

# COMMUTER TRAIN SERVICE BETWEEN SQUAMISH AND NORTH VANCOUVER

Report prepared at the Request of the District of West Vancouver, in partial fulfillment of UBC Geography 419: Research in Environmental Geography, for Dr. David Brownstein.



Downtown Squamish      Horseshoe Bay      Dundarave      Park Royal      Lonsdale Quay

By Brennan Guse, March 2016

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## Executive Summary

### Research Question

I have been asked by the Engineering and Environmental Services Department of the District of West Vancouver to provide an overview of the feasibility of a commuter train connecting the Sea to Sky Corridor to the North Shore in Metro Vancouver, which would link the communities of Whistler, Squamish, Lions Bay, West Vancouver, and the City and District of North Vancouver. My main point of contact for this work was John Calimente, Transportation Planning Analyst with the District of West Vancouver.

### Recommendations

1. I recommend implementing a commuter train service that travels between Squamish and North Vancouver.
2. There should be 3 commuter trains, leaving Squamish at 6:00, 6:30, and 7:00am. The trains would then leave North Vancouver at 4:00, 4:30 and 5:00pm, Monday to Friday.
3. A price of \$25.22 per passenger would cover the capital and operating costs of the train. However, with taxes, substitutes and investors I would reduce to cost to \$15 per person.
4. Single level tilting cars should be put in operation.
5. The main train stations should be located at Downtown Squamish, Horseshoe Bay, Dundarave, Park Royal, and Lonsdale Quay.

### Methods

This report has been conducted through both quantitative and qualitative research methods. First, a literature review was executed looking at an abundance of transportation reports along the corridor. An expert interview with Ian Fisher, Manager of Planning and Operations at Sky Train was completed for a better understanding of the type of service that can be implemented. This report also looked into a variety of databases including BC Data and the BC Ministry of Transportation and Infrastructure. Finally, GIS software allowed for the creation of maps and supplementary analysis to determine possible train station locations.



## Literature Review

An abundance of literature on transportation options along the Sea to Sky corridor was consulted in the creation of this report. (AECOM 2009, CANAC 2001, District of Squamish 2009, Seymour 2001, TSi 2002, Washbrook 2003). Many of these reports touched on topics such as demand, costs, type of service and review of communities along the line. Although these reports were highly influential for the results of this report, several gaps can be found in the literature. For example, many of the reports are from the early 2000s, during this period there was a large demand to look at transportation options along the Sea to Sky corridor in preparation for the 2010 Winter Olympic Games. For the Olympics it was decided to expand Highway 99, however now that the Olympics have past, there has been little research on transportation options in the region. I also noticed that many reports didn't measure demand for a train in response to a range of fair costs. Often the reports would have a high passenger cost for a train service, and because of the high cost it would deter ridership. This report tries to bridge the gaps and encourages the District of West Vancouver to continue discussion on a commuter train service along the Sea to Sky Corridor.

## BC Rail History

BC Rail is owned by CN and is currently the rail line that goes from North Vancouver to Prince George. The line originated in 1912 and was first called the Pacific Great Eastern Railway (PGE) (Ramsey, 1962). This line was vital in the growth of the BC economy in the early 20th century as it connected smaller towns in the north to the Lower Mainland. Over its lifetime it has been used for passengers, tourism, logging and other shipments (Harris, 1982). Passenger service ended on October 31, 2002. Currently the line is used for freight and tourism purposes. Freight trains run 2 to 3 times a day at varying schedules, and the Rocky Mountaineer runs daily except Tuesdays and Wednesdays from May 15<sup>th</sup> to September 21<sup>st</sup>.

## Review of Communities along the Line

Figure 1- Review of communities along the line

Location	Population in 2011	Population estimates for 2021	Population Growth	Current Transit System
Whistler	9,824	12,190	24%	-BC Transit -9 local bus routes -Greyhound
Squamish	15,051	25,000	66%	-BC Transit -4 local bus routes -Greyhound
Lions Bay	1,318	1,425	8%	-TransLink - 2 local bus routes
Bowen Island	3,402	4,300	26%	-BC Ferries -TransLink -2 local bus routes
West Vancouver	44,000	51,000	16%	-BC Ferries -Blue Bus -TransLink -23 local bus routes
North Vancouver	84,412	98,000	16%	-TransLink -Blue Bus -26 local bus routes (including SeaBus)
Metro Vancouver	2.4 million	2.7 million	12.5%	-TransLink -VIA Rail -Greyhound -Rocky Mountaineer

(BC Transit 2016, Corman 2006, Simply Map, Stats Can 2011, TransLink 2008)


Figure 1 is a review of the communities close to the line in terms of population in 2011, projected population for 2021, and the current transit systems in the selected locations. A general trend is the significant increase in population in all of the locations. However, what is most significant is Squamish's projected population growth. In 2011, the population was 15,051 and is projected to reach 25,000 by 2021 (Stats Can). This is a potential growth rate of 66%.

Squamish's massive population projections are partly due to major developments that are planned for the region. For example, Garibaldi at Squamish Ski Resort is projected to create 4000 jobs to operate the resort, have 1,500 hotel rooms, over 2000 residential units and estimates to bring in 730,000 skiers a year (Findlay, 2016). Another major development is Squamish's Oceanfront. This project is planned to have over 1,100 residential units, and will take more than 2,300 jobs to build. The land for this project has already been sold to the developer as of February 3<sup>rd</sup> 2016, and is projected to take 20 years to build all 6 phases (Squamish Oceanfront Development Corporation, 2016).

## Demand Analysis

The demand analysis will be split up into two case studies.

*Figure 2- Case studies*

	<b>1.Barb the Business woman:</b> Barb represents the demographic who live in Squamish where housing is relatively affordable, and commutes to work in Metro-Vancouver.
	<b>2.Sam the Skier:</b> Sam represents the tourist demographic and those who live in Whistler.

(Photos courtesy of Flickr and Wikipedia)

### Case Study- Between Squamish and North Vancouver



Barb the Business woman represents the demographic who live in Squamish where housing is relatively affordable, and commute to work in Metro Vancouver throughout the week. Like Barb, many locals in Squamish are young/ educated families. It is estimated that the median age in Squamish is 36.8 years old (Stats Can, 2011). Since Barb has lived in Squamish for over 10 years now, she has noticed a dramatic increase in the volume of cars on the highway. It sometimes takes Barb over an hour to get from Squamish to her office in downtown Vancouver, where she then has to pay a high cost for parking.

## Where are People Travelling in this Region

- It is estimated that there were 1,865 daily southbound commuters (people) from Squamish in 2012 (Seymour, 2001).
- Over 1,300 Squamish Residents work full time in Whistler (AECOM, 2009).
- Traffic peaks along the Sea to Sky highway, just south of Squamish occur at 7:00 – 8:00 am and 4:00 – 5:00pm (AECOM, 2009).

## Potential Train Passengers for this Region

The BC Ministry of Transportation and Infrastructure collects traffic data from various locations throughout the province. Using this traffic count data for a site called Eagles Ridge, north of Horseshoe Bay, estimates can be determined for the amount of train passengers. A base passenger rate of 25%, a medium passenger rate of 33% and a high passenger rate of 50% have been chosen for this analysis. For example, if 25% of the vehicles were taken off the road and put on a train, how many train passengers would there be, assuming there is one person per vehicle? These conversion percentages were decided on as they are used in another report that looked at a ferry service from Squamish to North Vancouver (Seymour, 2001).

*Figure 3- Potential train service between Squamish and North Vancouver*

<b>Date</b>	<b>Total Southbound commuters (vehicles) between 6:00 am and 9:00am</b>	<b>Passengers: Base 25%</b>	<b>Passengers: Med 33%</b>	<b>Passengers: High 50%</b>
<b>Wednesday, April 1<sup>st</sup> 2015</b>	1,927	482	636	964
<b>Friday, August 14<sup>th</sup>, 2015</b>	1,878	470	620	939
<b>Monday, January 19<sup>th</sup>, 2015</b>	2,131	533	703	1,066
<b>Average of the sample dates</b>	1,979	495	653	990

(BC Ministry of Transportation and Infrastructure, 2015)

For the sample dates, the base ridership is 495 southbound passengers which is equivalent to 990 total passengers a day. Again this is the base ridership, I would suggest a ridership of around 600 people a day, per direction, or a total of 1,200 people a day if you consider Squamish's projected population growth.

## Case Study- Between Whistler and Squamish



Sam the Skier represents the tourist demographic and those who live in Whistler. Sam finds getting from Whistler to Squamish a challenging task. Sam grew up abroad and is not accustomed to winter driving conditions and finds the highway is often unreliable due to all the closures. In addition, because Sam works primarily as a ski instructor, buying winter tires for his car is a relatively large expense.

### Where are people travelling

- Whistler receives around 2.1 million visitors each year. (Tourism Whistler, 2016).
- Most visitors travel to Whistler in a private vehicle on Highway 99, while others arrive through scheduled bus services that run from YVR more than 10 times daily (Tourism Whistler, 2016).
- Over 1,300 Squamish Residents work full time in Whistler (AECOM, 2009).

### Potential Train Passengers for this Region

Using the Ministry of Environment's traffic count data for a site just north of Squamish, estimates can be determined about the number of commuters from Squamish to Whistler. It is notable that most commuters in the area are going Northbound to Whistler in the mornings.

*Figure 4- Potential train service between Squamish and Whistler*

Date	Total Northbound commuters (Vehicles) between 6:00am and 9:00am	Passengers: Base 25%	Passengers: Med 33%	Passengers: High 50%
Wednesday, April 1 <sup>st</sup> , 2015	1,040	260	343	520
Friday, August 14 <sup>th</sup> , 2015	871	218	287	436
Monday, January 19 <sup>th</sup> , 2015	1,369	342	452	685
Average of the sample dates	1,093	273	361	547

Source: (BC Ministry of Transportation and Infrastructure, 2015)



Looking at the numbers above, for the sample dates the base ridership is 273 Northbound passengers, which is equivalent to 546 total passengers a day. I suggest that these numbers are too low to implement a commuter train service between Squamish and Whistler. I recommend implementing a commuter train from Squamish to North Vancouver, see how successful that line is, and then 10 to 20 years in the future relook at the demand analysis for Squamish to Whistler. It is also important to note that a commuter train varies from all day service, if the District of West Vancouver was interested in all day service to Whistler, the demand analysis would have to be altered.

## Type of Service

This section will look at when the trains should run, the type of trains, and where the train stations should be located.

### When the Trains will run

In 2008, the District of Squamish sent out a survey to 634 residents asking them what times they would want a potential commuter train to leave Squamish and the lower Mainland. According to the results, the best times to have a commuter train leave Squamish would be 6:00, 6:30, and 7:00am and the best times to leave North Vancouver would be 4:00, 4:30 and 5:00pm.

*Figure 5- Survey of when the trains will run*

Leaves Squamish at:		Leaves Lower Mainland at:	
4:00am to 4:50am	8	1:00am	1
5:00 am to 5:25am	15	6:00am to 7:10am	5
5:30am	28	9:00am to 1:30pm	4
5:45am	7	2:00pm to 2:45pm	7
6:00am	48	3:00pm	25
6:15am	8	3:15pm	3
6:30am	47	3:30pm	23
6:45am	30	4:00pm	53
7:00am	81	4:15pm	3
7:15am	12	4:30pm	50
7:30am	23	4:45pm	4
8:00am	16	5:00pm	76
8:30am	2	5:10pm	4
9:00am	3	5:30pm	26
1:30pm	1	5:45pm	1
3:30pm	1	6:00pm	19
4:00pm	1	6:15pm	2
		6:30pm	5
		7:00pm	12
		7:15pm to 11:00pm	6

(AECOM, 2009)

## **Type of Trains**

Ian Fisher, Manager of Planning and Operations for Sky Train indicated that each train car can hold 80 to 100 people. A train car is one unit of a train, where all the cars put together make up the entire train. He also told me that each car is approximately 25 meters long by 3 meters wide. I suggest there be 3 trains consisting of 3 cars each. Considering the demand numbers of approximately 600 people per day, per direction, then divide that by 3 trains you get roughly 200 people per train. Technically 200 people can fit into 2 train cars, but then the train would be at maximum capacity. By adding an extra car, it allows the train to respond to future service demands. The Canada Line, for example did not consider future ridership demand as much as it should have when it was built in Vancouver in preparation for the 2010 Olympics. Right now in 2016, the Canada Line is already at maximum capacity, and it would be very costly to increase the size of the prebuild station platforms to service an extra car on each train. Therefore, a potential train service from Squamish to North Vancouver should have platforms of at least 75 meters long at each train station. This way 3 train cars can fit on the stations, and the line will be well suited for future demand.

Ian also suggested that single level tilting cars would be the best type of train for the Sea to Sky corridor. Tilting cars can reduce travel time by 10% to 15%, create a smoother ride resulting in less motion sickness, and can be implemented in a wide variety of options such as diesel or electric. The bullets below show the run time of trains versus a passenger car from Squamish to North Vancouver. A Bud Rail Diesel car is the type of passenger train that used to run along the corridor, until the service ended in 2002.

- Bud Rail Diesel: 80 minutes
- Tilting Cars: 68 minutes
- Passenger Car: 55 minutes

The information above is retrieved from Ian Fisher and an extract from the 1998 BC Rail timetable.

I would recommend implementing single level tilting cars, however depending on the budget, technology advances and other factors, more discussion should be made about the type of train that would run along the corridor.

## **Where Should the Train Stations Be Located**

Using Geographic Information System (GIS) software, I was able to determine the best areas for train station locations. In order to do this, I had to collect data from various sources such as Geogratis, Abacus, BC Data, the City of North Vancouver, and the District of North Vancouver, West Vancouver and Squamish. I then performed a multi-criteria analysis to determine the best suitability for train station locations. A multi-criteria analysis basically entails weighing different factors that would affect the train station suitability. All of the factors combined must be equal to one. The factors considered in the analysis are shown in the chart below.

*Figure 6- Train station weighting system*

Criteria	Factors	Weighting
Zoning	Where can a station be built? (Ex: residential land= low values, public land= high values)	0.5
Bus Routes	Are the stations close to bus routes? (Within 500m)	0.2
Population	Are there enough people in the region to support a station? (Over 50 people and jobs per hectare)	0.2
Slope	Is the slope of the land suitable for a station? (Less than 45 degrees)	0.1

If necessary, the weighting and criteria can be altered for the specific needs of the District of West Vancouver and other municipalities.

The images below represent the suitability for train station locations from Squamish to North Vancouver. The areas in red represent the lowest suitability, the areas in yellow represent a medium suitability, and the areas in green represent a high suitability for a station. From this analysis it can be observed that the main train stations should be located at: Downtown Squamish, Dundarave, Park Royal, and Lonsdale Quay. Although Horseshoe Bay does not appear in green on the map, I would recommend adding it as a stop since it experiences heavy ferry traffic. In addition, the last stop should be Lonsdale Quay as it has a Sea Bus service that goes directly to downtown Vancouver. I would also recommend adding smaller stops in locations such as Lions Bay, Furry Creek and Porteau Cove.

Figure 7

### Train Station Suitability North Shore

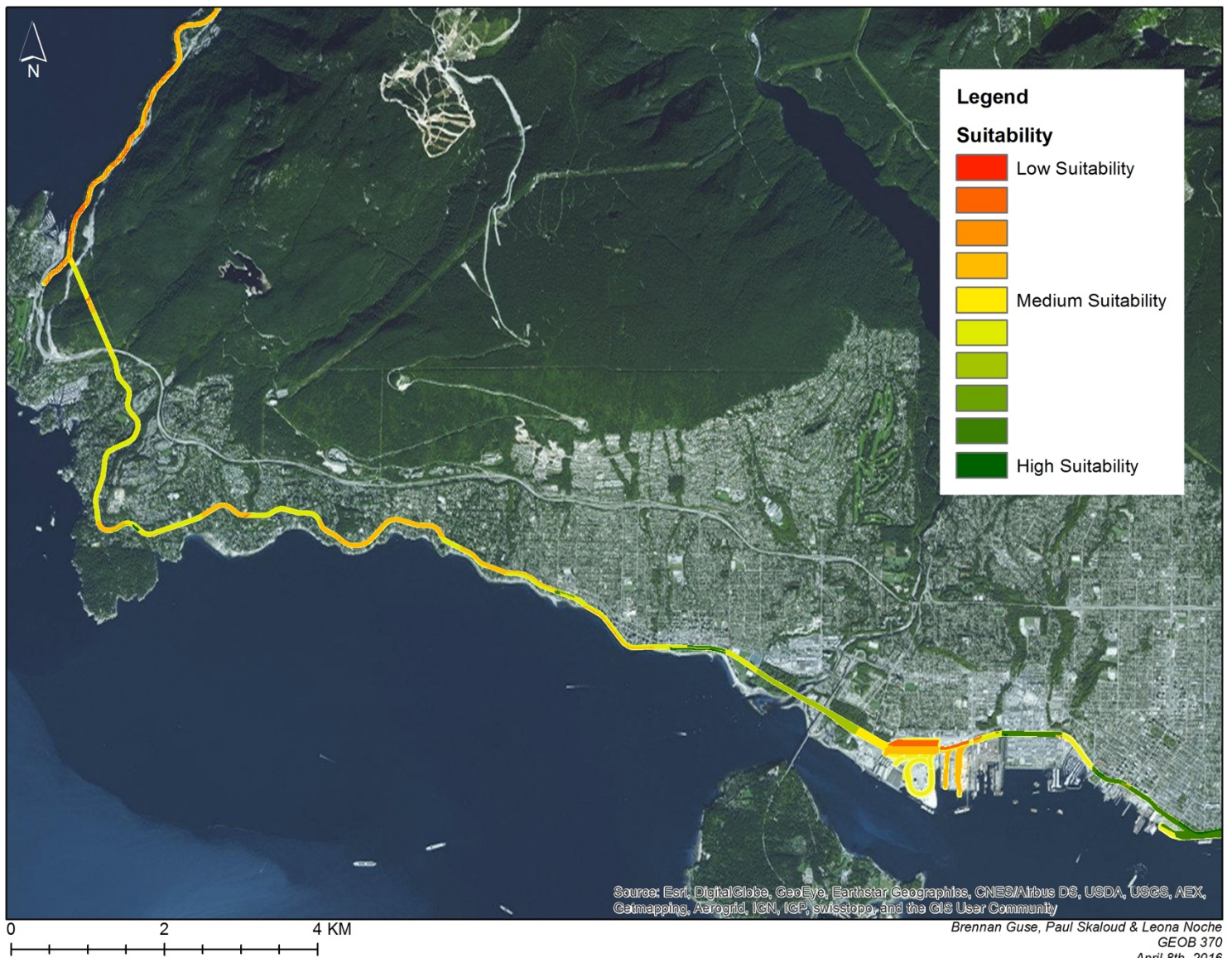
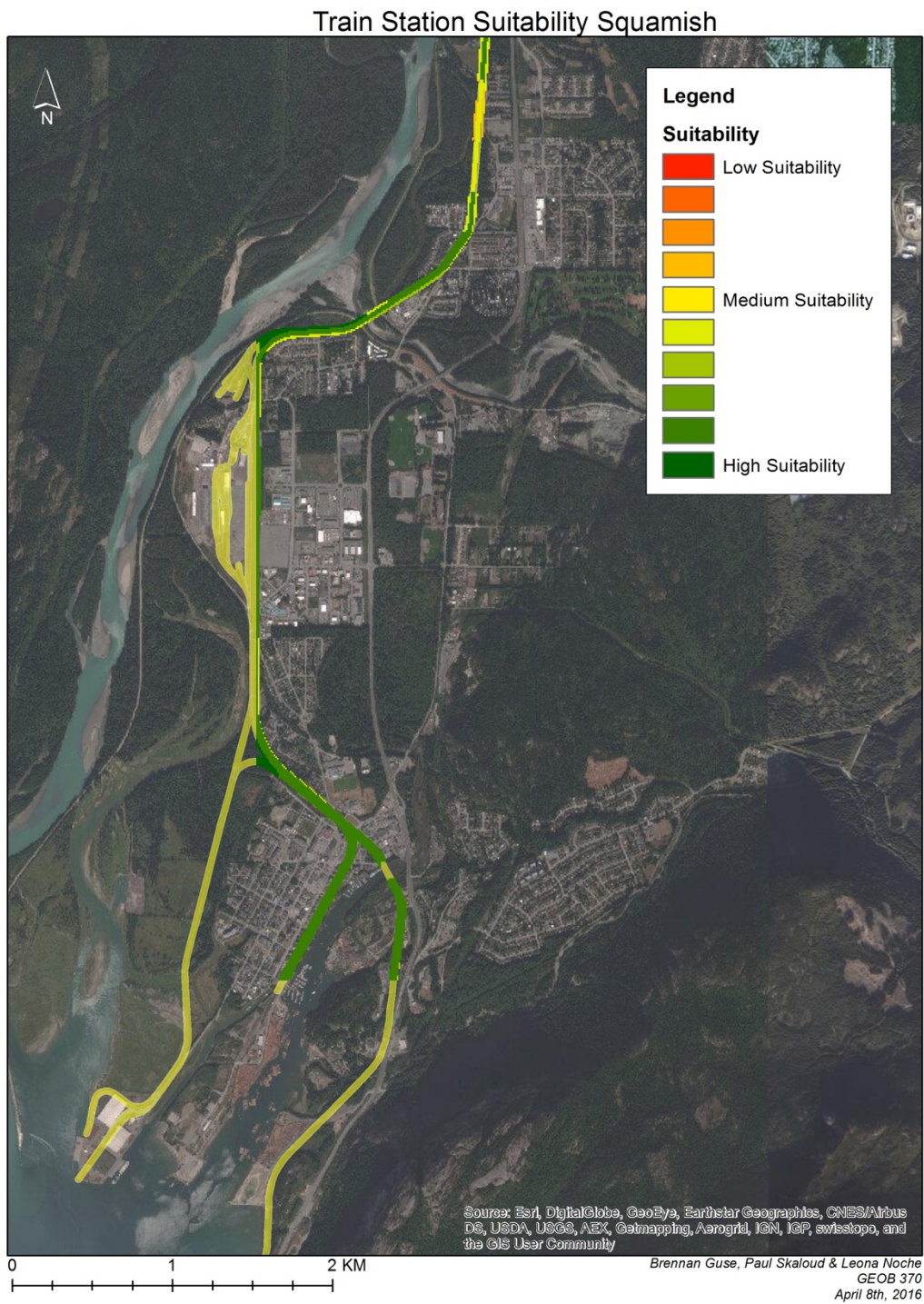




Figure 8



Further research would have to be done on what real estate is available for purchase in the areas that are shown in green on the map. When considering what real estate is available, a lot size of 75meters by 30 meters would be ideal for a train station. The report, *The Transportation Hub*, by the District of Squamish has selected exact locations where train stations are most suitable.

## Cost Analysis

The data below is from Patrick Condon, a University of British Columbia Professor in the faculty of Landscape Architecture.

*Figure 9*  
*Average Capital and Operating Costs Per Passenger Mile*

Mode	Capital Costs	Operating Costs
Diesel Bus	\$0.31	\$1.19
Light Rail	\$1.27	\$0.039
Heavy Rail	\$0.24	\$0.36
Commuter Rail	\$0.26	\$0.39
Sky Train	\$2.34	\$0.29
Ford Explorer	\$1.02	\$0.18
Modern Tram	\$0.71	\$0.51

*Source: (Condon and Dow 2009, The Antiplanner 2007)*

The number above are based on maximum capacity. If the modes listed above were not at maximum capacity, the costs would be much higher. Capital costs include acquiring the vehicles and constructing the infrastructure necessary to support them. Capital costs would be much lower along the Sea to Sky corridor since a rail line is already in place.

It is approximately 62.4 kilometres from the Sea Bus terminal in North Vancouver to Squamish. Therefore, a price of \$25.22 per person would apply to cover capital and operating costs for a commuter train to break even.

Transportation services run by the public sector traditionally do not expect to recover their full operating and capital costs from customer fares. For example, the West Coast Express is considered successful by governments even though it recovers only 60% of its costs through passenger fares (Washbrook, 2003). I recommend implementing a price around \$15 per passenger, therefore additional funding would have to be provided through taxes, subsidies, and investors.

## Cost Analysis- Driving Vs Train



How much does Barb spend on gas and parking during a day in the office?

Hourly rates at Vancouver's downtown meters and parkades range from \$1 to \$7 per hour (Aiello, Laanela and Smith 2014). Barb drives a Mazda 3, assuming gas prices in Vancouver are \$1.30 a liter, it costs her \$7.80 to go 100km on the highway. Barb drives 123km a day to and from work, therefore Barb spends around \$35.00 a day on gas and parking, assuming her parking is \$3.00/hour and she works 8 hours a day. If the train was \$15.00 one way, or a total of \$30 for both directions, Barb would save \$5 a day. This is a total savings of over \$1000 a year. Lets also remember that this does not take into account the actual price of a car and insurance, which is likely to be over \$4000 a year.

## Benefits of a Train

This section will discuss some of the benefits of a train (Condon, 2010).

- Economic: new business, attracts more events, growth, new investment, enhances the downtown core, more tourists.
- Social: promotes sustainability, active lifestyle, freedom (can get work done on a train), safety, spectacular views, comfort.
- Environmental: cars off the road, enhances the transit network, less demand to widen the highway, less emissions.

## Final Recommendations

1. I recommend implementing a commuter train service that travels between Squamish and North Vancouver.
2. There should be 3 commuter trains, leaving Squamish at 6:00, 6:30, and 7:00am. The trains would then leave North Vancouver at 4:00, 4:30 and 5:00pm, Monday to Friday.
3. A price of \$25.22 per passenger would cover capital and operating costs, however with taxes, substitutes and investors I would reduce to cost to \$15 per person per commute.
4. Single level tilting cars should be put in operation.
5. The main train stations should be located at Downtown Squamish, Horseshoe Bay, Dundarave, Park Royal, and Lonsdale Quay.



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