WAYFINDING & ACCESS TO INFORMATION: AN INVESTIGATION OF INTERMODAL DESIGN AT VANCOUVER'S PACIFIC CENTRAL STATION

by
Mike Smith
Bachelor of Arts, University of Victoria, 2003

RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF URBAN STUDIES

In the
Urban Studies Program

© Mike Smith 2008

SIMON FRASER UNIVERSITY

Fall 2008

APPROVAL

Name: **Mike Smith**

Degree: **Master of Urban Studies**

Title of Project: **Wayfinding & Access to Information: An Investigation of Intermodal Design at Vancouver's Pacific Central Station**

Examining Committee:

           Chair: **Dr. Peter V. Hall**

Anthony Perl
Senior Supervisor
Professor and Director, Urban Studies Program

Karen Ferguson
Supervisor
Associate Professor, Urban Studies Program and Department of History

---

Moreno Rossi
External Examiner
Program Manager, Facility Design and Integration
TransLink

Date Defended/Approved: July 23, 2008

SIMON FRASER UNIVERSITY
LIBRARY

Declaration of
Partial Copyright Licence

SFU SIMON FRASER UNIVERSITY
THINKING OF THE WORLD

STATEMENT OF
ETHICS APPROVAL

The author, whose name appears on the title page of this work, has obtained,
for the research described in this work, either:

- (a) Human research ethics approval from the Simon Fraser University Office of
    Research Ethics,

or

- (b) Advance approval of the animal care protocol from the University Animal
    Care Committee of Simon Fraser University;

or has conducted the research

- (c) as a co-investigator, in a research project approved in advance,

or

- (d) as a member of a course approved in advance for minimal risk human
    research, by the Office of Research Ethics.

A copy of the approval letter has been filed at the Theses Office of the
University Library at the time of submission of this thesis or project.

The original application for approval and letter of approval are filed with the
relevant offices. Inquiries may be directed to those authorities.

Bennett Library
Simon Fraser University
Burnaby, BC, Canada

ABSTRACT

This project investigates intermodalism and the benefits of an integrated transportation interface. The study attempts to identify the design aspects (or lack thereof) at Pacific Central Station (PCS) that contribute to a number of rail passengers becoming disoriented when entering the station. The research question asks: What specific design elements are needed in PCS to create a smoother intermodal connection and an overall better travel experience for rail passengers? The conceptual framework for this study views intermodalism through a Transit-Oriented Development (TOD) lens in conjunction with New Urbanist and Smart Growth principles. The study employs a mixed-method approach to collecting data on station intermodalism and wayfinding devices that includes the following: direct observation; passenger counts; in-depth, qualitative interviews; and an interview survey. Data is analyzed and recommendations are given for improving wayfinding and intermodal connections at the station. This study seeks to advance 'best practices' in station intermodalism and wayfinding for PCS and other similar stations.

Keywords: Intermodalism, Wayfinding, Station Design, Passenger Orientation, Transit-Oriented Development

DEDICATION

To my wife, Stephanie.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

As urban populations around the world continue to grow, it is becoming

increasingly clear that the demand for transportation is growing with them (Alt et.

al. 1997). As we enter the twenty-first century, the demand for public

transportation has shown an increase in social awareness and a desire to create

transportation systems that are both ethically based and sustainable (Sherry

2006). This project discusses intermodalism[1] as a new approach to the planning

of sustainable transportation systems (Szyliowicz 2000).

Currently, transportation in North America is heavily unbalanced with the majority

of travel being done by the automobile (Jones & Rowat 2003). Major problems

arising from this reliance, including congestion, land dispersion and

environmental degradation, can be alleviated when a shift towards a more

balanced system is organized in an efficient and connected fashion (Szyliowicz

2003). Thus, the potential benefits of an intermodal transportation system

include reduced fuel consumption, air pollution, and traffic volumes; better

coordination of bus, rail, and air schedules; and reduced pressure on

infrastructure (Graham et al. 2000:3).

---

[1] Intermodalism is best defined by the National Center for Intermodal Transportation at the University of Denver. They define intermodalism as "the seamless interconnection of two or more modes of transportation to create an efficient, safe, secure, sustainable, and ethical system of transportation" (Sherry 2006).

This study is concerned with the nodes between the modalities (Alt et. al. 1997) or, in other words, investigating how the transportation terminal can be best designed to enhance the efficiency of travel. By using Pacific Central Station (PCS) as a case study, this project investigates intermodalism and the functioning of an urban transportation gateway. More specifically, by examining rail passenger activity and station design the study will attempt to reveal the challenges that currently face the creation of an efficient connection for travellers at PCS.

PCS is located at 1150 Station Street in Vancouver B.C. and was erected in 1916 by the Canadian National Railways (CNR) as the Pacific terminus of the Canadian Northern mainline (Bohi 1977:79) and maintains that status today. In 1993, inter-city bus service was added and the station was converted into an inter-modal transportation hub (waymarking.com 2008).

Figure 1: Pacific Central Station (source: Mike Smith 2008)

Compared to the other major inter-modal facilities in Vancouver (i.e. the Vancouver International Airport (YVR), Waterfront Station and both ship terminals, Canada Place and Ballantyne), PCS offers a similar number of transportation modes (three), including rail, bus and taxi service[2]. The following table illustrates where and how PCS fits into Vancouver's system of intermodal connections.

---

[2] Two trains operate from the station, the VIA "Canadian" travels between Vancouver and Toronto, and the Amtrak "Cascades" travels daily between Vancouver and Seattle. International and inter-city bus service (Greyhound and Pacific Coach Lines) also operate from PCS. And Black Top Cabs have a pick up location out front of the station.

Table 1: Vancouver's Major Intermodal Terminals

Terminal	Air	Rail	Road bus	Road taxi	Water
Pacific Central Station		X	X	X	
Waterfront Station		X		X	X
Airport (YVR)	X		X	X	
Canada Place Terminal		X	X	X	X
Ballantyne Terminal			X	X	X

Once the Canada Line is operational, linking Waterfront Station to the airport (YVR), four of the five major terminals will be interconnected by rail. This will allow residents of the Lower Mainland and visitors to Vancouver to connect quickly with other regions in Metro Vancouver, as well as provide better access to places such as downtown Vancouver, Richmond, and YVR.

As the regional transit interface increases its connections to various communities within Metro Vancouver, it is important for facilities and stations to be planned in such a way to accommodate an increase in passenger activity. Therefore, transport terminals (i.e. nodes) should be built and designed towards achieving a larger intermodal vision of transportation efficiency. Alt et. al. (1997) claim, "the pieces of the modal infrastructure have been built, but they are crudely stuck together with inefficient and inflexible "fixes." Similar to the effect of a chain being only as strong as its weakest link, one poor connection in the transit interface and the whole system suffers. Therefore, navigation through any multimodal station should be clear and intuitive for the traveller, providing sufficient information about transportation options and allowing for passengers to

make well-informed transportation decisions.

This project takes the following steps to investigate passenger activity and intermodalism at PCS. First, it describes a problem, specifically the experiences of a select number of passengers arriving on Amtrak train 510 "Cascades" from Seattle. Second, a methodology is outlined for collecting information on these target subjects. Finally, the data is analyzed and results are presented with suggestions for improvements and areas for further research. The main objective of this study is to determine the design aspects of PCS that are affecting passengers' choice of on-going transportation and highlight the design changes necessary to increase the use of transit over the automobile.

Research Questions

The examination of passenger activity within PCS is based upon the following hypothesis: that efficient intermodal connectivity can be achieved through improved design and wayfinding devices at PCS. This hypothesis will be tested and advanced through the following research questions:

- What role does in-trip planning information (i.e. the types of information passengers gather during their trip) serve towards improving passenger orientation in Pacific Central Station?

- Why are a number of passengers who arrive on Amtrak train 510 "Cascades" disoriented[3] when they enter Pacific Central Station?

---

[3] The measurement of disorientation has been adapted from Arthur and Passini (1992:25) who have categorized how people's decisions are made in the process of wayfinding as either: *decision executing, decision making* or *information processing*. For the purposes of this study, target passengers will be categorized into these three distinct categories of spatial orientation. The criteria also measures passenger disorientation based on the time spent in the station, inside and outside station route patterns, and the type and frequency of information utilized while in the station. Refer to *Direct Observations Stage 2* in the Analysis section below for full criteria.

- What specific design elements are needed in Pacific Central Station to create a smoother intermodal connection and an overall better travel experience for all passengers?

The study will consider these questions in the context of sustainable transportation planning and transit-oriented development (TOD). TODs are mixed-use, dense developments often centred around transit stations or stops. The combination of an efficient intermodal transportation hub within a TOD has the potential to become an integrated and very efficient transit interface. Moreover, the study will be framed to view intermodalism through the eyes of New Urbanism and its principles of diversity, compactness, and integrated development it promotes (New Urbanism.org 2008). Approaching the study in this manner will help explain and define the transit supportive land uses and design elements that will be discussed throughout the paper. To begin, however, a brief review of transportation in the twentieth century will highlight our current challenges and help to contextualize intermodalism within the concept of a sustainable transportation system.

Background: The Changing Face of Transportation

Since the beginning of the twentieth century, particularly after the Second World War, the automobile has come to shape and define the form and function of cities across the world (Newman & Kenworthy 1999). North America in particular took advantage of cheap oil and became highly dependant on it for the majority of its transportation needs with over 85 percent of all local travel (trips of less than 50 kms) made by automobile (Newman & Kenworthy 1999; Gilbert & Perl 2008:68).

During this time, transportation infrastructure such as roads, bridges and expressways were built to accommodate the growing number of automobile drivers while public transportation (trains, streetcars, and buses) essentially took a backseat to the car. In fact, since the beginning of the twentieth century, the movement of people in vehicles increased steeply reaching over 2,000 km per person per year worldwide, with Canada averaging 1600 km per person (Gilbert & Perl 2008:85). And currently, oil accounts for 98 percent of all energy utilized by transportation, an increase from 92 percent in 1960 (Szyliowicz 2003:186).

The ease of movement cars create have taken people further distances away from the city and their places of work, helping to build the "Automobile City," but in the process creating a geography of suburban sprawl - an ideal that continues to define the way of life for a large number of people today (Newman & Kenworthy 1999).

In the last half-century, growing concerns about the detriments of sprawl such as road congestion and air quality, has brought public transportation back into the mix as a viable and sustainable transportation solution (Vuchic 1999). Peak oil costs in particular have forced governments and transportation agencies across North America to reconsider the financial and environmental costs of driving and work towards creating a more balanced and sustainable transportation system (EST 2000, Newman & Kenworthy 1999, Vuchic 1999). Most recently the State

of California's Low Carbon Fuel Standard (LCFS) and the province of BC's carbon tax are two examples of governments fighting to reduce greenhouse gas emissions and lower reliance on foreign oil (State of California 2008; CBC News.ca 2008).

In the last twenty-five years, movements such as Smart Growth,[4] New Urbanism[5], and Transit-Oriented Development (TOD) have provided alternative approaches to traditional forms of development and more sustainable solutions to the issue of land dispersal. These ideas support denser, mixed-use developments based around efficient public transportation systems. With an energy and environmental design ethic that establishes diversity, pedestrian scale, and public identity, these new forms of urban development, in theory, are attempting to change the undesirable impacts of (sub)urban sprawl (Calthorpe 1993). In the creation of vibrant, healthy and livable communities, these land use reforms also support equitable transportation development by building places that are accessible for all types of transit users regardless of their age, sex, or physical ability (Litman 2007a).

---

[4] Smart growth calls for building communities "that are more hospitable, productive, and fiscally and environmentally responsible than most of the communities that have been developed in the last century...[It] seeks to identify a common ground where developers, environmentalists, public officials, citizens, and others can all find acceptable ways to accommodate growth" (Porter, 2002).

[5] New Urbanism promotes "the creation and restoration of diverse, walkable, compact, vibrant, mixed-use communities composed of the same components as conventional development, but assembled in a more integrated fashion, in the form of complete communities. These contain housing, work places, shops, entertainment, schools, parks, and civic facilities essential to the daily lives of the residents, all within easy walking distance of each other" (New Urbanism.org, 2008).

Rail: A Growing and Viable Transportation Option

Since September 11, 2001, passenger rail in North America has been on the rise as a growing number of people are choosing the train for both leisure and business travel (Statistics Canada 2005). Despite a decrease in Canadian rail passenger travel in 2006, 4.24 million passengers still travelled 1.45 billion passenger kms by rail (Statistics Canada 2006). British Columbia in particular boasts a growing rail network that includes both commuter and light rail transit services (SkyTrain and West Coast Express), and will soon include the Canada Line, providing an important link between downtown Vancouver, Richmond, and the airport (YVR). Further proposed rail projects include SkyTrain extensions including the Evergreen Line and the UBC Line (TransLink 2008; BC Provincial Government 2008).

Rail tourism has been a growth market for the last fifteen years in BC, and the province is now considered to have the top tourist rail network in North America (BC Tourism Review 2007:18). BC lines include scheduled passenger rail (VIA Rail and Amtrak), destination rail (Rocky Mountaineer and the Royal Canadian Pacific) and short haul excursions including heritage railways such as the Spirit of Kamloops and the Armstrong Explorer (BC Tourism Review 2007).

From PCS two rail carriers operate, the VIA "Canadian" departs three times a week for Toronto, while the Amtrak "Cascades" runs daily to Seattle. Intercity bus service is provided by Pacific Coach Lines and Greyhound Canada; between

them they serve most communities in BC. Apart from the services offered from PCS, the area also supports a variety of transportation options all within a short walk of the station. These include public services with SkyTrain and buses operating from Main Street, and private services including taxis,[6] tour buses, and parking for automobiles[7] located closer to the station.

Amtrak Cascades ridership set an all-time record in 2007 with a 7.4 percent increase in passenger travel over 2006 (Washington State Department of Transportation 2008). With the extension of the Cascades service set to begin in mid 2008, PCS will likely see an increase in the flow of tourists from the United States, particularly as the 2010 Olympic and Paralympic Games approach (WSDOT 2008, BC Tourism Review 2007).

To accommodate the potential increase in rail passenger traffic, PCS must become a more efficient and user-friendly station. Passengers should have access to information, such as transit options, accommodation, and the location of various points of interest. They should also be able to easily find their way through the station in a smooth and seamless fashion.

However, many stations, including PCS, suffer from being isolated from other

[6] Based on five days of data collection, on average 18 taxis came daily during the arrival of Amtrak train 510. During the same time, the average number of SkyTrains headed downtown was eight.
[7] Parking at PCS consists of both a parking lot/drop off area and street parking. The lot holds a total of 23 metred parking stalls (two of which are delegated for Hertz rental cars). Along Station Street, parking is metred on one side and sign-restricted on the other, both sides can accommodate approximately 18 vehicles.

modes of transportation and can limit people's choice in how they get around
(Miller & Tsao 1999, Modak & Patkar 1984). Intermodalism is able to bridge that
gap and provide choice to passengers through cost-effective and sustainable
means of travel (Tait 1997).

Main Street Station Development History

PCS and Main Street SkyTrain Station have an interesting planning history
dating back to the inception of the SkyTrain system. Main Street Station was
originally constructed in 1982 during the development of the new Advanced Light
Rapid Transit (ALRT) system planned for Greater Vancouver (City of Vancouver
1987; Urban Transit Authority 1981). The station was selected as the terminus
for a demonstration line that would showcase the SkyTrain system to the public
during Expo '86 (Vancouver Regional Rapid Transit Project 1985).

Initial development plans described the Main Street Station as a future activity
centre. Located adjacent to the CN, VIA Rail/Amtrak, the station would provide
LRT passengers with convenient transfers from the Main Street bus and the
transcontinental passenger train terminus (Greater Vancouver Regional District
Rapid Transit Project 1979). At the time it was also the proposed location for the
inter-city bus terminal (GVRD Rapid Transit Project 1979). The site was seen as
a major focal point for intermodal transportation connections within the Lower
Mainland and gave excellent opportunity for "exciting urban design integrating
transit facilities, pedestrian walkways, public plazas and viewpoints, and new

development" (O & K Tract Developments 1982). City planning reports from the era state that Main Street Station be "developed as a somewhat self-contained mix of compatible and complementary uses that reflect the proximity to downtown, False Creek, the Expo '86 site and the ALRT and CNR stations" (Spaxman 1983:4). Assessment and Policy Plans for East False Creek suggested that mixed-use development focus primarily on "locations close to the Main and Terminal ALRT station and around Thornton Park" (City of Vancouver 1984).

Main Street Station is one of two stations, the other being Metrotown, whose location and design were influenced by a joint development opportunity between BC Transit, landowner and developer. Early development plans saw the station situated along Terminal Avenue adjacent to Station Street and within a short distance to the C.N. station. However, those plans changed once a private developer was willing to discount property and contribute to the cost of the station. The result was a slight shift in the station's location to optimize this relationship (Watts 1985:596). The increased physical distance between PCS and Main Street Station, however, caused a less attractive transfer for passengers between the two stations and arguably inhibited the area's growth of becoming a more efficient transportation hub.

Initial plans called for a hotel/commercial complex to be built atop the station (BC Transit 1985). As a result the station was designed with oversized footings to

accommodate this development and constructed as part of the station contract. Plans for the hotel ceased, however, when developer, Newco Development, failed to meet an agreed upon deadline - likely due to risky market at the time (Hein September 15, 2008, Personal Communication; Kuhlmann September 19, 2008, Personal Communication; BC Transit 1984:3). Site ownership was then given to Perkins and Cheung who developed a mixed-use complex of five towers each 30 storeys tall. Labelled as "transit-oriented condominium/apartments," the new "City Gate" development would provide residents with convenient access to the SkyTrain and the ability to shop either downtown or at Metrotown (BC Transit 1989:6). But as time progressed, City Gate and its surrounding area never fully developed into the TOD planners were hoping it would.

When the location of Main Street Station was being decided, there was little concern of integrating and developing a transportation connection between the station and PCS. Consequently, there is now a physical separation between the two stations - a distance of 463 feet. Passengers wanting to take public transit from PCS must walk along a path through Thornton Park. However, the walk is not always an attractive option as the park is often littered with trash and cigarette butts and also used by a number of homeless people. Particularly during the evening, neither the park nor the path is a safe or pleasant place.

However, research indicates that any distance between stations within 500 feet should be considered convenient walking distance (Shapiro et.al. 1996; Tait

1997). Yet, this is dependant on whether or not stations are properly designed to minimize the need to change levels or climb stairs, and if information, including clear signs and graphics to facilitate passenger wayfinding is provided. Currently, neither PCS nor Main Street Station possesses these qualities nor do they provide a safe space between the stations for transferring passengers.

Those passengers who do follow the path will reach the Main Street SkyTrain Station at the northeast corner of Main Street and Terminal Avenue. The only way of reaching the platform from this entrance is by taking the stairs (a total of 45). For those unable to manage steps or those with heavy luggage, reaching the platform is quite an ordeal. First, passengers must be aware that an elevator exists across the street at the station's west side entrance. They must then cross Main Street at Terminal Avenue, an intersection with one of the longest pedestrian cycles in Vancouver (LaClaire September 26, 2008, Personal Communication). Often pedestrians must wait over two minutes if they miss the light at this intersection. After crossing Main Street, they must then find their way to the far end of the station to where the elevator is located.

The situation does not improve as one heads north along Main Street. Here poor streetscape design has set shops too far back from the street and sunken slightly below ground creating dark and unattractive store fronts. In addition, the City Gate development towers directly above and casts a large shadow upon an already lifeless street. Needless to say there is not a great deal of pedestrian

traffic along this stretch of Main Street.

With the safety concerns in the park, the inaccessibility of Main Street Station, and the poor design of the public realm, the area has become a major deterrent for passengers wanting to take public transit to their on-going destination. Planning from the early 1980s imagined City Gate North[8] becoming a functional TOD and an "intermodal activity centre." However, the vibrancy and the active street life that is often associated with quality 'human scaled' urban environments is still missing. Some of the blame can to be contributed to poorly designed aspects of the public realm, but realistically, the major issue as to why the neighbourhood has been unable to revitalize on its own is because the City Gate development has sat in isolation for nearly 20 years. Since then, there has been no residential support for the area.

---

[8] This project will define City Gate North as the area within a half-mile radius surrounding Main Street Station, including PCS, Thornton Park, and parts of the False Creek flats and Strathcona neighbourhood.

LITERATURE REVIEW

The study draws from a variety of academic and professional sources but gathers the majority of its knowledge base from the transportation planning literature. Transit-oriented development (TOD) (Calthorpe 1993; Cervero 1998; Newman & Kenworthy 1999; Renne 2005) provides the conceptual framework for the study and is used to progress the discussion on intermodalism (Goetz 1999; Szyliowicz 2000; Handman 2002; Jones & Rowat 2003; Sherry 2006;) and station and wayfinding design (Arthur & Passini 1992; Timpf 2002; Carmona et. al. 2003).

A review of the urban design literature highlights New Urbanism (Calthorpe 1993; Duany Plater-Zyberk 1999) and Smart Growth (Porter 2002; Downs 2001) as two planning approaches with similar transportation principles to TOD. From the literature on intermodalism, this study extracts some of the key elements and considers them in the investigation of PCS.

Wayfinding[9] surfaced as an important way to understand and assess station design at PCS. The transport terminal is where the potential complexity of the public transport system is most intensely and immediately experienced. This

---

[9] Wayfinding can be defined as "a consistent use and organization of definite sensory cues from the external environment where the ultimate goal is to find the way from one place to another (Lynch 1960).

environment is where travellers enter and leave the system and which they change means of transport (Timpf 2004; Ruetschi & Timpf 2004). Passenger orientation is particularly valuable as it reveals traveller's perception of and response to information systems, indicating certain aspects of station design where change might be beneficial (Geehan 1996; Timpf 2002).

Intermodalism is one aspect of both TOD and New Urbanism that can assist in establishing more efficient linkages between different modes of transportation, most specifically, environmentally compatible and cost effective modes that may attract passengers who would otherwise travel by automobile (Tait 1997). In theory, as urban populations densify within TODs, residents will not have to rely so heavily on their vehicle to get around or need to own a vehicle at all. Research shows that motorized kilometres by private vehicles per resident decrease as residential density increases (Gilbert & Perl 2008:80). This suggests that the higher density of TOD has the potential to take people out of their cars and onto more sustainable modes of transportation such as public transit, bicycling or walking.

What is Intermodalism?

In its simplest form, intermodalism can be understood as the "movement of a combination of two or more modes" (Intermodal Association of America from Owens & Lewis 2002). Today, however, there are a number of different factors that contribute to the understanding of a true intermodal definition. One must consider how the points of connections between modes are made and why the

links that connect these points are important. Efficiency, safety, and sustainability have now become the benchmark principles of intermodalism and form part of a larger ethically based system of transportation (Sherry 2006).

Intermodalism can essentially be divided into dealing with freight and passenger systems. Historically, freight has utilized and benefited from intermodal connections more so than passenger transportation. The era of intermodal freight took off in the mid-1980s when ocean carriers and railroads partnered and began double-stacking rail container service. This approach proved to be cost-effective and created greater efficiency in the shipping of goods over sea and land (Owens & Lewis 2002). It also proved to passenger modal systems, which had always been planned, built, and operated independently of each other, that partnership and coordination was a favourable goal (Carmichael 2007:2).

As the demand for faster, reliable, and convenient travel service began increasing, people began to recognize the social and financial benefits of an integrated, intermodal system (Szyliowicz 2003). Today, across North America, bus and rail transit systems are coordinating their schedules and fare cards and providing easier and more efficient connections between modes. For example, Amtrak and intercity bus lines are recognizing the need to provide coordinated schedules and interline ticketing where synchronization of operations at the transport terminal is a real potential for time savings (Owens 2002:11; Goetz & Rodigue 1999:238).

Passenger intermodalism is continuing to gain in popularity within the transportation literature and within varying transportation organizations around the world. Now more than ever, it has become necessary for our transportation systems to reach a new level of efficiency and promote sustainable methods of how people get around. However, there are still several operational aspects that need to be resolved before a fully functional intermodal system of transportation can occur.

Institutional Barriers

Institutional barriers can often cause tremendous challenges for intermodal transportation. The interplay of agencies, each with its own methods, philosophies, and goals, requires skilful planning and coordination (Boyd and Caton 2001:15). Szyliowicz (2000:6) describes these agencies generally falling into three groups: government officials, the private and public sector, and various interest groups. Intermodalism is highly dependent on institutional cooperation, without it there is little chance of any project getting off the ground.

The reality of the situation is that as the demand for more sustainable transportation systems increase, agencies that have traditionally operated independently will now have to work together to provide the type of quality service the public demands. One must look only as far as Europe to see the successes from a well-planned intermodal transportation system. Overall,

European cities have had superior intermodal service compared to North American cities. While cities in North American tend to focus on access within the immediate metropolitan region, European cities are often connected inter-regionally, often by high-speed rail. Charles De Gaulle (CDG) airport in Paris is an excellent example of integrated transportation and an exemplary model of the operational and financial benefits accrued from a healthy institutional partnership (Miller & Loukakos 2001:9).

As is the case with the operation of many transport terminals, the CDG found that institutional barriers kept the planning of modes (namely air and rail) independent from each other. With no integration between the components the airport simply acted as a buffer between transport modes (Perl 1998:191). Thus, a partnership was formed between the Aéroports de Paris (ADP) and the Société Nationale des Chemins de fer Français (SNCF), the result of which was a TGV (Train à Grande Vitesse) interconnection facility beneath CDG with links to national and international destinations. This eliminated the need for a connection through central Paris and provided an obvious comparative advantage over competitors (Bory 1999:28; Vetrovsky, Kanafani 1994).

The station at CDG handles up to 25 trains a day and moves around a million passengers annually, combining flight with rail journey from Paris CDG airport to 19 French stations along the TGV, often without the need for passengers to carry their own luggage (Jones & Rowat 2003:45). Through proper station design

including strategic placement of TGV service within the airport, CDG passengers are able to transfer seamlessly between modes with minimal wait time.

The partnership of the SNCF and ADP was the impetus behind the success of the CDG and "demonstrated the advantageous opportunities for collaboration" (Perl 1998:193). Today, CDG remains an exemplary model of integrated transportation and illustrates what intermodalism looks like when it is properly planned and funded.

Intermodalism in North America

In Canada, transportation policy has traditionally fostered intermodal competition rather than cooperation. Since the 1950s, Canadian governments have been fixated on a unimodal approach to transportation planning (Jones et. al. 1992:4). This is partly due to the fact that over the last decade the Canadian government has seen infrastructure spending in the area of transportation as a cost and not an investment (Jones & Rowat 2003:45). Planning in this fashion has not only created huge barriers for reaching more sustainable means of transport, but has also placed Canada far behind other countries in terms of implementing any sort of intermodal transportation policy.

In the United States, legislation exists for intermodal policy in the form of ISTEA[10] (Intermodal Surface Transportation Efficiency Act), which integrates surface

---

[10] It also placed considerable emphasis on the planning, design, and construction of intermodal facilities and connections (Boyd & Caton 2001:7).

transportation infrastructure planning across modes, jurisdictions, and across the public and private sectors (Jones & Rowat 2003:49). The more recent Transportation Efficiency Act of the Twenty First Century (TEA-21) has further advanced the process. Since the implementation of these acts, a greater number of intermodal projects have appeared across the country.

For example, Amtrak's willingness to explore the benefits of intermodal cooperation has allowed them to operate more efficiently on all levels. They have partnered with Greyhound in several stations around North America to maximize customer convenience and avoid duplicative costs (Downs 1995:5). Amtrak has used the logic that when various modes of transportation are co-located, intercity carriers experience gains in ridership (Jones et.al. 1992:8). Public Private Partnerships (P3's) are often quite integral to forming intermodal relationships and in some cases, partnerships will form between several organizations to accommodate an intermodal arrangement.

King Street Station in Seattle, Washington is a good example of this type of working intermodal, multi-agency arrangement. The partnership is a coalition of transport operators (Amtrak, WSDOT, SDOT, Sound Transit, and BNSF) in the restoration of King Street Station and expansion of intercity and commuter rail (Owens 2003). Among the project benefits include, improved station access, traveller information, and wayfinding and signage (WSDOT 2008). The project has come to fruition in large part due to a healthy financial partnership between

seven different funding sources. The result will provide Seattle with a newly redesigned King Street Station and improved transit system, and hopefully stimulate further interest in forming intermodal, multi-agency partnerships in the future.

The above examples illustrate successful intermodal partnerships, in both cases agencies came together to think in real terms of how to improve service operations. PCS would likely benefit from a similar approach and partnership if the involved agencies were willing to cooperate. Lon LaClaire, Strategic Transportation Planning Engineer from the City of Vancouver, comments that the City meets with TransLink on a weekly basis on various projects but does not have the same type of relationship with VIA Rail. He says, "it is quite difficult to motivate all players... everyone is looking after their own needs, the railways tend to sit on their assets (LaClaire 2008, Personal Communication). There are many strategies to forming healthy working partnerships and different ways of convincing hesitant parties to participate. For example, a neutral third party, as in the case between the ADP and SNCF at Charles de Gaulle Airport, could help to establish a fair and equal playing field and encourage parties like VIA Rail to consider the benefits of forming partnerships.

Simply put, improving and integrating inter-city transport and transit service has the potential to attract customers (i.e. passengers), which in turn creates benefits for the public and the partnered institutions. Only through cooperation does

intermodalism work at its full potential. Dissolving the institutional barriers to intermodal transportation is often the first requirement. Once these barriers have disappeared, then real progress can be made and a truly integrated and efficient transportation system can begin to emerge.

Intermodal Station Design: The Importance of Wayfinding

On the ground, the transport terminal becomes extremely important to the success of intermodal transportation. The accessibility of the station and the quality of the built environment plays a crucial role in efficient modal connections. Successful intermodalism can efficiently connect passengers between separate modes of transportation, and if these modes are also coordinated, then the likelihood of a seamless trip for passengers and commuters will also increase (Handman 2002, Muller 1999). Poorly designed stations tend to confuse passengers and add to the amount of time spent in transfer, which is of significant burden to passengers as long as intermodal connections are unpredictable and unreliable (Miller & Loukakos 2001:10). Effective passenger intermodalism is facilitated by minimal waiting time with the fare for the entire trip covered in one or two payments (Owens 2002:5). Unified reservation systems and through ticketing also increase the attractiveness of intermodality as new information technologies, particularly the Internet, can offer convenient intermodal sales and reservation possibilities (Bory 1999:29).

According to Handman (2002), PCS would be considered a major transportation

hub and falls into that category of a public transportation intermodal centre.[11]

Furthermore, in conjunction with area's public transit services and transit

supportive land uses, PCS forms a special (symbiotic) relationship with

intermodality and TOD, able to enhance both the transit experience for the

traveller and the livability for residents.

Moving people through stations as efficiently and quickly as possible depends

highly on the ability to find one's way within the transport terminal. Connecting to

different modes along the transportation interface is also extremely important and

is where the study of wayfinding fits into the larger puzzle of intermodalism

(Beaty-Pownall 2007:20). Successful station wayfinding will tend to be part and

parcel of a larger wayfinding system (i.e. at a city-wide scale). To ensure a

certain degree of confidence in the wayfinder, the system must provide

integrated, consistent and user-friendly information to confirm chosen routes will

be efficient, safe, and ultimately lead people to where they want to go (Brown

2006:3; Shapiro et.al. 1996:155). Therefore, wayfinding can help lessen the

"perceived complexity of routes," or in other words, the perception of how difficult

a chosen route can be (Timpf 2003:2).

The ambiguity and confusing nature within multi-modal stations can often create

difficulties navigating especially for first time visitors unfamiliar with the station or

the transportation system. To better understand the complexity of the transport

---

[11] Public transportation intermodal centres serve as transfer points for one or more rail services, one or more types of bus service, taxicab access, and often includes parking facilities (Handman 2002).

terminal, the concept of "intermodal wayfinding" has surfaced and is used when a number of different modes to get around is the norm (Timpf 2002:3).

According to Timpf, there are certain features of an urban navigation system that can help ensure a positive wayfinding experience. On one hand, the degree of architectural differentiation, the degree of visual access, and the complexity of the spatial layout illustrate environmental factors important to good wayfinding (Timpf 2002:5). On the other, mental mapping, spatial problem solving and orientation, and environmental communication cover aspects of the behavioural field that contribute to how people absorb information and execute their decisions as part of the wayfinding process (Arthur & Passini 1992; Passini 1984; Geehan 1996). A successful wayfinding system will consider both sets of factors and provide a certain degree of wayfinding assurance for people navigating within and beyond the transportation system. It is proven that good legibility of the environment also improves spatial orientation and wayfinding (Brown 2006:3; Timpf 2003). London is a good case example of a city that has applied this principle and others in its goal of creating a more coherent and walkable city.

To help deliver the vision of making London a world-class walking city by 2015, London has created a scheme that will provide better information and wayfinding measures for people who want to walk. The strategy has been termed "Legible London" with the approach of establishing integrated urban information into a single reliable, consistent and authoritative system (AIG 2006). Newly developed

signs are located at street intersections, tube station exits and bus stops and show the direction to walk, how long it is going to take, and notable landmarks along the way. A main objective of Legible London is based on the idea that more walking can noticeably reduce pressure on the transportation system and is significant in achieving a modal shift away from congested public transport to walking (AIG 2006:10).

By using fundamental wayfinding concepts such as the use of landmarks as visual clues and the idea of 'mental mapping' in its approach, London is ensuring that citizens and visitors will be more confident about traveling around the city on foot (Arthur & Passini 1992; Geehan 1996; Timpf 2003; AIG 2006). Legible London illustrates that a quality urban environment and quality pedestrian environment can co-exist by integrating piecemeal information into a comprehensive spatial knowledge system (Golledge 1992:200).

When it comes to wayfinding, commonsense knowledge tends to suffice only to a certain degree, after that people need to be reminded as to where they are and how they are going to get there. Creating a legible environment strengthens the connection between the ease of wayfinding and the quality of the urban environment. Ensuring that people are on the right path should be the goal of any wayfinding system and becomes particularly important when dealing with the complexities of the transport terminal. Consequently, a station like PCS has the challenging task of not only designing a wayfinding system that is coherent to

passengers, but the system must also present the information with sustainable

means of transportation in mind.

RESEARCH DESIGN & METHODS

Through a mixed-methodology of data collection the research design involves both a theoretical and empirical approach to understanding intermodalism. The following section describes the methodological approaches that define the nature of the data collected.

A literature review has already extracted the salient theories and principles within the transportation planning and urban design disciplines. In particular, transit-oriented development (TOD) and New Urbanism surfaced as two areas that have helped to contextualize and understand station design and intermodalism. The literature provided a theoretical basis and allowed subsequent research to be conducted through a lens conducive with sustainable transportation planning.

Direct Observation

Direct observation contributed a considerable amount to the empirical aspect of the research and consisted of three general parts similar to Jan Gehl's (1996) approach to observing in public spaces. First, a preliminary evaluation of passenger activity in PCS was observed; second, a more thorough recording of passenger activity both inside and outside the station was conducted; and third, recommendations on improving intermodal design at PCS are suggested.

The objective of the observations was to analyze passenger activity in PCS and record any behavioural patterns that may have revealed information about station design in regards to connecting transportation choices. In this regard, a similar study conducted by Miller and Mitchell (2000) which made use of site observations and a survey interview, identified four stages of an intermodal transfer process[12] and became useful for organizing passenger observations at PCS.

The bulk of observations were recorded on passengers arriving on Amtrak train 510 "Cascades" from Seattle, in particular, the types of wayfinding patterns these passengers would form inside the station. For example, the amount of time spent inside the station was usually a good indication of wayfinding trouble.

Amtrak train 510 was primarily targeted because of its frequent arrivals (once a day, seven days a week). It was also thought that an international train arriving from Seattle would produce a greater number of passengers unfamiliar with PCS, thus supplying the study with a greater number of unbiased and genuine reactions to station design than might have passengers arriving on a VIA train or any other local intercity bus.

As it turned out, train 510 allowed for much easier and thorough passenger

---

[12] According to Miller and Mitchell (2000:4), an intermodal transfer consists of four stages: First, the approach to the facility and the quality of service to reach the terminal. Second, a transferring passenger must go through some sort of ticketing process. Third, the actual transfer including locating the new vehicle, the waiting time, and the physical qualities of the terminal. And fourth, the departure from the terminal.

observations than first imagined. Because passengers had to first pass through customs, the result was a staggered arrival of each passenger individually or in small groups. This helped the researcher to categorize passengers as they arrived instead of having the trouble of an "all at once" mass movement that is often experienced from other trains and buses arriving at the station.

Two stages of observations were conducted over a two-week period in February 2008. First, a week's worth of preliminary observations was conducted to confirm that there was a problem of passenger confusion at PCS. These preliminary observations focussed primarily at Amtrak train 510 but also considered passengers from VIA's train the "Canadian" from Toronto. However, the Canadian was dropped from continued observations in large part because the majority of these passengers received prior information about connecting modes of transportation while on the train (Henn 2008, Personal Communication).

Stage 2 spent another week observing passengers, but these observations were limited to only those arriving on Amtrak train 510. During this stage a passenger count was conducted that grouped passengers into three distinct categories adapted from Arthur and Passini's (1992) categorization of how decisions are made in the wayfinding process. Target passengers were categorized as being either in the process of: 1) *decision executing*, 2) *decision making*, or 3)

information processing[13].

Decision executing passengers were categorized and defined by the small amount of time spent in the station (usually less than 30 seconds). This suggests that *decision executing* passengers either had very little difficulty wayfinding, or they had prior knowledge of the station and already knew about the connecting transportation options available. If they did not simply exit the station as they came through customs, these passengers often had friends or family waiting to pick them up and therefore station wayfinding was not even a factor for them.

If it was clear that passengers were having a considerable amount of trouble wayfinding inside the station (i.e. wandering aimlessly, frequently referring to maps or brochures, or asking security for information) then they were categorized as *information processing*. These passengers were observed as having the most difficulty orientating themselves inside and outside PCS. The amount of time spent in the station was also a good indicator of wayfinding difficulty and helped define this group of passengers.

Heye and Timpf (2003) identify time as having an impact on the choice a traveller makes when discriminating between several alternatives. Therefore, any time

---

[13] According to Arthur and Passini (1992), these criteria help define wayfinding as the dynamic relationship to space. "*Decision executing*, which transforms the plan into appropriate behaviour at the right place in space, *decision making* and the development of a plan of action, and *information processing* understood as comprising environmental perception and cognition, which in turn are responsible for the information basis of the two decision-related processes" (1992:25).

spent between one to three minutes orientating and navigating in PCS (i.e. from the moment they entered the station to the moment they caught ongoing transportation) seemed to indicate a high level of passenger wayfinding difficulty. Any time over three minutes tended to be a sure sign of a passenger in the *information processing* stage. As their choice of on-going transportation, these passengers would often select a taxi seemingly out of frustration.

Passengers who were categorized as *decision making* were those who displayed some degree of wayfinding trouble, more so than *decision executing* passengers, but less than *information processing* passengers. For example, passengers who fell within this group might have paused only once to check signage or refer to a map, but would continue to on-going transportation shortly after.

The criteria also measured passenger disorientation based on the amount of time spent in the station, inside and outside station route patterns, and the type and frequency of information utilized. These categories provided an index of disorientation and helped to accurately define the level at which passengers were having difficulty wayfinding in the station.

The majority of observations were conducted inconspicuously as not to affect passenger's genuine experience within the station or to upset security. Thus, observations were generally taken from a bench near the arrival gate with a small notepad and pencil. Observations were reviewed, dated and transcribed at the

end of each day. All passengers' activities were noted but particular focus was paid to disoriented passengers and the patterns they created. For example, the amount of time spent in the station, the types of information sources utilized, whom they spoke to and, if possible, the subject matter of their conversations. Also noted, was their on-going mode of transportation once exiting the station.

Survey Interview

A survey interview was conducted for a subset of passengers arriving from Amtrak train 510 Cascades. Since VIA Rail, which own and operate PCS, did not permit the survey to be conducted inside the station, the survey was located outside the station across Station Street at the entrance of Thornton Park. The purpose of the interview was to unearth specific passenger information regarding their trip and their experience at PCS.

The survey consisted of fourteen questions that included *Yes or No, Open Ended, and Contingency* questions. In addition, a Likert scale was utilized that allowed respondents to rate PCS in terms of certain design elements. See Appendix B for a copy of the survey questionnaire.

In-Depth Interviews

Three in-depth, qualitative interviews were conducted with planning professionals at the City of Vancouver. The purpose of which was to learn about past developments surrounding PCS and Main Street Station and collect information about future planning initiatives for PCS and the surrounding area. Information

gathered was analyzed to determine whether or not future development would benefit the area. The Southeast False Creek (SEFC) development and the redesign of the Main Street SkyTrain Station surfaced as two major projects that were likely to bring improvements to PCS and the surrounding area.

Limitations

The most significant limitation within the study's methodology was the location where the survey was conducted. This separation prohibited the researcher access to all passengers that did not step off VIA Rail property. These passengers included those who chose automobile, taxi, and private bus once exiting the station, thus limiting the survey essentially to those who chose to take transit or walk to their destinations.

Another less significant but noteworthy limitation to the study was the time of year the empirical research was conducted. VIA Rail and Amtrak trains are less busy in the winter months with fewer passengers arriving at PCS. In 2007, the number of total passengers going through PCS on Amtrak train 510 was approximately 110,000, with ridership peaking during May, June, July and August (Washington State Department of Transportation 2008). A similar study conducted during the summer months would likely result in higher passenger counts and possibly more compelling passenger and station data than during the winter months. Also, the seasonal information booth, which provides a travel advisor inside PCS, could then be analyzed to determine its effectiveness in station wayfinding and choice of on-going transportation.

ANALYSIS

Preliminary Observations Stage 1

After observations were completed and the problem of passenger wayfinding was confirmed, several interesting findings were highlighted. After disembarking the train, approximately 50 percent of passengers caught a taxi, 40 percent had people or rides waiting for them, and approximately ten percent walked to, or in the direction of the Main Street Station. These were rough preliminary counts, but generally the percentages remained constant throughout the week.

It was found that approximately 20 percent of all passengers arriving to PCS aboard Amtrak train 510 appeared to be having some degree of wayfinding difficulty inside the station. Consequently, this was also affecting their ability to connect to on-going transportation in an efficient manner.

The choice of on-going transportation varied amongst these passengers, but taxis proved to be a convenient choice and were chosen by over half the number of passengers.

A few common scenarios for disoriented passengers were:

- If station information (i.e. signage, maps or information provided by staff) did not suffice, bemused passengers would often approach a security guard and ask for information.
- A number of passengers would exit the station and look around outside for information or clues, but would often return back inside when their attempt proved to be unsuccessful, and;
- Station loiterers (i.e. homeless, transients, street people) would occasionally approach confused passengers and offer information in exchange for money.

Nothing was obviously clear for this category of passenger and a number of possible reasons were undoubtedly accounting for their disorientation. It was then suspected that the ineffectiveness of the station's design elements, such as maps and signs, were contributing to passenger disorientation.

In the foyer of PCS there is a board with a map of the city and information about accommodation, attractions, and transportation. However, the board and the map are quite small and are almost entirely hidden from passengers as they enter the station through customs. There are two unused booths in the main foyer; one is for security purposes, the other is used as an information booth for passengers during summer months (May, June, July, August) (Henn 2008, Personal Communication).

Lynch (1960) emphasized the importance of the legibility of the environment where good legibility improves spatial orientation and, thus, wayfinding. Signage inside PCS is very simple in its approach but does require a certain level of local

transportation knowledge to make informed decisions about connecting modes. Outside the station wayfinding signage is sparse and apart from the "taxi cabs only" sign on the street, there is no other transportation type signage within sight. Here, a basic information sign would reveal to passengers that public transit and several sites of interest are within walking distance from the station.

For the majority of passengers on Amtrak train 510, wayfinding seemed to be a straightforward exercise; they did not become disoriented and on-going transportation was found rather easily. However, there were still a number of passengers showing signs of wayfinding difficulty, and it was not until Stage 2 of observations where several of the reasons began to surface.

Direct Observations Stage 2

It was noted that multiple factors were undoubtedly contributing to Amtrak train 510 passenger disorientation. Thus, stage 2 of observations focussed primarily on the station patterns of "target" passengers (i.e. those exhibiting some level of disorientation once entering the station). Similar patterns and scenarios to Stage 1 of observations also occurred during Stage 2, the only difference being that patterns were further analyzed.

A common scenario for target passengers was as follows: After passing through customs, passengers would walk towards the middle of the station, pause, look around for a brief moment, and without any real certainty, begin moving about the station. Often passengers would sit down to gather themselves or refer to a

map or brochure. A number of target passengers would walk in two or three different directions searching for information before returning, often to the same spot they had just left.

This circling behaviour can be partly explained by Arthur and Passini (1992) who claim that most settings are laid out in a plan or "shape" to which people can relate and determine their location, destination, and form a plan of action that will take them from their location to their destination. When the environment, in this case PCS, denies the ability to do any of these, passengers are effectively prevented from forming an efficient action plan. Thus, confusion sets in, and wandering begins, often in a circling fashion.

In all cases it appeared as though target passengers were waiting for something to grab their attention, something to tell them what to do and where to go. This "something" was most often a human source of information (i.e. generally security guards and occasionally staff at the currency exchange and/or ticket booths). Confused passengers tended to rely on other humans for information instead of trying their luck with station wayfinding devices (signs and maps). However, the quality of information received from station staff (i.e. security, currency exchange and ticket booths) must be questioned, as they have likely not been trained sufficiently to provide quality wayfinding information.

The problem was not limited to inside the station; there was also a wayfinding issue outside the station as well. Once exiting the station, target passengers often appeared equally as confused as they did inside. There were undoubtedly a number of reasons contributing to the wayfinding difficulty outside the station as well, and lack of sufficient signage appeared to be at the top of the list.

Also during Stage 2 of observations a passenger count from Amtrak train 510 was conducted. The passenger count included a total number count for all passengers on train 510 for that particular day and also categorized each passenger into one of three separate categories: 1) *decision executing*, 2) *decision making,* and 3) *information processing.* As mentioned earlier these categories helped determine the level of disorientation each passenger was experiencing in the station. Figure 2 (below) illustrates the results.
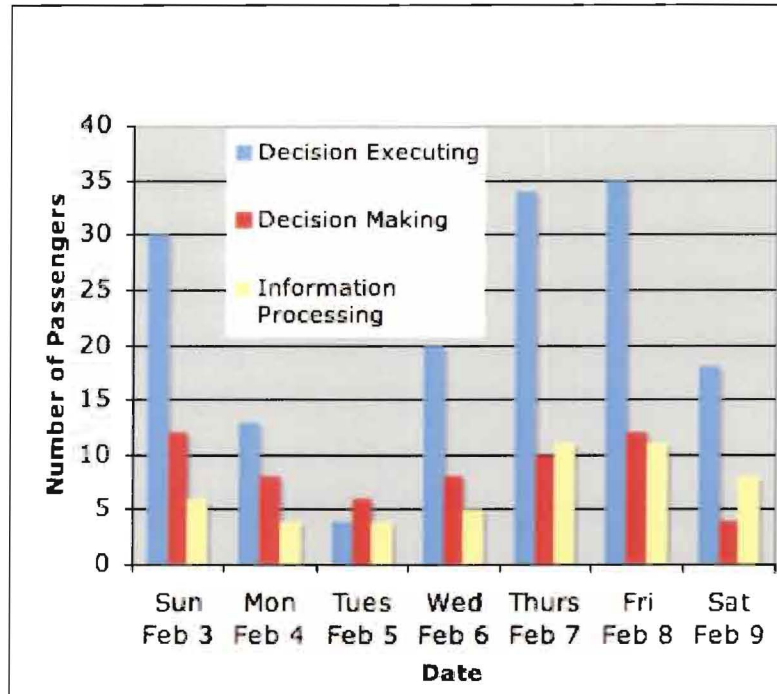
Figure 2: Passenger Counts & Level of Disorientation

The percentages for each category were: *decision executing* (58 percent),

decision making (23 percent), and *information processing* (17 percent). Station

passenger patterns and the amount of time spent inside the station were two

important factors of the station experience that helped define and differentiate

between the three types of passengers. These factors appeared to be directly

correlated with the amount of wayfinding trouble passengers were experiencing.

There was obviously a problem, particularly for passengers categorized as

information processing, but was it purely a station design and wayfinding issue?

Was it a matter of having more signs, more maps, and more access to information inside and/or outside the station?

These questions in particular became the impetus behind formulating the survey questionnaire. The purpose of which was to help understand the effectiveness of the design/wayfinding aspects of PCS. It was also meant to uncover any unknown but useful wayfinding elements passengers came across during their trip (i.e. from when they originally boarded the train, to entering PCS, and finally to when they arrived at their destination).

Survey Interview Analysis

Seven days of survey interview data was collected and a total of 30 respondents provided answers to 14 questions pertaining to passenger demographics, transportation choice, and station wayfinding and design. The survey also collected suggestions from respondents in terms of creating a better travel experience. The interviewer approached all passengers who walked past the survey location (at the entrance of Thornton Park across from Station Street) but only passengers who were aboard Amtrak train 510 were interviewed. A total of three people turned down the request for an interview.

The following is an analysis of the survey interview and attempts to provide a more complete understanding of passenger's thoughts and reactions to station wayfinding and design at PCS. This analysis highlights the major findings; full survey results can be seen in Appendix A.

The majority of respondents (43 percent) lived in Washington State. Other groups included travellers from other parts of the United States (20 percent) and overseas travellers (20 percent). Those residing in Vancouver only made up 10 percent of respondents. 46 percent of respondents reported originating their trip in Seattle while the other 53 percent boarded the train at a stop north of Seattle.

The idea behind knowing how respondents got to the boarding station to start their train trip was to understand the type of traveller aboard Amtrak train 510. Depending on how they got to the train station in the first place and why (i.e. for financial or ethical reasons) may have indicated how passengers were going to leave PCS when they arrived. Results were as follows: automobile (drop off or park n' ride) (50 percent), public bus (33 percent), taxi (13 percent), walk (3 percent).

Because the survey was conducted off VIA Rail property and on public land, the majority of respondents who the survey targeted were intercepted by the researcher en route toward public transit. If the study was able to compare passengers choosing private vehicles and taxis as on-going transportation as well, it may have resulted in a stronger correlation between the choice of travel to the boarding station and their choice of travel after having arrived at PCS.

43 percent of respondents reported that it was their first time to Vancouver and

57 percent said it was their first time in PCS. Those who had been through the station before had been through on average seven times in the last 24 months. These questions were designed to reveal if passengers had any prior experience in PCS.

Asking respondent's destinations was meant to reveal if certain locations in Vancouver were more popular than others among surveyed passengers. The results indicated that the majority of respondents (73 percent) were headed downtown while 20 percent of respondents were travelling to other parts of the city or Metro Vancouver (i.e. UBC, Kitsilano, Surrey). Destinations within the downtown area were varied, but included Gastown, Granville Island, and a number of different streets including Granville Street, Powell Street and Hornby Street. Not all respondents were willing to give the exact location of their destination, but most respondents heading downtown were doing so for accommodation and sightseeing purposes.

Respondent's choice of on-going transportation was as follows: SkyTrain (53 percent), public bus (23 percent), walking (17 percent), and getting a ride (7 percent). Here it is worth noting again that because of the survey's location, responses to this question are somewhat biased towards those using public transit.

The following is a list of reasons behind respondent's transportation choices. A variety of responses were given and the most common responses were:

1. Convenience (31 percent)
2. Affordability (18 percent)
3. Information provided by survey interviewer (i.e. author) (13 percent)
4. Necessity (had no car) (10 percent)
5. Speed (10 percent)
6. Word of mouth (8 percent)

13 percent of respondents reported that they did not know what mode of transportation they were going to use until they received information during the survey interview. In other words, there were still a number of respondents who had not decided upon an on-going mode of transportation even after they had exited the station, crossed the street and entered the park.

The study was interested in revealing at what point during the trip passengers determined their on-going mode of transportation from PCS. Was it before, on, or after boarding Amtrak train 510? Results to this question were as follows: before train (67 percent), on train (17 percent), after train (17 percent). Several "before train" respondents said they went online to receive information about on-going transportation from PCS. Feedback about these websites (i.e. TransLink, Tourism Vancouver, and Google Transit Maps) was varied in respect to access and quality of desired information (i.e. not everyone could find what they were looking for). For example, one respondent commented on being unable to find web information about alternative modes of transportation in Vancouver.

Approximately half of respondents who gained information on board the train said that on-board announcements were very clear and informative about on-going transportation from PCS, the other half, however, reported the opposite.

Several "after train" respondents commented that signage inside the station was somewhat straightforward, but the lack of signage and information outside the station was the major problem. The majority of these respondents admitted to having to ask somebody for information and directions.

87 percent of respondents reported having very little difficulty wayfinding in the station, remarking that the station and signage was quite 'straightforward.' 13 percent reported having some difficulty. Respondents who did have trouble wayfinding remarked that they would have appreciated a human source of information (i.e. someone they would be able to approach for maps or brochures). They also would have appreciated handheld maps, not just of the downtown core but maps of the surrounding area as well.

The Likert scale allowed respondents to rate their station wayfinding experience and the results are shown below in Figure 3. The average score was 5.6.
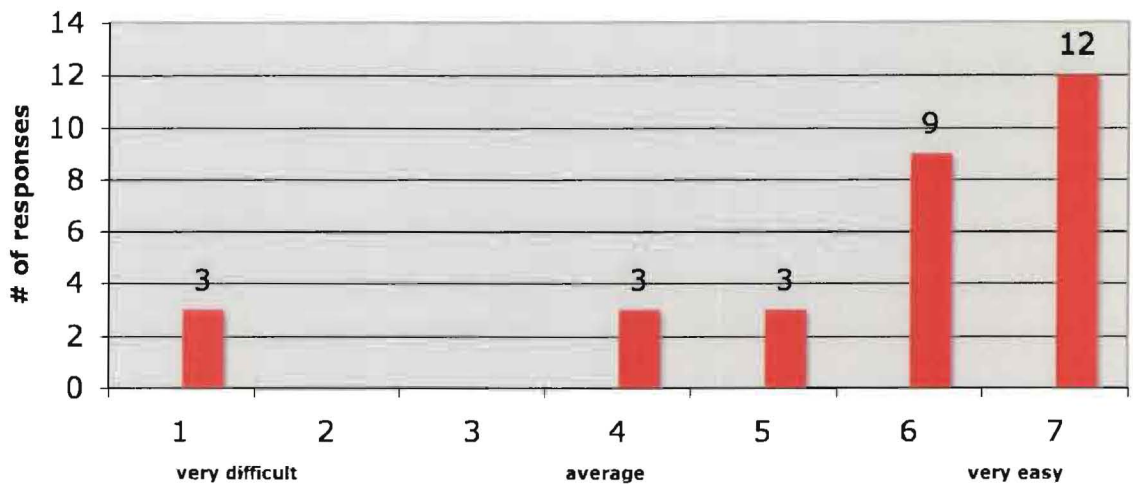
Figure 3: PCS Wayfinding

Asking respondents if they were aware of the public transit options (i.e. SkyTrain and buses) was meant to gauge respondent's knowledge of the local transit system. 77 percent of respondents said they were aware of the public transit options, 23 percent of respondents were 'unsure.'

When asked how and when respondents became aware of the public transit options, the answers were as follows: 44 percent from experience, 25 percent received the information on the train, while 11 percent found out inside PCS (from signage or a human source of information), the same percentage (11 percent) found the information via the Internet. Six percent became aware of the options once exiting the station and three percent said they knew by word of mouth. Answers were meant to help determine areas of the in-trip planning and transit interface that may needed further investigation.

A follow-up question pertaining to the design elements of PCS, asked whether respondents found information to be accessible in the station. For example, was the station well designed so that passengers were able to navigate by themselves, or did they have to ask someone for help and directions? Answers were as follows: 60 percent said "Yes" and found information to be accessible, 20 percent said "No" and another 20 percent had "no answer." Interestingly both Yes and No respondents had additional comments to provide and the most common two suggestions were: 1) more maps including handheld maps of the city and the surrounding area, and 2) a trained travel advisor (i.e. a human source of information).

The majority of respondents felt that station information was accessible although there were still a number of respondents who thought there was room for improvement. See Figure 4 for results. The average score was 5.1.
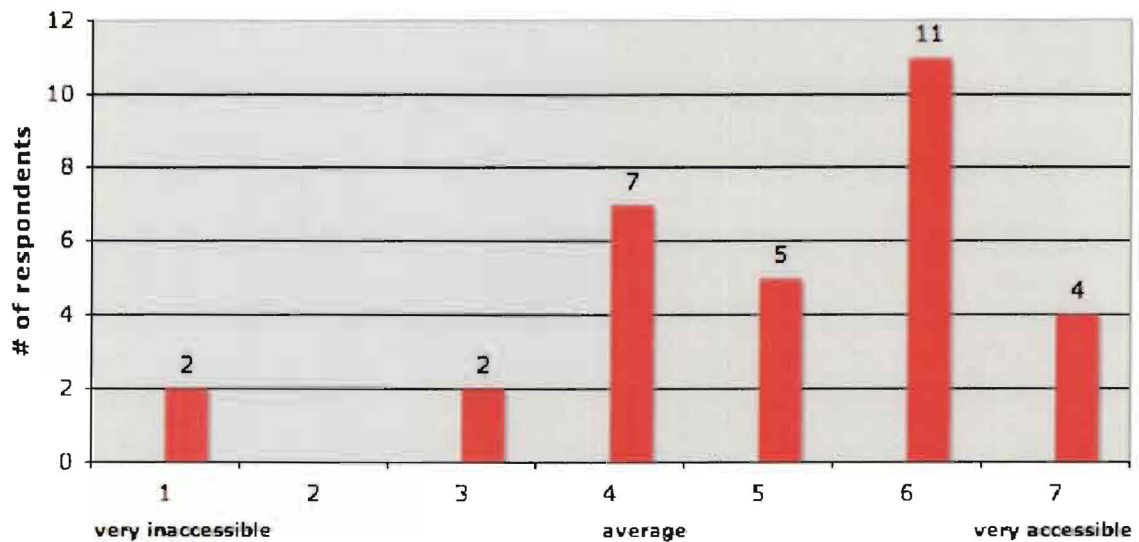
Figure 4: PCS Access to Information

Cost is often directly correlated to choice of travel and therefore respondents were asked if they knew the price of on-going transportation options from PCS. If travellers were aware of the costs of each option then respondents would be likely to choose a mode more appropriate to them. 37 percent of respondents answered "Yes" to knowing how much it was to where they were going, 57 percent answered "No." Seven percent were "unsure."

The average cost estimate given by respondents for a taxi was $18 compared to $2.30 for public transit. This is significant because the difference in cost could affect a change in passenger's attitudes and decisions about on-going transportation from PCS. Particularly for passengers en route to downtown

49

(where the average estimate for a taxi was $12.40), the cost savings for a trip of almost equal distance on the SkyTrain is over 10 dollars.

53 percent of respondents answered "Yes" that they knew how to pay for the trip compared to 23 percent "No" and 23 percent that said "maybe." 26 percent of respondents said they were going to use Canadian cash while 21 percent said US cash. 13 percent were planning on using their credit card, eight percent already had a transit pass and six percent had no answer. Asking respondents if they knew how to pay for the trip was meant to reveal the extent to which uncertainty about the transit system became a significant deterrent. Nearly half were "unsure" when it came to trip payment, suggesting a deficiency somewhere within the trip and possibly a consideration for clearer transit information inside PCS.

The first of two open-ended questions asked respondents if they had any suggestion on what would have made their travel experience easier or smoother in PCS, whether it be inside or outside the station. About a quarter of respondents had nothing to suggest and said that their travel experience was "fine." However the other three quarters had a variety answers to this question and, thus, the responses were categorized using the frequency of suggestions made.

Better signage was the most frequently given suggestion and indicated a demand for an easier wayfinding experience, both inside and outside station. Second on the list was signage and information. Respondent's suggestions were to provide better directional signage, more detailed maps of Vancouver and the transit system, and a human source of information (i.e. a tourist advisor as one respondent suggested - someone providing information upon arrival). Thirdly, the line-up for customs was an issue for a number of respondents. The customs area is not enclosed and often passengers are forced to wait outside in the cold and rain.

The second of open-ended questions was intended as a catch-all and asked respondents if they had any final comments or suggestions on any aspect of the survey interview. 37 percent of respondents had no further comments, but those who did, spoke to a number of different issues ranging from providing storage lockers to adding a fresh coat of paint to the station.

However, the number one suggestion was to increase the amount of signage. For those respondents unfamiliar with the station there seemed to be a level of uncertainty about what to do and where to go when they got off the train. This was particularly true once passengers exited the station where there was a lack of sufficient directional/information signage to support a smooth intermodal connection.

The survey interview was the final component of the analysis, and in conjunction with the literature review and the direct observations formed the recommendations in the final section of the project. However, first a brief discussion on the potential relationship between transit-oriented development (TOD) and PCS in forming a true intermodal and integrated transit interface.

Transit-Oriented Development & Pacific Central Station

For the most part, TODs are mixed-use, dense developments centred around transit stations or stops and are drawn up around a walkability boundary. This encompasses a fairly general definition of TOD and does not suggest that what is successful for one location will necessarily work for another. TODs must be planned with the proposed site in mind, considering the local environmental, social and financial conditions before any development occurs (Dittmar & Ohland 2004). A successful TOD will include the 3D's, or three dimensions (density, design, and diversity) and places a high priority on a walkable environment (Cervero 2003). Creating an environment that is conducive to the pedestrian increases the likelihood of people walking to their destinations rather than opting to drive.

Recent TOD literature has revealed that the original ¼ mile walking radius that was traditionally drawn around transit stations, has in fact increased, up to a ½ mile, as people are now willing to walk greater distances to access employment, commercial, and transit. The State of California has adopted a definition that does a good job of capturing the essence of TOD:

52

TOD's are moderate to higher density development located within an easy walk (approximately ½ mile) of a major transit stop, generally with a mix of residential, employment and shopping opportunities designed for pedestrians without excluding the auto. TOD can be new construction redevelopment of one or more buildings whose design and orientation facilitate transit use (California Department of Transportation 2002:3).

The area under investigation (see Figure 5 below) is unique in the fact that two stations exist within the TOD boundary. The boundary is centred around the Main Street Station because it is the area's hub for accessing public transportation. However, the close proximity of PCS forms a larger transit interface that creates both a challenge and an opportunity to connect these two stations in an effective way.

Figure 5: Area of Investigation (source: Google maps 2007)

Figure 6 (below) is a larger scale map and illustrates the central location of the

Main Street Station (blue icon inside smaller red circle) and PCS (blue icon to the right of small red circle).

Figure 6: TOD Boundary (source: Google maps 2007)

The scale of Figure 7 (below) is larger still and shows the TOD area in more detail. Notice the residential and commercial development to the northwest of the Main Street Station (City Gate and the VanCity building), which contributes to the density and TOD nature of the area.
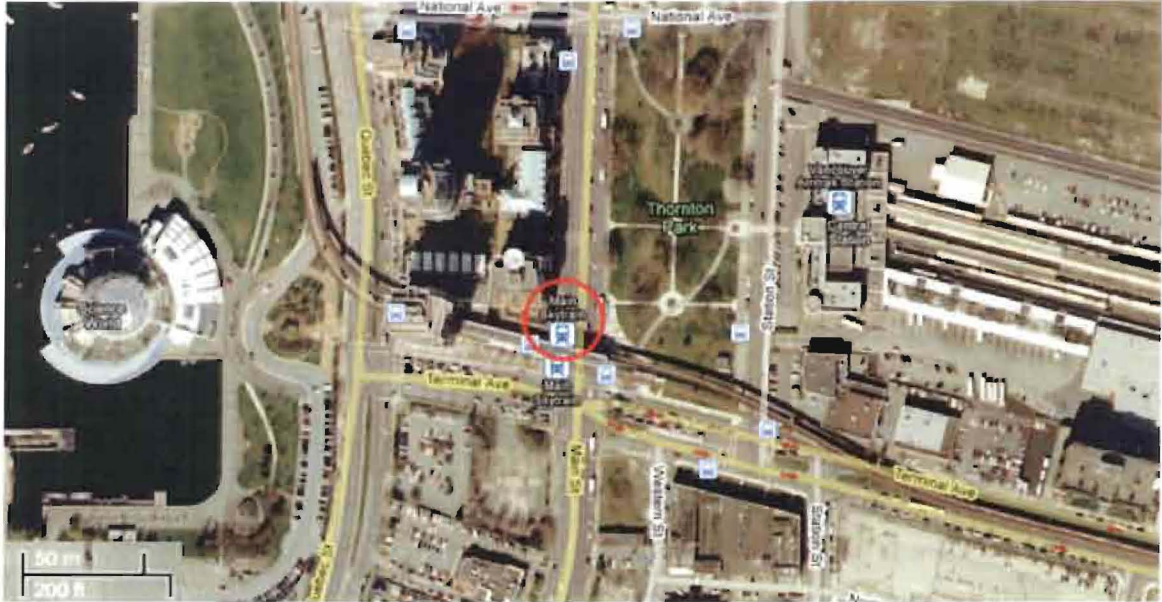
Figure 7: TOD Area (source: Google maps 2007)

Based on the idea that areas located around transit will support human scaled, pedestrian-friendly spaces (Litman 2007b), developing the intermodal aspect of PCS would help build a well-linked transit interface while creating the potential to enhance the area's image as a vibrant, livable community and a viable TOD.

Grand Central Terminal (GCT) in New York City is a prime example of a successful major intermodal transport terminal within a successful TOD. The landmark terminal provides efficient transfers for pedestrians, users of rail systems[14], buses, taxis, privately owned vehicles, and bicycles. It also includes retail, meeting and exhibition space (Broadhurst 2004). As a transportation hub, its 123 tracks covering 48 acres handle over half a million travellers daily (Stern

---

[14] Grand Central Terminal services Metro-North Railway and NYC subway.

1990, Real Estate Weekly 1996). In 2006, the Metro-North Railroad alone had over 75 million passengers ride on their trains (MTA 2006).

The immense amount of pedestrian traffic and the place-making characteristic of GCT have allowed Manhattan planners to classify the surrounding area the "Special Grand Central Zoning District." This permits the creation of housing and developments around a major transportation hub by using the air rights or transferable development rights (TDR's) from the land under GCT (Weiss 2007:1). This type of high-density development has made GCT an excellent example of a successful intermodal transport terminal and urban TOD being used to its full potential.

Lille-Europe station in France is another excellent example of what a TOD can do to integrate intercity rail, transit, residential, and commercial development in one place. The area consists of two stations (old and new) and is an important crossroads for the European TGV network on the Eurostar Line from the UK and the Thalys network to Brussels, Amsterdam and Cologne (Direct Rail.com 2008). The high-speed railway station opened in 1994 and proceeded parallel with the development of Euralille - a mixed-use development including offices, housing, shops, hotels, restaurants, cafes, and public service institutions – "a diverse concentration of activities with international allure" (Tiry 2001, Burtolini 1995:334).

Within a five minute walk from both stations, Euralille has become a competitive sub-centre where people like to meet and stroll (Tiry 1999:49). The redevelopment of Lille-Europe station has improved connections with local and regional transportation systems and "integrated the node in the place" (Burtolini 1995). In other words, the influx of passenger activity and the development surrounding the stations have resulted in a successful transportation terminal and an archetypical model of TOD.

When discussing PCS within the context of TOD, the study is able to highlight certain aspects of the surrounding area that are TOD supportive and others that need improving. Working towards residential intensification, providing better transit access, and creating a safe and comfortable pedestrian environment are the principle elements that sustain a successful TOD. Another key component is the ability to move passengers with greater efficiency from one mode to the next. In turn, this helps to understand the process of how PCS might be able to strengthen its intermodal connections and build towards becoming a fully functional TOD.

The Future of City Gate North & Pacific Central Station

Today, the City Gate development remains an integral element to the TOD nature of the area. According to Scot Hein, Senior Urban Designer at the City of Vancouver, the most important aspect that is missing from the area is the "critical mass" of people to support a shift from undesirable to desirable (Hein 2008, Personal Communication). There are currently several long-range and short-

range projects underway with the potential to create major improvements to the urban environment and bring a whole new energy to the area. One of these projects is the new Southeast False Creek (SEFC) development shown in Figure 8.

Figure 8: Southeast False Creek Development Boundary (source: City of Vancouver 1999)

Planned as a new standard for 'sustainable' urban living, the SEFC development will border City Gate North and will likely help to revitalize the area. The plan, which places a high priority on the pedestrian, will see fully redesigned areas of the public realm, improved access to the transit, and a priority to deliver the "highest levels of social equity, livability, ecological health and economic

prosperity" (City of Vancouver 1999:9). When complete the SEFC development

is expected to attract over 13,000 new residents (Transport Canada 2005).

Figure 9 highlights the location of adjacent City Gate North (circled in red).

Figure 9: Southeast False Creek (SEFC) and City Gate North (source: City of Vancouver 2002)

A primary objective of the SEFC planning will be to integrate and utilize adjacent

neighbourhoods (City of Vancouver 2007). Aspects of the development that will

directly benefit City Gate North will include new mixed-use commercial and high-

density residential along Quebec Street and Terminal Avenue that will create

"street wall energy" and bring new activity along the Main Street corridor. The

five residential towers that form City Gate, which have been sitting in isolation, will become part of a new residential intensification along Main Street and Terminal Avenue (Hein 2008, Personal Communication).

Designed as a mixed-use development, these new residential towers will also include a fully redesigned public realm. Thor Kuhlmann, Policy Planner at the City of Vancouver, says "more 'eyes on the street' will create a perceived and real sense of safety by attracting people and activity to the street level where the public realm will ensure a very comfortable urban experience" (Kuhlmann 2008, Personal Communication). Creating a more walkable environment will also improve access to transit and support the integration between SEFC and City Gate North.

Pedestrian movement is of key importance to the development of the SEFC. As Lon LaClaire says, "a good walking environment changes everything, people are willing to walk long distances if it is beautiful or enjoyable. The distance between PCS and Main Street Station is not long, it's just not inviting" (LaClaire 2008, Personal Communication). Under the SEFC Public Realm Plan, both Main Street and Terminal Avenue are planned as "primary" city sidewalks and illustrate a high level of pedestrian safety and comfort (City of Vancouver 2006:10). Both aesthetic and functional elements of sidewalk design are included such as concrete unit paving, granite set boulevards, and rain gardens at corner and midblock bulges (City of Vancouver 2006:10). Traffic signals at arterial intersections are to facilitate safe crossing opportunities for pedestrians while

building heights to street ratios are to allow for street-level sunshine (City of Vancouver 2007:29,31). Figures 10 & 11 illustrate the design and streetscaping of primary city sidewalks and what is to be expected along parts of Terminal Avenue and Main Street.

Figures 10 & 11: Primary City Sidewalks (source: City of Vancouver 2006)

The Downtown Transportation Plan designates the area surrounding Main Street Station including PCS as a "transit hub" where transit services will be well integrated and planned to make it easier to choose transit over driving (LaClaire 2008, Personal Communication; City of Vancouver 2005). The SEFC is utilizing a neighbourhood transportation demand management strategy to decrease automobile dependence and encourage the use of the pedestrian, cycling, and transit facilities. Together, these projects include transit-oriented improvements such as an increase number of buses, the development of three new greenways/bikeways, and a proposed streetcar system (Phase 1 to connect Main

Street Station and the new Cambie Station via Quebec Street and 1ˢᵗ Avenue)
(City of Vancouver 2007:29).

Main Street Station is to become part of a bigger 'Civic City Gateway' where
improvements in the public realm will better connect the station via Terminal
Avenue to a new streetcar station on Quebec Street (City of Vancouver 2006:9;
Kuhlmann 2008, Personal Communication). The streetcar is planned to alleviate
much of the increase in non-vehicle trips and will be the "glue" that connects the
other systems (Hein 2008, Personal Communication). A potential extension of
the streetcar route imagines a loop that would run along Station Street and in
front of PCS (Hein 2008, Personal Communication; LaClaire 2008, Personal
Communication; City of Vancouver 2005). This extension would improve the
integration at this hub and make it easier for passengers to get where they are
going. It also has the potential to decrease the number of passengers choosing
taxis as their on-going mode of transportation as the streetcar would become a
convenient alternative. However, the extension is uncertain as cost and
additional travel time reduces its feasibility (LaClaire 2008, Personal
Communication).

The gateways are planned as places of "entry, celebration, and interpretation"
and are meant to welcome residents and visitors while connecting the
surrounding community (City of Vancouver 2006:10). Including PCS as part of
the larger public realm project would be an excellent opportunity to integrate an

area wayfinding system that recognized the importance of an inter-city transportation link with the regional system. Interestingly, communication design firm, Karo Group Inc. has been hired by the City of Vancouver to develop a Wayfinding and Signage Strategy for the city. As part of a city-wide bus shelter program that will provide maps and wayfinding information on backlit sign boxes, 210 freestanding wayfinding sign structures will also be stationed around the city (Karo Group Inc. 2008). Similar in design to those in London, the sign structures will provide both city and neighbourhood information including key points of interest such as transportation hubs. This could provide another good opportunity to improve passenger wayfinding at PCS by positioning a sign structure nearby the station.

Another project set to bring significant changes to the area's accessibility to transit will be the newly redesigned Main Street Station. See Figure 12 (below).

Figure 12: Proposed/Preliminary Design of Main Street Station (source: VIA Architecture 2008).

The station will feature a new eastside elevator and escalators providing easier access to the platform, particularly for those passengers with disabilities or carrying luggage (Kuhlmann 2008, Personal Communication). New ATM's, TVM's (ticket vending machines) and information panels are added to improve ticket purchasing and transfers. Crime Prevention through Environmental Design (CPTED) principles such as proper lighting and station transparency are being considered in the redesign to help activate the corner of Main Street and Terminal Avenue and ensure walking through Thornton Park will become safer and a more desirable option for people (Hein 2008, Personal Communication). Trees will also be planted along Terminal Avenue adjacent to the southeast

station entrance. Based on the architectural plans and drawings obtained from TransLink, the redeveloped station will likely provide much better access and comfort for all passengers including those coming from PCS.

Planning and development on many of these projects still remains market dependant and it is doubtful that much improvement will occur in the short term (i.e. pre-Olympics) (Hein 2008, Personal Communication; Kuhlmann 2008, Personal Communication). Within the next five years, however, perception of the area might begin to change as a larger number of people will likely begin using the area for various reasons (shopping, transit, exercise etc.) (Kuhlmann 2008, Personal Communication).

Good development potential exists north of PCS where currently there are plans for a new medical district (Hein 2008, Personal Communication). Developing this area would attract a whole new population and bring with it further improvements to the public realm with new street networks and connections between Strathcona and Thornton Park (LaClaire 2008, Personal Communication). Future development south of the station will likely see the expansion of the Great Northern Way Campus including new commercial, residential, and an estimated 4,000 new students by 2020 (Cherewayko 2008; UBC Reports 2005). Acting as the area's hub, City Gate North would see a whole new level of transit and pedestrian activity from these long-range planning developments. This would signal to investors a high return on investment for the area, keeping it healthy

and sustainable for the long-term (Hein 2008, Personal Communication).

The SEFC development promises a whole new level of urban living and will bring significant changes to its adjacent areas. According to the planning reports and interviews with City staff, City Gate North will experience considerable spill off effects from SEFC. The problems currently facing City Gate North (namely a lack of residential density and a vibrant street life) will be considerably improved if not eradicated in the next five to ten years (Kuhlmann 2008, Personal Communication). In particular, the redesign of the public realm will create a higher level of accessibility, safety, and walkability for the area.

To a certain degree, New Urbanist thinking has proven to be an influence in the design of SEFC. Similarities can be found in their approaches to planning and the design and development of new and old neighbourhoods. New Urbanism promotes building density and making transit accessible, it also encourages pedestrian-friendly environments through the creation of attractive public spaces. SEFC utilizes the same principles to guide their own development and planning. And although the City's approach to planning tends to think in terms of "best practices" and not strictly theory based principles, the goals of place making and building identity are still the same (Hein 2008, Personal Communication).

Consequently, a newly redesigned public realm has the potential to create a more functional transportation hub. The distance between PCS and Main Street

Station, for example, can become an enjoyable walk and a simple transfer when design considers the safety and comfort of the pedestrian. When placed in the context of high-density residential and upgraded transit infrastructure, redesigning the public realm is essentially icing on the cake. This combination could act as a powerful magnet with the capability of transforming City Gate North into a quality urban environment.

CONCLUSION

By investigating and observing passenger activity from Amtrak train 510

Cascades, this study was able to reveal some interesting findings about

intermodal design at PCS. Preliminary observations revealed a wayfinding issue

in the station, and further observations were conducted that focussed on the

patterns of target passengers (i.e. those who fell into the categories of *decision*

making or information processing). These target passengers were then given a

survey questionnaire with the intention of revealing elements of PCS and the

transit interface needing improvement. Consequently, the observations and the

survey interview revealed similar findings in that the majority of passengers

experienced little or no trouble wayfinding inside or outside the station. The

problem arose for passengers (approximately 20 percent) who experienced a

certain level of difficulty navigating inside and outside the station and trouble

choosing on-going transportation.

Based on the study's findings, two recommendations for improving passenger

travel experience in PCS are proposed. First, passengers would benefit greatly

with the ability to interact with a trained travel advisor. According to Correa de

Jesus (1994:50) "wayfinding design at its best should make our collective and

individual experiences with the built world also an opportunity for communication

and human interaction." In the case of PCS, passengers should have access to

a human source of information throughout the year. VIA Rail provides this service during the summer when ridership is at its highest (May, June, July, August), but currently there is no human source of information during the other eight months of the year (personal communication, Henn 2008, WSDOT 2008).

Arthur & Passini (1992:210) state, "most of us would prefer being told where to go rather than having to figure it out from a directory, a sign, or even a map." Speech is actually the preferred medium for most people to receive certain types of information, namely to provide directions to destinations (Arthur & Passini 1992). Providing an information booth in the lobby of PCS during key times of the day, particularly for the arrival of international trains and buses, would likely alleviate passenger confusion and quicken transfer times.

Passengers want smooth and easy transitions from one mode to the next, particularly when taking public transit; an information booth inside the station would likely increase the chance of passengers being well informed about transportation options. Thus, providing a human source of information has two benefits: First, it provides a needed source of information and a first contact for passengers, and second, it has the potential to increase awareness and use of the public transit system. An inherently usable transit interface involving smooth connections onto public transit is also a key element of any TOD.

It is important, however, that this information does not come from security guards or staff as they are insufficiently trained to provide quality information. Only a trained travel advisor who is knowledgeable about Vancouver and the local transit system should be providing the information. Advisors would also take into account and be sensitive to visitors that may have articulation, hearing, seeing or understanding problems (Arthur & Passini 1992: 211).

However, a trained travel advisor is not the panacea to the wayfinding issue at PCS. In all likelihood train service will be increasing in the future, and providing a travel advisor in conjunction with better station signage, in-trip and on-board planning, and web travel information would be a more effective wayfinding approach.

Secondly, it recommended that maps and signage be redesigned inside the station and that a new sign be placed outside as well. Within transport terminals, signage 'cools down' the anxiety of unfamiliar terrains and replaces it with a familiar authority (Fuller 2002). What the majority of respondents seemed to suggest was to remove the 'guessing factor' from signs. 'Good' transportation signage can be seen in the design, content, and placement of signs and symbols that critically affect the passenger's ability to use a transit system successfully (TCRP Report 12 1996). A visitor unfamiliar with Vancouver and PCS could easily be misled and misinformed by the ambiguous nature of information inside the station.

The map that is currently placed within the station is poorly located, far too small, and lacks important wayfinding information. Map orientation is the most important aspect of designing a useful map and is best understood when properly aligned in a 'heads up orientation' and viewers are facing what is directly ahead of them (Arthur & Passini 1992; AIG 2006; Calori 2007). In general, an axonometric map (60 degree oblique view) is preferred by most people because it is regarded as more realistic and tends to be easier to understand (Arthur & Passini 1992). It is also helpful to have a prominent graphic ("You-Are-Here") indicating where the viewer's location is on the map (Calori 2007:123). As a rule of thumb, the cap-height of the smallest letters on a wayfinding map should be a minimum of 10 to 15 mm – letters on the map inside PCS are only 3 mm (Arthur & Passini 1992:189).

Providing walking distances and times to certain landmarks or points of interest (i.e. Main Street Station, Science World, ChinaTown) is also an effective way to encourage people to walk (Arthur & Passini 1992:188; AIG 2006:32). Research in spatial cognition shows that people use landmarks during spatial reasoning and communication of routes and that route directions enriched by local landmarks are easier to understand than the ones, which are only directions and distance based (Raubal & Winter 2002:243,246). Providing a legible and user-friendly map inside PCS that highlights certain landmarks and destinations would be extremely helpful for most passengers. It would likely alleviate passenger

disorientation and increase the likelihood of passengers walking or taking public transit to their destinations.

As a vital component to the wayfinding process, the map within PCS must lead passengers with confidence to the next stage of their chosen route. Once exiting the station it is important that passengers are reassured of route choice and that they are headed in the right direction. Currently, PCS does not provide this sort of assurance as a number of passengers were equally or more confused once exiting the station than inside. Therefore, the situation requires that signage be placed strategically outside the station as to support the 'bread and crumb' trail of information and ensure that passengers remain on the right path (Calori 2007).

Apart from the "taxis only" sign, there is no signage that would help passengers find on-going transportation once outside PCS. Here, there is a desperate need for a signage system that should inform and guide passengers to their chosen destination and/or mode of transportation. More importantly, it should aid people in finding their way from one point to another with an added sense of confidence.

Therefore, one of the major recommendations for wayfinding improvements at PCS would be to implement an external signage system. As a first step, and based upon the observations conducted and survey respondent's suggestions, it is recommended that a directional sign be implemented outside the station with the purpose of increasing passenger awareness of *all* the transportation options

and provide information on various landmarks and points of interest within and beyond the surrounding area. In general, directional signs are able to act as a type of 'homing beacon' that very clearly indicates the proximity and directions to major destinations (AIG 2006). They are a reliable point of information and are helpful in lessening the ambiguity and conflict of wayfinding in an unfamiliar environment (Arthur & Passini 1992:184). Figure 13 is an example of the type of sign that would improve passenger wayfinding. It provides directional and cost information about public transportation and also doubles as a 'points of interest' sign, highlighting particular destinations that are within walking distance.

Figure 13: Directional Sign (source: Mike Smith 2008)

The location of this sign is of critical importance as it must "provide the right information at the right time" (Arthur & Passini 1992:198). If VIA Rail would not allow this type of sign on their property, the study suggests placing it across the street at the entrance to the park where it would fall under the city's jurisdiction (see Figure 14).

Figure 14: Sign Location (source: Mike Smith 2008).

The above photograph shows the view for passengers once exiting the station. Placing a directional sign similar to the one in Figure 13 in the middle of the circular garden across the street would be optimal for alleviating passenger disorientation outside PCS. The sign placement is ideal because it would act as

a landmark and likely draw people towards the space. Studies show that landmarks are selected for route directions preferably at decision points and lead to better guidance, or less wayfinding errors than routes without landmarks (Raubal & Winter 2002:245). The literature also supports signs that are in sight lines, at crossings and along paths, three qualities of the sign placement in Figure 14 (Arthur & Passini 1992; Calori 2007). Most importantly the placement of the directional sign has the potential to draw passengers away from the entrance of the station where the taxi zone is located.

A trained travel advisor and better maps and signage are simply two pieces of the larger wayfinding system that need to be implemented at PCS. Each stage of the trip, from the moment passengers arrive in the station until they reach their destination, should be seamless and easy to navigate. As Calori (2007:83) suggests, keeping "a consistent sign message vocabulary is key to maintaining the bread-crumb trail of information." Much like the piecemeal approach or 'bite size' installments that characterize Legible London, ensuring confidence in wayfinder's ability to walk to their destination is the most importance objective. In turn, a pedestrian-friendly environment will help get people out of vehicles and using alternative modes of transportation.

In the future, PCS would benefit from working with other city and transportation agencies in designing a city-wide and regional wayfinding system. It would be prudent to consider implementing such a system as part of the larger public

realm improvements that City Gate North will experience from the SEFC development. In doing so, a more legible and unified system that is consistent and user-friendly could emerge, one that would benefit all transportation users, whether they are long-time transit riders or visitors using the system for the first time. Being able to 'get around' easily and efficiently is an important initiative for any wayfinding project and sustainable transportation system.

Further Research

This study was able to reveal certain intermodal and design aspects of PCS that could be developed to create a more efficient transit interface. Wayfinding issues such as better signage and a human source of information were found to be the two most important areas for improvement. However, this study was limited to investigating station intermodal design during the off-peak months of the year (January, February, March and April). A similar study conducted during the summer months when rail ridership and passenger activity at PCS is at its highest (WSDOT 2008) would likely support and strengthen the findings of this project.

As VIA operates an information booth during these busy months, the study could then investigate the effectiveness of a human source of information in respect to passenger choice of on-going transportation. Some key questions in this case would be: Does an information booth increase the use of public transit among passengers at PCS? What type of information in regards to on-going transportation are passengers receiving? Are public transit options

recommended or encouraged? How many people make use of this facility and how many are still seeking information independently?

Wayfiinding technologies such as talking signs, amplifiable public handsets, and cell phone interactivity (i.e. Bluetooth and GPS) are emerging as an improved medium for wayfiinding communication, namely for those with disabilities (Karo Group Inc. 2008; AIG 2006). The City of Vancouver's Wayfinding initiative is currently considering these technologies as part of a city-wide wayfinding system. Further research could explore how these types of technologies might be integrated within the city's major transportation stations and as part of the larger transportation system.

Currently, more than 80 percent of all rail passengers exiting PCS are choosing private vehicles as their on-going mode of transportation. Working towards a balance requires a "great reversal" and a shift in our thinking towards more sustainable means of transportation. If current trends persist and rail passenger activity continues to increase, PCS must become a more efficient people mover. Improved intermodal station design (i.e. wayfinding and access to information) has the potential to strengthen existing modal connections and, in particular, increase the likelihood of public transit use. This is essential for PCS evolving as a major intermodal transport terminal, becoming part of a successful TOD, and exemplifying a model of sustainable transportation for the future.

APPENDIX A

Survey Questionnaire for passengers arriving on Amtrak Train 510 "Cascades" from Seattle. This version of the survey provides all answers, comments and suggestions given by respondents during the survey interview.

1. Where do you live?

Table 2: Place of Residency

Location	# of responses	percent
Washington	13	43%
United States (other than Washington)	6	20%
Overseas	6	20%
Vancouver	3	10%
Canada (other than BC)	2	7%

(i) Where did your trip originate?

Table 3: Origin of Train Trip

Location	# of responses	percent
Seattle	14	46%
Washington (other than Seattle)	16	53%

2. *How did you get to the boarding station to start your train trip?*

Table 4: Modes of Transportation

Mode	# of responses	percent
Car (drop off or park)	15	50%
Public bus	10	33%
Taxi	4	13%
Walk	1	3%

3. *Is this your first time to Vancouver? Y or N*

Yes	13 responses	43%
No	17 responses	57%

i) To the station? Y or N

Yes	17 responses	57%
No	13 responses	43%

ii) No? How many times have you been through the station in the last 24 months?
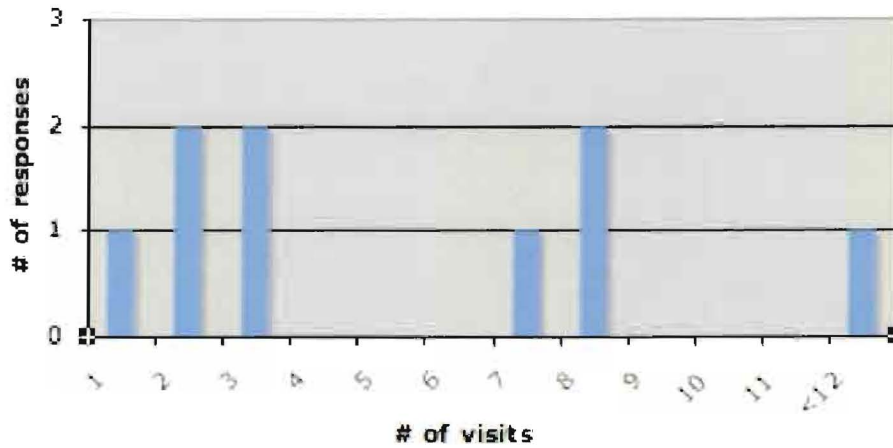
Figure 15: Station Visits

Note: there was an outlier of 24 that made this answer considerably higher and possibly not reflective of the true value.

4. Where are you going today?

Answers to this question were grouped into four:

Table 5: Destinations from PCS

Destination	# of responses	percent
Downtown	22	73%
Other parts of Metro Vancouver	6	20%
Other parts of BC	1	3%
Unsure	1	3%

5. How are you planning on getting there?

Table 6: Mode of Transportation to Destination

Mode	# of responses	percent
SkyTrain	16	53%
Public Bus	7	23%
Walk	5	17%
Getting a ride	2	7%

6. *What made you decide to choose that option?*

Table 7: Reasons Behind Transportation Choice

Reason	# of responses	percent
Convenient	12	31%
Affordable	7	18%
Interviewer informed them	5	13%
Fast	4	10%
Had no car	4	10%
Word of mouth	3	8%
Efficient	1	3%
Eco-friendly	1	3%

Further comments included that driving a car in the city would be a hassle and that for students, public transportation is the most affordable choice.

7. *When did you decide to choose that option? Before, on, or after the train ride?*

Before train	20 responses	67 percent
On train	5 responses	17 percent
After train	5 responses	17 percent

Additional comments were:

- Very confused after exiting the station, on-board announcement was not clear.
- Planned ahead from experience.
- Had no plans until they were able to ask questions during the interview survey.
- Acquired SkyTrain information from on-line source.

8. *Have you had any difficulty navigating (finding your way) in the station? Y or N*

Yes   4 responses   13 percent

No   26 responses   87 percent

(i) If Yes, ask for details:

Additional comments from respondents who answered Yes to having difficulty

wayfinding in the station were:

- Station not labelled well
- Needed human source of information (i.e. tourist information booth).
- Did not see a map at all
- Needed area information
- No information about city
- Did not have trouble herself but noticed a lot of people who did
- Needed tourist information

    i)   *On a scale of 1 to 7 (1=very difficult, 4=average, 7=very easy) how would you rate navigation (i.e. finding your way) in the station?*

       1   *2*   *3*   *4*   *5*   *6*   *7*

Station Wayfinding
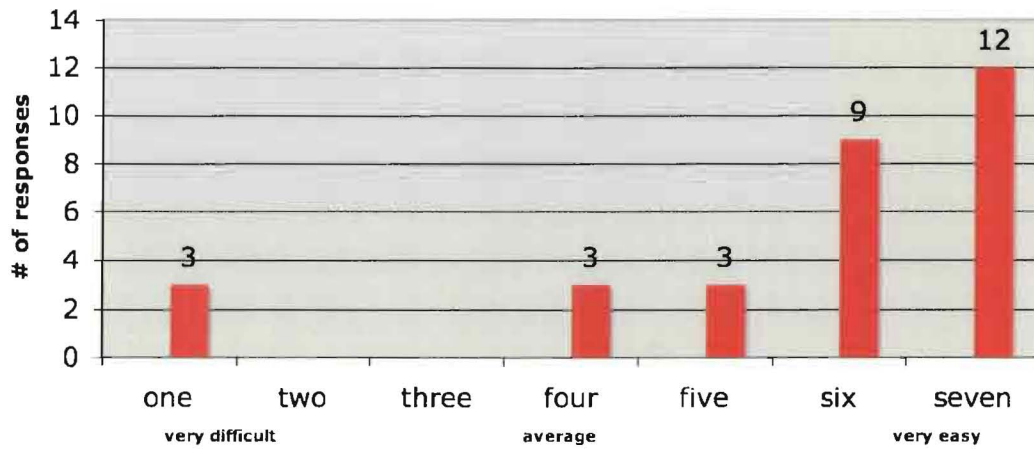
Figure 16: PCS Wayfinding

9. *Are you aware of the public transit options? (Sky Train, buses)? Y or N*

Yes	23 responses	77 percent
No	0 responses	0 percent
Unsure	7 responses	23 percent

i) If Yes, when and how did you become of aware of them?

Table 8: Public Transit Awareness

Public transit awareness	# of responses	percent
From experience	16	44%
Onboard Amtrak Train 510	9	25%
In station	4	11%
Online	4	11%
Outside station	2	6%
Word of mouth	1	3%

Additional comments made by respondents were:

- Station signage wasn't clear
- Poor directions (outside the station)
- No cost information about public transit
- Confused once they got outside
- Acquired transit information from Google maps
- Acquired transit information from TransLink website
- On-train information was very understandable, where to buy tickets etc...
- No help from signs

10. *Did you find information to be accessible in this station? Y or N EXPLAIN*

Yes	18 responses	60 percent
No	6 responses	20 percent
No answer	6 responses	20 percent

When asked to explain their answer, many respondents commented on how there were no accessible maps and thought that handheld maps should have been easier to find. Others found there to be a lack of information on other modes of transportation. Additional comments were:

- Wayfinding difficult
- Needed to ask a person for information and directions
- Did not need to use wayfinding devices, very easy to find way
- Wanted information about other trains and transportation within Pacific Central Station
- Acquired information from currency exchange

i) *On a scale of 1 to 7 (1=very inaccessible, 4=average, 7=very accessible) how would you rate the accessibility of information in the station?*

1   2   3   4   5   6   7

Station Access to Information
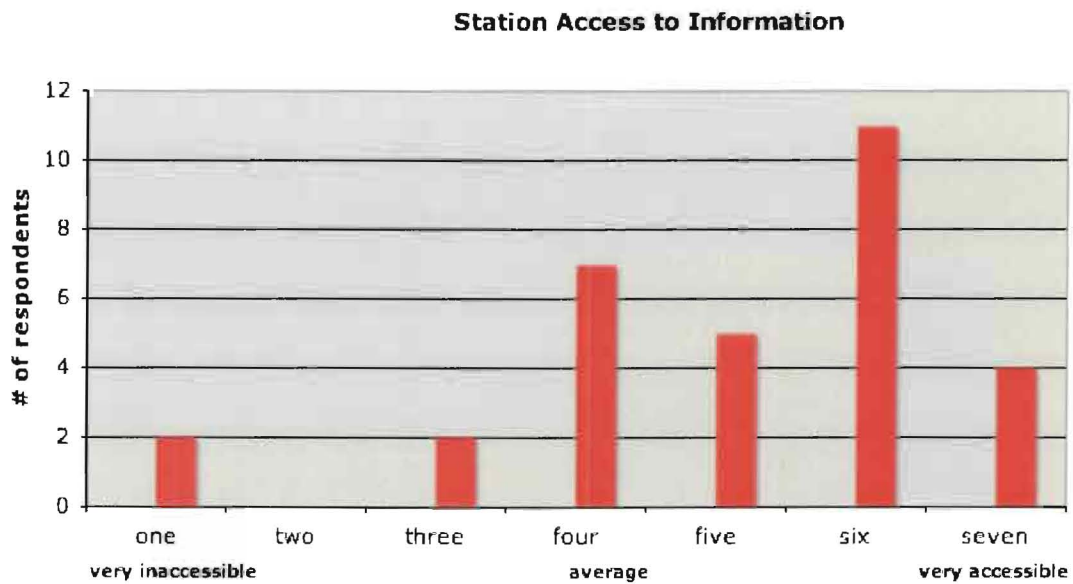
Figure 17: PCS Access to Information

11. *Do you know how much it costs to get where you're going? Y or N*

Yes	11 responses	37 percent
No	17 responses	57 percent
Unsure	2 responses	7 percent

i) By Taxi or public transit? (ask for an estimate)

Estimates for public transit averaged to be $2.30 while estimates for the same trips by taxi averaged to be $18. The average estimate for a taxi downtown was $12.40.

12. Do you know how to pay for the trip? Y or N

Yes	16 responses	53 percent
No	7 responses	23 percent
Unsure 7 responses		23 percent

i) Are you using cash or credit cards? US dollars or Cdn dollars?

Table 9: Type & Currency of Payment

Form of Payment	# of responses	percent
Cash	14	26%
Credit	7	13%
$US	11	21%
$CDN	14	26%
Transit Pass	4	8%
No Answer	3	6%

Note: More than one answer could be given for this response.

13. Do you have any suggestion on what would have made your travel experience easier or smoother in Pacific Central Station? Inside or outside the station?

Seven respondents had no suggestion or comments to this question, but those who did had the following to say. Below is the full list of comments/suggestions respondents gave to the question.

- More brochures, maps, info on Vancouver
- An easily found web site for transportation alternatives
- Ferry information
- Enclosed warm area during while going through customs
- Better signage
- Better restaurants – something other than McDonalds
- Transit cost information
- Easier to follow directional signs
- Better City wayfinding
- Signage outside the station
- Maps of City (with a YOU ARE HERE orientation point)
- Locations of public transit and where it goes (Public Transit Map)
- Public transit zone information and bus routes

14. Do you have anything else to add? Final comments/suggestions on any aspect of what we've been discussing so far?

- Responses to this question were as follows:
- More seating inside
- Water fountain
- Information about tourist destination/activities/attractions
- New building paint
- Impressed with Vancouver public transit
- More transit information and how to use it
- More signs – too ambiguous
- 5 minute walking distance map – highlighting important locations
- baggage lockers and whereabouts
- An accessible human source of information

APPENDIX B

Survey Questionnaire

510 to Vancouver: Investigating Interconnectivity and Station Design in Pacific Central Station
by: Mike Smith

SURVEY – for passengers arriving on Train 510 "Cascades" from Seattle. Conducted just outside the Pacific Central Station on public space.

1. Where do you live? Where did your trip originate?

2. How did you get to the boarding station to start your train trip?

3. Is this your first time to Vancouver? Y or N

    i) To the station? Y or N

    ii) No? How many times have you been through the station in the last 24 months?

4. Where are you going today?

5. How are you planning on getting there?

6. What made you decide to choose that option?

7. When did you decide to choose that option? Before, on, or after the train ride?

8. Have you had any difficulty navigating (finding your way) in the station? Y or N

If Yes, ask for details:

i)   On a scale of 1 to 7 (1=very difficult, 4=average, 7=very easy) how would you rate navigation (i.e. finding your way) in the station?

1   2   3   4   5   6   7

9. Are you aware of the public transit options? (SkyTrain, buses)? Y or N

i) If Yes, when and how did you become of aware of them?

10. Did you find information to be accessible in this station? Y or N
    EXPLAIN

      i)   On a scale of 1 to 7 (1=very inaccessible, 4=average,
                7=very accessible) how would you rate the accessibility
                of information in the station?

    1   2   3   4   5   6   7

11. Do you know how much it costs to get where you're going? Y or N

    i) By Taxi or public transit? (ask for an estimate)

12. Do you know how to pay for the trip? Y or N

    i) Are you using cash or credit cards? US dollars or Cdn dollars?

13. Do you have any suggestion on what would have made your travel experience easier or smoother in Pacific Central Station? Inside or outside the station?

14. Do you have anything else to add? Final comments/suggestions on any aspect of what we've been discussing so far?

THANK YOU! AWARD FREE TRANSIT PASS

BIBLIOGRAPHY

Applied Information Group. (2006). *Legible London: A wayfinding study*. London: City of London.

Adachi, R S. (n.d.). *The Vancouver rapid transit system: Design management, rapid transit project*. Vancouver, BC: Fenco Lavalin Corp.

Alt, R, Forster, P W and King J L. (1997). *The great reversal: Information and transportation infrastructure in the intermodal vision*. Irvine, California: Center for Research on Information Technology and Organizations, University of California at Irvine.

Arthur, P and Passini, R. (1992). *Wayfinding: People, signs, and architecture*. Whitby, Ontario: McGraw-Hill Ryerson Limited.

Babbie, E and Benaquisto, L. (2002). *Fundamentals of social research: First Canadian edition*. Scarborough, Ontario: Thomson Nelson.

Beaty-Pownall, P. (2007). Re-thinking station design. *Rail Professional*, (123), 20.

BC Provincial Government. (2008, January 14). *Transit plan to help B.C. reach greenhouse gas targets* (News Release). Retrieved October 31, 2008, from http://www2.news.gov.bc.ca/news_releases_2005-2009/2008OTP0003-000020.htm

BC Transit. (1989). *SkyTrain: A catalyst for development*. Burnaby, BC: BC Transit.

BC Transit. (1985). *Vancouver regional rapid transit project quarterly report #8*. Burnaby, BC: BC Transit.

Bernick, M and Cervero, R. (1997). *Transit villages in the 21st century*. San Francisco, California: McGraw-Hill.

Bertolini, L. (1996). Nodes and places: Complexities of railway station redevelopment. *European Planning Studies*, 4(3).

Bohi, C. (1977). *Canadian National's western depots: The country stations in western Canada*. Don Mills, Ontario: Railfare Enterprises Limited.

Broadhurst, J V. (2004). From highways to skyways and seaways: The intermodal challenge. *Public Roads, 68*(1). Retrieved May 10, 2008, from http://www.tfhrc.gov/pubrds/04jul/05.htm

California Department of Transportation. (2002). *Statewide transit-oriented development study: Factors for success in California.* Sacramento, California: Business, Transportation and Housing Agency.

Calori, C. (2007). *Signage and wayfinding design.* Hoboken, New Jersey: John Wiley & Sons Inc.

Calthorpe, P. (1993). *The next American metropolis: Ecology, community, and the American dream.* New York, New York: Princeton Architectural Press.

Canadian Urban Transit Association. (1992). *Modal shift to transit study* (Final Report). Toronto, Ontario: Canadian Urban Transit Association.

Carmona, M, Heath, T, Oc, T and Tiesdell, S. (2003). *Public places urban spaces: The dimensions of urban design.* Burlington, MA: Architectural Press.

Carpman, R J and Grant, M A. (2002). Wayfinding: A broad view. In Bechtel, B R and Churchman, A (Eds.), *Handbook of environmental psychology* (pp. 427-442). New York: John Wiley & Sons Inc.

CBC News.ca. (2008, February 20). *BC budget hikes fuel costs with new carbon tax.* Retrieved June 7, 2008, from http://www.cbc.ca/canada/british-columbia/story/2008/02/19/bc-provincial-budget.html

Cervero, R and Duncan, M. (2001). *Transit's value-added: Effects of light and commuter rail services on commercial land values.* Washington, DC: National Research Council.

City of London. (2007). *An overview of legible London.* Retrieved September 3, 2008, from www.legiblelondon.info/wp01/?p=54

City of Vancouver. (2005). *Downtown transportation plan* (Summary Report). Vancouver, BC: City of Vancouver.

City of Vancouver. (2006). *Transportation plan progress report* (Progress Report). Vancouver, BC: City of Vancouver.

City of Vancouver. (1984). *East False Creek: Impact assessment.* Vancouver, BC: City of Vancouver.

City of Vancouver. (1984). *East False Creek: Policy plan*. Vancouver, BC: City of Vancouver.

City of Vancouver Planning Department. (1987). *Joyce station area plan*. Vancouver, BC: City of Vancouver.

City of Vancouver. (1983). *Planning for the community & rapid transit: An overall planning context for ALRT development* (Summary and Full Report). Vancouver, BC: City of Vancouver.

Congress for the New Urbanism. (November 2007). *Charter of the new urbanism*. Retrieved November 13, 2007, from http://www.cnu.org/charter

Correa de Jesus, S. (1994). Environmental communication: Design planning for wayfinding. *Design Issues, 10*(3), 33.

Council of Tourism Associations of British Columbia. (2007). All aboard: Passenger rail in British Columbia. *BC Tourism Review, 2*(1).

Demetsky, M J, Hoel, L A and Virkler, M R. (1976). *Methodology for the design of urban transportation interface facilities* (Final Technical Report). Springfield, Virginia: National Technical Information Service.

Desautels, A T. (2004). *Improving the transfer experience at intermodal transit station through innovative dispatch strategies* (Masters). Boston MA: Massachusetts Institute of Technology.

Direct Rail.com. (2008). *Eurostar Lille station*. Retrieved June 7, 2008, from http://www.directrail.com/eurostar_lille.html

Dittmar, H and Ohland, G. (2004). *The new transit town - Best practices in transit-oriented development*. Washington, DC: Island Press.

Downs, A. (2001). What does "smart growth" really mean? *Foresight, 8*(2).

Duany, A and Plater-Zyberk, E. (2007). *DPZ*. Retrieved February 26, 2008, from http://www.dpz.com/

Dutton, J A. (2000). *New American urbanism - Re-forming the suburban metropolis*. Milano, Torino: Skira Editore.

Fuller, G. (2002). The arrow - directional semiotics: Wayfinding in transit. *Social Semiotics, 12*(3), 231.

Gateway Program. (2006). *Program definition report*. Victoria, BC: British Columbia Ministry of Transportation.

Geehan, T. (1996). *Improving transportation information: Design guidelines for making travel more accessible*. North Vancouver, BC: Transvision Consultants.

Geehan, T, Rutenberg, U, McCannell, B and Arnold, A K. (1997). *A plan for implementing accessible wayfinding techniques in an airport terminal* (Final No. 8469). Montreal, Quebec: Transport Canada.

Gilbert, R and Perl, A. (2008). *Transport revolutions: Moving people and freight without oil*. London, United Kingdom: Earthscan.

Goetz, A R and Rodrigue, J P. (1999). Transport terminals: New perspectives. *Journal of Transport Geography*, *7*, 255.

Golledge, G R. (1992). Place recognition and wayfinding: Making sense of space. *Geoform*, *23*(2), 199-214.

Graham, W D, Cassady, R C, Bowden Jr, R O and LeMay, S A. (2000). Modeling intermodal transportation systems: Establishing a common language. *Transportation Law Journal*, *34*.

Greater Vancouver Regional District. (1979). *Rapid transit project: Rapid transit preliminary design report* No. 2. Vancouver, BC: Greater Vancouver Regional District.

Greene, D L and Wegener, M. (1997). Sustainable transport. *Journal of Transport Geography*, *5*(3), 177-190.

Handman, A L. (2002). Intermodalism - A solution for highway congestion at the millenium? *The Review of Policy Research*, *19*(2), 51. Retrieved January 11, 2008, from http://www.blackwell-synergy.com/doi/abs/10.1111/j.1541-1338.2002.tb00264.

Heye, C and Timpf, S. (2003). *Factors influencing the physical complexity of routes in public transportation networks*. Paper presented at the 10th International Conference on Travel Behaviour Research, Lucerne, Switzerland.

Jones, C and Rowat, B. (2003). A case for investment in rail and intermodal transport. *Policy Options*, 45.

Jones, J, Fu, H and Boon C J. (1992). *Modal integration in passenger transportation: A discussion of key issues* (No. 91-9). Kingston, Ontario: Canadian Institute of Guided Ground Transport.

Jones, W. (2006). *New transport architecture*. London, United Kingdom: Octopus Publishing Group Ltd.

Kandee, S. (n.d.). *Intermodal concept in railway station design* (Unpublished Manuscript). Retrieved January 14, 2008 from http://www.bu.ac.th/knowledgecenter/epaper/jan_june2004/somruedee.pdf.

Karo Group Inc. (2008). *City of Vancouver wayfinding and signage strategy - Design development*. Vancouver, BC: Karo Group Inc.

KRW Inc. (1996). *TCRP report 12: Guidelines for transit facility signing and graphics*. Washington, DC: National Academy Press.

Kuhlmann, T. (2008). *Policy report development and building*. Vancouver, BC: City of Vancouver.

Larice, M and Macdonald, E. (Eds.). (2007). *The urban design reader*. Abingdon, United Kingdom: Routledge.

Leven, D. (2006). *Which way is up? Towards accessible wayfinding in transit stations* (Master of Science in Transportation and City Planning). Boston, MA: Massachusetts Institute of Technology.

Lewis, C A and Owens, E. (2002). *ISTEA and intermodalism: A user reference guide to intermodalism* (No. SWUTC/02/466050-1). Austin, Texas: Southwest Region University Transportation Center.

Litman, T. (2007a). *Community livability: Helping to create attractive, safe, cohesive communities*. Retrieved March 24, 2008 from http://www.vtpi.org/tdm/tdm97.htm

Litman, T. (2007b). *New urbanism: Clustered, mixed-use, multi-modal neighborhood design*. Retrieved March 25, 2008, from http://www.vtpi.org/tdm/tdm24.htm

Litman, T. (2006). *Transport management demand encyclopedia*. Retrieved November 13, 2006, from http://www.vtpi.org/tdm/index.php

Litman, T. (2003). Measuring transportation: Traffic, mobility and accessibility. *Institute of Transport Engineers, 73*(10).

Liu, R, Pendyala, R M and Polzin, S. (1997). Assessment of intermodal transfer penalties using stated preference data. *Transportation Research Record, 1607*, 74-80.

Lynch, K. (1960). *The image of the city*. Cambridge, MA: MIT Press.

Metropolitan Transportation Authority. (2008). *Metro-north railroad annual ridership*. Retrieved May 12, 2008, from http://www.mta.info/mta/ind-perform/annual/mnr-ridership.htm

Miller, M and Loukakos, D. (2001). *Assessing opportunities for intelligent transportation systems in California's passenger intermodal operations and services*. Richmond, California: California Partners for Advanced Transit and Highways.

Miller, M and Tsao, C. (1999). *Assessing opportunities for intelligent transportation systems in California's intermodal operations and services - Review of literature*. Richmond, California: California Partners for Advanced Transit and Highways.

Mitchell, C and Miller, M. (2000). *A field survey of site visits to passenger intermodal transfer facilities in California*. Richmond, California: California Partners for Advanced Transit and Highways.

Modak, S K and Patkar, V N. (1984). Transport terminal design and passenger orientation. *Transport Planning and Technology*, 9(2).

National Commission on Intermodal Transportation. (1994). *Toward a national intermodal transportation system* (Final Report). Alexandria, Virginia: National Commission on Intermodal Transportation.

Nelson, D, Niles, J and Hibshoosh, A. (2001). *A new planning template for transit-oriented development*. San Jose, California: Mineta Transport Institute, College of Business.

New Urbanism.org. (2007). *New urbanism*. Retrieved February 26, 2008, from http://www.newurbanism.org/

Newman, P and Kenworthy, J. (1999). *Sustainability and cities*. Washington, DC: Island Press.

Passini, R. (1984). Spatial representations: A wayfinding perspective. *Journal of Environmental Psychology*, *4*, 153-164.

Porter, D. (2002). *Making smart growth work*. Washington DC: Urban Land Institute.

Project for Public Spaces. (2006). *Jan Gehl*. Retrieved February 20, 2007, from http://www.pps.org/info/placemakingtools/placemakers/jgehl

Raubal, M and Egenhofer, M. (1998). Comparing the complexity of wayfinding tasks in built environments. *Environment & Planning*, *25*(6), 895.

Raubal, M and Winter, S. (2002). Enriching wayfinding instructions with local landmarks. In Egenhofer, M J and Mark, D M (Eds.), *GIScience*, 243-259.

Real Estate Weekly. (1996). *Grand Central renovation project begins.* New York, New York. Retrieved May 11, 2008, from http://findarticles.com/p/articles/mi_m3601/is_n33_v42/ai_18335580

Renne, J L and Wells, J S. (2005). *Research results digest 294 - Transit-oriented development: Developing a strategy to measure success.* Rutgers University, New Brunswick, New Jersey: National Cooperative Highway Research Program.

Research and Innovative and Technology Administration. (2008). *Amtrak ridership: Number of passengers - monthly data.* Retrieved April 24, 2008, from http://www.bts.gov/publications/white_house_economic_statistics_briefing_room/october_2005/html/rail_amtrak_ridership.html

Ruetschi, U J and Timpf, S. (2004). Schematic geometry of public transport spaces for wayfinding. *Geoinformation und Mobilität,* 191-203.

Shapiro, P S. (1997). *Intermodal ground access to airports: A planning guide - A good start.* Paper presented at the Sixth TRB Conference on the Application of Transportation Planning Methods, Dearborn, Michigan.

Sherry, P. (2006). *Intermodalism: The transportation imperative for the 21st century.* Congressional testimony delivered to the House Committee on Transportation and Infrastructure, Intermodal Transportation Institute, University of Denver, Denver, Colorado.

State of California: Office of the Governor. (2008). *Gov. Schwarzenegger issues directive to establish world's first low carbon standard for transportation fuels.* Retrieved June 7, 2008, from http://gov.ca.gov/index.php?/press-release/5074/

Statistics Canada. (2007). *Rail in Canada 2005.* Retrieved January 22, 2008, from http://www.statcan.ca/english/freepub/52-216-XIE/2005000/part1.htm

Statistics Canada. (2008). *Rail in Canada 2006.* Retrieved January 22, 2008, from http://www.statcan.ca/english/freepub/52-216-XIE/2006000/part1.htm

Statistics Canada. (2008). *Railway carriers: Operating statistics.* Retrieved April 30, 2008, from http://www40.statcan.ca/l01/cst01/trad46a.htm

Stern, J. (2008). *Grand Central, grand plan: Metro-north commuter railroad plans renovation of New York's Grand Central Terminal.* Retrieved May 11, 2008, from http://findarticles.com/p/articles/mi_m1215/is_n6_v191/ai_9154717

Stump, R L. (2000). *Intermodal personalized transit: An exploratory study to identify secondary market and technology resources for concept testing*. Baltimore, MD: National Transport Centre.

Szyliowicz, J S. (2000). *Intermodalism: The challenge and the promise. Transportation Law Journal. 27*, 299.

Szyliowicz, J S. (2003). Decision-making, intermodal transportation, and sustainable mobility: Towards a new paradigm. *International Social Science Journal, 55*(2), 185-197.

Tait, R D. (1997). *A conceptual analysis and evaluation for the Harrisburg International Airport as an intermodal and multimodal facility*. Springfield, VA: National Technical Information Service.

Timpf, S. (2002). Ontologies of wayfinding: A traveler's perspective. *Networks and Spatial Economics, 2*(1), 9-33.

Timpf, S. (2002). *A collage metaphor to support inter-modal wayfinding*. Department of Geography, University of Zurich. Retrieved January 14, 2008, from http://e-collection.ethbib.ethz.ch/view/eth:25485

Tiry, C. (1999). From Lille Flanders to Lille Europe: The evolution of a railway station. *Japan Railway and Transport Review, 20*, 44-49.

Tiry, C. (2001). Stations help define urban image: Kyoto and Lille Europe. *Japan Railway and Transport Review, 28*, 18-21.

TransLink. (2008). *Northwest route decided for Evergreen Line* (News Release). Retrieved November 1, 2008, from http://www.translink.bc.ca/About_TransLink/News_Releases/news04180801.asp

Transport Canada. (2006). *Transportation in Canada 2006: Annual report*. Ottawa, Ontario: Minister of Public Works and Government Services.

University of British Columbia. (2005). Planning for the Great Northern Way Campus. *UBC Reports, 51*(2). Retrieved September 29, 2008, from http://www.publicaffairs.ubc.ca/ubcreports/2005/05feb03/planning.html

Urban Transit Authority. (1981). *Advanced light rapid transit: The system for Greater Vancouver*. Vancouver, BC: Urban Transit Authority.

Vuchic, V. (1999). *Transportation for livable cities*. Rutgers University, New Brunswick, New Jersey: The Center for Urban Policy Research.

Washington State Department of Transportation. (2007). *Amtrak Cascades 2007 performance report*. Olympia, Washington: WSDOT State Rail and Marine Office.

Washington State Department of Transportation. (2007). *Amtrak Cascades: Ridership and station on off information*. Olympia, Washington: WSDOT State Rail and Marine Office.

Washington State Department of Transportation. (2008). *Amtrak Cascades ridership sets all time record in 2007*. Retrieved May 1, 2008, from http://www.wsdot.wa.gov/News/2008/03/AmtrakCascadesridershipsetsall-timerecordin2007.htm

Washington State Department of Transportation. (2008). *Amtrak Cascades ridership report March 2008*. Olympia, Washington: Washington State Department of Transportation.

Washington State Department of Transportation. (2008). *Rail: King Street station renovation*. Retrieved August 17, 2008, from www.wsdot.wa.gov/Projects/Rail/KingStreetStationRenovations

Waymarking.com. (2008). Pacific Central station, Vancouver BC waymark. Retrieved June 4, 2008, from http://www.waymarking.com/waymarks/WM2FQX

Weiss, L. (2007, July 6). Air rights make deals fly. *New York Post*. Retrieved May 10, 2008 from http://www.nypost.com/seven/07062007/business/air_rights_make_deals_fly_business_lois_weiss.htm

Yevdokimov, Y V. (2004). Sustainable transportation in Canada. In Ruggeri, J (Ed.), *Sustainable transportation in Atlantic Canada, Fredericton* (pp.19-42). University of New Brunswick: Policy Study Centre.