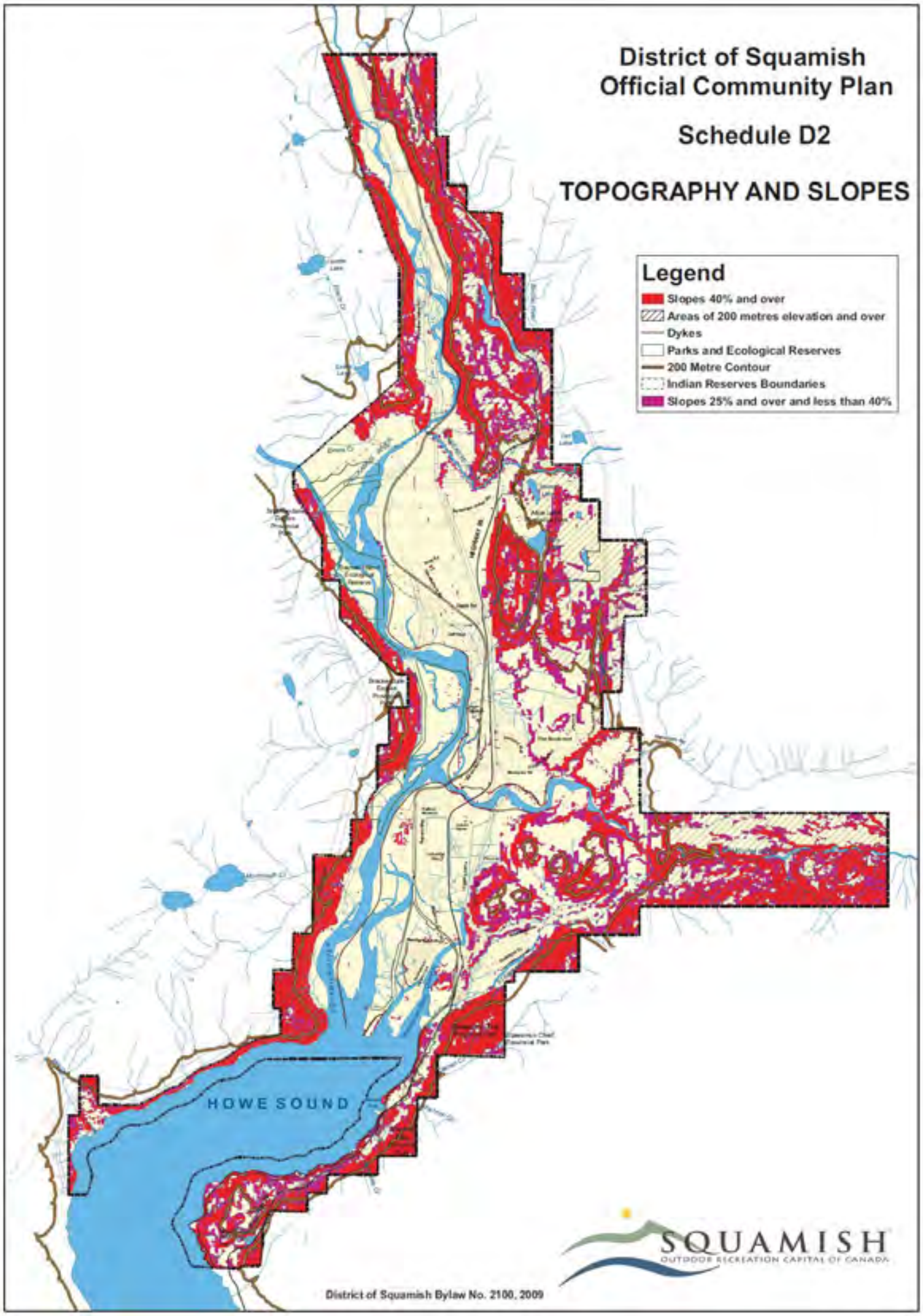


FIGURE 2.2.2 Squamish Topography and Slopes – OCP Schedule D2

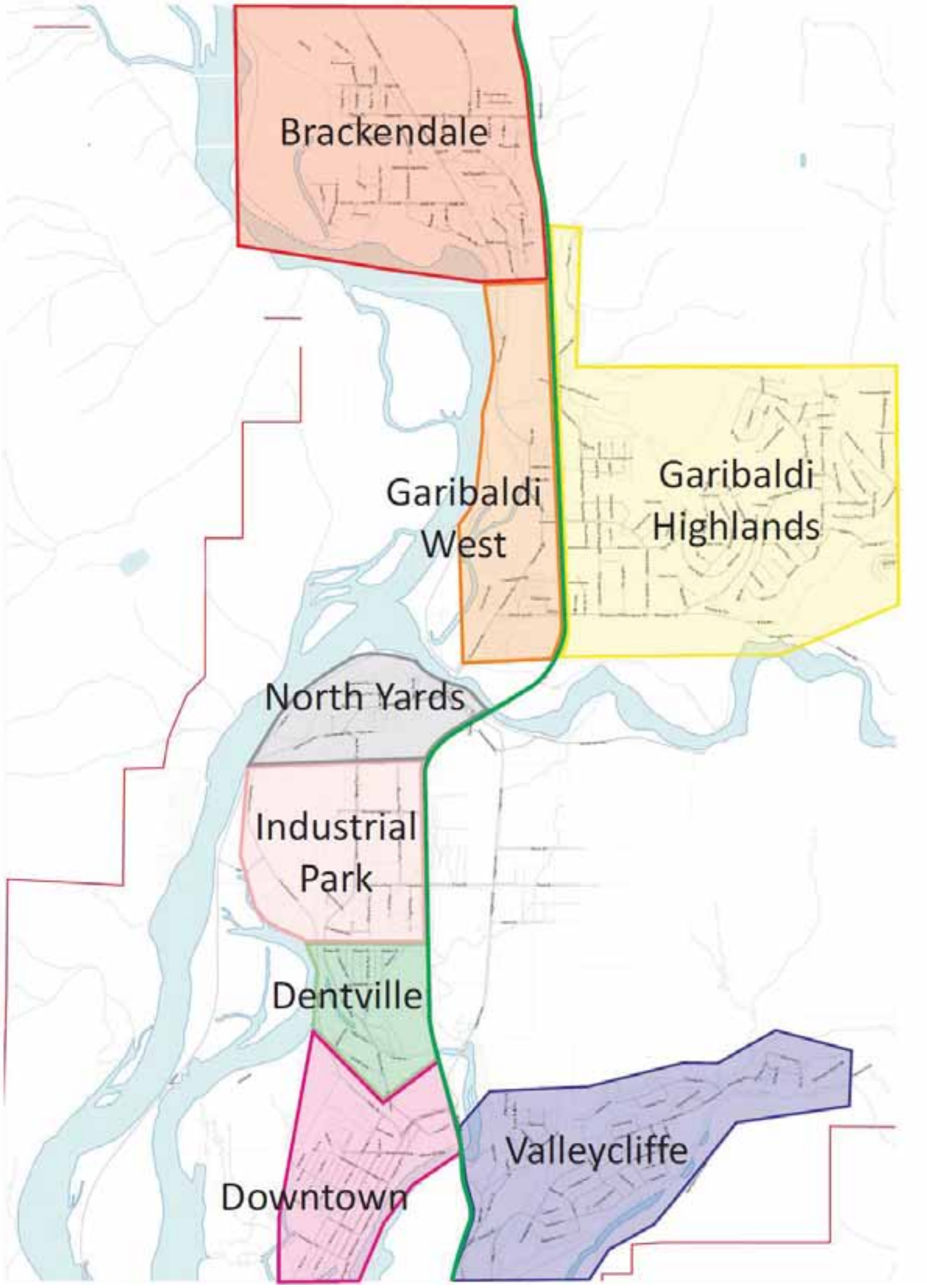


FIGURE 2.2.3 Squamish Super-zones

3.0 HIGHWAY INTERFACE AND REGIONAL TRANSPORTATION

3.1 Highway 99

3.1.1 Background

As part of the Squamish 2031 Multi-Modal Transportation Study, the Highway 99 traffic patterns and intersection operations were assessed using the following approach:

1) Review of background reports;
2) Site observations of the physical and traffic characteristics;
3) Collection of traffic volumes during the weekday peak periods; and
4) Analysis of existing traffic operations based on available traffic volumes and signal timing information.

A document review was conducted, and the most relevant documents related to Highway 99 and external traffic are listed in TABLE 3.1.1.

TABLE 3.1.1 Relevant Documents for Highway 99 and External Traffic Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	District of Squamish Official Community Plan	2009	Document
2	Garibaldi Village Phase II Commercial Development (Bunt & Associates Engineering)	2008	Document
3	Newport Ridge/Skyline Drive Traffic Report (Bunt)	2008	Document
4	RedPoint RV Park Development Traffic Impact Assessment Reviews (Bunt)	2008	Document
5	Thurderbird Creek Residential Development Traffic Study (Bunt)	2007	Document
6	Traffic Impacts of Squamish Industrial Park (Ward Consulting Group)	2004	Document
7	Traffic Operations and Projections – Highway 99 North Conceptual Design Study (Ward)	2002	Document
8	Safer City Initiative - A Review of Collision and Claim Trends – Squamish (Hamilton)	2002	Document

3.1.2 Existing Conditions

Highway 99 runs north-south through the District of Squamish and serves as the sole access into and out of Squamish for all vehicle traffic. Within the urban area bounded by Valley Drive on the south and Depot Road on the north, Highway 99 functions as the primary north-south road in Squamish. Government Road is the only alternative route north of the Mamquam River; while Queensway/ Buckley and Loggers Lane provide limited options to Highway 99 south of the Mamquam River.

Because of its location along Highway 99 the Squamish road network is heavily influenced by external trips between Metro Vancouver and Whistler. In addition to traffic generated between Metro Vancouver and Whistler, external trip patterns are affected by the number of Squamish residents who work outside of Squamish. According to 2006 Census data, almost 30 percent of Squamish's employed labour force works outside of the District, as shown in TABLE 3.1.2. The actual number of Squamish residents working outside of Squamish may be even more substantial, given the significant portion of the workforce with no fixed work place address. Affordable housing and recreation opportunities make it attractive to live in Squamish while holding a job in Metro Vancouver or elsewhere.

TABLE 3.1.2 PLACE OF WORK STATUS

PLACE OF WORK	Employed Labour Force	Percent of employed labour force
Worked within Squamish	4,345	52%
Worked outside of Squamish	2,415	29%
No fixed workplace address	1,575	19%

Source: Census 2006, Statistics Canada

Personal vehicle trips (car, truck, van, etc.) are the predominant form of transportation in Squamish, and the majority of residents within Squamish rely on personal vehicles as their main transportation mode. Results of the on-line public opinion survey show that an overwhelming majority of trips are personal vehicle trips. Auto driver and passenger trips account for approximately 68 percent of work or school related and approximately 79 percent of shopping trips as shown in FIGURE A-4 in APPENDIX A. 2006 Census data shows an even higher percentage of vehicle trips, with personal vehicle driver and passenger trips accounting for 88.3 percent of the mode share for travel to work in Squamish, as shown in TABLE 3.1.3.

TABLE 3.1.3 Mode of Transportation to Work

MODE	SQUAMISH		BRITISH COLUMBIA	
	PERSONS	PERCENT	PERSONS	PERCENT
Car, truck, van, as driver	5,885	75.1%	1,353,790	71.6%
Car, truck, van, as passenger	1,035	13.2%	145,840	7.7%
Public transit	215	2.7%	195,145	10.3%
Walked or bicycled	555	7.1%	167,650	8.9%
All other modes	150	1.9%	27,620	1.5%
TOTAL	7,840	100%	1,890,045	100%

Source: Census 2006, Statistics Canada

Speed Limits

Speed limits along Highway 99 vary throughout the District. Starting from the south end of Squamish, speed limits are:

- 80 km/h south of Valley Drive;
- 60 km/h from Valley Drive to Clarke Drive;
- 70 km/h from Clarke Drive to Garibaldi Way;
- 80 km/h from Garibaldi Way to Depot Road; and
- 90 km/h north of Depot Road.

Laning

Highway 99 is two lanes in each direction through Squamish south of Depot Road. Just north of Depot Road, Highway 99 becomes three lanes, providing two lanes in the northbound direction and one lane in the southbound direction.

Intersection Controls

Intersections along Highway 99 are controlled and operated by the Ministry of Transportation and Infrastructure. The Ministry controlled intersections in Squamish include nine signalized intersections and three un-signalized intersections. The intersections are:

- Highway 99 @ Squamish Valley Road (un-signalized, at grade)
- Highway 99 @ Depot Road
- Highway 99 @ Garibaldi Way
- Highway 99 @ Mamquam Road
- Highway 99 @ Centennial Way (un-signalized, grade separated)
- Highway 99 @ Commercial Way
- Highway 99 @ Industrial Way
- Highway 99 @ Cleveland Avenue
- Highway 99 @ Clarke Drive
- Highway 99 @ Valley Drive
- Highway 99 @ Mamquam FSR (un-signalized, at grade)
- Highway 99 @ Darrell Bay Road

3.1.3 Existing Traffic Conditions

Temporal Traffic Variation

The high volume of traffic generated by Metro Vancouver and Whistler results in unique traffic patterns along Highway 99. A detailed description of traffic patterns along Highway 99 just north and south of Squamish is discussed in detail below.

Until 2005 there were two Ministry of Transportation and Infrastructure permanent count stations along Highway 99 north and south of Squamish at the south end of the Cheekye River Bridge (P-15-3NS) and 2.1 km north of the Murrin Park Access (P-15-8NS) respectively. The Murrin station was removed in the course of the highway upgrade. Up to date data are available for the count station north of Squamish; however, 2005 was the most recent year of full data at the count station south of Squamish. Therefore, 2005 was selected as the representative year for conducting temporal analysis of the count station data; no significant changes in traffic patterns are expected between 2005 and the present day north and south of Squamish along Highway 99.

FIGURE 3.1.1 and FIGURE 3.1.2 show average daily two-way traffic north and south of Squamish respectively. Monthly traffic variations generally followed the same pattern north and south of Squamish, and exhibited only minor variations between northbound and southbound volumes month to month. Higher volume periods throughout the year correspond to the winter ski season and the summer holiday season, with peaks in February and August. August was the peak month, exhibiting the highest average daily traffic, at approximately 25 percent greater than the annual average daily traffic (AADT). October exhibited the lowest volumes, averaging daily volumes approximately 16 percent less than the AADT. TABLE 3.1.4 provides a summary of monthly factors based on a comparison of monthly average daily traffic (MADT) to AADT at both ministry count stations.

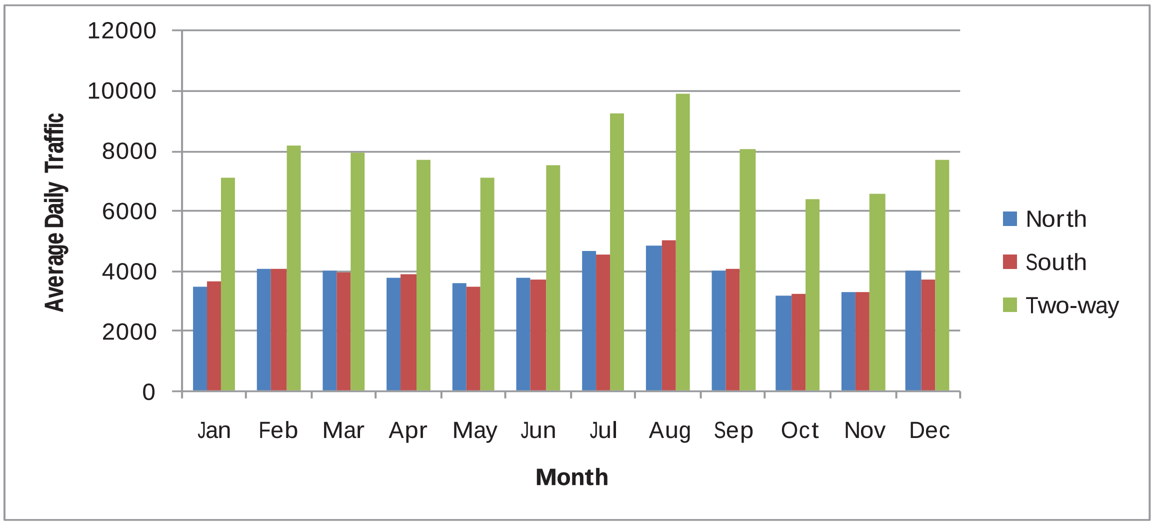


FIGURE 3.1.1 Monthly Traffic Variation – Squamish North
(P-15-3NS – Highway 99 south of Cheekye River Bridge)

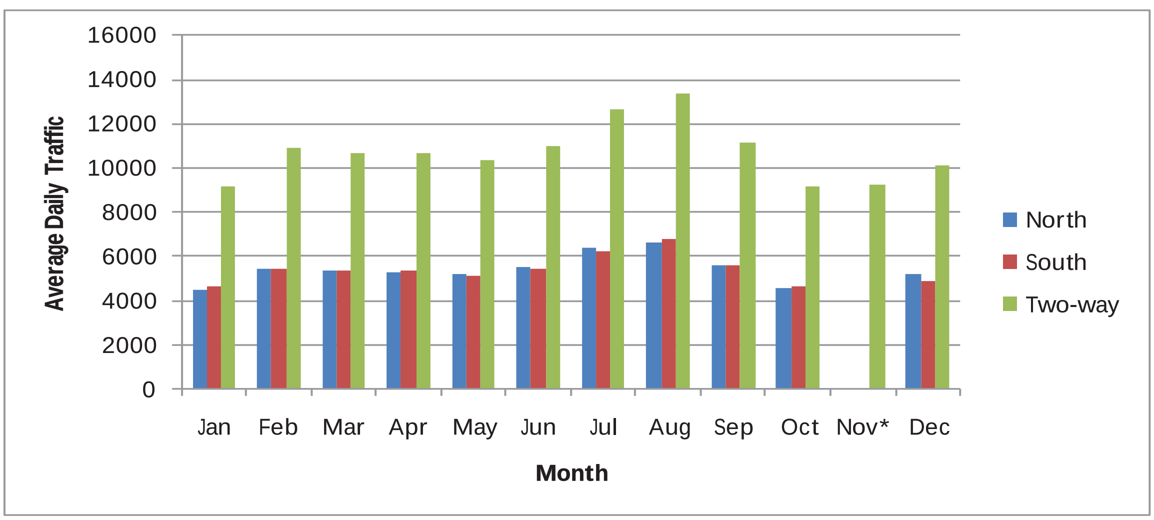


FIGURE 3.1.2 Monthly Traffic Variation – Squamish South
(P-15-8NS – Highway 99 2.1 km north of Murrin Park Access)
* November data missing, Two-way volume approximated from 2004 data

TABLE 3.1.4 Monthly Traffic Variation on Highway 99

	South of Squamish	North of Squamish	Two-way
Jan	0.85	0.91	0.87
Feb	1.01	1.05	1.03
Mar	0.99	1.02	1.00
Apr	0.99	0.99	0.99
May	0.96	0.91	0.94
Jun	1.02	0.97	1.00
Jul	1.17	1.19	1.18
Aug	1.24	1.27	1.25
Sep	1.04	1.04	1.04
Oct	0.85	0.82	0.84
Nov	0.86	0.85	0.85
Dec	0.94	0.99	0.96

FIGURE 3.1.3, FIGURE 3.1.4 and FIGURE 3.1.5 show the variation of traffic volumes throughout the week during February, August, and October of 2005 respectively at the count station south of Squamish. In general, volumes were highest on weekends, and exhibited greater peaking during the peak months of February and August. Peak volumes were observed on Sundays, with yearly average Sunday volumes being approximately 19 percent greater than the AADT. Traffic volumes were low during the week, and were typically lowest on Tuesdays which, throughout the year, averaged volumes 14 percent less than the AADT. TABLE 3.1.5 provides a summary of daily factors based on a comparison of average traffic throughout the week to AADT at both ministry count stations.

The proportion of northbound to southbound traffic showed a distinct pattern, with high northbound volumes on Fridays and Saturdays, and high southbound volumes on Sundays and Mondays. Traffic characteristics throughout the week indicate that Highway 99 experiences a high volume of recreational traffic on weekends. High Friday and Saturday northbound volumes can be attributed to recreational travellers heading up to Whistler as the weekend begins, and high Sunday southbound volumes can be attributed to the same users returning to Metro Vancouver as the weekend ends.

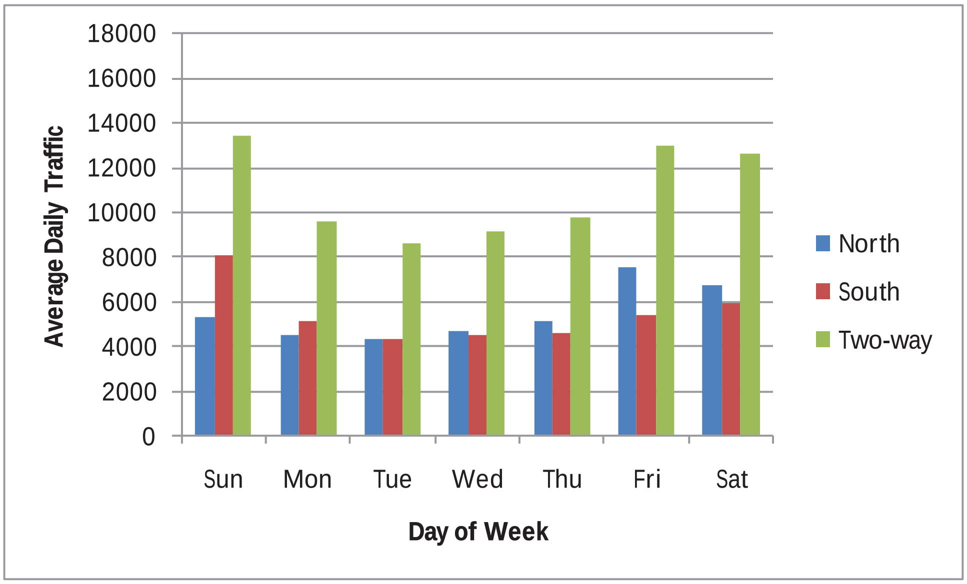


FIGURE 3.1.3 Daily Traffic Variation in February

(P-15-8NS – Highway 99 2.1 km north of Murrin Park Access)

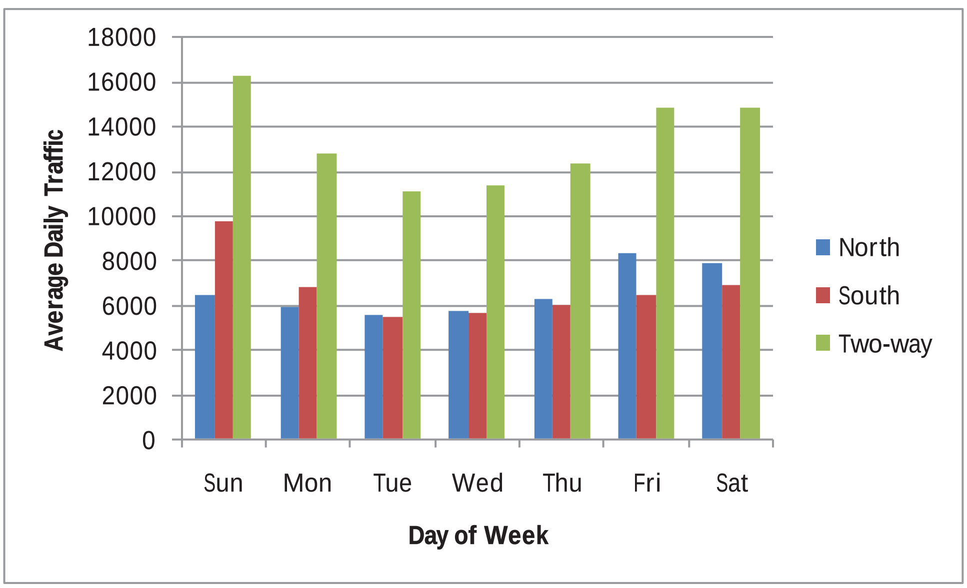


FIGURE 3.1.4 Daily Traffic Variation in August

(P-15-8NS – Highway 99 2.1 km north of Murrin Park Access)

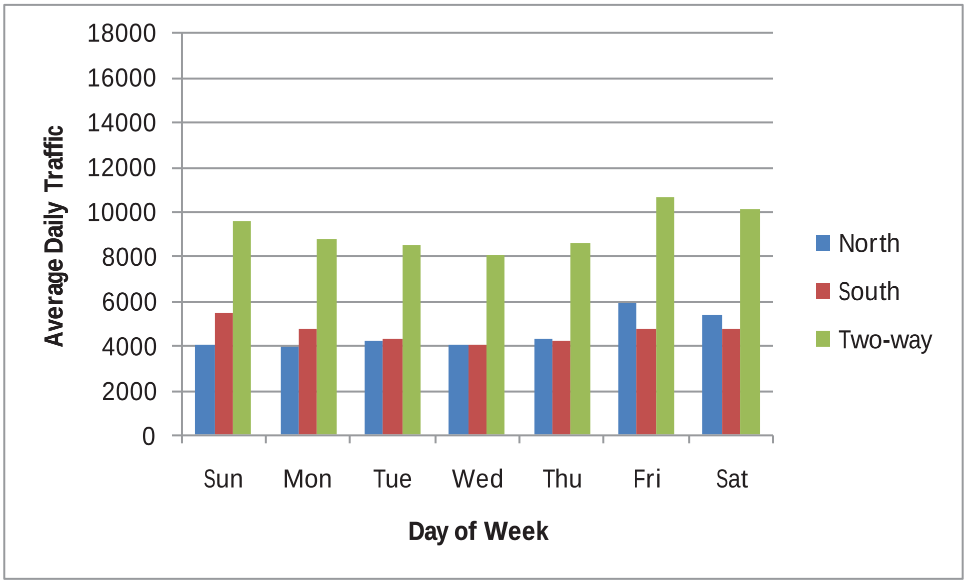


FIGURE 3.1.5 Daily Traffic Variation in October

(P-15-8NS – Highway 99 2.1 km north of Murrin Park Access)

TABLE 3.1.5 Daily Traffic Variation on Highway 99

	South of Squamish	North of Squamish	Two-way
Sun	1.18	1.20	1.19
Mon	0.93	0.92	0.93
Tue	0.83	0.83	0.83
Wed	0.87	0.85	0.86
Thu	0.93	0.92	0.93
Fri	1.15	1.18	1.16
Sat	1.11	1.10	1.11

FIGURE 3.1.6, FIGURE 3.1.7, and FIGURE 3.1.8 show hourly traffic variations during the months of February, August, and October for Sundays, Wednesdays, and Fridays respectively at the count station south of Squamish. Sunday southbound traffic exhibited a distinct afternoon peak between 4:00 p.m. and 6:00 p.m. during February and August. Northbound traffic and southbound traffic in October did not feature any significant peaks throughout the day. Friday northbound traffic also peaked during the afternoon between 4:00 p.m. and 6:00 p.m. Friday southbound volumes also showed some minor peaking in the afternoon. Sunday and Friday hourly patterns support the idea that Highway 99 experiences heavy recreational traffic on weekends. Wednesday hourly traffic shows a distinctly different distribution that resembles a typical commuter pattern.

Southbound volumes exhibit a morning peak between 7:00 a.m. and 8:00 a.m. as commuters head to Metro Vancouver to work, whereas northbound volumes generally peak around 5:00 p.m. as commuters are returning home from work.

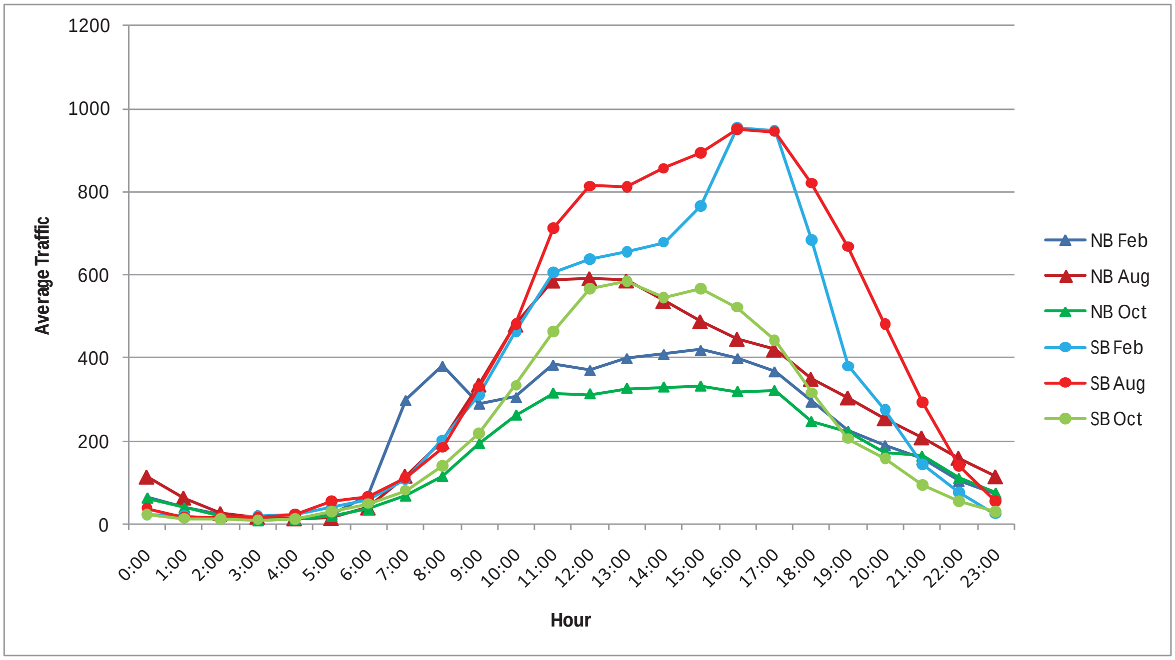


FIGURE 3.1.6 Hourly Traffic Variation on a Sunday

(P-15-8NS – Highway 99 2.1 km north of Murrin Park Access)

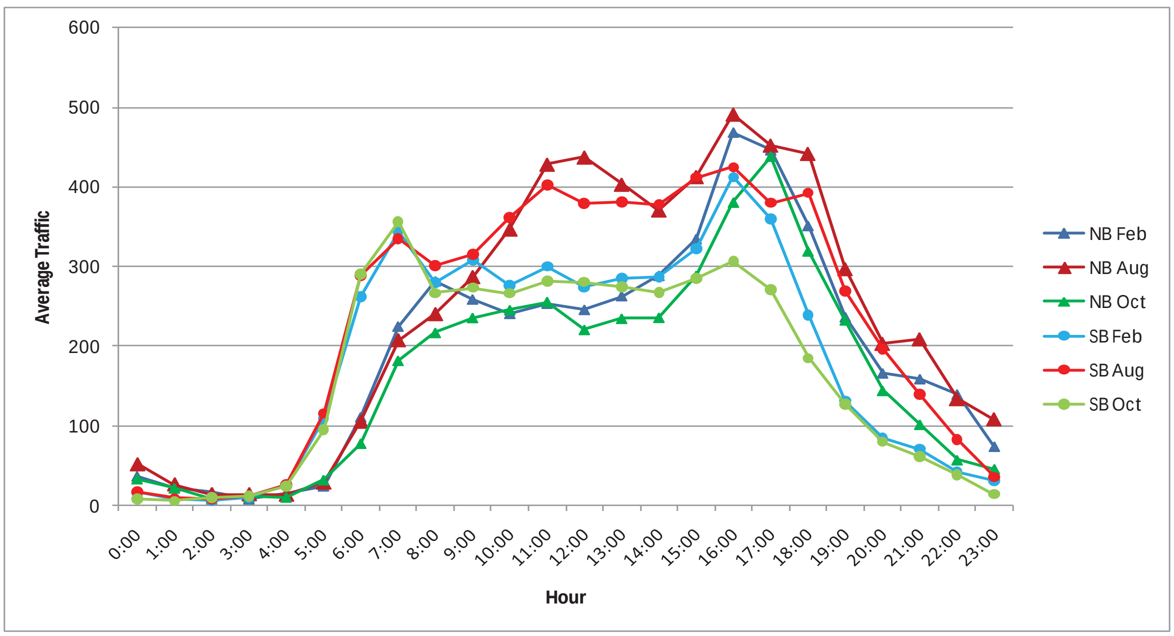


FIGURE 3.1.7 Hourly Traffic Variation on a Wednesday

(P-15-8NS – Highway 99 2.1 km north of Murrin Park Access)

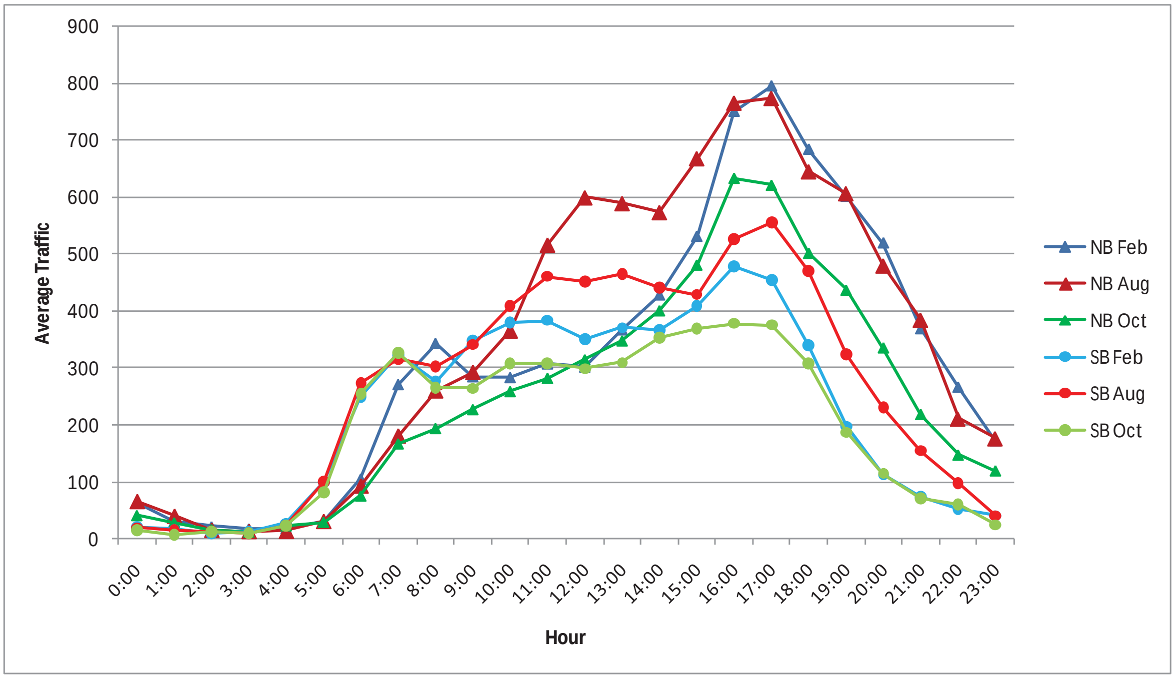


FIGURE 3.1.8 Hourly Traffic Variation on a Friday
(P-15-8NS – Highway 99 2.1 km north of Murrin Park Access)

Intersection Volumes – Weekday in September

FIGURE 3.1.9 shows turning movement volumes in September at key intersections within the District during the system wide afternoon peak between 4:00 p.m. and 5:00 p.m., as well as overall intersection levels of service, and levels of service for individual movements. The volumes shown are based on a combination of MoTI loop detector data, origin-destination traffic counts conducted by Creative Transportation Solutions (CTS), and short counts conducted by Opus during site visits.

Ministry of Transportation and Infrastructure loop detectors are located at all signalized intersections along Highway 99 through Squamish. Three weeks of turning movement volumes were collected at these intersections were compiled between Tuesday, September 21, 2010 and Thursday, September 23, 2010 to develop a weekday average afternoon peak that corresponded to the CTS turning movement counts and site visit short counts.

As part of the origin-destination survey, CTS conducted turning movement counts north and south of Squamish at Alice Lake and Shannon Falls respectively between 3:00 p.m. and 6:00 p.m. on Thursday, September 23, 2010.

During the site visit conducted on Thursday, September 23, 2010, intersection short counts were taken at various intersections during the morning and afternoon peak periods. Short count data was used for non-Ministry controlled intersections (i.e. off the highway), un-signalized Ministry intersections (i.e. Highway 99 @ Centennial Way), and where gaps existed in the Ministry data.

During the study period, Government Road was closed between Mamquam Road and Garibaldi way due to construction. Because traffic was blocked on Government road, traffic patterns at the Depot Road, Garibaldi Way, and Mamquam Road highway intersections were significantly affected. Turning movement volumes between the three intersections were proportioned to reflect the findings of previous traffic studies. Where the magnitude of volumes differed significantly from the findings of previous traffic studies, volumes were taken from those studies and factored to represent existing conditions.

As shown in FIGURE 3.1.9, Highway 99 experiences heavy afternoon traffic during weekday afternoons. The highway intersections at Mamquam Road and Cleveland Avenue act as major intersections within Squamish, both of which feature turning movements on and off the highway with volumes up to and exceeding 400 vehicles during the weekday afternoon peak hour. In general, northbound volumes are greater nearer to the south of Squamish, whereas southbound volumes are greater nearer to the north end of Squamish, indicating that there is more inbound traffic in the afternoon.

Because Highway 99 is the main north-south route through Squamish, it acts as a local road for residents of Squamish. Turning movements on and off the highway, and volumes along the highway in general are greatest between the Depot Road and Clarke Drive intersection and can be attributed to the addition of local traffic. The Mamquam Road and Cleveland Avenue intersections experience the greatest volumes along the highway; this corresponds to the fact that they act as the main accesses to the Garibaldi Highlands and Downtown Squamish neighbourhoods respectively, which can be considered the two more densely developed areas in Squamish.

Levels of Service – Weekday in September

Based on the turning movement volumes presented, an intersection level of service analysis was conducted. Capacity performance of the intersections was assessed using Synchro Version 7.0 software, developed by Trafficware. FIGURE 3.1.9 shows that overall, intersections operate at good levels of service. All movements operated at a level of service D or better at all intersections. In general, volume-to-capacity ratios were observed to be higher for through movements at intersections along the highway, which is expected given the relatively high through volumes the highway experiences. Analysis showed a volume to capacity ratio of 0.79 for the westbound left-turn movement at Mamquam Road, suggesting that the movement may experience capacity issues, and would have difficulty accommodating additional traffic without experiencing significant delays.

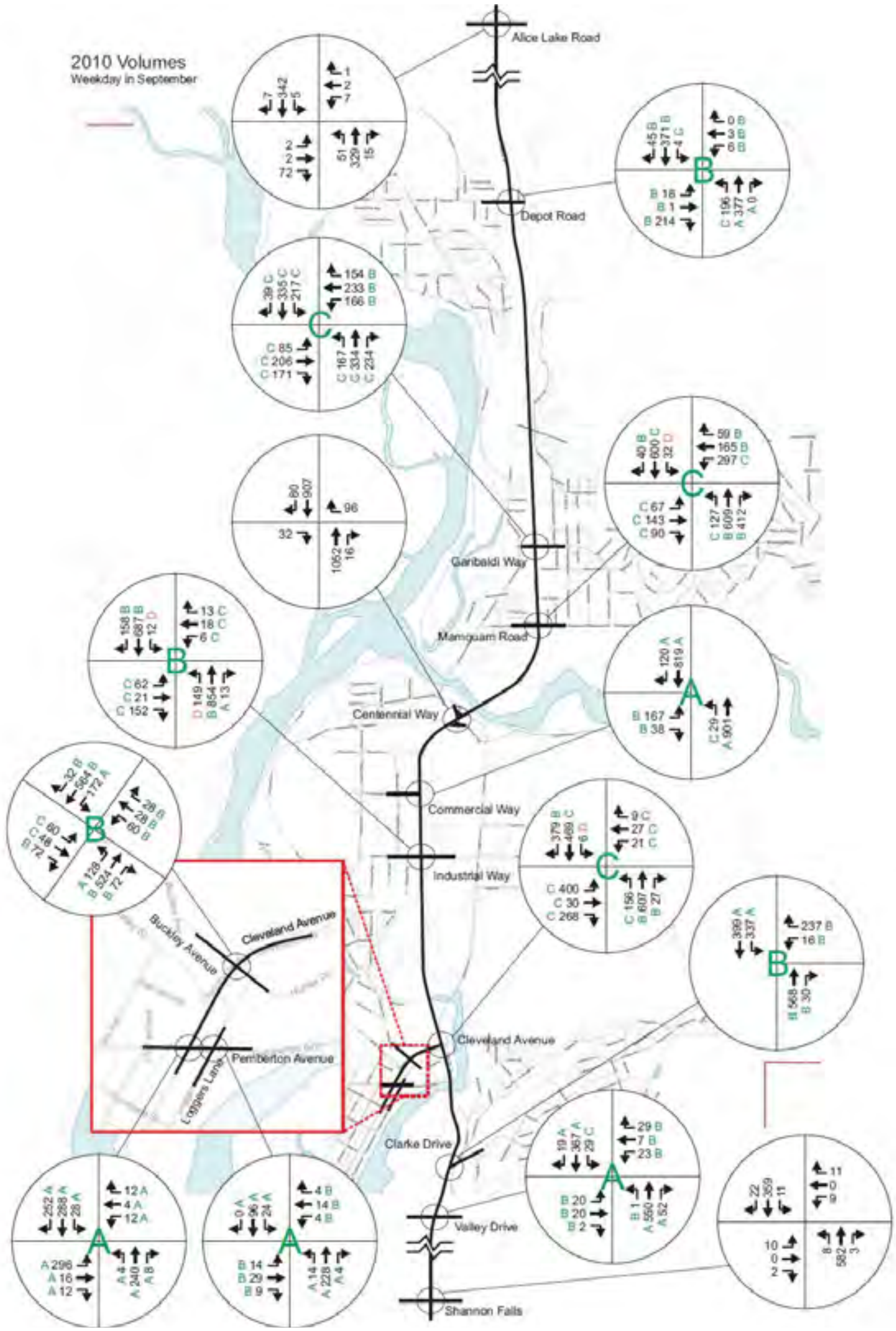


FIGURE 3.1.9 Weekday Average PM Peak Traffic Volumes and Levels of Service – September 2010

Intersection Volumes – Friday in August

Based on the temporal analysis of data from the Ministry's count stations, Friday afternoons in August were identified as a peak condition for the Squamish road network. FIGURE 3.1.10 shows Friday afternoon peak hour turning movement volumes in August, overall intersection levels of service, and levels of service for individual movements.

Factors were applied to convert weekday average volumes in September to Friday volumes in August. As identified above, Fridays exhibited a unique travel pattern that differed significantly from weekday patterns. Because of this, separate factors were determined for the northbound and southbound directions. Based on September weekday volume data from the Ministry permanent count stations, a factor of 1.54 was developed for northbound highway traffic and a factor of 1.12 was developed for southbound highway traffic. The September weekday-to-Friday conversion factors were only applied to northbound and southbound through movements on the highway. It is assumed that the majority of recreational traffic responsible for unique Friday patterns stays on Highway 99 and has a minimal effect on local Squamish traffic.

August volumes were established by applying a factor of 1.21. This September-to-August conversion factor was determined by comparing the respective MADT volumes obtained from the MoTI permanent count stations and averaging between the two.

Levels of Service – Friday in August

An intersection level of service analysis was conducted based on Friday volumes in August. Overall levels of service were worse for most intersections along the highway; however, intersections still operated at acceptable levels of service. The intersection at Mamquam Road showed the worst overall level of service. Analysis showed that the westbound left-turn movement at Mamquam Road does in fact experience significant capacity issues given the increased volumes. The movement operates above capacity with a volume-to-capacity ratio of 1.09 and experiences delays of over 100 seconds. Results suggest that although the system operates well under normal conditions, facilities may not be able to adequately handle the high volumes experienced during extreme peak situations.

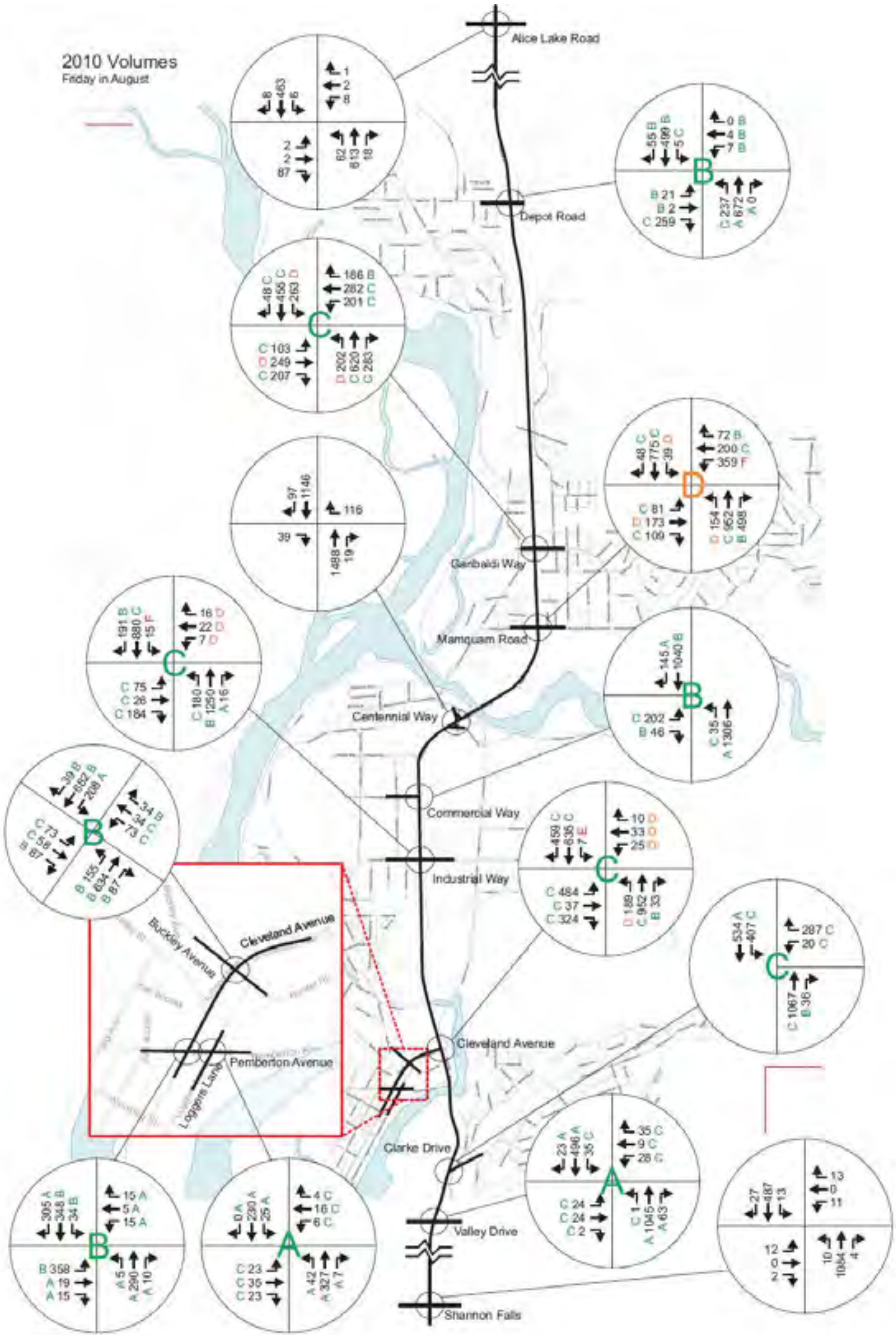


FIGURE 3.1.10 Friday PM Peak Traffic Volumes and Levels of Service – August 2010

AM Peak Hour Performance – Weekday in September

Based on the above level of service analysis, the highway intersections at Mamquam Road, Industrial Way, and Cleveland Avenue were identified as key intersections. A level of service analysis was conducted for these intersections on a weekday in September during the AM peak hour. Similar to volumes during the PM peak period, AM volume are based on a combination of MoTI loop detector data and short counts conducted by Opus during site visits. TABLE 3.1.6 shows turning movement volumes at key intersections within the District during the system wide morning peak between 8:00 a.m. and 9:00 a.m., as well as overall intersection levels of service, and levels of service for individual movements.

In general, results show that during the AM peak period, highway through volumes in the northbound direction are approximately half those during the PM peak period, whereas highway through traffic in the southbound direction remains relatively constant between the AM and PM peak periods. It can genearlly be said that turning movements on and off the highway switch volumes between the AM and PM peaks (i.e. northbound left-turn volumes in the AM are similar to eastbound right-turn volumes in the PM). Overall, the level or service analysis shows good levels of service at the key intersections during the AM peak period.

TABLE 3.1.6 Weekday Average AM Peak Traffic Volumes and Levels of Service – September 2010

Highway Intersection	Weekday in September			
	Overall LOS	Movement		
		Movement	Volume	LOS
Mamquam Road	C	EBL	57	C
		EBT	89	C
		EBR	82	C
		WBL	336	C
		WBT	75	B
		WBR	30	B
		NBL	74	C
		NBT	384	B
		NBR	159	B
		SBL	23	D
		SBT	567	C
		SBR	84	B
Industrial Way	B	EBL	55	C
		EBT	15	C
		EBR	123	C
		WBL	7	C
		WBT	21	C
		WBR	5	C
		NBL	119	C
		NBT	370	A
		NBR	8	A
		SBL	12	D
		SBT	658	B
		SBR	208	B
Cleveland Avenue	B	EBL	10	C
		EBT	12	C
		EBR	32	C
		WBL	12	C
		WBT	18	C
		WBR	4	C
		NBL	139	C
		NBT	320	B
		NBR	15	A
		SBL	3	C
		SBT	368	B
		SBR	352	B

Critical Volume Analysis

Two-way hourly volume data was obtained from the count station north of Squamish for the entire year of 2009. The 2000 highest hours were ranked and are shown in FIGURE 3.1.11 along with two-way hourly volumes of 686 and 1095 vehicles north of the Alice Lake intersection corresponding to the 2010 Weekday in September and 2010 Friday in August scenarios respectively. A critical volume of 1200 was determined. The volume at which through movements at Industrial Way went to LOS E was determined to be the critical point. FIGURE 3.1.11 shows that volumes greater than critical occur during 70 hours of the year, or less than 2% of the daytime driving hours in a year.

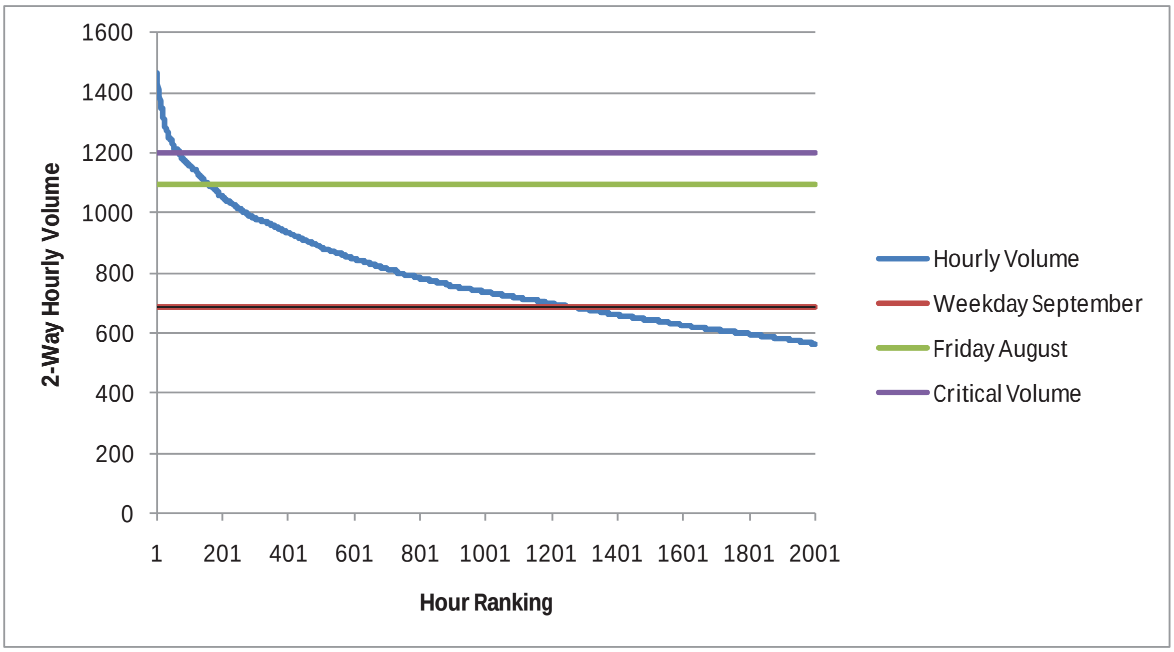


FIGURE 3.1.11 2009 Hourly Volumes in Descending Order

(P-15-3NS – Highway 99 south of Cheekye River Bridge)

TABLE 3.1.7 provides a breakdown of when the critical volume hours occurred. It is important to note that the majority of the critical volume hours occurred on Sundays and were most numerous during February, March, July, and August. It is also important to note that there were multiple critical volume hours that occurred on the same day. Analysis of 2009 hourly data showed that critical volume hours were limited to 32 days of the year. In general, high volumes occurred during only one to three hours per day; however, during July and August, high volume periods occurred throughout the day and at their greatest lasted up to 7 hours of the day. It should be noted that the high volumes generally correspond to days with statutory holidays and long weekends.

TABLE 3.1.7 2009 Critical Volume Hours

		Hour							
Date	Day	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
11/01/2009	Sun						1426		
18/01/2009	Sun						1383		
25/01/2009	Sun						1217	1389	
08/02/2009	Sun					1211	1344		
15/02/2009	Sun						1408	1249	
20/02/2009	Fri							1212	
27/02/2009	Fri						1201	1277	
28/02/2009	Sat						1316		
01/03/2009	Sun						1346	1261	
15/03/2009	Sun							1376	
21/03/2009	Sat						1237	1350	
22/03/2009	Sun					1212	1467	1411	
29/03/2009	Sun						1434	1334	1210
05/04/2009	Sun						1344	1252	
18/05/2009	Mon		1268	1230					
05/07/2009	Sun					1312	1239		
12/07/2009	Sun		1246						
17/07/2009	Fri							1209	
19/07/2009	Sun		1212	1224	1235		1209	1253	
26/07/2009	Sun			1221		1210	1280		
02/08/2009	Sun		1259	1203					
03/08/2009	Mon	1428	1353	1351	1354	1210	1219		
14/08/2009	Fri							1221	
16/08/2009	Sun	1240	1364	1288	1277	1328	1291	1387	
23/08/2009	Sun	1247	1292	1240	1277		1202	1210	
30/08/2009	Sun			1234		1210			
09/10/2009	Fri							1218	
11/10/2009	Sun					1206			
12/10/2009	Mon				1245	1215			
22/11/2009	Sun						1274		
19/12/2009	Sat						1302		
27/12/2009	Sun					1250	1282		

3.1.4 External Origin-Destination Survey

To better understand the relationship between local and non-local traffic on Highway 99, an origin-destination license plate survey was conducted by CTS between 3:00 p.m. and 6:00 p.m. on Thursday, September 23, 2010. Survey stations were set up at the entry and exit points on Highway 99 north of Squamish just north of the Alice Lake intersection and south of Squamish just south of the Shannon Falls intersection. Entering and exiting vehicle license plates were recorded at each station and time stamped. To determine which vehicles were entering, exiting, or passing through, license plates were matched between stations. For this study, vehicles that entered then exited Squamish and spent less than 20 minutes between count stations were considered to be external-external trips; trips where vehicles entered Squamish and took more than 20 minutes to exit Squamish were considered as two separate trips.

TABLE 3.1.8 and TABLE 3.1.9 provide a summary of the afternoon peak hour origin-destination license plate survey results by destination and origin percentages respectively. The peak periods identified during the license plate survey and the system wide afternoon peak differ slightly, but are similar enough that the results are applicable. TABLE 3.1.8 shows that trips originating north (from Alice Lake) and south (from Shannon Falls) of Squamish had similar destination distributions, with greater than 80 percent of vehicles staying in Squamish, and less than 20 percent of vehicles continuing past Squamish. TABLE 3.1.9 shows that only 74 percent of vehicles headed north (to Alice Lake) originated from Squamish; this is less than the 83 percent of southbound (to Shannon Falls) vehicles originating internally. The higher percentage of external-external trips in the northbound direction corresponds to the trend of recreational traffic travelling from Metro Vancouver to Whistler as the weekend approaches, as identified previously in SECTION 3.1.3.

An O-D survey was not conducted for the Friday PM peak in August. However it can be surmised that a large majority of the increase in traffic described in Figure 3.1.10 is attributable to recreational traffic. This would suggest that the percentage of northbound vehicles passing through Squamish in the August peak condition may be over 50%.

TABLE 3.1.8 Origin-Destination Survey Results by Destination

DESTINATION %		DESTINATION						
		Internal Trips		External Trips				Total
				Shannon Falls		Alice Lake		
ORIGIN	Shannon Falls 15:45-16:45	531	86%			84	14%	**615**
	Alice Lake 16:15-17:15	317	83%	67	17%			**384**

TABLE 3.1.9 Origin-Destination Survey Results by Origin

ORIGIN %			DESTINATION	
			Shannon Falls	Alice Lake
ORIGIN	Internal Trips		328	235
			83%	74%
	External Trips	Shannon Falls 15:45-16:45		84
				26%
		Alice Lake 16:15-17:15	67	
			17%	
	Total		**395**	**319**

Highway 99 is integral to all almost all external traffic, and external transportation options are limited to vehicle travel on Highway 99 in one form or another. The large majority of all external trips in Squamish are single-occupancy vehicle trips. TABLE 3.1.10 provides a summary of Synovate origin-destination data for external-internal trips originating from Metro Vancouver and Whistler, and shows virtually all trips from Metro Vancouver involve auto travel. External trips from Whistler show up to five percent non-auto mode travel, which may reflect the fact that a transit service runs between Squamish and Whistler.

TABLE 3.1.10 Surveyed External-Internal Trip Mode

TRIP MODE	Percentage of Trips from Metro Vancouver	Percentage of Trips from Whistler
Auto Driver	77%	62%
Auto Passenger	20%	28%
Commercial Vehicle	3%	5%
Transit/ Other Bus	0%	3%
Other	1%	2%

3.1.5 Future Scenarios and Sensitivity Analysis

The land use information described in SECTION 2.0 was input to the calibrated VISSIM model along with a growth factor of 2% applied over 20 years to external-external trips on Highway 99. A calibration report is provided in APPENDIX B.

The calibrated VISUM model was used to determine peak PM link volumes for a weekday in September and a Friday in August for the 2031 base land-use scenario. From the link volume outputs, turning movement volumes were calculated based on existing turning movements. A detailed capacity analysis for the two 2031 base land-use conditions, as well as the 2031 hypergrowth scenario, is provided in APPENDIX E.

To test the implications of the assumed growth rate, a sensitivity analysis was conducted for the 2031 base land-use scenario for a weekday in September. For this analysis, growths of 1% and 3% for through volumes along the highway were tested. FIGURE 3.1.12 provides shows overall intersection levels of service at highway intersections for an:

- Expected weekday in September;
- Expected Friday in August;
- Weekday in September with 1% highway traffic growth; and
- Weekday in September with 3% highway traffic growth.

Key findings are summarized below:

- In 2031, for a typical weekday in September, intersections will continue to operate at acceptable overall levels of service. However, the Mamquam Road and Industrial Way intersections may experience some capacity issues with some movements failing at these locations.
- Levels of service worsen significantly between Garibaldi Way and Clarke Drive for a Friday in August in 2031. Unacceptable delays are observed at Mamquam Road, Industrial Way, Cleveland Avenue, and Clarke Drive.
- The sensitivity analysis shows that a 1% change to the expected growth of external highway traffic in either direction has little-to-no effect on overall intersection performance along the highway.

Implications of 2031 Base land-use Scenario

2031 base condition capacity performance analysis suggests that although highway interfaces are generally functioning within capacity under typical conditions, improvements will be required at specific intersections along Highway 99. Results also suggest a significant decrease in performance during periods of higher volumes such as a Friday in August; however, it is unlikely that these conditions will occur frequently enough to warrant additional intersection improvements. Continual monitoring of volumes and operations along highway intersections is recommended to determine how often such volumes will occur in the future.

Given the constrained topography and land-use in Squamish, it is possible that intersection improvements may not be feasible or may not suffice, and alternative solutions will need to be considered.

The sensitivity analysis shows that the external highway traffic growth assumptions used for the analysis of the 2031 Base land-use scenario are fairly robust. External-external traffic growth is expected to have a minor effect on traffic operations within the District; internal land-use growth and development is likely the most significant factor affecting traffic volumes and operations moving forward.

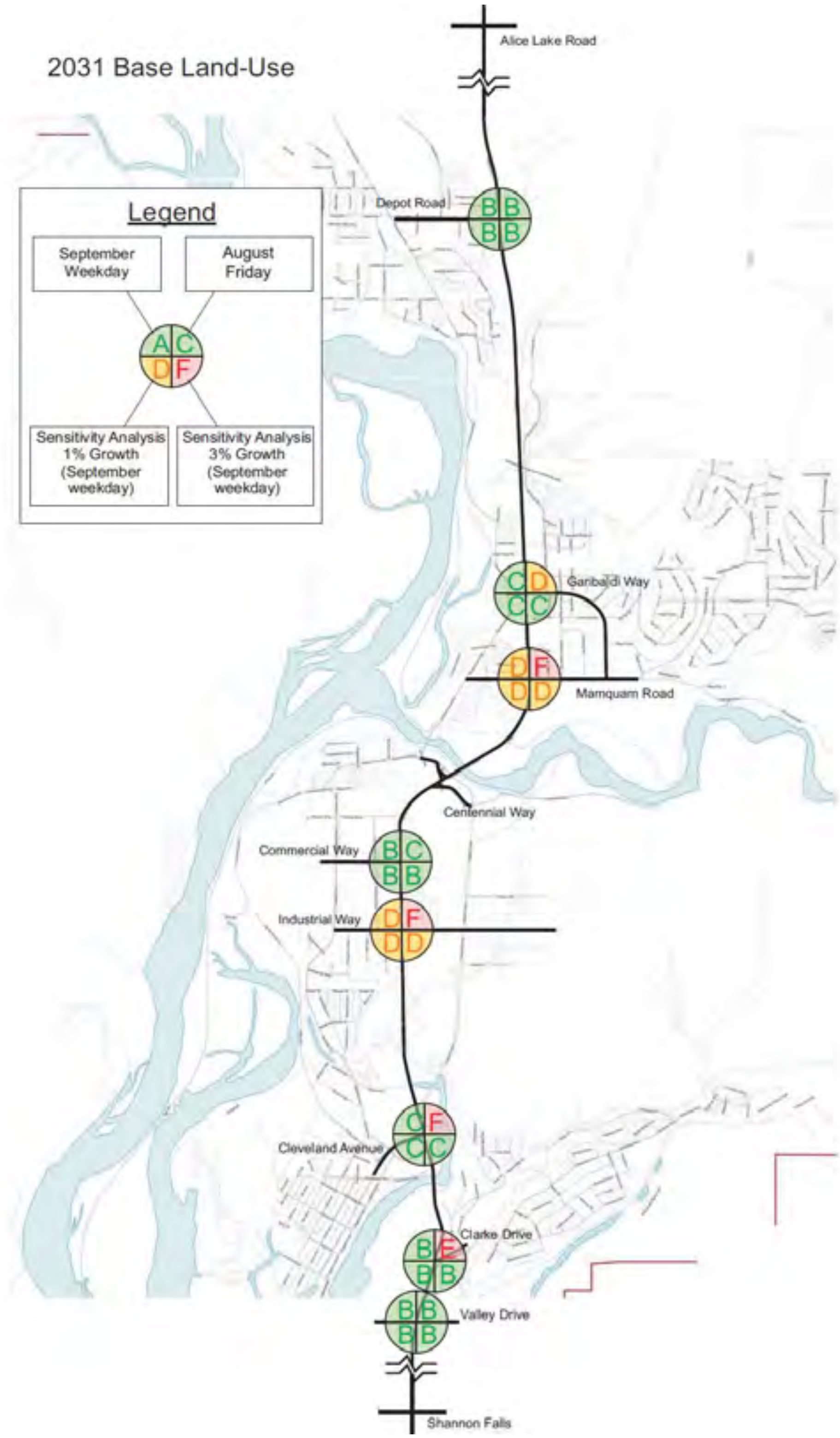


FIGURE 3.1.12 Overall Intersection Levels of Service – 2031 Base Land-use Scenario

Implications of 2031 Hypergrowth Scenario

Under 2031 hypergrowth conditions, the majority of intersections are failing and numerous links are approaching capacity. **This indicates that if the population were to increase significantly above the 2031 base condition and vehicle usage characteristics remained the same, widening existing roads or building new roads would become necessary.**

The model was also used to examine the need for an additional Mamquam River crossing. Results showed that such a crossing would be required as the population in Squamish reached 50,000.

3.1.6 Safety

Available collision data from ICBC for the years from 2005 to 2009 was summarized by the District, and the top locations by collision frequency were provided. This data was compared with a similar period from 1996 to 2000, which had been reviewed for the report Safer City Initiative - A Review of Collision and Claim Trends - Squamish, British Columbia (Hamilton Associates, 2002). The results are summarized in TABLE 3.1.11 below.

TABLE 3.1.11 SUMMARY OF COLLISION FREQUENCIES

RANK	ON STREET	AT STREET	1996-2000* TOTAL COLLISIONS	2005-2009 TOTAL COLLISIONS
1	Highway 99	Cleveland Avenue	135	130
2	Highway 99	Garibaldi Way	81	77
3	Highway 99	Industrial Way	70	73
4	Buckley Avenue	Cleveland Avenue	62	34
5	Highway 99	Mamquam Road	44	84
6	Highway 99	Clarke Drive	41	29
7	Cleveland Avenue	Pemberton Avenue	29	13
8	Highway 99	Centennial Way	25	17
9	2nd Avenue	Victoria Street	16	N/A
10	Highway 99	Valley Drive	16	N/A
11	Highway 99	Alice Lake Road	14	23
12	Cleveland Avenue	Winnipeg Street	13	n/a
13	Garibaldi Way	Government Road	12	17
14	3rd Avenue	Victoria Street	11	n/a
15	Government Road	Mamquam Road	10	14
16	Highway 99	Depot Road	10	19

*59 Month Period

A significant increase was noted at the intersection of Highway 99 and Mamquam Road. This is not surprising since significant development has occurred on the approaches to that intersection in the 5 years between the two data sets. Significant decreases occurred at the intersections of Cleveland Avenue with Buckley Avenue and with Pemberton Avenue, likely due to traffic control changes implemented as a result of the Safer City Report.

It is also interesting to note that the collision frequency at the top 3 locations along Highway 99 remained relatively constant. These intersections were reviewed in the Safer City Report, and some contributing factors were identified in that report. These safety issues are summarized in FIGURE 3.1.14, excerpted from that report. Recommended improvements were also identified, and are shown in FIGURE 3.1.15. A drive-through review conducted in the course of the study indicated that many of the issues identified in that report prevail today.

The District of Squamish should continue to work with the Ministry to identify opportunities to modify the road form to reduce collisions related to channelized right turns, and to speeding on the approach to signalized intersections.

"Smart Channel" Right Turn Lanes

Studies have found that the geometry of channelized right-turns presents several unintended risks that may contribute to rear-end or sideswipe collisions:

- Difficulty stopping due to high entry speed;
- Difficult for motorists to look over their shoulder to judge gaps in traffic, particularly elderly drivers;
- Increased crossing risk for pedestrians; and
- Incompatibility of geometry with yield control.

To reduce the risk of collisions associated with these issues, the channelized right-turn lane may be reconfigured to reduce the angle of the turn. U.S. Federal Highway Administration (FHWA) has recently recommended a 'pork chop' layout, as shown in FIGURE 3.1.13 below.

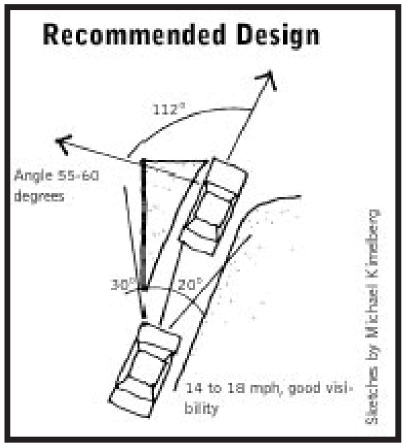


FIGURE 3.1.13 Modified Channelized Right Turn
(Source: FHWA Matrix website)

The modified alignment can be expected to result in a decrease in speed for turning vehicles, increasing the time available to drivers to observe other road users to whom they must yield. The shallower approach angle also allow drivers to better observe conflicting road users approaching from the left (vehicles, pedestrians and cyclists), and right (pedestrians and cyclists on the sidewalk).

Implementing channelized right-turns with tighter turning angles will require collaboration with the Ministry, especially for right turns coming off the highway. These modified right turn lanes were recently implemented on Highway 97 through the urban section of Kelowna. Additional guidance on these "smart Channels" can be found in the following resources *City of Edmonton Integrated Corridor Safety Project Report (2009) [Section 3]* and the *ITE Urban Street Geometric Design Handbook [Section 4.5.6].*

Recommended Safety Improvements

Corridor-wide safety improvements were generated to address the issues identified. In addition, several intersection-specific improvements were also suggested. The recommended improvement strategies are illustrated in FIGURE 3.1.15, and include:

- Provide protected-only phasing;
- Improve delineation and signing of right-turn acceleration lanes; or consider "smart-channel" right turn lanes with reduced radius

- Increase speed enforcement;
- Relocate advance warning flashers and review timing;
- Upgrade pavement markings;
- Optimize signal timing plans; and
- Provide open-graded pavement treatment.

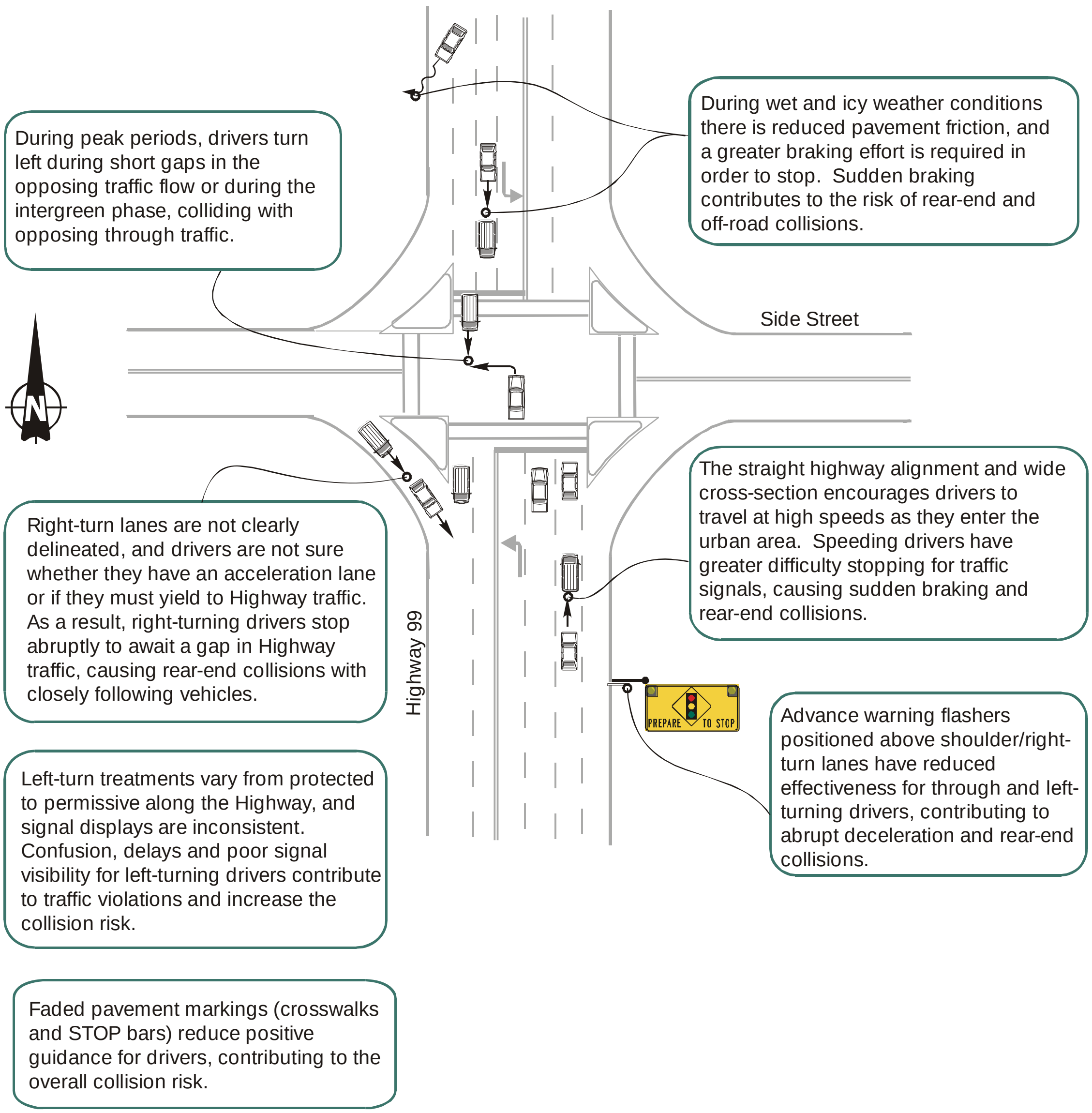


FIGURE 3.1.14 SUMMARY OF CORRIDOR SAFETY ISSUES AT INTERSECTIONS ON HIGHWAY 99

(Source: Highway 99 Intersections Safety And Operational Reviews Squamish, Hamilton Associates, 2002)

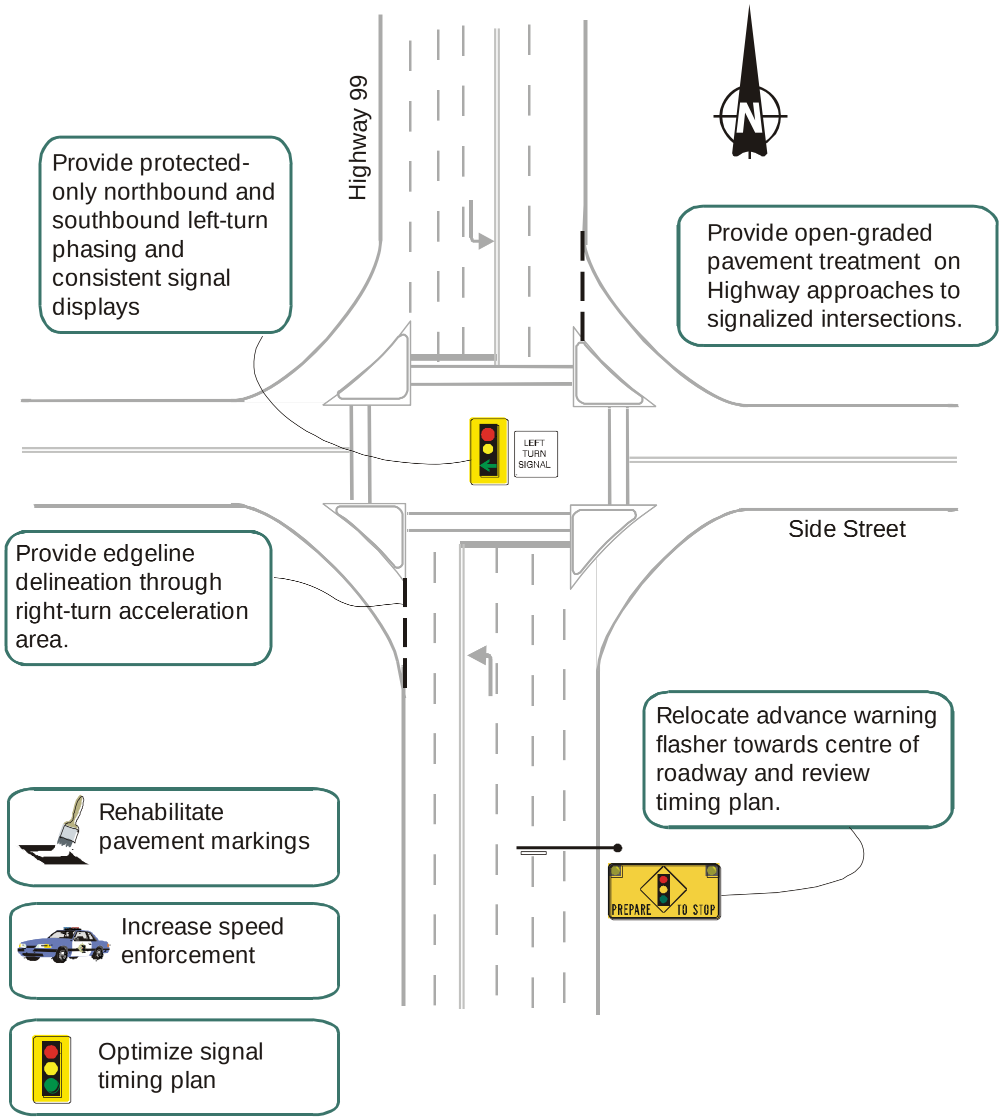


FIGURE 3.1.15 SUMMARY OF CORRIDOR SAFETY IMPROVEMENTS

(Source: Highway 99 Intersections Safety And Operational Reviews Squamish, Hamilton Associates, 2002)

3.1.7 Opportunities

The following opportunities were noted during this study:

- **Generally good Level of Service with few delays for normal weekday afternoon peak.** Most intersections operate at level of service B or C, even in peak periods.

3.1.8 Issues

The following issues were noted during this study:

- **Scattered work locations south of Squamish.** Employment options south of Squamish are extremely diverse. Because employment opportunities are spread throughout Metro Vancouver and other parts of the lower mainland, coordinating carpool pick-up/drop-off locations becomes difficult.

- **Significant percentage of the workforce employed outside of Squamish.** Because 30 percent or more of the Squamish workforce works outside of Squamish and auto travel is the predominant form of transportation, reducing auto-trips to destinations outside of Squamish is a significant challenge.

- **High volume of recreational traffic on weekends.** Recreational traffic between Metro Vancouver and Whistler adds a significant amount of traffic to highway 99 during weekends. The distinct travel patterns during the weekend put significant one-way strain on the system depending on the day. Additionally, during ski season when traffic is dominated by skiing trips, Sunday southbound afternoon peak volumes can experience a very sharp peak that corresponds to ski lift closing times. Short peak periods with extremely high volumes create pressure on the road network, and make it difficult to accommodate peak traffic volumes without overdesigning for the more typical traffic volumes that occur during the rest of the time.

- **Significant seasonal variation in traffic volumes.** Because peak month volumes can be up to 25 percent greater than the AADT, the network experiences additional strain. Seasonal traffic variations compound the difficulty of accommodating for high peak volumes without overdesigning.

- **Highway intersection capacity issues during peak times.** Intersections along Highway 99 may not be able to provide adequate service during peak hours during peak seasons.

- **Queue lengths at the Mamquam Road highway intersection.** A specific issue noted by residents and District staff, and supported by capacity analysis results, is the long westbound left-turn queues that form along Mamquam Road at the Highway 99 intersection. The existing left-turn lane is relatively short, and during peak times left-turning vehicle queues extend beyond the left-turn bay and block westbound through traffic on Mamquam Road.

- **Safety issues along Highway 99 corridor.** Collisions frequencies at top locations within Squamish have remained relatively constant. Safety improvements are likely required to improve safety at these locations.

Issues Identified During Public Consultation

Review of the web-based public survey responses revealed few statements made by residents and stakeholders regarding the road network and traffic conditions in Squamish. This may reflect the fact that the majority of respondents generally had issue with alternative modes as opposed to personal vehicle travel. It is also possible that the lack of responses regarding road network and traffic conditions is a product of the survey design and its focus on alternative modes. In general, driving related comments typically alluded to the fact that a personal vehicle was required for work or that driving was often the only feasible option. No specific issues related to the road network or traffic conditions were mentioned.

A review of comments gathered during the public Open House (Public Information Meeting #1) revealed the following comment: "The intersections with Highway 99 at Commercial Way and Industrial Way do not function well".

3.1.9 Recommendations

The following discussion provides in-depth analysis or additional discussion related to certain highway interface and regional traffic recommendations. A full list of recommendations made as part of this plan is provided in SECTION 6.0.

A. Highway Intersection Performance Improvements

The intersections encountering level of service D or E during a typical weekday PM peak were considered "trigger intersections" for the purposes of evaluating the performance of the highway interfaces for the existing and 2031 base land-use scenarios. The improvement measures recommended below were based on the following performance criteria:

- Achieve an overall intersection level of service D or better.
- Achieve a level of service E or better for all individual movements.

Existing highway intersection performance for a weekday in September during the AM and PM peak is shown above in TABLE 3.1.6 and FIGURE 3.1.9 respectively. Although no highway intersections meet the overall LOS criteria for "trigger intersections", the westbound left-turn movement at Mamquam Road is operating between a D and E LOS in the PM peak.

Highway intersection performance for the 2031 Base land-use scenario for a weekday in September during the AM and PM peak is shown in TABLE E-1 and FIGURE E-1 in APPENDIX E.

Results show that the existing Highway 99 interfaces will function adequately during typical conditions without the need for significant reconfiguration or alternative corridor. However, it is expected that signal timing improvements will be required to optimize performance of the Mamquam Road and Industrial Way intersections.

In summary, to improve levels of service at highway intersections it is recommended that the following improvements be made:

<u>Short term</u>

- Convert existing westbound through lane to a shared left-turn through lane at Mamquam Road and Highway 99

It is recommended that a shared westbound left-turn/ through lane at Mamquam Road and Highway 99 be implemented as soon as possible to alleviate existing capacity issues.

Long term

- Optimize signal timing at Mamquam Road and Highway 99
- Optimize signal timing at Industrial Way and Highway 99

Optimizing signal timings at Mamquam Road and Industrial Way can be implemented at virtually zero cost, so the timeframe depends only on when improvements are required. Optimization will improve the overall level of service at each of these intersections; however an adequate balance between local and regional traffic must be considered. Optimization at Mamquam improves local traffic movements across the highway at the expense of regional traffic. Optimization at Industrial Way improves regional traffic flow at the expense of local movements.

It is assumed that a natural local redistribution of volumes will occur at the Industrial Way and Commercial Way intersections. Based on the existing volume splits, the model predicts a large proportion of turning movements will occur at Industrial Way. It is more likely, however, that as delays at Industrial Way increase, more drivers may choose to make turning movements at Commercial Way instead. Accurate turning movement data will be required to best determine the timeframe of implementation and signal timing changes required.

It is recommended that the District request that BC MoTI commit to not changing signal timing on any of the Highway intersections in Squamish without consultation and further that an ongoing dialogue be established between the District and BC MoTI on how a level of balance may be reached between regional and local traffic demands that accomplishes the goals of both parties.

It is recommended that the District regularly request turning movement data for the highway intersections from BC MoTI and augment with short counts as necessary.

It is recommended that the District request that the Murrin Park counting station (P-15-8NS) or equivalent be reinstated by BC MoTI.

It is also recommended that the District conduct traffic counts at strategic locations on Government Road annually on Sundays in August as a means of establishing the impact of peak highway traffic on the local road network.

B. *Highway Intersection Safety Improvements*

Recent data shows that collision frequencies were reduced at intersections where the recommended improvements of the Safer City Initiative - A Review of Collision and Claim Trends - Squamish, British Columbia (Hamilton Associates, 2002) were implemented.

Based on 2005-2009 ICBC collision data, collision frequencies are highest at the following highway intersections:

- Cleveland Avenue at Highway 99
- Mamquam Road at Highway 99
- Garibaldi Way at Highway 99
- Industrial Way at Highway 99

The corridor wide improvement measures recommended by the report are illustrated in FIGURE 3.1.15 above and include:

- Provide protected-only phasing;
- Improve delineation and signing of right-turn acceleration lanes; or consider “smart-channel” right turn lanes with reduced radius
- Increase speed enforcement;
- Upgrade pavement markings;
- Optimize signal timing plans; and
- Provide open-graded pavement treatment.

The District should regularly monitor collision statistics at highway intersections to both monitor the effect of implemented safety improvements and identify any intersections where collision frequencies are increasing. The District will have to coordinate its efforts with the BC MoTI to determine the best method and time-frame for implementing safety improvements.

It is recommended that the District continue to work with BC MoTI to implement the safety improvements recommended in the Safer City Initiative to improve safety and lower collision frequencies at highway intersections.

3.2 Commuter Transit

3.2.1 Background

Regional commuter transit services are a key consideration moving forward. A document review was conducted, and the most relevant documents related to external commuter transit in Squamish are listed in TABLE 3.2.1. Of the documents listed, the AECOM document Transportation Options for the Squamish Metro Vancouver Corridor proved to be the most relevant because it discusses regional transit service model options; these options are discussed below.

TABLE 3.2.1 Relevant Documents for Regional Commuter Transit Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	Transportation Options for the Squamish-Metro Vancouver Corridor (AECOM)	2009	Document
2	District of Squamish Official Community Plan	2009	Document
3	Transportation Hub Report (Bunt/ HB Lanarc)	2009	Document
4	Downtown Squamish 2031 Transport Plan (CTS)	2009	Document
5	STS MOT Modal Diversion Study (TSI)	2002	Document
6	STS MOT Demand Study (TSI)	2002	Document
7	STS MOT Multi-Modal (Reid Crowther)	2001	Document
8	STS MOT Non-Auto Report (ACTRAN)	1999	Document

3.2.2 Existing Service

Squamish Commuter to Whistler Bus Route

BC Transit Route 98 was a year-round commuter service that ran four times a day at 8am, 3pm, 4:30pm, 5pm and 11pm. It provided public transit connection to Whistler. Fares were $8.00 for regular passengers, $6.50 for seniors and students. Children four years of age or younger rode free. 10 Tickets could be purchased for $72.00 and a monthly pass was $232.00. FIGURE 3.2.1 shows the Squamish to Whistler transit route. The service was not sustainable in this form and was suspended at the end of August 2011, pending further discussions with BC Transit on Sea to Sky Corridor transit service.

The Squamish Commuter to Whistler bus route is currently the only regional public transit service provided; there is no public transit service between Squamish and Metro Vancouver.

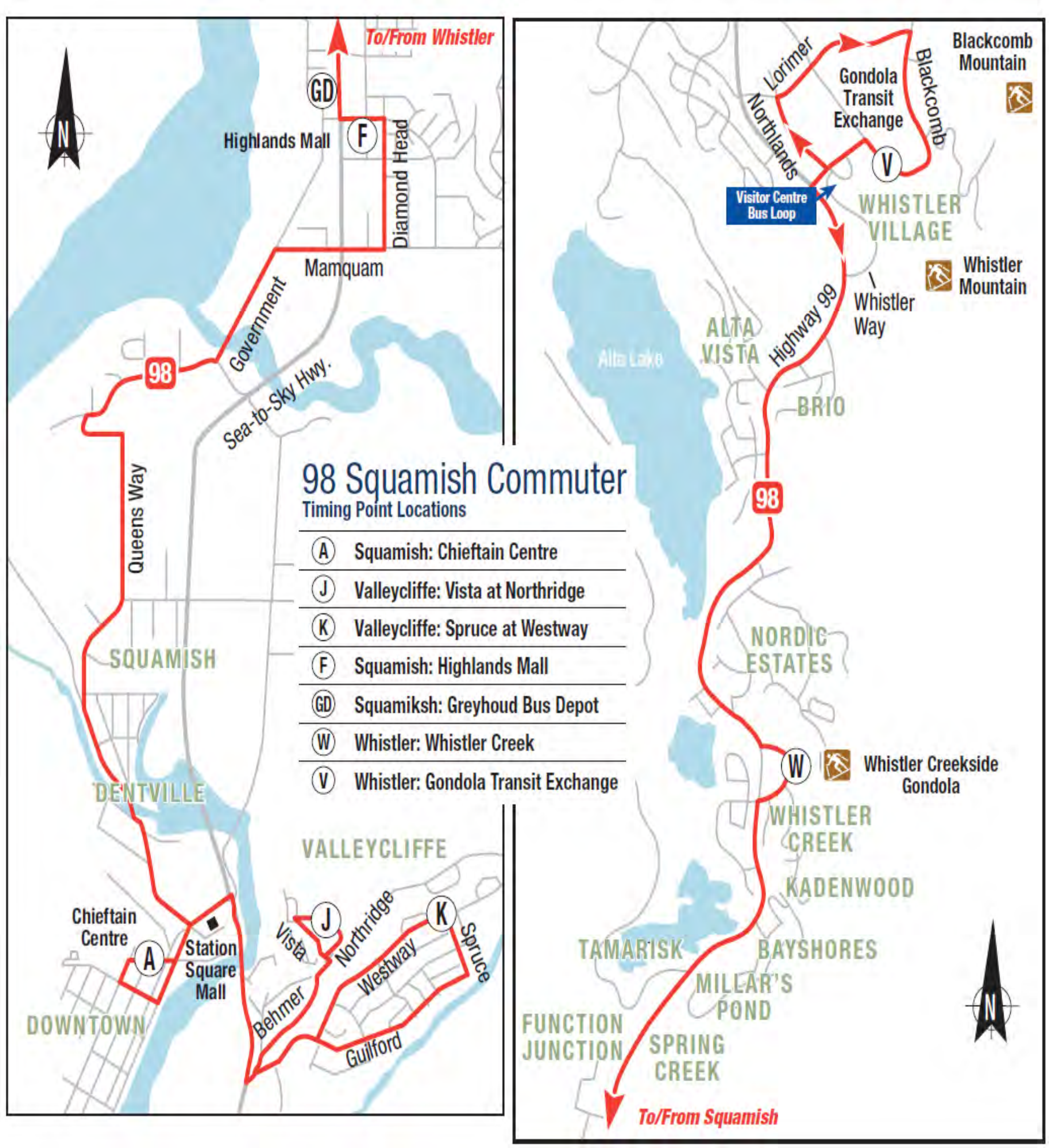


FIGURE 3.2.1 Squamish Commuter to Whistler Transit Route

Source: BC Transit

3.2.3 Opportunities

The following opportunities were noted during this study:

- **Existing core of commuters and desire for alternatives.** Because upwards of 30 percent of the Squamish workforce works outside of Squamish, a large market exists for transportation options. In most cases, commuters are looking for an alternative to single-occupancy vehicles; therefore viable alternatives are likely to have a strong buy-in from residents of Squamish.

3.2.4 Issues

The following issues were noted during this study:

- **No commuter service to Metro Vancouver and limited commuter service to Whistler.** Without public transit service to Vancouver, commuters are limited to driving or taking Greyhound to reach Metro Vancouver. Limited service times to Whistler reduce the convenience of the bus service for commuters who need to travel at times other than the four times a day the service currently operates.

- **Diverse work hours north of Squamish.** Whistler is the main employment area north of Squamish. Because the majority of employment there relates to the service industry, work hours vary greatly throughout the day. Because of the diverse hours, and extremely limited transit service, departure times are not convenient for a large majority of northbound commuters. Additionally, diverse hours make planning and coordinating carpools difficult.

- **Lack of ridership on the Whistler-Squamish commuter transit service.** As discussed in SECTION 3.2.2, the Whistler-Squamish Commuter service was implemented in 2005 and represents approximately 5000 service hours. However this service is currently operating under capacity for some of the reasons mentioned above.

- **Scattered work locations south of Squamish.** Similar to difficulties in coordinating carpool pick-up/drop-off locations, a single bus route service would likely be inadequate and would require transfers to be able to serve all possible work destinations in Metro Vancouver.

Issues Identified During Public Consultation

Review of open-ended responses gather during the online public opinion survey revealed the following statements made by residents and stakeholders regarding external trips to/from Squamish:

- Existing bus service times and drop-off locations are inconvenient.
- Existing bus service trips take too long; it is much more convenient and faster to drive.

In general, external commuter transit related comments suggested that the existing transit service does not adequately meet the needs of most Squamish-Whistler commuters.

3.2.5 Recommendations

At the time of writing this report the District was engaged in discussions with BC Transit on the future of Squamish/ Whistler commuter services. Furthermore the District understands that BC Transit will be completing a Sea to Sky Corridor Transit Master Plan in 2012. Therefore, this report provides some commentary on transit issues but does not include specific recommendations on this subject.

A. *Sea to Sky Corridor Commuter Bus Service Options*

Transit service options to Metro-Vancouver have been examined in detail in the Transportation Options for the Squamish Metro Vancouver Corridor Report (AECOM Canada Ltd, 2009). The service options proposed in the report include the following:

- Develop new express commuter bus service
- Subsidize existing commercial bus service to help reduce fares
- Subsidize existing commercial bus service to enhance services and reduce fares

- Subsidize the Jack Bell vanpooling program
- Subsidize employer carpools

Evaluation criteria for new or supplementary/enhancement services as outlined in the AECOM report included the following:

- Affordable
- Offers a convenient schedule (accommodates employees and visitors)
- Is flexible (does not require users to be committed to the system or adhere to a strict travel schedule)
- Minimizes travel time
- Offers conveniently located pick-up and drop-off locations
- Provides convenient means for transporting bicycles
- Is universally accessible
- Is reliable
- Offers convenient connections to local transit
- Offers free transfers to local transit systems
- Provides easy access to service schedule
- Is cost-effective
- Is relatively easy to establish
- Does not directly compete with existing services
- Able to attract significant ridership
- Reduces the environmental impact of transportation
- Supports the establishment of a multi-modal hub in the Downtown
- Reduces traffic congestion

Ultimately, the report recommended that a new express commuter bus service be developed while commercial bus service is subsidized to reduce fares. However, as noted above, BC Transit will be completing a Sea to Sky Corridor Transit Master Plan Study in 2012.

It is therefore recommended that the District of Squamish work closely with BC Transit and other corridor communities to establish a viable, regularly scheduled transit service for the Sea to Sky corridor.

B. Regional Transportation Hub

Aside from helping to provide regional transit service itself, the strongest measure Squamish can take to support regional transit is to facilitate a centrally located, accessible and efficient multi-modal transportation hub.

In 2009 Bunt & Associates/ HB Lanarc completed a Transportation Hub report for the District of Squamish. The report outlined hub rationale, planning and design considerations, possible hub locations, and an action plan for establishing transportation hubs in Squamish. One of the key items identified in the action plan was to "establish the optimal location for the downtown central hub and guidance on the satellites within the community".

The downtown central hub is envisaged as the primary regional transit interface in the community. It would also link directly to all modes of local transportation. A preliminary case study for downtown hub locations was included as part of the report. FIGURE 3.2.2 shows the potential downtown hub locations.

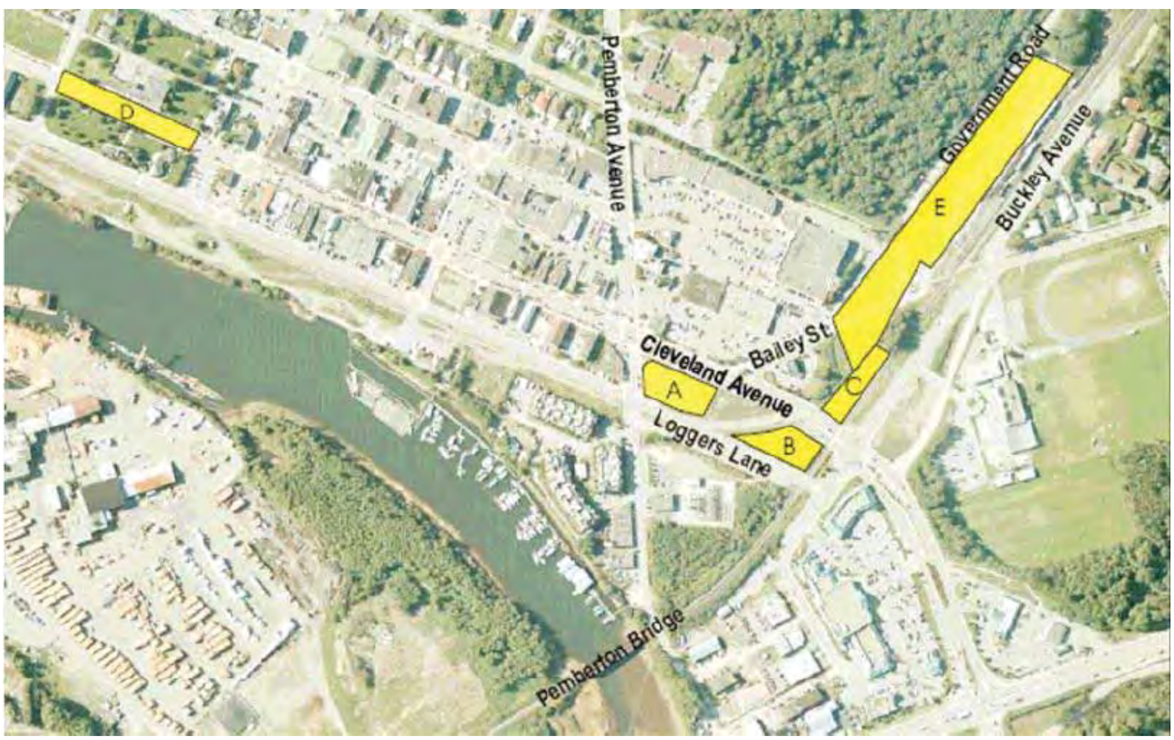


FIGURE 3.2.2 Potential Downtown Central Hub Locations

Location A - Pemberton / Loggers

- On vacant land (acres 1.0 acre)
- Generally square in shape.
- Access could potentially be from all four sides, but direct access from Cleveland Avenue could difficult given the proximity to the Pemberton and Bailey intersections, and more generally, that it is a busy street.

Location B - Buckley / Loggers

- On vacant land (acres 0.8 acres)
- Odd shape lot given the access road between Loggers Lane and Cleveland Avenue
- Access as Location A.

Location C - Cleveland / Buckley

- On vacant land (acres 0.75 acres)
- Rectangular in shape
- Access limited from Buckley only

Location D - Cleveland / Victoria

- On-street but with available either side
- Square in shape
- Access from Cleveland or Victoria

Location E - Railway Land Adjacent to Government Road (Bailey / 3rd)

- Land potentially available through BC Rail (12 acres)
- Rectangular in shape
- Access restricted from Cleveland and no direct access to north Squamish on Government Road

The hub report recommended that a scoring system be developed to further evaluate potential central hub locations. TABLE 3.2.2 ranks each location from 1 to 5, with 5 being the highest score, for various criteria.

TABLE3.2.2 Central Transit Hub Options

	A	B	C	D	E
CRITERIA	Pemberton/ Loggers	Hunter Pl / Loggers	Cleveland / Buckley	Cleveland / Victoria	Bailey / Third
Land ownership not an issue	1	3	1	5	1
Good Site Size	3	2	1	1	5
Good Site Access	5	3	1	4	4
Unaffected by land use or street changes	3	3	3	1	3
Close to Regional Connections	3	4	4	2	4
Close to Local Transit Connections	5	3	3	5	3
Good Pedestrian Connections	4	3	4	4	4
Good Cycling Connections	3	3	4	2	4
Close to schools	2	3	3	1	4
Near high density residential	4	3	2	2	4
Near employment	4	4	4	4	4
Community focused commercial and retail use	3	4	3	4	4
Close Proximity to High Activity centres	3	3	3	2	3
No Issues with sensitive uses	5	5	5	4	4
TOTAL	48	46	41	41	51

The analysis shows that Location E at Bailey Street and 3rd Avenue is the preferred site. Options A and B are relatively close in value.

Ultimately the decision to create a central (regional) transportation hub and the selection of a site will depend on a variety of factors, including:

- Sea to Sky Corridor Transit Master Plan Needs.
- property ownership and development interest
- acceptability to transportation service providers
- relative costs and benefits
- Cleveland Avenue Gateway Plan
- Analysis of Loggers/ Bailey/ Cleveland/ Pemberton Road Network Options

At the current level of understanding of this issue it is reasonable to conclude that in the event a regional transportation hub is established in the downtown it should be located in the upper portion of the downtown somewhere in the area bounded by Buckley Avenue on the north, Pemberton Avenue on the south, Loggers Lane to the east and Third Avenue to the west.

It is therefore recommended that the District include the potential for a regional transportation hub in its discussion of the Sea to Sky Corridor Transit Master Plan as well as any land use or transportation network decisions taken in the upper downtown area bounded by Buckley Avenue, Pemberton Avenue, Third Avenue and Loggers Lane.

3.3 Other Regional Transportation Options

3.3.1 Background

Although external vehicle traffic accounts for a large majority of regional transportation, it is equally important to examine alternatives for commuter traffic. A document review was conducted, and the most relevant documents related to external transportation options in Squamish are listed in TABLE 3.3.1.

TABLE 3.3.1 Relevant Documents for Regional Transportation Options Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	Transportation Options for the Squamish-Metro Vancouver Corridor (AECOM)	2009	Document
2	District of Squamish Official Community Plan	2009	Document
3	Downtown Squamish 2031 Transport Plan (CTS)	2009	Document
4	STS MOT Modal Diversion Study (TSI)	2002	Document
5	STS MOT Demand Study (TSI)	2002	Document
6	STS MOT Marine Options (Seymour)	2001	Document
7	STS MOT Multi-Modal (Reid Crowther)	2001	Document
8	STS MOT Non-Auto Report (ACTRAN)	1999	Document

3.3.2 Existing Options

As discussed above in SECTION 3.1 and SECTION 3.2, the majority of all external trips in Squamish are single-occupancy vehicle trips with some commuter transit trips between Squamish and Whistler. Besides personal vehicles and public transit, the existing alternative modes for external trips are:

- **Greyhound bus service.** Greyhound operates a transit service between Metro Vancouver and Squamish. The Vancouver terminal is located at the Pacific Central Station, and the Squamish terminals are located in Brackendale and Squamish South. One way trips from Vancouver to Squamish take between 85 minutes to 115 minutes. Service runs seven times a day throughout the week, departing from Vancouver at 5:15 a.m., 8:00 a.m., 10:00 a.m., 12:30 p.m., 3:00 p.m., 5:00 p.m., and 7:00 p.m. and departing from Squamish at 9:10 a.m., 11:35 a.m., 2:35 p.m., 5:30 p.m., 6:00 p.m., 7:35 p.m., and 9:50 p.m. These times may not be convenient for commuters. Additionally, terminals may not provide access to key destinations or linking transit.

- **Pacific Coach Lines bus service.** Pacific Coach Lines provide a transit service between Vancouver International Airport (YVR) and Whistler, which makes stops in Squamish upon request. The bus stops at the Adventure Centre in Squamish. One way trips between YVR and Squamish are 105 minutes long, and depart every hour from YVR starting at 8:30 a.m. and ending at 11:00 p.m. during the peak ski season. Outside of ski season, service runs every two hours from 8:30 a.m. to 7:30 p.m. Similar to the Greyhound Service, the schedule and terminal may not serve commuters very well.

- **Jack Bell vanpooling.** The Jack Bell Foundation runs a vanpooling between Squamish and Metro Vancouver. As of September 2008, a total of nine vehicles (four vans and five cars) provided service to 106 registered commuters. The Jack Bell Foundation suggests that not all of the 106 registered users found vanpools, and were inactive. The service costs $226 per month for the 4-5 passenger cars and $183 per month for the 7-8 passenger vans.

- **Resident-organized carpooling.** Carpooling organized between Squamish residents themselves is another regional transportation option. Several informal free park-and-rides exist within Squamish that support carpooling amongst residents by serving as convenient meeting/parking locations. Some examples include:
  - The Highland Mall Shopping Centre near Extra Foods;
  - Wal-Mart Parking Lot;
  - Parking Lot at the Eagle’s Nest Restaurant
  - Clarke Drive at Highway 99.

  Some of these locations are discouraged by property owners. The Clarke Drive location is approaching capacity and may impact operations of the adjacent intersection. Other informal park-and-rides may exist towards the south end of Squamish and towards the Brackendale area; however, municipal staff were unable to identify exact locations.

3.3.3 Opportunities

The following opportunities were noted during this study:

- **Existing core of commuters and desire for alternatives.** Because upwards of 30 percent of the Squamish workforce works outside of Squamish, a large market exists for transportation options. In most cases, commuters are looking for an alternative to single-occupancy vehicles; therefore viable alternatives are likely to have a strong buy-in from residents of Squamish.

- **Higher instance of carpooling to work.** Based on 2006 Census data, Squamish residents exhibit a higher instance of carpooling to work, with 13.2% of employed Squamish residents travelling to work as an auto passenger versus the provincial average of 7.7% (TABLE 3.1.13). Results suggest that there is a core of commuters willing to carpool to work, and that car-pool initiatives would likely have significant support.

3.3.4 Issues

The following issues were noted during this study:

- **Lack of affordable alternatives.** Regional transportation options are relatively expensive compared to single-occupancy vehicle travel and public transit. For many commuters, the high cost of travel makes commercial bus service simply not viable as a mode of transportation to/from work.

- **Existing services cater to recreational users.** The service provided by Greyhound and Pacific Coach Lines is intended or recreational users, and is not ideal for travel to/from work. The extremely limited departure/arrival times in the morning and evening mean that the service lacks the flexibility and reliability that most commuters require.

Issues Identified During Public Consultation

Review of open-ended responses gather during the online public opinion survey revealed the following statements made by residents and stakeholders regarding external trips to/from Squamish:

- Cost of alternative modes to Vancouver are too expensive, a Vancouver to Squamish transit service would be desirable. Cost becomes prohibitive especially for infrequent commuters.
- Conflicting work schedules make coordinating carpools difficult. Carpooling also lacks flexibility and are not suitable when there are errands to run.
- Jack Bell vanpool service is too expensive for those who do not travel every day. Jack Bell service operates on limited schedules that do not fit with working hours.

A large number of respondents expressed strong a desire for light rail, marine, and/or transit services as an alternative to vehicle travel on Highway 99 for external trips, many of which mentioned that such a service would be their preferred mode of transportation between Squamish and Vancouver.

3.3.5 Recommendations

The following discussion summarizes other regional transportation alternatives and recommendations. A full list of recommendations made as part of this plan is provided in SECTION 6.0.

A. *Ridesharing Options*

1. Park and Rides

   As noted above, informal park-and-rides exist at:

- The Highland Shopping Centre at the Extra Foods;
- Clarke Drive at Highway 99;
- On Government Road between Garibaldi Way and Chiefview Road; and
- Just off Centennial Way on the municipal right of way.
- Eagle Run Neighbourhood Shopping Centre

It has been noted that these sites are frequently used for car-pooling. Allowing parking space for carpoolers as well as a convenient location to meet is a key function of these spaces. Procuring, protecting, and developing the potential of these lands will contribute to a mode shift away from single occupancy vehicles. Beyond the sites listed above, the District should look to procure and protect lands that are:

- Near the Highway in the Downtown
- Near/in Garibaldi Village Mall
- Near potential ferry service areas in the Downtown

The District should also develop zoning and/or design guidelines to further facilitate and encourage ride-sharing and multi-modal trips.

It is recommended that at a minimum the District should develop two formal park and ride sites in close proximity to the highway, one towards the south end of the urban area and the other towards the north end.

2. Jack Bell Car Pool/ Van Pool
   This is a useful service which should be encouraged by the District as one commuting option.

3. On-Demand Ridematching
   It is recommended that the District consider hosting an on-demand ride-matching database or alternatively partnering with other service providers to offer this service.

B. *Marine Transportation*

Passenger ferry service was well analyzed in the lead up to 2010 Winter Olympic Games. Although this service was not implemented at the time, the business case was reasonably strong. It is believed that technological advances in propulsion systems and hull designs have the potential to significantly reduce operating speeds while reducing fuel consumption over what has been previously analyzed. If this is proven out in the coming years this should make the business case for passenger ferry service in this region quite attractive. Likely the impetus for such a service will come from the private sector or senior levels of government.

Potential sites for passenger ferry docks have been identified along the Oceanfront Peninsula. They are shown in FIGURE 3.3.1 along with other regional linkages and deep water amenable shoreline. Policies should be set to protect the existing deep water amenable and short sea shipping amenable shoreline.

It is recommended that the District preserve the opportunity to implement passenger ferry service as a means of regional transportation.

C. *Rail Transportation*

Commuter rail transportation services have been deemed to be economically unfeasible because of the extraordinary capital costs associated with bringing the railbed up to the required standards. Nevertheless, tourist oriented services such as the Whistler Mountaineer provide an opportunity to expand rail service as a travel option to and from Squamish and this should be explored.

It is recommended that the investigation of a central transportation hub should also refer to potential rail services.

D. *Air Transportation*

The traffic out of the Squamish Airport is broken down into recreational aviation (primarily fixed wing) and tourism/ commercial aviation (helicopter). The potential for a passenger oriented commuter service is limited.

The other identifiable potential passenger service is by float plane. A service has operated in the Mamquam Blind Channel in the past and there is still some interest in resuming this service. Such a service is seen as providing a useful commuting option but not one having a significant impact on overall regional travel patterns. Figure 3.1.1 identifies a potential float plane runway in the Blind Channel.

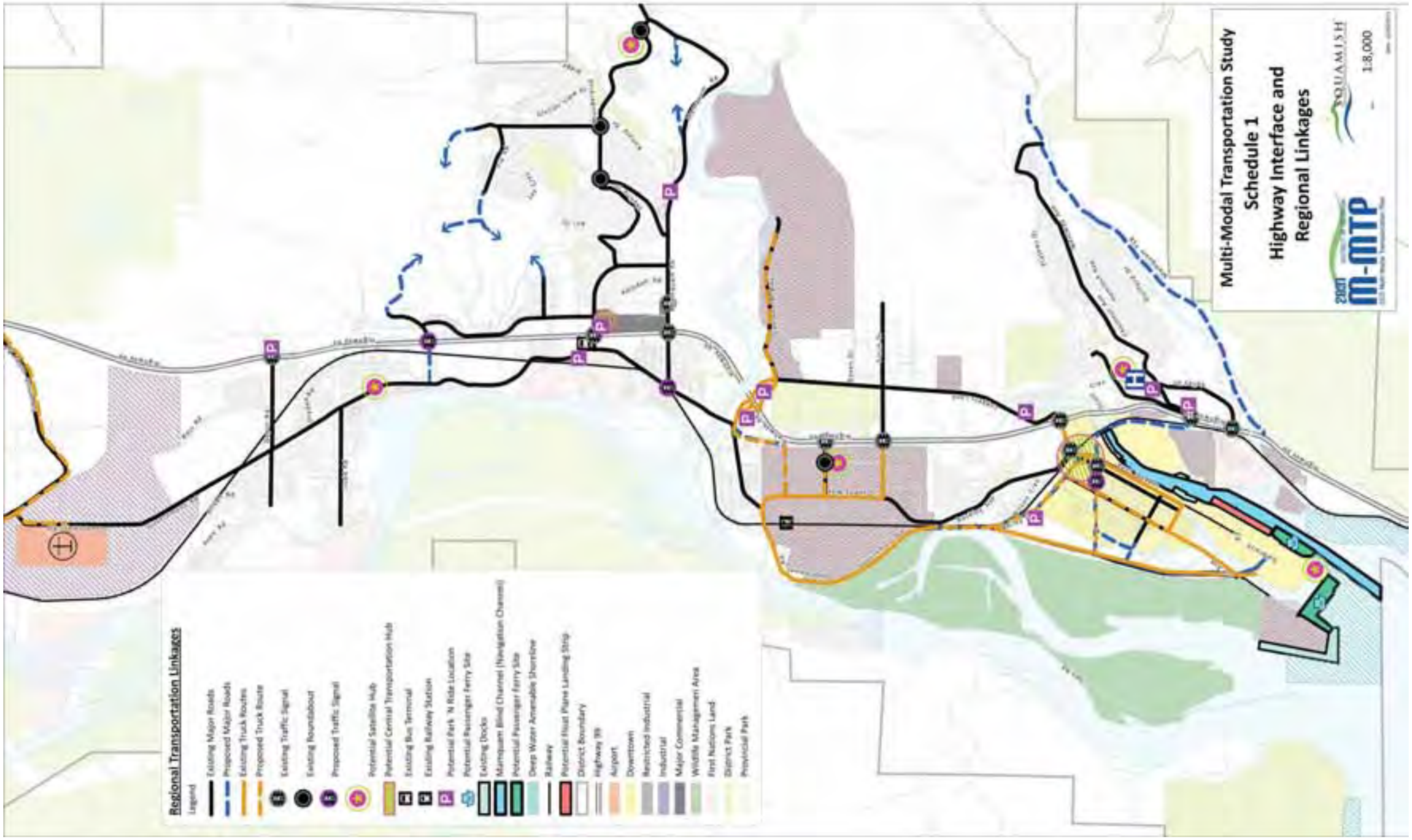


FIGURE 3.3.1 Schedule 1 – Highway Interface and Regional Linkages

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

THIS PAGE INTENTIONALLY LEFT BLANK

4.0 LOCAL NETWORKS

4.1 Road Network and Existing Traffic

4.1.1 Background

As part of the Squamish 2031 Multi-Modal Transportation Study, the existing road network and traffic patterns within the District were assessed using the following approach:

1) Review of background reports;
2) Site observations of the physical and traffic characteristics;
3) Collection of traffic volumes during the weekday peak periods; and
4) Analysis of existing traffic operations on major corridors based on available traffic volumes and signal timing information.

Previous documents dealing with the road network and traffic volumes in Squamish were reviewed. Documents are listed in TABLE 4.1.1.

TABLE 4.1.1 Relevant Documents for Road Network Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	District of Squamish Official Community Plan	2009	Document
2	Downtown Squamish 2031 Transport Plan (CTS)	2009	Document
3	Garibaldi Village Phase II Commercial Development (Bunt & Associates Engineering)	2008	Document
4	Newport Ridge/Skyline Drive Traffic Report (Bunt)	2008	Document
5	RedPoint RV Park Development Traffic Impact Assessment Reviews (Bunt)	2008	Document
6	Thurderbird Creek Residential Development Traffic Study (Bunt)	2007	Document
7	Traffic Impacts of Squamish Industrial Park (Ward Consulting Group)	2004	Document
8	Traffic Operations and Projections – Highway 99 North Conceptual Design Study (Ward)	2002	Document

4.1.2 Road Network

The existing road network, including proposed major routes, as defined in the District's current OCP Schedule G is shown in FIGURE 4.1.1.

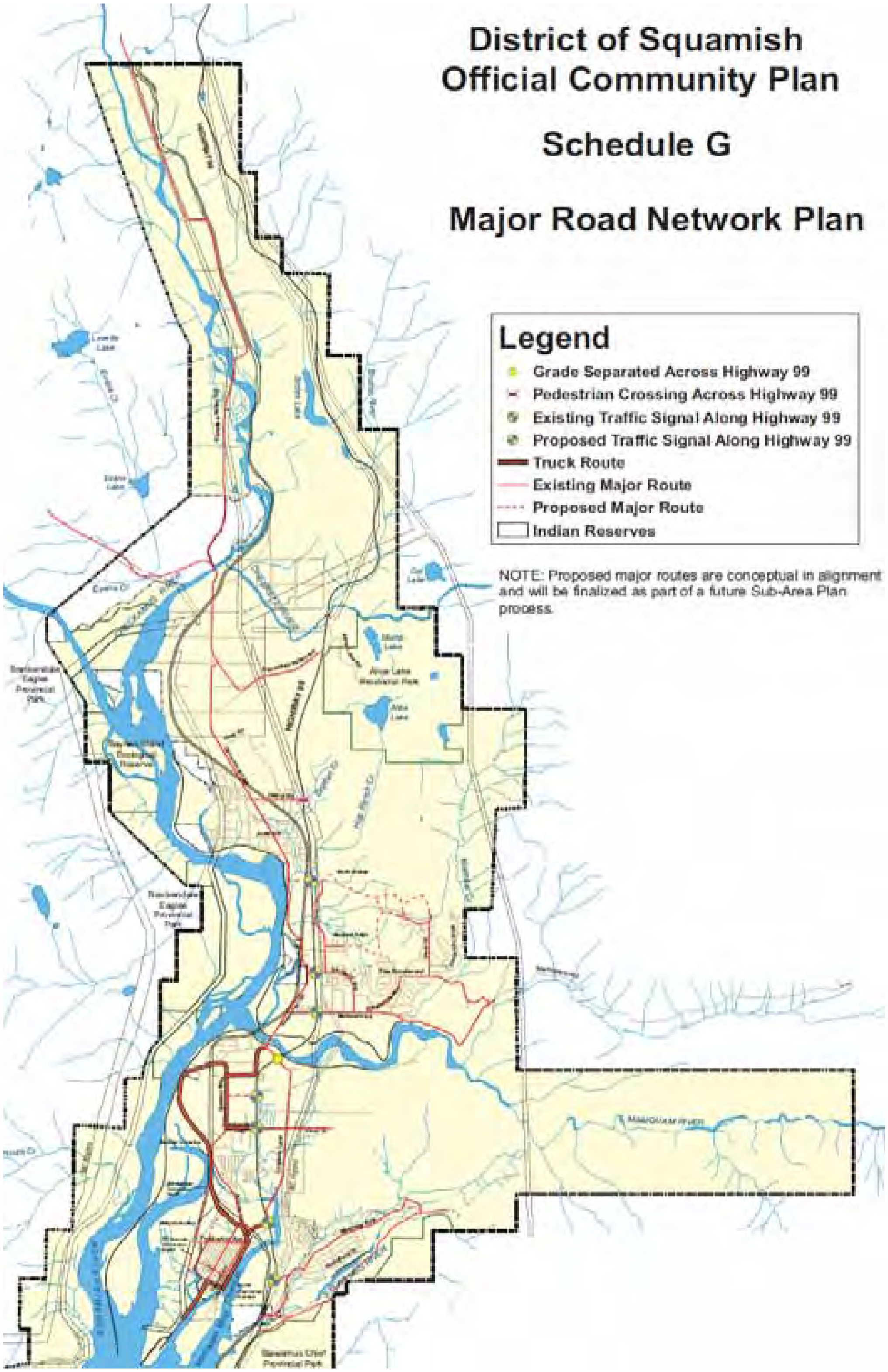


FIGURE 4.1.1 Major Road Network in Squamish – OCP Schedule G

The District of Squamish has a developing road network. Within Squamish, each community is served by its own contained road network, which offers little connectivity to other communities. Within Downtown Squamish, the road network forms a typical grid-like pattern. Most of the road networks within other communities feature irregular patterns which are due to local topography. The majority of inter-community connectivity is provided by Highway 99.

Aside from Highway 99, the OCP defines only major roads in Squamish and does not differentiate between arterial and collector roads (as would be recommended by Transportation Association of Canada Guidelines), as shown in FIGURE 4.1.1. Notable major roads within the District include:

- Buckley Avenue / Queens Way / Government Road – forms a single road that runs north-south through Squamish to the west of Highway 99. The road serves as the secondary north-south route through the District, and connects the Downtown, Industrial Park, and Brackendale communities.
- Cleveland Avenue – connects the Downtown to Highway 99, and serves as the main commercial roadway through Downtown Squamish.
- Clarke Drive, Guilford Drive, and Westway Avenue – Clarke Drive and Guilford Drive provide the primary access to Valleycliffe off Highway 99. Westway Avenue serves as the main roadway through Valleycliffe.
- Loggers Lane – provides an alternative north-south route east of Highway 99 south of the Mamquam River between Cleveland Avenue and Centennial Way. It also parallels the waterfront in Downtown Squamish.
- Industrial Way and Commercial Way – provide access to the Industrial Park off Highway 99 and also provide connection between the highway and Queens Way. Industrial Way becomes Finch Drive east of the highway, and also provides connection to Loggers Lane.
- Mamquam Road and Garibaldi Way – both provide access from Highway 99 to the Garibaldi Village shopping area and the Garibaldi Highlands beyond.
- Depot Road – provides the main access into the Brackendale community, and along with Government Road serves as the main roadway through Brackendale.

Speed Limits

Speed limits are 50 km/h on all district roads (not including school zones), with the only exception being Squamish Valley Road, which has a speed limit of 80 km/h between Highway 99 and the BC Hydro Substation.

Laning

The majority of roads in Squamish have two lanes, providing one travel lane in each direction. The following roads have four lanes with two travel lanes in each direction:

- Cleveland Avenue from Pemberton to Highway 99;
- Commercial Way from Queensway to Highway 99;
- Industrial Way from Discovery Way to Highway 99;
- Mamquam Road from Glenalder Place to the East Leg of Willow Crescent;
- Garibaldi Way from Tantalus Road to Government Road (3 lanes total, 2 lanes eastbound).

Some roads, mostly in the downtown, provide two parking lanes in addition to the two travel lanes. These roads typically have four lanes or the capacity for four lanes at intersections. These roads include:

- Westway Avenue from Cherry Drive to Plateau Drive;
- Cleveland Avenue from Permberton Avenue to Vancouver Street;
- Victoria Street from 3rd Avenue to Loggers Lane;
- Winnipeg Street from 3rd Avenue to Loggers Lane;
- Main Street from 2nd Avenue to 5th Avenue;
- Second Avenue from Pemberton Avenue to Main Street;
- Pemberton Avenue from 4th Avenue to Loggers Lane;
- 3rd Avenue from Bailey Street to Pemberton Avenue;
- The Boulevard from Skyline Drive to the University Bridge;
- Pia Road from Perth Drive to Jay Crescent;
- Village Drive from Mamquam Road to University Boulevard;
- Queens Way from Production Way to Pioneer Way;
- Discovery Way from Industrial Way to Pioneer Way;
- Mamquam Road between the East and West Leg of Willow Crescent;

- Tantalus Road from Garibaldi Way to Cheakamus Way;
- Tantalus Road from Newport Ridge Drive to north of North Road;
- Newport Ridge Drive; and
- North Road from Highway 99 to east of Tantalus Road.

FIGURE 4.1.2 shows the number of travel lanes available in each direction for roads within Squamish.

FIGURE 4.1.2 Squamish Road Network Laning

* Only one southbound lane provided on Highway 99 north of Depot Road

Intersection Controls

Non-highway intersections within Squamish are controlled by the District. The majority of intersections controlled and operated by the District are stop-controlled intersections. The only exceptions are signalized intersections at:

- Cleveland Avenue @ Buckley Avenue;
- Cleveland Avenue @ Pemberton Avenue; and
- Mamquam Road @ Glenalder Place

And roundabouts at:

- Pemberton Avenue @ 4th Avenue;
- Commercial Way @ Discovery Way; and
- The Boulevard @ Highlands Way South
- The Boulevard @ Perth Drive

Intersection Control Warrants

The need for intersection controls at the following intersections was examined. The location of these intersections is shown in FIGURE 4.1.3. The existing intersections are all three-way intersections with one-way stop control on the side street (i.e. the street with no through movement).

- Government Road @ Garibaldi Way (A)
- Government Road @ Mamquam Road (B)
- Government Road @ Centennial Way (C)

The <u>TAC Signal Warrant Procedure</u> (2005) was applied using available link volumes and 2010 model output data. The signal warrant is a "cumulative factor methodology" that is calibrated to utilize a value out of 100 points as the basis of determining traffic signalization need. Any intersection with a warrant score greater than 100 is deemed to require signalization; however intersections with a warrant score over 75 may also be suitable for signalization depending on the specific conditions.

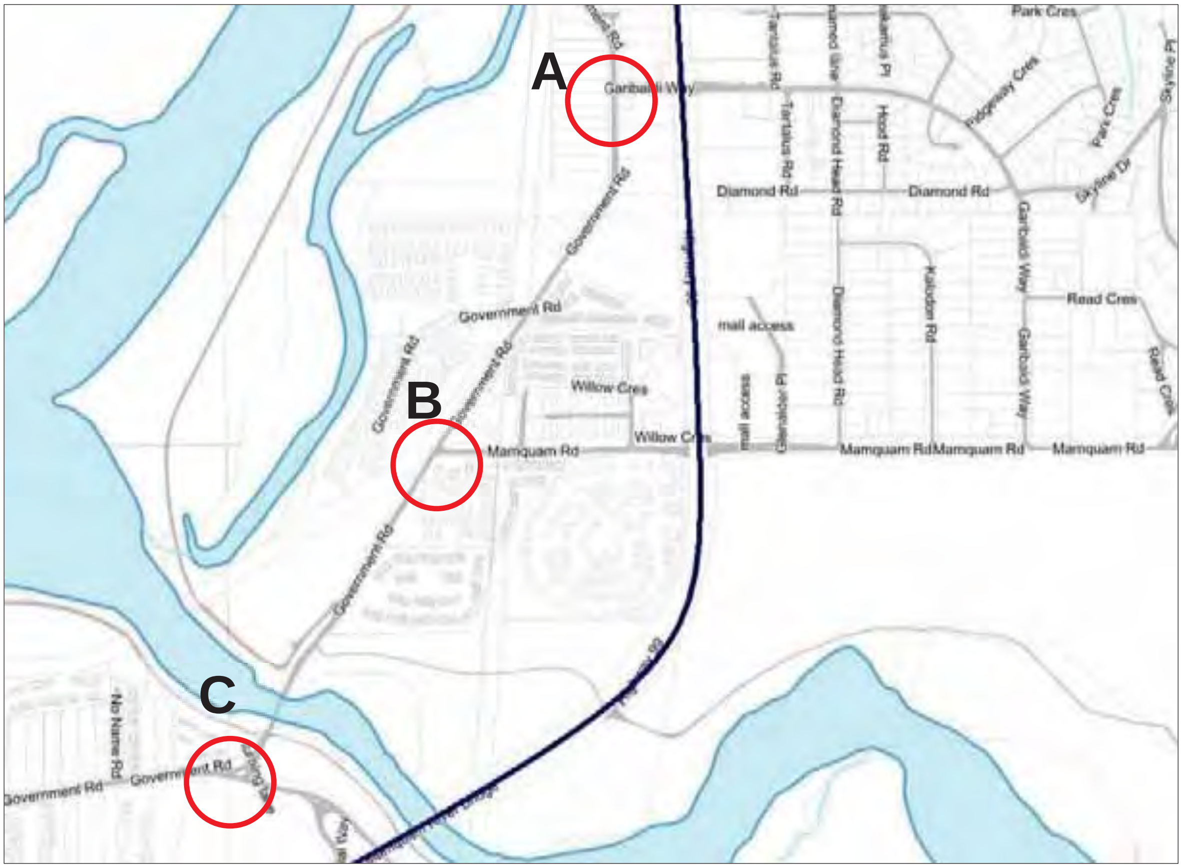


FIGURE 4.1.3 Signal Warrant Locations

TABLE 4.1.2 shows the result of the signal warrant procedure for the Garibaldi Way, Mamquam Road, and Centennial Way intersections respectively. Warrant calculation sheets are provided in APPENDIX C.

TABLE 4.1.2 RESULTS OF SIGNAL WARRANT ANALYSIS

	2010		2031	
LOCATION	WARRANT SCORE	RESULT	WARRANT SCORE	RESULT
Government Road/ Garibaldi Way	34	Not Warranted	72	Not Warranted
Government Road/ Mamquam Road	63	Not Warranted	119	Warranted
Government Road/ Centennial Way	55	Not Warranted	128	Warranted

Given that turning movement counts were not available, turning movement volumes were assumed based on the behaviour at nearby intersections. Based on the results, traffic signals are not recommended at any of the intersections in the short term. In the long term, results indicate that the Government Road intersections at Mamquam Road and Centennial Way may require signalization.

The District may also wish to explore the option of a roundabout at the Government Road and Centennial Way intersection. In general, a roundabout may be considered instead of signalization when:

- Volumes are balanced evenly across all approaches;
- The location is not too close to a railway crossing;
- The location is not too close to a signalized intersection that queues could extend into the roundabout; and
- Grades in the area are less than 8%.

Roundabouts may be considered as an alternative for any new signals implemented in the District should they meet these requirements.

Parking

On-street parking is available throughout most of the downtown and on most residential roads as well. The majority of large commercial developments and institutional buildings provide parking lots. In general, the majority of parking throughout Squamish is free. On-line public opinion survey results indicated that only 14 percent of respondents who parked regularly had to pay for parking. Those who had to pay to park were asked to indicate the monthly cost of their parking. On average, it cost residents $140/month for pay parking; however, monthly cost varied greatly, ranging from $10 to $560 per month and included parking costs in Vancouver. The sample size of prices was fairly small, with only 17 respondents indicating what price they paid for parking, therefore the cost estimate provided may be fairly inaccurate. It is assumed that the actual percentage of pay parking and average price of parking in Squamish are both lower than represented by the survey results. Survey values are likely inflated by the inclusion of parking outside of Squamish, namely parking in Metro Vancouver.

4.1.3 Public Consultation Results

Synovate's survey of 520 households within the District of Squamish indicated that on average each household owned 2.15 automobiles. The total number of surveyed personal vehicle trips taken by respondents during the typical weekday PM peak accounted for a majority of total trips during that time period, accounting for 1445 out of a total 1777 trips, approximately 81 percent of total trips.

TABLE 4.1.3 and TABLE 4.1.4 provide a summary of Synovate survey responses for PM peak trips as an auto driver. Residents were surveyed about their trips on weekdays between 3 – 6 p.m. TABLE 4.1.3 displays the origin and destination of auto driver trips by neighbourhood within Squamish normalized to reflect actual neighbourhood sizes and TABLE 4.1.4 summarizes surveyed auto trip purpose types. Trends can be observed indicating that the majority of auto driver trips originate from the downtown, Garibaldi Highlands, or outside of Squamish. The majority of trips destinations were either residential areas or areas with heavy commercial land use, with a large proportion of trips ending in Garibaldi Highlands. The most common trip type was personal trips, accounting for over half of all trips. Commute trips were the second most common, accounting for just under a third of all auto driver trips. The high instance of both trips originating from areas with heavy commercial land use and ending up in key residential communities indicates that weekday afternoon commute trips likely consist mostly of return home trips.

TABLE 4.1.3 Normalized Surveyed Auto Driver Trips, Weekdays 3 – 6 PM

	AUTO DRIVER TRIPS (Normalized)	DESTINATION											
		Brackendale	Dentville	Downtown	Garibaldi Highlands	Garibaldi West	Industrial Park	North Yards	Valleycliffe	Metro Vancouver	Whistler / Pemberton	Unknown / Other / Outside of Squamish	TOTAL FROM
ORIGIN	Brackendale	249	17	539	131	14	61	11	12			136	1169
	Dentville	83	152	412	180	28	45	22	35			30	988
	Downtown	318	203	1901	567	153	121	89	350	45		91	3839
	Garibaldi Highlands	414	305	951	988	112	197	78	152	30	15	470	3711
	Garibaldi West	41	68	190	90		15		35			61	500
	Industrial Park	69	51	285	166	28	30	22	23			45	720
	North Yards		34	158	55			22	23			30	324
	Valleycliffe	14	118	792	97	28	30	33	128	45		106	1393
	Metro Vancouver	166	51	190	270	56		33	163	61			989
	Whistler / Pemberton	69	17	63	117	28		11	128		15	15	465
	Unknown/Other/ Outside of Squamish	207	118	444	270	14	15	45	175	15		61	1363
	TOTAL	1630	1134	5925	2930	460	515	368	1225	197	30	1046	15461

TABLE 4.1.4 Surveyed Auto Driver Trip Purpose

TRIP PURPOSE	Number of Trips	Percentage of Auto Driver Trips
Commute	309	28%
Business	15	1%
Personal	602	55%
Pick-up / Drop-off	159	15%
TOTAL	1777	100%

4.1.4 Downtown Intersection Volumes and Operations

PM Peak turning movement volumes at key intersections were examined for existing and 2031 conditions as discussed in SECTION 3.1 above. Key non-highway intersections within the District that were examined as part of this study include:

- Cleveland Avenue @ Buckley Avenue
- Cleveland Avenue @ Pemberton Avenue
- Loggers Lane @ Pemberton Avenue

Existing and future traffic volumes and operations at these District intersections are examined below.

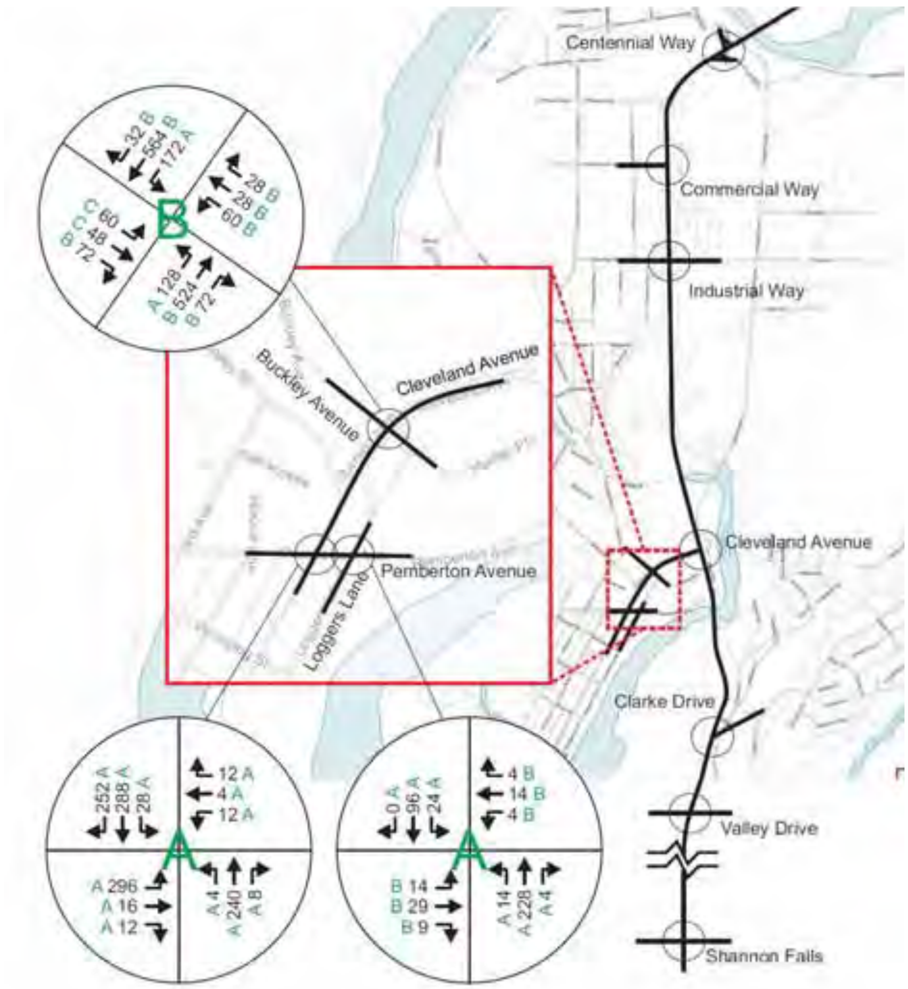


FIGURE 4.1.4 Weekday Average PM Peak Traffic Volumes and Levels of Service – September 2010

Existing – Weekday in September

As shown in FIGURE 4.1.4, volumes are greatest at the Cleveland Avenue and Buckley Avenue intersection. None of the Downtown intersections are shown to experience any significant delay issues during a typical weekday in September.

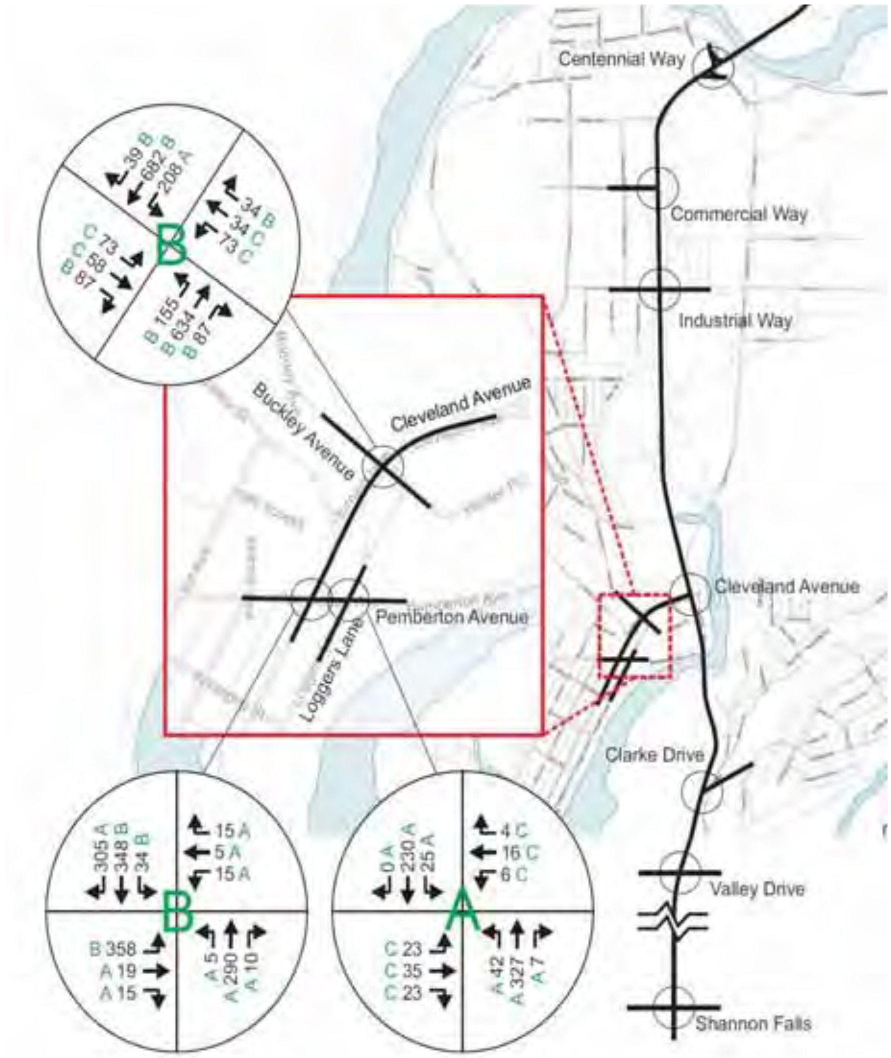


FIGURE 4.1.5 Friday PM Peak Traffic Volumes and Levels of Service – August 2010

Existing – Friday in August

FIGURE 4.1.5 shows the volumes and levels of service for the three Downtown intersections for existing Friday in August conditions. No significant delay issues were observed.

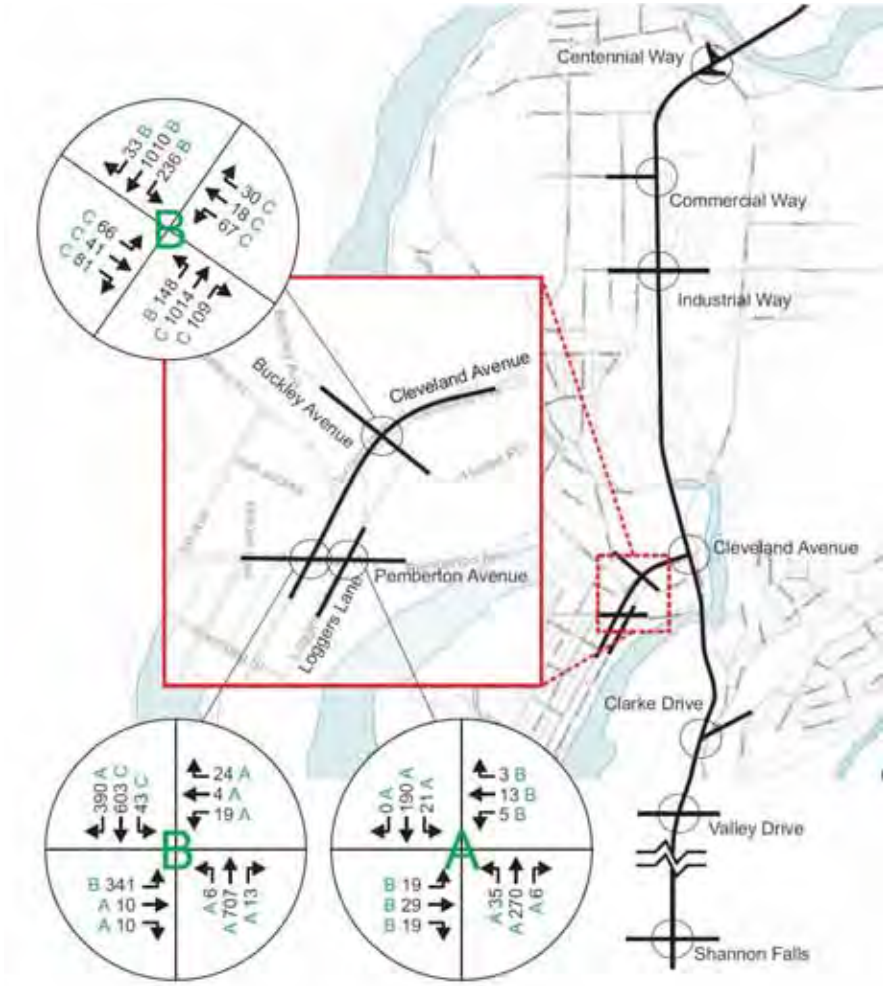


FIGURE 4.1.6 Weekday in September PM Peak Traffic Volumes and Levels of Service – 2031 Base

2031 Base – Weekday in September

FIGURE 4.1.6 shows weekday in September volume and level of service projections for the 2031 Base scenario. Through volumes along Cleveland Avenue experience a significant increase relative to other volumes. Levels of service, however, do not show any significant decreases and operate at acceptable levels.

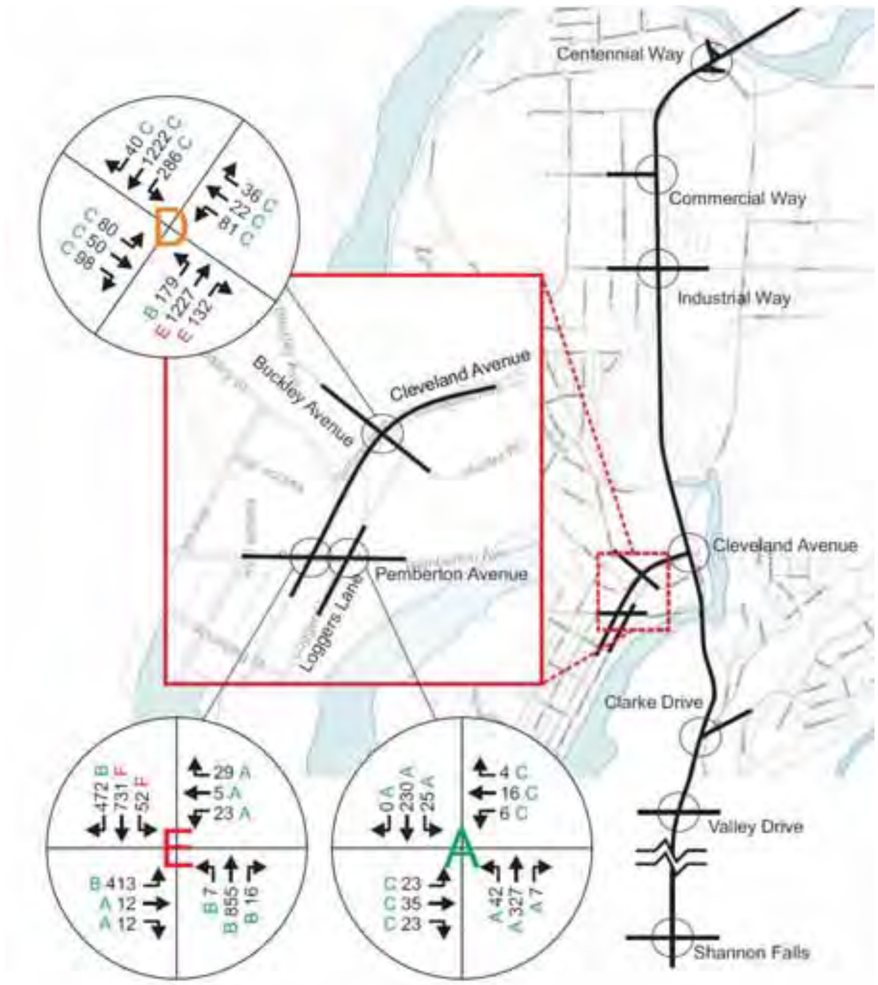


FIGURE 4.1.7 Friday in August PM Peak Traffic Volumes and Levels of Service – 2031 Base

2031 Base – Friday in August

FIGURE 4.1.7 shows the PM peak turning movement volumes and levels of service for the 2031 base scenario for a Friday in August. A significant decrease in overall levels of service is observed at the Cleveland Avenue @ Buckley Avenue and Cleveland Avenue @ Pemberton Avenue intersections. In general, through movements along Cleveland Avenue and turning movements off Cleveland Avenue are the worst movements. Operations at Loggers Lane and Pemberton Avenue remain at good levels of service.

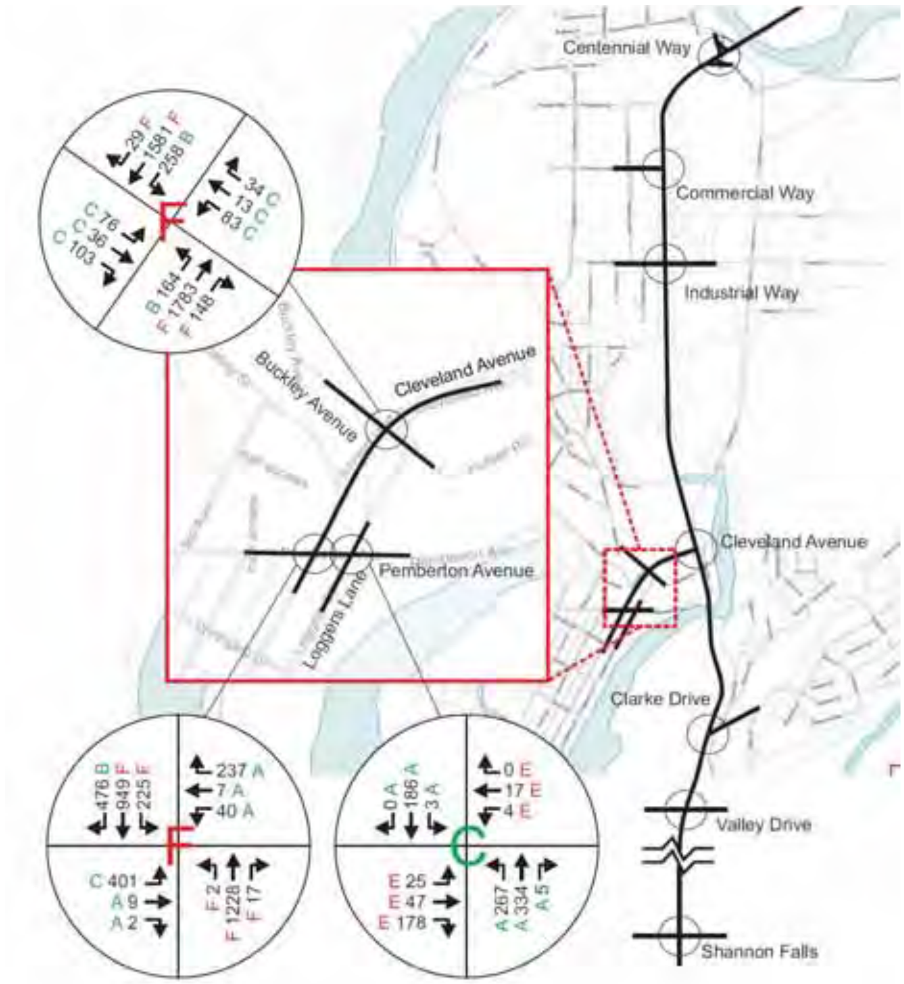


FIGURE 4.1.8 Weekday in September PM Peak Traffic Volumes and Levels of Service – 2031 Hypergrowth

2031 Hypergrowth Scenario – Friday in August

FIGURE 4.1.8 shows the PM peak turning movement volumes and levels of service for the 2031 hypergrowth scenario for a weekday in September. The most notable change is a significant increase in northbound left-turn volumes at Loggers Lane and Pemberton Avenue, and westbound right-turn volumes at Cleveland Avenue and Pemberton Avenue. The intersection at Cleveland Avenue and Pemberton Avenue also shows greatly increase through volumes along Cleveland Avenue. As a result, the two intersections along Cleveland Avenue decrease to an overall level of service F. Results of the capacity analysis suggest that all three intersections would require some improvements to continue functioning at acceptable levels of service.

4.1.5 Opportunities

The following opportunities were noted during this study:

- **Government Road provides an alternative north-south route through Squamish.** Government Road runs north-south parallel to Highway 99 reducing local reliance on the highway. It provides connection between the downtown and Brackendale, and also features connection to the Garibaldi Highlands via Mamquam Road and Garibaldi Way.

- **Good Levels of service are provided at Squamish Intersections on typical weekdays.**

4.1.6 Issues

The following issues were noted during this study:

- **Major roads are not classified.** The existing OCP only defines "Major Routes" and does not designate road type (i.e. Collector or Arterial). Road types are useful for guiding the cross-sectional design of roadways.

- **Isolated local road networks.** There is a lack of connectivity between individual communities and inter-community connectivity is dependent on Highway 99. During peak highway volume conditions, the highway acts as an east-west barrier, virtually isolating individual communities.

- **Future operations at intersections along Government Road.** As shown above, intersections along Government Road at Mamquam Road and Centennial Way may warrant signalization in the long term.

- **Bailey Avenue/ Loggers Lane Disconnect**
  There is no actual connection between Bailey Avenue and Loggers Lane. This is somewhat problematic for the road network but is primarily an issue for truck traffic destined for the rail yards and business park.

- **Downtown Entrance.** Cleveland Avenue is the main entrance to the downtown and currently is the only practical entrance. It is compromised by the CN Rail mainline which crosses Cleveland Avenue and Loggers Lane just south of the Buckley Avenue traffic signal. Cleveland and Loggers distribute all vehicular traffic entering the downtown and in turn funnel all exiting traffic bound for the highway. These movements are complicated by a number of network and planning issues that have focused on the area.

They include:

1. Emergency access to the Downtown
   The District has had a long standing issue with critical access to and from the downtown being affected by the CNR mainline. Although operational improvements have limited interruptions to downtown access, the potential still exists for the downtown to be essentially isolated. Bailey Street/ Government Road is the only option to Cleveland Avenue and this route includes a two lane unfinished road that is also limited by an at grade rail crossing approximately 2.8 kms to the north.

2. Pemberton Avenue Entrance/ Laurelwood Connector
   The future road network proposes a new entrance to the downtown originating at Highway 99 and Clarke Drive that would be unfettered by the rail line. This route would include a rail overpass and a Blind Channel bridge. In addition to these significant and costly structures Pemberton Avenue and the intersections at Loggers Lane and Cleveland Avenue would require improvements to manage the anticipated redistribution of traffic.

3. Bailey Street/ Loggers Lane Disconnect/ Truck Routing
   The lack of a connection between Loggers Lane and Bailey Street poses a problem for northbound truck traffic destined for the railyards and Business Park. Currently this traffic must use the highway northbound and re-enter the municipal road network at Industrial Way.

4. Cleveland Avenue Gateway
   The District recognizes the importance of the Cleveland Avenue corridor as the gateway to the downtown. This presents both opportunities and challenges for the road network. The gateway impact should be taken into account when addressing transportation network issues.

5. Downtown Regional Transportation Hub
   As discussed in section 3.2.5 of this report the three most suitable locations for a regional transportation hub in the downtown are all in the vicinity of the subject area. Again this presents both opportunities and challenges for the road network.

6. Other Modes of Transportation
   The vision for the downtown is that is should be cyclist and pedestrian friendly area. It is critical that this central entrance area accommodate all clear, convenient and safe cycling and walking routes that connect seamlessly to their respective downtown networks.

It is beyond the scope of this study to reconcile all of these issues and a further more detailed study is needed.

Issues Identified During Public Consultation

Review of the web-based public survey responses revealed few statements made by residents and stakeholders regarding the road network and traffic conditions in Squamish. This may reflect the fact that the majority of respondents generally had issue with alternative modes as opposed to personal vehicle travel. It is also possible that the lack of responses regarding road network and traffic conditions is a product of the survey design and its focus on alternative modes. Comments that did relate to driving in Squamish include the following:

- Overnight parking in the downtown is unsafe due to the threat of theft.
- Inadequate parking for people who work in the downtown core.

In general, driving related comments typically alluded to the fact that a personal vehicle was required for work or that driving was often the only feasible option. No issues related to the road network or traffic conditions were mentioned.

A review of comments gathered during the public Open House (Public Information Meeting #1) revealed the following comments:

- Scott Crescent is in very poor condition and may be unsafe given that vehicles, bicycles, and pedestrians all share the road.
- Too much vehicle parking on the side of streets increases risk for other modes. Drivers parking within bike lanes is a problem on Government Road and Tantalus Road especially.

4.1.7 Recommendations

The following discussion provides in-depth analysis or additional discussion related to specific local road network recommendations. A full list of recommendations made as part of this plan is provided in SECTION 6.0.

A. *Road Classification for Collectors and Arterials*

One of the key outcomes of the Squamish 2031 Multi-Modal Transportation Plan is to define road classifications for major roads in Squamish. The existing OCP document does not differentiate between arterial and collector roads, defining only "major routes".

The TAC Geometric Design Guide for Canadian Roads describes the characteristics of each road hierarchy classification. TABLE 4.1.5 summarizes the key characteristics of the collector and arterial roads.
TABLE 4.1.6 shows which classification major routes match for each characteristic and which classification the corridors match overall; this analysis includes new major routes as proposed in this study. Because all roadways within Squamish have a speed limit of 50 km/h, which adheres to the criteria of collector and arterial roads, analysis ignored the design speed characteristic. Similarly, because almost all roadways in Squamish are one lane in each direction except at intersections, analysis ignored right of way width as an indicator of road type.

TABLE 4.1.5 Characteristics of Urban Road Types

Characteristic	Collector	Arterial
Traffic service function	Traffic movement and land access of equal importance	Traffic movement major consideration
Land service/access	Traffic movement and land access of equal importance	Some access control
Traffic volume	1,000- 12,000 vehicles per day	5,000-20,000 vehicles per day
Design speed	50-80 km/hr	50-100 km/hr
Desirable connections	Locals, collectors, arterials	Collectors, arterials, expressways, freeways
Parking	Few restrictions other than peak hour	Peak hour restrictions
Right of way width	20-24 m	20-45m

TABLE 4.1.6 Characteristics of Urban Roads in Squamish

	Traffic service function	Land service/access	Traffic volume	Desirable connections	Parking	**OVERALL**
3rd Ave.	C	C	C	C	C	**C**
6th Ave.	C	C/A	C	C	C	**C**
7th Ave.	A	A	-	C	-	**A**
Bailey St.	A	A	C	C	A	**A**
Buckley Ave.	C	C/A	C/A	C	C	**C**
Centennial Way	A	C/A	C	A	C	**C/A**
Clarke Dr.	C	C	C/A	A	C/A	**C**
Cleveland Ave.	C/A	C/A	C/A	A	C	**C/A**
Commercial Way	C/A	A	C	A	C	**C/A**
Depot Rd.	C/A	C/A	C/A	A	C	**C/A**
Garibaldi Way	C/A	C	A	A	C	**C/A**
Government Rd.	A	A	C/A	C	A	**A**
Guilford Dr.	C	C	C/A	C	C	**C**
Industrial Way/ Finch Dr.	C/A	A	C/A	A	C	**A**
Loggers Lane	A	A	C	C	A	**A**
Main St.	C	C	C	C	C	**C**
Mamquam Rd.	A	A	A	A	C	**A**
Pemberton Ave.	A	C	C/A	C	C	**C**
Perth Dr.	C	C	C	C	C	**C**
Pia Rd.	C	C	C	C	C	**C**
Queens Way	A	A	C/A	C	A	**A**
S Highlands Way	A	A	C	C	A	**A**
Tantalus Rd.	C	C/A	C	C	C	**C**
The Boulevard	C/A	C	C	C	C	**C**
Valley Dr.	C	A	C	A	C	**C**
Vancouver St.	C	C	C	C	C	**C**
Westway Ave.	C	C	C	C	C	**C**

C=Roadway matches Collector, A=Roadway matches Arterial, C/A=Matches both Classifications

Based on which road classification each specific corridor predominantly matched, overall road classifications were determined. FIGURE 4.1.9 shows the local major road network as proposed by the 2031 Multi-Modal Transportation Plan which includes the proposed road classifications.

Additional Classifications

Once the road classifications have been embedded into the OCP, the District should amend the P-1 Road Calssifications in its Subdivision and Development Control Bylaw to conform. Should the District wish to provide additional differentiation for the purpose of design standards, the following supplementary classifications could be considered at that time:

- Hillside Collector (Highlands Area)
- Industrial Collector
- Rural Collector

These classifications can provide special provisions to meet the road requirements specific to the Highlands, Industrial Park, and rural areas of Squamish.

It is recommended that the District revise the P-1 plan in its Subdivision and Development Control Bylaw to reflect the road classifications identified in Schedule 2A, Figure 4.1.9 below and further that the geometric design standards for each road class be reviewed.

B. *Local Road Network Improvements*

Proposed changes to the local road network are shown in FIGURE 4.1.9, Schedule 2A – Major Roads, below. Where arrowheads on dashed lines are indicated, the intent is for a future road connection to be made when demand dictates and the alignment is known.

C. *Downtown Entrance*

A detailed network analysis, which will take all the issues identified above into account, is needed for the downtown entrance. The Gateway Study, Transportation Hub Report, and Downtown Neighbourhood Plan should be reconciled with the multi-modal network recommendations of this report in one holistic approach. If taken separately, any one of the issues identified above could compromise other initiatives. For instance a road network only solution would address commercial transport but may not best suit gateway treatments, leave flexibility for a viable transportation hub or necessarily suit cycling and pedestrian movements.

It is recommended that the District complete a Downtown Entrance Study for the area bounded by Highway 99 on the north, Pemberton Avenue on the south, Bailey Street/ Third Avenue to the west and Loggers Lane to the east taking into account the following key issues:

- **Alternate Downtown Access**
- **Pemberton Avenue entrance**
- **Bailey Loggers Lane disconnect/ truck routing**
- **Cleveland Avenue gateway**
- **Downtown transportation hub**
- **Network connections for all modes of transportation**

D. *Network Intersections*

Where traffic congestion will become an issue in the future will be at intersections. The majority of local intersections are stop-controlled. Typically intersection controls such as signals or roundabouts would be introduced at key intersections as a means of improving the safety and efficiency of the local road network. The need for intersection control should be considered on a case-by-case basis using standard signalization and roundabout warrant procedures.

Preliminary analysis conducted as part of this study shows that signalization may be warranted at the following intersections by 2031:

- Government Road @ Mamquam Road
- Government Road @ Centennial Way

To determine whether or not signalization will be required at these intersections and others, the District should conduct turning movement counts at key intersections as development and growth occur. Roundabouts should be considered as an option at any intersection where warrants are met, including the two above mentioned intersections.

E. *Structures*

Proposed Structures are described in Appendix F. They are typically associated with proposed roads and will be delivered with those projects when warranted. There are two exceptions, being, two existing one lane bridges.

1. Third Avenue Flood Gate Bridge

   Third Avenue is constricted to one lane crossing the Catermole Creek Floodgates. Currently this only poses a nuisance for traffic going to and from Squamish Terminals. However when significant development proceeds on the Oceanfront Peninsula and second access will be required. A connection to Third Avenue across Catermole Slough will be required and this will make the one-lane Floodgate Bridge unworkable. It will need to be replaced or widened to accommodate two lanes of traffic cyclists and pedestrians.

2. Paradise Valley Bailey Bridge

   The District is currently contemplating replacing this temporary bridge with an appropriate two lane structure.

No specific action is recommended here for either of these structures.

F. *Cost Estimates*

A summary of costs for all proposed road network improvements is provided in TABLE 4.1.7. Where bicycle lanes or sidewalks are associated with proposed roads, the costs have been embedded in the road estimates.

Although the costs are formidable, the expectation is that the need for many of the proposed roads will be triggered by and therefore be funded by new development either through the DDC structure or as direct costs of development. Some of the projects funded from the DCC reserve will require amendment of the Development Cost Charge Bylaw. A detailed list of the proposed projects, including the recommended funding source(s), is provided in APPENDIX F.

TABLE 4.1.7 Local Road Network Improvement Cost Summary

IMPROVEMENT TYPE	ESTIMATED COST	FUNDING SOURCE			
		DCC	Developer	General	Other
SHORT-TERM					
New Major Roads	$8,040,000	$4,380,000	$1,500,000	$2,010,000	$150,000
Bridges	$8,000,000	$0	$5,000,000	$3,000,000	$0
Intersections	$400,000	$250,000	$150,000	$0	$0
Short-term Sub-total	$16,440,000	$4,630,000	$6,650,000	$5,010,000	$150,000
MEDIUM TO LONG-TERM					
New Major Roads	$19,090,000	$5,955,000	$10,750,000	$2,385,000	$0
Bridges	$10,000,000	$7,500,000	$1,250,000	$1,250,000	$0
Intersections	$1,600,000	$1,300,000	$0	$300,000	$0
Medium to Long-term Sub-Total	$30,690,000	$14,755,000	$12,000,000	$3,935,000	$0
TOTAL	**$47,130,000**	**$19,385,000**	**$18,650,000**	**$8,945,000**	**$150,000**

(Note: This list of improvements has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

It is recommended that the proposed network roads not currently associated with specific land developments be included in the next update of the Development Cost Charge Bylaw.

It is also recommended that proposed network roads whose need arises from general growth (traffic and/or safety concerns) be implemented through the District's capital budget planning process.

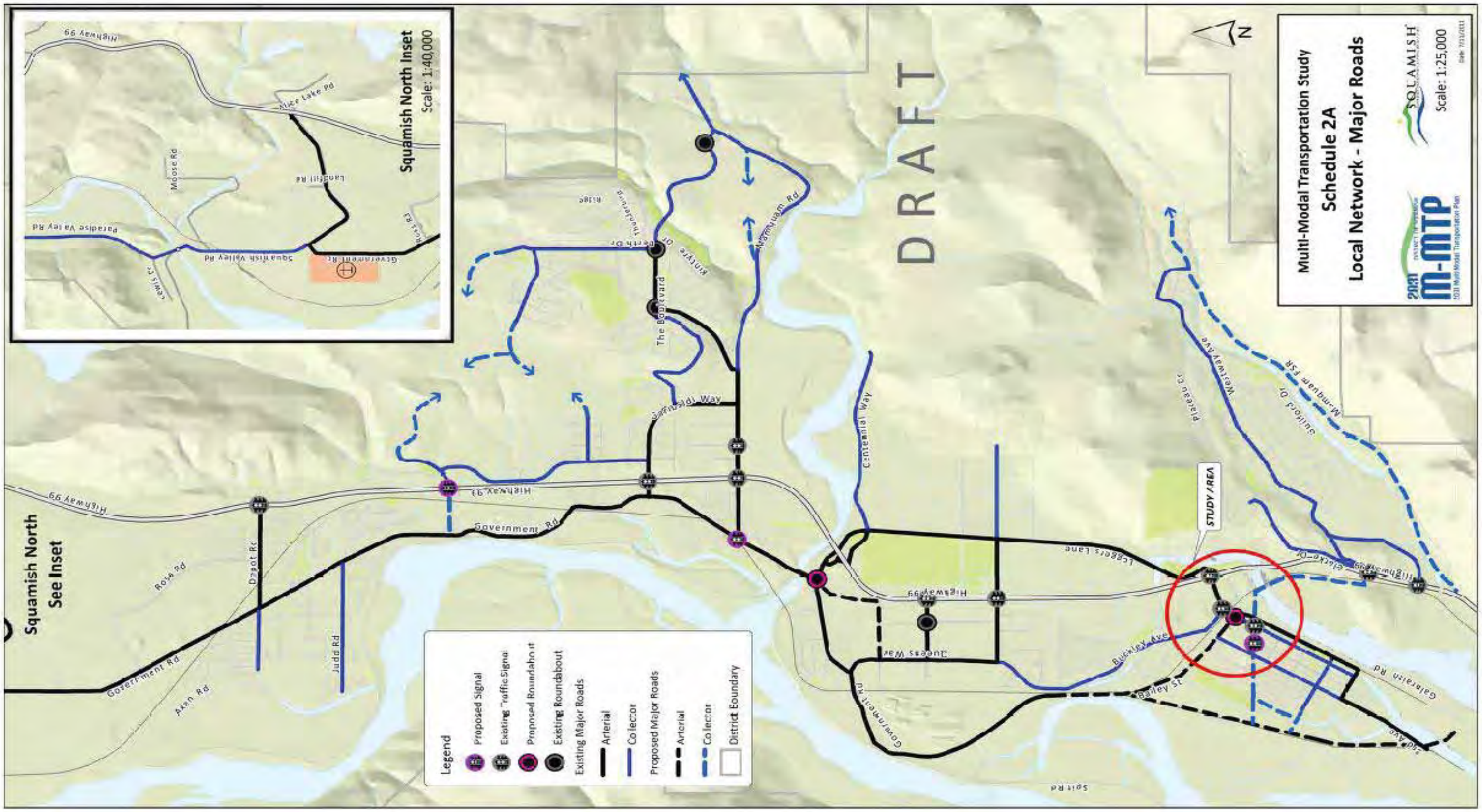


FIGURE 4.1.9 Schedule 2A – Proposed Major Road Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

THIS PAGE INTENTIONALLY LEFT BLANK

4.2 Local Transit

4.2.1 Background

Transit services are an integral component of an effective transportation system, providing low-cost access to education, jobs, public services, culture, recreation, and the natural environment. Transit services should be a key focus within Squamish given the District's goal of providing a balanced transportation system that minimizes greenhouse gas emissions.

Although the transit system's annual service hours have remained relatively unchanged between 1996 and 2008. Over this same period ridership increased by over 38%. However from 2008 to 2010 the service hours increased by 51% and ridership only increased by 33%. While the increase in ridership over this two year period is formidable, the increase in service hours and therefore the costs are out of alignment. This suggests that some of the added service may be misaligned with the actual demand and should be revisited.Squamish annual ridership and service hours from 1991 to 2010 are shown in FIGURE 4.2.1:

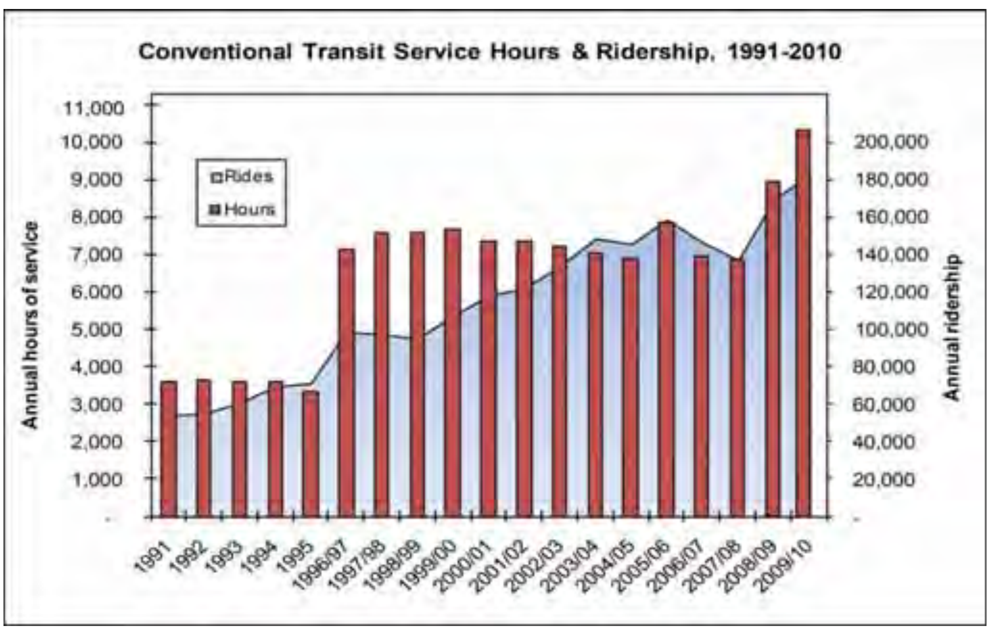


FIGURE 4.2.1 Transit Service and Ridership in Squamish

Source: BC Transit

The web-based public opinion survey also revealed a strong demand for transit improvements amongst respondents. When asked to rank which type of transportation preference should be given to, almost half of all respondents (175 out of 366 respondents) ranked transit as the most favoured choice as shown in FIGURE A-2 in APPENDIX A. Similarly, when asked to rank the highest transportation priority in Squamish, 148 out of 362 respondents ranked "expanding local bus transit service" as the most favoured choice, as shown in FIGURE A-3 in APPENDIX A.

The transit system and future transit plans were reviewed in relationship to the future growth and other transportation modes in Squamish. The most relevant documents related to transit are listed in TABLE 4.2.1.

TABLE 4.2.1 Relevant Documents for Transit Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	District of Squamish Regional Transit Route Map	2009	Map
2	Transportation Options for the Squamish-Metro Vancouver Corridor (AECOM Canada Ltd)	2009	Document
3	District of Squamish Official Community Plan	2009	Document
4	Downtown Squamish 2031 Transport Plan (CTS)	2009	Document
5	District of Squamish Transit Business Plan (UMA Engineering Ltd)	2008	Document
6	Squamish Transit System Ridership and Performance Summary	2007	Document

4.2.2 Existing Conditions

As of 2006, transit accounted for a 2.7 percent mode share for travel to work in Squamish, as shown in TABLE 3.1.3 above. This is significantly lower than the provincial average of 10.3 percent transit mode share to work.

BC Transit currently provides transit service in Squamish that consists of three bus routes within Squamish and a handyDART service. In addition a commuter route between Squamish and Whistler was established after 2007. The conventional bus routes are shown in FIGURE 4.2.2.

FIGURE 4.2.2 Existing Transit Routes in Squamish
Source: BC Transit

Transit Service

Characteristics of the existing transit service are highlighted below:

- Three conventional bus routes that serve the Brackendale, Garibaldi Highlands, and Valleycliffe regions within Squamish. All three routes connect to the downtown. Service runs Monday to Saturday, TABLE 4.2.2 provides a break-down of route frequencies and service hours for each route.

TABLE 4.2.2 Summary of Squamish Bus Transit Services

MONDAY – THURSDAY

Route	Service	Approximate Service Frequency (minutes)				Hours of Operation	
		AM Peak *	Midday	PM Peak **	Evening	Start	End
1	Brackendale	30 - 60	60	30	n/a	6:20 AM	7:31 PM
2	Highlands	60	60	30 - 60	n/a	7:18 AM	7:16 PM
3	Valleycliffe	30	30 - 60	30 - 60	n/a	6:30 AM	6:34 PM

FRIDAY

Route	Service	Approximate Service Frequency (minutes)				Hours of Operation	
		AM Peak *	Midday	PM Peak **	Evening	Start	End
1	Brackendale	30 - 60	60	30	90 - 120	6:20 AM	10:51 PM
2	Highlands	60 - 90	60	30 - 60	90 - 100	7:18 AM	10:36 PM
3	Valleycliffe	30	30 - 60	30 - 60	90 - 120	6:30 AM	9:57 PM

SATURDAY

Route	Service	Approximate Service Frequency (minutes)				Hours of Operation	
		AM Peak *	Midday	PM Peak **	Evening	Start	End
1	Brackendale	90	60	30 - 90	n/a	7:21 AM	7:31 PM
2	Highlands	90	60	30 - 60	n/a	7:37 AM	7:16 PM
3	Valleycliffe	90	60	30 - 60	n/a	8:15 AM	6:34 PM

** AM Peak from 6:00 – 900 AM*

*** PM Peak from 3:00 – 7:30 PM (extended to match transit service hour trends for discussion purposes)*

- Route 1 – Brackendale runs 15 times a day Mondays to Thursdays, 17 times a day on Fridays, and 13 times a day on Saturdays

- Route 2 – Highlands runs 14 times a day Mondays to Thursdays, 16 times a day on Fridays, and 13 times a day on Saturdays

- Route 3 – Valleycliffe runs 20 times a day Mondays to Thursdays, 2 times a day on Fridays, and 13 times a day on Saturdays

Accessibility

- Low floor buses provide a ramp for wheelchair and scooter accessible transit, as well as a kneeling feature and no entry steps for those who experience difficulty climbing stairs.

- handyDART service provides door-to-door transit service for those unable to use regular transit due to physical or mental impairment. handyDART service is provided from 8:00 a.m. to 4:30 p.m. from Monday to Friday; no weekend service is provided.

Ridership

The following are general characteristics of transit ridership in the District of Squamish. TABLE 4.2.3 and FIGURES 4.2.3 and 4.2.4 are based on two-week counts on the Squamish transit system conducted in February of 2007.

- FIGURE 4.2.3 and TABLE 4.2.3 show Squamish conventional transit ridership trends throughout the day for typical weekdays (Monday to Thursday), Fridays, and Saturdays. Squamish's transit ridership averages over 500 riders per day on weekdays. Transit ridership drops by about half on Saturdays, to 240 riders per day.

- Results show that total AM and PM peak ridership was fairly low. Demand during these periods is typically associated with travel to and from work and the low total ridership observed during these periods supports 2006 census data indicating that few Squamish residents rely on transit as a mode of travel to work.

- Weekday (Monday to Thursday) ridership experiences significant morning and afternoon peaks. AM ridership peaks at around 80 riders at 8 a.m. then drops off quickly. During the midday period ridership is relatively constant at around 40 riders per hour. The PM peak occurs fairly early at around 2:00 p.m., and experiences around 60 riders per hour. Although it may be insignificant relative to other modes, the peak transit ridership observed during the AM period may suggest some level of travel to work behaviour within the system.

- Friday ridership is generally more or less constant throughout the AM peak, midday, and PM peak periods averaging around 45 riders per hour.

- Saturday ridership is extremely low compared to the weekdays. A maximum ridership of around 35 is experienced during the midday at around 1:00 p.m.

- Overall the average weekday ridership of approximately 40 riders per hour translates to 15 riders per route per hour, meaning that the existing buses are operating well below capacity.

- Evening ridership is low compared to other periods, and equals approximately 10 riders per hour throughout the week. Total evening ridership on Fridays is greater due to extended service hours.

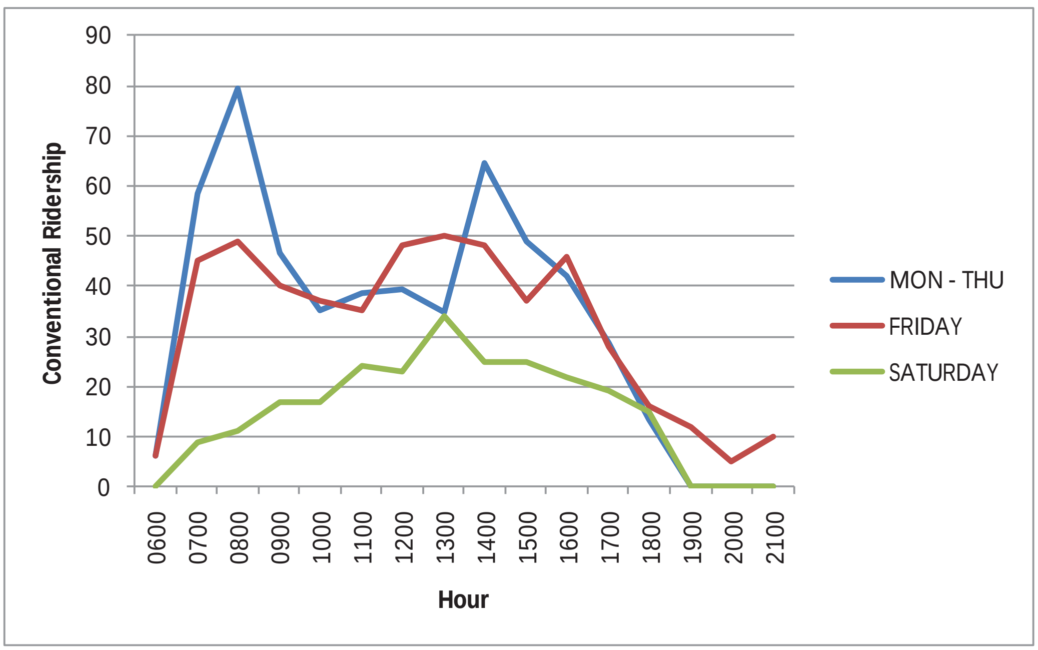


FIGURE 4.2.3 Conventional Transit Ridership by Hour in Squamish

Source: BC Transit, Two-week Counts in February 2007

TABLE 4.2.3 Conventional Transit Ridership by Time Period in Squamish

	AM	Midday	PM	Evening
Mon – Thu	26.9%	48.4%	22.2%	2.5%
Friday	19.6%	50.3%	21.8%	8.3%
Saturday	8.4%	58.2%	27.2%	6.3%
AVERAGE	24.3%	50.0%	22.8%	2.9%

Source: BC Transit, Two-week Counts in February 2007

- FIGURE 4.2.4 summarizes average daily transit ridership in Squamish by passenger group. As expected, adults and students (those in full time attendance up to Grade 12) make up the majority share of transit riders, accounting for almost 90% of average daily ridership. Besides a higher adult ridership share, 44.5% versus a Tier 3 average of 33.5%, and a lower BC Pass ridership share, 4.1% versus a Tier 3 average of 12.4%, Squamish's transit ridership demographics generally show the same trends as similarly sized communities.

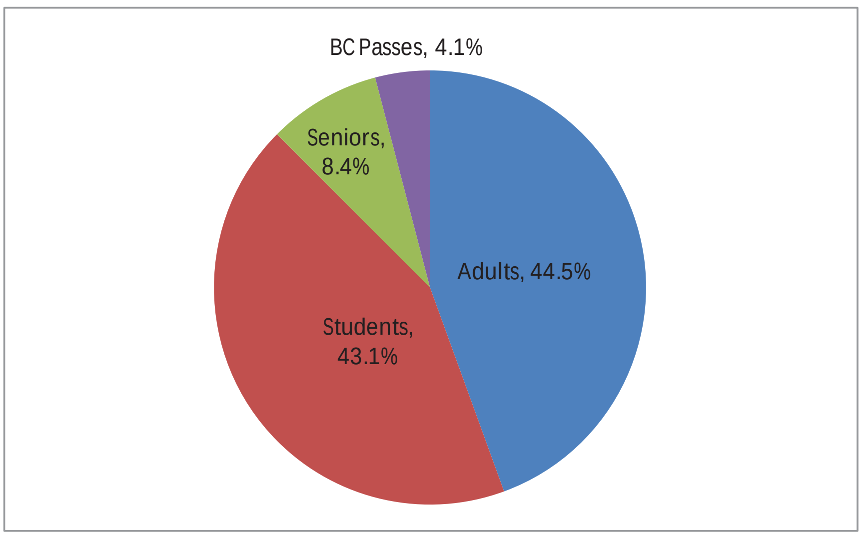


FIGURE 4.2.4 Average Daily Ridership by Passenger Group in Squamish

Source: BC Transit, Two-week Counts in February 2007

Resources and Performance

The District of Squamish is classified as having a Tier 3 conventional transit system (population served under 25,000) by BC Transit. TABLE 4.2.4 provides a summary of conventional transit services and performance in Squamish in comparison to the average for all Tier 3 communities with a conventional transit system (12 in total) based on 2009/10 figures. The rightmost column in TABLE 4.2.4 shows projections for 2011/12. The Squamish figures shown do not include the Whistler-Squamish commuter route.

TABLE 4.2.4 Comparison of Tier 3 Conventional Transit Services 2009/10 and 2011/2012 Projections

	SQUAMISH (2009/10)	TIER 3 AVERAGE (2009/10)	SQUAMISH (2011/12)
Population Served	15,700	15,092	16,200
Licensed Vehicles (In service)	4(3)	5.58	4
Routes Provided	3	5.8	3
Total Service Hours	10,404	11,461	10,601
Annual Ridership	186,090	247,767	186,555
Total Revenue ($)	$ 175,893	$ 265,538	$ 186,555
Total Cost ($)	$ 1,299,191	$ 1,262,238	$ 1,323,098
Operating Cost ($)	$ 1,205,109	$ 1,143,464	-
BC Transit Share ($)	$ 562,672	$ 530,024	-
Municipal Share ($)	$ 560,626	$ 466,677	-
Cost Recovery	13.5%	21.0%	14.1%
Service Hours/Capita	0.66	0.76	0.65
Rides/Capita	11.7	16.4	11.52
Rides/Service Hour	17.6	21.6	17.6
Cost/Ride ($)	$ 7.10	$ 5.09	$ 7.09
Operating Cost / Service Hour ($)	$ 115.83	$ 99.77	-
Total Cost / Service Hour ($)	$ 124.87	$ 110.13	$ 124.81

Source: BC Transit

Comparing 2009/10 transit service figures, Squamish's transit system can be considered under-used relative to other similar transit systems. Although the population served and total service hours provided by the Squamish transit service in 2009/10 were on par with those of other tier 3 communities, annual transit ridership was only approximately 75% of the average Tier 3 annual ridership. Low ridership means that the cost recovery from revenue is diminished and that the municipal share paid by Squamish must be greater to account for the lower revenues. It is likely that the sprawling land use in Squamish is the most significant factor contributing to the low ridership relative to similarly sized communities.

TABLE 4.2.5 shows that Squamish has the lowest population density amongst tier 3 communities and that the population density of 140.9 residents/km^2 in Squamish is significantly lower than the tier 3 average of 547.1 residents/km^2 (FIGURE 4.2.5 excludes the Kootenay Boundary and Sunshine Coast regions given that a population density is difficult to define for these regions because their transit systems service multiple municipalities). A lower population density generally means increased travel times and fewer opportunities to pick up additional riders along the way. This means that fewer riders can be captured given the same amount of service hour; this explains the low ridership exhibited by the Squamish transit system relative to other tier 3 systems.

TABLE 4.2.5 Population Densities of Tier 3 Communities

COMMUNITY	POPULATION DENSITY (per km^2)
Cranbrook	726.5
Dawson Creek	492.5
Fort St. John	765.4
Kitimat *	733.6
Nelson	789.6
Port Alberni	881.0
Powell River	435.3
Prince Rupert	233.4
Squamish	**140.9**
Terrace	272.7
AVERAGE	547.1

Source: Census 2006, Statistics Canada

**Note: Population density of Kitimat based on developed townsite, port, and industrial lands totalling 1225 hectares (12.25 km^2) rather than District Municipal Area of 242.63 km^2*

A comparison of the 2009/10 transit service and the 2011/12 transit projections shows a slight growth in service hours provided that will match the growth in population expected. The number of service hours and rides per capita are not anticipated to change significantly and the overall efficiency and effectiveness of the system is expected to remain relatively constant under the current model.

TABLE 4.2.6 provides a summary of para-transit services and performance in Squamish in comparison to the average for all tier 3 communities with para-transit services (39 in total) based on 2009/10 figures.

TABLE 4.2.6 shows that para-transit service usage in Squamish is significantly less than the average usage of para-transit in similarly sized communities. Para-transit in Squamish experiences 2.47 rides per service hour provided, which is approximately 38% of the average of 6.52 rides per service hour amongst tier 3 communities. The Squamish para-transit system is also shown to be much more expensive than other services with each service hour costing $123.29, which is approximately 66% greater than the average cost amongst tier 3 communities. In general, the Squamish para-transit underperforms relative to para-transit in other tier 3 communities.

TABLE 4.2.6 Comparison of Tier 3 Para-transit Services 2009/10

	SQUAMISH	TIER 3 AVERAGE
Municipal Population	18,500	11,621
Registered Users	0	27
Licensed Vehicles (In service)	3(1)	2.64
Total Service Hours	2,008	3,807
Annual Ridership	4,960	24,841
Total Revenue ($)	8,116	41,338
Total Cost ($)	247,562	282,396
Operating Cost ($)	233,226	262,550
BC Transit Share ($)	146,214	120,239
Municipal Share ($)	93,232	120,820
Cost Recovery	3.3%	14.6%
Rides/Service Hour	2.47	6.52
Cost/Ride ($)	$49.91	$11.37
Operating Cost / Service Hour ($)	$116.15	$68.96
Total Cost / Service Hour ($)	$123.29	$74.18

Source: BC Transit

4.2.3 Opportunities

The following opportunities were noted during this study:

- **Captive student ridership.** Student populations attending Quest University and Capilano University represent a significant captive ridership.

University students in Squamish represent a key market where significant growth can be expected.

- **Good route coverage.** The three existing conventional transit routes in Squamish provide good coverage of all neighbourhoods in Squamish. Transit users are willing to walk up to 400 metres to reach transit services; in general most residences in Squamish lie within 400 metres of a bus stop.

- **Concentrated population.** Concentrated populations make it easy to identify key service areas. Because fewer routes are needed, focus can be put on improving service levels rather than improving coverage or service.

4.2.4 Issues

The following issues were noted in the 2008 District of Squamish Transit Business Plan and during this study:

- **Infrequent service throughout the day**. The peak period frequency of all bus routes is 30 minutes or more. Midday headways are typically 60 minutes, and evening headways can reach up to 120 minutes. For two way trips, long headways can represent up to an additional 60 to 120 minutes of travel time; the additional travel time represents a significant disincentive to using transit. According to Level of Service (LOS) criteria outlined in the Transit Capacity and Quality of Service Manual, First Edition (Transit Cooperative Research Program, 1999), the District's current transit service would be considered LOS F, because a transit passenger could potentially have a one-way wait time of an hour or more, plus walk time to and from bus stops.

- **Lack of evening service.** Monday to Thursday and Saturday transit service ends by 7:30 p.m. or earlier on all routes within Squamish, and typically operates at 60 minute frequencies. Only Friday service extends later than 7:30 p.m. (to around 10:30 p.m. average); and even then, it features long headways of 90 to 120 minutes. A lack of evening service may act as an impediment for those wishing to take transit to work, but have shifts that start or end later than 7:30 p.m.

- **No Sunday and holiday service**. For those who wish to live car-free, a lack of transit service on certain days of the week severely limits their travel options, making it difficult to stop relying on automobiles.

- **No commuter service to Metro Vancouver and limited commuter service to Whistler.** Without public transit service to Vancouver, commuters are limited to driving or taking Greyhound to reach Metro Vancouver. Limited service times to Whistler reduce the convenience of the bus service for commuters who need to travel at times other than the four times a day the service currently operates.

- **Indirect routing.** Currently the three routes (Brackendale, Highlands, and Valleycliffe) operate radially from Downtown Squamish and serve their respective areas exclusively, with little to no overlap in service. This means that in most cases where a transit rider wishes to travel to another area within Squamish that is not downtown, he or she must take one bus downtown and transfer to another bus to reach his or her destination. The existing "hub-and-spoke" arrangement in Squamish is inefficient for two reasons: 1) given that headways are long, requiring a transfer downtown may significantly increase travel times if a rider misses his or her transfer; and 2) the "hub" downtown is not located at a central location within Squamish, increasing the total distance one must travel if a transfer is required.

- **Only three buses providing scheduled service.** Because the three conventional routes served by three buses, reliability of service can become compromised. One unforeseen circumstance, such as a bus breakdown or traffic accident, can significantly delay multiple bus schedules. It was noted during public consultation for the 2008 <u>District of Squamish Transit Business Plan</u>, that the handyDART bus was used on conventional transit routes when there were problems with one of the regular buses.

- **Lack of ridership.** The existing transit service model in Squamish does not generate sufficient ridership. The total cost per ride is $7.80, and ridership revenue only represents a 12.8% cost recovery. The existing low ridership means that Squamish's transit service is among the worst, if not the worst in the province in terms of efficiency and value for money.

- **Limited accessibility to on-street facilities.** A lack of sidewalk coverage along many Squamish roads limits accessibility to bus stops, especially for persons in wheelchairs, while also presenting an increased safety risk for persons walking to bus stops, with little to no separation between pedestrians and vehicles on the road. Since every transit rider is a pedestrian at the beginning and end of every trip, it is important that accessible pedestrian facilities and safety features be present within a reasonable walking distance (400 metres) of every transit stop. Streets which are transit routes should provide sidewalks on both sides of the street and well-marked crossing facilities at intersections nearest to transit stops.
- **Lack of adequate on-street facilities.** Currently, many bus stops within Squamish offer little to no on-street facilities (bus shelters). According to the District of Squamish Transit Business Plan (UMA Engineering Ltd, 2008) there are only two bus shelters in the existing Squamish system. FIGURE 4.2.5 shows an example of a typical bus stop within the District where no seating or weather protection is provided.

FIGURE 4.2.5 Photograph of a Bus Stop in Squamish, Buckley Avenue near Squamish Elementary School

Because of the long headways along Squamish bus routes, it is important that the District provide comfortable waiting areas at bus stops. Good on-street facilities include some form of weather protection, benches, trash cans, and lighting for visibility/security at night. Given Squamish's location at the tip of Howe Sound, protection from the elements is especially important to reduce exposure to the frequent rain and powerful winds that funnel through the valley. On-street facilities can also incorporate information on routes and scheduling.

Issues Identified During Public Consultation

Review of the web-based public survey responses and responses collected during Public Information Meeting #1 revealed the following statements made by residents and stakeholders regarding the public transit system in Squamish:

- Bus service to Quest University is too infrequent (only 4 times a day)
- Bus service too infrequent and unreliable. Missing a bus leaves few alternatives if time is an issue. Having one bus out of service contributes to overall system delays.
- No evening and Sunday service makes not owning a car unfeasible. No evening service on weekdays stops residents from using transit to get to/from work. No Sunday service prohibits those who do not drive from attending church or running errands.
- Lack of convenience and comfort during multi-stop trips; due to stops being too far from desired destinations, long wait times, and increased exposure to weather caused by long wait times and little/no weather protection (i.e. lack of bus shelters).
- Using transit just takes too long compared to driving (1-2 hours versus 10-15 minutes).
- Bus service is inefficient, often running empty during the midday period. May wish to eliminate midday service as a means of cost-savings.

Comments specific to certain locations in Squamish included:

- No bus stop at the seniors centre in the Downtown.
- The southbound bus stop on Clarke Drive near the hospital is unsafe.
- Bus stops should be shifted to stop directly in front of grocery stores within mall parking lots, as the grocery stores are the primary destination within each mall.

In general, comments focused on providing bus shelters and more frequent service, while supporting the ideas of establishing transit hubs. A significant portion of comments related to increasing service, accessibility, and safety for the senior population in Squamish.

4.2.5 Recommendations

The District of Squamish is currently engaged in a discussion with BC Transit on how transit services might be applied more effectively. The following discussion provides some options for consideration but makes no specific local transit recommendations.

A. *Alternative Transit Model Options*

It is understood that the District is currently involved in talks with BC Transit to redefine the local Squamish transit service, and that a possible outcome of the discussions is the disbandment of BC Transit service in Squamish. Given that the continuation of conventional transit service in Squamish is not certain, it is recommended that the District explore alternatives to the existing service model.

To provide a service that functions efficiently and meets the needs of Squamish residents, a better understanding of the existing transportation demand is required. Survey results gathered during the course of the study indicate a strong preference towards improved transit in Squamish; however, more information is required on when and where key demand occurs. Before the District can reasonably develop new routes and service models, such information must be gathered.

Transit Vehicle Options

Conventional buses, community shuttles, and taxis are viable transit vehicle options for Squamish. Transit service is not limited to a single vehicle type, and any combination of the three is viable.

TABLE 4.2.7 provides a brief profile of the three vehicle options suitable for Squamish. The estimated operating costs include driver wages, fuel, and maintenance.

The capital cost associated with taxis is not explicitly stated since it is highly likely that the District would partner with an existing private taxi service and would not purchase its own fleet. Again assuming such a partnership, the District could provide discounted service in the form of taxi coupons which are paid in-part by the District. Operating costs would vary depending on how much the District was willing to subsidize taxi travel. For the case where the District did purchase and maintain its own fleet of taxis, the capital and operating costs would depend on the vehicles purchased for use as taxis.

TABLE 4.2.7 Transit Vehicle Options

VEHICLE	CAPITAL COST	OPERATING COST	COMPATIBLE SERVICE OPTIONS	ADVANTAGES	DISADVANTAGES
Community Shuttle	$175,000	$40 per hour per shuttle	Fixed Route Flexible Route Demand-response	• high manoeuvrability • room for bike racks • wheelchair and stroller accessible	• low carrying capacity (around 16 passengers)
Conventional Bus	$440,000	$110 per hour per bus	Fixed Route	• high carrying capacity (around 60 passengers) • room for bike racks • wheelchair and stroller accessible	• low manoeuvrability: not suitable for roads with steep gradients and/or tight turns
Taxi	-	varies	Demand-response	• door-to-door service capability	• very low carrying capacity (around 4 passengers)

Transit Service Options

Three different service options were considered to meet the transit needs of the District of Squamish. TABLE 4.2.8 provides a summary of the advantages and disadvantages of each service option. The service options are:

1. *Fixed Route Service*

Vehicles operate conventionally on a predetermined route following a set schedule. Specific stops are typically identified for locations where passengers will be picked up and dropped off with the aim of keeping to the set schedule.

2. Flexible Route Service

This option is a combination of the fixed route and demand-response services where transit vehicles could have the flexibility of route or checkpoint deviation.

3. Demand-Responsive Service

This option provides door-to-door service scheduled by a dispatcher and normally requires advance reservations. Reservations can be made on an individual basis through a variety of potential options ranging from telephone bookings to WAP or internet bookings. There is also the option of having subscription trips for regular journeys, for example to work every weekday, or once a week to attend a weekly medical appointment. This service option is the one used to operate the 'HandyDART' public transit service. This shared-ride transit service uses specially equipped vehicles designed to carry passengers with physical or cognitive disabilities who are unable to use public transit without assistance.

TABLE 4.2.8 Transit Service Options

SERVICE	ADVANTAGES	DISADVANTAGES
Fixed Route	• Fixed schedule and journey time available • Advance reservation of the service not required • Increased service reliability	• Not convenient for passengers with mobility impairments • Ineffective in a small community with low density and low transit demand • Stops may be far away from destinations
Flexible Route	• Flexible in providing demand-responsive service • Service is scheduled within a designated time window to specified checkpoints • Flexibility while maintaining some structured route and timetable	• Slightly longer travel time for some passengers due to route changes • May not be suitable for peak commuting hours
Demand-response	• door-to-door service convenient for elderly and disabled passengers, as well as those who are able but not willing to walk to a transit stop • effective for a small community with low density and transit demand	• advance reservation may be required • service level may be limited by vehicle fleet • longer journey time is anticipated in picking up passengers from various locations • may not be suitable for peak commuting hours

Possible Operating Models

The operating models for the Squamish transit service can be:

- Owned and operated by BC Transit;
- Financed by BC Transit but contracted out to be operated by a private contractor;
- Owned and operated by a private company, which would require self-financing; or
- Owned and operated by a private company, potentially with subsidy from the District.

B. *Transit Supportive Infrastructure*

Given the climate in Squamish, shelters or other forms of weather protection are an extremely important transit supportive measure, and will likely have a significant impact on transit ridership. The District may wish to explore public-private partnerships as a means of funding for bus shelters. These typically involve advertising agencies that use bus shelter walls for advertising space. Bus stop furniture is only required given the continuation of a conventional transit service as flexible services are capable of picking up residents at their homes.

Transit stop design standards should also be developed which include provisions for lighting, sidewalk “clear-zone” around the stop, accessibility for wheelchairs, trash bins, and shelter from weather.

C. *Multi-modal Transportation Hubs*

In 2009 Bunt & Associates/ HB Lanarc completed a Multi-modal Hub report for the District of Squamish. The report outlined reasoning, planning and design, possible hub locations, and proposed an action plan for establishing a multi-modal hub in Squamish.

The key recommendation identified in the action plan was to “establish the optimal location for a downtown central hub and guidance on the satellites within the community”. For the central hub to meaningful it would have to be the primary interface with regional transit interface in the community. Options are discussed in section 3.2.5 B of this report.

Satellite Hubs

While satellite hubs may include regional linkages their primary role is to provide inter community transportation network linkages between neighbourhoods, particularly to the Downtown Central Hub, or other centres of interest. FIGURE 4.2.7, below, shows the potential satellite hub locations.

The Highlands Mall in the Garibaldi Estates is recommended as the premier location for establishing a satellite hub. Although the site provides limited potential for regional transportation connections, it satisfies other hub criteria by being a higher density employment location, having numerous commercial uses including entertainment and retail, being in close proximity to existing transit routes and generally acting as a high activity centre in the area. It has also been identified as one of the informal park and ride sites. Because the land is privately held, establishing a formal transportation hub will mean working collaboratively with the owner.

Other satellite hubs could be less formal until development of demand dictates that improvements be considered.

Figure 4.2.6
Potential Satellite Hubs Locations

It is recommended that the District explore the potential to establish a satellite transportation hub, including transit service and park and ride capability preferably in the vicinity of the Highlands Mall Property.

It is also recommended that other possible satellite hub sites be monitored with a view towards formalizing the sites if and when development or demand dictate.

4.3 Cycling

4.3.1 Background

As part of the Squamish 2031 Multi-Modal Transportation Study, cycling has been considered a primary mode of transportation in support of the District's mode share goals. Cycling has a rich history in Squamish. What was essentially a recreational pastime and a means of pursuing a healthy and active lifestyle is now becoming a transportation mode of choice. The average household in Squamish has three to four bicycles.

The existing commuter bicycle transportation network in the District of Squamish consists of bicycle facilities along Highway 99 and 12 other existing Major Routes as defined in the District of Squamish OCP Schedule G. Bicycle facilities vary between each corridor, but generally consist of either: on road bicycle lanes (conventional bike lanes); shared use bicycle lanes (hybrid bike lanes); signed bicycle routes; or off-road paths. In addition to the bicycle transportation network, Squamish features an extensive network of off-road trails that are mainly used for recreation. For the purposes of this study only those trails that have a commuter potential have been considered.

In researching cycling transportation for the study area, Opus reviewed available data including traffic volumes, road widths, on-street parking locations, and slopes. Several documents were reviewed and are listed in TABLE 4.3.1.

TABLE 4.3.1 Relevant Documents for Cycling Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	Squamish Trail and Recreation Map	-	Map
2	Preliminary SW Bike Lane Plan – Rev.1	2010	Map
3	District of Squamish Existing Sidewalk and Commuter Bicycle Plan	2010	Map
4	District of Squamish Official Community Plan	2009	Document
5	Downtown Squamish 2031 Transport Plan (CTS)	2009	Document

Site visits were conducted in September and October of 2010, and one of the objectives was to observe bicycle facilities within the District of Squamish.

4.3.2 Existing Conditions

Existing Facilities

The existing bicycle transportation network within the District, based on the District of Squamish Existing Sidewalk and Commuter Bicycle Plan Map, is shown in FIGURE 4.3.1.

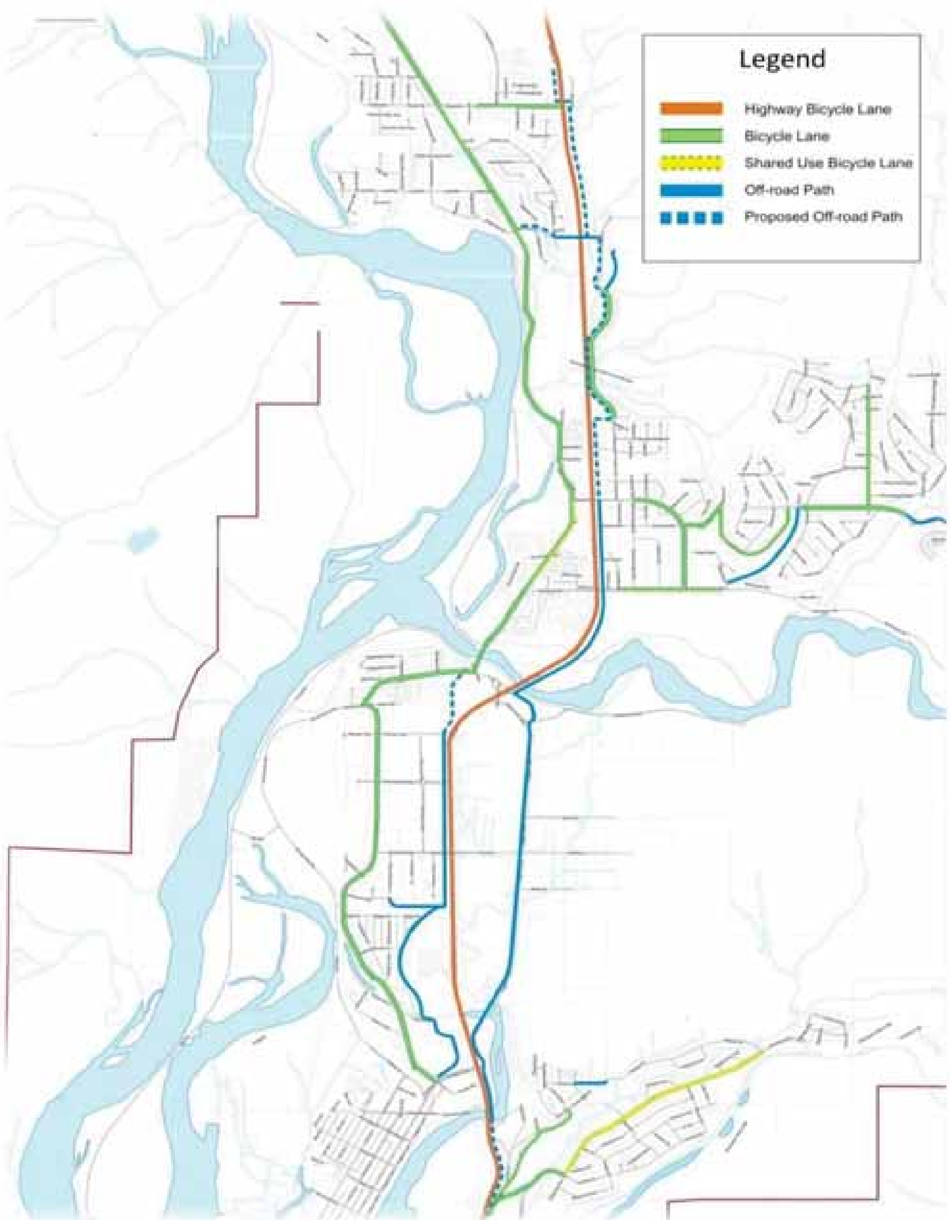


FIGURE 4.3.1 Bicycle Transportation Facilities in Squamish

A review of bicycle route traffic volumes, speed, street widths, and slopes are summarized in TABLE 4.3.2.

TABLE 4.3.2 Designated Bicycle Routes Along Major Corridors

STREET NAME	VEHICLES/ DAY (two-way)	POSTED SPEED LIMIT (km/h)	AVERAGE STREET WIDTH* (m)	CURB LANE WIDTH* (m)	MAX GRADE	BICYCLE FACILITY TYPE
Highway 99	15,000 – 22,000	70/80	20	3.5	<25%	Bike lanes & Off-road path
Behrner Drive	n/a	50	9.2	4.6	25-40%	Paved shoulder
Guilford Drive	n/a	50	8.6	4.3	25-40%	Bike lane
Westway Avenue	< 3,000	50	8.6	4.3	<25%	Wide curb lane
Buckley Avenue / Queens Way / Government Road	5,000 – 10,000	50	9.0	4.4	<25%	Bike lanes
Mamquam Road	10,000	50	7.8	4.4 / 3.4	<25%	Wide curb lane / Paved shoulder
Garibaldi Way	10,000	50	9.2	4.6	<25%	Bike lanes
Tantalus Road	n/a	50	13.2	4.5	<25%	Bike lanes & Off-road path
Skyline Drive	n/a	50	9.0	5.0	<25%	Wide curb lane / Paved shoulder
The Boulevard	< 3,000	50	17.5	5.5 (with parking)	<25% - >40%	Bike Lanes / Off-road Path
Perth Drive	< 3,000	50	8.6	4.3	<25%	Wide curb lanes / Paved shoulder
Highlands Way S	n/a	50	-	-	>40%	Off-road Path
Depot Road	6,000	50	8.4	4.2	<25%	Wide curb lanes / Paved shoulder
Loggers Lane / Rotary Trail	-	-	-	-	<25%	Off-road Path
Discovery Trail	-	-	-	-	<25%	Off-road Path

** Street and curb widths are approximate, measured from Google Earth*

Bicycle facilities along designated bicycle routes were evaluated based on TAC bike lane and shared lane width guidelines. Although the street and curb lane widths shown in TABLE 4.3.2 are approximate and bicycle lane widths were not available, a comparison of existing facilities to TAC guidelines indicated that in general, where bicycle facilities consisted of wide curb lanes, lane widths were adequate. The only bicycle facility that may not be in compliance with TAC guidelines is along Depot Road, where conditions warrant a shared lane width of at least 4.3 metres; however, both the daily volume and width measurements are approximate in nature, and the current width is already quite close to standards.

In general the standard roadway lane width is adequate for shared curb lanes on roadways experiencing less than 3,000 vehicles per day, roadways experiencing between 3,000 and 6,000 vehicles per day require a shared lane of at least 4.0 metres wide, and roadways with more than 6,000 vehicles per day require a shared lane at least 4.3 metres wide.

Public Consultation Results

Synovate's survey of 520 households within the District of Squamish revealed that on average each household owned 3.12 bicycles. However, the total number of surveyed bicycle trips taken by respondents during the typical weekday PM peak accounted for an extremely small fraction of total trips during that time period, accounting for only 45 out of a total 1777 trips, approximately 2.5% of total trips.

TABLE 4.3.3 provides a summary of Synovate survey responses regarding PM peak bicycle trips. Residents were surveyed about their bicycle trips on weekdays between 3 – 6 p.m. TABLE 4.3.3 displays the bicycle trip results by neighbourhood within Squamish normalized to reflect actual neighbourhood sizes. Although the sample size for bicycle trips is relatively small, trends can be observed indicating that the majority of bicycle trips take place within a single community.

TABLE 4.3.3 Normalized Surveyed Bicycle Trips on Weekdays 3 – 6 PM

		DESTINATION									
	BICYCLE TRIPS (Normalized)	Brackendale	Dentville	Downtown	Garibaldi Highlands	Garibaldi West	Industrial Park	North Yards	Valleycliffe	Other / Outside of Squamish	TOTAL FROM
ORIGIN	Brackendale	83			7	14					104
	Dentville	14		32					12	15	72
	Downtown		17	222	7				12		257
	Garibaldi Highlands		51	32	55					15	153
	Garibaldi West				7						7
	Industrial Park										0
	North Yards				7						7
	Valleycliffe								12		12
	Unknown/Other/ Outside of Squamish	28			21				23		72
	TOTAL TO	124	68	285	104	14	0	0	58	30	683

The web-based public opinion survey also revealed significant demand for bicycle transportation improvements amongst respondents. When asked to rank which type of transportation preference should be given to, approximately 31% of respondents (112 out of 366 respondents) ranked cycling as the most favoured choice as shown in FIGURE A-2 in APPENDIX A.

4.3.3 Opportunities

The following opportunities were noted during this study:

- **Compact and flat downtown area.** The topography of the downtown area is well suited to bicycle travel. The addition of minor bicycle facility upgrades such as signage and pavement markings can easily transform the downtown into a bicycle friendly area.

- **High bicycle ownership.** Existing bicycle ownership in Squamish is fairly high at 2.64 and 3.12 bicycles per household according to the on-line public opinion survey and the Synovate origin-destination survey respectively. This suggests that the majority of Squamish residents already cycle in some capacity, and may be more open to cycling as a viable mode of transportation.

- **Core of dedicated bicycle riders.** Cycling is already prominent in Squamish given its reputation for recreational cycling. Promoting cycling as an alternative to single occupancy vehicle travel may benefit from a core of capable and willing cyclists.

- **Existing Dyke Network.** There is an existing network of dykes in Squamish that could be used to complement the on-road commuter network, if property access issues can be addressed.

- **Two sets of multi-use trails parallel to Highway 99.** The Discovery Trail and the Corridor Trail (in progress) provide parallel facilities along Highway 99 for those cyclists who are not comfortable travelling on the highway's paved shoulder.

4.3.4 Issues

The following issues were noted during this study:

- **Shoulders not clearly defined.** Some streets within Squamish that do not have a curb and gutter do not have well defined shoulders. This occurs on designated bicycle routes as well as normal roads. Without a line defining the shoulder, drivers may encroach in the space intended for cyclists. Additionally, on designated bicycle routes that have a defined shoulder, it is unclear whether it is intended that bicycles share the curb lane or travel on the shoulder provided.

- **Steep grades in Highlands and Valleycliffe areas.** Steep grades in Squamish can act as barriers for cyclists. Cyclists typically prefer flat smooth surfaces, and grades of six percent or greater may discourage potential cyclists. FIGURE 2.2.2 above shows District of Squamish OCP Schedule D2, which provides a summary of grades throughout Squamish. Good bicycle facilities are especially important in steep graded areas where cycling can be difficult and the potential for error is greater. FIGURE 4.3.2 shows a steep slope, over 40%, along Guilford Drive in Valleycliffe.

FIGURE 4.3.2 Photograph of Steep Grade, Guilford Drive

- **Inconsistent bicycle facilities**. Not all bicycle routes in the District are marked with Bicycle lane or route markings; in some cases, lanes are provided, but lack symbols or signage designating them as bicycle lanes. Road users may not know certain routes are intended as bicycle routes. Cyclists may not feel safe on routes where little or no marking is provided, as automobile drivers may not be watching for cyclists on the road. FIGURE 4.3.3 shows a cyclist riding on the sidewalk where the street is designated as a “Shared Use Bike Lane”.

FIGURE 4.3.3 Photograph of Cyclist on Sidewalk, Westway Avenue

FIGURE 4.3.4 shows a sidewalk ending into a bicycle lane. Inconsistent separation of bicycle and pedestrian facilities sends the wrong message, and may encourage cyclists to travel on sidewalks where they are not intended to.

FIGURE 4.3.4 Photograph of Bicycle Lane, Buckley Avenue

- **Automobile driver behaviour and lack of supporting bylaws may increase risks associated with cycling.** Because there is a lack pavement markings and signage clearly identifying bicycle routes, drivers in Squamish are less likely to expect cyclists to be sharing the road. Because drivers may not specifically be looking out for cyclists or know how to behave when sharing the road with cyclists, a cyclist riding on a shared road is exposed to greater risk. FIGURE 4.3.5 shows an example of driver behaviour that exposes cyclists to greater risk. The automobile parked in a bicycle lane observed in FIGURE 4.3.5 may be a result of faded lane markings or lack of driver education regarding cyclists; however, regardless of the cause, obstructions in the bicycle lane do not create a bicycle-friendly environment, and serves to further discourage cycling in Squamish. Currently, parking is not always restricted in bicycle lanes in Squamish.

FIGURE 4.3.5 Vehicles Parked in Bicycle Lane, Tantalus Road

- **Lack of East-West connectivity across Highway 99.** Cyclists' options are limited when required to cross Highway 99. Currently only one pedestrian overpass across Highway 99 exists. Away from the overpass, cyclists must cross Highway 99 at large intersections, increasing exposure to vehicle traffic. FIGURE 4.3.6 shows cyclists on Loggers Lane approaching Highway 99. The off-road path along Loggers Lane ends before the intersection and cyclists are forced to share the road if they wish to continue to the intersection.

A pedestrian bicycle underpass is provided on the north side of the Mamquam Blind Channel Bridge but it does not provide linkage to any bicycle routes in the downtown.

FIGURE 4.3.6 Photograph of Cyclists on Roadway, Loggers Lane

- **No designated bicycle routes in the Downtown.** There are currently no bicycle routes established in Downtown Squamish. Cyclists are either forced to share lanes with automobiles where they are no expected, or ride on the sidewalk which can be a hazard to pedestrians. Cyclists were observed using sidewalks and crosswalks in the Downtown, as seen in FIGURE 4.3.7.

FIGURE 4.3.7 Photographs of a Cyclist Using Pedestrian Facilities

- **Lack of substantial landing area at Discovery Trail intersections.** The Discovery Trail crossings at Industrial Way and Commercial way require users to deviate from the path to use the pedestrian push-button crossings at Highway 99. FIGURE 4.3.8 shows the crossing for a channelized right-turn. A lack of space for cyclists and pedestrians to wait before crossing increases exposure to vehicle traffic and reduces the perceived safety of these crossings. Additionally, the curvature of the channelized right-turns allows vehicles to make the movement at fairly high speeds, further increasing the risk of conflict.

FIGURE 4.3.8 Photograph of Crossing at Commercial Way and Highway 99

- Some of the possible cycle routes traverse private property. In some cases trails have developed and been used without the owners knowledge or permission. In other cases property owners have known and not taken issue with the use. And in still other cases, historical use has been interrupted by property owners. An example that exhibits all three of these scenarios is the Squamish River Dyke from Brackendale to the Mamquam River. Portions of the dyke platform are public land, portions are under fee simple title and the remainder is through Squamish Nation Lands. As the Dyking Authority, the District has a right to enter all of these lands for maintenance and emergency management purposes. This right does not extend to public use unless it is stipulated in right of way agreement. Clearly for proposed trails across private properties to be formalized the cooperation of property owners will be essential.

- The Discovery Trail is an important north south commuter route which runs from Howe Sound Secondary School to Centennial Way on the west side of Highway 99. The crossings at Industrial Way and Commercial Way are a mobility concern and can be a safety concern if trail users do not follow the appropriate routing at the intersections. Additionally, the lack of a significant landing area at the channelized right-turn crossings represents a safety risk to pedestrians and cyclists wishing to cross these intersections.

  A number options to the existing configuration have been identified:

  1. Median cut-out to allow an at-grade crossing in line with the Discovery Trail
  2. Overpass in line with the Discovery Trail
  3. Pedestrian/cyclist bridges spanning the existing ditches to provide a more direct path to intersection crossing, combined with a protected landing area.

  Although a direct path across Industrial Way would be preferred from a mobility perspective, there are issues related to the options available that make a direct crossing difficult to implement without imposing significant safety risks. These issues are highlighted in TABLE 4.3.4 below along with recommended safety features should each option be considered.

  Should the District wish to change the existing crossing configuration, it is recommended that bridges across existing ditches be further explored as the preferred option. This recommended configuration provides a more direct path relative to the existing configuration without compromising safety. The analysis provided in Table 4.3.4 below is applicable to the Discovery Trail Crossing at Commercial Way as well.

TABLE 4.3.4 Crossing Configuration Options

CROSSING OPTION	ISSUES	IF PURSUED, RECOMMENDED FEATURES
Straight at-grade crossing	• Drivers may not anticipate cyclists crossing mid-block, particularly within the functional intersection area • Right-turning vehicles off the highway have obstructed views and may not have sufficient time to stop • Cyclists/pedestrians must cross 5 lanes of traffic	• Median cut-out • Bollards / stop signs where trail meets Industrial Way • Coloured pavement treatment
Overpass	• Overpass may obstruct eastbound drivers' view of traffic signals • Overpass will have to extend very far back to provide acceptable grades for cyclists to cross without dismounting • May encourage j-walking west of the intersection as travelling up and down the overpass may be viewed as a hassle • Very high costs	• Grades less than 6% • Additional set of signals on west leg of intersection infront of overpass

FIGURE 4.3.9 provides an aerial of the Commercial Way crossing and shows the existing crossing route configuration as well as the desired and recommended crossing routes.

Regardless of whether the District continues with the existing configuration or chooses one of the above mentioned crossing configurations at the Discovery Way crossings at Industrial Way and Commercial Way, there are measures that can be taken to improve safety performance. Key measures are described below.

<u>Providing greater landing areas</u> for the channelized right-turn crossings will allow pedestrians and especially cyclists to wait comfortably for a crossing opportunity while maintaining an adequate buffer zone between them and right-turning traffic.

Implementing tighter radius channelized right-turns will reduce speeds for southbound to westbound right turns, improving likelihood of these vehicles yielding to pedestrians and cyclists. This improvement may also contribute to a reduction in right turn rear-end collisions and side swipe collisions on the westbound exit leg. Further discussion related to tight radius channelized right-turns or "smart channels" is covered in SECTION 3.1.6 above.

FIGURE 4.3.9 Discovery Trail Crossing at Commercial Way
(Base Map Source: Google Earth, 2011)

Issues Identified During Public Consultation

In general, there was no one definitive reason why residents choose not to cycle identified during the web-based public survey. Respondents were asked to rank their reasons for not cycling and although "issues with bike lanes" was the reason most ranked #1, it only accounted for 30% of respondents, as shown in FIGURE A-6 in APPENDIX A.

Review of open-ended responses from the web survey and comments from the Public Information Meeting #1 revealed the following statements made by residents and stakeholders regarding bicycle facilities in Squamish:

- Existing lanes/paths in general are inadequate; not enough bike lanes on major routes; lack of consistency along routes.
- The Highway 99 overpass is not wide enough to accommodate all users, making it inconvenient for cyclist looking to cross the Highway.
- Bad driver behaviour, drivers ignore cyclist and travel at high speeds making cycling unsafe; separated bike lanes are desirable. Many respondents felt that painted bike lanes are insufficient. Cyclists are often blinded by drivers at night. It was also acknowledged that cyclists have a responsibility to follow the rules of the road, including signalling intentions and having appropriate lighting for low light conditions.
- Vehicles parking in bicycle lanes also an issue.
- Weather in Squamish makes cycling unattractive; frequent rain/snow.
- A lack of adequate lighting along bicycle facilities makes cycling during the evening, night, or early morning unsafe.
- A lack of separated bicycle paths discourages inexperienced cyclists such as children; parents are also discouraged from cycling as family transportation and must use other modes when travelling with children.
- Where separated bicycle paths cross intersections with the highway, cyclists are forced to divert off the most direct route.
- Steep grades deter biking in certain communities such as Valleycliffe and Highlands; adequate facilities especially important at these locations. Access between Valleycliffe and downtown has challenges.

- A lack of bicycle amenities, especially bicycle racks or storage. Concerns regarding bike theft.
- It is inconvenient to use the intersection crosswalks at Highway 99 where the Discovery Trail crosses Industrial Way (and to a lesser extent at Commercial Way). It would be more convenient to either: a) have a cut-out in the Industrial Way median to allow bikes/peds to travel straight through, or b) have an overpass to connect Discovery Trail across Industrial Way.

Overall, statements reflected sentiments that cycling in Squamish was perceived to be unsafe and many expressed a desire for separated bicycle lanes and paths.

4.3.5 Recommendations

The following discussion provides in-depth analysis or additional discussion related to specific bicycle network recommendations. A full list of recommendations made as part of this plan is provided in SECTION 6.0.

A. *Bicycle Routes*

The new bicycle routes proposed as Schedule 2B of the Squamish 2031 Multi-Modal Transportation Plan are shown in FIGURE 4.3.10.

An evaluation of the new cycling routes was conducted in terms of likelihood to attract ridership, value of connection provided, and implementation cost. The following assumptions were made:

- Routes in areas that were flat and had dense populations were deemed more likely to attract ridership.
- Valuable connections were those that were considered to either provide a unique link where no route existed or connect existing links that would otherwise be separated.
- The least expensive bicycle route type would be implemented where applicable (i.e. on-road route types where existing the right-of-way is adequate, no roadway widening or off-road paths unless necessary).

- Very expensive projects (e.g. grade separations) were typically considered to be long-term projects.
- The cost of bike routes where new development was likely to take place was considered part of the cost of the development, therefore they were considered low cost.

Based on the evaluation, proposed routes were separated into short-term (zero to four years), short to medium-term (zero to nine years), medium to long-term (ten years to twenty years) recommendations. An additional classification was defined for routes that either: a) would be implemented during a timeframe corresponding to new development in the area; or b) should be considered beyond the planning horizon of 20 years. In general:

- Key commuter routes that were likely to attract ridership, provided a valuable connection, and were likely to have low costs or be easy to implement were favoured for the short-term;
- Commuter routes providing a secondary or alternative route were favoured for the middle-term;
- Recreational routes and redundant commuter routes were favoured for the long-term; and
- Higher priority was given to those routes where protecting cyclist was a key concern, which typically feature higher vehicle volumes.

A evaluation of the proposed bicycle routes grouped by short, medium, and long-term is shown in TABLE 4.3.5, below. A more detailed assessment that looks at existing constraints, contemplates specific bicycle route types on a case by case basis and engages stakeholders is recommended.

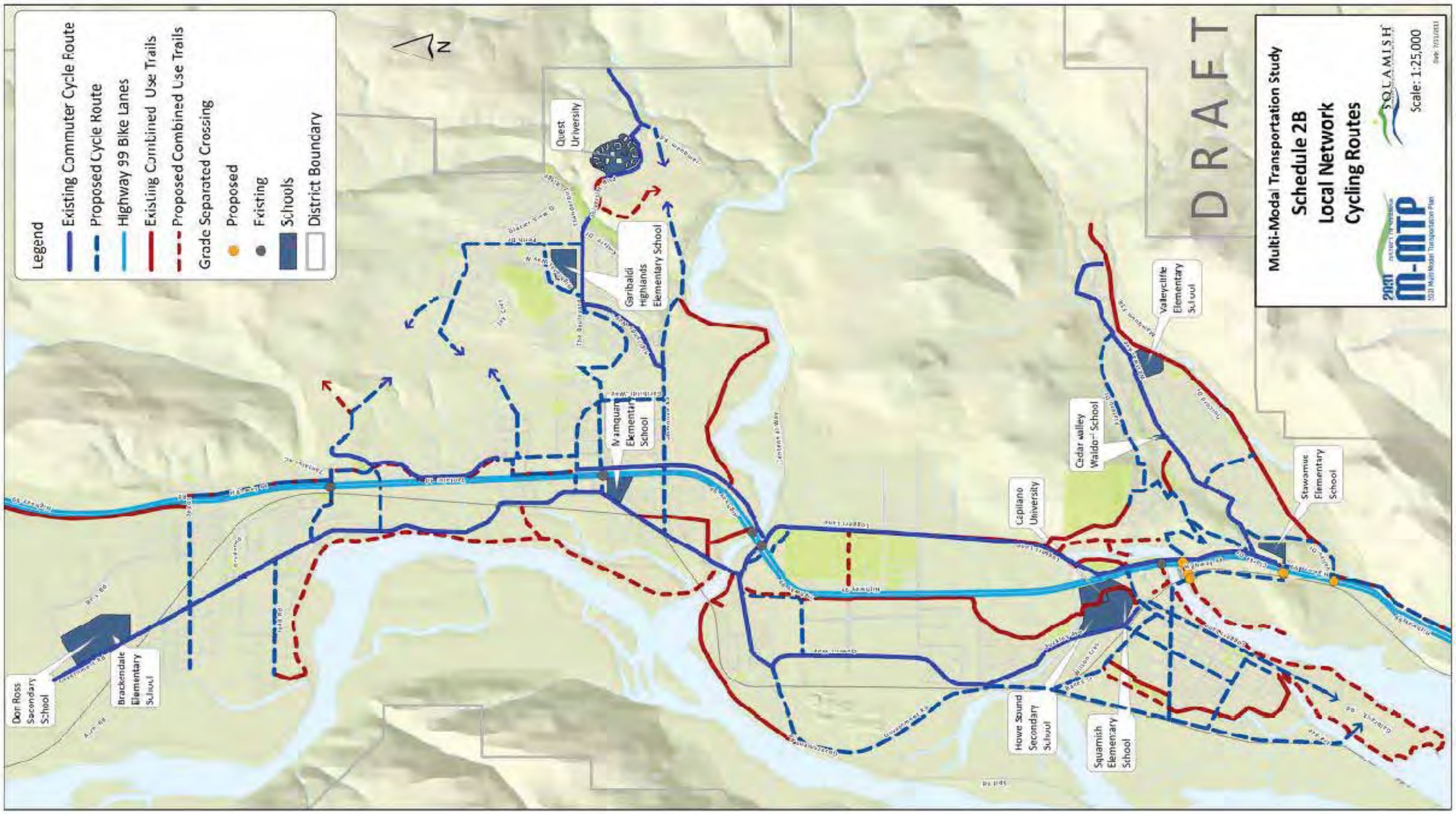


FIGURE 4.3.10 Schedule 2B – Proposed Cycling Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE 4.3.5 Evaluation of Proposed Bicycle Routes

Location	Likely to attract ridership	Provides valuable connection	Low cost to implement	Lower Rating better	Comments
Short Term Projects					
Tantalus Road from Garibaldi Way to Tantalus Place	●	⬤	⬤	6	Includes Corridor Trail Link.
Skyline Drive Bike Route	⬤	⬤	•	7	Critical Highlands Estates Linkage.
Diamond Road	⬤	⬤	●	7	Route to school.
Hunter Place	⬤	⬤	●	7	From Pemberton Ave on east side of CNR line.
Depot Road	⬤	⬤	●	7	Important feeder.
Main Street	⬤	●	⬤	7	Dedicated greenway
Tantalus Road north of North Road	●	⬤	⬤	7	Important Corridor Trail and Kingswood Crossing Link.
Highway 99 Grade Separated crossing between Clarke Drive and Valley Drive intersections	●	⬤	⬤	7	Very High Cost – Grade Separated Crossing - MoTI commitment.
Corridor trail from Garibaldi Way to Depot Road along Highway 99	●	⬤	●	8	Currently committed in 2011 DOS Budget.
Multi-use trail between Highway 99 and Loggers Lane across Brennan Park	●	⬤	●	8	Only realistic east-west cycling linkage between Cleveland Avenue and Centennial

Location	Likely to attract ridership	Provides valuable connection	Low cost to implement	Lower Rating better	Comments
Garibaldi Way from Tantalus Way to Government Road	●	●	●	9	
Clarke Drive to Northridge	●	●	●	9	
Eagle Run Drive from Gov't Road to Highway 99 crossing	●	●	●	9	
*Multi-use trail south of The Boulevard at Quest University	•	●	⬤	10	By Developer – committed.
Short to Mid-term Projects					
*Scott Crescent	⬤	⬤	⬤	5	Depends on development.
Cleveland Avenue from Highway 99 to Pemberton Avenue	⬤	⬤	•	6	Key linkage involving costly reconstruction.
Upper Mamquam Blind Channel Trail	⬤	⬤	●	7	Subject to resolving private property issues.
Pioneer Way/ Old Hwy 99	⬤	⬤	●	7	Main north-south arterial route in DCC Bylaw associated with road reconstruction.
*Laurelwood Connector from Clarke/ Hwy 99 to Pemberton Avenue	⬤	⬤	●	7	Grade Separation - Very high cost dependent on development.
Loggers Lane from Hunter Place to Galbraith Avenue	⬤	⬤	●	7	Work with railway. Ridership depending on Oceanfront Development

Location	Likely to attract ridership	Provides valuable connection	Low cost to implement	Lower Rating better	Comments
Multi-use trail connection between Maple Drive and Clarke Drive	●	●	⬤	8	Route to school.
Mamquam Road	●	⬤	●	8	Main east-west arterial in DCC Bylaw associated with road reconstruction.
*Perth Drive	●	⬤	●	8	By Developer
Cleveland Avenue from Main Street to Galbraith Avenue	⬤	●	●	8	Ridership depending on Oceanfront development
Pemberton Avenue	⬤	⬤	•	8	Depends on Laurelwood Connector proceeding.
Highlands Way N and Portree Way	●	●	●	9	Route to school.
Plateau Drive connection to Northridge Drive	●	●	●	9	
*Pia Road	•	⬤	●	9	Depends on development.
Bailey Street	●	●	●	9	Associated with development in employment lands.
Cedar Drive	•	●	●	11	
Mid to Long Term Projects					
* Connection from Pia Drive to Newport Ridge Drive or North Road	●	⬤	●	8	Potential environmental issues. Depends on development.

Location	Likely to attract ridership	Provides valuable connection	Low cost to implement	Lower Rating better	Comments
* North Road from Government Road to Tantalus Road (across Highway 99)	●	⬤	●	8	Depends on construction of new road/intersection through ALR.
Government Road from Queens Way to Bailey Street	●	⬤	●	8	Future Route dependent on Oceanfront Development and build-out of Employment Lands.
3rd Avenue Bailey to Main Street	●	⬤	•	9	
* Multi-use trails along Downtown waterfront	●	●	●	9	Dual purpose – recreational and travel
7th Avenue Connector	●	●	●	9	If a truck route is implemented on 7th Avenue and Oceanfront and employment lands.
Multi-use trail along River Dyke from Judd Road to Government Road	●	●	●	9	Private property and First Nation issues.
Judd Road	●	●	●	10	
Extension of highway multi-use trail north of Depot Road and South of Valley Drive	●	⬤	•	10	Cost depends on how far trails extend north and south
Multi-use trail south of Valleycliffe on River Dyke	•	●	●	11	
Valley Drive from Guildford Drive to Highway 99	•	•	●	11	

Location	Likely to attract ridership	Provides valuable connection	Low cost to implement	Lower Rating better	Comments
6th Avenue Trail from Bailey Street to Pemberton Avenue	Medium	Poor	Medium	11	Recreational or alternate route.
Long Term Projects					
New Road connecting North Road to Pia Road	Medium	Good	Good	7	Will depend on and be delivered by development.

* Assumption: can be implemented with redevelopment in the area, therefore lower costs

● Good	● Medium	● Poor

The preliminary evaluation and prioritization of new bicycle routes shown above can serve as a starting point for the development of implementation plans. Specific considerations could include:

a. Establish bicycle routes in the Downtown

To promote cycling within the District, it is important to raise the profile of cycling. Because the downtown often acts as a focal point within a community, conditions observed in the downtown reflect on the community as a whole. The downtown is ideal for cycling because it is flat and compact and experiences a relatively high number of trips. Providing bicycle facilities and established routes within Downtown Squamish will increase awareness about cycling, encourage more residents to cycle, and provide a safer cycling experience in the downtown.

A recommended option is establishing 3rd Avenue as the main downtown commuter bicycle route. Depending on the route treatment selected, changes to the existing right-of-way may be required. Additionally (or alternatively), the District may wish to consider pursuing a dedicated pathway parallel to the underutilized rail line along Loggers Lane (Rails with Trails). This should be considered a long term option, as considerable negotiation will likely be required with the rail operator. These route options envision Cleveland Avenue and 2nd Avenue as bicycle “end of trip” corridors which will also feature bicycle-friendly infrastructure; however, the primary purpose of these routes will not be the throughput of commuter cycling traffic.

b. Complete off-road bicycle facilities along Highway 99

Consistent with the District's vision of Highway 99 as a parkway as identified in the Smart Growth on the Ground plan, continue to extend off-road paths along Highway 99. The Highway 99 trail extending throughout the entire district will provide a backbone for commuter cycling.

c. Provide a connection through Downtown to connect to the underpass on the north side of the Mamquam Blind Channel Bridge.

The underpass on the north side of the Mamquam Blind Channel should be supported by a cycling route along Pemberton Avenue and a new linkage between Pemberton Avenue and Hunter Place, skirting the east side of the CNR line.

d. Improve safety at Discovery Trail intersections at Industrial Way and Commercial Way

Issues have been raised regarding existing path/roadway intersections along Discovery Trail at Industrial Way and Commercial Way. Although residents desire straight crossings across Industrial Way and Commercial Way , it is recommended that the existing intersection crosswalks continue to be used as the designated crossing facilities. The District should look to increase the safety and effectiveness of these crossings with measures such as:

- Increasing the landing area available to cyclists and pedestrians waiting to cross the channelized right-turn lanes;
- Implementing right-turn channels with tighter turning angles; and
- Providing a more direct path from the trail to the crosswalk (requires the installation of bridges spanning the ditch) that will encourage more users to use the crosswalk.

B. *Bicycle Routes Types*

FIGURE 4.3.10 does not differentiate between bicycle route types. It is beyond the scope of the Transportation Study to determine which route type is best for each proposed route. Such decisions should be made on a case-by-case basis as the network is realized. TABLE 4.3.6 outlines the five types of on-road bicycle routes recommended for the District of Squamish.

TABLE 4.3.6 Bicycle Route Types

TYPE	DESCRIPTION	ILLUSTRATION
Segregated Bicycle Lane/ Multi-use path	Typically used where additional separation between cyclists and traffic is desired. The lane is not part of the roadway and is separated from traffic with curbing or another form of barrier and/or landscaping. The path may or may not be shared by cyclists and pedestrians.	
Conventional Bicycle Lane	Typically used on high-volume, high-speed roads. Lane within the roadway that is separated from traffic with a painted white line and marked with bicycle symbols for the exclusive use of cyclists.	
Hybrid Bicycle Lane	Typically used on roads with moderate volumes and speeds. A wide curb lane that is marked with bicycle symbols, but has no line separating the two modes of traffic. The lane is shared between the two modes, but is wide enough for cyclists and vehicles to ride side by side.	
Paved Shoulder	Typical on highways and rural roads. In general, it functions like a Conventional Bicycle Lane on roads where no curb and gutter are present. Can be signed and/or marked.	

TYPE	DESCRIPTION	ILLUSTRATION
Signed Bicycle Route	Typically used on low-volume, low-traffic residential roads, where special treatment or pavement markings are generally not necessary. The route has only signs to indicate it is a cycling route that connects to other routes.	

Typical design dimensions for the above listed lane types (other than signed bicycle routes) are shown in FIGURE 4.3.11 through FIGURE 4.3.14.

Where new bicycle routes cross Highway 99, the District should explore opportunities to improve the bicycle riding experience. Measures can be found in the TAC Guidelines for the Design and Application of Bikeway Pavement Markings.

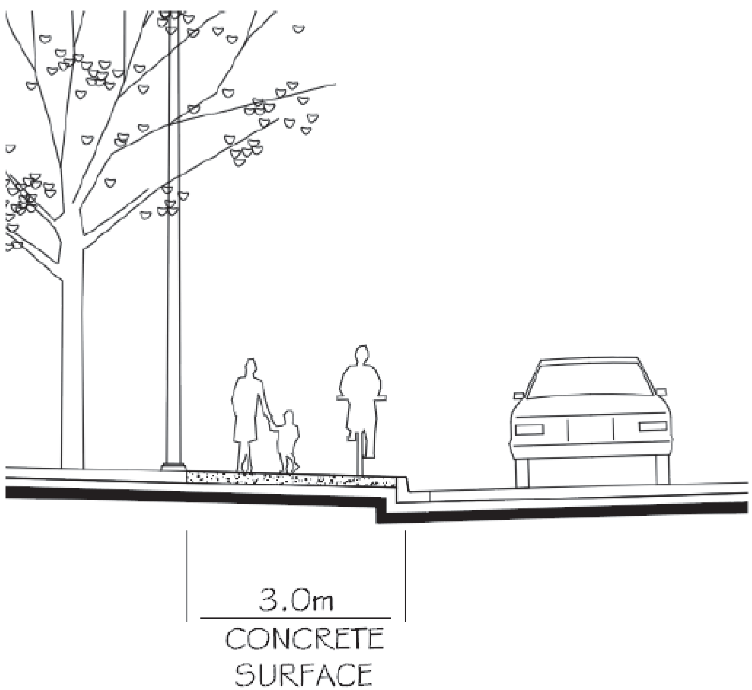


FIGURE 4.3.11 Urban Segregated Bicycle Lane (Two-Way) Dimensions and Markings

(Source: Prince George Active Transportation Plan, City of Prince George, 2011)

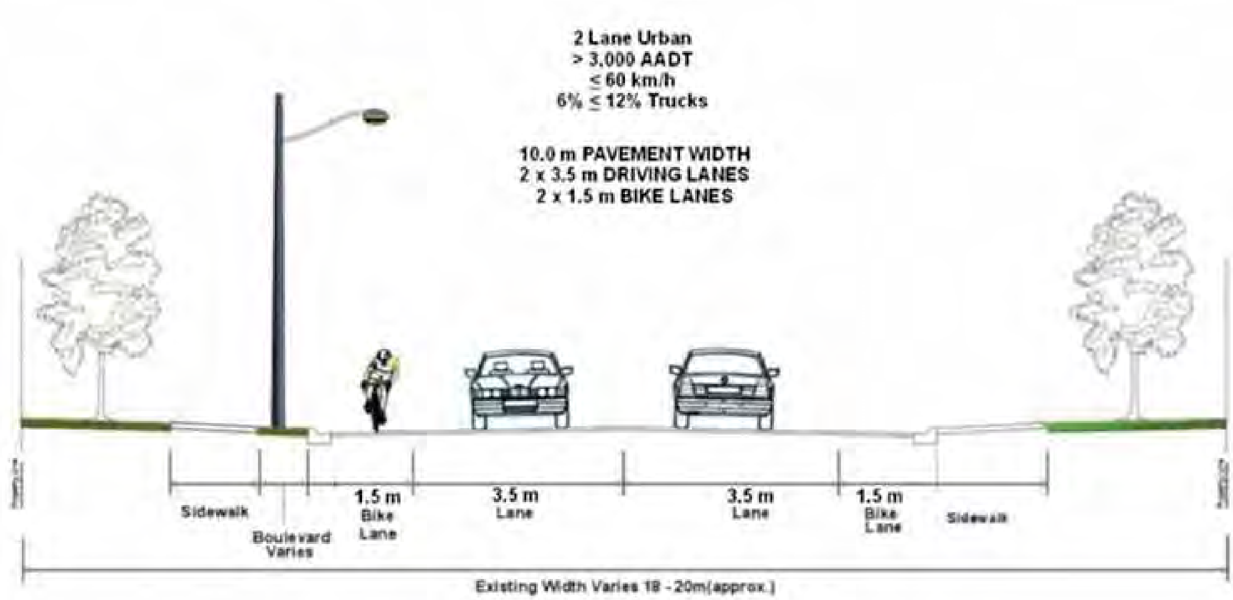


FIGURE 4.3.12 Conventional Bicycle Lane Dimensions and Markings
(Source: Prince George Active Transportation Plan, City of Prince George, 2011)

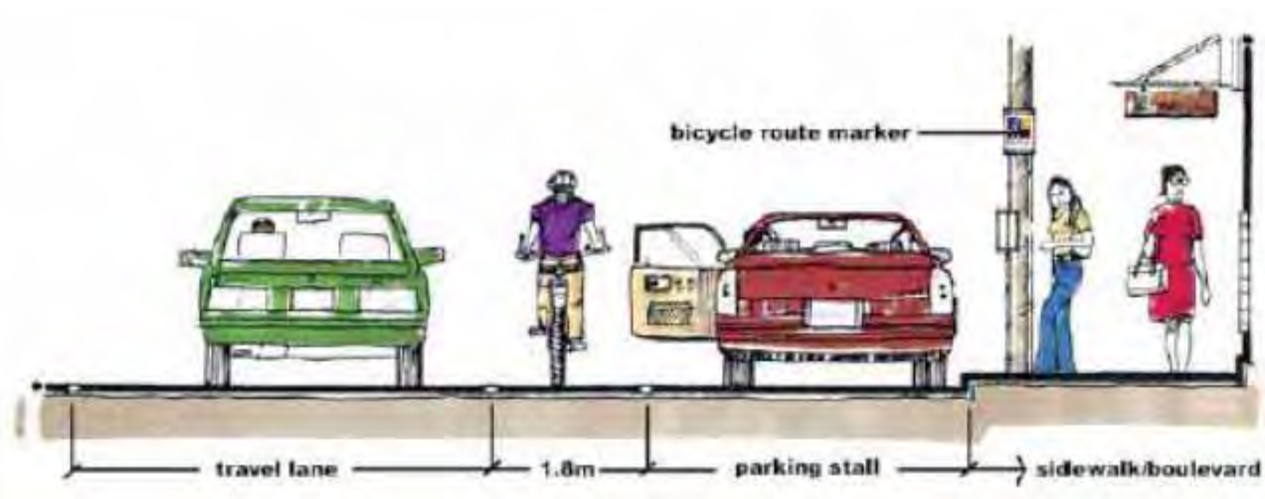


FIGURE 4.3.13 Hybrid Lane Dimensions and Markings
(Source: Prince George Active Transportation Plan, City of Prince George, 2011)

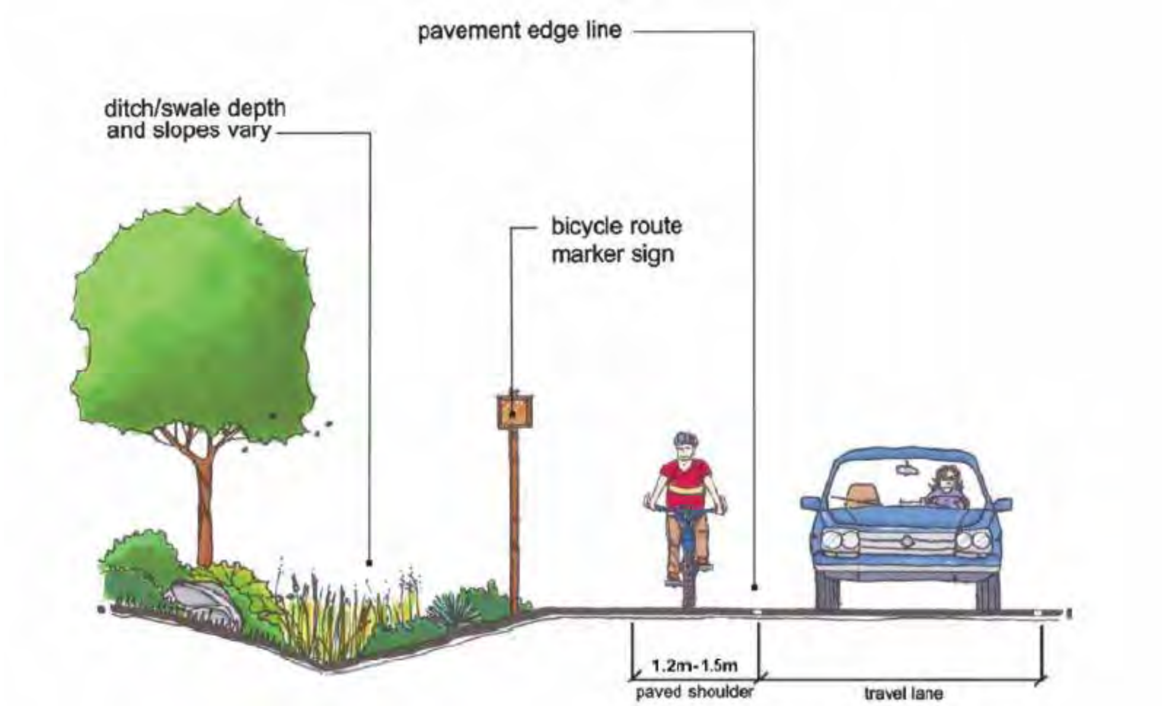


FIGURE 4.3.14 Paved Should Dimensions and Markings

(Source: Prince George Active Transportation Plan, City of Prince George, 2011)

C. *Existing Bicycle Routes*

In addition to constructing new cycling routes according to these route types, the District should evaluate existing bicycle routes to ensure consistency and improve safety. The following existing bicycle routes are recommended for evaluation in the short term as a starting point.:

- Westway Avenue
- Government Road
- Tantalus Road
- Corridor Trail/Highway 99 interfaces
- Discovery Trail intersections at Industrial Way and Commercial Way
  Issues have been raised regarding existing path/roadway intersections along Discovery Trail at Industrial Way and Commercial Way. Although residents desire straight crossings across Industrial Way and Commercial Way, it is recommended that the existing intersection crosswalks continue to be used as the designated crossing facilities. The District should look to

increase the safety and effectiveness of these crossings with measures such as:

- Increasing the landing area available to cyclists and pedestrians waiting to cross the channelized right-turn lanes;
- Implementing right-turn channels with tighter turning angles; and
- Providing a more direct path from the trail to the crosswalk (requires the installation of bridges spanning the ditch) that will encourage more users to use the crosswalk.

D. *Bicycle Route Preliminary Cost Estimates*

As a point of reference, FIGURE 4.3.15 provides an example of the typical costs associated with various bicycle route treatments.

Pathway	Width	Terrain	Description/Considerations	Cost ($/m)
Multi-Use Granular Trail	3.0 m	easy	packed granular trail traversing level greenspace with few impediments; includes trail signing	60
		difficult	packed granular trail traversing challenging greenspace with impediments; includes trail signing	120
Multi-Use Paved Trail	3.0 m	easy	paved trail traversing level greenspace with few impediments; includes trail signing	140
		difficult	paved trail traversing challenging greenspace with impediments; includes trail signing	200
Rural Boulevard Granular Trail	3.0 m	easy	packed granular trail following road r/w with few impediments; includes trail signing	80
		difficult	packed granular trail following road r/w with difficult slopes; includes trail signing	160
Rural Boulevard Paved Trail	3.0 m	easy	paved trail following road r/w with few impediments; includes trail signing	160
		difficult	paved trail following road r/w with difficult slopes; includes trail signing, does not include handrails, retaining walls, major earthworks	240
Urban Boulevard Trail - new construction	3.0 m	easy	concrete trail abutting existing curb; include trail signing; level terrain with few utility conflicts	400
		difficult	concrete trail abutting existing curb; include trail signing; difficult terrain with utility conflicts	500
Urban Boulevard Trail - upgrade existing sidewalk	1.5 m	easy	widen sidewalk to concrete trail; include trail signing; level terrain with few utility conflicts;	250
		difficult	widen sidewalk to concrete trail; include trail signing; difficult terrain with utility conflicts;	300
Bike Lane - No parking both sides	n/a	n/a	Paint lines, bike symbols and bike route signs every 800 metres both sides; no parking signs both sides every 30-50 m	8.9
Bike Lane - Shared Parking one side	n/a	n/a	Paint lines, bike symbols and bike route signs every 800 metres both sides; no parking signs one side every 30-50 m	5.9
Pave Road Shoulders (both sides)	1.5 m ea	n/a	pave/paint existing gravel shoulders, both sides; add bike route signs every 800 m	80
Shared Lanes (both sides)	4.0 m	n/a	"Share the Road" signs and painted bike/sharrow symbols every 800 m, both sides	1.1

FIGURE 4.3.15 Sample Bicycle Route Treatment Costs

(Source: Prince George Active Transportation Plan, City of Prince George, 2011)

A cost summary of the new bicycle routes proposed within the 20 year planning horizon is provided in TABLE 4.3.7. A more detailed list of the proposed new bicycle routes is provided in APPENDIX F.

TABLE 4.3.7 New Bicycle Route Cost Summary

CLASSIFICATION	AREA	LENGTH (m)	COST	NET DISTRICT COST
Commuter Routes		10300	$1,502,000	$1,152,000
Neighbourhood Routes	Downtown	7000	$720,000	$18,000
	Valleycliffe	1400	$210,000	$210,000
	Estates	400	$60,000	$60,000
	Highlands	1600	$365,000	$240,000
	Brackendale	1300	$195,000	$195,000
	TOTAL	22000	$3,052,000	$1,875,000

(Note: This list of improvements has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

E. *Summary of Recommendations*

It is recommended that the District undertake the following measures to pursue the cycling network described herein:

- **Amend the Subdivision and Development Control Bylaw to include standards for Bicycle Routes based on current TAC standards;**
- **Develop a systematic approach for routine evaluation of existing bicycle routes with the objective being to bring them up to the prescribed standards;**
- **Include Bicycle Routes in the next update of the Development Cost Charge Bylaw;**
- **Evaluate the proposed short term bicycle routes in enough detail to determine the standard which should be applied, the estimated project cost, the proposed source of funding;**
- **In consultation with user groups develop of list of priority projects;**
- **Consider an annual allowance of $100,000 for the development and improvement of bicycle routes in the Capital Budget;**
- **Develop a Public Education Strategy that will endeavour to raise awareness and understanding of cycling supportive infrastructure and promote respectful behaviour; and,**
- **Develop a “Cycling Squamish User Guide”**

4.4 Walking

4.4.1 Background

Issues related to pedestrian facilities and walking within Squamish are reviewed in this section. Walking is an important part of transportation – almost all trips start and end with walking. The benefits of a "walkable" community are immeasurable, ranging from economic development through increased access to business; to reduced vehicle traffic, resulting in less air pollution; to promoting a sense of community and transforming neighbourhoods into friendlier, more vibrant and more attractive places to live; to health benefits, as residents discover that walking is one of the most affordable and accessible types of exercise available.

Within the urban environment "walkability" should also mean accessibility for persons with physical disabilities. Although this will not always be possible in a community with so much mountainous terrain, the large majority of pedestrian routes should be fully accessible.

A document review was conducted, and the most relevant documents related to walking in Squamish are listed in TABLE 4.4.1.

TABLE 4.4.1 Relevant Documents for Walking Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	Squamish Trail and Recreation Map	-	Map
2	Preliminary SW Bike Lane Plan – Rev.1	2010	Map
3	District of Squamish Existing Sidewalk and Commuter Bicycle Plan	2010	Map
4	District of Squamish Official Community Plan	2009	Document
5	Downtown Squamish 2031 Transport Plan (CTS)	2009	Document
6	Downtown Squamish Smart Growth on the Ground Concept Plan (Design Centre for Sustainability – UBC)	2005	Document

Site visits were conducted in September and October of 2010, and one of the objectives was to observe pedestrian facilities within the District of Squamish.

4.4.2 Existing Conditions

The existing pedestrian paths within the District, based on the District of Squamish Existing Sidewalk and Commuter Bicycle Plan Map, are shown in FIGURE 4.4.1.

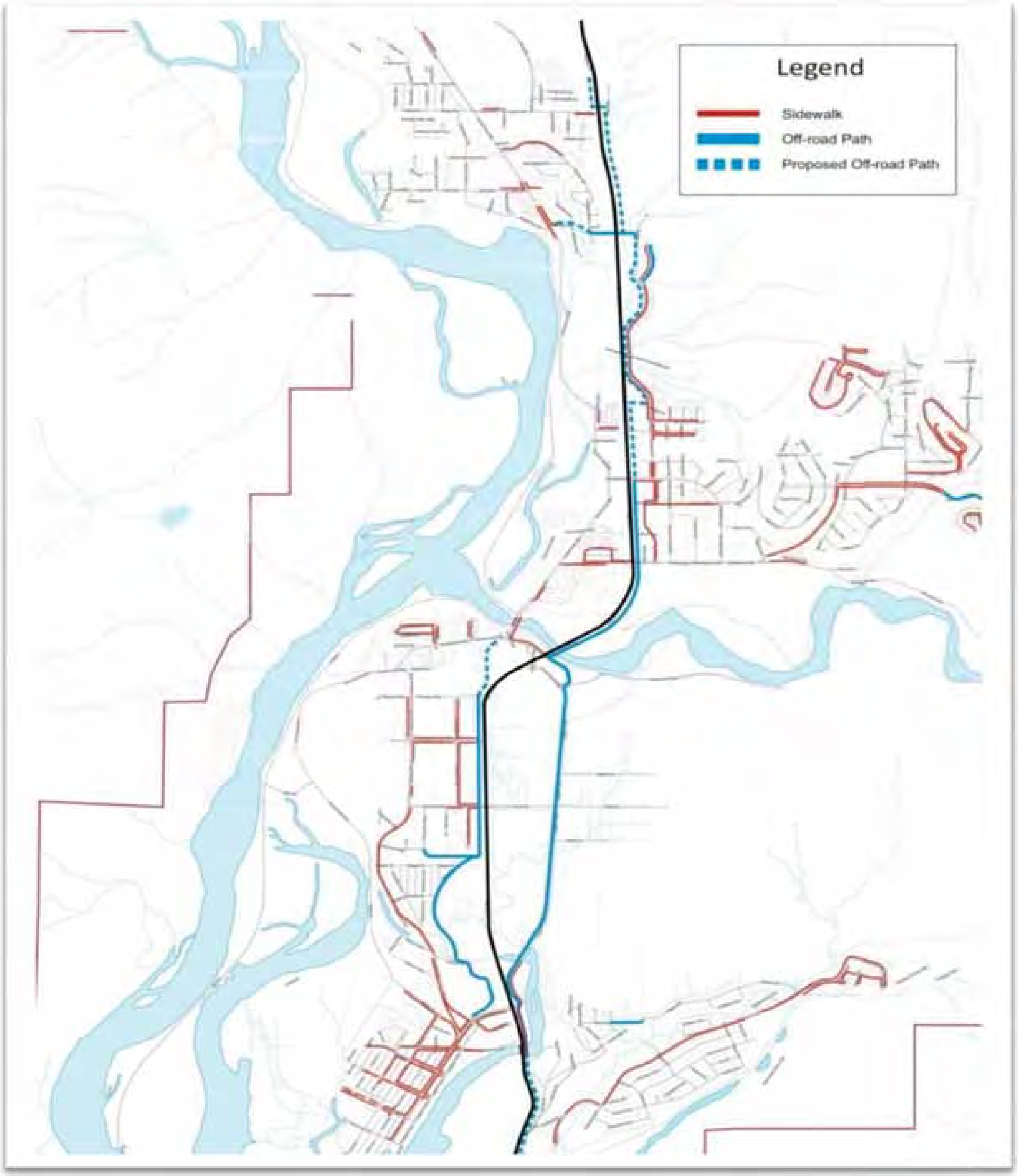


FIGURE 4.4.1 Pedestrian Facilities in Squamish

Sidewalk coverage along major corridors excluding Highway 99, based on the District of Squamish Existing Sidewalk and Commuter Bicycle Plan Map, is summarized by zones in TABLE 4.4.2. Sidewalk coverage was estimated using Google Earth, and considered only roads designated as Existing Major Routes in the District of Squamish OCP Schedule G. The sidewalk coverage estimate considered both sides of the road as available space for sidewalks and calculated coverage as a percentage length. TABLE 4.4.2 shows that in general the sidewalk coverage along major routes is fairly low, around one third of total available length in Squamish. As expected, Downtown Squamish featured the greatest sidewalk coverage. In general, it is expected that sidewalk coverage values would be lower than those in TABLE 4.4.2 if non-major roads were considered as well, with the exception of Downtown Squamish, where factoring non-major roads would likely increase the sidewalk coverage value.

TABLE 4.4.2 Sidewalk Coverage on Major Roads by Neighbourhood

COMMUNITY/NEIGHBOURHOOD	SIDEWALK COVERAGE*
Brackendale	14%
Dentville	50%
Downtown	58%
Garibaldi Highlands	34%
Garibaldi West	19%
Industrial Park	44%
North Yards	0%
Valleycliffe	38%
TOTAL	33%

** Based on approximate measurements from Google Earth*

Public Consultation Results

Synovate's survey of 520 households within the District of Squamish revealed that the total number of surveyed walking trips taken by respondents during the typical weekday PM peak accounted for approximately 11% of total trips during that period, with 198 out of a total 1777 trips being walking trips. Results for walking trips included one surveyed rollerblade/skateboard trip.

TABLE 4.4.3 and TABLE 4.4.4 provide a summary of Synovate survey responses regarding PM peak walking trips. Residents were surveyed about their walking trips on weekdays between 3 – 6 p.m. TABLE 4.4.3 displays the origin and destination of walking trip results by neighbourhood within Squamish normalized to reflect actual neighbourhood sizes and TABLE 4.4.4 summarizes walking trip purpose. Although the sample size is relatively small, trends can be observed indicating that the majority of walking trips take place within a single community. Given that the community sizes examined are relatively large, the trend may reflect the inconvenience and physical difficulty of walking long distances. Because of physical barriers between communities, residents are likely to walk only to destinations within their local area. Walking trips consists mostly of personal trips, which account for almost two thirds of all walking trips during weekday afternoons. Pick-up and drop-off trips were the second most common type of walking trip, account for nearly one third of walking trips during the survey study period. The number of commute walking trips, although relatively low, is significant, and implies that walking to/from work is feasible for some residents.

TABLE 4.4.3 Normalized Surveyed Walking Trips on Weekdays 3 – 6 PM

		DESTINATION									
	WALKING* TRIPS (Normalized)	Brackendale	Dentville	Downtown	Garibaldi Highlands	Garibaldi West	Industrial Park	North Yards	Valleycliffe	Unknown / Other / Outside of Squamish	TOTAL FROM
ORIGIN	Brackendale	525		32						30	587
	Dentville		169	253		14			23		460
	Downtown		68	349	7				12		435
	Garibaldi Highlands				477	28				106	611
	Garibaldi West				69	98				15	182
	Industrial Park										0
	North Yards										0
	Valleycliffe								152		152
	Unknown/Other/ Outside of Squamish	28			41	14		11			94
	TOTAL TO	552	237	634	594	153	0	11	187	152	2520

** Walking trips include 1 rollerblade/skateboard trip*

TABLE 4.4.4 Surveyed Walking Trip Purpose

TRIP PURPOSE	Number of Trips	Percentage of Walking Trips
Commute	18	9%
Personal	124	63%
Pick-up / Drop-off	56	28%

4.4.3 Opportunities

The following opportunities were noted during this study:

- **Land use density in the downtown.** Land use density is relatively high in the downtown and small block sizes encourage walking. Maintaining and promoting increased density and diverse land use in the downtown will further facilitate walking and increase its mode share. Additional opportunity exists to promote density in growing communities such as Garibaldi Highlands.

- **Pedestrian friendly practices and traffic calming in the downtown.** Current features in the downtown, including: curb extensions; wide sidewalks; street furniture and greenery; on-street parking; and pavement treatments at pedestrian crossings, create an environment that promotes walking by creating a pleasant walking experience and increasing pedestrian safety. Other areas within Squamish, such as along The Boulevard, also feature a number of these measures.

- **Highway 99 pedestrian overpass.** The pedestrian bridge over Highway 99 north of North Road provides connectivity between Brackendale and Garibaldi Highlands for pedestrians while allowing them to avoid interaction with high vehicle volumes on the highway.

- **Smart Growth on the Ground Concept Plan.** The Downtown Squamish Smart Growth on the Ground Concept Plan includes a vision of Highway 99 as a parkway that will provide a pedestrian friendly north-south corridor through Squamish and improved crossings across the highway which typically acts as a barrier separating east and west. The concept plan also includes guidelines for downtown development that promote a pedestrian-friendly character.

4.4.4 Issues

The following issues were noted during this study:

- **Lack of sidewalks.** A lack of sidewalks requires pedestrians to walk on the roadway, increasing their exposure to vehicle traffic and therefore increasing the risk associated with walking. Increased exposure to risk creates an unpleasant walking experience and may discourage walking. Currently, many streets in Squamish lack sidewalks and there are large areas without sidewalks creating a lack of connectivity. Some areas within Squamish provide few sidewalks that are very short; these sidewalks do little to facilitate walking, since they offer no connection to other routes are in the end still require pedestrians to travel on the roadways. FIGURE 4.4.2 shows an example of pedestrians on the roadway.

FIGURE 4.4.2 Photograph of Pedestrians on Roadway, Westway Avenue

- **Discontinuous sidewalks.** Where sidewalks end, pedestrians are forced to continue walking on the roadway to reach their destination. Discontinuity in sidewalks may be perceived as unreliability, and may discourage walking. Additionally, discontinuous sidewalks create significant barriers to persons in wheelchairs, especially where letdowns are inadequate or not provided. FIGURE 4.4.3 shows an example of a discontinuous sidewalk.

FIGURE 4.4.3 Photograph of Discontinuous Sidewalk, Government Road

Lack of street trees or "buffer zone". In some places a lack of separation between vehicles and pedestrians can create perceived or actual safety issues. Additionally, a buffer zone including vegetation such as trees creates an aesthetically pleasing pedestrian environment which can help promote walking. FIGURE 4.4.4 is an example of a sidewalk with little separation between pedestrian and traffic.

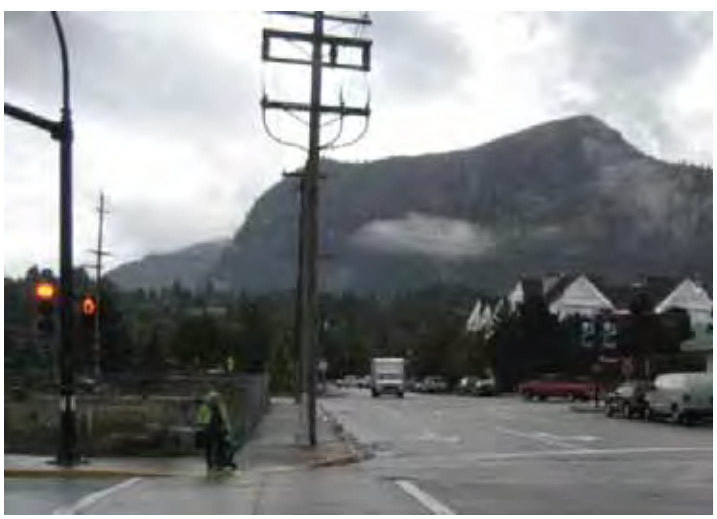


FIGURE 4.4.4 Photograph of Lack of Buffer Zone, Pemberton Avenue

- **Lack of lighting along highway trail.** A lack of lighting on the trail adjacent to Highway 99 decreases pedestrian safety along the trail. Because the trail runs north-south parallel to the highway, it is expected that the majority of walking trips along it would have relatively long durations. Dark conditions can present pedestrians with an uncomfortable walking experience, which they may tend to avoid especially on long trips, and decreases the overall quality of the walking environment along the highway trail.

- **Frequent driveways and lack of substantial curbs.** Similar to a lack of a "buffer zone", frequent driveways or lack of a substantial curb may create perceived or actual safety issues. Frequent driveways create additional conflict points for pedestrians and may mean that vehicles are frequently crossing the path of pedestrians. Numerous driveways along a sidewalk, or the lack of a substantial curb along a sidewalk may decrease the perception of safety for pedestrians, and decreases the overall quality of the walking environment. FIGURE 4.4.5 shows a sidewalk with frequent driveways and, and a sidewalk that lacks a real curb and gutter.

FIGURE 4.4.5 Photograph of Sidewalks, Buckley Avenue

- **Obstructions in sidewalk.** Objects within the walking space on sidewalks impede pedestrian traffic and create considerable difficulty for persons in wheelchairs. Sidewalks that do not provide a minimum 1.5 metre consistent "clear zone" for pedestrians create an unpleasant walking environment and make travelling difficult for those with wheelchairs or strollers. The sidewalk featured in FIGURE 4.4.4 above is an example of obstructions in the sidewalk.

- **Physical barriers to walking.** Numerous barriers to walking exist due to Squamish's topography and existing road network. The distance between communities is the main barrier, as some destinations are simply too far to realistically walk to. Other physical barriers include steep slopes in some communities and the fact that Highway 99 bisects the district, and is difficult for pedestrians to cross.

- **Lack of information on existing demand.** A lack of data on pedestrian volumes along District roads increases the difficulty of predicting pedestrian demand. Provision of adequate pedestrian facilities along District roads without overdesigning depends on having accurate and up-to-date pedestrian demand information.

Issues Identified During Public Consultation

Responses to the web-based public survey identified trip distances within Squamish as the main impediment to walking. Respondents were asked to rank their reasons for not walking and "Work or other destinations are too far to walk from my home"" was the reason most ranked #1, accounting for 40% of top votes, as shown in FIGURE A-7 in APPENDIX A.

Review of open-ended responses from the web survey and comments gather during the Public Information #1 revealed the following statements made by residents and stakeholders regarding walking and pedestrian facilities in Squamish:

- Lack of lighting along walkways makes walking at night dangerous.
- No safe pedestrian connection between Valleycliffe and the Downtown.

- Lack of sidewalks in Squamish. Lack of direct walking routes makes walking time consuming.
- Sidewalk facilities are inconsistent and inadequate. May not be able to accommodate all users; for example those with strollers.
- Weather conditions in Squamish prevent walking.
- No safe routes to/from school to pick up/drop off children.
- Steep grades prevent walking; steps may be desirable at locations such as Skyline Drive.
- In general distances are just too far to walk; lack of adequate transit service means transit/walking trips are eschewed in favour of auto trips.
- Carrying purchases from shopping or grocery trips is too difficult considering the long distances and steep grades.
- Snow on pedestrian paths impedes walking; snow removal for sidewalks is required. Additionally, street snow clearing often pushes snow onto pedestrian pathways, blocking them.
- The sidewalks along the Government Road river crossing are inadequate.
- A pedestrian connector between the highlands and the lowlands is required in Garibaldi Heights.
- The Squamish Dyke should be maintained and used as a major pedestrian trail.

Statements suggested that in general, residents felt that destinations within Squamish were inaccessible by walking due to long distances, extreme grades, safety concerns, weather conditions, or lack of connectivity between communities and across Highway 99 (especially in the case of Valleycliffe).

4.4.5 Recommendations

The following discussion provides in-depth analysis or additional discussion related to specific local pedestrian network recommendations. A full list of recommendations made as part of this plan is provided in SECTION 6.0.

A. *Prioritize Sidewalk Construction*

The District of Squamish should adopt a sidewalk construction policy with the following requirements for new construction on urban roads:

- Arterials should have sidewalks on at least one side.
- Collectors should have sidewalks on one side.
- Local roads should have sidewalks on one side.
- Roads proximate to a school or in pedestrian priority areas should have sidewalks on both sides.

These requirements should be incorporated into the District's design guidelines. For existing arterial and collector roads that do not meet these guidelines, the District may wish to commit to addressing gaps in the medium-long term, and to request funding to address these gaps. Gaps on the local street network could be addressed through a Local Area Service Plan as outlined in http://www.burnaby.ca/cityhall/departments/engnrn/engnrn_lclars.html. If the District is concerned about the expense of providing sidewalks on extremely low volume roads (especially in rural areas), options such as asphalt curbs or paved shoulders can be considered.

The District may wish to utilize a priority index methodology to identify and rank the need for new pedestrian facilities. This process prioritizes proposed initiatives by utilizing a point system that measures the pedestrian potential (i.e. likelihood of walking) and deficiency (i.e. probability of improving safety) of each proposed initiative. Points are awarded for specific characteristics, such as whether it is required on a transit route, if a school is nearby, and if there have been pedestrian-related collisions on the street. The greater the number of points awarded, the greater the need for a new sidewalk. This method has been used by Opus for communities such as Kelowna, Prince George, Victoria and the District of North Vancouver.

TABLE 4.4.5 and TABLE 4.4.6 show the pedestrian potential and deficiency index fields that were used for the District of North Vancouver (DNV) pathway prioritization process. Given the unique constraints of the Squamish network, this method could be streamlined to be appropriate for conditions within Squamish.

The scoring criteria shown below serve as an example of the characteristics that can be taken into account.

TABLE 4.4.5 Pedestrian Potential Index Fields (DNV)

<table>
<tr><th rowspan="2">DATA FIELD</th><th colspan="3">CONTENTS</th></tr>
<tr><th>Feature</th><th>Points Given (otherwise 0)</th><th>Maximum Points</th></tr>
<tr><td>Commercial Land Use</td><td>Pedestrian-Oriented Commercial
Local Commercial Area
Single Commercial Property</td><td>7
6
5</td><td>7</td></tr>
<tr><td>Transit</td><td>Transit Route</td><td>2</td><td>2</td></tr>
<tr><td>Existing Walkway</td><td>Existing Walkway
(Can be footpath)</td><td>2</td><td>2</td></tr>
<tr><td>Elementary School Proximity</td><td>< 0.5 km
0.5 km to 0.9 km
1.0 km to 1.4 km
1.5 km to 2.0 km</td><td>4
3
2
1</td><td>4</td></tr>
<tr><td>Middle or Secondary School Proximity</td><td>< 0.5 km
0.5 km to 0.9 km
1.0 km to 1.4 km
1.5 km to 2.0 km</td><td>4
3
2
1</td><td>4</td></tr>
<tr><td rowspan="4">Other Destinations within 0.5 km</td><td>Pedestrian-Friendly Commercial
(not on block face itself)</td><td>2</td><td rowspan="4">8</td></tr>
<tr><td>Transit Stop on Block</td><td>2</td></tr>
<tr><td>Park</td><td>2</td></tr>
<tr><td>Community Centre or Library</td><td>2</td></tr>
<tr><td>Employment within walking distance</td><td>< 0.5 km
0.5 km to 1.0 km</td><td>2
1</td><td>2</td></tr>
<tr><td>Local Interest</td><td>High Interest/ Scenic
Medium Interest/ Pleasant</td><td>2
1</td><td>2</td></tr>
<tr><td>Average Parcel (Lot) Size</td><td>< 600 square metres
< 10,000 square metres</td><td>2
1</td><td>2</td></tr>
<tr><td>Grade</td><td>< 2 percent
Between 2 and 8 percent</td><td>2
1</td><td>2</td></tr>
<tr><td>Pedestrian Potential Index</td><td colspan="2">Total Maximum Points</td><td>35</td></tr>
</table>

TABLE 4.4.6 Deficiency Index Fields (District of North Vancouver)

DATA FIELD	CONTENTS		
	Feature	Points Given (otherwise 0)	Maximum Points
Sidewalk Continuity Factor (% of sidewalk in block, one side of street for collector roads, both sides of street for arterial roads)	0% 1 to 24% 25 to 49% 50 to 74% 75 to 99% 100%	5 4 3 2 1 0	5
Pedestrian Crashes (within 250 m radius in 3-year period)	1 to 2 crashes 3 to 4 crashes > 4 crashes	4 6 10	10
Posted Traffic Speed	>= 80 kph 70 to 79 kph 60 to 69 kph 50 to 59 kph 40 to 49 kph	5 4 3 2 1	5
Traffic Volume (daily, two-way)	>= 20,000 15,000 to 19,999 10,000 to 14,999 5,000 to 9,999 2,000 to 4,999	5 4 3 2 1	5
Road Width (number of through lanes, both directions, including parking)	Number of Lanes (if > 6, use 6)	One point per lane (1-6)	6
Street Segment Length	>= 300 m 240 to 299 m 180 to 239 m 120 to 179 m 60 to 119 m	5 4 3 2 1	5
Public Concerns (Formal Requests Received)	5 + request 4 requests 3 requests 2 requests 1 request	5 4 3 2 1	5
Vulnerable road users	High proportion of vulnerable road users	5	5
Deficiency Index	Total Maximum Points		46

Selection of Preferred Placement When Only One Sidewalk Required

When a new sidewalk is to be placed on one side of the street only, the following criteria could be used to help evaluate which side is the most appropriate for a sidewalk. Whichever side of the street meets more of these criteria should be the preferred location for the sidewalk. The District could also use these guidelines to determine which sidewalk on a local street should be maintained. **Continuity of the pedestrian network is a highly important factor as pedestrians are not likely to cross back and forth from one side of the street to the other to access the sidewalk but will maintain a linear path as much as possible.**

Pedestrian Demand

- Existing worn path: In existing neighbourhoods, if a path exists, this is the most important factor, as it clearly indicates the pedestrian desire lines.
- Residential density: Multi-family units will generate more trips per metre of frontage than single family dwellings, not just because of the increased density, but also because car ownership rates tend to be lower in such units. Even in single family neighbourhoods, the side of the street with more households is likely to generate more pedestrian trips.
- Presence of a school. Schools are prime attractors of pedestrian trips.
- Other pedestrian attractors/generators: parks, transit stops, hospital, street-oriented commercial, day cares, community centres, libraries, seniors housing, employment.

Cost/Constructability/Maintainability

- External funding available
- Grade less than 5 percent (where possible)
- Available right-of-way/lack of obstructions in right-of-way. Lack of right-of-way, and or obstructions in the right-of-way such as utility poles, trees or physical formation such as rock faces, watercourses, etc., can reduce the available width for sidewalks, and/or can significantly increase the cost of the project. Where possible, such locations should be avoided.

Utilities should not be located beneath the proposed sidewalk location. If utilities end up under the proposed location of the sidewalk, the sidewalk would have to be dug up every time those utilities must be accessed, increasing life-cycle maintenance costs, and therefore, this practice should be avoided where possible.

Services would be considered okay to be located underneath sidewalks if they are able to be accessed by service boxes. Snow storage and snowmelt runoff are also maintenance considerations.

The following pleasant pedestrian environment criteria should be used to help evaluate which side is the most appropriate for a sidewalk. Whichever side of the street meets more of these criteria should be the preferred location for the sidewalk. Input from the Development, Maintenance and Engineering areas should be sought in conducting this evaluation:

- Connects to existing sidewalks on adjacent blocks. **Providing a linear route for pedestrians is preferable to having pedestrians cross back and forth to sidewalks**. Where possible, the sidewalk should be constructed to connect to existing sidewalks on adjacent blocks.
- Sunny side: The sunny side is warmer, and therefore more pleasant to walk on during most seasons. Additionally, the ice melts more quickly on the sunny side, which may allow pedestrians a more stable foothold.
- Existing street lighting: For personal security reasons, pedestrians generally prefer to walk on the side of the street with street lighting.
- Parking permitted: Parking provides a buffer between pedestrians and moving traffic, creating a more pleasant pedestrian environment. Additionally, people walking to access their parked cars generate more pedestrian traffic.
- Better view: Pedestrians are likely to be attracted to walk on the side with the better view.

A buffer zone should be provided where applicable to separate pedestrians from the street. This provides a safety advantage and boulevard area between the roadway and the sidewalk provides a location for snow storage from roadway ploughing operations.

Different sidewalk surface materials or patterns of cross-hatching, dimpling, or scoring should be considered for application at sloped or potentially slippery areas.

The new sidewalks and pedestrian paths proposed as <u>Schedule 2C</u> of the <u>Squamish 2031 Multi-Modal Transportation Plan</u> are shown in FIGURE 4.4.6.

THIS PAGE INTENTIONALLY LEFT BLANK

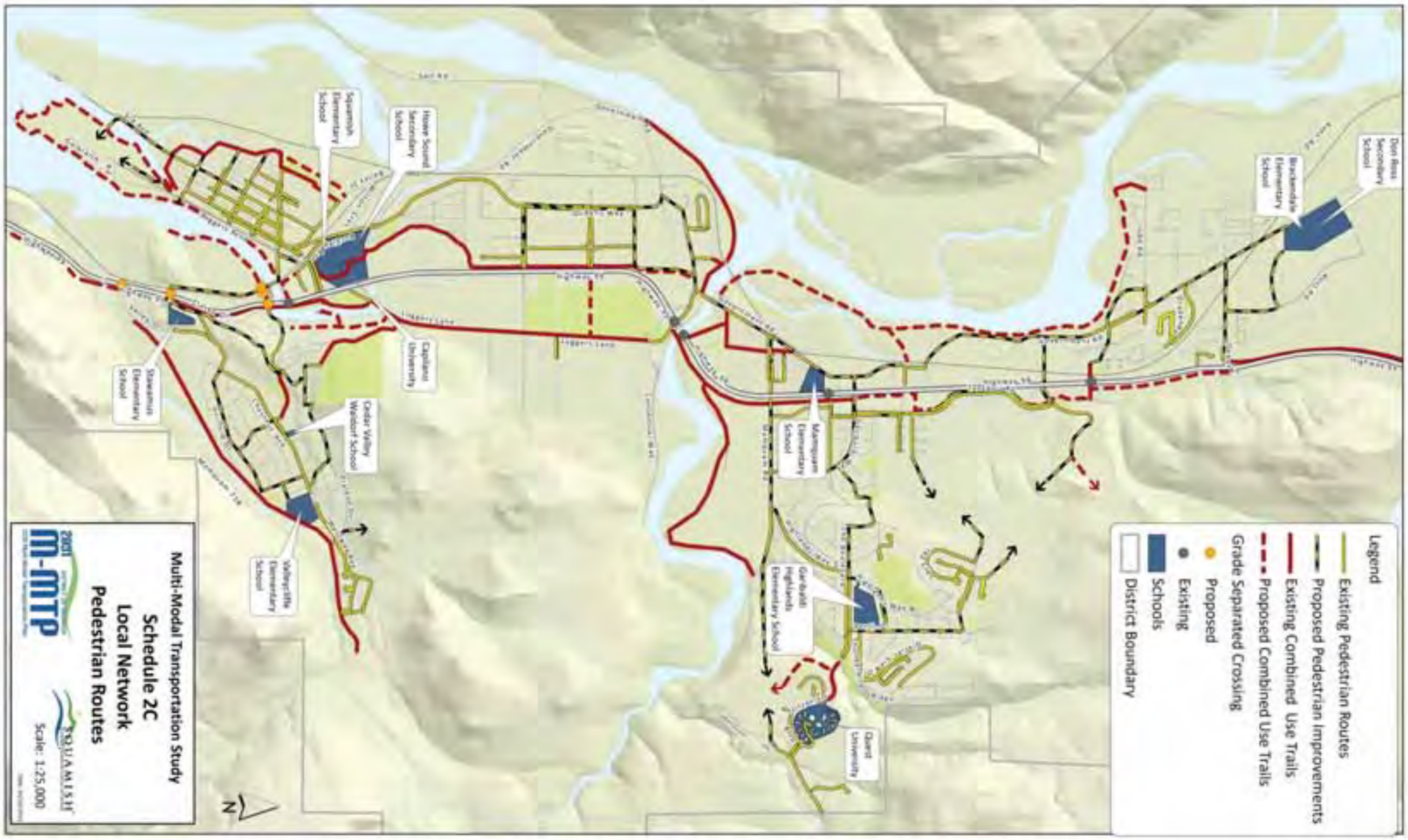


FIGURE 4.4.6 Schedule 2C – Proposed Pedestrian Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

The following new sidewalks are deemed to be high priority initiatives that should be evaluated and ranked in the short term:

- Depot Road from Government Road to Highway 99
- Government Road from Ross Road to Eagle Run Drive
- Garibaldi Way
- Perth Drive
- Mamquam Road from Highway 99 to Highlands Way S
- Government Road from Harris Road to Mamquam Road
- Tantalus Road from Starview Place to Garibaldi Way
- Scott Crescent from Hunter Trail to Highway 99

These new sidewalks are proposed as those that would provide key pedestrian connections (i.e. routes to schools) or easily improve continuity and connectivity.

B. *Formalize Trails that Provide Significant Shortcut to Pedestrians*

Formalize necessary links to provide more direct pathways for pedestrians. These links should be paved, lit and accessible. The location and prioritization for these trails will depend on the conditions of the surrounding pedestrian networks as well as pedestrian demand and should be more closely evaluated by the District. After a cursory examination of the proposed trails shown above in FIGURE 4.3.9, the following trails stand out as having the most potential as significant shortcuts:

- Connection between Maple Drive and Clarke Drive
- The Hunter Trail between Hospital Hill and the Upper Mamquam Blind Channel (This recommendation to be forwarded to the Upper Mamquam Blind Channel Land Use Study)
- Scott Crescent
- Connection between Plateau Drive and Northridge
- Connections to the pedestrian overpass from Tantalus Road and Eaglerun Drive

The District may wish to consider integration of funding with their Trails Plan. Key conditions where integration may be applicable include:

- When the trail will likely be used primarily for transportation purposes (versus primarily recreational);
- When the trail will significantly improve safety conditions over an on-road pedestrian facility; and/or
- When the trail will fill a “missing link” and/or provide a more direct route that cannot be accommodated with an on-road route.

Under these conditions and when funding from the sidewalk budget is insufficient to complete a sidewalk project, the District may wish to apply that funding to trails development.

C. *Pedestrian Priority Zone in the Downtown*

Providing good pedestrian facilities in the Downtown is consistent with the District’s vision for a pedestrian friendly downtown that is the focal point of the community. However, it is likely that a priority index methodology for pedestrian initiatives may determine initiatives on Downtown roads to be of a lower priority, given their function as mainly local roads. Low construction priorities for initiatives along Downtown roads are contradictory to the District’s goals and can impede the provision of sidewalks in the Downtown as initiatives along major roads elsewhere are favoured.

To ensure that new pedestrian facilities are provided along Downtown roads, it is recommended that the District of Squamish implement policy to define the Downtown as a “Pedestrian Priority Zone”. The policy should also include provisions for sidewalks and pedestrian paths within Pedestrian Priority Zones so that their construction is prioritized relative to similar facilities that do not lie within such zones.

D. *Safe Routes to School*

The District of Squamish (District) has six public elementary schools. They are listed as follows:

- Stawamus Elementary School;
- Brackendale Elementary School;
- Garibaldi Highlands Elementary School;

- Mamquam Elementary School;
- Squamish Elementary School; and,
- Valleycliffe Elementary School.

There is also a private elementary school known as the Cedar Valley Waldorf School.

To help promote walking as a sustainable transportation choice for travelling to school, it is suggested that the District implement a Safe Routes to School Program (Program) for its elementary schools.

The Program is intended to promote walking and cycling as a sustainable transportation choice for travelling to school by addressing safety concerns. Based on available information, such as aerial photographs, preliminary safety concerns for each of the schools were evaluated. With the lack of on-site observations, the general safety concerns common to most of the elementary schools are summarized below:

- **Sidewalks -** Lack of sidewalks in most neighbourhoods require school children to walk on the roadway, increasing their exposure to vehicle traffic.

- **Crossings -** Many of the crossings near the schools do not provide adequate level of control to facilitate pedestrian crossing. To improve pedestrian safety, curb extensions can be constructed at many of the school crossings. In addition, lighting, pavement, and other visibility improvements can be implemented to encourage walking as a mode of transportation to school.

- **Site Layout** – Many of the schools front high volume roads, which increase pedestrian exposure to vehicle traffic. For example, Brackendale Elementary is accessed via Government Road, which serves as an alternative north-south route to Highway 99.

At the private school, it is expected that students are from all areas of the District. Due to further distances, the percentage of students walking to school is expected to be considerably lower. Although fewer students walk, there are concerns regarding students potentially needing to cross Highway 99. Similar issues exist for Don Ross Secondary and Howe Sound Secondary.

Safe Routes to School Maps – Suitable routes would be identified and mapped for each elementary school in the District. There are four tasks involved in developing the safe routes to school maps.

1. Inventory of Active Transportation Assets

   It is suggested that the District collect data on the extent of existing cycling, pedestrian, and transit networks in the surrounding areas of the elementary schools. This includes: sidewalk coverage, bike lanes or paths, greenway facilities, transit stops, crosswalks, signs, traffic calming, and traffic controls.

2. Identify Stakeholders

   To understand the concerns and needs of the intended users, including those at drop-off and pick-up locations, major stakeholders should be identified and contacted for their perception of safety issues, facility deficiencies, and preferred routes. Stakeholder opinion can be obtained through public consultation in the form of a workshop or via web survey.

   It is suggested that the list of stakeholders include the following:

   - School District
   - Parent Advisory Committee
   - Law enforcement officers
   - District staff
   - Local residents, including students and parents

3. Identify Issues and Improvement Measures

   The District should identify pedestrian safety concerns based on the stakeholder responses and the condition/extent of existing assets. A number of short-term and long-term solutions should be evaluated. The District should develop a strategy to implement the solutions as part of routine maintenance, or as part of its capital works program.

4. Safe Routes to School Maps

   The District's engineering department should work together with the GIS department to prepare maps illustrating the preferred routes to each of the schools. Upon completing these maps, the District should distribute them to the schools.

There are also roles for others in the community to develop safe routes to schools, as shown in FIGURE 4.4.7.

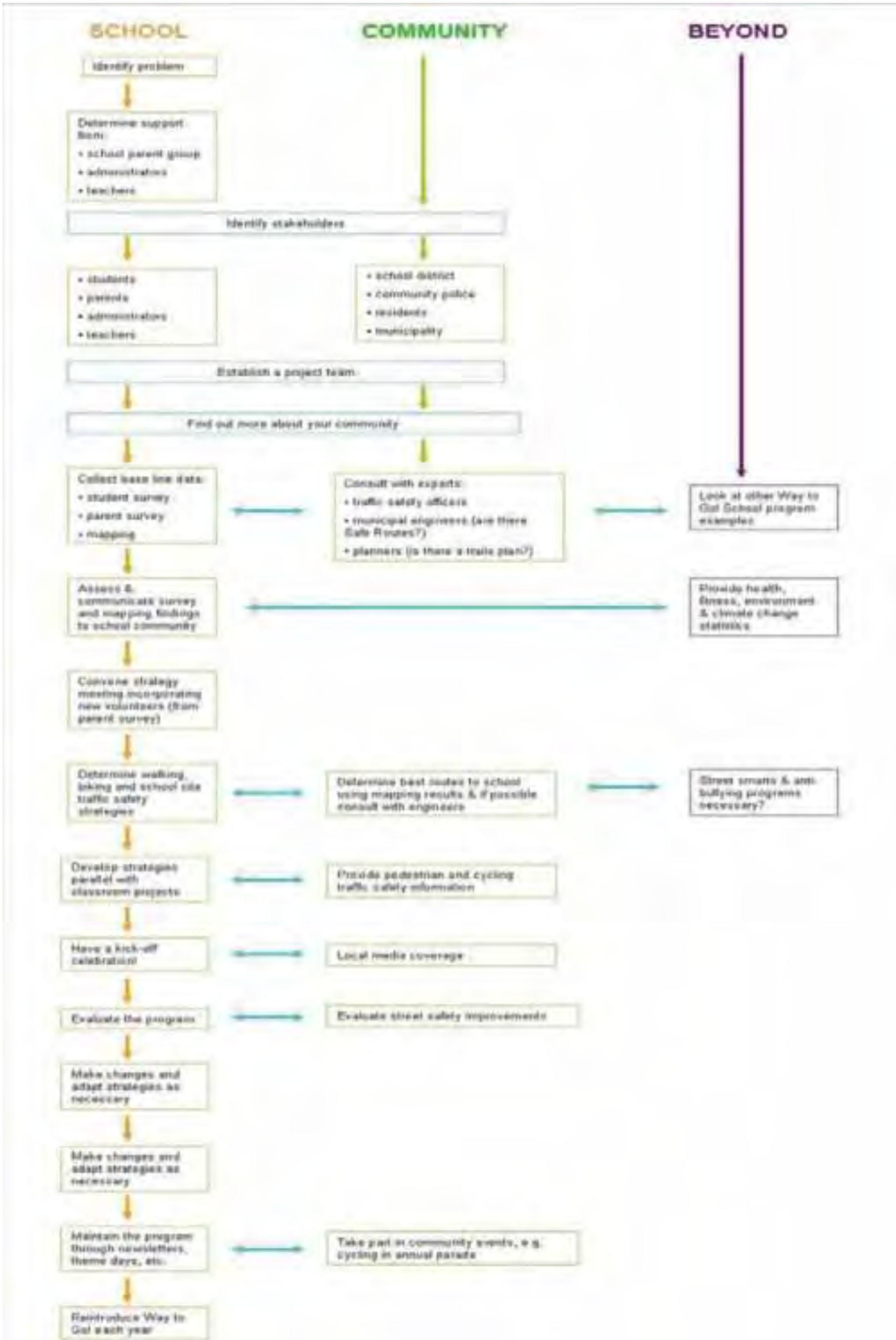


FIGURE 4.4.7 Safe Routes to Schools Roles

E. *Summary of Pedestrian Network Recommendations*

It is recommended that the District undertake the following measures to pursue the pedestrian network described herein:

- **Develop a systematic approach for routine evaluation of existing pedestrian routes with the objective being to eliminate discontinuities and obstacles to accessibility to the greatest extent possible;**
- **Based on the findings of the Safe Routes to School Program develop a list of priority pedestrian routes to complete in the short term;**
- **Consider an annual allowance of $100,000 in the Capital Budget for the development and improvement of pedestrian routes;**
- **Ensure that all traffic reports commissioned by or completed for the District gather information on current pedestrian and cycling movements;**
- **Establish Downtown Squamish as a pedestrian first zone.**

4.5 Wildlife Corridors

4.5.1 Background

Squamish is surrounded by wilderness which is one of its great gifts. This wilderness interface means that the community has a very close relationship with its wildlife populations and not neccessarily only when recreating in the wild. For this relationship to continue to be a harmonious one, a good understanding of animal travel patterns is needed, particularly, the corridors that animals with extensive ranges use on a regular basis. If left unheeded human/ wild animal conflicts will proliferate as urbanization continues.

In recent years the District has begun to gather information that will be needed to develop strategies to protect both human and wildlife populations but at this stage there is very little information on the subject. In 2009 the District completed a Terrestrial Ecosystem Mapping Study. This study sought to establish the presence or absence of a number of marker species and to determine the ecological conditions associated with their success. The study did not specifically look at corridors but may offer some useful inferences that could lead to further study. The District of Squamish is also a Bear Aware Community and since 2008 has kept statistics on bear sightings in the urban area.

The Ministry of Transportation and Infrastructure keeps statistics of animal recovery on the Sea to Sky Highway but that information alone is insufficient to establish specific patterns. While this information is useful more information needs to be gathered from sources such as the Ministry of Forests and Lands.

4.5.2 Recommendations

The District should endeavour to determine where wildlife corridors exist, so that the planning of greenways and riparian zones can appropriately account for animal movements. Having such information will also help identify potential conflicts with human transportation systems.

It is recommended that the District collaborate with Provincial agencies having information and expertise on the subject of wildlife movements and develop a strategy for identifying and managing wildlife corridors.

5.0 COMMERCIAL TRANSPORT

5.1 Truck Routes and Goods Movement

5.1.1 Background

As part of the Squamish 2031 Multi-Modal Transportation Study, commercial traffic and goods movement were assessed.

Previous documents dealing with commercial traffic in Squamish were reviewed. Documents are listed in TABLE 5.1.1.

TABLE 5.1.1 Relevant Documents for Commercial Traffic Review

No.	DOCUMENT TITLE	YEAR	FORMAT
1	Squamish Oceanfront Peninsula Sub-area Plan	2010	Document
2	District of Squamish Official Community Plan	2009	Document
3	Downtown Squamish 2031 Transport Plan (CTS)	2009	Document
4	Retail, Commercial, Industrial Strategy (Van Struth)	2005	Document

Truck routes are typically designated as the road which will provide:

- As direct routing as possible;
- Access to the desired destinations;
- A roadway capable of safely accommodating the expected vehicle; and
- Minimal intrusion to the surrounding community.

Given these criteria, existing conditions were examined and opportunities and issues were identified.

5.1.2 Existing Conditions

Existing Truck Routes

The existing truck routes and proposed major routes, as defined in the District's OCP Schedule G are shown above in FIGURE 4.1.1. The primary downtown truck route is comprised of Cleveland Avenue from the Highway 99 to the Cleveland Avenue/ Buckley Avenue intersection, Loggers Lane from this intersection to

Vancouver Street, Vancouver Street from Loggers Lane to Third Avenue and Third Avenue south of Vancouver Street. In addition the OCP identifies an alternate route connecting the Downtown with the Railyards and Business Park by way of Bailey Street and Government Road. Although the portion of Government Road west of Queensway is designated as a truck route in the OCP, it currently consists mainly of unpaved gravel road from Bailey to the Railyards, which is generally unsuitable for the majority of commercial traffic. In addition there is no physical connection between Loggers Lane and Bailey Avenue for northbound traffic, making Cleveland Avenue the only viable truck route. As such, Highway 99 provides connection for commercial traffic between major destinations within Squamish. This is not considered to be a sustainable situation by the District. A more direct connection between the Industrial Lands in the south end of the Downtown peninsula and the Railyards/ Business Park is thought to be an imperative from an economic development perspective and it is believed that the use of the existing primary truck route will become less and less palatable as residential housing and public amenities are developed on the Loggers Lane corridor.

Plans exist in the Squamish OCP Schedule G for a new truck route, the 7th Avenue Connector which is proposed to follow the existing CN spur line south from Government Road to a westerly extension of Pemberton Avenue and/ or Vancouver Street. The proposed connector would provide a more direct connection between downtown industrial lands and Railyards/ Business Park that does not route through the downtown It would thereby improve the efficiency of goods movement by avoiding turning limitations and traffic volumes associated with the existing Loggers Lane/Bailey Street connection, as well as promote a more pedestrian and bicycle friendly downtown image. FIGURE 5.1.1 shows a close-up of the 7th Avenue Connector as defined in the District's OCP Schedule G.

Major Commercial Destinations

Areas designated as Employment and Industrial Land uses are outlined in the District's OCP Schedule B, which is shown in FIGURE 2.2.1 above. Within these areas, key destinations include the:

- Squamish Terminals;
- Squamish Industrial Park; and
- CN Rail Terminal west of the Industrial Park.

- Squamish Oceanfront Peninsula

Among destinations that are not necessarily considered Employment and Industrial, but may act as major destinations for commercial vehicles in Squamish include large grocery and big box stores such as Extra Foods, Nester's Market, Canadian Tire, and Wal-Mart.

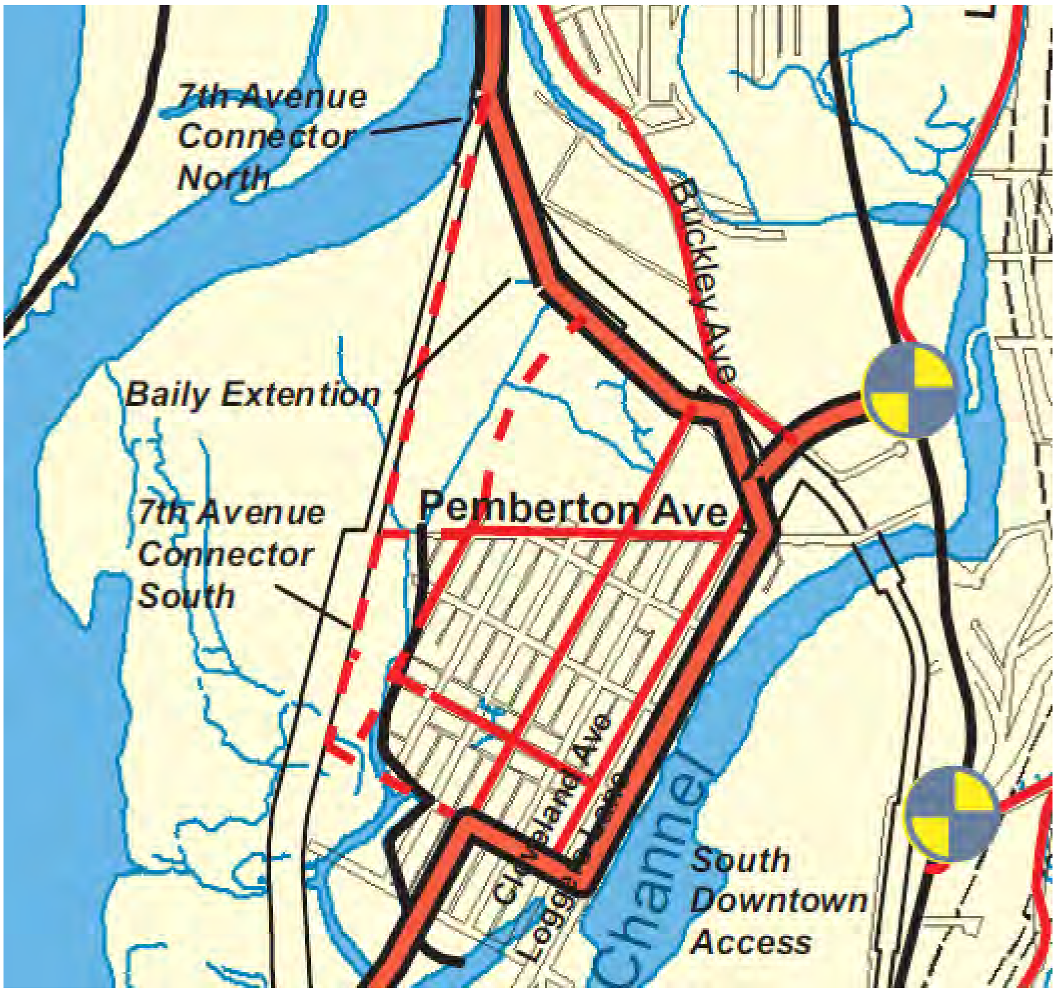


FIGURE 5.1.1 7th Avenue Connector, OCP Schedule G

Existing Commercial Vehicle Traffic

As mentioned above in SECTION 3.1.4, an origin-destination license plate survey was conducted to determine internal and external trips. Commercial vehicle license plate origin-destination results were isolated and analyzed separately. The results are summarized in TABLE 5.1.2 and TABLE 5.2.3, which show that commercial vehicles generally follow the same trends as vehicles overall, but in all cases exhibit significantly fewer external-external trips. It is important to note that commercial vehicles were separated based on their license plates, and may not necessarily be representative of heavy truck traffic.

Results suggest that Squamish is a major commercial vehicle destination within the region as relatively few commercial vehicles pass through without stopping. This likely corresponds to the presence of inter-modal port and rail facilities, industrial and commercial land use within Squamish, and the District's proximity to resource-based industry.

TABLE 5.1.2 Commercial Vehicle O-D Survey Results by Destination

DESTINATION %		DESTINATION						
		Internal Trips		External Trips: Shannon Falls		External Trips: Alice Lake		Total
ORIGIN	Shannon Falls 15:45-16:45	105	90%			12	10%	**117**
ORIGIN	Alice Lake 16:15-17:15	69	93%	5	7%			**74**

TABLE 5.1.3 Commercial Vehicle O-D Survey Results by Origin

ORIGIN %			DESTINATION: Shannon Falls	DESTINATION: Alice Lake
ORIGIN	Internal Trips		69	47
			93%	80%
	External Trips	Shannon Falls 15:45-16:45		12
				20%
	External Trips	Alice Lake 16:15-17:15	5	
			7%	
	Total		**74**	**59**

Traffic counts conducted by CTS suggest that Squamish experiences relatively low truck volumes, with only 1.7% heavy trucks observed at Shannon Falls and 3.8% heavy trucks observed at Alice Lake during the afternoon peak period.

5.1.3 Opportunities

The following opportunities were noted during this study:

- **Centralized industrial land uses.** Aside from some Restricted Industrial land use north of Brackendale, the OCP defined employment and industrial land uses are all located within the southern half of Squamish below the Mamquam River. Besides the Squamish Terminals, Oceanfront lands and some smaller areas off Highway 99 south of the Downtown, the majority of Employment and Industrial land is concentrated around the Business Park and Railyards west of the highway and along the Mamquam River east of the highway. Given the relative proximity of industrial uses, fewer dedicated truck routes will be required to facilitate efficient goods movement.

5.1.4 Issues

The following issues were noted during this study:

- **Existing truck route goes through the Downtown.** The existing truck route to the Squamish Terminals travels through the Downtown along Loggers Lane, and is accessed from Highway 99 at the Cleveland Avenue intersection. The Loggers Lane right-of-way may not be ideal for heavy truck traffic and given the potential future development of the waterfront, continued truck routing along Loggers Lane may be considered an undesirable intrusion into the surrounding community.

- **Turning limitations at Bailey Street/Loggers Lane and Cleveland Avenue.** The Squamish OCP Schedule G defines a connection between Bailey Street and Loggers Lane. Given the existing configuration of the Bailey Street and Loggers Lane intersections with Cleveland Avenue, through movement between Bailey Street and Loggers lane is not possible. The District is currently exploring options to reconfigure the intersection.

- **Government Road unpaved.** The section of Government road between the Downtown and the Squamish Rail Yards is currently unpaved. The existing roadway can be deemed inadequate to accommodate heavy truck traffic, which contradicts its designation as a truck route and its intended use as an alternate route to Highway 99.

- **7th Avenue Connector may affect environmentally sensitive lands.** Based on the Squamish OCP Schedule G, the proposed 7th Avenue Connector occupies a transportation corridor through the Squamish Estuary which was identified in the 1999 Squamish Estuary Management Plan. The potential environmental impacts of road construction for the connector will require careful evaluation and mitigation strategies may have to be developed before construction can begin.

- **Physical restrictions on existing truck routes.** Stakeholders and the Downtown Squamish Plan have identified numerous physical constraints on the existing truck routes. These include the one-lane bridge at the south end of 3rd Avenue, as well as difficult turns from Vancouver Street to Loggers Lane.

- **Planned Land Use on Loggers Lane may be incompatible with truck route.** Long term plans have identified property west of Loggers Lane for redevelopment to medium-density residential. This fronting land use, and the presence of pedestrians, may prove incompatible with truck volumes.

5.1.5 Recommendations

The following discussion provides in-depth analysis or additional discussion related to commercial transport recommendations where applicable. A full list of recommendations made as part of this plan is provided in SECTION 6.0.

A. *Evaluation of Downtown Truck Routes*

The Squamish Terminals is a key industry, and represents the major truck destination in the Downtown. As such, the primary purpose of truck routes through the Downtown is to provide connection to the Squamish Terminals.

Providing connection to marine industrial uses on the peninsula as proposed in the Oceanfront Sub-Area Plan is also a minor consideration. Other key considerations include:

- The current OCP designates Loggers Lane as the primary truck route connecting Highway 99 and the Squamish Terminals. Future plans envision a developed downtown waterfront with residential and commercial uses. As plans proceed, the impact of trucks along Loggers Lane will become undesirable.

- Highway 99 is the only means of connection between the Squamish Terminals and the Industrial Park/Rail Yards.

- The current OCP defines Bailey Street as an alternate connection between the Squamish Terminals and the Industrial Park/Rail Yards. There are several issues with this:
    - No viable truck connection currently exists between Loggers Lane and Bailey Avenue.
    - Bailey Avenue is not paved north of the Downtown.
    - The District has plans to develop a multi-modal hub in the Downtown. The most likely potential location is Bailey Street and 3rd Avenue. Given the location of the hub, it may be undesirable to have significant truck traffic on Bailey Street.

- The District is exploring configuration options for the Loggers Lane/Bailey Street intersection. The objectives of a new configuration are three-fold: 1) to facilitate a connection between Loggers Lane and Bailey Street; 2) to deliver multi-modal connectivity that would be needed if a central transportation hub was to be established in the vicinity; and, to support Cleveland Avenue as a gateway to the Downtown. Given the latter two objectives, re-configuration of the intersection may move forward whether or not a Loggers Lane/Bailey Street truck connection is desired.

- The proposed 7th Avenue Connector has historically been viewed as the ultimate truck route for the Downtown. There are some issues with this:

- o The route is surrounded by environmentally sensitive estuary lands. Although the connector was included in the 1999 Squamish Estuary Management Plan (SEMP) there are concerns with the impact a truck route might have.
- o Connection to Cleveland Avenue/ Highway 99 would likely be by way of Pemberton Avenue. It is important to determine if establishing the 7^{th} Avenue Connector as the ultimate truck route precludes any alternative truck routes in the Downtown.

It is suggested that the District conduct an in-depth evaluation of truck routes before firmly establishing plans and policies for truck routes in the Downtown. The objective of this evaluation is to achieve balance between efficient truck movement, impacts on other modes, impact to the surrounding community, and the other considerations mentioned above. Key evaluation criteria include:

- Long term transportation needs of downtown industries
- Cost of implementation
- Direct routing (movement efficiency)
- Impact to traffic operations
- Impact to adjacent property
- Environmental impacts
- Potential for alternative connections
- Long term goals of the District

A cursory evaluation of truck routes for the Downtown was conducted for discussion purposes and is shown in TABLE 5.1.4. Although some roads are clearly not suitable as truck routes, the evaluation includes all north-south roads in the Downtown for comparison. This cursory analysis assumes that Bailey Street will be paved, and that the existing Loggers Lane / Bailey Street intersection remains in its current configuration (i.e. no connection between Loggers Lane and Bailey Street).

TABLE 5.1.4 Downtown Truck Route Evaluation

Road	Low cost to implement	Direct routing / minimal conflict with other traffic	Low impact to adjacent property	Minimal potential Environmental Impacts	Provides connection to Industrial Park/ Rail Yards
Loggers Lane	Medium	Medium	Poor	Medium	Poor
Cleveland Avenue	Poor	Poor	Poor	Good	Medium
2nd Avenue	Medium	Medium	Poor	Good	Poor
3rd Avenue	Medium	Good	Poor	Good	Good
6th Avenue (Proposed)	Poor	Good	Medium	Medium	Medium
7th Avenue (Proposed)	Medium	Good	Good	Poor	Good

● Good	● Medium	● Poor

Results of the cursory evaluation indicate that the best option to the 7th Avenue Connector is 3rd Avenue. A truck route on 3rd Avenue can be seen as desirable given it provides a reasonably direct route through to the Squamish Terminals, few commercial developments are located along the route (although residential and institutional uses are an issue), and it does not reside on any environmentally sensitive lands. This evaluation is preliminary at best, and is meant to highlight the most feasible options available for truck movement through the Downtown.

None of the routes satisfy all criteria. Based on results shown above, it is recommended that the District undertake a detailed evaluation of truck routes in the Downtown and that options be limited to Loggers Lane, 3rd Avenue, 6th Avenue, and the 7th Avenue connector as the most feasible truck routes. Once a preferred route is identified, mitigating measures could be developed in greater detail.

It is recommended that once the needs of industry are better understood that the District complete a detailed analysis of truck route options in the downtown based on the key factors and preliminary assessments included in this report.

It is recommended that as an interim measure that the District consider improvements to the existing truck route at the intersections of Vancouver Street with Third Avenue and with Loggers Lane and that parking be set back far enough from the intersections so as not to pose a hazard.

Additional Truck Routes

Notwithstanding any new plans for truck routes in the Downtown, the changes to the existing truck routes proposed as part of the Squamish 2031 Multi-Modal Transportation Plan are shown below in FIGURE 5.1.2. These changes ensure that all industrial and restricted industrial land uses in Squamish are served by truck routes. Proposed new truck routes are highlighted below:

- 7th Avenue Connector (Downtown Option1)
- 3rd Avenue (Downtown Option 2)
- Commercial Way
- Extension of Centennial Way
- Squamish Valley Road

B. *Marine and Rail Transport*

The District of Squamish already has fairly well established marine and rail infrastructure. There is little potential for expanding land use associated with commercial marine and rail transport given that:

- Existing rail lines already serve the industrial park and the Squamish Terminals; and

- Environmentally sensitive lands limit the expansion of land available for the Squamish Terminals.

The land belonging to the Squamish Nation on the east side of the Mamquam Blind Channel, known locally as Site 'B', is zoned industrial and is adjacent to the CNR mainline so depending on the ultimate use of this land there may be a need for rail service.

It is recommended that the District take steps to ensure that rail and marine transport are as attractive and efficient as possible. This involves:

- **Protecting currently zoned industrial land uses near the terminal and rail yards.**
- **Improving the connection between the terminals and rail yards by establishing truck route(s) that provide the most direct connection between the two sites.**

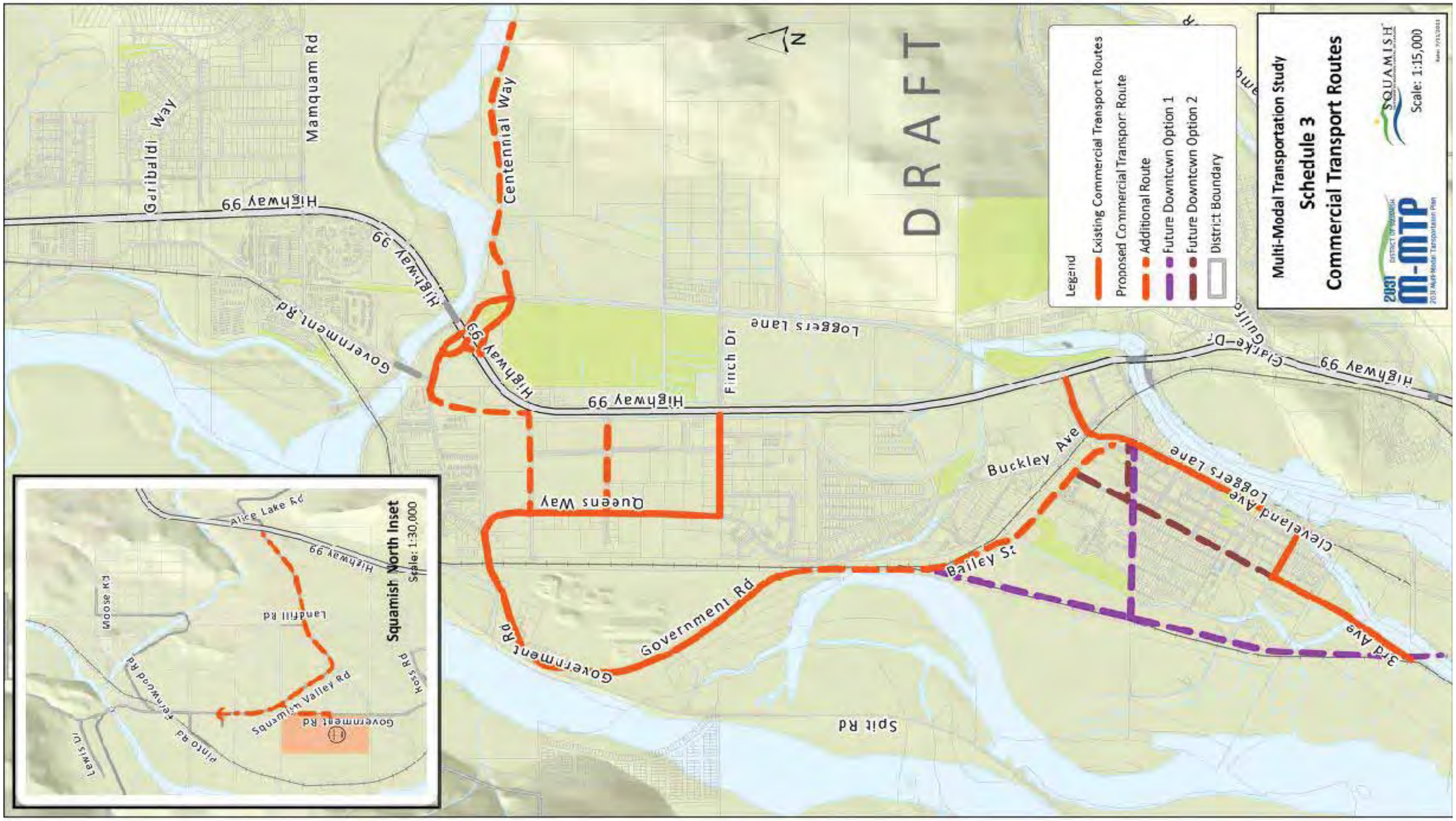


FIGURE 5.1.2 Schedule 3 – Proposed Commercial Transport Routes

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

6.0 FINDINGS AND RECOMMENDATIONS

6.1 Introduction

The following sections provide a summary of recommendations that are extracted from SECTION 3.0 - Highway Interface and Regional Transportation, SECTION 4.0 – Local Networks and SECTION 5.0 Commercial Transport. Included are recommendations previously made as part of the Squamish 2031 Multi-modal Transportation Plan Report #1 – Network Issues that have been refined throughout Phase II of the study, as well as new recommendations developed based on the feedback and additional analysis involved in Phase II.

Cursory evaluations of the issues and recommendations were conducted for each of the study sub-topics to provide the District with some guidance in setting priorities and timelines. A 'good', 'medium' or 'poor' rating was applied to each one of the following criteria:

- Cost
- Benefit (i.e. addresses key gaps in the Squamish system)
- Ease of implementation
- Likelihood of affecting mode shift
- Difficulty associated with coordinating with other agencies

Recommendations are grouped into short-term (zero to five years), mid-term (six to ten years), long-term (longer than ten years) and on-going recommendations. Recommendations that showed the greatest benefit relative to cost or those that were deemed necessary to address fundamental network gaps were favoured for the short-term unless they were very difficult to implement. Those that required prior resolution of significant issues were designated medium-term. Complex issues or issues associated with future development were shown as long-term. On-going recommendations are changes that span the entire network and will involve many individual changes with varying timeframes.

In addition, because the fundamental goal of this study is to move the District towards more sustainable forms of transportation, it is critical that progress towards that goal be tracked. Therefore the last section recommends a mode shift target and proposes a set of key success measures that should be monitored and reported on annually.

6.2 Highway Interface and Regional Transportation

6.2.1 Highway Interface Issues

Highway intersections are expected to perform at acceptable levels of service within the 2031 Planning horizon with some cautions and exceptions. The traffic congestion on the highway during the Friday PM and Sunday PM peaks, particularly in February and August, is expected to worsen. It is difficult to say if and when local traffic will be affected to the point where conditions become unpalatable. It is also possible that as the level of service on the highway deteriorates that highway traffic will spill over into the municipal road network causing local delays.

Some of the key Highway 99 Interface issues which have emerged from this study are discussed below.

A. Address Queue Length Issues at Mamquam Road

The existing level of service and queue length issues for the westbound left-turn movement at the Mamquam Road and Highway 99 intersection should be addressed. This movement in particular experiences significant capacity issues during most if not all peak times, and it is recommended that the District work the the Ministry of Transportation to explore short-term solutions, such as changing the existing westbound through lane to a shared left-through lane, to alleviate delays.

B. Address delays at key intersections

Where delays are unacceptable, the District should explore means of alleviating delays. Solution options may range from short-term solutions, such as changing signal phasing/timing, to long-term solutions, such as road network improvements. Good decisions will require good data. It will be critical for the District to develop a close working relationship with the MoTI so that as issues arise they can be dealt with expeditiously and to the mutual satisfaction of both parties. Key intersections include the Highway intersections at Mamquam Road, Industrial Way, and Cleveland Avenue. It is anticipated that major intersection improvements will be required in the long term.

C. *Look to negotiate safety improvements along Highway 99 Corridor*

Safety issues persist along the Highway 99 corridor. It is recommended that the District work with the MoTI to continue implementing the safety improvements recommended in the Safer City Initiative - A Review of Collision and Claim Trends - Squamish, British Columbia (Hamilton Associates, 2002). Highway corridor safety is both a local and regional concern and recommended improvements should also be viewed as regional transportation initiatives.

TABLE 6.2.1, below, provides a cursory evaluation of Highway 99 interface issues.

TABLE 6.2.1 EVALUATION OF HIGHWAY 99 INTERFACE ISSUES

Recommendation	Low cost to implement	Addresses Key Gaps	Ease of Implementation	Likelihood of Affecting Mode Shift	Coordination with Other Agencies not an Issue
Address Queue Lengths at Mamquam Rd	Good	Poor	Good	n/a	Medium
Address delays at Highway Intersections	Good	Poor	Good	n/a	Medium
Hwy intersection Safety Improvements	Medium	Poor	Medium	Poor	Medium

Good	Medium	Poor

HIGHWAY INTERFACE RECOMMENDATIONS
The following steps are recommended to address Highway Interface issues:

SHORT-TERM

1. **Through BC MoTI, add a shared westbound left-turn/ through lane at Mamquam Road and Highway 99 as soon as possible to alleviate existing capacity issues.**

2. Request that the Murrin Park counting station (P-15-8NS) or equivalent be reinstated by BC MoTI.

ONGOING

3. Request that BC MoTI commit to not changing signal timing on any of the Highway intersections in Squamish without first consulting the District and further that an ongoing dialogue be established on how regional and local traffic demands may be balanced in a way that meets the objectives of both parties.

4. Regularly request turning movement data for the highway intersections from BC MoTI and augment with short counts as necessary.

5. Conduct traffic counts at strategic locations on Government Road during the PM peak on Fridays and Sundays in August as a means of establishing the impact of peak highway traffic on the local road network.

6. Continue to work with BC MoTI to implement the safety improvements recommended in the Safer City Initiative Report as a means of improving safety and lowering collision frequencies at highway intersections.

6.2.2 Regional Transportation Issues

Some of the key issues associated with regional transportation patterns are discussed below.

A. Formalize Park-and-Ride Facilities in Squamish

Providing formal park-and-ride facilities with adequate amenities will provide additional opportunities for commuters to take multi-modal trips in addition to facilitating carpooling amongst residents. The regional multi-modal impacts of park-and-ride facilities will depend on the existence of commuter transit or other services between Squamish, Whistler, and Metro Vancouver.

B. Support Ride Matching Services

A formal ride matching service can facilitate matching of potential carpool partners. Carpooling within Squamish may prove to be efficient given the concentrated populations and centres of employment. To facilitate car/vanpooling, a formal on-line ride matching service, such as SKWEZ, can be supported by the District, or alternatively, the District could provide this service. The service can take the form of a website that allows users to find commuters with similar travel patterns. Given the largely varying schedules and destinations or external commuters, a user operated system would be most effective at matching potential carpool partners.

C. Co-ordinate efforts to reduce demands on Highway 99, particularly during peak periods.

In the long term, the District should work with other regional agencies to understand and address regional transportation concerns. Highway 99 is a key corridor both regionally and locally, and as such its performance will need to be evaluated in the long-term as the goals, expectations, and growth of each community in the region changes.

The District should coordinate efforts with the Resort Municipality of Whistler to market Whistler as a pedestrian and cycling friendly community. Without the need for a personal vehicle in Whistler, visitors may be more inclined to use alternative modes when travelling to Whistler.

D. Look to provide more internal employment opportunities

A large proportion of Squamish's workforce is employed externally. To reduce external SOV trips, the District can take steps towards increasing the number of employment opportunities within Squamish. Establishing Squamish as a major centre of employment will reduce external trips overall, which will in turn reduce the overall number of SOV trips.

E. Work with Corridor Municipalities, the Province and BC Transit to Establish a Sea to Sky Corridor Transit Service

BC Transit is undertaking a Sea to Sky Corridor Transit Master Plan Study which will be completed in 2012. It is clear that for such a service to be successful it will have to address the needs of Squamish residents. Currently it is estimated that over 30% of the Squamish work force commutes to either Whistler or the Lower Mainland on a regular basis. Despite the District's best efforts to create more employment opportunities within the District limits it is not expected that this percentage of commuters will change appreciably in the foreseeable future.

F. Consider Regional Transportation Hub Options

In order to plan transportation networks, transit services and land use appropriately it will be necessary to evaluate downtown options for a Regional Transportation Hub. If the opportunity to create a hub is not protected and embedded in planning policy it may well be lost by default.

G. Explore options for establishing ferry and/or rail service for external trips

Demand has been expressed for light rail and/or ferry services to/from Squamish. The District may wish to explore these transportation alternatives, and should provide planning space for such improvements in their future plans and policies. It is critical that the District protect available lands for these uses should they be considered a viable option moving forward.

TABLE 6.2.2, below, provides a cursory evaluation of Highway 99 interface issues.

TABLE 6.2.2 EVALUATION OF REGIONAL TRANSPORTATION ISSUES

Initial Priority	Issue	Low cost to implement	Addresses Key Gaps	Ease of Implementation	Likelihood of Affecting Mode Shift	Coordination with Other Agencies not an Issue
1	Ride-matching service	⬤	●	⬤	●	⬤
2	Park-and-Rides	●	•	●	●	●
3	Sea to Sky Commuter Bus Service	•	⬤	•	⬤	●
4	Multi-modal hub in the Downtown	•	●	•	⬤	●

5	Ferry and/or rail services	•	⬤	•	●	●
Initial Priority	**Issue**	**Low cost to implement**	**Addresses Key Gaps**	**Ease of Implementation**	**Likelihood of Affecting Mode Shift**	**Coordination with Other Agencies not an Issue**
6	Reduce demands on Highway 99	●	•	•	●	•
7	Provide more internal employment opportunities	n/a	•	•	●	⬤

A Sea to Sky Corridor commuter bus service would deliver much higher benefits than Park-and-Rides, however, the cost and lesser ease of implementation take it out of the realm of short term deliverables. It is still considered to be a short term action items in that sense that attention to the issue is recommended in the short term.

REGIONAL TRANSPORTATION RECOMMENDATIONS

The following summarizes the steps which are recommended with respect to Regional Transportation Services:

SHORT-TERM

1. **Consider hosting an on-demand ride-matching database or alternatively partnering with other service providers to offer this service.**

2. **Develop two formal park and ride sites in close proximity to the highway, one towards the south end of the urban area and the other towards the north end.**

3. **Work closely with the Province, BC Transit and other corridor communities to establish a viable, regularly scheduled transit service for the Sea to Sky corridor.**

4. **Consider the potential for a regional transportation hub through discussion of the Sea to Sky Corridor Transit Master Plan with BC Transit and include hub considerations in any land use or transportation network decisions taken in the upper downtown area bounded by Buckley Avenue, Pemberton Avenue, Third Avenue and Loggers Lane.**

LONG-TERM

5. **Preserve the opportunity to implement passenger ferry service as a regional transportation option.**

6. **Investigate the potential for expanding rail services and include in analysis of a central transportation hub.**

Figure 6.2.1, Schedule 1 below, identifies the regional networks as well as existing and potential linkages that should be expanded or reserved for the future.

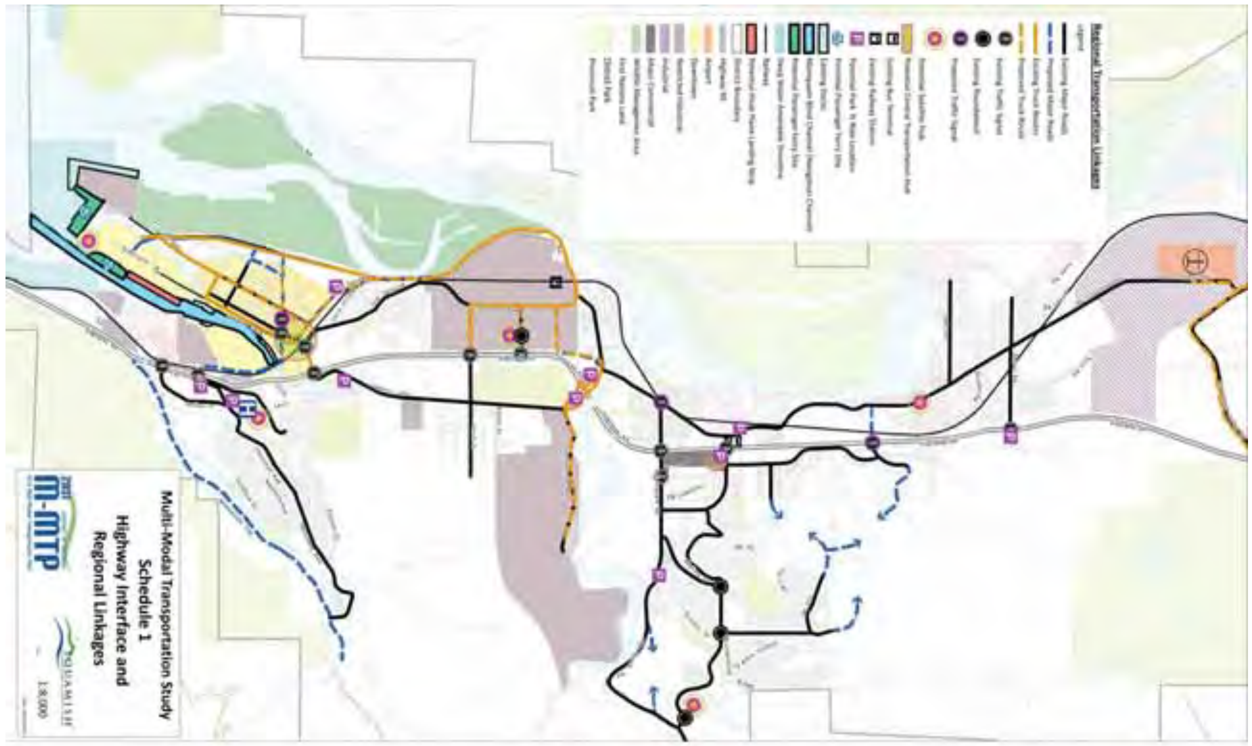


FIGURE 6.2.1 Schedule 1 – Highway Interface and Regional Linkages

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

6.3 Local Networks

6.3.1 Road Network Improvements

Proposed changes to the local road network are shown in FIGURE 6.3.1, Schedule 2A - Major Roads, below. Where the schedule shows arrowheads the intent is for a future road connection to be made when demand dictates and an alignment is known.

Table 6.3.1, below, evaluates proposed major road network improvements and provides a coarse comparison. Each item was given a good/ medium/ or poor rating under each of the following criteria:

Affordability
This factor assesses the cost of the project versus the availability of funding from other sources, primarily from the development cost charge reserve fund or a specific development project.

Mode Shift
This factor addresses the benefit of the project from the perspective of supporting mode shift by either delivering infrastructure for other modes such as transit, cycling or walking or preferably by creating a reasonable mode shift opportunity.
Addresses Key Gaps
The importance of the project from a connectivity perspective is evaluated here. Consideration is also given to whether there is likely to be a GHG reduction benefit from shortening trips.

Readiness
This factor assesses the number of issues that would have to be addressed for the project to proceed. These could include outside agency approvals, property requirements or environmental impacts. A project that is shelf ready but is not funded would have a high rating here but a low rating under affordability.

Timing
This factor indicates the imminence of the project from the perspective of need or value delivered but not necessarily readiness. A project that is needed but is dependent on development to proceed could have a high rating here but a low rating under readiness.

TABLE 6.3.1 Comparison of Local Road Network Improvements

Initial Priority	Proposed Improvement	Affordability	Mode Shift	Address Key Gaps	Readiness	Timing
1	North 7th Ave Connector	●	●	⬤	●	⬤
2*	Laurelwood Connector	⬤	●	⬤	•	●
3	Downtown Entrance	•	⬤	⬤	•	⬤
4*	Newport Ridge Drive Extension	⬤	●	⬤	•	●
5	Pioneer Way/ Queensway to Gov't Rd Bridge	●	●	⬤	•	●
6	North Road/ Hwy 99 to Gov't Road	●	●	⬤	•	●
7*	Mamquam Road/ Mashiter Cr to Quest University	⬤	●	⬤	•	•
8	South 7th Ave Connector	•	●	●	•	•
9	Mamquam FSR	•	•	●	•	•
10*	North Road/ Tantalus Road to Pia Road	●	•	●	•	•

**delivered through development*

⬤ Good	● Medium	• Poor

The above analysis indicates that for the most part the proposed roads address gaps in the network. It also points out that none of the projects are ready to go. Nevertheless, a viable alternate access to the downtown and/ or resolving issues with the Cleveland Avenue entrance remain relatively high priorities that if left unattended will become impediments to a number of downtown initiatives.

With some improvements the existing road network is expected to perform well up to the 2031 planning horizon. A summary of short-to-mid-term and long-term costs for proposed road network improvements is provided in TABLE 6.3.2. These costs represent only those improvements that will be needed by 2031 irrespective of the level of development activity. They have been extracted from the complete list of projects which is included in Appendix 'F' to this report. Major new developments will trigger the need for additional improvements and will presumably carry the cost burden either through the DCC structure or as direct costs.

TABLE 6.3.2 Local Road Network Improvement Cost Summary

IMPROVEMENT TYPE	ESTIMATED COST	FUNDING SOURCE		
		DCC	General	Reserve
SHORT to MID-TERM PROJECTS (2012 -2021)				
New Major Roads	$5,040,000	$2,880,000	$2,010,000	$150,000
Bridges	$3,000,000	$0	$3,000,000	$0
Intersections	$850,000	$550,000	$300,000	$0
Short to Mid-term Sub-total	$8,890,000	$3,430,000	$5,310,000	$150,000
LONG-TERM PROJECTS (2022 - 2031)				
New Major Roads	$6,840,000	$4,455,000	$2,385,000	$0
Bridges	$7,500,000	$6,250,000	$1,250,000	$0
Intersections	$500,000	$500,000	$0	$0
Long-term Sub-Total	$14,840,000	$11,205,000	$3,635,000	$0
TOTAL	**$23,730,000**	**$14,635,000**	**$8,945,000**	**$150,000**

(Note: This list of improvements has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports). A complete list of improvements is included in Appendix 'F'.

The following steps are recommended with respect to the Major Road Network:

SHORT TERM

1. **Revise the P-1 plan in the Subdivision and Development Control Bylaw to reflect the road classifications identified in Schedule 2A ~ Major Roads and review the geometric design standards and typical cross-sections for each road class.**

2. **Complete a Downtown Entrance Study for the area bounded by Highway 99 on the north, Pemberton Avenue on the south, Bailey Street/ Third Avenue to the west and Loggers Lane to the east taking into account the following key issues:**
   - **Emergency access**
   - **Pemberton Avenue entrance**
   - **Bailey Loggers Lane disconnect/ truck routing**
   - **Cleveland Avenue gateway**
   - **Downtown transportation hub**
   - **Network connections for all modes of transportation**

3. **Add the proposed network roads which are not currently associated with specific land developments in the next update of the Development Cost Charge Bylaw.**

ON-GOING TO LONG TERM

4. **Include the proposed network roads whose need arises from general growth (traffic and/or safety concerns) in the District's capital budget planning process.**

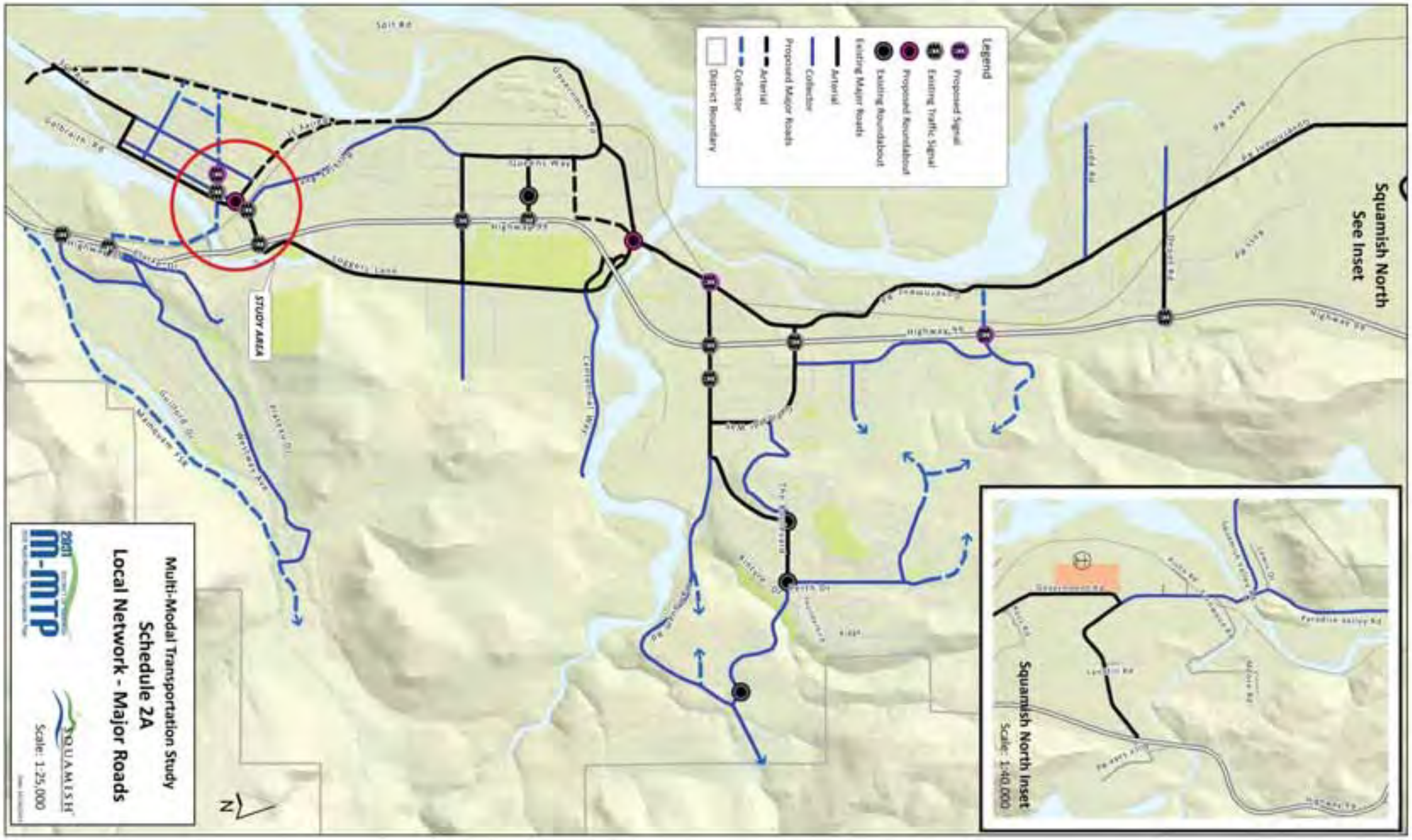


FIGURE 6.3.1 Schedule 2A – Proposed Major Road Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

6.3.2 Local Transit

The District is currently in a dialogue with BC Transit on options for the delivery of local public transit services. Accordingly, this report does not make specific recommendations regarding the service model. Two things are clear - there is a significant unfulfilled demand for transit service and the cost of the current service model is unsustainable.

Public transportation in some form will be critical to meeting the multi-modal concept of this plan and its mode shift objectives. Some key issues associated with local transit have been identified that should be included in this process.

It is recommended that the following items be part of the assessment of Local Transit Options:

SHORT-TERM

1. **In addition to a Regional Transportation Hub in the downtown, explore the potential to establish a satellite transportation hub, including transit service and a park and ride lot in the vicinity of Highlands Mall;**

MID-TERM

2. **Develop transit supportive infrastructure once a local transit service model is adopted by the District; and,**

LONG-TERM

3. **Monitor other possible satellite hub sites with a view towards formalizing the sites if and when development and/ or demand dictate.**

6.3.3 Bicycle Routes

The preliminary assessment of bicycle routes described in section 4.3 will need to be refined into a prioritized list of projects that will ultimately deliver the bicycle network described in Figure 6.3.2. Specific considerations should include:

a. Develop Standards for all forms of Bicycle Routes

The District should develop a set of standards for bikeways based on the Transportation Association of Canada (TAC) standards as well as international best practices. These should include intersection treatments that deliver a legible and consistent message to cyclists and motorists alike. Key examples of where such standards would be applied are where the Corridor Trail or the Discovery Trail cross major roads or at the intersection of major roads with bike lanes.

FIGURE 6.3.2 Bike Box Intersection Option

b. Develop Parking Policy on Bike Routes

An important adjunct to applying a set of standards for bikeways on roads is to review parking requirements so that the two functions can be reconciled. There are instances where the physical limitations of the road allowance may impinge on one use or the other. A policy describing if and when parking is allowed and how the available space should be allocated will ensure that solutions account for all needs and are developed to a consistent set of standards.

c. Collect Bicycle and Pedestrian Traffic Data

Bicycle and pedestrian traffic volumes should be monitored when vehicle volume counts are conducted. This will act as a base case when evaluating future improvements that are implemented. Counts should be concentrated on currently identified cycling and pedestrian routes. In the long term, the District should work towards monitoring usage on off-street commuter routes as well. The District can enact policy to require developers to collect bicycle and pedestrian data while they are conducting counts for traffic impact assessments. It is also recommended that the District store all bicycle and pedestrian count information within a database or their GIS system. This will greatly improve the storage and retrieval efficiency of such information.

d. Improve bicycle route signage and markings

Additional bicycle route signage or pavement markings are recommended for a number of bicycle routes in Squamish, such as Westway Avenue to raise both driver and cyclist awareness that the road is a shared use bike lane. The District can implement these changes in conjunction with regular maintenance. The District should also consider additional measures to increase the conspicuousness of bicycle lanes, such as the use of green pavement treatment to designate bicycle lanes.

FIGURE 6.3.3 Photograph of Bicycle Lane Treatment, Kelowna B.C.

e. Eliminate discontinuities in bicycle routes

Discontinuous routes within neighbourhoods and a lack of connectivity between neighbourhoods represent major disincentives to commuter cycling and in some cases may be safety issues. Identifying and mitigating discontinuities will improve the cycling experience and make cycling a more attractive choice.

f. Provide more bicycle end-trip amenities

Amenities such as bicycle racks and bicycle lockers are required if cycling is expected to be used for transportation rather than recreation. Given that theft is concern among residents, bicycle lockers may be a better alternative than conventional bicycle racks where feasible. Lockers may also offer better weather protection for bicycles. It may be beneficial to encourage business owners to sponsor such upgrades in dense commercial areas such as the downtown. FIGURE 6.3.4 provides examples of business sponsored bicycle racks.

FIGURE 6.3.4 Examples of Artistic Bicycle Racks

g. Improve east-west connectivity across Highway 99

Highway 99 represents a significant barrier to commuter cycling. The District should examine existing crossing facilities to identify ways in which cyclists may be better accommodated while reducing conflicts between cyclists and pedestrians. Grade separated crossings may be strategically applied if it can be demonstrated that safety concerns and crossing volumes warrant their consideration.

h. Negotiate Right of Ways for Proposed Commuter Bicycle Routes Crossing Private Property

Some of the proposed cycle routes would traverse private property. This includes fee simple parcels and in a number of instances, Squamish Nation Lands. The District should attempt to negotiate public access for the benefit of the community.

i. Develop Map of Existing Bicycle Routes

In addition to the Cycling Route Map included herein, the District should develop a **Users' Guide** which could include maps of existing routes, route type information, level of rider proficiency required, local regulations and tips. Ideally this information would be available in both hard copy and on-line. The District should engage the cycling community in the conceptualization of the guide and seek sponsorship opportunities to defray some of the costs. Mapping routes will provide awareness of the variety of facilities available and help to integrate commuting and recreational systems. The District may wish to provide bicycle route designations on street signs as well. In conjunction with a users guide. This will improve awareness of the available options.

j. Consider Cycling in Development Cost Charges

In its upcoming Development Cost Charges Bylaw Review, the District should include provisions for bicycle facility upgrades to help pay for infrastructure improvements that promote multi-modal transportation alternatives.

k. Allocate budget for cycling improvements in the capital works plan

Improving bicycle facilities with the goal of promoting cycling as a viable alternative transportation mode requires a commitment to provide funding for bicycle facility projects and improvements.

l. Public Education Regarding Cycling Infrastructure and Appropriate Behaviour

For a shared transportation system to function safely and efficiently it is necessary for cyclists and motorists alike to be aware of the rules of road and to respect each others' rights. The District should play an pivotal role in delivering this message.

m. Estimated Cost of Proposed Cycle Routes

Proposed new bicycle routes are described in FIGURE 6.3.5 below. A cost summary of the bicycle routes proposed within the 2031 planning is provided in TABLE 6.3.3. It should be noted that bicycle routes that would accompany proposed major roads are not included in this summary. A detailed breakdown of the proposed new bicycle routes is provided in APPENDIX F.

TABLE 6.3.3 New Bicycle Route Cost Summary

CLASSIFICATION	AREA	LENGTH (m)	COST	NET DISTRICT COST
Commuter Routes		10300	$1,502,000	$1,152,000
Neighbourhood Routes	Downtown	7000	$720,000	$18,000
	Valleycliffe	1400	$210,000	$210,000
	Estates	400	$60,000	$60,000
	Highlands	1600	$365,000	$240,000
	Brackendale	1300	$195,000	$195,000
	TOTAL	**22000**	**$3,052,000**	**$1,875,000**

(Note: This list of improvements has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports. A more detailed list is included in Appendix 'F' to this report.)

The following measures are recommended with respect to the Cycling Network:

SHORT-TERM

1. **Amend the Subdivision and Development Control Bylaw to include standards for Bicycle Routes based on current TAC standards;**
2. **Develop a systematic approach for the routine evaluation of existing bicycle routes with the objective being to bring them up to TAC standards;**
3. **Include Bicycle Routes in the next update of the Development Cost Charge Bylaw;**

4. **Evaluate the preliminary short-term bicycle routes in enough detail to determine the standard which should be applied, the estimated project cost and the proposed source of funding;**

5. **In consultation with user groups develop of list of priority projects;**

MID-TERM

6. **Develop a Public Education Strategy that will endeavour to raise awareness and understanding of cycling supportive infrastructure and promote respectful behaviour; and,**

7. **Develop a "Cycling Squamish" users guide"**

LONG-TERM

8. **Engage the Squamish Nation and private property owners in discussions on securing right-of-ways over lands that would provide continuity to important commuter cycling routes;**

ON-GOING

9. **Consider an annual allowance of $100,000 for the development and improvement of bicycle routes in the Capital Budget;**

10. **Ensure that all traffic reports required by or completed for the District address pedestrian and cycling movements.**

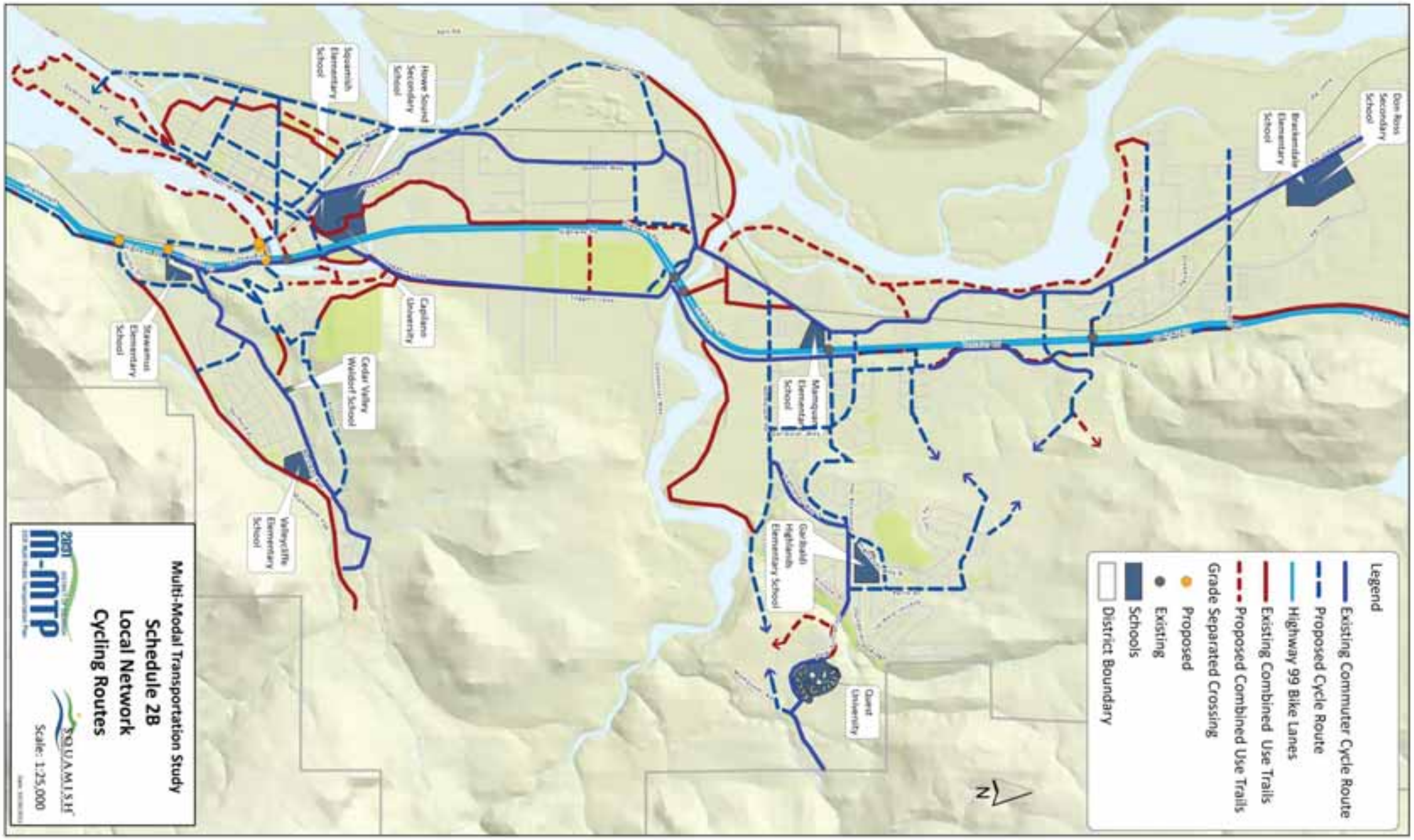


FIGURE 6.3.5 Schedule 2B – Proposed Cycling Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

THIS PAGE INTENTIONALLY LEFT BLANK

6.3.4 Pedestrian Routes

FIGURE 6.3.6 shows the existing and proposed new pedestrian routes. It is important to ensure that sidewalks are provided on both new and existing routes. The construction of sidewalks should be based on priorities to be established by the District, and should follow sidewalk design standards. Crosswalks should also be considered in conjunction as new sidewalks are constructed.

Some of the key considerations associated with Pedestrian movement are discussed below.

a. Identify and designate pedestrian priority zones

A "pedestrian priority zone" is an area that allows for access by all modes, but prioritizes the comfort and safety of pedestrians over moving vehicles quickly through the area. A pedestrian priority zone should include features such as sidewalks on both sides of every street, frequent crosswalks, slow –moving vehicle traffic, and traffic calming measures such as on-street parking, narrow vehicle lanes, curb extensions, and textured pavement treatments. Downtown Squamish represents a good potential candidate for a pedestrian priority zone as it already features pedestrian friendly infrastructure; other potential zones can be identified as growth progresses within Squamish.

b. Establish safe routes to schools

It is recommended that the District identify and prioritize improvements on walking routes to school. Establishing and promoting safe routes to school will both promote walking and increase pedestrian safety for pick-up / drop-off trips to schools. Given the lack of existing sidewalks, safe routes to school become a key criteria for the prioritization of sidewalk construction.

c. Develop prioritization for sidewalk construction and allocate funding

Sidewalk construction priorities can be established based on criteria such as: short missing links; streets with no sidewalks on either side; and provision of sidewalks on both sides of a street. Within the context of the existing sidewalk network, priority should be given to improving connectivity and eliminating discontinuities as opposed to providing sidewalks in high volume areas. Funding and prioritization should also consider the maintenance and update of existing sidewalks.

Improving pedestrian connection between Valleycliffe and the Downtown via off-road paths and/or sidewalks is recommended as a top priority.

d. Establish sidewalk design standards based on TAC guidelines and sidewalk provision guidelines

Maintenance on existing sidewalks to achieve compliance with TAC guidelines is important for maintaining consistency and safety. Consistent walking facilities can improve perceived and actual safety and provide a level of confidence for pedestrians using said facilities.

It is also key that the District set policy to establish minimum sidewalk provisions for new roads and road reconstruction. It is recommended that at minimum all arterials should have sidewalks on both sides of the road, and all collectors and locals should have sidewalks on at least one side of the road.

e. Introduce traffic calming measures to pedestrian priority zones

As areas are identified as "pedestrian priority zones", traffic calming measures should be implemented to ensure that the zones behave in function as they are intended to. Some corridors within Squamish, such as The Boulevard, already incorporate traffic calming elements. It is recommended that such measures be adopted throughout Squamish along key corridors as a means of increasing safety for all road users while simultaneously increasing the attractiveness of non-auto modes.

f. Implement street design guidelines outlined in the Smart Growth on the Ground Concept Plan in areas besides the Downtown

Implementing the guidelines developed in the Downtown Squamish Smart Growth on the Ground Concept Plan, and expanding their application to other growing communities in Squamish such as Garibaldi Highlands, will help raise the profile of walking as a viable transportation mode.

TABLE 6.3.4, below, provides a cursory evaluation of Pedestrian Network issues that is intended to guide decision making.

TABLE 6.3.4 Evaluation of Pedestrian Network Issues

Recommendation	Low cost to implement	Addresses Key Gaps	Ease of Implementation	Likelihood of Affecting Mode Shift	Other Agencies not an Issue
New pedestrian routes	●	⬤	●	●	⬤
Set-up pedestrian priority zones	n/a	•	⬤	⬤	⬤
Safe routes to school	●	⬤	⬤	●	●
Prioritize sidewalk construction and allocate funding	n/a	⬤	⬤	⬤	⬤
sidewalk design standards and requirements	n/a	⬤	⬤	⬤	⬤

A summary of new sidewalks required on existing roads and costs broken down by neighbourhood is provided in TABLE 6.3.5 and in APPENDIX F. Sidewalks required on new roads should be considered as a design element of the road and costs embedded in the road estimates. Preliminary recommendations for sidewalks that should be considered a high priority in the short-term as well as an example of how to further prioritize sidewalks are provided in SECTION 4.4.5.

TABLE 6.3.5 New Sidewalks on Existing Roads Cost Summary

NEIGHBOURHOOD	LENGTH (m)	UNIT COST ($/m)	COST	NET DISTRICT COST
Downtown	2517	96	$242,200	$117,000
Valleycliffe/ Hospital Hill	4034	367	$1,479,600	$1,067,100
Business Park/ North Yards	3338	132	$440,000	$214,000
Estates	4270	235	$1,002,000	$582,000
Highlands	3990	254	$1,013,500	$456,000
Brackendale	3770	364	$1,374,000	$1,202,750
TOTAL	**21919**		**$5,551,300**	**$3,638,850**

(Note: This list of improvements has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

The following steps are recommended with respect to the Pedestrian Network objectives described herein:

SHORT-TERM

1. **Develop a systematic approach for routine evaluation of existing pedestrian routes with the objective being to eliminate discontinuities and obstacles to accessibility to the greatest extent possible;**

2. **Based on the findings of the Safe Routes to School Program develop a list of priority pedestrian routes to complete in the short term;**

MID-TERM

3. **Establish Downtown Squamish as a pedestrian first zone.**

ON-GOING

4. **Consider an annual allowance of $100,000 in the Capital Budget for the development and improvement of pedestrian routes;**

5. **Ensure that all traffic reports required by or completed for the District address pedestrian and cycling movements.**

6.3.5 Wildlife Corridors

MID-TERM

It is recommended that the District collaborate with Provincial agencies having information and expertise on the subject of wildlife movements and develop a strategy for identifying and managing wildlife corridors.

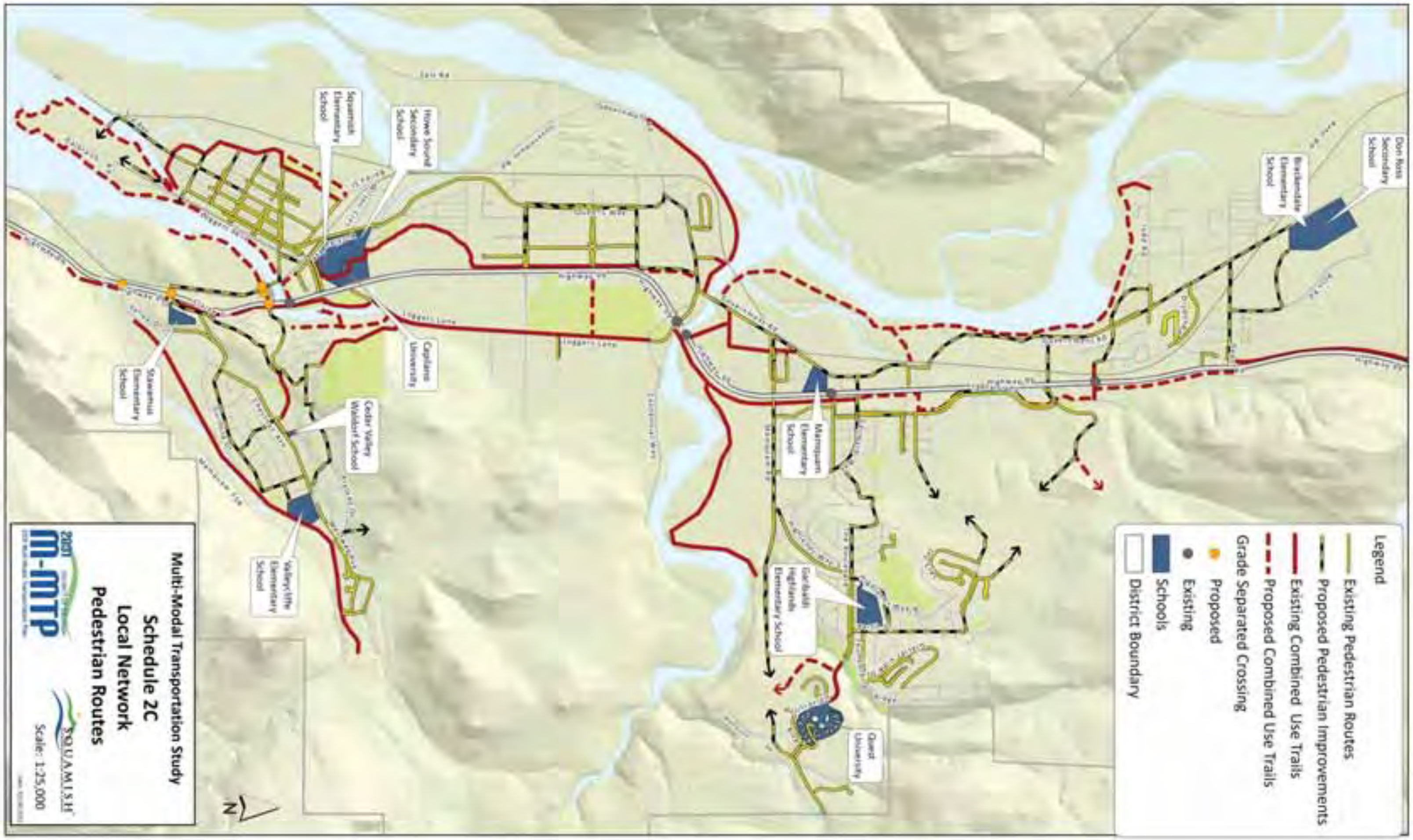


FIGURE 6.3.6 Schedule 2C – Proposed Pedestrian Network

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

6.4 Commercial Routes

A number of key issues associated with the movement of goods and materials are summarized below.

6.4.1 Network Changes

A. Implement Improvements to the Existing Truck Route Corridor in the Short-term.

A number of issues with the existing Truck Routes in the downtown area have been identified. Those that are relatively low cost should be implemented in the short term to improve conditions for commercial vehicles until a long-term route is selected. Downtown truck route options are shown in FIGURE 6.4.1 above.

B. Finish paving Government Road

It is expected that any downtown truck route option which eventually emerges will include the portion of Government Road from Bailey Street to Queensway as the preferred connection to the Rail Yards and Business Park. It is therefore recommended that the District include completion of the road to industrial route standards in their Capital Works Plan.

6.4.2 Policy Recommendations

A. Implement freight delivery time limitations

As Squamish grows, freight delivery operations may begin to interfere with traffic flow. Limiting freight delivery times can help reduce congestion.

B. Define additional truck routes

The existing truck routes as defined in the OCP serve only the Downtown and Industrial Park areas of Squamish. Depending on the level of growth in land uses that require commercial transport among other areas of Squamish, the District should evaluate the need to define additional truck routes.

6.4.3 Strategies and Areas for Further Study

A. Evaluate truck route options in the Downtown

The current truck route in the Downtown runs along Cleveland Avenue from Highway 99 then Loggers Lane as shown in FIGURE 5.1.1. Before moving forward with plans to reconfigure the existing intersection at Bailey Street and Cleveland Avenue, construct the 7th Avenue connector, or implement other potential options, the District should carefully evaluate each option to select an optimal route. Preliminary evaluation criteria can include environmental impacts, cost of implementation, and impact to adjacent property.

B. Improve rail and marine transport infrastructure

Trucking as a means of commercial transport is generally less efficient, in terms of energy per unit of transport, than rail of marine transport. Improving rail and marine transportation infrastructure and services can increase the attractiveness of these modes. Although rail and marine transport are not necessarily suitable for all types of goods, encouraging a mode shift towards rail or marine transport where it is suitable can help improve the long term sustainability of commercial transport operations in Squamish while simultaneously reducing the overall demand on the road network. The District should provide planning space for such improvements in their future plans and policies; it is key that the District protect available lands for future rail and marine transport infrastructure.

6.4.4 Evaluation and Recommendations

TABLE 6.4.1, below, provides a cursory evaluation of the commercial transport recommendations. It is only intended to help guide the District with prioritization and the timeframe for implementation of recommendations.

TABLE 6.4.1 Evaluation of Commercial Transport Recommendations

Recommendation	Low cost to implement	Addresses Key Gaps	Ease of Implementation	Likelihood of Affecting Mode Shift	Coordination with Other Agencies not an Issue
Pave Government Road (N.7th Ave)	Medium	Good	Medium	Medium	Medium
Define Additional Truck Routes	n/a	Good	Good	n/a	Good
Evaluate truck route options in the Downtown	n/a	Good	Good	n/a	Good
Support marine and rail goods movement	Poor	Medium	Poor	Medium	Medium

● Good	● Medium	• Poor

It is recommended that the District take the following steps with respect to Commercial Transport:

SHORT-TERM

1. **Include the completion of Government Road from Bailey Street to the Rail Yards to industrial route standards in the Capital Works Plan.**

2. **Consider improvements to the existing downtown truck route, including at the intersections of Vancouver Street with Third Avenue and with Loggers Lane and ensure that parking be set back far enough from the intersections so as not to pose a hazard.**

3. **Protect land that is currently zoned industrial and has marine or rail transport capability for the future.**

MID-TERM

4. **Once the needs of industry are better understood, complete a detailed analysis of truck route options in the downtown based on the key factors and preliminary assessments included in this report.**

5. **Improve the connection between the Terminals and Rail Yards by establishing truck route(s) that provide the most direct connection between the two sites.**

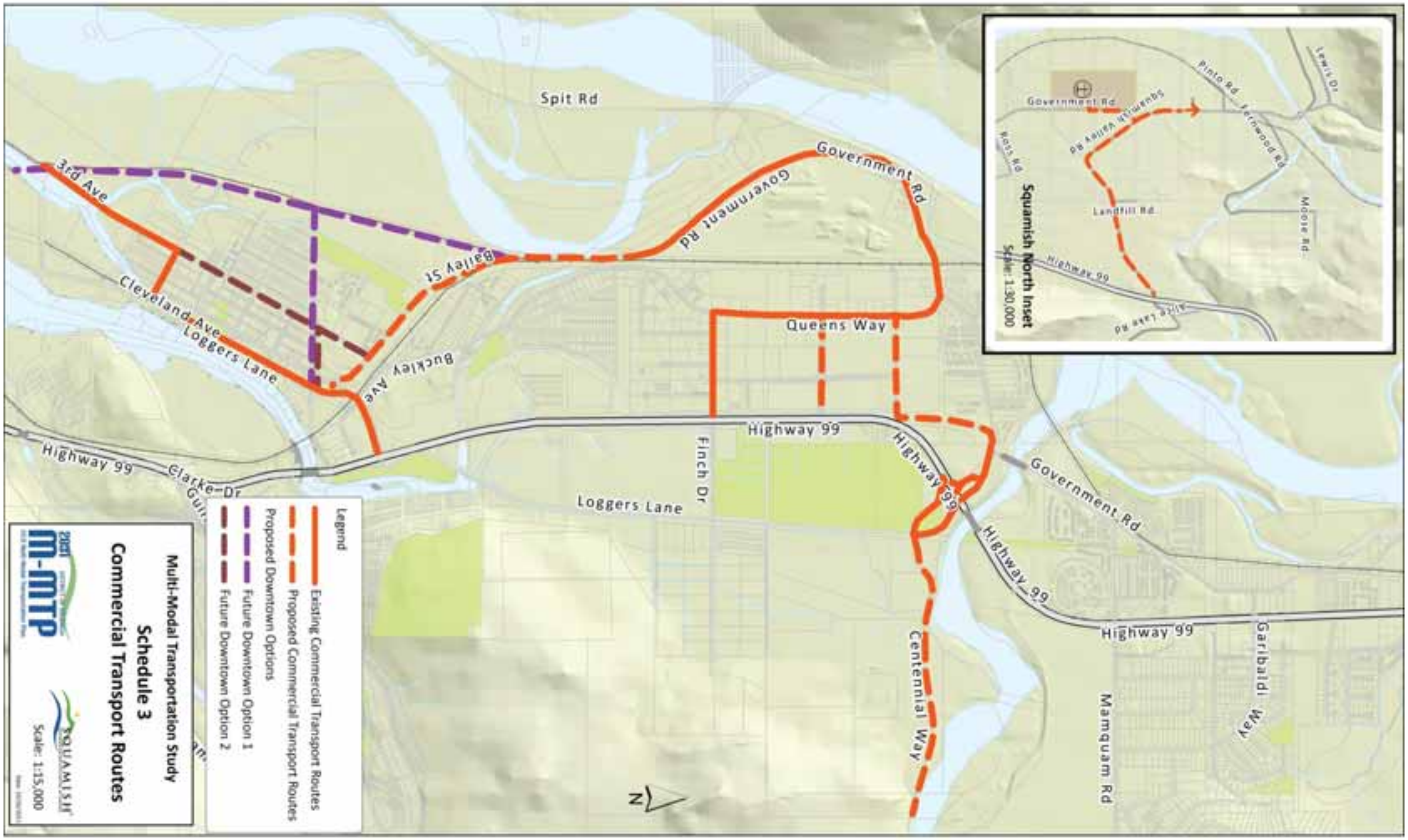


FIGURE 6.4.1 Schedule 3 – Proposed Commercial Transport Routes

(Note: This map has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

6.5 Pursuing the Vision

6.5.1 Introduction

To achieve the goal set out in the study vision will require a commitment to sustainable transportation values and actions. While some of the recommendations described above will deliver greater benefits than others, in terms of progress towards the goal, for the most part the recommendations will each deliver a small improvement. It will be the sum of many small changes that will create the large change and ultimately determine the District's success in achieving a sustainable transportation future.

This section describes some specific mode shift targets - on-going or sustained actions that are recommended to keep momentum towards the vision - and some suggestions for how progress should be monitored.

The most important next step will be to complete an Official Community Plan amendment to embed the vision and create the policy framework to support it.

6.5.2 Mode Shift Targets

It is important to establish measurable goals in order to confirm that improvements are successful in encouraging more sustainable forms of transportation, namely mode shift. It is typical practice for plans to set specific goals of increasing transit ridership, cycling or walking trips by a specified amount and implementing these goals via policy. This may not be ideal for Squamish. There are several reasons for this:

- Squamish experiences rain, snow, strong winds, or other harsh conditions during a significant portion of the year; the climate in Squamish is often a barrier to cycling or walking. This could work in favour of public transportation, providing transit stops are well sheltered.
- Land use in Squamish is spread out over a relatively large area; long distances act as a barrier to cycling and particularly walking. They can also make the cost of conventional transit service unattractive if long, sparsely populated stretches separate neighbourhoods.
- Steep terrain - The Garibaldi Highlands is one of the most populated neighbourhoods in Squamish and any inter-neighbourhood trips involve terrain which is steep enough to discourage many cyclists and pedestrians.

- A significant portion of the work force is employed outside of Squamish. Cycling and walking to work are not realistic options.

Therefore, it is recommended that instead of setting targets for each mode, the District express mode shift as a reduction in single occupancy car, truck, and van (SOV) trips. This reduction will represent an increase in walking, cycling, ridesharing and transit trips, which are all desirable modes from a multi-modal standpoint.

According to 2006 Census data, upwards of 75% of trips to work by Squamish residents were SOV trips (car, truck, van, etc.). This compares to the findings of the on-line survey and origin-destination telephone survey of 71 % and 61%, respectively. Looking just at external trips, SOV trips are in the order of 90% .

Clearly the District is a community that is highly involved with their vehicles. As mentioned above geography has much to do with this reality. For behaviour to change in any meaningful way transit must play a central role. With 30% or more of the workforce commuting to locations outside of the community there is an opportunity to significantly reduce the SOV numbers by offering commuting options such as, transit, ridesharing or possibly passenger ferry.

Creating complete, compact neighbourhoods with good jobs close to home will also have a significant impact on improving local conditions. As this unfolds it will be critical for the District to have safe, convenient and affordable transportation options in place. Fluid networks and integrated transportation hubs will make sustainable transportation choices possible.

While there are some examples of communities where the mode split is significantly better than the District's it is difficult to make comparisons. For instance, SOV usage in Vancouver represents 52% of trips to work. On the other hand, the District's Downtown Study indicated that Revelstoke also has a summertime SOV rate of 52%. For communities similar to Squamish mass transit is not likely to be a solution. However telecommuting, cycling and a densified, pedestrian-first downtown with local employment opportunities are within our grasp. Having said that, the 'Squamish Solution' will likely involve an array of changes, including, network improvements, supporting infrastructure, sustainable transportation policy development and a long term commitment.

An example of a possible future condition is illustrated in the tables below.

Currently Squamish has a workforce of approximately 8,500. As noted above the portion that travels to work by SOV is 75% or 6,300 daily trips. Thirty percent of the workforce commutes to out of town locations. The present day (2010) mode split is shown in Figure 6.5.1 below.

TABLE 6.5.1 2010 Daily Trip Distribution by Mode

Mode	Work Trips	%	Out of Town				In Town	
			South	North	Total	%	#	%
Total	8481	100.0	1716	1000	2716	100.0	5103	100.0
Bus	229	2.7	20	84	104	3.8	125	2.2
Bike	507	6.0	0	0	0	0.0	507	8.8
Walk	272	3.2	0	0	0	0.0	272	4.7
Rideshare	1177	13.8	317	100	417	15.4	700	13.0
SOV	6306	**74.4%**	1379	816	2195	80.8	3589	71.3

Based on current travels patterns 74.4% of all work trips are by SOV. An additional 13.8% are passengers. So fully 88.2% of all trips involve a car, truck or van.

Table 6.5.2, below, describes a possible mode shift and 2031 trip distribution.

TABLE 6.5.2 Possible 2031 Daily Trip Distribution by Mode

Mode	Work Trips	%	Out of Town				In Town	
			South	North	Total	%	#	%
Total	11352	100.0	2200	1282	3482	100.0	7869	100.0
Bus	1329	15.7	880	223	1103	31.7	226	2.9
Bike	916	8.1	0	0	0	0.0	916	11.6
Walk	491	4.3	0	0	0	0.0	491	6.2
Rideshare	2108	18.6	573	181	753	21.6	1355	17.2
Ferry	300	2.6	300	0	300	8.6	0	0.0
SOV	6208	**54.7%**	447	879	1326	38.1	4882	62.0

This scenario assumes the following shifts by 2031:

- Total trips will increase by 1.25% per annum;
- Use of Transit to Whistler will increase by 5.0% per annum;
- A new transit and/ or passenger ferry service will account for 50% of the commute Vancouver;

- Locally, transit use for work trips, commuter cycling, ridesharing and walking trips will each increase by 3% per annum.

Under these assumptions the table shows an SOV split of 54.7%. Today, the sustainable modes of transportation (transit, cycling and walking), only account for 11.9% of work trips in the PM peak. What this suggests is that there is hardly any usage of these modes, largely because the systems are not in place or in the case of transit, the service is not responding to the demand. Although a 3% annual increase over 20 years may seem formidable, the more likely scenario is that when the systems are in place there will be a significant jump in usage and then a steady growth will occur year over year at a rate more in the range of 1-2%.

There is no question that the mode shift scenario described above would represent a significant challenge. However, if the full array of recommendations described in this report, are vigorously pursued, it is an attainable goal. Even if this level of mode shift is somewhat aspirational, it is consistent with the District's values and recent policy statements on sustainability, greenhouse gas emission reductions and community leadership.

6.5.3 Key Success Measures

Tracking the change, celebrating successes and making adjustments will be critical to success. SOV usage has been identified as the primary measure. In addition to the SOV metric, others which could be considered include:

- LOS at Highway Intersections and key District Network Intersections;
- Drop in collision rates (from ICBC);
- Transit ridership and cost per ride;
- Bicycle ridership on key commuter routes
- % sidewalk coverage on Safe Routes to School

Once a method is established for collecting this data it will be relatively straightforward to generate data on an annual basis. It is recommended that the findings be reported to Council on a regular basis perhaps as part of the Annual Capital Plan presentation.

6.5.4 On-going Recommendations

The recommendations that involve a concerted and multi-faceted effort extending over the twenty year planning period are reported here. These are typically associated with commitments to pursue sustainable transportation values or infrastructure that will result in the desired changes in behaviour. TABLE 6.5.3, below, provides a summary of the evaluation of strategic initiatives.

TABLE 6.5.3 Evaluation of Strategic Recommendations

Recommendation	Low cost to implement	Addresses Key Gaps	Ease of Implementation	Likelihood of Affecting Mode Shift	Coordination with Other Agencies not an Issue
Policies, Strategies and Areas for Further Study					
Set mode split targets	n/a	n/a	⬤	n/a	⬤
Increase land use density	●	•	●	⬤	⬤
Parking strategy for employers and the Downtown	⬤	•	●	⬤	⬤
Explore car sharing programs	⬤	•	●	⬤	⬤
Transit Performance Monitoring	●	•	⬤	•	●
Implement Alternative Transit Model	varies	⬤	varies	⬤	⬤
Construct off-street exchanges at transit hubs	•	●	●	⬤	⬤
Increase land use density	●	•	●	⬤	⬤

A. Land Use

Continuing to increase land use density and supporting mixed use developments generally encourage non-auto modes. Having strong transit and cycle network connections to employment lands will also be critical. The District may wish to explore concepts such as *Transit Oriented Development* and *Pedestrian Oriented Development* when reviewing land development plans. Guidelines exist in the ITE publication Promoting Sustainable Development through Site Design.

B. *Explore Other Transportation Demand Management (TDM) Measures*

The majority of transit, cycling, and pedestrian network measures described above can already be considered TDM measures. It is recommended that the District explore additional short, medium, and long-term TDM measures to further support multi-modal transportation, such as:

Short Term

- Implement a Wayfinding system for bicycle routes
- Support and improve Bike to Work week participation
- Introduce maximum parking requirements to reduce an over-supply of parking
- Consider introducing pay parking
- Support the development of Site based TDM projects including carpooling, flexible work scheduling, videoconferencing, teleworking, and work from home initiatives
- Participate in International Walk to School Week (IWSW)
- Develop appropriate communication methods between District departments to ensure TDM requirements are taken into consideration for any new development and are incorporated into the development approval process (see Promoting Sustainable Transportation Through Site Design: an ITE Recommended Practice)
- Coordinate transit planning with land development

Medium Term

- Identify and incorporate Crime Prevention through Environmental Design (CPTED) requirements for major bus stops, pedestrian facilities, bicycle end-of-trip facilities, and new buildings.
- Identify events and marketing campaigns to incentivize transit
- Identify events and marketing campaigns to raise awareness of cycling issues and opportunities. Encourage greater cycling participation, especially for commuter travel
- Promote and support the implementation of Bike to School/ Work Week programs
- Identify appropriate locations for introducing *Pedestrian Oriented Design* and *Transit Oriented Design*
- Develop TDM plans for major employers

Long Term

- Develop a Pedestrian Master Plan
- Integrate *Pedestrian Oriented Design* and *Transit Oriented Design* into future sub-area plans

To *pursue the vision* the following on-going strategic actions are recommended:

1. **It is recommended that the District adopt a goal of reducing Single Occupancy Vehicle (SOV) use for work trips in the weekday PM Peak to no more than 50% of total trips by 2031;**

2. **It is recommended that the District pursue all Transportation Demand Management Measures (TDM) possible to further the mode shift objectives of this plan;**

3. **It is recommended that transportation planning be fully integrated with land use and economic development planning; and,**

4. **It is recommended that the District establish a program to monitor the success of the mode shift targets established in the 2031 Multi-Modal Transportation Plan Study and that staff report to Council on a regular basis.**

6.6 SUMMARY OF REPORT RECOMMENDATIONS

The following is a summary of the recommendations described in the foregoing sections. They are grouped under the three major areas of the study, being: Highway Interface & Regional Transportation; Local Networks; and, Commercial Transport. A fourth category describing ongoing strategic actions that are recommended to strive towards the study vision, entitled "Pursuing the Vision" has also been added.

Within each area recommendations may be further categorized as: short-term (zero to five years); mid-term (six to ten years); long-term (longer than ten years); and, ongoing. Ongoing recommendations are those that will involve a sustained effort over 20 year planning horizon.

I. HIGHWAY INTERFACE & REGIONAL TRANSPORTATION

A. HIGHWAY INTERFACE

SHORT-TERM

1. Through BC MoTI, add a shared westbound left-turn/ through lane at Mamquam Road and Highway 99 as soon as possible to alleviate existing capacity issues.
2. Request that the Murrin Park counting station (P-15-8NS) or equivalent be reinstated by BC MoTI.

ON-GOING

3. Request that BC MoTI commit to not changing signal timing on any of the Highway intersections in Squamish without first consulting the District and further that an ongoing dialogue be established on how regional and local traffic demands may be balanced in a way that meets the objectives of both parties.
4. Regularly request turning movement data for the highway intersections from BC MoTI and augment with short counts as necessary.
5. Conduct traffic counts at strategic locations on Government Road during the PM peak on Fridays and Sundays in August as a means of establishing the impact of peak highway traffic on the local road network.
6. Continue to work with BC MoTI to implement the safety improvements recommended in the Safer City Initiative Report as a means of improving safety and lowering collision frequencies at highway intersections.

B. REGIONAL TRANSPORTATION

SHORT-TERM

1. Consider hosting an on-demand ride-matching database or alternatively partnering with other service providers to offer this service.

2. Develop two formal park and ride sites in close proximity to the highway, one towards the south end of the urban area and the other towards the north end.

3. Work closely with the Province, BC Transit and other corridor communities to establish a viable, regularly scheduled transit service for the Sea to Sky corridor.

4. Consider the potential for a regional transportation hub through discussion of the Sea to Sky Corridor Transit Master Plan with BC Transit and include hub considerations in any land use or transportation network decisions taken in the upper downtown area bounded by Buckley Avenue, Pemberton Avenue, Third Avenue and Loggers Lane.

LONG-TERM

5. Preserve the opportunity to implement passenger ferry service as a regional transportation option.

6. Investigate the potential for expanding rail services and include in the analysis of a central transportation hub.

II. LOCAL NETWORKS

A. MAJOR ROADS

SHORT-TERM

1. Revise the P-1 plan in the Subdivision and Development Control Bylaw to reflect the road classifications identified in Schedule 2A ~ Major Roads and review the geometric design standards and typical cross-sections for each road class.

2. Complete a Downtown Entrance Study for the area bounded by Highway 99 on the north, Pemberton Avenue on the south, Bailey Street/ Third Avenue to the west and Loggers Lane to the east taking into account the following key issues:

   - Emergency access
   - Pemberton Avenue entrance

- o Bailey Loggers Lane disconnect/ truck routing
- o Cleveland Avenue gateway
- o Downtown transportation hub
- o Network connections for all modes of transportation

3. Add the proposed network roads which are not currently associated with specific land developments in the next update of the Development Cost Charge Bylaw.

ON-GOING TO LONG-TERM

4. Include the proposed network roads whose need arises from general growth (traffic and/or safety concerns) in the District's capital budget planning process.

B. LOCAL TRANSIT

SHORT-TERM

1. In addition to a Regional Transportation Hub in the downtown, explore the potential to establish a satellite transportation hub, including transit service and a park and ride lot in the vicinity of Highlands Mall;

MID-TERM

2. Develop transit supportive infrastructure once a local transit service model is adopted by the District; and,

LONG-TERM

3. Monitor other possible satellite hub sites with a view towards formalizing the sites if and when development and/ or demand dictate.

C. BICYCLE ROUTES

SHORT-TERM

1. Amend the Subdivision and Development Control Bylaw to include standards for Bicycle Routes based on current TAC standards;

2. Develop a systematic approach for the routine evaluation of existing bicycle routes with the objective being to bring them up to TAC standards;

3. Include Bicycle Routes in the next update of the Development Cost Charge Bylaw;

4. Evaluate the preliminary short-term bicycle routes in enough detail to determine the standard which should be applied, the estimated project cost and the proposed source of funding;

5. In consultation with user groups develop of list of priority projects;

MID-TERM

6. Develop a Public Education Strategy that will endeavour to raise awareness and understanding of cycling supportive infrastructure and promote respectful behaviour; and,

7. Develop a "Cycling Squamish Users Guide"

LONG-TERM

8. Engage the Squamish Nation and private property owners in discussions on securing right-of-ways over lands that would provide continuity to important commuter cycling routes;

ON-GOING

9. Consider an annual allowance of $100,000 for the development and improvement of bicycle routes in the Capital Budget.

D. PEDESTRIAN ROUTES

SHORT-TERM

1. Develop a systematic approach for routine evaluation of existing pedestrian routes with the objective being to eliminate discontinuities and obstacles to accessibility to the greatest extent possible;

2. Based on the findings of the Safe Routes to School Program develop a list of priority pedestrian routes to complete in the short term;

MID-TERM

3. Establish Downtown Squamish as a pedestrian first zone.

ON-GOING

4. Consider an annual allowance of $100,000 in the Capital Budget for the development and improvement of pedestrian routes;

5. Ensure that all traffic reports commissioned by or completed for the District gather information on current pedestrian and cycling movements

E. WILDLIFE CORRIDORS

1. It is recommended that the District collaborate with Provincial agencies having information and expertise on the subject of wildlife movements and develop a strategy for identifying and managing wildlife corridors.

III. COMMERCIAL TRANSPORT

SHORT TERM

6. Include the completion of Government Road from Bailey Street to the Rail Yards to industrial route standards in the Capital Works Plan.

7. Consider improvements to the existing downtown truck route, including at the intersections of Vancouver Street with Third Avenue and with Loggers Lane and ensure that parking be set back far enough from the intersections so as not to pose a hazard.

8. Protect land that is currently zoned industrial and has marine or rail transport capability for the future.

MID-TERM

9. Once the needs of industry are better understood, complete a detailed analysis of truck route options in the downtown based on the key factors and preliminary assessments included in this report.

10. Improve the connection between the Terminals and Rail Yards by establishing truck route(s) that provide the most direct connection between the two sites.

IV. PURSUING THE VISION

To pursue the vision the following on-going strategic actions are recommended:

1. It is recommended that the District adopt a goal of reducing Single Occupancy Vehicle (SOV) use for work trips in the weekday PM peak to no more than 50% of total trips by 2031.

2. It is recommended that the District pursue all Transportation Demand Management Measures (TDM) possible to further the mode shift objectives of this plan.

3. It is recommended that transportation planning be fully integrated with land use and economic development planning; and,

4. It is recommended that the District establish a program to monitor the success of the mode shift targets established in the 2031 Multi-Modal Transportation Plan Study and that staff report to Council on a regular basis.

END OF REPORT

APPENDIX A
RESULTS OF PUBLIC SURVEYS

THIS PAGE INTENTIONALLY LEFT BLANK

1.0 RESULTS OF PUBLIC SURVEYS

Public consultation was implemented as an important element of this plan to ensure the goals and strategies are consistent with the needs and vision of the community.

1.1 On-line Travel Preference Survey

Public consultation was implemented as an important element of this plan to ensure the goals and strategies are consistent with the needs and vision of the community.

As part of the study, the District of Squamish conducted an on-line travel preference survey from September 10 to 30, 2010. The objective of the on-line survey was to explore the travel preferences of residents, identify issues residents have with the existing transportation network, and understand how residents made transportation mode choices for both trips within the community and in the Sea-to-Sky corridor. The following section provides a summary of key results from the on-line survey; a detailed summary of survey results is provided in the Summary of On-Line Travel Preference Study Report document.

A total of 367 responses were received. In general, respondents indicated that although automobiles are currently the predominant form of transportation in Squamish, there is a strong preference for promoting alternatives to single-occupancy vehicles, and results showed that improvements to other non-auto facilities were favoured. FIGURE A-1 to FIGURE A-3 summarize responses to questions regarding respondent opinions about transportation improvement priorities.

It is important to note that this was not a random survey – all residents were invited to respond, and those who have a strong interest in transportation issues would be more likely to respond.

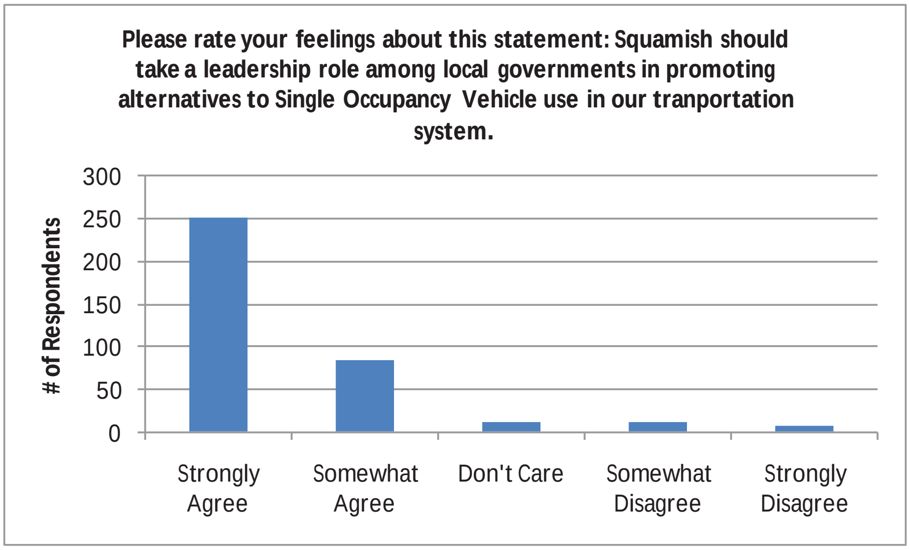


FIGURE A-1 Online Survey Results – Question 11

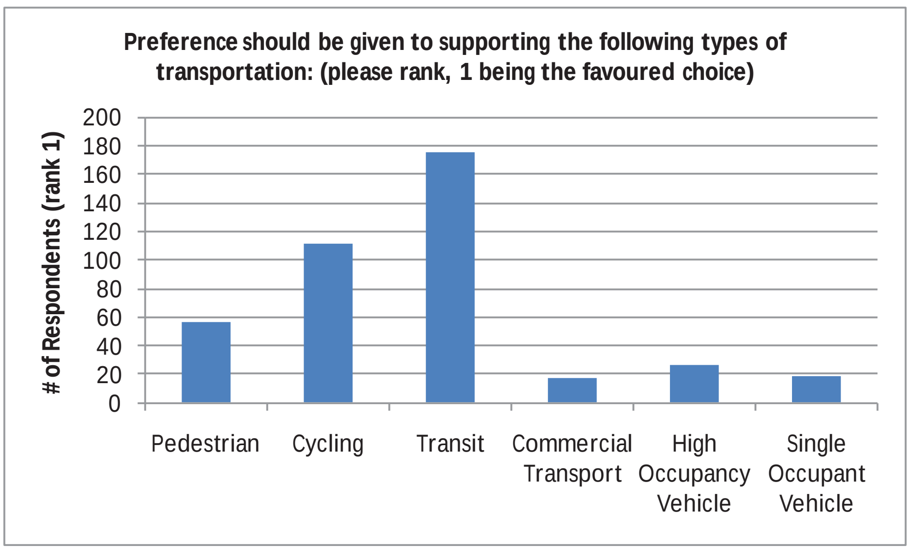


FIGURE A-2 Online Survey Results – Question 12

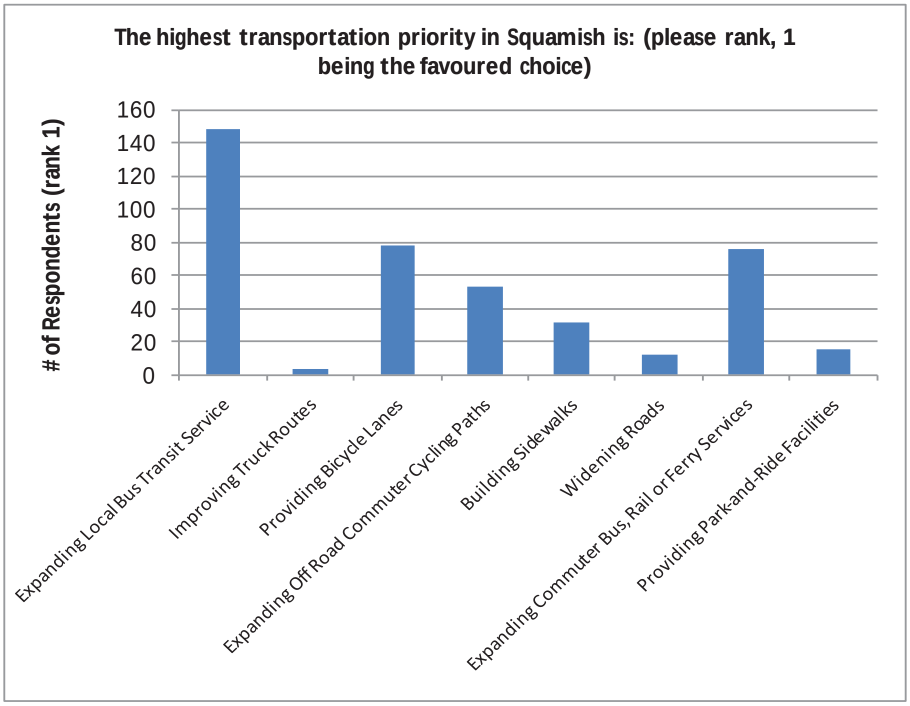


FIGURE A-3 Online Survey Results – Question 13

FIGURE A-4 provides a breakdown of the travel modes respondents most typically use for work and shopping trips.

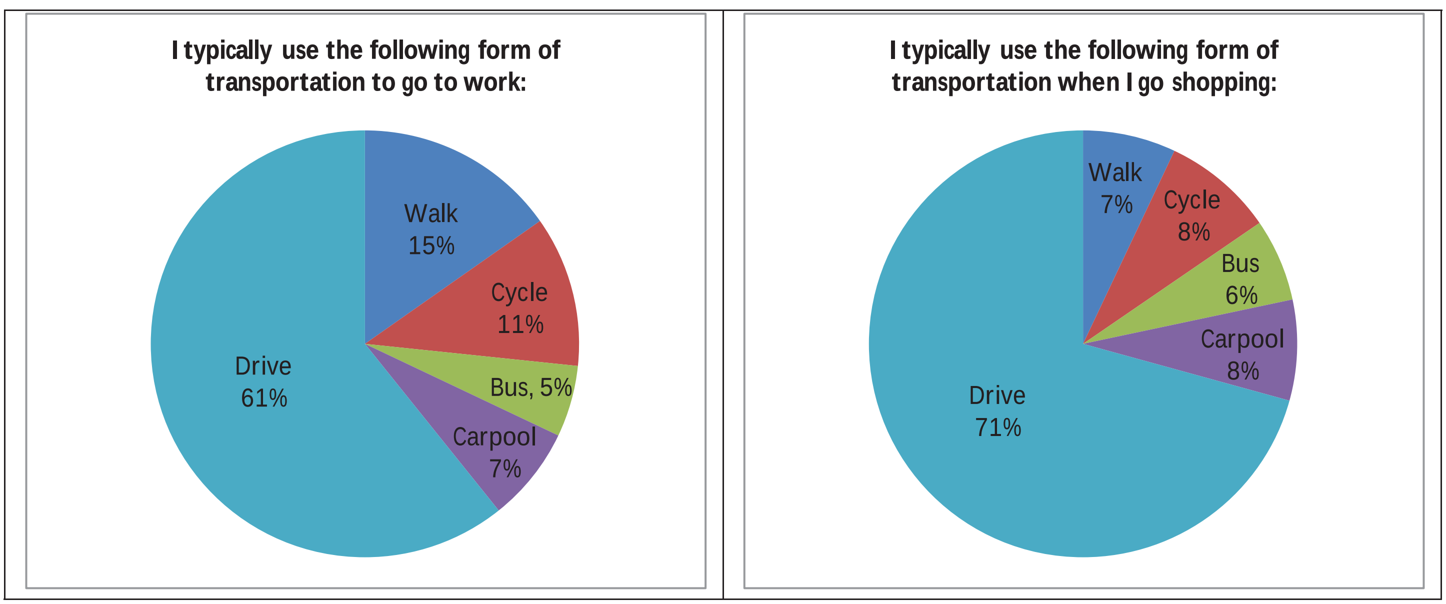


FIGURE A-4 Online Survey Results – Questions 14 & 15

FIGURE A-5 summarizes reasons why respondents choose not to take transit to destinations outside of Squamish. Although responses to other questions in the survey indicated that only 77 respondents worked or studied outside of Squamish, a total of 198 respondents gave reasons as to why they didn't take transit to work/school outside of Squamish. This inconsistency may represent a misinterpretation of the intended question. However, results of this question are still useful in understanding public opinion regarding transit services in general. 140 respondents indicated that the transit service was not feasible for their intended journey because there was no service or the times did not suit their schedule.

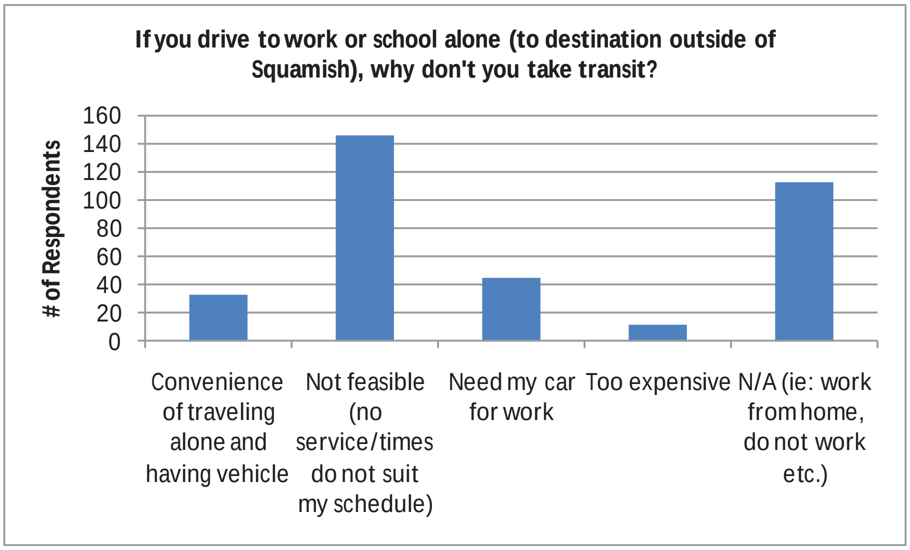


FIGURE A-5 Online Survey Results – Question 18

FIGURE A-6 and FIGURE A-7 show survey responses regarding why respondents did not cycle or walk to work.

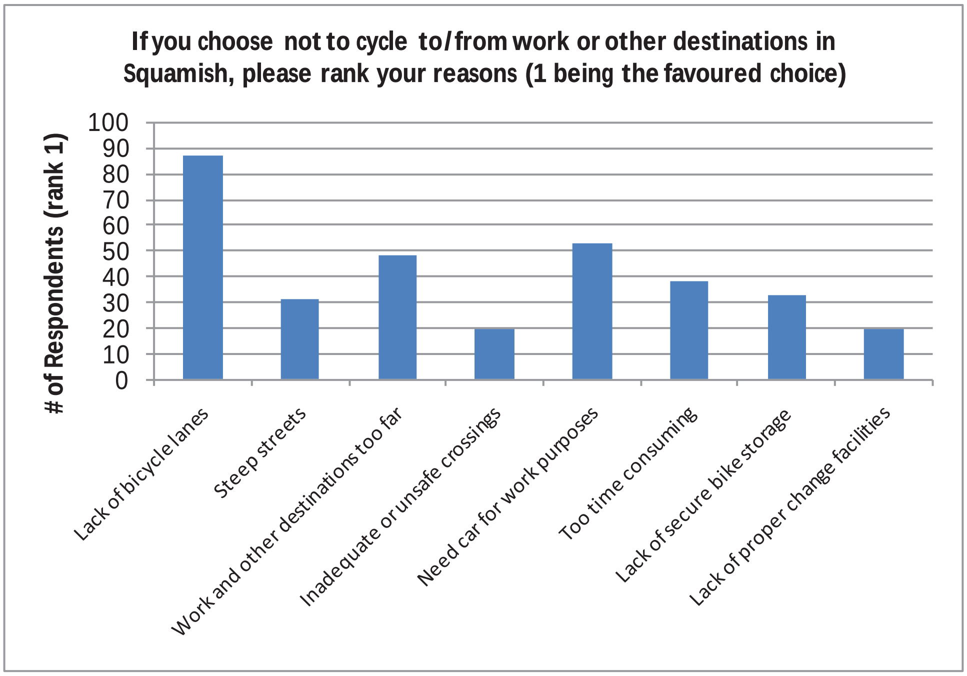


FIGURE A-6 Online Survey Results – Question 23

FIGURE A-7 Online Survey Results – Question 24

1.2 Origin-Destination Phone Survey

As part of the study process, an origin/destination phone survey was conducted. The survey was administered by Synovate from their central telephone facilities located in Vancouver and used their Computer Assisted Telephone Interviewing system. Squamish was split into a number of zones, and the number of households surveyed in each zone was proportioned to match the overall percentage of total households that zone represented.

A total of 520 households were surveyed to determine trip origin-destination outcomes for specified zones within Squamish between 3:00 p.m. and 6:00 p.m. on a typical weekday, with the purpose of populating a transportation model. Analysis of the data was also useful in identifying general trends regarding trips during the afternoon peak period, the results of which are discussed below.

For the analysis of survey data, the individual zones identified within Squamish, were grouped into seven "super-zones" to represent major residential communities within Squamish. The super-zones are: Brackendale; Dentville; the Downtown; Garibaldi Highlands; Garibaldi West; North Yards; and Valleycliffe. TABLE A-1 provides a summary of the number of households surveyed in each zone as well as occupancy and vehicle ownership averages. On average, households had approximately three occupants, two automobiles, and three bicycles.

TABLE A-1 Surveyed Household Data

SUPERZONE	Total Households Surveyed	Average Occupants per Household	Average Automobiles per Household	Average Bikes per Household
Brackendale	84	3.11	2.10	3.49
Dentville	26	2.81	2.46	2.35
Downtown	19	1.95	1.21	1.63
Garibaldi Highlands	237	2.99	2.24	3.45
Garibaldi West	38	2.84	1.84	2.37
North Yards	26	2.58	1.96	2.58
Valleycliffe	90	2.74	2.24	2.90
ALL ZONES	520	2.89	2.15	3.12

Respondents were also surveyed regarding their trip mode type, trip purpose, and trip travel times. TABLE A-2 provides a summary of trip mode types, and TABLE

A-3 provides a summary of trip purpose. It can be seen that the large majority of trips involved automobiles, with 81 percent of trips being either auto driver or auto passenger trips; transit trips represented the least common trip type. Personal trips were the dominant trip purpose, totalling 55 percent of all trips during the afternoon peak period. For the purposes of this study, personal trips were defined as any non-commute, -business, or –pick-up/drop-off trip; this includes trips such as shopping trips, doctors appointments, trips to the gym, etc. Some of the personal trips may be discretionary and can be carried out during other time periods. Many of the personal trips involved trips to area schools.

Analysis of trip travel times showed that auto trips were generally short, averaging 10 minutes between destinations within Squamish. The longest trip within Squamish took 30 minutes, and occurred between Brackendale and Valleycliffe, which makes sense given the relative distance between the two communities. As expected, external trips took much longer, generally lasting around 60 minutes and with the longest lasting 90 minutes.

TABLE A-2 Surveyed Trip Mode

TRIP MODE	Number of Trips	Percentage of Total Trips
Auto Driver	1085	61%
Auto Passenger	360	20%
Commercial Vehicle	16	1%
Transit	13	1%
School Bus	54	3%
Bicycle	45	3%
Walking	198	11%
Unknown / Other	6	<1%
TOTAL	1777	100%

TABLE A-3 Surveyed Trip Purpose

TRIP PURPOSE	Number of Trips	Percentage of Total Trips
Commute	428	24%
Business	17	1%
Personal	981	55%
Pick-up / Drop-off	351	20%
TOTAL	1777	100%

The 520 households surveyed conducted a total of 1777 trips during the weekday afternoon peak period. The trip analysis includes four additional super-zones to accommodate trips that involve non-residential areas and external communities. The additional zones are: the Squamish Industrial Yards; Metro Vancouver; Whistler/Pemberton; and other destinations outside of urban Squamish, including Alice Lake and the Squamish Airport. TABLE A-4 provides a summary of the origins and destinations of surveyed trips.

TABLE A-4 Surveyed Trips on Weekdays 3 – 6 PM

		DESTINATION											
	ALL TRIPS	Brackendale	Dentville	Downtown	Garibaldi Highlands	Garibaldi West	Industrial Park	North Yards	Valleycliffe	Metro Vancouver	Whistler / Pemberton	Unknown / Other / Outside of Squamish	TOTAL FROM
ORIGIN	Brackendale	81	3	26	45	3	6	2	3	1		17	187
	Dentville	19	21	26	49	7	3	6	15			5	151
	Downtown	31	22	90	103	14	9	11	37	3		8	328
	Garibaldi Highlands	46	23	41	274	12	17	8	17	2	2	60	502
	Garibaldi West	3	7	8	32	8	1		5			5	69
	Industrial Park	6	3	10	29	2	2	2	2			3	59
	North Yards		3	8	10			2	3			3	29
	Valleycliffe	1	9	34	16	4	2	4	30	3		14	117
	Metro Vancouver	18	5	7	45	5		3	21	6		1	111
	Whistler / Pemberton	10	5	3	24	3		2	13		3	1	64
	Unknown/Other/ Outside of Squamish	21	7	19	69	5	2	6	24	2		5	160
	TOTAL TO	236	108	272	696	63	42	46	170	17	5	121	1777

To determine the actual total number of trips expected between 3:00 p.m. and 6:00 p.m., surveyed trips were normalized based on the ratio of surveyed households to actual households in the destination super-zone. The four non-residential or external super-zones, trips were normalized based on an average factor of all the residential super-zones.

TABLE A-5 shows the factors applied to each destination super-zone to obtain a normalized total number of trips. TABLE A-6 provides a summary of the origins and destinations of surveyed trips normalized to reflect trips proportionate to the number of households in each neighbourhood.

TABLE A-5 Normalization Factors

DESTINATION SUPERZONE	Adjustment Factor
Brackendale	13.81
Dentville	16.92
Downtown	31.68
Garibaldi Highlands	6.91
Garibaldi West	13.95
North Yards	11.15
Valleycliffe	11.67
ALL OTHER ZONES	15.16

TABLE A-6 Normalized Surveyed Trips on Weekdays 3 – 6 PM

		DESTINATION											
	ALL TRIPS (Normalized)	Brackendale	Dentville	Downtown	Garibaldi Highlands	Garibaldi West	Industrial Park	North Yards	Valleycliffe	Metro Vancouver	Whistler / Pemberton	Unknown / Other / Outside of Squamish	TOTAL FROM
ORIGIN	Brackendale	1119	51	824	311	42	91	22	35	15		258	2767
	Dentville	262	355	824	339	98	45	67	175			76	2241
	Downtown	428	372	2852	712	195	136	123	432	45		121	5417
	Garibaldi Highlands	635	389	1299	1894	167	258	89	198	30	30	909	5900
	Garibaldi West	41	118	253	221	112	15		58			76	895
	Industrial Park	83	51	317	200	28	30	22	23			45	800
	North Yards		51	253	69			22	35			45	476
	Valleycliffe	14	152	1077	111	56	30	45	350	45		212	2092
	Metro Vancouver	249	85	222	311	70		33	245	91		15	1320
	Whistler / Pemberton	138	85	95	166	42		22	152		45	15	760
	Unknown/Other/ Outside of Squamish	290	118	602	477	70	30	67	280	30		76	2040
	TOTAL TO	3259	1828	8618	4810	879	637	513	1983	258	76	1849	24709

In the 3:00 to 6:00 p.m. time period, intra-zonal trips within each of the super-zone generally dominate. This suggests that many of the trips are of relatively short-distance (although some may be long round-trips), and could possibly be accomplished by bicycle or on foot.

This origin-destination distribution information was used to assist in calibrating the VISSIM Transportation Model.

APPENDIX B
SQUAMISH 2010 TRAVEL MODEL UPDATE CALIBRATION REPORT

THIS PAGE INTENTIONALLY LEFT BLANK

Background

In 2010 SNC-Lavalin was contracted as a sub to Opus to update and refine the District of Squamish (The District) transportation model (The Model). The objective was to develop a model that is sensitive to policy and capital decisions that aim to reduce reliance on automobiles. Another objective was to refine the current model to allow for better inputs to the operational model.

Scope of the Model

The previous model used weekend PM peak hour. Existing counts and previous studies show that weekend PM peak hour does not represent the local peak hour, and is more reflective of the peak hour on Hwy 99 which is largely driven by external traffic rather than local traffic. This made it hard to distinguish set of improvements required for local traffic from those required for external traffic.

As a result, it was decided to model the highest local peak hour on Squamish roads on a typical September weekday (Tuesday to Thursday) from 4 to 5 PM. This was to identify set of improvements that are driven by local traffic only.
However, at District's request operational analysis was also completed for weekend conditions to gauge improvements required to accommodate external traffic on weekends as well.

The scope of the Model was to incorporate typical weekday PM peak hour commuter traffic. It was not the intent to model recreational traffic and, as such, recreational bike trails and bike-only routes were outside the scope.

Data Collection

To replicate ground conditions in a model it is important that adequate data is collected. Data collection for update of the Model included a Household Survey, a License Plate Survey, and traffic volume counts. In addition to these other pertinent data was obtained for transit, trucks, pedestrians, roadway geometries, posted speeds, number of lanes, traffic control devices, turn restrictions, etc.

Household Survey

The household survey was limited in its scope and budget. The objective of the survey was to capture commuter trip-making characteristics on a typical weekday in the PM peak period.

As part of the model update process, a household survey was conducted by Synovate. The survey results were used to develop and refine various aspects of the mode, such as trip purposes, trip generation rates, mode choice and external trips.

The survey helped to refine trip generation rates. The survey results were used to refine the trip generation rates. However, due to the limited coverage of the household survey, the sample size for transit during the PM peak was not statistically significant. There were only two transit trips reported during the period of interest. As such, no definite inference could be made about transit usage as it relates to mode-choice. Overall, the survey showed approximately 3.5% of trips made by non-motorized modes, by bikes and walking.

License Plate Survey & External Traffic Volumes

Synovate also conducted a License Plate Survey at the two main external stations on Highway 99 on the north and south of Squamish, to establish traffic characteristics of trips to and from outside of Squamish.

By license plate matching within the peak hour it was determined how many external trips to or from outside of Squamish were either originating or destined inside Squamish respectively. It also determined how many trips were entirely external to Squamish; i.e. not to and from Squamish or "external-external" (X-X).

The License Plate Survey showed that on average only approximately 15% of trips to/from outside Squamish were entirely external to Squamish; i.e. with no origin or destination in Squamish. The License Plate Survey showed that approximately 14% of northbound trips from the south of Squamish are completely external, and 17% of southbound trips from the north are completely external.

The previous model, which was a weekend model, and showed approximately 50% X-X trips, which were mainly recreational in nature.

License Plate Survey was used to establish traffic volumes at the external stations for the year 2010 model.

A 2% growth was used to determine year 2031 traffic volumes at the external stations. The 2% growth is consistent with historical traffic volume data and was also used in the previous model.

Volume Counts

PM peak hour volume counts were obtained which included automobiles, trucks, busses, bikes and pedestrians. These included both directional link volumes and Turn Movement Counts (TMC's) at study intersections. These counts were used to calibrate and validate the Model.

Other Data

Transit and truck routes were obtained from the District of Squamish. Details about roadway network were also obtained and verified with site visits. Speed limits and turn penalties were based on site visits and Google Earth.

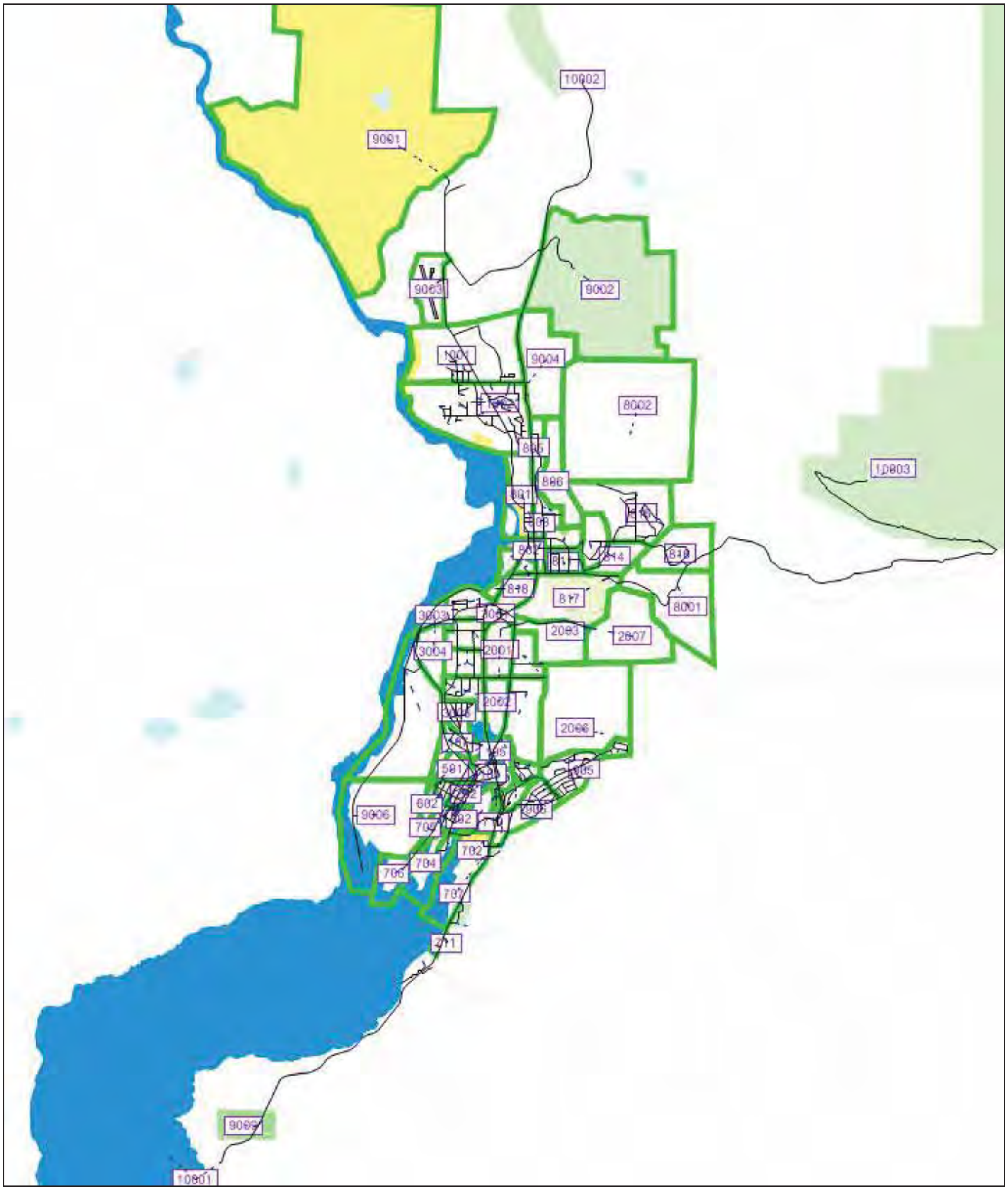
Model Development

Model development encompasses many aspects and components. At the highest level the Model is based on supply and demand. The supply side consists of traffic zones and transportation network. The demand side is mainly defined by landuse. The rest of the chapter describes development of the various components of the Model.

Traffic Zones and Connectors

The previous model in VISUM had 35 Transportation Analysis Zones (TAZ's) and three external stations, which was found to be out-dated as the area has grown and, as such, the model needed more refinement for a more realistic model. The new model now has 86 TAZ's and three external zones (total of 89 zones), as shown for existing (year 2010) in **Figure 1**. Local street connections to the major roadway network were represented by TAZ connectors. Existing connectors were also modified as appropriate.

Figure 1 2010 Transportation Analysis Zones



Transportation Network Refinement

As part of the update process the model roadway network was updated to add newer roads and also to accommodate more TAZ's.

Existing (year 2010) transit routes were coded based on information from the District. Existing truck routes were coded based on District of Squamish Official Community Plan (OCP) designations and also information from the District.
As noted in the scope section, recreational bike trails and bike-only routes were not included in this model. However, bike lanes were included.

Model Structure

Trip Purposes

The model has the same three trip purposes as the old model, namely Home-based Work (HBW), Home-based Other (HBO) and Non-home-based (NHB). The household survey did not show a need for adding other trip types.

Landuse

District of Squamish provided existing (year 2010) landuse data for the categories of Single-Family Housing Units, Multi-Family Housing Units, Retail employment (number of employees), Highway Commercial employment, Service employment, Government Office employment, Industrial employment, University/College enrollment (number of students) and Hotel/Motel rooms.

In addition to these the District provided data on work at home, employment with no fixed workplace address and out of town commuters. It is reasonable to assume that once out of town commuters and people with no foxed work place address enter Squamish their trip-making characteristics are like any other local resident. Based on directions from the District out of town commuters and people with no fixed work place address were allocated to various zones.

The final year 2010 (existing) landuse data is summarized in **Table 1**.

Table 1 2010 Landuse Data

		SF	MF	Retail	Service	Hotel	Hwy. Comm.	Govt.	Ind.	Univ.
Zone	**Name**	Units	Units	Emp.	Emp.	Rooms	Emp.	Emp.	Emp.	Students
101	Station Square Shopping Mall+Ford+Gov +Ind	0	0	35	90	0	25	50	19	0
102	Gateway South + Chieftain Mall	0	0	45	75	0	0	0	0	0
103	Squamish Elementary	0	0	0	0	0	0	22	0	0
104	McDonalds + Esso + 711	0	0	0	0	0	12	0	0	0
105	Visitors Centre	0	0	3	4	0	0	10	2	0
106	Capilano University + HSS	0	0	1	0	0	0	88	0	431

Zone	Name	SF Units	MF Units	Retail Emp.	Service Emp.	Hotel Rooms	Hwy. Comm. Emp.	Govt. Emp.	Ind. Emp.	Univ. Students
107	Dentville - South	50	238	0	163	0	0	0	0	0
201	Commercial Core Northwest	0	60	98	65	26	0	20	0	0
202	Commercial Core Northeast	0	8	48	70	0	0	9	13	0
203	Commercial Core Southwest	5	33	23	49	81	0	79	56	0
204	Commercial Core Southeast	0	0	0	4	0	0	0	0	0
301	Mamquam Blind Channel Northwest	3	102	81	134	0	0	7	8	0
302	Mamquam Blind Channel Southwest	0	0	0	2	0	0	0	7	0
401	Downtown South	10	73	137	97	0	0	11	114	0
501	Downtown Residential North+Eaglewind+Seniors+ Castle R	0	433	0	121	0	0	0	215	0
502	Downtown Residential South+Skye	128	69	136	0	0	0	0	0	0
503	Downtown Residential East	22	30	11	27	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	0	0	0	0	0	0	6	0
702	Mamquam Blind Channel Southeast+IR24	29	0	0	18	0	0	0	42	0
703	Lower Peninsula East	0	0	0	2	0	0	0	19	0
704	Lower Peninsula South	0	0	0	0	0	0	5	6	0
705	Estuary South	0	0	0	0	0	0	0	0	0
706	Port	0	1	0	0	0	0	0	119	0
707	Klahanie North	0	0	0	9	0	0	0	0	0
708	Shell, KFC	0	0	0	0	0	8	0	0	0
709	Mamquam Blind East	0	0	0	0	0	0	0	6	0
710	Church	0	0	0	5	0	0	0	0	0
711	Kiewet	0	0	0	0	0	0	0	6	0
712	Residential	5	0	0	1	0	0	0	1	0
801	Garibaldi West-North	35	97	0	78	0	0	0	0	0
802	Garibaldi West-Southeast	6	0	0	54	0	8	36	0	0

Zone	Name	SF Units	MF Units	Retail Emp.	Service Emp.	Hotel Rooms	Hwy. Comm. Emp.	Govt. Emp.	Ind. Emp.	Univ. Students
803	Garibaldi West-South	24	274	0	0	0	0	0	208	0
804	Garibaldi West-Southwest +Spiral	74	87	0	96	0	0	0	0	0
805	Garibaldi North-South	33	73	24	7	0	0	0	119	0
806	Resort+ Executive Inn	0	0	0	26	111	0	0	0	0
807	Garibaldi East-North	86	56	68	32	0	0	0	0	0
808	Garibaldi Commercial-North	0	79	62	0	0	0	21	0	0
809	Garibalid Commercial+STS Hotel+Tant	0	3	10	111	52	20	10	0	0
810	Garibaldi Commercial - South	0	2	25	49	0	70	0	0	0
811	Garibaldi East-South	134	0	0	78	0	0	0	0	0
812	Garibaldi East	139	33	0	100	0	0	0	0	0
813	Highlands West	214	0	13	29	0	7	23	47	0
814	Highlands East-South	272	0	16	36	0	9	29	59	0
815	Highlands East-North	639	35	0	0	0	0	128	317	0
816	Quest University + University Highlands	25	108	0	25	0	0	135	72	280
817	Golf Club + Auto	0	101	0	33	0	0	0	62	0
818	Garibaldi West South	20	239	0	149	0	0	0	0	0
819	District WWTP & Operations Centre	0	0	0	0	0	0	90	0	0
901	Squamish Inn	0	0	0	4	30	0	0	0	0
902	Loggers Lane	0	0	0	0	0	0	0	2	0
903	Scott Cres	0	0	0	0	0	0	0	12	0
904	Smoke Bluffs	80	20	6	13	0	3	11	22	0
905	Valleycliffe North	405	34	29	155	0	0	41	147	0
906	Valleycliffe	285	112	25	56	0	13	45	92	0
907	Hospital + Residential	34	16	0	0	0	0	257	0	0
908	Clarke Access+ Casino Gas Bar	0	10	0	22	0	0	17	0	0
1001	Brackendale North+IR	276	0	0	0	0	0	117	107	0
1002	Brackendale South	655	154	37	129	0	0	219	137	0
2001	Parks +RCMP + Loggers Sports	0	0	0	0	30	0	50	0	0

Zone	Name	SF Units	MF Units	Retail Emp.	Service Emp.	Hotel Rooms	Hwy. Comm. Emp.	Govt. Emp.	Ind. Emp.	Univ. Students
2002	Protected Natural Env	0	0	0	0	0	0	0	0	0
2003	MOF+ Camp+ Asphalt + Concrete Plant	0	2	0	2	30	0	27	75	0
2004	Raven	45	1	0	0	0	0	0	32	0
2005	Robin	11	3	1	2	0	0	1	3	0
2006	Crumpit South	0	0	0	0	0	0	0	0	0
2007	Crumpit North	0	0	0	0	0	0	0	0	0
3001	MOT	0	0	0	0	0	0	0	0	0
3002	North Yards-North	205	289	0	0	0	0	0	330	0
3003	Railway Heritage Park	0	0	0	0	0	0	15	25	0
3004	Rail Yards + IR	7	4	0	0	0	0	0	235	0
3005	Business Park-North	0	0	0	17	95	0	0	68	0
3006	Business Park-Mid	0	0	0	21	0	130	0	282	0
3007	Business Park-South	0	5	10	165	87	15	6	372	0
3008	Dentville - North	152	0	9	20	0	5	16	33	0
8001		0	0	0	0	0	0	0	0	0
8002	North Highlands	0	0	0	0	0	0	0	0	0
9001	Cheakamus+PV Wellness +Camp+NVan O/S	56	0	0	40	20	0	4	23	0
9002	Alice Lake + Parks Office	0	2	0	0	55	0	9	0	0
9003	Airport	0	1	0	0	0	0	0	38	0
9004	Garibaldi North-North + Dryden Creek	4	0	0	5	30	0	0	0	0
9005	Estuary-North	0	0	0	0	0	0	0	0	0
9006	Estuary-West+Log Sort	0	0	0	0	0	0	0	6	0
9007	Stawamus Prov Park	0	0	0	0	53	0	10	0	0
9008	Klahanie RV Park +Restaurant	0	20	0	9	0	10	0	0	0
9009	Murrin Provincial Park	0	0	0	0	0	0	0	12	0
10001	Vancouver	0	0	0	0	0	0	0	0	0
10002	Whistler	0	0	0	0	0	0	0	0	0
10003	Garibaldi Provincial Park	0	0	0	0	0	0	0	0	0

Trip Generation

Trip generation rates for the most part were derived from the Household Survey. Trip rates were developed for the following trip types:

1. Home to Work
2. Work to Home
3. Home to Other
4. Other to Home
5. Non-home-based

For some landuses the Survey sample size was not statistically significant, and as such ITE trip rates were used instead. The final trip rates are very close to ITE trip generation rates. It should be noted that even though the landuse data differentiates between retail and highway commercial employment, the trip generation rates are the same.

Trip Distribution

Trip Distribution remains unchanged and is a simple gravity model with smoothed feedback skims.

Trip Assignment

Trip Assignment was equilibrium-based.

Mode Choice

As mentioned in the Household Survey section, the sample size for non-automobile trips was not statistically significant and as such no definitive determination can be made about mode split. For example, during the period of interest (weekday PM peak hour from 4 PM to 5 PM), the Survey showed only two transit trips.

However, overall the Survey showed approximately 6% non-automobile trips. As a result 6% modesplit was applied to total trips for non-automobile trips. Of these 2% modesplit was applied to account for non-motorized trips (bikes and pedestrians). The remaining 4% was assigned to transit. It should be noted that non-motorized trips were calculated but not assigned to the network.

The current model setup uses travel-time as the “cost” of travel. Mode-choice based on “generalized cost” is more flexible and allows for more elaborate mode-choice models especially that include factors like parking cost, transit fare, etc.

It is recommended that for a future update of this Model, “generalized cost” be used instead of travel-time as the cost of travel. In order to use generalized cost a more elaborate household survey is required and also a study about the perceived value of time. In addition, it requires more data items such as fares, transfer fares, parking cost, cost of owning an automobile, value of time, etc.

Transit Trips

Currently, transit trips are headway-based and do not take factors like fare, transfer cost, and parking cost into account. As discussed in the modechoice section these factors can only be included if generalized cost is used instead of travel-time.

Truck Trips

Truck trips have typically different trip-making characteristics than commuter trips. Trucks also have restrictions on which routes they can take and at times which hours. In addition, the origins and destinations for trucks are typically defined by commodity flows rather than landuses, and places like truck stops. For example, housing units is not a factor in determining truck trip generation rates. As such truck trips for travel models, as in the Model, are typically assigned independently of automobile and other motorized trips.

Truck routes were coded in the Model based on OCP designations and also directions of the District staff.

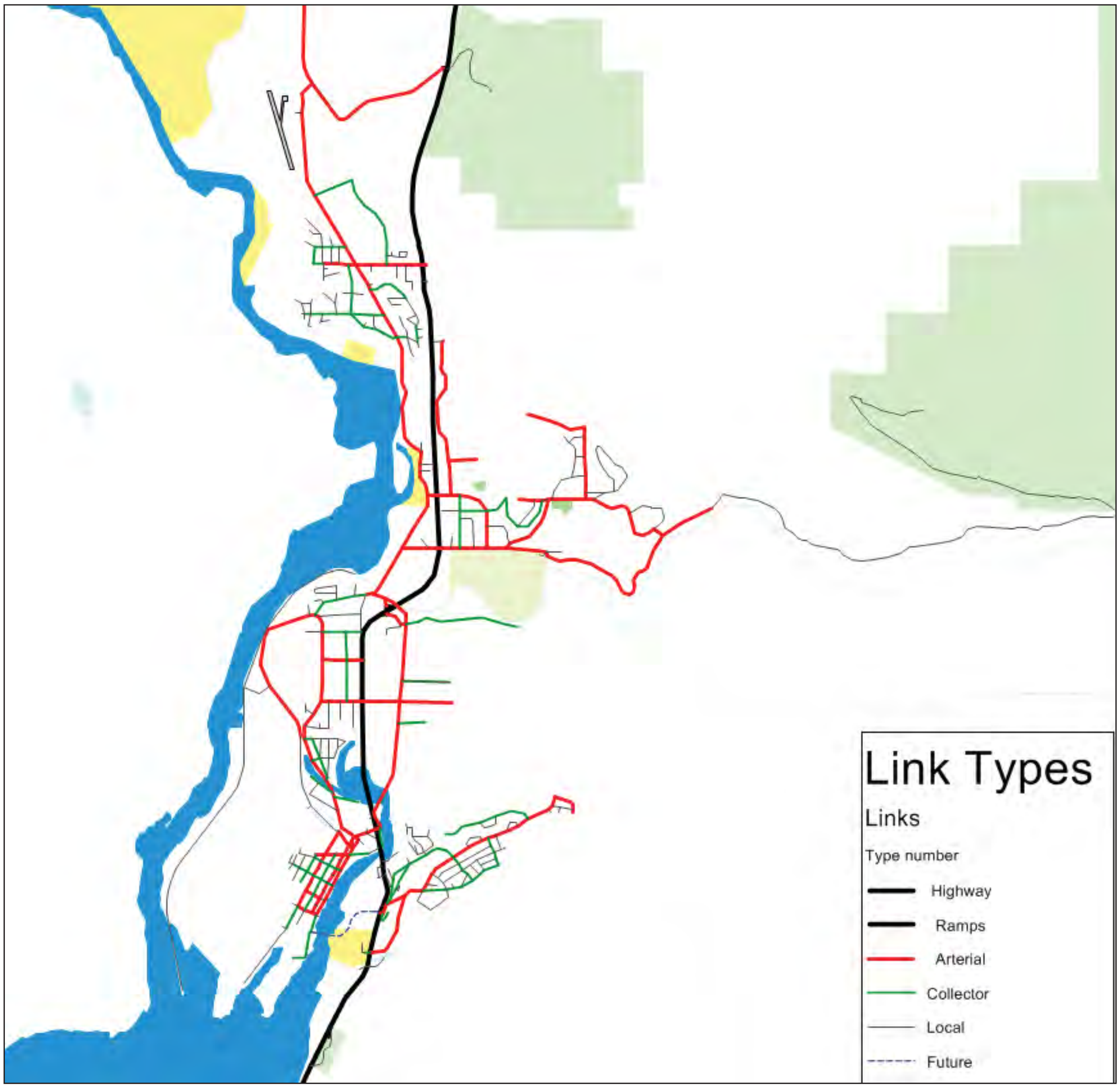
Truck volumes were derived from available classification counts and TMC's. The District also provided a list of known truck origins and destinations. Based on this data and engineering judgment a truck Origin-Destination (O-D) table was developed. This truck O-D table was pre-loaded to the truck routes in the Model based on all-or-nothing assignment. This is reasonable as trucks have limited routes available with a more or less fixed O-D and trucks typically do not change routes based on congestion.

Automobile and transit trips were assigned later on in the modeling stream. Truck volumes were validated based on available classification counts.

Existing Model Calibration/validation

It should be noted that for the purpose of this Model additional roadway functional types were defined in addition to the OCP designations of "Highway" and "Arterial". "Collectors" and "Residential" were also included to delineate trip-making hierarchy and to ensure that the amount of traffic on a roadway is proportional to the functional hierarchy of road type. The respective Volume-Delay functions then dictated the final traffic assignment on the links according to the functional types. The final functional types for the existing Model are shown in **Figure 2**.

Figure 2 2010 Roadway Functional Classification

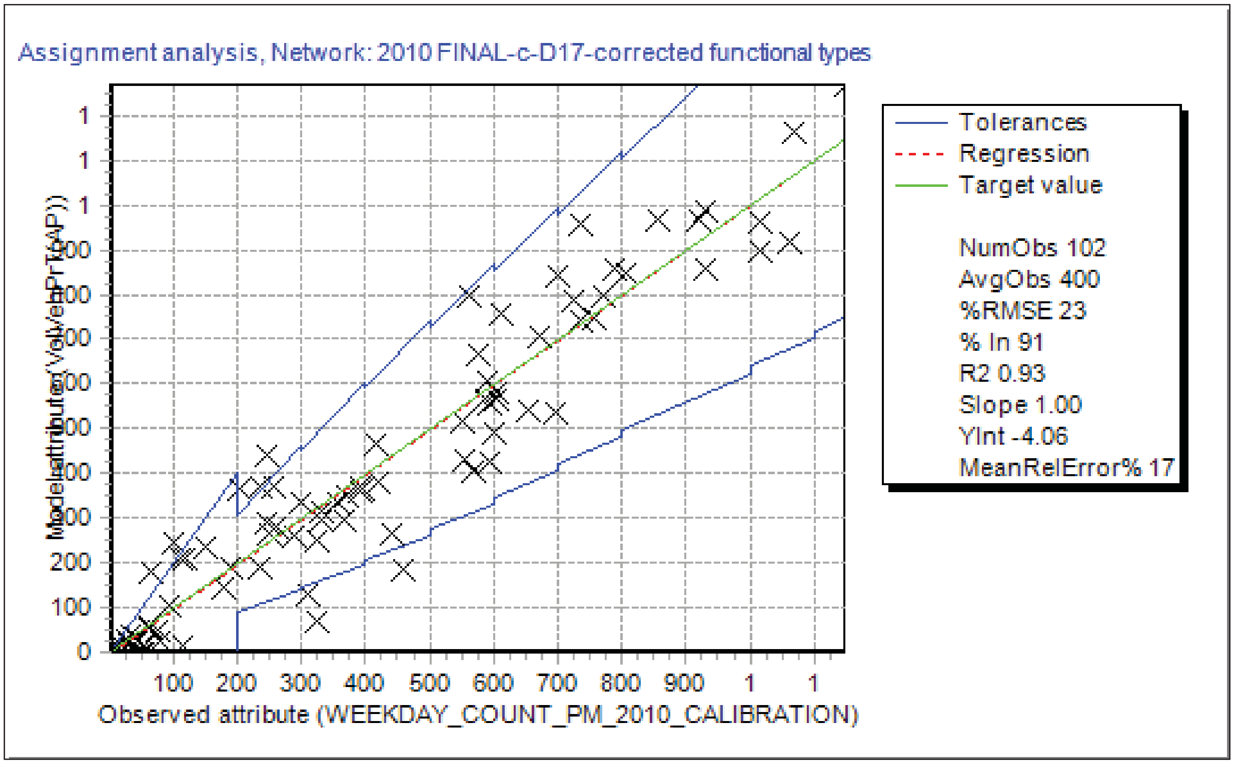


The test of a model is how well it replicates existing conditions. Only then it can be relied on to forecast future conditions adequately. The process of calibration/validation verifies that the model is replicating existing conditions within acceptable tolerances.

There are a number of ways to calibrate/validate a model. The VISUM platform has a built-in calibration utility that compares coded existing directional link volume counts with assigned existing directional link volumes.

The results of the 102 link counts are summarized in **Figure 3**.

Figure 3 Calibration Results



The results show that the Model is replicating existing counts within acceptable tolerances, as follows:

1. The correlation coefficient of the linear regression line comparing actual to simulated volumes was 0.93 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 is at the ideal value of 1.00;
3. The y-intercept was -4.06 which is very close to the ideal value of 0; and

The %in statistic was 91% and the recommended Caltrans standard is that 75% of the assigned volumes on principal arterial streets and higher classification roadways are within these standards.

Apart from link volumes, other aspects were also checked for reasonability. For example, O-D patterns between various zones and external stations were checked. Traffic assignments on various roads were checked to see if they follow functional type hierarchy; for example, an arterial typically carries more traffic than a residential street.

In some instances, TAZ connectors were modified to match observed and/or reasonable travel characteristics and hierarchy. In other instances, posted speeds for selected links were adjusted for the same reason.

Conclusion and Future Recommendations

The current Model has a number of improvements over the previous model as follows:

1. The Model is significantly superior and refined with more than double the zones and more roadways. Some old zones were split into smaller zones to reflect new growth and for better loading
2. The entire roadway network was reviewed and updated to match existing realities on the ground, including functional types and hierarchy, posted speeds, roadway capacities, turn prohibitions (including u-turn prohibitions wherever needed), directional restrictions wherever needed, and better zone connectors
3. Truck routes were added to the model and truck traffic assigned separately
4. Transit routes were adjusted and added to match existing transit routes and stops
5. Out-of-town commuters and workers with no fixed addresses were accounted for in the landuse
6. The new count data has 102 data points compared to the previous 66. This allows for better calibration/validation
7. The new Model has superior volume distribution and hierarchy, thereby making it a better tool to derive PM peak hour turning movements for operational analysis
8. The new Model is based on typical weekday PM peak hour instead of the weekend PM peak in the previous model, which modeled composite travel patterns including external recreational travel. This allows to identify deficiencies/improvements required by local commuter traffic, and thus to identify funding responsibilities
9. The License Plate Survey showed approximately 17% external traffic as compared to almost 50% in the previous weekend Model

The current Model has superior calibration as discussed in the Calibration section

During the development of the new Model, a set of recommendations for future enhancement of the Model were also identified, as follows:

- The Survey conducted for this study was limited in scope and coverage. As such, while some deductions were made, in some aspects statistically significant data points were not available. For example, while trip generates rates were slightly adjusted; there was not enough data to make any inference about transit trips. It is strongly recommended that a more comprehensive survey be conducted with more coverage and a statistically large sample size, so definitive conclusions can be made about preference for various modes
- The current transit assignment, as in the previous Model, is headway-based and travel-time is used as cost of travel, which is not conducive to a refined mode-choice model, as it is not sensitive to other factors like parking cost, cost of auto-ownership, transit fares, and transfer fares etc. It is strongly recommended that generalized cost be used instead of travel-time as the cost of travel. In addition, a fare-based transit assignment be considered in future enhancements of the Model. However, this also needs a more comprehensive survey that also evaluates the perceived value of time

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C
TAC SIGNAL WARRANT RESULTS

THIS PAGE INTENTIONALLY LEFT BLANK

2005 Canadian Traffic Signal Warrant Matrix Analysis

Main Street (name)	Government Road	Direction (EW or NS)	NS	Date:	Feb 23, 2011
Side Street (name)	Garibaldi Way	Direction (EW or NS)	EW	City:	Squamish, BC
Quadrant (if appl)					

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signa (m)	# of Thru Lanes	
Government Road	NB	0	0	1	0	0	2,000	1	
Government Road	SB	0	0	1	0	0	2,000	1	
Garibaldi Way	WB	0	0	1	0	0			
Garibaldi Way	EB	0	0	0	0	0			

Demographics		
Elementary School	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	15000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Government Road	NS	50	2.0%	y	0.0
Garibaldi Way	EW		2.0%	y	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side
7:30 - 8:30	0	44	113	127	35	0	57	0	227	0	0	0	0	0	0	0
8:30 - 9:30	0	69	177	94	25	0	56	0	224	0	0	0	0	0	0	0
11:30 - 12:30	0	53	135	129	35	0	55	0	221	0	0	0	0	0	0	0
12:30 - 13:30	0	62	157	120	33	0	52	0	207	0	0	0	0	0	0	0
16:00 - 17:00	0	79	202	188	51	0	87	0	352	0	0	0	0	0	0	0
17:00 - 18:00	0	78	200	130	35	0	80	0	322	0	0	0	0	0	0	0
Total (6-hour peak)	**0**	**386**	**984**	**787**	**214**	**0**	**386**	**0**	**1,553**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**64**	**164**	**131**	**36**	**0**	**64**	**0**	**259**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\ (X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	34	34	0
		Veh	*Ped*

NOT Warranted

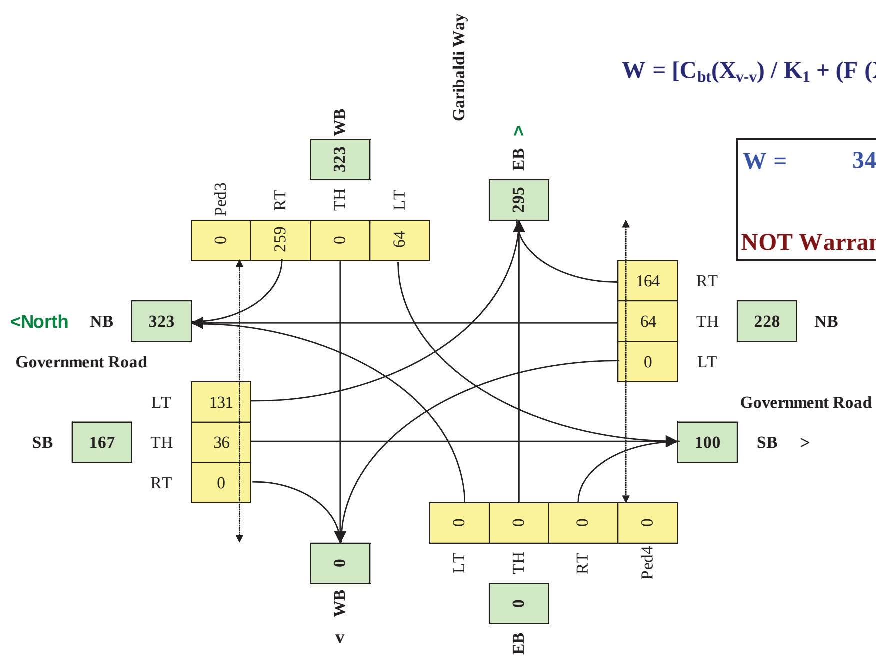


FIGURE C-1 Government Road @ Garibaldi Way 2010

2005 Canadian Traffic Signal Warrant Matrix Analysis

Main Street (name)	Government Road	Direction (EW or NS)	NS	Date:	Feb 23, 2011
Side Street (name)	Mamquam Road	Direction (EW or NS)	EW	City:	Squamish, BC
Quadrant (if appl)					

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signa (m)	# of Thru Lanes	
Government Road	NB	0	0	1	0	0	2,000	1	
Government Road	SB	0	0	1	0	0	2,000	1	
Mamquam Road	WB	0	0	1	0	0			
Mamquam Road	EB	0	0	0	0	0			

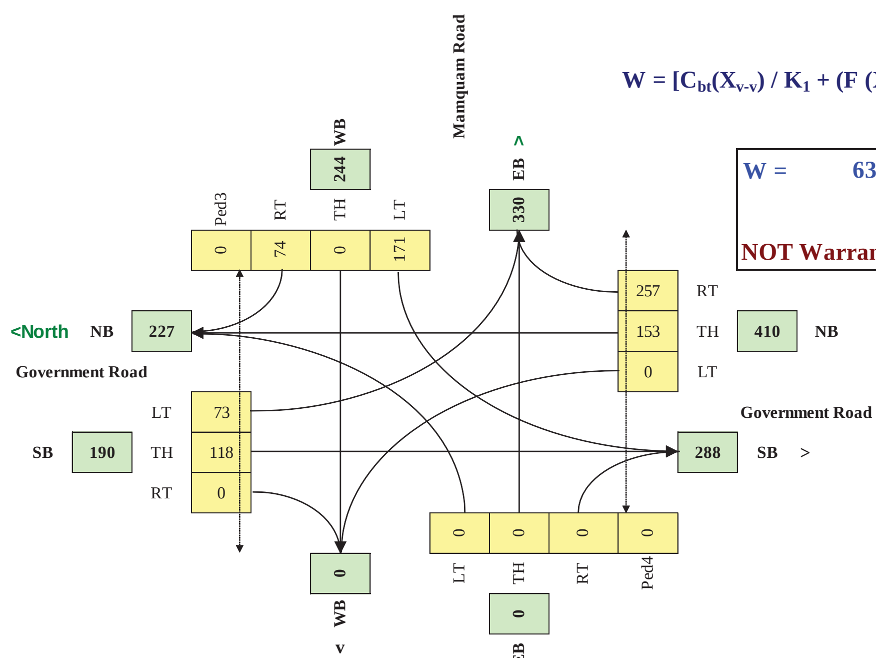
Demographics		
Elementary School	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	15000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Government Road	NS	50	2.0%	y	0.0
Mamquam Road	EW		2.0%	y	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side
7:30 - 8:30	0	89	149	50	81	0	150	0	65	0	0	0	0	0	0	0
8:30 - 9:30	0	140	235	78	127	0	148	0	64	0	0	0	0	0	0	0
11:30 - 12:30	0	137	230	60	97	0	146	0	63	0	0	0	0	0	0	0
12:30 - 13:30	0	168	282	70	113	0	137	0	59	0	0	0	0	0	0	0
16:00 - 17:00	0	191	321	90	145	0	232	0	100	0	0	0	0	0	0	0
17:00 - 18:00	0	194	326	88	143	0	212	0	91	0	0	0	0	0	0	0
Total (6-hour peak)	**0**	**918**	**1,543**	**436**	**705**	**0**	**1,025**	**0**	**441**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**153**	**257**	**73**	**118**	**0**	**171**	**0**	**74**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F\ (X_{v-p})\ L) / K_2] \times C_i$$



W =	63	63	0
		Veh	*Ped*
NOT Warranted			

FIGURE C-2 Government Road @ Mamquam Road 2010

2005 Canadian Traffic Signal Warrant Matrix Analysis

Main Street (name)	Government/Centennial	Direction (EW or NS)	EW		Date:	Feb 23, 2011
Side Street (name)	Government Road	Direction (EW or NS)	NS		City:	Squamish, BC
Quadrant (if appl)						

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signa (m)	# of Thru Lanes	
Government/Centennial	WB	0	0	1	0	0	2,000	1	
Government/Centennial	EB	0	0	1	0	0	2,000	1	
Government Road	NB	0	0	1	0	0			
Government Road	SB	0	0	0	0	0			

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	15000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Government/Centennial	EW	50	2.0%	y	0.0
Government Road	NS		2.0%	y	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side
7:30 - 8:30	0	0	0	17	0	147	0	96	69	264	66	0	0	0	0	0
8:30 - 9:30	0	0	0	27	0	232	0	95	68	260	65	0	0	0	0	0
11:30 - 12:30	0	0	0	26	0	226	0	93	67	257	64	0	0	0	0	0
12:30 - 13:30	0	0	0	32	0	278	0	87	63	241	60	0	0	0	0	0
16:00 - 17:00	0	0	0	36	0	316	0	148	107	408	102	0	0	0	0	0
17:00 - 18:00	0	0	0	37	0	320	0	136	98	373	93	0	0	0	0	0
Total (6-hour peak)	**0**	**0**	**0**	**175**	**0**	**1,519**	**0**	**654**	**472**	**1,803**	**451**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**29**	**0**	**253**	**0**	**109**	**79**	**300**	**75**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F\ (X_{v-p})\ L) / K_2] \times C_i$$

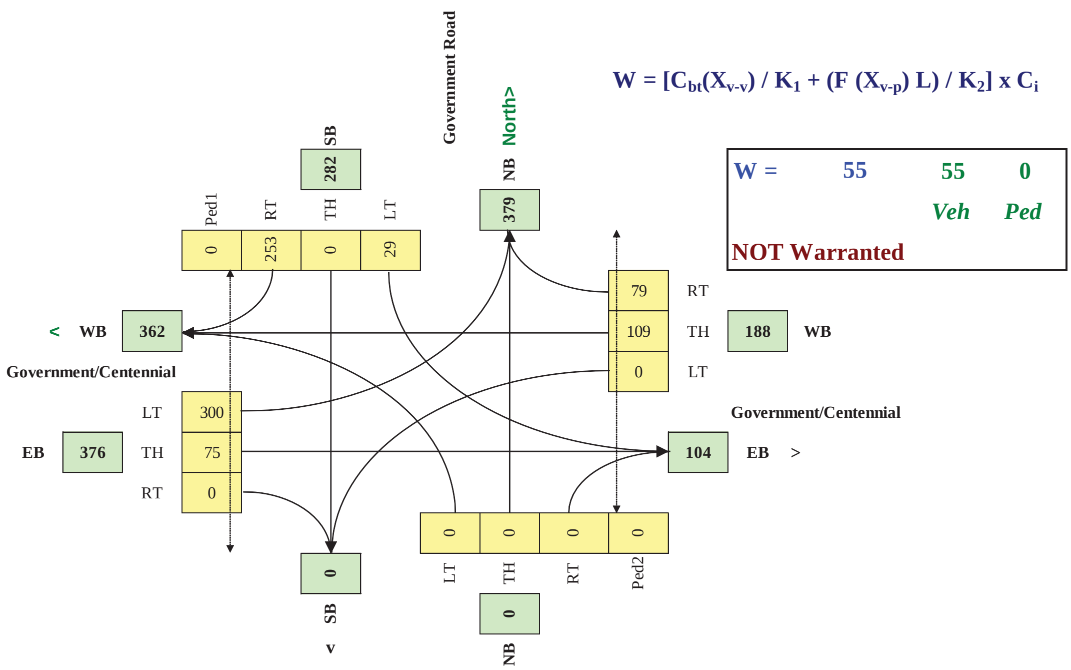


FIGURE C-3 Government Road @ Centennial Way 2010

2005 Canadian Traffic Signal Warrant Matrix Analysis

Main Street (name)	Government Road	Direction (EW or NS)	NS		Date:	Feb 23, 2011
Side Street (name)	Garibaldi Way	Direction (EW or NS)	EW		City:	Squamish, BC
Quadrant (if appl)						

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Government Road	NB	0	0	1	0	0	2,000	1	
Government Road	SB	0	0	1	0	0	2,000	1	
Garibaldi Way	WB	0	0	1	0	0			
Garibaldi Way	EB	0	0	0	0	0			

Demographics		
Elementary School	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	30000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Government Road	NS	50	2.0%	y	0.0
Garibaldi Way	EW		2.0%	y	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side
7:30 - 8:30	0	66	168	189	51	0	70	0	280	0	0	0	0	0	0	0
8:30 - 9:30	0	103	263	139	38	0	69	0	276	0	0	0	0	0	0	0
11:30 - 12:30	0	79	201	191	52	0	68	0	272	0	0	0	0	0	0	0
12:30 - 13:30	0	91	233	178	48	0	64	0	256	0	0	0	0	0	0	0
16:00 - 17:00	0	118	301	279	76	0	108	0	433	0	0	0	0	0	0	0
17:00 - 18:00	0	116	297	193	52	0	99	0	396	0	0	0	0	0	0	0
Total (6-hour peak)	**0**	**573**	**1,462**	**1,169**	**318**	**0**	**476**	**0**	**1,914**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**96**	**244**	**195**	**53**	**0**	**79**	**0**	**319**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F\ (X_{v-p})\ L) / K_2] \times C_i$$

W =	72	72	0
		Veh	*Ped*

NOT Warranted

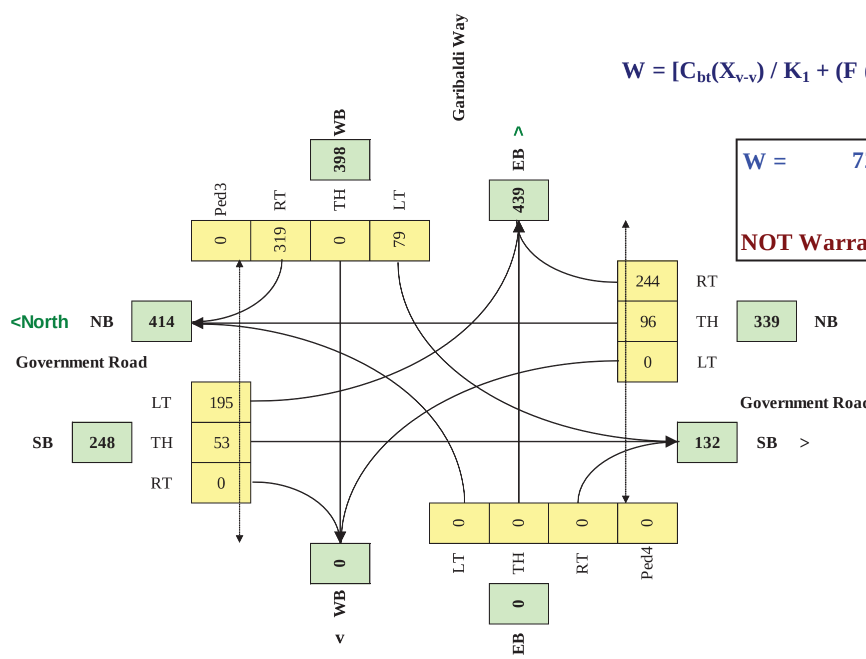


FIGURE C-4 Government Road @ Garibaldi Way 2031

OPUS

2005 Canadian Traffic Signal Warrant Matrix Analysis

Main Street (name)	Government Road	Direction (EW or NS)	NS		Date:	Feb 23, 2011
Side Street (name)	Mamquam Road	Direction (EW or NS)	EW		City:	Squamish, BC
Quadrant (if appl)						

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signa (m)	# of Thru Lanes	
Government Road	NB	0	0	1	0	0	2,000	1	
Government Road	SB	0	0	1	0	0	2,000	1	
Mamquam Road	WB	0	0	1	0	0			
Mamquam Road	EB	0	0	0	0	0			

Demographics		
Elementary School	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	30000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Government Road	NS	50	2.0%	y	0.0
Mamquam Road	EW		2.0%	y	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side
7:30 - 8:30	0	132	222	74	120	0	175	0	75	0	0	0	0	0	0	0
8:30 - 9:30	0	208	350	116	188	0	173	0	74	0	0	0	0	0	0	0
11:30 - 12:30	0	203	341	89	144	0	170	0	73	0	0	0	0	0	0	0
12:30 - 13:30	0	250	420	103	167	0	160	0	69	0	0	0	0	0	0	0
16:00 - 17:00	0	284	477	133	215	0	271	0	116				0	0	0	0
17:00 - 18:00	0	288	484	131	212	0	248	0	107	0	0	0	0	0	0	0
Total (6-hour peak)	**0**	**1,365**	**2,293**	**648**	**1,048**	**0**	**1,195**	**0**	**514**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**227**	**382**	**108**	**175**	**0**	**199**	**0**	**86**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\ (X_{v\text{-}p})\ L) / K_2] \times C_i$$

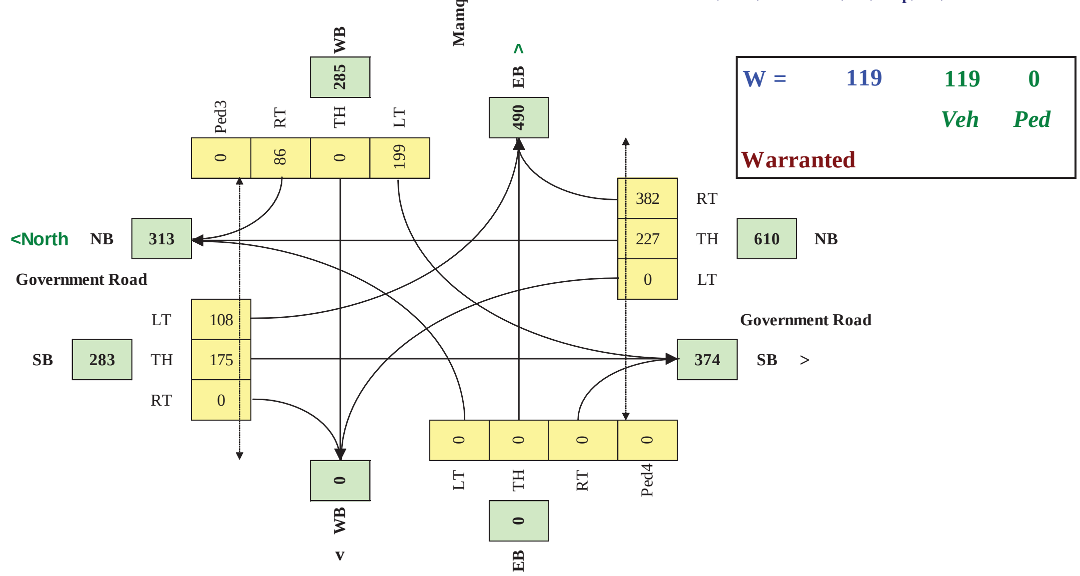


FIGURE C-5 Government Road @ Mamquam Road 2031

2005 Canadian Traffic Signal Warrant Matrix Analysis

Main Street (name)	Government/Centennial	Direction (EW or NS)	EW	Date:	Feb 23, 2011
Side Street (name)	Government Road	Direction (EW or NS)	NS	City:	Squamish, BC
Quadrant (if appl)					

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signa (m)	# of Thru Lanes	
Government/Centennial	WB	0	0	1	0	0	2,000	1	
Government/Centennial	EB	0	0	1	0	0	2,000	1	
Government Road	NB	0	0	1	0	0			
Government Road	SB	0	0	0	0	0			

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	30000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Government/Centennial	EW	50	2.0%	y	0.0
Government Road	NS		2.0%	y	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side
7:30 - 8:30	0	0	0	25	0	219	0	142	103	392	98	0	0	0	0	0
8:30 - 9:30	0	0	0	40	0	344	0	140	101	387	97	0	0	0	0	0
11:30 - 12:30	0	0	0	39	0	336	0	138	100	381	95	0	0	0	0	0
12:30 - 13:30	0	0	0	48	0	413	0	130	94	358	89	0	0	0	0	0
16:00 - 17:00	0	0	0	54	0	469	0	220	159	606	152	0	0	0	0	0
17:00 - 18:00	0	0	0	55	0	476	0	201	145	555	139	0	0	0	0	0
Total (6-hour peak)	**0**	**0**	**0**	**260**	**0**	**2,257**	**0**	**973**	**702**	**2,678**	**670**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**43**	**0**	**376**	**0**	**162**	**117**	**446**	**112**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F\ (X_{v-p})\ L) / K_2] \times C_i$$

W =	128	128	0
		Veh	*Ped*
Warranted			

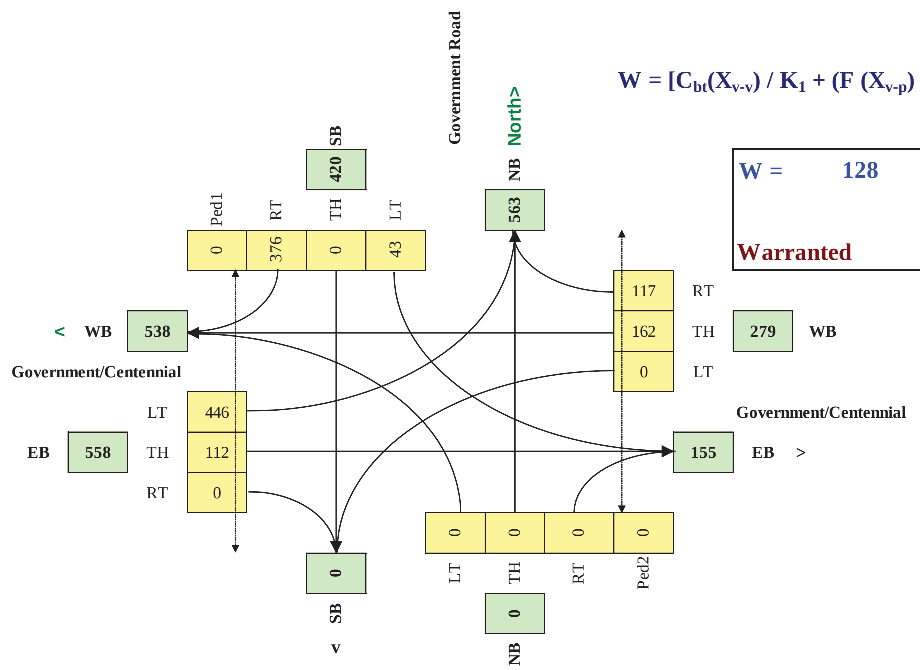


FIGURE C-6 Government Road @ Centennial Way 2032

OPUS

APPENDIX D
BREAKDOWN OF LAND USE

THIS PAGE INTENTIONALLY LEFT BLANK

2010 BASE CONDITIONS

TAZ	Name	SF & Duplex	MF/ TH	MF/ APT & Mobile	Retail Store	Service	Work at Home	No Fixed Workplace and Out of Town Commuters	Hotel/ Motel/ Inn +Campsites	Hwy Comm	Govt/ Instit	Ind	Univ	Elem/ Sec School	XI-O	IX-D
		units	units	units	emp	emp	emp	emp	rms	emp	emp	emp	Stud	Stud		
101	Station Square Shopping Mall+Ford+Gov +Ind	0	0	0	35	90	0	0	0	25	50	15	0	0	0	0
102	Gateway South + Chieftain Mall	0	0	0	45	75	0	0	0	0	0	0	0	0	0	0
103	Squamish Elementary	0	0	0	0	0	0	0	0	0	22	0	0	225	0	0
104	McDonalds + Esso + 711	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0
105	Visitors Centre	0	0	0	3	4	0	0	0	0	10	2	0	0	0	0
106	Capilano University + HSS	0	0	0	1	0	0	0	0	0	88	0	431	647	0	0
107	Dentville - South	50	63	175	0	4	20	163	0	0	0	0	0	0	0	0
201	Commercial Core Northwest	0	0	60	80	53	5	34	26	0	16	0	0	0	0	0
202	Commercial Core Northeast	0	0	8	45	66	5	5	0	0	8	5	0	0	0	0
203	Commercial Core Southwest	5	0	33	20	44	5	22	81	0	70	20	0	0	0	0
204	Commercial Core Southeast	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
301	Mamquam Blind Channel Northwest	3	0	102	60	100	8	60	0	0	5	5	0	0	0	0
302	Mamquam Blind Channel Southwest	0	0	0	0	2	1	0	0	0	0	5	0	0	0	0
401	Downtown South	10	0	73	112	79	25	47	0	0	9	50	0	0	0	0
501	Downtown Residential North+Eaglewind+Seniors+Castle R	0	142	291	0	35	30	246	0	0	0	20	0	0	0	0
502	Downtown Residential South+Skye	128	54	15	25	0	16	112	0	0	0	0	0	0	0	0
503	Downtown Residential East	22	0	30	4	10	0	30	30	0	0	0	0	0	0	0
601	Estuary North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
602	Estuary West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

OPUS

701	Mamquam Blind Channel Northeast	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
702	Mamquam Blind Channel Southeast+IR24	29	0	0	0	13	2	16	0	0	0	25	0	0	0	0
703	Lower Peninsula East	0	0	0	0	2	0	0	0	0	0	15	0	0	0	0
704	Lower Peninsula South	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0
705	Estuary South	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
706	Port	0	0	1	0	0	0	1	0	0	0	95	0	0	0	0
707	Klahanie North	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0
708	Shell, KFC	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
709	Mamquam Blind East	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
710	Church	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
711	Kiewet	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
712	Residential	5	0	0	0	0	0	3	0	0	0	0	0	0	0	0
801	Garibaldi West-North	35	75	22	0	4	10	75	0	0	0	0	0	0	0	0
802	Garibaldi West-Southeast	6	0	0	0	53	0	3	0	8	35	0	0	378	0	0
803	Garibaldi West-South	24	156	118	0	0	15	169	0	0	0	20	0	0	0	0
804	Garibaldi West-Southwest +Spiral	74	10	77	0	9	10	91	0	0	0	0	0	0	0	0
805	Garibaldi North-South	33	53	20	15	4	5	60	0	0	0	30	0	0	0	0
806	Resort+ Executive Inn	0	0	0	0	26	0	0	111	0	0	0	0	0	0	0
807	Garibaldi East-North	86	42	14	15	7	10	81	0	0	0	0	0	0	0	0
808	Garibaldi Commercial-North	0	0	79	30	0	4	45	0	0	10	0	0	0	0	0
809	Garibalid Commercial+STS Hotel+Tant	0	0	3	10	110	0	2	52	20	10	0	0	0	0	0
810	Garibaldi Commercial - South	0	0	2	25	48	0	1	0	70	0	0	0	0	0	0
811	Garibaldi East-South	134	0	0	0	4	9	76	0	0	0	0	0	0	0	0
812	Garibaldi East	139	5	28	0	2	15	98	0	0	0	0	0	0	0	0
813	Highlands West	214	0	0	0	0	15	121	0	0	0	0	0	0	0	0
814	Highlands East-South	272	0	0	0	0	18	154	0	0	0	0	0	0	0	0
815	Highlands East-North	639	35	0	0	0	33	382	0	0	25	20	0	268	0	0
816	Quest University + University Highlands	25	4	104	0	18	8	75	0	0	93	30	280	0	0	0
817	Golf Club + Auto	0	52	49	0	13	8	57	0	0	0	20	0	0	0	0
818	Garibaldi West South	20	119	120	0	9	15	147	0	0	0	0	0	0	0	0
819	District WWTP & Operations Centre	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0
901	Squamish Inn	0	0	0	0	4	0	0	30	0	0	0	0	0	0	0
902	Loggers Lane	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
903	Scott Cres	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
904	Smoke Bluffs	80	20	0	0	0	7	57	0	0	0	0	0	0	0	0
905	Valleycliffe North	405	29	5	10	53	35	249	0	0	14	20	0	157	0	0
906	Valleycliffe	285	30	82	0	0	40	225	0	0	0	0	0	0	0	0
907	Hospital + Residential	34	16	0	0	0	3	28	0	0	23	0	0	0	0	0

											0					
908	Clarke Access+ Casino Gas Bar	0	10	0	0	19	0	6	0	0	15	0	0	87	0	0
1001	Brackendale North+IR	276	0	0	0	0	25	157	0	0	34	25	0	438	0	0
1002	Brackendale South	655	140	14	5	18	60	459	0	0	30	15	0	325	0	0
2001	Parks +RCMP + Loggers Sports	0	0	0	0	0	0	0	30	0	50	0	0	0	0	0
2002	Protected Natural Env	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	MOF+ Camp+ Asphalt + Concrete Plant	0	0	2	0	2	0	1	30	0	27	60	0	0	0	0
2004	Raven	45	0	1	0	0	0	26	0	0	0	8	0	0	0	0
2005	Robin	11	0	3	0	0	0	8	0	0	0	0	0	0	0	0
3001	MOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3002	North Yards-North	205	135	154	0	0	30	280	0	0	0	30	0	0	0	0
3003	Railway Heritage Park	0	0	0	0	0	0	0	0	0	15	20	0	0	0	0
3004	Rail Yards + IR	7	0	4	0	0	0	6	0	0	0	185	0	0	0	0
3005	Business Park-North	0	0	0	0	17	0	0	95	0	0	55	0	0	0	0
3006	Business Park-Mid	0	0	0	0	21	0	0	0	130	0	227	0	0	0	0
3007	Business Park-South	0	0	5	10	164	0	3	87	15	6	298	0	0	0	0
3008	Dentville - North	152	0	0	0	0	10	86	0	0	0	0	0	0		
9001	Cheakamus+PV Wellness +Camp+NVan O/S	56	0	0	0	22	3	32	20	0	2	10	0	0	0	0
9002	Alice Lake + Parks Office	0	0	2	0	0	0	1	55	0	8	0	0	0	0	0
9003	Airport	0	0	1	0	0	0	1	0	0	0	30	0	0	0	0
9004	Garibaldi North-North + Dryden Creek	4	0	0	0	4	0	2	30	0	0	0	0	0	0	0
9005	Estuary-North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9006	Estuary-West+Log Sort	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
9007	Stawamus Prov Park	0	0	0	0	0	0	0	53	0	10	0	0	0	0	0
9008	Klahanie RV Park +Restaurant	0	0	20	0	4	0	11	0	5	0	0	0	0	0	0
9009	Murrin Provincial Park	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
10001	Vancouver	0	0		0		0		0	0	0	0	0		431	289
10002	Whistler	0	0		0		0		0	0	0	0	0		202	395
10003	Garibaldi Provincial Park	0	0		0		0		0	0	0	0	0		10	10
	Totals=	**4168**	**1190**	**1717**	**550**	**1229**	**505**	**4015**	**730**	**293**	**987**	**1407**	**711**	**2525**	**643**	**694**

2031 BUILDOUT FORECAST

TAZ	Name	SF & Duplex	MF/ TH	MF/ APT & Mobile	Retail Store	Service	Work at Home	No Fixed Workplace Address	Out of Town Commuters	Hotel/ Motel/ Inn +Campsites	Hwy Comm	Govt/ Instit	Ind incl Const	Univ	Elem/ Sec School	X1-O	X1-D
		units	units	units	emp	emp	emp	emp	emp	rms	emp	emp	emp	Stud	Stud		
101	Station Square Shopping Mall+Ford+Gov +Ind	0	0	0	74	250	0	0	0	0	96	107	29	0	0	0	0
102	Gateway South + Chieftain Mall	0	0	0	174	200	0	0	0	0	0	0	0	0	0	0	0
103	Squamish Elementary	0	0	0	0	0	0	0	0	0	0	39	0	0	225	0	0
104	McDonalds + Esso + 711	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0
105	Visitors Centre	0	0	0	20	20	0	0	0	0	0	18	0	0	0	0	0
106	Capilano University + HSS	0	0	0	0	0	0	0	0	0	0	116	0	0	707	0	0
107	Dentville - South	55	63	175	0	20	29	18	33	0	0	0	0	0	0	0	0
201	Commercial Core Northwest	0	0	60	347	200	6	4	7	26	0	36	0	0	0	0	0
202	Commercial Core Northeast	0	0	8	248	200	1	0	1	0	0	14	0	0	0	0	0
203	Commercial Core Southwest	5	0	33	174	150	4	2	4	81	0	71	39	0	0	0	0
204	Commercial Core Southeast	0	0	0	99	25	0	0	0	0	0	0	0	0	0	0	0
301	Mamquam Blind Channel Northwest	3	20	162	124	350	18	11	21	0	0	9	0	0	0	0	0
302	Mamquam Blind Channel Southwest	0	0	160	0	20	16	10	18	0	0	0	0	0	0	0	0
401	Downtown South	15	20	88	174	357	12	8	14	0	0	16	0	0	0	0	0
501	Downtown Residential North+Eaglewind+Seniors+ Castle R	0	172	411	0	208	57	36	66	0	0	0	0	0	0	0	0
502	Downtown Residential South+Skye	133	54	115	50	0	29	19	34	0	0	0	0	0	0	0	0
503	Downtown Residential East	22	0	30	20	50	5	3	6	30	0	0	0	0	0	0	0
601	Estuary North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
602	Estuary West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
701	Mamquam Blind Channel Northeast (SWL)	20	700	525	0	60	121	77	141	0	0	0	0	0	0	0	0
702	Mamquam Blind Channel Southeast+IR24	139	60	0	124	45	19	12	23	0	0	0	0	0	0	0	0
703	Lower Peninsula East	0	10	30	0	40	39	25	46	0	0	0	49	0	0	0	0

			0	5													
704	Lower Peninsula South (SODC)	0	430	465	99	149	87	55	101	200	0	214	94	750	0	0	0
705	Estuary South	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
706	Port	0	0	1	0	0	0	0	0	0	0	0	375	0	0	0	0
707	Klahanie North	0	0	0	0	26	0	0	0	0	0	0	188	0	0	0	0
708	Shell, KFC	0	0	0	0	45	0	0	0	80	48	0	0	0	0	0	0
709	Mamquam Blind East	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
710	Church	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0
711	Kiewet	0	0	0	0	0	0	0	0	0	0	0	47	0	0	0	0
712	Residential	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
801	Garibaldi West-North	50	75	22	0	13	14	9	17	0	0	0	0	0	0	0	0
802	Garibaldi West-Southeast	11	0	0	0	157	1	1	1	0	19	63	0	0	378	0	0
803	Garibaldi West-South	29	161	118	0	0	30	19	35	0	0	0	0	0	0	0	0
804	Garibaldi West-Southwest +Spiral	74	10	77	0	26	16	10	18	0	0	0	0	0	0	0	0
805	Garibaldi North-South	38	73	20	60	13	13	8	15	0	0	0	0	0	0	0	0
806	Resort+ Executive Inn	65	40	0	20	78	10	6	12	111	0	0	0	0	0	0	0
807	Garibaldi East-North	86	42	54	99	21	18	11	21	0	0	0	0	0	0	0	0
808	Garibaldi Commercial-North	10	30	119	149	0	15	10	18	0	0	71	0	0	0	0	0
809	Garibalid Commercial+STS Hotel+Tant	0	0	3	50	327	0	0	0	52	96	18	0	0	0	0	0
810	Garibaldi Commercial - South	0	0	2	99	203	0	0	0	0	192	0	0	0	0	0	0
811	Garibaldi East-South	149	20	0	99	13	16	10	19	0	0	0	0	0	0	0	0
812	Garibaldi East	154	45	53	0	60	25	15	29	0	0	0	0	0	0	0	0
813	Highlands West	224	0	0	0	0	22	14	25	0	0	0	0	0	0	0	0
814	Highlands East-South	272	0	0	0	0	26	17	31	0	0	0	0	0	0	0	0
815	Highlands East-North	864	350	150	0	0	133	84	155	0	0	45	0	0	268	0	0
816	Quest University + University Highlands	275	150	1000	0	179	139	88	162	0	0	357	0	1200	0	0	0
817	Golf Club + Auto	0	102	49	0	39	15	9	17	0	0	0	0	0	0	0	0
818	Garibaldi West South	40	129	120	0	26	28	18	33	0	0	0	0	0	0	0	0
819	District WWTP & Operations Centre	0	20	0	0	0	2	1	2	0	0	357	0	0	0	0	0
901	Squamish Inn	0	0	0	0	10	0	0	0	30	0	0	0	0	0	0	0
902	Loggers Lane	10	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
903	Scott Cres	80	35	0	0	0	11	7	13	0	0	0	0	0	0	0	0
904	Smoke Bluffs	5	20	0	0	0	2	2	3	0	0	0	0	0	0	0	0
905	Valleycliffe North	585	329	5	99	223	89	56	104	0	0	25	0	0	157	0	0

906	Valleycliffe	315	80	122	0	0	50	32	59	0	0	0	0	0	0	0	0
907	Hospital + Residential	34	16	0	0	0	5	3	6	0	0	536	0	0	0	0	0
908	Clarke Access+ Casino Gas Bar	0	10	0	0	57	1	1	1	0	48	0	0	0	87	0	0
1001	Brackendale North+IR	396	400	80	0	0	85	54	99	0	0	61	49	0	438	0	0
1002	Brackendale South	705	395	79	50	149	115	72	134	0	0	54	0	0	325	0	0
2001	Parks +RCMP + Loggers Sports	0	0	0	0	0	0	0	0	30	0	107	0	0	0	0	0
2002	Protected Natural Env	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	MOF+ Camp+ Asphalt + Concrete Plant	0	0	2	0	5	0	0	0	30	0	55	234	0	0	0	0
2004	Raven	295	310	1	0	0	59	37	69	0	0	0	39	0	0	0	0
2005	Robin	103	277	3	0	0	37	24	43	0	0	0	0	0	0	0	0
2006	Crumpitt South	894	25	0	0	0	89	56	104		0	0	0				
2007	Crumpit North	600	0	0	0	0	58	37	68		0	0	0				
3001	MOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3002	North Yards-North	215	199	190	0	0	59	37	68	0	0	0	0	0	0	0	0
3003	Railway Heritage Park	0	0	0	0	0	0	0	0	0	0	36	469	0	0	0	0
3004	Rail Yards + IR	7	0	4	0	0	1	1	1	0	0	0	1149	0	0	0	0
3005	Business Park-North	0	0	0	0	900	0	0	0	95	192	0	469	0	0	0	0
3006	Business Park-Mid	0	0	0	0	250	0	0	0	0	301	0	489	0	0	0	0
3007	Business Park-South	0	0	5	99	1500	0	0	1	87	36	18	636	0	0	0	0
3008	Dentville - North	167	30	0	0	0	19	12	22	0	0	0	0	0	0		
8001	Ring Creek Highlands	660	300		0	0	93	59	109		0	0	0				
8002	North Highlands	2000	300	0	0	0	224	141	261		0	0	0				
9001	Cheakamus+PV Wellness +Camp+NVan O/S	56	0	0	0	65	5	3	6	20	0	4	47	0	0	0	0
9002	Alice Lake + Parks Office	0	0	2	0	0	0	0	0	55	0	27	0	0	0	0	0
9003	Airport	0	0	1	0	0	0	0	0	0	0	0	94	0	0	0	0
9004	Garibaldi North-North + Dryden Creek	68	0	0	0	10	7	4	8	30	0	0	0	0	500	0	0
9005	Estuary-North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9006	Estuary-West+Log Sort	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9007	Stawamus Prov Park	0	0	0	0	0	0	0	0	53	0	27	0	0	0	0	0
9008	Klahanie RV Park +Restaurant	100	81	20	0	94	20	12	23	0	24	0	0	0	0	0	0
9009	Murrin Provincial Park	0	0	0	0	0	0	0	0	0	0	0	94	0	0	0	0

100 01	Vancouver	0	0		0		0			0	0	0	0	0		431	289
100 02	Whistler	0	0		0		0			0	0	0	0	0		202	395
100 03	Garibaldi Provincial Park	0	0		0		0			0	0	0	0	0		10	10
	Totals=	**10033**	**5673**	**4839**	**2550**	**6850**	**2000**	**1263**	**2329**	**1010**	**1082**	**2500**	**4600**	**1950**	**3085**	**643**	**694**
	Original (2010) Totals=	*4168*	*1190*	*1717*	*550*	*1229*	*505*	*856*	*2554*	*730*	*293*	*987*	*2012*	*711*	*2525*	*643*	*694*
	Difference=	*5865*	*4483*	*3122*	*2000*	*5621*	*1495*	*407*	*-225*	*280*	*789*	*1513*	*2588*	*1239*	*560*	*0*	*0*

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX E
FUTURE CAPACITY ANALYSIS

THIS PAGE INTENTIONALLY LEFT BLANK

Future Volume and Level of Service Analysis

The land use information described in SECTION 2.0 was input to the calibrated VISSIM model along with a growth factor of 2% applied at the external count stations on Highway 99. A calibration report is provided in APPENDIX B.

The following information indicates the future levels of service for the 2031 base scenario weekday and Friday afternoon peak conditions and 2031 build-out scenario weekday afternoon peak conditions. Key findings are summarized below:

- In 2031, for weekday conditions, most intersections will continue to operate at acceptable levels of service, with the exception of Mamquam Road, Industrial Way, and Cleveland Avenue.
- However, for August Friday conditions, most intersections will have unacceptable delays in 2031.
- For the Buildout scenario, most highway intersections will have unacceptable levels of service even during weekday conditions.

2031 Base – Weekday in September

The calibrated VISUM model was used to determine peak PM link volumes for a weekday in September for the 2031 base condition. From the link volumes, turning movement volumes were calculated based on existing turning movements. FIGURE E-1 shows the turning movement volumes and levels of service for the 2031 base scenario for a weekday in September. Results show that Highway 99 through traffic is highest between Industrial and Mamquam.

The level of service analysis shows an overall decrease in levels of service throughout the system. The intersections at Mamquam Road and Industrial Way showed movements with unacceptable delays. North-south through movements along Highway 99 generally operated with acceptable delays, with the exception of the Industrial Way intersection which showed a southbound through movement with a level of service E.

FIGURE E-2 shows VISSIM volume-to-capacity ratio outputs for the 2031 base scenario. As shown, no links are expected to experience capacity issues.

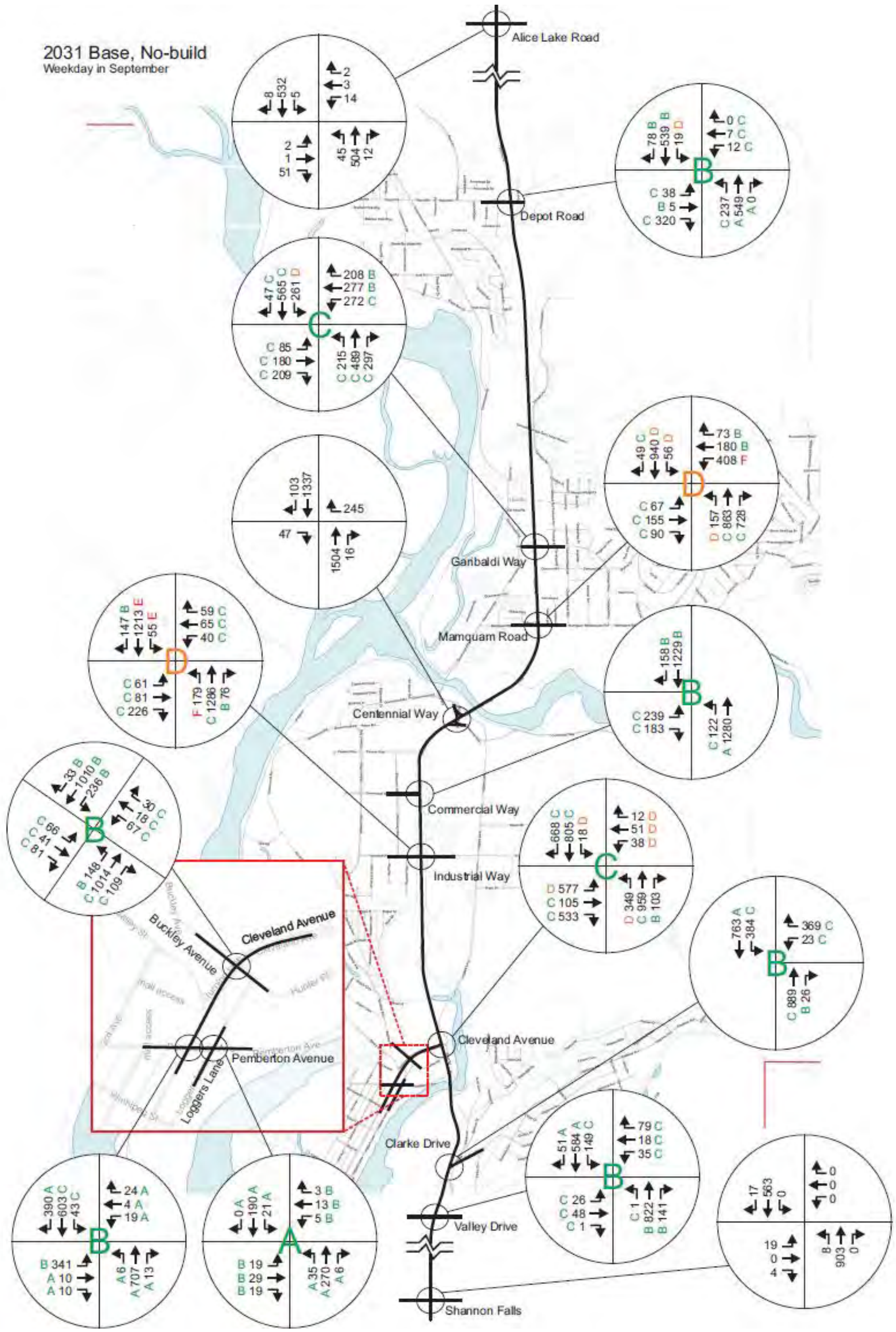


FIGURE E-1 Weekday in September PM Peak Traffic Volumes and Levels of Service – 2031 Base

OPUS

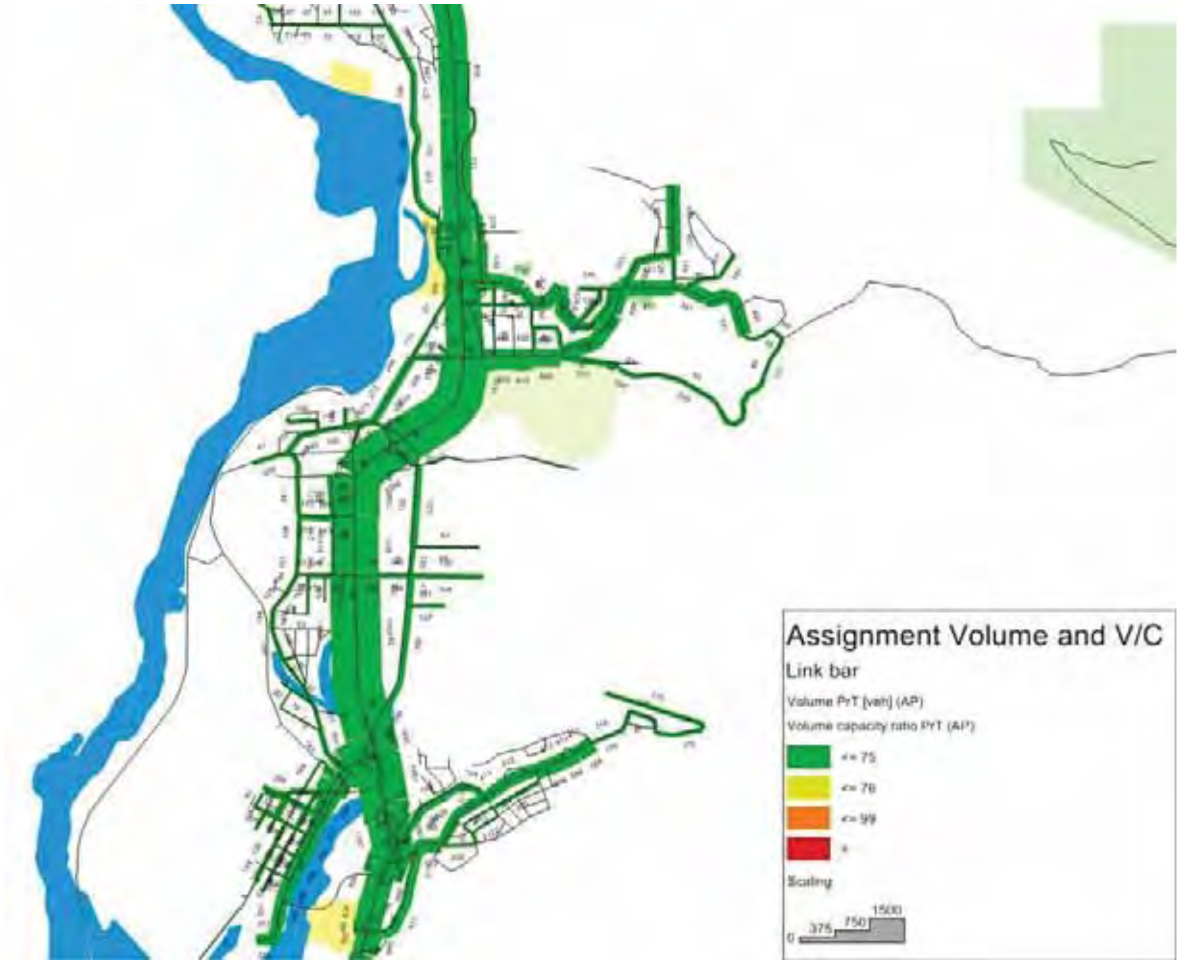


FIGURE E-2 Weekday in September PM Peak Volume-to-Capacity – 2031 Base

AM Peak Hour Performance – Weekday in September

Similar to the existing AM conditions examined in SECTION 3.1.3, an AM level of service analysis was conducted for the key highway intersections at Mamquam Road, Industrial Way, and Cleveland Avenue for the 2031 Base land-use scenario. TABLE E-1 shows the turning movement volumes, overall intersection levels of service, and levels of service for individual movements at the key intersections during the system wide morning peak between 8:00 a.m. and 9:00 a.m.

Because the model was developed for the PM peak only, future AM volumes were approximated based on the PM peak model outputs and the relationships observed between the existing AM and PM volumes as discussed in SECTION 3.1.3.

Levels of service observed for the AM peak decrease more significantly than those observed for the PM peak. Overall, the intersections at Mamquam Road and Industrial Way show unacceptable delays. Key failing movements include the westbound left-turn at Mamquam Road, and the southbound through movement at Industrial Way.

TABLE E-1 Weekday in September AM Peak Traffic Volumes and Levels of Service – 2031 Base

Highway Intersection	Weekday in September			
	Overall LOS	Movement		
		Movement	Volume	LOS
Mamquam Road	F	EBL	49	C
		EBT	135	C
		EBR	157	C
		WBL	728	F
		WBT	116	B
		WBR	56	B
		NBL	90	C
		NBT	432	C
		NBR	204	C
		SBL	73	C
		SBT	940	E
		SBR	67	C
Industrial Way	E	EBL	1	C
		EBT	49	C
		EBR	179	C
		WBL	76	C
		WBT	61	C
		WBR	55	C
		NBL	226	E
		NBT	643	B
		NBR	40	B
		SBL	59	D
		SBT	1213	F
		SBR	147	B

Highway Intersection	Weekday in September			
	Overall LOS	Movement		
		Movement	Volume	LOS
Cleveland Avenue	D	EBL	334	D
		EBT	38	C
		EBR	349	C
		WBL	103	D
		WBT	79	D
		WBR	18	D
		NBL	533	E
		NBT	480	B
		NBR	19	B
		SBL	12	D
		SBT	805	C
		SBR	577	C

2031 Base – Friday in August

FIGURE E-3 shows the PM peak turning movement volumes and levels of service for the 2031 base scenario for a Friday in August. The same factors described in SECTION 3.1.3 above were applied to the weekday in September volumes to determine Friday in August volumes.

The level of service analysis shows widespread failure; most highway intersections between Garibaldi Way and Clarke Drive exhibit multiple failing movements.

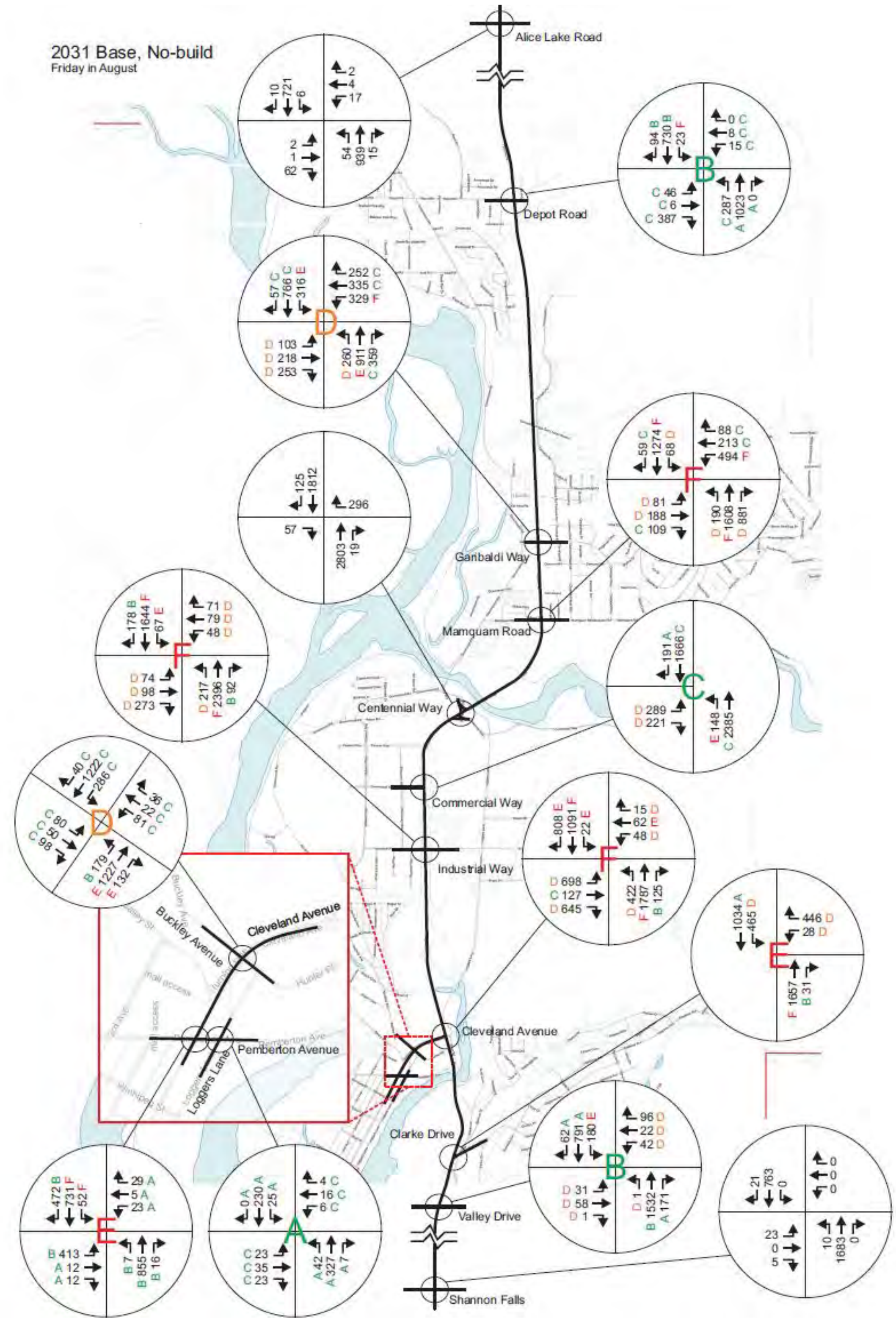


FIGURE E-3 Friday in August PM Peak Traffic Volumes and Levels of Service – 2031 Base

Implications of 2031 Base

2031 base condition capacity performance analysis suggests that although all links are functioning well within capacity, improvements will be required at intersections along Highway 99. In addition, given the constrained topography and land-use in Squamish, these intersection improvements may not be feasible or may not suffice, and alternative solutions will need to be considered.

2031 Build-out – Weekday in September

The calibrated VISUM model was also used to determine peak PM link volumes for a weekday in September for the 2031 build-out condition. Future peak hour turn movements were developed from future assigned link volumes. FIGURE E-4 shows the turning movement volumes and levels of service for the 2031 build-out scenario for a weekday in September. In addition to high through volumes along Highway 99, the build-out scenario features much greater turning movements both onto and off of the highway, which reflects the increased land-use density within Squamish.

The level of service analysis shows widespread failure at highway intersections between Garibaldi Way and Clarke Drive. Numerous turning movements both onto and off of the highway can be seen to have unacceptable delays.

FIGURE E-5 shows VISUM volume-to-capacity ratio outputs for the 2031 build-out scenario for a weekday in September. As shown, capacity issues are expected along Highway 99 between Mamquam Road and Cleveland Avenue. Significant capacity issues are also expected along some roads in the Garibaldi Highlands area, especially along Tantalus Road.

2031 Build-out – Friday in August

Given that the widespread failure shown for a weekday in September can already be considered unacceptable, and that levels of service for a Friday in August are expected to be worse, a level of service analysis for the 2031 build-out condition was not conducted.

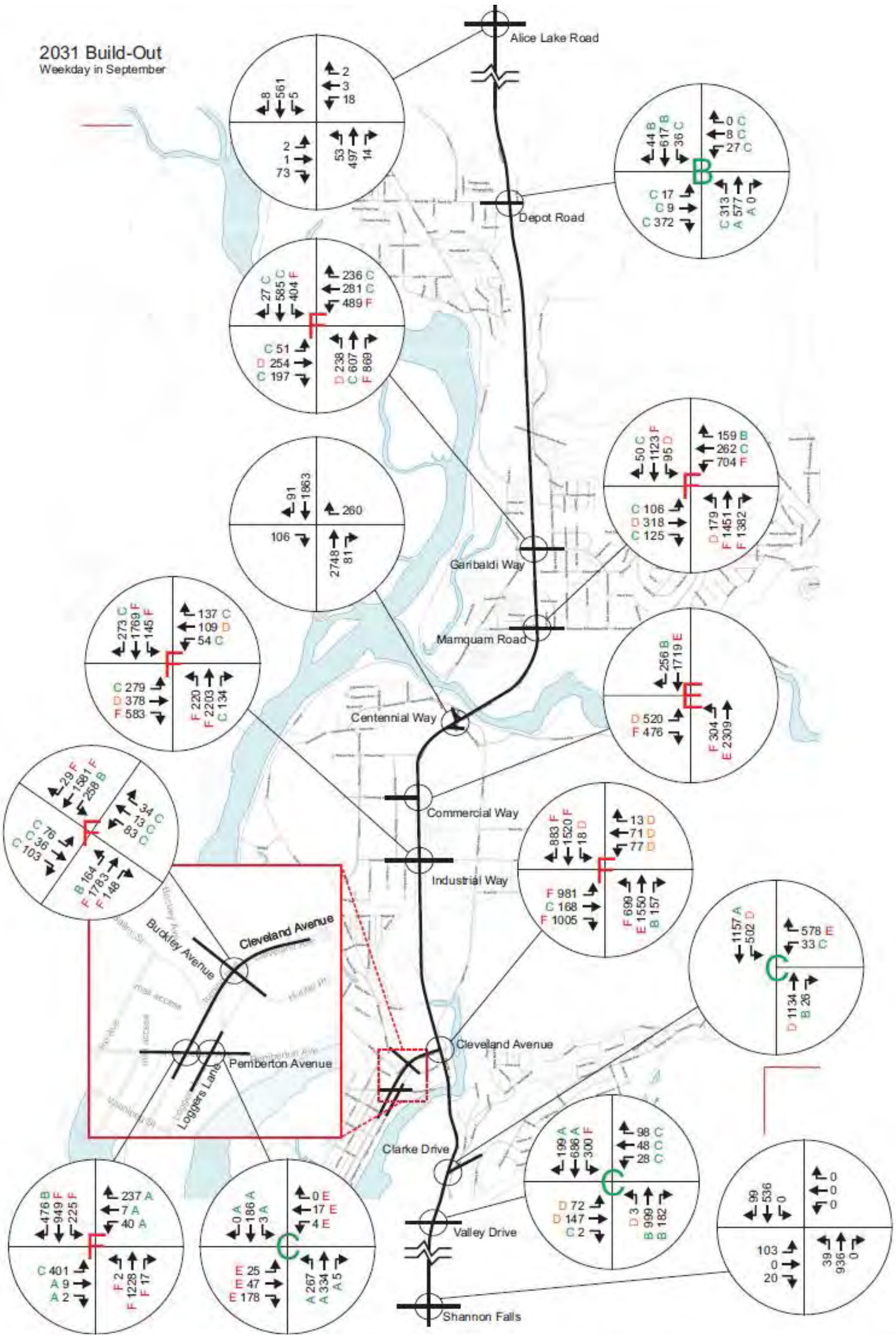


FIGURE E-4 Weekday in September PM Peak Traffic Volumes and Levels of Service – 2031 Build-out

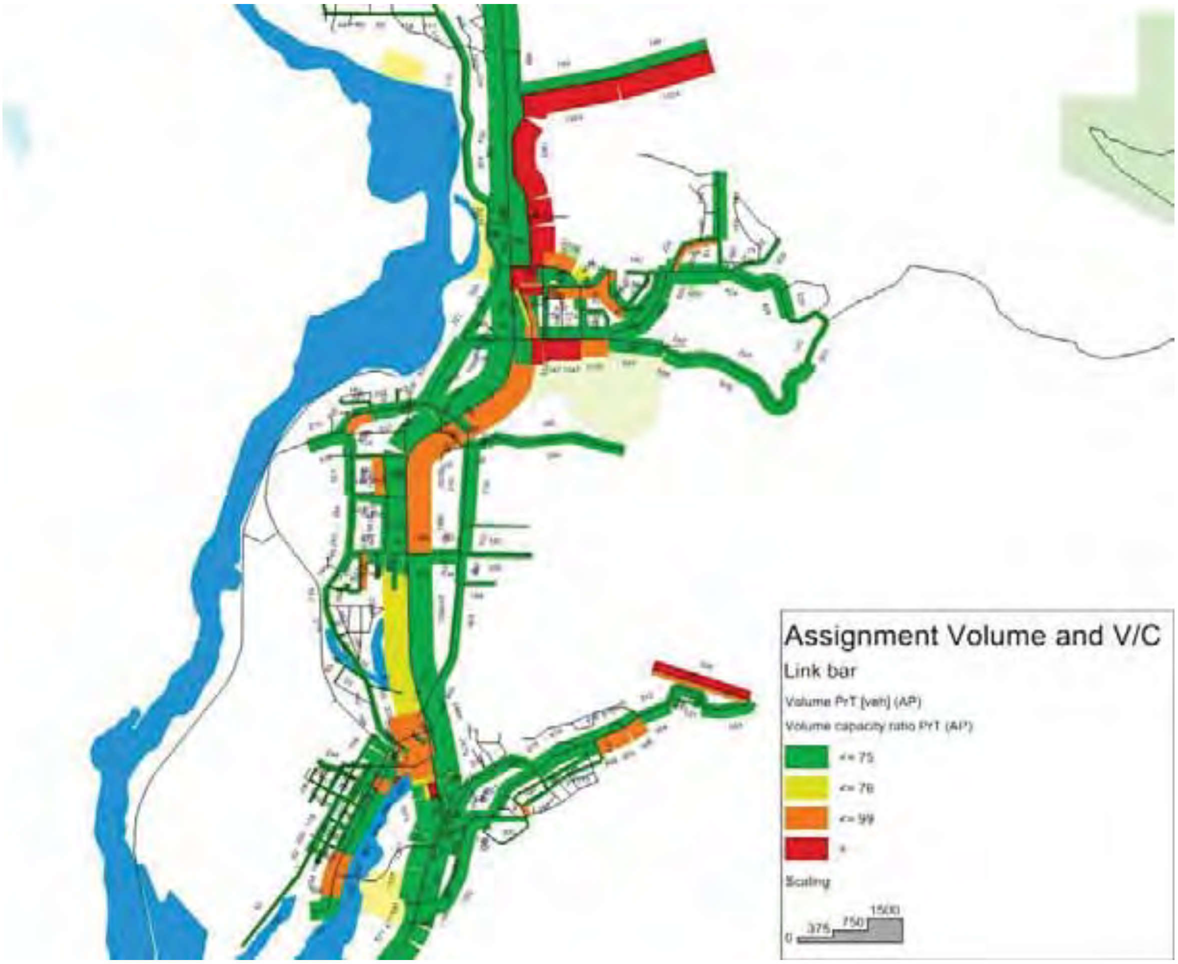


FIGURE E-5 Weekday in September PM Peak Volume-to-Capacity – 2031 Build-Out

Implications of 2031 Build-out

At 2031 build-out conditions, even links are approaching capacity. This indicates that widening existing roads or building new roads will be necessary if vehicle usage characteristics remain the same.

APPENDIX F
LOCAL NETWORK IMPROVEMENT LISTS

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE F-1 ROAD NETWORK IMPROVEMENTS

PRIORITY #	NAME	From	To	Road Class	Length (m)	Cost ($/m)	Description of Work	Estimated Cost ($)	Funding Source ($)				Year of Delivery
									DCC	Developer	General Revenue	Reserve	
New Major Roads													
1	Pioneer Way Extension	Queensway	Centennial Way	UAU	900	4000	Complete four lane arterial road with curbs, sidewalks, bicycle lanes, no parking.	3,600,000	1,800,000	0	1,650,000	150,000	<2021
2	North Downtown Connector	Bailey Street	Swan Crossing	RCU	800	1800	New two lane road with bicycle lanes and biofiltration ditches.	1,440,000	1,080,000	0	360,000	0	<2021
3	Laurelwood Connector	Hwy 99/ Clarke Drive	Pemberton Avenue	UCU	600	2500	New two lane road with curbs, sidewalks, bicycle lanes, limited parking. Obligation of the Squamish Waterfront Landing Development. Developer will be entitled to DCC offsets.	1,500,000	0	1,500,000	0	0	Dev
4	Cleveland Avenue Extension	Vancouver Street	Galbraith Avenue	UCU	500	3000	New two lane road with curbs, sidewalks, bicycle lanes, limited parking.	1,500,000	1,500,000	0	0	0	Dev
5	Newport Ridge Drive Extension	exist	Pia	UCU	1200	2500	New two lane road with curbs, sidewalks, bicycle lanes, limited parking. Dependent on development. Add to DCC List of Projects.	3,000,000	1,500,000	1,500,000	0	0	Dev
6	North Road	Hwy 99	Gov't Rd	UAU	380	2500	New two lane road with curbs, sidewalks, bicycle lanes, no parking. ALC approval required.	950,000	475,000	0	475,000	0	<2031
7	North Road	DL 510	Perth Drive	UCU	2500	2500	New two lane road with curbs, sidewalks, bicycle lanes, limited parking. Dependent on development. Add to DCC List of Projects.	6,250,000	0	6,250,000	0	0	Dev
8	Mamquam Road	Mashiter Bridge	Quest University	UAU	1200	2500	New two lane road with curbs, sidewalks, bicycle lanes, no parking. Add to DCC List of Projects. Developer will be entitled to offsets.	3,000,000	0	3,000,000	0	0	Dev

TABLE F-1 ROAD NETWORK IMPROVEMENTS

PRIORITY #	NAME	From	To	Road Class	Length (m)	Cost ($/m)	Description of Work	Estimated Cost ($)	Funding Source ($)				Year of Delivery
									DCC	Developer	General Revenue	Reserve	
9	South 7th Avenue or Third Avenue Reconstruct-ion.	Third Ave	Bailey Street	RCU	2300	1800	Future commercial transport route option to be selected based on needs of industrial lands in south downtown peninsula.	4,140,000	3,105,000	0	1,035,000	0	<2031
10	Main Street Extension	Fifth Avenue	Downtown Connector	UCU	250	2500	New two lane road with curbs, sidewalks, bicycle lanes, no parking. Add to DCC List of Projects.	625,000	312,500	0	312,500	0	<2031
11	Pemberton Avenue Extension	Fourth Ave	Downtown Connector	UCU	450	2500	New two lane road with curbs, sidewalks, bicycle lanes, no parking. Add to DCC List of Projects.	1,125,000	562,500	0	562,500	0	<2031
							New Major Roads Sub-Total	**27,130,000**	**10,335,000**	**12,250,000**	**4,395,000**	**150,000**	
Bridges													
1	Laurelwood CN Overpass	N/A	N/A	ULD/ UCU	N/A	N/A	Part of alternate downtown access originating at Clarke Drive and Highway 99. Must be bike and pedestrian network compatible. Obligation of the Squamish Waterfront Landing Development. Developer will be entitled to DCC offsets.	1,500,000	0	1,500,000	0	0	**Dev**
2	Pemberton Ave MBC Bridge	N/A	N/A	ULD/ UCU	N/A	N/A	Part of alternate downtown access originating at Clarke Drive and Highway 99. Must be bike and pedestrian network compatible. Obligation of the Squamish Waterfront Landing Development. Developer will be entitled to DCC offsets.	3,500,000	0	3,500,000	0	0	**Dev**
3	Paradise Valley Bridge	N/A	N/A	ULD/ UCU	N/A	N/A	Replace existing one lane Bailey Bridge crossing the Cheakamus River.	3,000,000	0	0	3,000,000	0	**<2021**
4	Catermole Creek Bridge	Oceanfront Lands	Third Avenue	UAU			Alternate access to the Oceanfront peninsula. Must be	3,000,000	3,000,000	0	0	0	**Dev**

TABLE F-1 ROAD NETWORK IMPROVEMENTS

PRIORITY #	NAME	From	To	Road Class	Length (m)	Cost ($/m)	Description of Work	Estimated Cost ($)	Funding Source ($)				Year of Delivery
									DCC	Developer	General Revenue	Reserve	
							bike and pedestrian network compatible. Add to DCC List of Projects.						
5	Third Avenue at Flood Gates	N/A	N/A	UCU	N/A	N/A	Currently one lane alternating traffic. Need tied to expansion of industrial activity and alternate access to the Oceanfront peninsula lands. Must be bike and pedestrian network compatible. Add to DCC List of Projects.	2,000,000	2,000,000	0	0	0	**<2031**
6	Newport Ridge Drive Bridge	N/A	N/A	ULD/ UCU	N/A	N/A	Alternate access between Highlands and Estates dictated by development in the Highlands. Must be bike and pedestrian network compatible. Add to DCC List of Projects.	2,500,000	1,250,000	1,250,000	0	0	**Dev**
7	Dryden Creek Bridge	N/A	N/A	ULD/ UCU	N/A	N/A	Associated with Brackendale & Estates connector from North Road at Highway 99 to Government Road.	2,500,000	1,250,000	0	1,250,000	0	**<2031**
							Bridges Sub-Total	**18,000,000**	**7,500,000**	**6,250,000**	**4,250,000**	**0**	
Intersections													
1	2nd Ave/ Pemberton Signalization	N/A	N/A	ULD/ UCU	N/A	N/A	Developer obligation to reconstruct and signalize intersection.	150,000	0	150,000	0	0	**<2016**
2	Gov't Rd/ Centennial/ Pioneer Signal or Roundabout	N/A	N/A	UAU / UAU	N/A	N/A	Major intersection on arterial network associated with Pioneer Connector. Must accommodate semi-railers as Centennial is a commercial transport route. Must be bike and pedestrian network compatible.	250,000	250,000	0	0	0	**<2021**
3	Gov't Rd/ Garibaldi Way Signal	N/A	N/A	UAU / UCU	N/A	N/A	Major connection between Highlands and Estates. Need to be determined by traffic	250,000	250,000	0	0	0	**<2021**

TABLE F-1 ROAD NETWORK IMPROVEMENTS

PRIORITY #	NAME	From	To	Road Class	Length (m)	Cost ($/m)	Description of Work	Estimated Cost ($)	Funding Source ($)				Year of Delivery
									DCC	Developer	General Revenue	Reserve	
							warrants. Must be bike and pedestrian network compatible.						
4	Downtown Roundabout or Alternate	N/A	N/A	ULD/ UCU	N/A	N/A	To connect Loggers Lane, Cleveland Avenue, Bailey Street and Pemberton Avenue. Must be bike and pedestrian network compatible. Property acquisition required.	600,000	300,000	0	300,000	0	**<2021**
5	Gov't Rd/ Mamquam Rd Signal	N/A	N/A	UAU / UAU	N/A	N/A	Major Local Network Option to Highway. Need to be determined by traffic warrants. Must be bike and pedestrian network compatible.	250,000	250,000	0	0	0	**<2021**
6	Garibaldi Way/ Tantalus Rd Signal	N/A	N/A	UAU / UCU	N/A	N/A	Major connection to North Estates. Needs to be determined by traffic warrants. Must be bike and pedestrian network compatible.	250,000	250,000	0	0	0	**Dev**
7	Mamquam Rd/ Highlands Way South Roundabout	N/A	N/A	UAU / UCU	N/A	N/A	Major connection between Highlands and Estates. Need to be determined by traffic warrants. Must be bike and pedestrian network compatible.	250,000	250,000	0	0	0	**<2026**
							Intersections Sub-Total	**2,000,000**	**1,550,000**	**150,000**	**300,000**	**0**	
							ROAD NETWORK IMPROVEMENTS TOTAL	**47,130,000**	**19,385,000**	**18,650,000**	**8,945,000**	**150,000**	

(Note: This list of improvements has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports. The projects which are highlighted in red denote projects that are expected to be needed irrespective of development trends. The remaining projects will be triggered by development activity)

TABLE F-2 NEW BICYCLE ROUTES

Classification	Length (m)	Cost ($/m)	Description of Work	Estimated Cost	Funding Source		
					DCC	Developer	General
Commuter Routes							
Conventional On-road Bike Lanes	3000	50	Cost of adding 1.5m wide bike lanes both sides of existing or proposed road including, bike/ sharrow symbols, line painting and signage.	$150,000	$0	$0	$150,000
Conventional On-road Bike Lanes with new shoulders added.	2200	150	Cost of adding 1.5m wide bike lanes both sides of existing or proposed road including, 1.5m x 2 shoulder widening, bike/ sharrow symbols, line painting and signage.	$330,000	$0	$0	$330,000
Shared Use Bike Lanes	1200	10	Cost of adding signage and bike / sharrow symbols to existing roads.	$12,000	$0	$0	$12,000
Separated Bike Lanes with existing ROW	500	500	Cost of 3.0m wide paved bike lane within road allowance but separated from the roadway by curbing or other form of barrier and/ or spatially separated.	$250,000	$0	$0	$250,000
Paved Multi Use Trails in Urban Areas	2400	250	Cost of 3.0m wide paved trail outside of road allowance including signage and lighting. Incomplete sections of the Corridor Trail are included here.	$600,000	$0	$350,000	$250,000
Paved Multi Use Trails in Rural Areas	1000	160	Cost of 3.0m wide gravel trail within road allowance on rural roads including signage.	$160,000	$0	$0	$160,000
Sub-Total Length	**10300**		**Commuter Routes Sub-Total**	**$1,502,000**	**$0**	**$350,000**	**$1,152,000**
Neighbourhood Routes							
Downtown							
Shared Use Bike Lanes	1800	10	Cost of adding signage and bike / sharrow symbols to existing roads.	$18,000	$0	$0	$18,000
Paved Multi Use Trails in Urban Areas	600	250	Cost of 3.0m wide paved trail outside of road allowance including signage and lighting. Incomplete sections of the Corridor Trail are included here.	$150,000	$150,000	$0	$0
Waterfront Walkways	4600	120	Delivered through development.	$552,000	$120,000	$432,000	$0
Sub-Total Length	**7000**		**Downtown Sub-Total**	**$720,000**	**$270,000**	**$432,000**	**$18,000**
Valleycliffe							
Conventional On-road Bike Lanes including widening.	1400	150	Cost of adding 1.5m wide bike lanes both sides of existing or proposed road including, 1.5m x 2 widening, bike/ sharrow symbols, line painting and signage.	$210,000	$0	$0	$210,000
Sub-Total Length	**1400**		**Valleycliffe Sub-Total**	**$210,000**	**$0**	**$0**	**$210,000**

TABLE F-2 NEW BICYCLE ROUTES

Classification	Length (m)	Cost ($/m)	Description of Work	Estimated Cost	Funding Source		
					DCC	Developer	General
Garibaldi Estates							
Conventional On-road Bike Lanes including widening.	400	150	Cost of adding 1.5m wide bike lanes both sides of existing or proposed road including, 1.5m x 2 widening, bike/ sharrow symbols, line painting and signage.	$60,000	$0	$0	$60,000
Sub-Total Length	**400**		**Estates Sub-Total**	**$60,000**	**$0**	**$0**	**$60,000**
Garibaldi Highlands							
Conventional On-road Bike Lanes including widening.	1600	150	Cost of adding 1.5m wide bike lanes both sides of existing or proposed road including, 1.5m x 2 widening, bike/ sharrow symbols, line painting and signage.	$240,000	$0	$0	$240,000
Paved Multi Use Trails in Urban Areas	500	250	Cost of 3.0m wide paved trail outside of road allowance including signage and lighting. Incomplete sections of the Corridor Trail are included here.	$125,000	$0	$125,000	$0
Sub-Total Length	**1600**		**Highlands Sub-Total**	**$365,000**	**$0**	**$125,000**	**$240,000**
Brackendale							
Conventional On-road Bike Lanes including widening.	1300	150	Cost of adding 1.5m wide bike lanes both sides of existing or proposed road including, 1.5m x 2 widening, bike/ sharrow symbols, line painting and signage.	$195,000	$0	$0	$195,000
Sub-Total Length	**1300**		**Brackendale Sub-Total**	**$195,000**	**$0**	**$0**	**$195,000**
Total Length	**22000**		**TOTAL**	**$3,052,000**	**$270,000**	**$907,000**	**$1,875,000**

(Note: This list of improvements has been generated by the District of Squamish, and summarizes the results of this study as well as previous OCP documents and other reports)

New Bicycle Route Notes:

1. It is understood that where bicycle lanes are to be supplied on new roads the costs are embedded in the road estimates.
2. The priority attached to certain bike routes will be determined in consultation with the Community.
3. Funding will vary depending on whether the bike route is associated with a development project or a District program.
4. Bike routes should be included in the DCC structure.

TABLE F-3 NEW SIDEWALKS ON EXISTING ROADS

Priority #	Street	From	To	Length (m)	Cost ($/m)	Estimated Cost	Funding Source			School Route	Details
							Developer	General	Other		
Downtown											
1	Loggers Lane	Pemberton Ave	Hunter Place	180	$500	$90,000	$0	$90,000	$0	Y	Concrete S/W one side.
2	Vancouver Street	3rd Ave	Galbraith Rd	225	$0	$0	$0	$0	$0	N	Included in road reconstruction project.
3	3rd Avenue	Vancouver	Victoria	410	$0	$0	$0	$0	$0	N	Included in road reconstruction project.
4	Vancouver Street	3rd Ave	Seadyke	85	$200	$17,000	$0	$17,000	$0	N	One side, paved pathway adjacent to road shoulder.
5	Victoria Street	6th Ave	Seadyke	50	$200	$10,000	$0	$10,000	$0	N	One side, paved pathway adjacent to road shoulder.
6	Laurelwood Road	Pemberton Ave	Hwy 99	820	$0	$0	$0	$0	$0	Y	Included in roads and bridges to be delivered by SWL Project.
7	Pemberton Avenue	Marina Estates	CNR Line	121	$0	$0	$0	$0	$0	N	Included in road reconstruction project.
8	3rd Avenue	Peninsula	Westminster	626	$200	$125,200	$125,200	$0	$0	N	Concrete S/W one side, including curb & gutter and drainage improvements by Developer.
			Sub-Total	**2517**		**$242,200**	**$125,200**	**$117,000**	**$0**		
Valleycliffe/ Hospital Hill											
1	Westway Avenue	Birch Drive	Myrtlewood Cres	110	$400	$44,000	$0	$44,000	$0	Y	Concrete S/W one side, behind existing curb.
2	Scott Crescent	Hwy 99	Hunter Trail	260	$0	$0	$0	$0	$0	Y	Included in road reconstruction project by Developer.
3	Clarke Drive	Hwy 99	Behrner Dr	209	$400	$83,600	$0	$83,600	$0	N	Concrete S/W one side, including curb & gutter and drainage improvements.
4	Berhner Drive	Clarke Drive	Clarke Drive	475	$400	$190,000	$0	$190,000	$0	N	Concrete S/W one side, including curb & gutter.
5	Clarke Drive	Berhner Dr	Northridge Dr	290	$400	$116,000	$0	$116,000	$0	Y	Concrete S/W one side, including curb & gutter.
6	Guilford Drive	Westway Ave	Spruce Drive	1030	$500	$515,000	$0	$257,500	$257,500	Y	Possible LIP, concrete S/W one side, including curb & gutter and drainage improvements.

TABLE F-3 NEW SIDEWALKS ON EXISTING ROADS

Priority #	Street	From	To	Length (m)	Cost ($/m)	Estimated Cost	Funding Source			School Route	Details
							Developer	General	Other		
7	Spruce Drive	Guilford	Westway Ave	340	$500	$170,000	$0	$85,000	$85,000	Y	Possible LIP, concrete S/W one side, including curb & gutter and drainage improvements.
8	Hemlock Ave	Spruce Drive	Valleycliffe El	135	$400	$54,000	$0	$54,000	$0	Y	Concrete S/W one side, including curb & gutter and drainage improvements.
9	Maple Avenue	Westway Ave	Guilford Ave	350	$400	$140,000	$0	$70,000	$70,000	Y	Possible LIP, concrete S/W one side, including curb & gutter and drainage improvements.
10	Plateau Drive	Northridge Dr	Plateau Cres	695	$200	$139,000	$0	$139,000	$0	Y	One side, paved pathway adjacent to road shoulder.
11	Trail	Plateau Cres	Westway Ave	140	$200	$28,000	$0	$28,000	$0	Y	Paved pedestrian trail.
			Sub-Total	**4034**		**$1,479,600**	**$0**	**$1,067,100**	**$412,500**		
Business Park/ North Yards											
1	Pioneer Way	Queensway	Centennial Way	950	$0	$0	$0	$0	$0	N	Included in road reconstruction project.
2	Government Road	Queensway	Centennial Way	648	$500	$324,000	$0	$162,000	$162,000	N	Possible LIP, concrete S/W one side, including curb & gutter and drainage improvements.
3	Queensway	Commercial Way	Government Rd	580	$200	$116,000	$64,000	$52,000	$0	N	Concrete Sidewalk one side by Developer.
4	Queensway	Industrial Way	Commercial Way	900	$0	$0	$0	$0	$0	N	Concrete Sidewalk both sides by frontage owner.
5	Industrial Way	Queensway	Discovery Way	260	$0	$0	$0	$0	$0	N	Concrete Sidewalk both sides by frontage owner.
			Sub-Total	**3338**		**$440,000**	**$64,000**	**$214,000**	**$162,000**		
Garibaldi Estates											
1	Government Road	Mamquam River	Leskies Crossing	1500	$600	$900,000	$420,000	$480,000	$0	Y	Concrete S/W one side, including curb & gutter and drainage improvements. 700 metres associated with redevelopment.
2	Garibaldi Way	Mamquam Rd	Government Rd	1245	$0	$0	$0	$0	$0	Y	Included in road reconstruction project.

TABLE F-3 NEW SIDEWALKS ON EXISTING ROADS

Priority #	Street	From	To	Length (m)	Cost ($/m)	Estimated Cost	Funding Source			School Route	Details
							Developer	General	Other		
3	Mamquam Road	Government Rd	Hwy 99	450	$0	$0	$0	$0	$0	N	Included in road reconstruction project.
4	Parkway Road	Park Crescent	Garibaldi Way	210	$200	$42,000	$0	$42,000	$0	N	One side, paved pathway adjacent to road shoulder.
5	Tantalus Rd	Cheakamus Way	Starview Place	150	$400	$60,000	$0	$60,000	$0	N	Concrete S/W one side, including curb & gutter.
6	Mamquam Road	Glen Alder	Highlands Way S	715	$0	$0	$0	$0	$0	N	Included in road reconstruction project.
			Sub-Total	**4270**		**$1,002,000**	**$420,000**	**$582,000**	**$0**		
Garibaldi Highlands											
1	Highlands Way N	The Boulevard	Perth Drive	435	$400	$174,000	$0	$174,000	$0	Y	Concrete S/W one side, including curb & gutter and drainage improvements.
2	Perth Drive	The Boulevard	Pia	850	$500	$425,000	$425,000	$0	$0	Y	Concrete S/W one side, including curb & gutter and drainage improvements by Developer.
3	The Boulevard	Highlands Way S	Ayr Drive	335	$500	$167,500	$0	$167,500	$0	Y	Concrete S/W one side, including curb & gutter and drainage improvements.
4	Pia Road	Perth Drive	Pitlochry Way	170	$500	$85,000	$85,000	$0	$0	N	Concrete S/W one side, including curb & gutter and drainage improvements by Developer.
5	Ayr Drive	The Boulevard	Skyline Place Trail	190	$500	$95,000	$0	$47,500	$47,500	N	Possible LIP, concrete S/W one side, including curb & gutter and drainage improvements.
6	Skyline Place Trail	Ayr Drive	Park Crescent	335	$200	$67,000	$0	$67,000	$0	N	Paved pedestrian trail.
7	Mamquam Road	Paco Road	Quest University	1675	$0	$0	$0	$0	$0	N	Included in road reconstruction project.
			Sub-Total	**3990**		**$1,013,500**	**$510,000**	**$456,000**	**$47,500**		
Brackendale											
1	North Road	Hwy 99	Government Rd	350	$0	$0	$0	$0	$0	N	Included in new road.

TABLE F-3 NEW SIDEWALKS ON EXISTING ROADS

Priority #	Street	From	To	Length (m)	Cost ($/m)	Estimated Cost	Funding Source			School Route	Details
							Developer	General	Other		
2	Government Road	Judd Rd	Brackendale El	1210	$500	$605,000	$0	$605,000	$0	Y	Concrete S/W one side, including curb & gutter and drainage improvements.
3	Depot Road	Hwy 99	Government Rd	685	$500	$342,500	$0	$171,250	$171,250	Y	Possible LIP, concrete S/W one side, including curb & gutter and drainage improvements.
4	Ross Road	Depot Rd	Brackendale El	400	$200	$80,000	$0	$80,000	$0	Y	Concrete S/W one side, behind existing curb.
5	Eagle Run	Government Rd	Kingswood Park	320	$200	$64,000	$0	$64,000	$0	N	Concrete S/W one side, behind existing curb.
6	Eagle Run	Government Rd	Judd Rd	400	$200	$80,000	$0	$80,000	$0	N	Concrete Sidewalk one side.
7	Government Road	North Rd	Eagle Run	405	$500	$202,500	$0	$202,500	$0	N	Concrete S/W one side, including curb & gutter and drainage improvements.
			Sub-Total	**3770**		**$1,374,000**	**$0**	**$1,202,750**	**$171,250**		
			TOTAL	**21919**		**$5,551,300**	**$1,119,200**	**$3,638,850**	**$793,250**		

Notes:

1. The proposed treatments described above are for budgetary purposes only. Actual treatment of pedestrian routes will be the result of more detailed assessments.
2. Where pedestrian facilities are included in new roads or road reconstruction projects, those costs are not included in the above summary.
3. Priorities are subject to review and consolidation once Safe Routes to School are assessed.

THIS PAGE INTENTIONALLY LEFT BLANK

- Traffic Operations
- Transportation Planning
- Road Safety Engineering
- Transit and Sustainability
- Asset Management
- Project Management