

**THE 2010 OLYMPIC DOWNTOWN TRANSPORTATION
EXPERIENCE: LESSONS FOR VANCOUVER AND
FUTURE HOST CITIES OF MEGA-EVENTS**

by

Steve Chou
Bachelor of Arts, University of British Columbia, 2008

RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF URBAN STUDIES

In the
Faculty of Arts and Social Sciences

© Steve Chou 2010
SIMON FRASER UNIVERSITY
Fall 2010

All rights reserved. However, in accordance with the *Copyright Act of Canada*, this work may be reproduced, without authorization, under the conditions for *Fair Dealing*. Therefore, limited reproduction of this work for the purposes of private study, research, criticism, review and news reporting is likely to be in accordance with the law, particularly if cited appropriately.

APPROVAL

Name: Steve Chou
Degree: Master of Urban Studies
Title of Thesis: The 2010 Olympic Downtown Transportation Experience: Lessons for Vancouver and Future Host Cities of Mega-Events

Examining Committee:

Chair: **Karen Ferguson**
Associate Professor, Urban Studies and History

Anthony Perl
Supervisor
Director, Urban Studies
Professor, Urban Studies and Political Science

Meg Holden
Second Supervisor
Associate Professor, Urban Studies and Geography

Ken Cameron
External Examiner
Adjunct Professor, Urban Studies

Date Defended/Approved: November 22 2010



SIMON FRASER UNIVERSITY
LIBRARY

Declaration of Partial Copyright Licence

The author, whose copyright is declared on the title page of this work, has granted to Simon Fraser University the right to lend this thesis, project or extended essay to users of the Simon Fraser University Library, and to make partial or single copies only for such users or in response to a request from the library of any other university, or other educational institution, on its own behalf or for one of its users.

The author has further granted permission to Simon Fraser University to keep or make a digital copy for use in its circulating collection (currently available to the public at the "Institutional Repository" link of the SFU Library website <www.lib.sfu.ca> at: <<http://ir.lib.sfu.ca/handle/1892/112>>) and, without changing the content, to translate the thesis/project or extended essays, if technically possible, to any medium or format for the purpose of preservation of the digital work.

The author has further agreed that permission for multiple copying of this work for scholarly purposes may be granted by either the author or the Dean of Graduate Studies.

It is understood that copying or publication of this work for financial gain shall not be allowed without the author's written permission.

Permission for public performance, or limited permission for private scholarly use, of any multimedia materials forming part of this work, may have been granted by the author. This information may be found on the separately catalogued multimedia material and in the signed Partial Copyright Licence.

While licensing SFU to permit the above uses, the author retains copyright in the thesis, project or extended essays, including the right to change the work for subsequent purposes, including editing and publishing the work in whole or in part, and licensing other parties, as the author may desire.

The original Partial Copyright Licence attesting to these terms, and signed by this author, may be found in the original bound copy of this work, retained in the Simon Fraser University Archive.

Simon Fraser University Library
Burnaby, BC, Canada

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, collaborator or research assistant 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.

Simon Fraser University Library
Simon Fraser University
Burnaby, BC, Canada

ABSTRACT

The XXI Olympic Winter Games presented Vancouver with significant transportation challenges and generated concerns about the potential difficulties of travelling during the 17-day period of the Games. Olympic partner organizations developed and implemented a range of transportation demand management (TDM) strategies to influence the travel behaviour of residents. The result was a very successful transportation experience.

This paper examines the details of the Olympic downtown transportation experience including changes that residents made to their travel behaviour and the factors that contributed to the success of transportation in the downtown. In the end, ten transportation lessons for Vancouver were generated from this research. These lessons have a range of applications from informing long-term transportation planning to planning for episodic events. Additionally, this paper highlights the opportunity that future host cities have to leverage mega-events like the Olympic Games to generate valuable and insightful lessons on addressing current and future transportation challenges.

Keywords: transportation demand management; Olympic transportation; Vancouver; lessons learned; sustainable transportation; episodic events

DEDICATION

To my family.

ACKNOWLEDGEMENTS

I would like to take this opportunity to thank those who played an important part in the completion of my research project. I would like to firstly acknowledge the faculty, staff, and students of the Urban Studies Program. In particular, I sincerely thank Anthony Perl who provided his continual guidance, regularly provided feedback, and helped me in the development and completion of the project. I also thank Ken Cameron and Meg Holden for their comments that pushed me go further in my analysis.

I would like to recognize Kathrine Richardson for giving me my first opportunity to go out in the field and gain experience with conducting interviews. As well, thanks to all interviewees in this project for taking the time to participate and provide their input.

Finally, special thanks goes out to my family for their support throughout my academic career.

TABLE OF CONTENTS

Approval.....	ii
Abstract.....	iii
Dedication.....	iv
Acknowledgements.....	v
Table of Contents.....	vi
List of Figures.....	viii
List of Tables.....	ix
Glossary.....	x
1: Introduction.....	1
2: Background.....	3
2.1 Downtown Transportation Infrastructure.....	3
2.2 Downtown Vancouver Mode Share.....	5
2.3 The Olympic Transportation Plan.....	7
2.3.1 Olympic Transportation Challenges.....	8
2.3.2 Transportation Strategies.....	9
3: Literature Review.....	13
3.1 TDM and Travel Behaviour.....	14
3.1.1 Definition and Emergence of TDM.....	14
3.1.2 Effectiveness of TDM.....	17
3.1.3 Travel Behaviour.....	19
3.2 Transportation Challenges Facing Cities.....	23
3.2.1 Long Term Transportation Planning.....	24
3.2.2 Planning for Episodic Events.....	36
3.2.3 State of Research on TDM Strategies.....	42
3.2.4 Applicability of Olympic Lessons.....	45
3.3 Olympic Transportation.....	46
4: Methodology.....	49
4.1 Research Design.....	49
4.2 Pre-Planning.....	50
4.3 Data Sources.....	51
4.3.1 Media Reports.....	51
4.3.2 Travel Survey.....	52
4.3.3 Data Describing Driving Conditions.....	53
4.3.4 Data Describing Transit Conditions.....	54
4.3.5 Data Describing Walking and Cycling Conditions.....	55
4.3.6 Interviews with Experts.....	56

5: Olympic Transportation Analysis	58
5.1 Pre-Olympic Expectations, Issues, and Targets	58
5.2 Olympic Downtown Transportation Experience	60
5.2.1 Transportation Initiatives.....	60
5.2.2 Driving Experiences.....	62
5.2.3 Transit Experiences.....	63
5.2.4 Walking and Cycling Experiences.....	66
6: Analysis Of The Downtown Transportation Experience	70
6.1 Post-Games Assessment.....	70
6.2 Factors Contributing to the Outcome of the Olympic Downtown Transportation Experience	74
6.2.1 Structural Factors	75
6.2.2 Psychological Factors.....	77
6.2.3 Random Factors.....	79
7: Transportation Lessons	84
7.1 Applicability of Olympic Lessons	84
7.1.1 Long Term Transportation Planning.....	84
7.1.2 Planning for Episodic Events	85
7.2 Transportation Lessons for Vancouver.....	87
7.2.1 It is Possible to Achieve Higher than Current Levels of Sustainable Mode Use	89
7.2.2 Transit Has the Potential to Attract Almost Anyone.....	92
7.2.3 Minimizing the Space That Transportation Takes Up Can Create Valuable Public Spaces	93
7.2.4 Our Transportation System is Resilient but Could Be Improved With Additional TDM Strategies	95
7.2.5 We Are More Effective When We Work Together	97
7.2.6 Set a Date for Change and Celebrate.....	101
7.2.7 Define What 'Normal' Travel Conditions Will Be Like	102
7.2.8 Modelling Change to the Transportation System Provides Valuable Insight.....	104
7.2.9 There Are Many Ways of Disseminating Travel Information.....	105
7.2.10 We Gained Improved Operational Knowledge of Our Transportation System	108
7.3 Transportation Lessons for Future Host Cities	109
7.3.1 Generating Transportation Lessons.....	109
7.3.2 Transportation Planning for the Olympics	112
8: Conclusion	114
Reference List	117

LIST OF FIGURES

Figure 1: Boundaries of Downtown Vancouver.....	3
Figure 2: Mode Share of All Trips to Downtown Vancouver.....	7
Figure 3: Timeline of Select Transportation Initiatives Implemented in the Downtown	12
Figure 4: Three Ingredients in Structural and Psychological Measures	21
Figure 5: Queue Management Strategy for Waterfront Station.....	65
Figure 6: Burrard Bridge Monthly Pedestrian and Bicycle Volumes.....	67

LIST OF TABLES

Table 1: Journey to Work Mode Shares in 2006	6
Table 2: Change in Trips Taken By Mode Over the Duration of the TravelSmart Pilot Project.....	34
Table 3: Breakdown in Changes to Transit Ridership.....	63
Table 4: Person Trips to and from UBC on a Typical Weekday in Fall 2008	81
Table 5: Summary of Stadium Event Transportation Survey Mode Split	82
Table 6: List of Transportation Lessons for Vancouver	89
Table 7: Comparing First-Quarter Revenue Ridership (First Time One Boards a Transit Vehicle) 2009 versus 2010	116

GLOSSARY

ORGANIZATIONS

2010 Integrated Security Unit	The unit responsible for securing the 2010 Olympic and Paralympic Games.
British Columbia Ministry of Transportation and Infrastructure	The provincial government ministry responsible for transportation infrastructure and law in British Columbia.
British Columbia Rapid Transit Company	A subsidiary of TransLink. It operates and maintains the Expo and Millennium SkyTrain Lines.
British Columbia Transit	A provincial Crown agency responsible for coordinating the delivery of public transportation in British Columbia outside of the Metro Vancouver region.
City of Vancouver	The local government body of Vancouver responsible for providing various services, operations, and programs.
Coast Mountain Bus Company	A subsidiary of TransLink. It operates bus service and the SeaBus in Metro Vancouver.
Downtown Vancouver Business Improvement Association	Serves a 90 block area in downtown Vancouver consisting of 8,000 businesses, property owners, and tenants.
HandyDART	A transit service for persons with disabilities which is operated by MVT Canadian Bus Inc.
Insurance Corporation of British Columbia	A provincial Crown corporation that provides universal automobile insurance to motorists in British Columbia.
Olympic and Paralympic Transportation Team	Composed of members from Olympic partner organizations responsible for planning transportation during the Olympics.

ProTrans BC	The private operator of the Canada Line.
TransLink	Legally known as the South Coast British Columbia Transportation Authority. It is responsible for transit, funding the major road network, and transportation demand management in Metro Vancouver.
Vancouver Organizing Committee	A not-for-profit organization responsible for the planning, organizing, financing, and staging of the 2010 Olympic and Paralympic Games.

ABBREVIATIONS

BCRTC	British Columbia Rapid Transit Company
DTP	Downtown Transportation Plan
DVBIA	Downtown Vancouver Business Improvement Association
ICBC	Insurance Corporation of British Columbia
IOC	International Olympic Committee
LRSP	Livable Region Strategic Plan
OPTT	Olympic and Paralympic Transportation Team
OTP	Olympic Transportation Plan
SOV	Single Occupant Vehicle
TDM	Transportation Demand Management
UBC	University of British Columbia
UTSP	Urban Transportation Showcase Project
VANOC	Vancouver Organizing Committee

1: INTRODUCTION

The XXI Olympic Winter Games were held from February 12th to February 28th, 2010. In this research project, I examine the questions of what happened with transportation in downtown Vancouver during the Olympics and what can be learned from the Olympic downtown transportation experience?

The first part of the paper focuses on understanding the response of residents to the 2010 Olympics and the Olympic Transportation Plan (OTP). I examine travel conditions and the travel behaviour of residents during the 17-day period of the Games. In particular, changes to travel mode, trips made, and the quality of transportation for residents who travelled by automobile, transit, foot, or bicycle are analyzed. This examination involved the use of quantitative data from counts and surveys as well as observations gathered from media reports, interviews, and personal experiences.

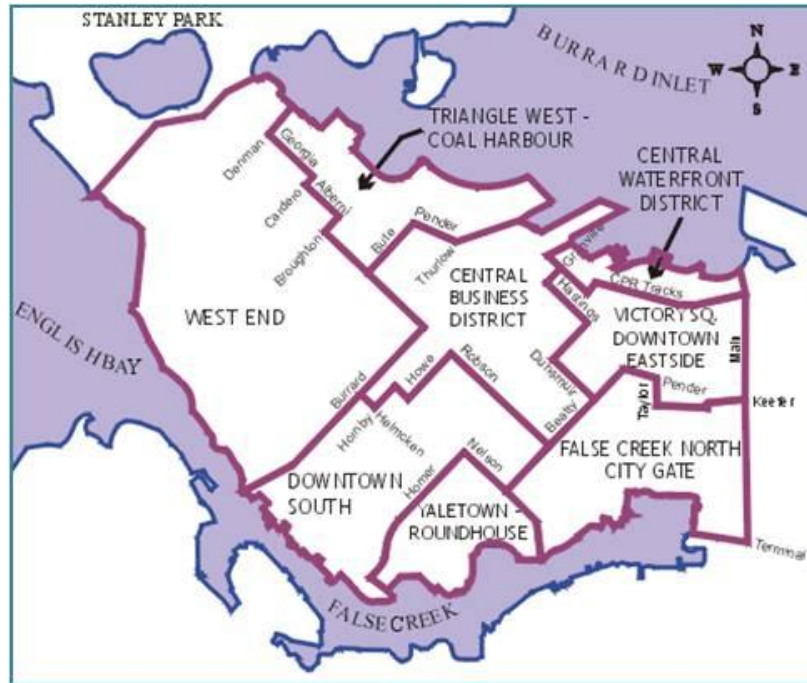
The second part of the paper provides an analysis of the Olympic downtown transportation experience. I compare the outcome of Olympic transportation with prior expectations and determine whether pre-established targets were met. An evaluation of Olympic transportation is then provided along with an analysis of the factors that contributed to the outcome. In the end, transportation lessons from the Olympics are generated using data gathered in this project and input provided by commentators in the media, local experts, and transportation planners. The main purpose of these lessons is to inform future

decision-making about transportation in the city and region of Vancouver. As well, transportation lessons for future host cities of mega-events are generated. These lessons provide insight into how mega-events like the Olympics can be leveraged by host cities to generate transportation lessons that are relevant to their respective localities. The lessons described in this paper, both for Vancouver and future host cities, help provide an improved understanding of how to address the current and future transportation challenges facing cities.

2: BACKGROUND

2.1 Downtown Transportation Infrastructure

Figure 1: Boundaries of Downtown Vancouver¹



Downtown Vancouver is located on a peninsula and encompasses eight communities as defined within the Downtown Transportation Plan² (see Figure 1 for boundaries). To the north of the downtown is Burrard Inlet and to the south is False Creek. Access to and from the west side of the downtown is provided by the Lions Gate bridge, which crosses Burrard Inlet. The Burrard, Granville Street, and Cambie Street bridges span False Creek and provide access to and from the south side of the downtown. Major roads provide access to and from

¹ Taken from City of Vancouver, "Background to the Downtown Transportation Plan", (City of Vancouver, 2010) Available: <<http://vancouver.ca/dtp/transportationchallenge.htm>>

² City of Vancouver, Downtown Transportation Plan, (City of Vancouver, 2002)

the east side of the downtown and these include Hastings Street, Pender Street, and the Dunsmuir and Georgia Viaducts.

Transit service is provided by TransLink³. There is a commuter rail service known as the West Coast Express which connects the downtown and six cities to the east of Vancouver including Port Moody, Coquitlam, Port Coquitlam, Pitt Meadows, Maple Ridge, and Mission. Also, three rapid transit lines known as SkyTrain⁴ serve the downtown. These are the Expo and Millennium Lines, which connect to the cities of Burnaby, New Westminister, and Surrey, and the Canada Line, which connects to the city of Richmond and Vancouver International Airport. Additionally, passenger ferry service known as SeaBus connects the North Shore with downtown Vancouver across Burrard Inlet. In total, there are eight major transit stations in the downtown: Waterfront station is a major hub and is served by the SeaBus, West Coast Express, and all three SkyTrain lines; Vancouver City Centre and Yaletown-Roundhouse stations are served by the Canada Line; and Burrard, Granville, Stadium-Chinatown, and Main Street stations are served by the Expo and Millennium Lines. The downtown is also served by an extensive public bus network⁵, a public transportation service for people with disabilities⁶, private ferry service on False Creek, and private taxis.

³ TransLink is a regional transportation authority responsible for public transportation, cycling, and other commuting options.

⁴ SkyTrain is a system of automated light rail trains. The BC Rapid Transit Company operates and maintains the Expo and Millennium Lines while ProTrans BC operates and maintains the Canada Line.

⁵ Bus service in the region is operated by the Coast Mountain Bus Company (CMBC) which is a subsidiary of TransLink.

⁶ This service is known as HandyDART.

The seawall provides pedestrians and cyclists with a pathway that runs along the waterfront of downtown Vancouver. As well, a section of Granville Street in the downtown was closed to motor vehicles leading up to and during the Olympics. For cyclists, there also exists a network of bike lanes along 12 major streets in the downtown.

2.2 Downtown Vancouver Mode Share

Census data⁷ collected in 2006 indicates that 41.1% of residents in the city of Vancouver use transit, walk, or cycle to work. A comparison made by the City of Vancouver to other select municipalities in North America shows that Vancouver residents rank relatively high for the use of sustainable modes. In particular, “[t]ransit use is much higher in Vancouver than in all the US cities”⁸ although it is lower than in Toronto or Montreal. In addition, Vancouver has the second highest percentage of people walking to work in comparison to other Canadian and American cities⁹. Vancouver can also be compared to the Metro Vancouver region as a whole where mode shares for transit, walking, and cycling total 18.1%¹⁰ (see Table 1 for a breakdown of mode shares).

⁷ City of Vancouver, Transportation Trends – 2006 Census and Central Business District Counts, City of Vancouver, 2008

⁸ More details can be found in City of Vancouver, Vancouver Transportation Plan, Progress Report, (City of Vancouver, 2006). This comparison was made to selected cities in the US and in Canada.

⁹ Ibid.

¹⁰ Data source: City of Vancouver, Transportation Trends

Table 1: Journey to Work Mode Shares in 2006

Location of Residents	Mode Share				
	Auto Driver	Auto Passenger	Transit	Walk	Bike
Downtown Vancouver¹¹	32.7%	3.3%	20.4%	38.8%	2.6%
Vancouver¹²	51.5%	6.1%	25.1%	12.2%	3.8%
Metro Vancouver¹³	67.3%	7.1%	16.5%	6.3%	1.7%

Data shows the relatively high modal share of downtown Vancouver residents for taking transit, walking, and cycling to work.

In terms of the downtown, a report from the City of Vancouver¹⁴ using Census data from 2006 shows that for journeys to work, 61.8% of downtown residents use transit, walk, or cycle. A travel survey completed in 2004 by TransLink shows a similarly high use of sustainable modes for trips made to the downtown (see Figure 2 for a breakdown of the mode share).

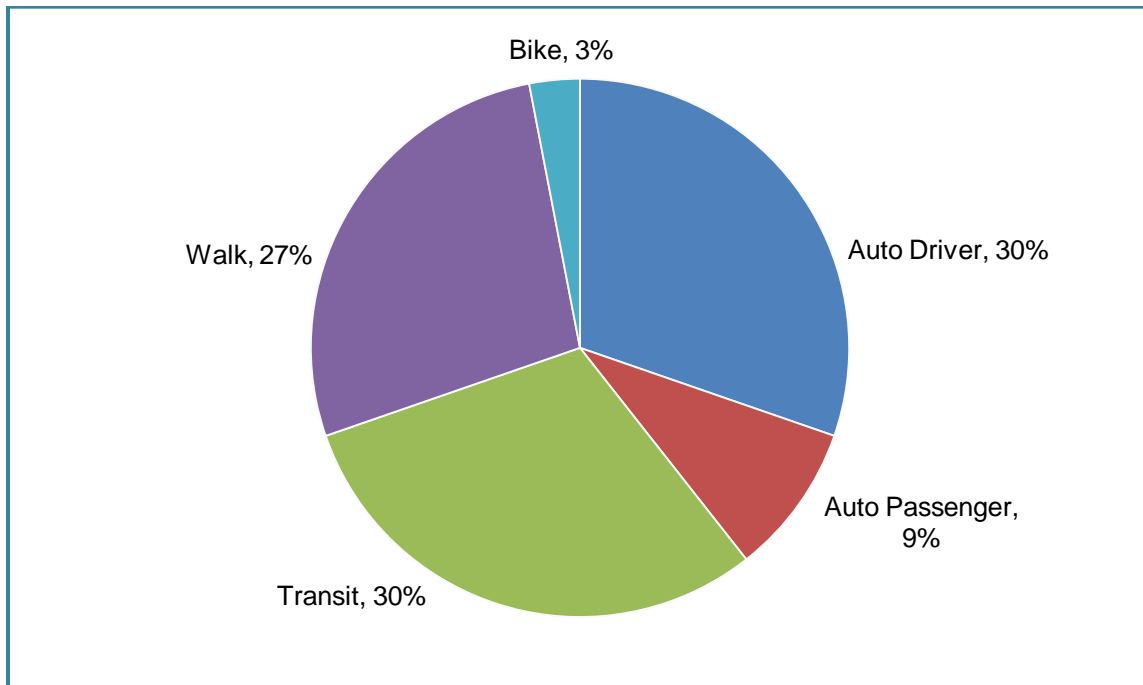
¹¹ Ibid.

¹² Ibid.

¹³ Statistics Canada, Employed labour force by mode of transportation, both sexes, percentage distribution, for Canada, census metropolitan areas and census agglomerations, and component census subdivisions (municipalities) of residence - 20% sample data, 2006 Census, Ottawa, 2009, Available from <<http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/hlt/97-561/T603-eng.cfm?SR=1>>

¹⁴ City of Vancouver, Transportation Trends

Figure 2: Mode Share of All Trips to Downtown Vancouver¹⁵



The majority of trips to the downtown are made by transit, foot, or bike.

2.3 The Olympic Transportation Plan

The bidding process to host the XXI Olympic Winter Games was won by Vancouver on July 2nd, 2003. In preparation for the Olympics, the Vancouver Organizing Committee (VANOC) proposed that three venues located in downtown Vancouver be used for the staging of the Games. These venues were BC Place Stadium for the opening, closing, and victory ceremonies, the Vancouver Convention Centre for the Main Media Centre, and Canada Hockey Place for Ice Hockey. In addition, leading up to the Games, plans were being developed for pavilions to be set up in the downtown for the Olympics.

¹⁵ Data source: City of Vancouver, [Vancouver Transportation Plan Progress Report](#)

Consequently, many visitors, including members of the Olympic family¹⁶ and out of town tourists, and residents attending Olympic events and activities were expected to fill the downtown peninsula of Vancouver. Left alone, this increase in the number of people in the downtown could create potentially challenging transportation conditions characterized by high congestion and immobility for those travelling into, out of, and within the downtown.

2.3.1 Olympic Transportation Challenges

The need to accommodate the travel demand from an influx of visitors and residents represented one of the main challenges for downtown Vancouver's transportation system. Another challenge involved maintaining acceptable conditions for residents who needed to travel for the purposes of work, shopping, or leisure. As well, Games-time operation required the addition of a transportation system that was operated by VANOC to move athletes, media, officials, and other Olympic Games clientele.

Predictions were that approximately 10,000 accredited media, 5,500 athletes, and 55,000 members of the workforce were to be located in the Vancouver and Whistler areas. Approximately 135,000 spectators per day were expected to attend sporting events in Vancouver and 60,000 people per day were expected at the two LiveCity gathering sites¹⁷. It was also estimated that at any one time, there could be approximately 100,000 people on the streets of

¹⁶ The Olympic Family includes Organizing Committees for the Olympic Games; athletes and their families, National Olympic Committees; International Sport Federations; United Nations agencies; sponsors; and the media.

¹⁷ VANOC, Fact Sheet: Transportation Planning for the 2010 Olympic Winter Games, (VANOC, 2009)

downtown Vancouver¹⁸. As Ken Hardie, spokesperson for TransLink, suggested, “the daily number of people roaming the downtown core for Olympic entertainment on any given night would be equivalent to the crush after a summer fireworks night coupled with a Madonna concert”¹⁹.

At the same time, Olympic venues and other large special events required that certain streets be closed for staging and security purposes. As a result, there was going to be reduced space in the downtown available for vehicles, pedestrians, and cyclists. In fact, the OTP stated that “Games-time operations will reduce the capacity of the local road network into downtown by 50 per cent from the east, and overall into downtown by 20 per cent”²⁰. The OTP suggests that to accommodate the increased travel demand and to facilitate travel during the Olympic Games, a minimum 30% reduction in vehicle traffic would be required for downtown Vancouver. As for the transit system, it was suggested that the system would need to handle a 33% increase in the number of daily transit trips during the Olympics, which would be equivalent to an additional 230,000 trips²¹.

2.3.2 Transportation Strategies

In anticipation of these potential transportation problems, VANOC, the City of Vancouver, the Resort Municipality of Whistler, TransLink, BC Transit, the

¹⁸ Ken Hardie, spokesperson for TransLink in Kelly Sinoski, “TransLink expecting nearly a million passengers a day during 2010 Games”, Vancouver Sun, Mar 3, 2009

¹⁹ Kelly Sinoski, “Nine major downtown Vancouver traffic routes to close for the Olympics”, Vancouver Sun, Oct 14, 2009

²⁰ VANOC, Fact Sheet

²¹ Ibid.

provincial Ministry of Transportation and Infrastructure, and the 2010 Integrated Security Unit (ISU) assembled the Olympic and Paralympic Transportation Team (OPTT). One of their main goals was to develop transportation initiatives for the downtown that would mitigate potential transportation problems. The outcome of this process was the 2010 Olympic Transportation Plan (OTP). The overall goals of the OTP were to

- Ensure safe, reliable, accessible travel during the 2010 Winter Games,
- Take into account everyone's travel needs,
- Make the best use of the existing transportation networks,
- Reduce vehicle traffic during the Games, and
- Create legacies of sustainable transportation choices²².

Details of the OTP were publicly released in phases in March and October 2009. In the downtown, the OTP called for an Olympic route network to be established, which consisted of designated Olympic lanes for VANOC accredited vehicles, emergency vehicles, and TransLink buses. A number of temporary road closures in the downtown were also set out in the OTP. Six major roads were identified for closure to the public for security purposes²³ and four pedestrian corridors were identified which would require the closure of additional roads in the downtown to motor vehicles from noon to midnight every day²⁴. Other temporary road modifications named in the OTP included extending rush-hour parking and turn restrictions, implementing new 24 hour parking restrictions,

²² Ibid.

²³ In downtown, these are Expo Boulevard, Pacific Boulevard, Georgia Viaduct, Dunsmuir Viaduct, Canada Place Way and Waterfront road.

²⁴ The four corridors would consist of 32 pedestrian only blocks running along Granville Street from Helmcken to W. Hastings street, Robson Street from Beatty to Jarvis Streets, Hamilton Street from Drake to Georgia Streets, and Beatty Street from Smithe to Dunsmuir Streets.

and modifying traffic signals. As well, the OTP stated that temporary changes to existing bike routes would be made and some temporary bike parking in the downtown would be established for the Games. Additionally, pedestrians and cyclists would be provided with improved wayfinding and signage (see Figure 3 for a timeline of the implementation of select initiatives).

The OPT also outlined a number of Games-time transit improvements affecting the downtown. These include

- Adding more trips to the West Coast Express,
- Providing an additional 180 buses where required,
- Providing 30 additional HandyDART²⁵ vehicles,
- Establishing a free streetcar line known as the Olympic Line which would run just outside the edge of the downtown,
- Making available a limited edition two month souvenir transit pass,
- Providing for all ticketed Olympic spectators unlimited access to public transit for the day of the event, and
- Extending the operating hours of the Expo Line and SeaBus.

Lastly, two other major initiatives relevant to the downtown were named in the OTP. The first was the creation of a TravelSmart 'Know Before You Go' campaign. This campaign would involve the creation of a transportation management centre that would address transportation issues and provide real-time updates to the public about travel conditions. The public would be encouraged to use travel tips and travel information to plan their trips accordingly during the Games. The second initiative was to have post-secondary institutions

²⁵ HandyDART is a door-to-door shared ride public transit service aimed at travellers with physical or cognitive disabilities.

in Metro Vancouver extend their reading breaks to coincide with the two-week period of the Games in order to ease demand on the transportation network.

With its release, the OTP became the subject of much discussion regarding the impact it would have on the overall Olympic transportation experience. In this project, I used the OTP to guide the focus of my examination. The OTP was useful in helping to understand changes to travel conditions and the travel behaviour of residents and to evaluate the Olympic downtown transportation experience.

Figure 3: Timeline of Select Transportation Initiatives Implemented in the Downtown



3: LITERATURE REVIEW

A core component of the Olympic Transportation Plan (OTP) is the use of transportation strategies that fall under the term transportation demand management (TDM). To better understand and inform analysis of the OTP and its impacts during the Olympics, I draw upon literature to review the concept of TDM. I explore the history of TDM including its emergence in public policy and experiences with the implementation of TDM. In doing so, I develop an understanding for the role that TDM currently plays in public policy and reveal the uncertainty that surrounds TDM in terms of its effectiveness. Research into this uncertainty highlights the importance of considering the structural, psychological, and random factors that influence travel behaviour when analyzing the impacts of TDM strategies such as those in the OTP.

In addition, I examine the applications of TDM. In doing so, I identify two sets of transportation challenges for which lessons from the Olympics could be generated. This review also provides insight into the nature of current and future transportation challenges facing cities and the gaps that exist in research.

Lastly, literature on Olympic transportation was examined. This literature helps to outline the opportunities to generate transportation lessons from examining the transportation experience during an Olympic Games. Examining past studies also helped to shape and inform the methodology for this research project.

3.1 TDM and Travel Behaviour

3.1.1 Definition and Emergence of TDM

According to Transport Canada²⁶, the term TDM, also referred to as mobility management, encompasses a wide range of policies, programs, services, and products developed by transportation planners with one primary purpose - to achieve transportation goals by influencing people's travel behaviour. A common way of viewing TDM is that it involves the use of a carrot and stick approach where incentives and disincentives could be provided to induce people to make certain transportation choices. The outcome of implementing TDM policies as anticipated by planners and policymakers is that travellers will make one or more of several changes such as,

- Changes to the amount of travel (e.g. reducing the total number of trips taken),
- Changes to the routes taken (e.g. shifting trips from congested routes to less congested routes),
- Changes to the time of travel (e.g. shifting trips from congested times to less congested times), and
- Changes to the mode of travel (e.g. shifting trips from low occupancy to high occupancy travel modes).²⁷

In the United States, the beginnings of TDM have been traced by Michael Meyer²⁸ and Martin Wachs²⁹ to the early 1970s. According to Wachs, for three

²⁶ Transport Canada, "TDM definition, overview, and rationale", Transport Canada, 2010, <<http://www.tc.gc.ca/eng/programs/environment-utsp-tdmintro-1039.htm>>

²⁷ Derived from Greater Vancouver Regional District, Greater Vancouver Region Transportation Demand Management Project: Final Report, (GVRD, 1996)

²⁸ Michael D. Meyer, "Demand management as an element of transportation policy: using carrots and sticks to influence travel behaviour", Transportation Research Part A, 33, (1999) 575-599

decades after the Second World War, public policy in the US was focused on the construction of new infrastructure such as highways and transit facilities. New infrastructure would provide adequate capacity for increasing travel demand. However, the early 1970s was a time when a new concept was introduced at the federal and local levels. This new concept was centred on better managing existing urban transportation systems in ways that could allow increasing travel demand to be satisfied without building more capacity.

According to Meyer and Wachs, new interest in managing travel demand arose mainly in response to three factors. The first was growing pressure from the public to address transportation challenges such as traffic congestion. The second was a declining funding base available for the construction of new transportation infrastructure. Finally, the third was the focus of federal and state law on reducing the use of single occupant vehicles (SOVs). This last factor arose from concerns related to the oil supply disruptions of the 1970s and concerns over the environmental consequences of heavy reliance on the automobile. According to Meyer, the result of this new interest was a clear shift in policy away from moving more vehicles towards more efficient movement of people that continued well into the 1990s.

In Canada, the movement towards managing travel demand appears to have come at a later time in the 1990s. In a paper published in 1997, Russ

²⁹ Martin Wachs, "Policy Implications of Recent Behavioural Research in Transportation Demand Management", *Journal of Planning Literature*, 5, (1991) 333-341

Robinson³⁰ presents the beginnings of what appeared to be a paradigm shift towards the use of TDM strategies in Canada. He suggests that Canadian municipalities were beginning to realize that financial resources to support policies of major expansions of infrastructure would not be available. As well, there was growing recognition among municipalities that the “past reliance on technology alone to address energy and environmental impacts of transportation must now be modified to include the fundamental social change that is the primary focus of TDM”³¹. Robinson suggests that these factors would prompt governments to consider TDM-based transportation options for the future.

Today, TDM appears to be recognized as an important transportation policy option across Canada. This can be exemplified by Transport Canada and their development of a TDM resource centre³² which currently profiles the use of TDM strategies around the world and whose purpose is to act as a starting place for Canadian cities to understand how they can increase sustainable transportation options. As well, the Federation of Canadian Municipalities³³ has recognized the benefits of TDM and the important role that TDM can play in the future of cities. Recognition can be seen through their development of resources and tools to promote the use of TDM in cities³⁴.

³⁰ Russ Robinson, “Transportation demand management in Canada: an overview”, Energy policy, 25, (1997) 1189-1191

³¹ Ibid., pg. 1190

³² Transport Canada, “Transportation Demand Management (TDM) Resource Centre”, 2010, <<http://www.tc.gc.ca/eng/programs/environment-utsp-tdmresources-1051.htm>>

³³ The Federation of Canadian Municipalities (FCM) is the national voice of municipal governments in Canada since 1901.

³⁴ For example, see Federation of Canadian Municipalities, Improving Travel Options with Transportation Demand Management (TDM), (FCM, 2008)

3.1.2 Effectiveness of TDM

Yet, despite the lengthy history of TDM implementation especially in the US and the numerous studies conducted by researchers to examine the effects of TDM, there appears to be an ongoing debate over the prospects of TDM and its potential for achieving significant changes in travel behaviour. My examination of studies involving the use of mathematical simulations and analysis based on empirical evidence has shown varied results.

On the one hand, there are arguments and evidence for TDM as demonstrated by Todd Litman³⁵ who profiles many successful TDM programs from around the world. On the other hand, there are arguments and evidence against TDM as an effective strategy for changing travel behaviour and addressing transportation problems. For example, Pascal Poudenx³⁶ examines TDM strategies deployed in cities around the world and finds evidence that they are failing to reduce private vehicle use.

A number of researchers have looked into the literature on TDM and have found some issues that exist with past research, which could explain the varied results. Jennifer Dill and Erin Wardell³⁷ explain the difficulty and complexities of evaluating TDM programs. They state that TDM programs can be “diverse in scope and involve individual behaviour patterns, which are complex and difficult

³⁵ Todd Litman, “Success stories: Examples of TDM Programs that work”, Victoria Transport Policy Institute, 2010, <<http://www.vtpi.org/tdm/tdm71.htm>>

³⁶ Pascal Poudenx, “The effect of transportation policies on energy consumption and greenhouse gas emission from urban passenger transportation”, *Transportation Research Part A*, 42, (2008) 901-909

³⁷ Jennifer Dill and Erin Wardell, “Factors affecting worksite mode choice: findings from Portland, Oregon”, *Transportation Research Record: Journal of the Transportation Research Board*, 1994, (2007) 51-57

to measure.”³⁸ Moreover, they point out that rarely do TDM programs exist in a vacuum. Rather, TDM programs are usually implemented as part of larger regional efforts to address transportation challenges. As such, accounting for other changes adds to the difficulties and complexities of evaluating TDM.

In the third International Symposium on the success and failure of TDM measures³⁹, there was a general consensus among participants that past research on the implementation and assessment of impacts of TDM measures suffers from a number of methodological issues. Among the critiques were that some of the work produced was too simplistic and ignored the dynamics of behavioural response. As well, many so-called proofs were flawed or based on flawed assumptions. This critique also appears in a study conducted for the National Cooperative Highway Research Program that examines TDM strategies⁴⁰. The study states, “Few evaluation studies have been conducted using robust and consistent methods.”⁴¹ Limited funding for evaluation efforts is one reason that n given in the study for the current state of research.

Finally, David Ungemiah and Casey Dusza⁴² point out that to date, there is limited research that has identified metrics that can be used to compare TDM

³⁸ Dill, “Factors affecting worksite mode choice”, pg. 51

³⁹ Wafaa Saleh, “Success and failure of transportation demand management: Is congestion charging the way forward?”, Transportation Research Part A, 41, (2007) 611-614

⁴⁰ Cambridge Systematics Inc. and Eastern Research Group Inc., Evaluate the Interactions between Transportation-Related Particulate Matter, Ozone, Air Toxics, Climate Change, and Other Air-Pollutant Control Strategies, (National Cooperative Highway Research Program, 2010)

⁴¹ Cambridge Systematics Inc., Evaluate the Interactions, pg. 6

⁴² David Ungemiah and Casey Dusza, “Transportation Demand Management Benchmark: Results from 2008 TDM Program Survey”, Transportation Research Record: Journal of the Transportation Research Board, 2118, (2009) 55-66

programs. As well, it has been pointed out⁴³ that the potential effectiveness of some TDM strategies such as telecommuting is evolving due to changes in technology.

In summary, much of the research on the effectiveness of TDM appears to be characterized by poor methodology and weak analysis. This makes it difficult to determine the theoretical and practical implications of research. Therefore, there does not appear to be strong consensus about the potential of TDM to address transportation challenges and there remains uncertainty about the impact that TDM can have on travel behaviour. However, this state of research has not deterred TDM from being seriously considered in public policy. Promise has been shown from some TDM programs. As well, the factors that led to the emergence of TDM in public policy have not disappeared. These factors include pressure to address transportation problems, limited resources for new infrastructure, recognition of the problems associated with reliance on the automobile, and realization that technology by itself might not be the solution to transportation problems.

3.1.3 Travel Behaviour

The varied results from past evaluations of TDM programs highlight the importance of analyzing the factors that influence people's travel behaviour. This is one point that appears in Saleh's paper, which criticizes some of the work on TDM as "ignor[ing] the dynamics of behavioural response."⁴⁴ This sentiment

⁴³ Cambridge Systematics Inc., Evaluate the Interactions

⁴⁴ Saleh, "Success and failure", pg. 611

seems to have resonated with researchers because it appears that TDM research has been evolving over the years to include analysis of travel behaviour. Dill and Warnell⁴⁵ note that recent research has attempted to explain what factors influence the results of TDM programs.

I have identified three sets of factors that influence travel behaviour and may determine and influence the outcome and effectiveness of a TDM strategy. Structural factors are one set of factors that has been found to be statistically significant in influencing travel decisions. These factors include the quantity of goods and services available such as the frequency and speed of a travel mode and the user cost of travel such as travel time and the price of fares⁴⁶. The second set is psychological factors such as people's beliefs, attitudes, and values. The third set is random factors, which can include media coverage and past travel behaviour.

According to Satoshi Fujii⁴⁷, money, power, and words represent three ingredients that planners and policymakers can use to influence the structural and psychological factors that shape travel behaviour (see Figure 4). Money refers to economic factors that can include goods and services; power can refer to physical power such as barriers and legal power such as regulations; and words can refer to different forms of communication including providing

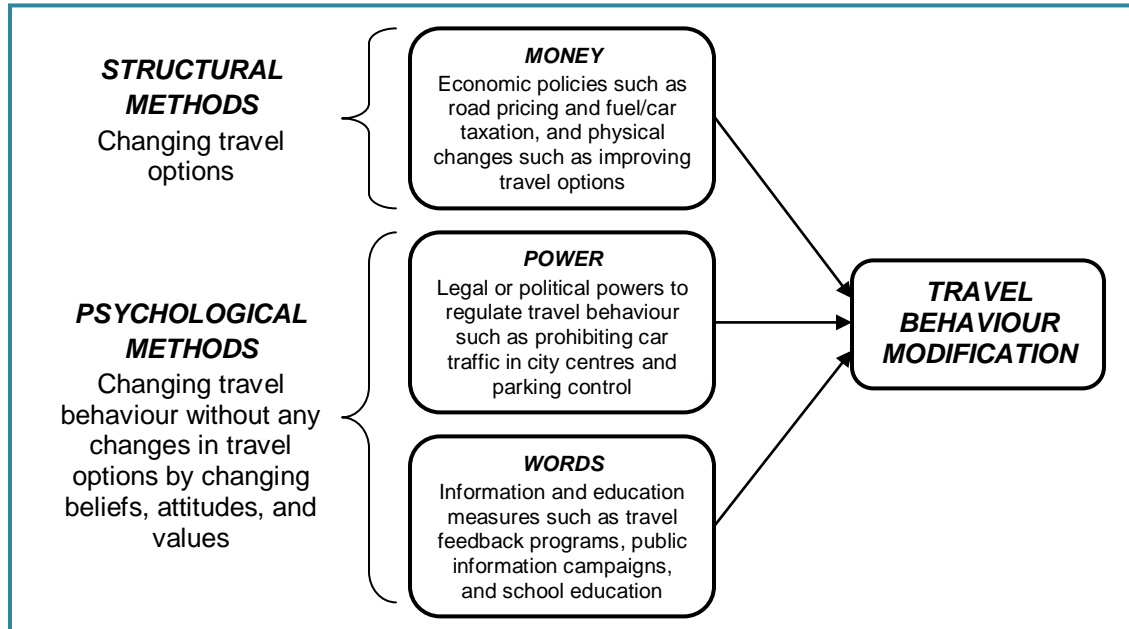
⁴⁵ Dill, "Factors affecting worksite mode choice", 2007

⁴⁶ Stéphanie Souche, "Measuring the structural determinants of urban travel demand", Transport Policy, 17, (2010) 127-134

⁴⁷ Satoshi Fujii, "Retrospectives and Perspectives on Travel Behavioural Modification Research: A report of the "Behavioural Modification" Workshop", in The expanding sphere of travel behaviour research and selected papers from the 11th International Conference on Travel Behaviour Research, edited by Ryuichi Kitamura, Toshio Yoshii, and Roshiyuki Yamamoto, (UK: Emerald Group Publishing Limited, 2009)

information and education. Methods centred on money and power have been the basis of traditional transport policy while methods based on words have not been extensively used.

Figure 4: Three Ingredients in Structural and Psychological Measures⁴⁸



The comparison between influencing structural factors and psychological factors is made by Tommy Gärling and Satoshi Fujii⁴⁹. Their paper attempts to disentangle and theoretically understand the different components of a TDM program by looking at the divide between structural and psychological measures of TDM. Although structural methods can be effective at changing behaviour, the authors argue that once the social, monetary, or physical means associated with structural methods are discontinued, behavioural changes do not endure. The

⁴⁸ Taken from Tommy Gärling and Satoshi Fujii, "Travel behaviour modification: theories, methods, and programs", in The expanding sphere of travel behaviour research and selected papers from the 11th International Conference on Travel Behaviour Research, edited by Ryuichi Kitamura, Toshio Yoshii, and Roshiyuki Yamamoto, (UK: Emerald Group Publishing Limited, 2009) 106

⁴⁹ Ibid.

authors continue to argue that unless forced by social, monetary, or physical means, a change in travel behaviour is determined by changes in an individual's beliefs, attitudes, and/or values. As such, the authors suggest that if actual behaviour is to an extent dependent on these factors then psychological methods may have an advantage in terms of effectiveness. In the end, they suggest that psychological TDM measures such as providing information could be more important in driving change than structural measures.

The analysis by Ryuichi Kitamura et al.⁵⁰ also speaks to the importance of psychological aspects of travel changes. The authors argue that a TDM scheme will not work unless a certain majority of individuals abide by the rule set out by the scheme. They explain that if the rule is not observed by the majority of individuals, then there would be less incentive for an individual to comply with it. I think this is a perspective that is particularly relevant to certain TDM schemes such as those employed during special events where there is greater media attention and a higher likelihood for people to see others following the rule.

Their analysis also adds another set of factors that are important to consider when thinking about travel behaviour. They argue that whether or not policy measures can be successful may also depend on random factors. These random factors include media coverage and initial conditions. Initial conditions refers to the initial compliance rate of individuals and "implies path dependence in the system's behaviour; its future behaviour depends on its past behaviour."⁵¹

⁵⁰ Ryuichi Kitamura, S. Nakayama, and T. Yamamoto, "Self-reinforcing motorization: can travel demand management take us out of the social trap?", Transport Policy, 6, (1999) 135-145

⁵¹ *Ibid.*, pg. 143

Through the use of simulations, the authors argue that in the end, the effectiveness of a TDM measure is subjected to a large extent to these chance elements.

These three factors, structural, psychological, and random, thus appear to be significant determinants of people's travel behaviour. Therefore, it will be important to take into account these factors when analyzing and interpreting the impact of the OTP and the outcome of the Olympics downtown transportation experience.

3.2 Transportation Challenges Facing Cities

TDM has been examined and advocated by planners, researchers, and policy makers as a possible solution for addressing many transportation challenges that are facing cities. It is revealed in the literature how TDM can provide travel options that can be used on a daily basis or during an episodic event. This ability makes TDM important for enhancing the resilience of the city. The concept of a resilient city is described by Peter Newman et al.⁵² as having “built-in systems that can adapt to change, such as a diversity of transport and land-use systems”⁵³. This quality is important because it allows cities to better deal with future transportation challenges and to respond to potential crises such as peak oil and climate change thereby avoiding collapse.

⁵² Peter Newman, Timothy Beatley, and Heather Boyer, Resilient Cities: Responding to Peak Oil and Climate Change, (Washington: Island Press, 2009)

⁵³ Ibid., pg. 6

This section focuses on understanding these transportation challenges that TDM has been linked to as a potential solution and determining the potential applications of lessons generated in this research project. I also examine the state of research regarding how cities could address these challenges. Doing so helps to provide an understanding of the current research needs of planners and policy makers by identifying limitations and gaps in past research. This is useful in helping to inform analysis of the Olympic experience so that useful and relevant lessons can be generated for planners and policy makers.

3.2.1 Long Term Transportation Planning

The first type of transportation challenge that has been linked to TDM involves preparing cities to be more sustainable in the long term. This challenge involves dealing with problems like congestion and pollution. TDM could be one possible solution for addressing these challenges due to its ability to influence travel behaviour and potentially encourage people to travel in more sustainable ways.

Sustainable Transportation

Many researchers and policymakers have noted the potential role that TDM can play in promoting sustainable transportation by encouraging behaviour changes over the long term that are consistent with the goals of sustainability. This appears to be the focus of the majority of research regarding TDM.

The interest in using TDM to promote sustainable transportation can be linked to the growing recognition among researchers, policy-makers, and

planners that current transportation systems are not sustainable environmentally, economically, and socially and that there is a need to develop more sustainable transportation systems in cities around the world. This sentiment has been expressed in a number of academic research articles as well as government and institutional documents such as in TransLink's *Transport 2040* document which describes TransLink's dedication to "creating and sustaining a transportation system that meets the needs of residents, businesses, and goods movers, in a manner that protects the environment and supports the economic and social objectives of the region."⁵⁴

As indicated in the previous section on the emergence of TDM, one of the reasons why TDM emerged in the field of transportation planning was in response to the consequences of cities being over-reliant on the automobile. Because automobiles run by burning products derived from petroleum, they emit carbon emissions and other air pollutants. For this reason, Tommy Gärling et al. argue that automobiles are a major contributor to air pollution and climate change⁵⁵.

Furthermore, in light of the finite amounts of fossil fuels, there is the argument that the growth of automobile use simply cannot go on forever and that the cost of travel will increase as fuel prices rise thereby significantly limiting the

⁵⁴ TransLink, [Transport 2040](#), (TransLink, 2008). Transport 2040 is the document that constitutes the long term strategy for the regional transportation system.

⁵⁵ Tommy Gärling, Anita Gärling, and Peter Loukopoulos, "Forecasting Psychological Consequences of Car Use Reduction: A Challenge to an Environmental Psychology of Transportation", [Applied Psychology: An International Review](#), 51.1, (2002) 90-106

mobility of individuals⁵⁶. Many experts including Richard Gilbert and Anthony Perl⁵⁷ argue that oil production will peak early this decade, possibly in the year 2012. The ramifications of this peak are made clear by Gilbert and Perl who identify the dependency of current transportation on oil as a fuel source with about 95% of the fuel used for transport being a liquid petroleum product made from crude oil⁵⁸. Consequently, continuing current rates of oil use by transportation is at threat and needs to be addressed.

Many commentators have also noted the social consequences of current transportation systems that are over-reliant on the automobile. Robert Gifford and Linda Steg⁵⁹ note that in the United States, 44% of all accidental deaths are the result of a motor vehicle accident, which they point out does not include the much larger number of citizens who were injured in motor vehicle accidents nor the number of family members and friends affected by these deaths or injuries. In contrast, Gifford and Steg suggest that transit vehicles are safer. For example, on a per passenger mile basis, automobiles are 25 times more likely to lead to death than buses.

Although many lives are indeed lost as a result of motor vehicle accidents, John Adams⁶⁰ has made the point that increases in vehicular traffic and

⁵⁶ OECD, Towards Sustainable Transportation, (OECD, 1996)

⁵⁷ Robert Gilbert and Anthony Perl, Transport revolutions: moving people and freight without oil, (Sterling: Earthscan, 2008)

⁵⁸ *Ibid.*, pg. 120

⁵⁹ Robert Gifford and Linda Steg, "The impact of automobile traffic on quality of life", in Threats from Car Traffic to the Quality of Life, edited by Tommy Gärling and Linda Steg, (Netherlands: Elsevier, 2007)

⁶⁰ John Adams, "The social implications of hypermobility", in The Economic and Social Implications of Sustainable Transportation: Proceedings from the Ottawa Workshop, (OECD, 2000)

increases in traffic speeds are not correlated with increased road accident fatalities but rather they are correlated with a decrease. This is because higher levels of traffic mean that fewer people will attempt to cross the road and fewer cyclists will venture onto the road. According to Adams, the biggest social cost of this scenario would be children. Children would be increasingly confined to their homes and be chauffeured by parents. The costs would include impairment of social development and impairment of fitness as they get less physical exercise. In fact, a study by Lawrence D. Frank et al.⁶¹ provides evidence that “each additional hour spent in a car per day was associated with a 6% increase in the likelihood of obesity”⁶². This would also have implications for all age groups.

Thus, one challenge facing cities appears to be moving away from over-reliance on the automobile, which has become a fixture in current transportation systems, towards sustainable forms of transportation such as transit, walking, and cycling. As Tommy Gärling and Geertje Schultema⁶³ put it, policy measures must be implemented that decrease car use. TDM is one possible strategy that could be effective at addressing this challenge. One of the roles that TDM can play is to induce changes in travel behaviour such as encouraging a modal shift away from the automobile and towards more sustainable modes of transportation. However, as noted earlier, research on the effectiveness of TDM

⁶¹ Lawrence D. Frank, Martin A. Andresen, and Thomas L. Schmid, “Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars”, American Journal of Preventive Medicine, 27.2, (2004) 87-96

⁶² *Ibid.*, pg. 87

⁶³ Tommy Gärling and Geertje Schultema, “Travel demand management targeting reduced private car use: effectiveness, public acceptability, and political feasibility”, Journal of Social Issues, 63.1, (2007) 139-153

is still unclear and there is evidence that questions the role that TDM might have in addressing transportation problems.

The use of technology is another solution that has been examined for its role in creating a sustainable transportation system. Technological solutions include improving the fuel efficiency of vehicles and using alternative fuel sources. These solutions can be beneficial in substantially reducing vehicle emissions and mitigating the adverse environmental effects of driving. As well, technology can be important in the long run because of the energy and cost savings that can be accrued. In addition, technological solutions are generally viewed as being more acceptable to the public compared to behavioural changes because technological solutions tend not to restrict the freedom to move.

However, Linda Steg and Robert Gifford⁶⁴ make the point that there are certain limits to technological solutions. For example, they note that technological solutions are aimed at reducing the negative impact of driving on a per car and per kilometre basis and do little to curb the use of cars. If anything, these solutions may actually encourage more car use because drivers might be “tempted to use their energy-efficient car more often because it is cheaper and more environmentally friendly”⁶⁵. As a result, Steg and Gifford argue that the “mitigating effects of new technologies tend to be overshadowed by the continuing growth of car use”⁶⁶. Another point made by Steg and Gifford is that

⁶⁴ Linda Steg and Robert Gifford, “Sustainable transportation and quality of life”, Journal of Transport Geography, 13, (2005) 59-69

⁶⁵ *Ibid.*, pg. 60

⁶⁶ *Ibid.*, pg. 59

technological solutions like energy efficient cars do little to solve social problems such as health and safety.

Another advantage of TDM is that it is not subjected to the severe technical and economic constraints that technological solutions face. According to Moriarty and Honnery, these constraints make the technological breakthroughs that are necessary for continuing along a high-mobility path unlikely to occur, unlikely to make much impact regardless, and likely to increase the cost of transportation.

Both local and regional governments in Vancouver have recognized the challenges of developing a sustainable transportation system. This can be seen, for example, in the City of Vancouver's Downtown Transportation Plan⁶⁷ (DTP). The DTP outlines the population and employment growth that is projected for downtown Vancouver to the year 2021, which could pose challenges to the sustainability of the city. It is expected that the number of residents living in downtown Vancouver will reach 100,000 by the year 2021, a 62% increase over 25 years from 1996 population numbers. Similarly, employment in downtown Vancouver is expected to rise to 175,000 jobs, up 33% from the 1996 figure of 132,000. Consequently, an increase of 18% in the total number of trips into downtown Vancouver from beyond the downtown peninsula and an increase of 64% in the total number of trips made within the peninsula from 1996 levels are projected for the year 2021⁶⁸.

⁶⁷ City of Vancouver, Downtown Transportation Plan, (City of Vancouver, 2002) Available: <<http://vancouver.ca/dtp/dtpfinalplan.htm>>.

⁶⁸ Figures are taken from the City of Vancouver, Downtown Transportation Plan

Similarly, Transport 2040⁶⁹ projects that the population in the region will increase by 1 million people from 2.2 million in 2006 to 3.2 million in 2040. It recognizes that this growth in population could put pressure on existing infrastructure especially if private vehicle use continues to grow at its current trend. The ongoing transportation challenge facing Vancouver is therefore to accommodate the increase in the number of people travelling. An additional constraint for the City of Vancouver is that they must do this without adding more road capacity to the existing network of roads and bridges. This restriction was put forth by the Vancouver Transportation Plan which recognized that road capacity is finite and that even if more roads were to be built, they would simply be filled with more cars and be congested⁷⁰.

TDM is one strategy that has been recognized for a long time by the City of Vancouver and Metro Vancouver for its potential to support sustainable transportation. The importance of TDM has been formally recognized in guiding policies. For example, TDM is recognized in the Transport 2021 long range transportation plan⁷¹, which helps to guide regional transportation decision-making to the year 2021. In the document, it suggests that TDM is the “most promising public policy lever” that can be used to “change travel behaviour and help solve urban transport problems.”⁷² It continues by pointing out that while TDM is not a panacea, it is important because it can “postpone capital investment

⁶⁹ TransLink, Transport 2040

⁷⁰ This restriction is mentioned in ‘Section 3.1 - Terms of Reference’ in the Downtown Transportation Plan.

⁷¹ Greater Vancouver Regional District and the Province of BC, A Long-Range Transportation Plan for Greater Vancouver: Transport 2021 Report, (GVRD and Province of BC, 1993)

⁷² *Ibid.*, pg. 21

and reshape travel demand to boost transit and carpool use.”⁷³ This principle of “applying transportation demand management (TDM), to change the behaviour of travellers in order to make better use of the existing transportation system”⁷⁴ has also been adopted by the City of Vancouver as an “essential framework for transportation planning in the city”⁷⁵ in the Vancouver Transportation Plan.

The role of TDM is also embedded in the Livable Region Strategic Plan⁷⁶ (LRSP) adopted in 1996 by what is now Metro Vancouver. The LRSP recognizes the importance of prioritizing sustainable modes of transportation and the need to “have land use that brings origins and destinations together at sufficient density”⁷⁷. One strategy outlined in the LRSP is to “increase transportation choice” through the following three policies:

1. Manage growth and development to reduce travel distances and emphasize sustainable modes as priorities;
2. Encourage sustainable modes of transportation such as transit and discourage others such as the single occupant vehicle,
3. Create a transportation system that supports the goals of the LRSP including the development of complete communities⁷⁸.

⁷³ Ibid., pg. 21

⁷⁴ City of Vancouver, “[3] Principles, Policies and Priorities”, (City of Vancouver, Engineering Services, 2010) Available: <<http://vancouver.ca/engsvcs/transport/plan/1997report/3-1.htm>>

⁷⁵ Ibid.

⁷⁶ The LRSP is the regional growth strategy that provides a framework for making decisions on regional land use and transportation.

⁷⁷ Ken Cameron in Mike Harcourt, Ken Cameron, and Sean Rossiter, City Making in Paradise: Nine Decisions that Saved Vancouver, (Vancouver: Douglas & McIntyre, 2007) pg 134

⁷⁸ Greater Vancouver Regional District, Livable Region Strategic Plan, (Burnaby: Policy and Planning; 1999)

The implementation of TDM strategies in the past ten years provides an illustration of the role that TDM has played in Vancouver. A U-Pass program was introduced to the University of British Columbia and Simon Fraser University in September 2003. The U-Pass is a mandatory transit pass that is subsidized for post-secondary students. This program was later expanded in 2009 to include Capilano University and Langara College. Recently in June 2010, the Province of BC announced the expansion of the program to a province wide initiative⁷⁹.

The Urban Transportation Showcase Program (UTSP)⁸⁰ also introduced a number of TDM initiatives. The first was the TravelSmart pilot program, which used information, incentives, and rewards to encourage people to reduce car travel by being more informed about sustainable modes of transportation. The delivery of individualized marketing to pilot communities in Metro Vancouver began in October 2005 and the pilot program ended in October 2006. The second was the development of plans for transit villages around two SkyTrain stations in Metro Vancouver. The third was the Main Street Transit and Pedestrian Priority Project, which aimed to achieve a modal shift from the car to transit, walking, and cycling through the improvement of Main Street as a transit and pedestrian environment.

⁷⁹ Office of the Premier, "U-Pass BC to save students on transit fares", Ministry of Transportation and Infrastructure, June 9, 2010

⁸⁰ The UTSP is a Transport Canada initiative that helped to provide financial support to transportation strategies that reduce GHG emissions.

Analysis of these past TDM initiatives has indicated some success. A study by Graham Senft⁸¹ indicates that the U-Pass had immediate success at UBC. Data used by Senft indicates that by December of 2003, SOV traffic had been reduced by 9% from 2002 levels and there was an increase of 51% in transit trips made in Fall 2003 than in Fall 2002. However, walking and cycling trips also decreased by 27% and 5% respectively over that period. This is important to keep in mind when evaluating the program because it may not be completely in keeping with the goals of sustainability to discourage those modes.

The TravelSmart pilot project also appeared to be successful in encouraging people to reduce their car travel. This success is indicated by survey data gathered by TransLink, which shows an increase in the number of trips taken by sustainable modes (see Table 2 for survey results). However, it is difficult to conclude whether this increase was due to residents shifting modes to transit, walking, and cycling or due to an increase in the number of overall trips taken.

⁸¹ Graham Senft, U-pass at the University of British Columbia: Lessons for Effective Demand Management in the Campus Context, 2005 Annual Conference of the Transportation Association of Canada, Calgary, 2005

Table 2: Change in Trips Taken By Mode Over the Duration of the TravelSmart Pilot Project⁸²

Neighbourhood	Travel Mode				
	Walk	Bike	Auto Driver	Auto Passenger	Transit
Kitsilano	3%	9%	-13%	8%	5%
Richmond	14%	85%	-6%	1%	35%
Burnaby	14%	85%	-6%	1%	35%
South Surrey	28%	66%	-7%	0%	17%
Coquitlam	8%	n/a	-3%	-1%	14%
Tsawwassen	6%	54%	-11%	12%	2%
Control Group	4%	8%	-1%	-5%	1%

A ‘before’ survey was launched in September 2005 and an ‘after’ survey was launched in September 2006. Data collected during the TravelSmart pilot project suggests there is potential effectiveness in providing travel information for influencing the mode of transportation used for trips.

This is not to say that Vancouver relies exclusively on TDM as a transportation strategy. There has also been significant funding put into the construction of new infrastructure. A new rapid transit line, the Canada Line, and a major cycling and walking route, the Central Valley Greenway⁸³, were recently completed in 2009. As well, new technology has been investigated in the transportation system including new bus technology like buses that run on biofuel or compressed natural gas. There has also been experimentation with electric

⁸² Taken from TransLink, “TravelSmart Pilot Project”, TransLink, <<http://www.translink.ca/en/Plans-and-Projects/Urban-Showcase/Travel-Smart-Pilot-Project.aspx>>. Note that no data was available for ‘motorcycle’.

⁸³ The Central Valley Greenway is a 24 km route linking Vancouver, Burnaby, and New Westminster.

and hydrogen powered automobiles. However, it is important to note that there has also been expansion in highway capacity in the region from projects like the Gateway Program⁸⁴, which may work against the effectiveness of TDM.

While Vancouver has a history of implementing TDM programs, it is hard to say that they are necessarily a leader in TDM but it does appear they have been keeping up with the growing use of initiatives in North America. This is because the initiatives described above had been implemented in many areas prior to Vancouver. For example, a U-Pass program was initiated at the University of Washington in September 1991. That program was also successful by decreasing vehicle trips to campus by 16% and increasing transit ridership by 35%⁸⁵. As well, the City of Portland implemented two two-year TravelSmart pilot programs – one in 2002 and a larger one in 2005. These programs were successful in producing a 12% reduction in vehicle miles travelled, 9% decrease in car travel, and 8% increase in walking, cycling, and transit in the targeted neighbourhoods⁸⁶.

As well, TDM strategies appear to be commonly utilized in municipalities across Canada. For example, in 2002, Calgary was the first municipality to offer a regional rideshare program in Canada and the Waterloo region in Ontario has implemented a 'You Can Clear the Air' program that adds curriculum to grade 3

⁸⁴ The Gateway Program is a provincial initiative that involves the construction and expansion of a number of highways in the region.

⁸⁵ M.E. Williams and K.L. Petrait, "U-Pass: A model transportation management program that works", Transportation Research Record, 1404, (1993) 73-81

⁸⁶ Transport Canada, "Targeted marketing and outreach", Transport Canada, <<http://www.tc.gc.ca/eng/programs/environment-utsp-tdm-prj49e-953.htm>>

students that provides education on transportation choices and air quality issues. Many other examples are profiled in Transport Canada's TDM resource centre.

3.2.2 Planning for Episodic Events

The second type of transportation challenge linked to TDM is episodic events, which involve major and sudden disruptions to transportation systems. These disruptions can come from a variety of sources and can potentially cause entire cities to grind to a halt. Episodic events can affect travel demand such as during a special event where large numbers of people travel to one location in the same time period. Travel supply can also be affected such as during a disaster where portions of a transportation system are damaged or destroyed. Either way, the balance between travel demand and supply are brought out of balance and this can cause ramifications for residents and the city as a whole.

TDM has been suggested as a solution to help bring the demand and supply of travel back into line thereby helping to minimize interruptions and mitigate the negative impacts of disruptions on the city.

Energy Crisis

A study by Robert B. Noland et al⁸⁷ suggests that major oil disruptions that affect the mobility of residents could be one transportation challenge that TDM may be suited for as a transportation strategy. Geopolitical situations, natural disasters, and coordinated terrorist attacks on critical energy infrastructure are

⁸⁷ Robert B. Noland, William A. Cowart, and Lewis M. Folton, "Travel demand policies for saving oil during a supply emergency", *Energy Policy*, 34 (2006) 2994-3005

some of the potential sources for oil disruptions. Noland et al.⁸⁸ suggest that TDM is one strategy that could be employed during an oil disruption to reduce travel demand, which would in turn reduce the demand for fuel. The authors state that during a crisis, some TDM strategies might be suitable for offering customers more flexibility which could result in less economic hardship compared to alternative strategies such as mandatory fuel rationing. The potential disruptions for Metro Vancouver can be exemplified by its large modal share for private car use (see section 2.2 for modal share).

Another potential energy crisis could involve electric power outages. While this has not been studied extensively⁸⁹, it is important to point out that traffic signals and street lights are powered by electricity as well as other vital parts of the transportation system such as gasoline pumps, electric trolley buses, and rail systems. As demonstrated by experience in the recent past, electric power outages could have significant ramifications on transportation. For example, coverage by the local media of the power outage in downtown Vancouver on August 26th, 2006 noted that “just before 5 p.m., eastbound traffic on Georgia Street was at a near standstill as far back as Jervis Street” and “at Hornby and Georgia streets, many vehicles ignored the temporary stop signs as cars darted into the intersection from all directions. Pedestrians huddled together for safety as they crossed the road.”⁹⁰ A longer power outage occurred on the

⁸⁸ Ibid.

⁸⁹ There appears to be some research that examines the vulnerability of the North American electric grid system (for example see Reka Albert, Istvan Albert, and Gary L. Nakarado, “Structural vulnerability of the North American power grid”, *Physical Review E*, 69.2, (2004) 025103) but limited research on its implications for transportation.

⁹⁰ Vancouver Sun, “Power outage causes chaos downtown”, *Vancouver Sun*, Aug 26th, 2006

morning of July 14th, 2008 and it took approximately 3 days before power was fully restored to customers⁹¹. A study of the impact of this power outage on businesses indicated that employees had difficulty getting to work, there was difficulty in getting deliveries, and businesses experienced reductions in the number of customers⁹².

Natural and Human Disasters

Natural disasters such as earthquakes can cause major disruptions to travel and severe damage to a city or region's transportation infrastructure. For example, during the 1994 Northridge earthquake in Los Angeles, severe damage was done to 4 major freeways and parts of arterial networks⁹³. Human disasters can include transit strikes and the collapse of transportation infrastructure from criminal or accidental means. Transportation systems could fall victim to terrorist attacks such as the July 7th, 2005 attack that occurred on London's Underground Tube system. Accidents could also affect the mobility of commuters. For example, in September 2006, a portion of the Papineau-Leblanc Bridge in Laval, suddenly collapsed affecting the commuters in the 57,000 cars that cross the

⁹¹ BC Hydro, "Press Release: Report released on downtown Vancouver power outage", BC Hydro, Sept 29, 2008, <http://www.bchydro.com/news/articles/press_releases/2008/report_released_on.html>

⁹² Study and results from Rajan Dhariwal, "Downtown Vancouver Blackout 2008: Assessing Disruptions to Businesses", UBC Centre for Human Settlements, March 16th, 2010

⁹³ Genevieve Giuliano and Jacqueline Golob, "Impacts of the Northridge earthquake on transit and highway use", Journal of Transportation and Statistics, 1.2, (1998) 1-20

bridge daily⁹⁴. These examples illustrate the potentially disruptive effect that a single event can have on the mobility of commuters.

For these types of disruptions, Transport Canada⁹⁵ suggests that TDM strategies can be used to help minimize interruptions to travel and other effects. According to Transport Canada, “communities that have well-established TDM programs can often cope better with such disruptions because transportation alternatives are already in place.”⁹⁶ Specific benefits regarding the use of TDM strategies can include contributing significantly to getting employees to and from work safely and maintaining economic viability and community cohesion following a disaster. TDM is especially important given that immediate infrastructure improvements or repair can be unrealistic and unfeasible in post-disaster situations.

In Vancouver, the risk and ramifications of an earthquake are described by Karthick Pathman⁹⁷ who states that “over the next 10 years, research suggests that there is a 2.5% probability that a structurally damaging earthquake could strike Metro Vancouver. Over the next 50 and 100 years, this probability increases to 12% and 22%, respectively”⁹⁸. This risk is due to the tectonic setting of Vancouver, which is located near the boundary between the oceanic plate of Juan de Fuca and the North American plate.

⁹⁴ Transport Canada, “TDM strategies during transportation disruptions and episodic events”, Transport Canada, 2010, <<http://www.tc.gc.ca/eng/programs/environment-utsp-casestudy-cs75etdmstrategies-890.htm>>

⁹⁵ Ibid.

⁹⁶ Ibid.

⁹⁷ Karthick Pathman, Urban change and transportation vulnerability to earthquakes: the case of metro Vancouver, Masters thesis, University of British Columbia, Vancouver, 2010

⁹⁸ Ibid., pg. 1 Pathman cites research by Onur and Seemann, 2004

The ramifications of damage to Metro Vancouver bridges is described by Pathman who points out that because of Metro Vancouver's unique geography, the region relies on a suite of bridges. This is especially true with downtown Vancouver, which is served by four bridges. Pathman also makes the point that earthquakes can cause damage to public transit infrastructure. In Vancouver, this infrastructure would consist of SkyTrain guideways and stations, many of which are elevated, as well as the SkyBridge, which is a bridge for SkyTrain that spans the Fraser River. Moreover, Vancouver's trolley bus fleet, which has been described as the "backbone of transit service in Vancouver"⁹⁹ as trolleys serve on some of the busiest routes in Vancouver, could be affected as the trolley wires that support Vancouver's trolley bus fleet could be at risk.

As well, accidents have occurred in the past on vital transportation infrastructure. For example, a fire in 2009 on the Pattullo Bridge, which connects New Westminster and Surrey in the Metro Vancouver region and is used by 80,000 users a day, caused the closure of the bridge for a week for repairs¹⁰⁰. TDM was one strategy used to mitigate the impacts of the bridge closure. Commuters were encouraged to use transit with extra transit service being provided and temporary park and rides being set up. Commuters were also encouraged to telecommute if possible and to rideshare.

⁹⁹ Harold Munro, "Replace old trolley buses, officials say: They recommend replacing Vancouver's fleet of 244 by 2006, at a cost of more than \$300 million", Vancouver Sun, Jun 16, 2000

¹⁰⁰ Vancouver Sun, "Pattullo Bridge Closed", Vancouver Sun, Jan 19, 2009

Special Events

As exemplified by the use of TDM strategies during the 2010 Olympics, TDM also appears to have applications for addressing the transportation challenges associated with hosting special events. Derek Robbins et al¹⁰¹ outline the challenges and importance that transportation plays in the hosting of events. They state that transportation plays a key role in events because for an event to be successful, it is essential that participants and customers be able to travel to and from the event. However, the addition of these participants and out of town visitors attending the event can increase the demand for travel. Robbins et al. describe this demand as heavily constrained in both space and time because visitors share common locations and very similar optimal times of travel. Thus, the impacts of this transportation demand created by a special event are profound and cities need to provide the additional capacity to meet the demand. Failure to do so could lead to high levels of congestion and overcrowding. Solutions may come from the construction of additional infrastructure but may also come from the use of TDM strategies.

The use of TDM has been suggested as a solution to the problems posed by special events. As outlined by Todd Litman¹⁰², TDM can be used to reduce traffic and parking problems, improve safety and security, reduce stress, and improve transportation options particularly for non-drivers. Litman makes this point by providing an example that illustrates how the same number of

¹⁰¹ Derek Robbins, Janet Dickinson, and Steven Calver, "Planning transport for special events: A conceptual framework and future agenda for research", *International Journal of Tourism*, 9, (2009) 303-314

¹⁰² Todd Litman, "Special Event Transport Management", Victoria Transport Policy Institute, 2010 <<http://www.vtpi.org/tdm/tdm48.htm>>

participants arriving at a sports stadium by bus will only need a fifth of the parking area and a sixth of the time to fill and empty the parking lot compared to a situation where all participants arrived by automobile.

Being an international city, the relevance for Vancouver of having to deal with the challenges of hosting large events is high. Vancouver does play host to events on a regular basis such as sporting events involving local sports teams like the BC Lions and Vancouver Canucks. Vancouver also hosts a variety of large annual events like the Celebration of Light fireworks show. As well, in the past, Vancouver has hosted major events like the World Expo and the Molson Indy. TDM strategies have been used during some of these events. Strategies included closing down roads to vehicles and encouraging residents to purchase transit fares in advance.

3.2.3 State of Research on TDM Strategies

Although research on TDM strategies has been an interest for many decades, researchers have suggested that there still exist a number of research gaps. Articles by Sara J. Hendricks and Nevine Labib Georggi¹⁰³ and Jochen Richter et al.¹⁰⁴ suggest a need to better understand the factors that contribute to the effectiveness of TDM strategies. Specifically, there is the need to understand how successful TDM programs can be duplicated. As well Hendricks and Georggi suggest the need to collect baseline information about prior commuting

¹⁰³ Sara J. Hendricks and Nevine Labib Georggi, "Documented Impact of Transportation Demand Management Programs Through the Case Study Method", Journal of Public Transportation, 10.4, (2007) 79-98

¹⁰⁴ Jochen Richter, Margareta Friman, and Tommy Gärling, "Review of Evaluations of Soft Transport Policy Measures", Transportation: Theory and Application, 2.1, (2010) 5-18

characteristics. This is important so that travel behaviour can be compared after the implementation of the TDM program.

Furthermore, the study prepared for the National Cooperative Highway Research Program¹⁰⁵ suggests that one of the topic areas where information is particularly lacking and most needed is understanding the impacts of non-work TDM programs. Philip L. Winters¹⁰⁶ makes a similar assertion as he notes that research has been focused on forecasting commuter changes at the employer level. He suggests for future research the value of looking at impacts from a larger scale.

In addition, I have noticed that it appears much research conducted on TDM has been focused in the United States and has tended to concentrate on only a few select strategies such as ridesharing, HOV lanes, and tolling. While Vancouver's OTP incorporates some of these TDM elements, there is little research that focuses on Canadian cities and that has looked at the other TDM components of the OTP such as closing down roads to traffic, creating pedestrian corridors, and providing improved communications.

As well, despite the potentially important role that TDM could play in addressing transportation challenges brought on by episodic events, many researchers have noted the very fragmented nature of research. Noland et al.¹⁰⁷ point out that the TDM literature has focused on estimating effects of strategies

¹⁰⁵ Cambridge Systematics Inc., Evaluate the interactions

¹⁰⁶ Philip L. Winters, "Transportation Demand Management", Transportation Research Board, (2000), Available: <<http://www.trb.org/publications/millennium/00123.pdf>>

¹⁰⁷ Noland, "Travel demand policies"

under normal conditions and not under disruptive conditions. Yet, the effects of TDM strategies might be different under disruptive conditions.

Furthermore, despite the key role that transportation plays in the successful staging of special events, Robbins et al.¹⁰⁸ argue that transportation has not emerged as a core focus in event management literature. One of the reasons for this is that there is more impetus for organizers and funding agencies to fund predictive economic impact studies to help justify the event rather than focus on potentially negative transportation issues. Perhaps for this reason, there has been a lack of funding for research into transportation during special events. Moreover, Robbins et al. note that most studies conducted do little to advance conceptual knowledge and have limited application beyond the event itself.

This fragmented state of research is one of the reasons why Robbins et al. gear the purpose of their research towards informing future research directions. They argue that much might be accomplished by quantitative surveys or structured observations. Research could map out critical issues related to event typology where different events attract different profiles of visitors and event destination geography where location is a significant contributor to modal choice and local impact. However, this research should be supplemented with qualitative research to offer insight into the experience of travel during events.

¹⁰⁸ Robbins, "Planning transport for special events"

3.2.4 Applicability of Olympic Lessons

Before identifying the parallels that exist between the transportation challenges facing cities and those experienced during the 2010 Winter Olympics, it is important first to point out some key differences. One notable difference between the challenges of an energy crisis or a disaster and the challenges of the Olympics is the opportunity for planning ahead. There was much more information and time available for planners and residents ahead of the 2010 Olympics to properly plan and prepare for the challenges brought on by the event. In contrast, energy crises and disasters can hit suddenly and the location and magnitude of damage caused by these events can be unpredictable. Thus, I think the predictability of the situation could be an important factor in influencing the effectiveness of TDM and the types of strategies that could be implemented.

Another difference involves the time scale of change. The Olympics involves dealing with a sudden increase in travel demand from a large number of people travelling to and from the downtown. This surge can be contrasted to the gradual change in travel demand that occurs from the relatively slower growth of population and employment levels that planners address in the long term. These types of differences are key to understanding the limitations of lessons that can be learned from the Olympics.

While there are limitations, there also appear to be opportunities for lessons to be generated that are relevant and useful to planners. A consistent theme across the challenges noted in the literature review is that policy makers are placing an emphasis on promoting a modal shift towards more sustainable

modes of travel in order to make more efficient use of existing transportation infrastructure. Furthermore, one common feature of these challenges is a restriction in the amount of new infrastructure that could be built. Thus, it appears that the 2010 Olympics can produce conditions comparable in many respects to those of other transportation challenges facing cities.

3.3 Olympic Transportation

The relevance of examining Olympic transportation is argued by Genevieve Giuliano et al.¹⁰⁹ who state that the Olympic Games provide a unique opportunity to test the effectiveness of transportation management practices under extreme conditions. The reason is that extensive transportation strategies, especially TDM measures, are often implemented in the host cities of Olympic Games due to the high level of travel demand brought on by the Games and their festivities. Thus, Giuliano et al. state that valuable lessons about what worked and what did not can be generated from an Olympics transportation experience. These lessons can be important for helping inform future transportation policy decisions and answering the 'obvious' question of whether the strategies employed during the Olympics could be implemented on a more permanent level for addressing urban transportation problems.

A number of lessons have indeed been generated in the past from studying transportation during the Olympics. The evaluation of the 1984 Olympic

¹⁰⁹ Genevieve Giuliano, Kevin Habolon, Joseph Prashker, and Will Recker, Evaluation of 1984 Los Angeles Summer Olympics Traffic Management, Institute of Transportation Studies, University of California, (1987)

Summer Games in Los Angeles by Giuliano et al.¹¹⁰ noted the flexibility of residents who made a number of voluntary travel reductions. The experience also showed that a unique institutional environment was key to the success of the TDM program. For the 2000 Olympic Summer Games in Sydney, Hensher and Brewer state that the most powerful lesson was the “apparent willingness of individuals, under special circumstances, to use public transport and leave their cars at home”.¹¹¹ In reflecting on this lesson, the authors point out a lingering question of why people behave differently under the special circumstances experienced during the Olympics?

However, even though the Olympics provide an opportunity to examine transportation choices of residents, many studies that look at Olympic transportation do not directly examine the impacts of transportation strategies on residents and their everyday travel patterns. Rather, many studies have focused on the transportation behaviours of spectators and the Olympic family. This is noted in Hensher and Brewer’s study¹¹² where the authors were only able to examine people travelling to and from events but not residents travelling to and from work. As well, past studies appear to have focused mainly on assessing the changes of travel conditions on roads and freeways with relatively little attention paid to pedestrian and cycling conditions.

¹¹⁰ Genevieve Giuliano, “Transportation Demand Management: Promise or Panacea?”, Journal of the American Planning Association, 58.3, (1992) 327-335

¹¹¹ David A. Hensher and Ann M. Brewer, “Going for Gold at the Sydney Olympics: how did transport perform?”, Transport Reviews, 22.4, (2002) 381-399, 393

¹¹² Ibid.

This gap in research may be due to the reasons noted earlier by Robbins et al.¹¹³ regarding the lack of funding available for these studies. As a consequence, Hensher and Brewer note, “There is often little recorded of strategic value with a loss of corporate memory as the event fades away and officials move on.”¹¹⁴ Eva Kassens¹¹⁵ has also pointed out the lack of attention towards generating lessons from the Olympic experience. She notes in her paper that there is the potential to leverage knowledge of transportation operations during the Games. However, most cities leverage only physical changes and neglect operational ones. In fact, Kassens suggests that so far, only Sydney has reapplied its knowledge and experience gained from the staging of the Olympics, which it does for the Royal Easter show.

For the 2010 Games, the IOC has mandated the Olympic Games Impact study be conducted to monitor, measure, and report on the long term impact of hosting the Olympic Games. The results of the study will be used by the IOC to make future Games more sustainable. Transportation is one area that is covered in this study. However, while this study is useful for assessing the sustainability of the Games, it does not focus on assessing the actual transportation strategies used during the Games or directly informs future transportation planning in the host cities after the Games.

¹¹³ Robbins, “Planning transport for special events”

¹¹⁴ Hensher, “Going for Gold”, 381

¹¹⁵ Eva Kassens, Transportation Planning for Mega-Events: A model for urban change, PhD. Thesis, Massachusetts Institute of Technology, 2009

4: METHODOLOGY

4.1 Research Design

Past research on TDM and Olympic transportation was used to provide insight into the research design of this project. The importance of pre-planning is emphasized in one framework¹¹⁶ as being an important step to generating credible and reliable findings. This framework was developed for assessing the economic impacts of special events but is generic enough to be applied to this research. It suggests that researchers should obtain as much information as possible before the event about likely impacts and about available data. It advises that during this stage, researchers should make predictions and identify respondent groups.

In terms of analyzing the transportation experience, Hensher and Brewer's study¹¹⁷ on transportation during the Sydney Olympic Games provides a useful framework for developing a comprehensive analysis. They looked at each mode of transportation separately; from buses and trains to taxis and airports. As well, they structured their analysis by first determining expectations regarding travel on each mode of transportation and then documenting and comparing the Olympic experience with expectations. This structure is useful in helping to understand the Olympic transportation experience and its overall success.

¹¹⁶ UK Sport, "The Economic Impact of Major Events", Staging Major Events: The Guide, UK Sport, 2005

¹¹⁷ Hensher, "Going for Gold"

Hensher and Brewer¹¹⁸ also employed a mixed methods approach to produce a comprehensive picture of the Olympics experience, which is also a goal for this research project. Media reports were used to gain broad coverage of transportation events. Interviews were used as a source of more detailed information and quantitative data was gathered to provide empirical evidence. Data collected by public authorities and organizations were used heavily by Hensher and Brewer as well as previous studies on Olympic transportation. Similar to past studies, the public sector was relied upon for data in this project.

4.2 Pre-Planning

Approximately six months prior to the Olympics, I contacted various organizations and agencies to determine the availability of data for this study. A number of potential sources for data relating to travel behaviour and travel conditions were identified including questionnaires conducted by TransLink; traffic, bus, pedestrian, and cyclist counts collected by the City of Vancouver; and accident rates produced by the Insurance Corporation of British Columbia (ICBC).

This initial contact was useful for two reasons. It helped firstly to identify the amount of data that could be available for this research and in doing so, suggested that there might be a lack of data describing transit conditions. Given the important role that transit has played in previous Olympic Games and the role it was expected to play in Vancouver, I decided to also make some structured observations about transit during the Olympics. Secondly, the initial contact was

¹¹⁸ Ibid.

useful for identifying potential interviewees who provided valuable insight for this study.

In addition, I scanned local media reports for potential data sources, statements made by commentators, and potential problems that were raised in respect to travel conditions. One item that I found to be significant was the concern expressed in a CBC News report¹¹⁹ over the potential increase in accidents in downtown Vancouver during the Olympics. This prompted my attention to accident rates.

Using the guidance provided from the literature review and the knowledge of the potential data that might be available, I developed a detailed methodology for data collection and analysis.

4.3 Data Sources

4.3.1 Media Reports

The local media represented a valuable source for information. I examined and analyzed media reports for data such as surveys, interview responses, observations, expectations over changes to travel conditions during the Olympics, and details of any major transportation incidents during the Olympics such as major traffic delays and bomb threats. Media outlets that were chosen included two major local newspapers: the *Province* and the *Vancouver Sun*. I also examined news reports from News1130, an official broadcaster of the 2010 Games, and CBC News. In addition, media from the City of Vancouver and

¹¹⁹ CBC News, "Olympics could boost insurance costs," CBC, Sept 30th, 2009. The estimates presented in the report indicate a possible increase in accident rates of 30%.

TransLink were gathered which included information, releases, and links made available from the websites, blogs, and twitter accounts associated with those organizations. These media sources also provided links to blogs and online posts made by various commentators including those of Brent Toderian, Director of Planning at the City of Vancouver; Jarrett Walker, an international consultant in public transit network design and policy; John Calimente, who writes the TransitFan column for re:place Magazine; and Frances Bula, a journalist specializing in urban issues in the Vancouver region.

Findings from media reports served a number of purposes. Firstly, they provided details about transportation plans and initiatives that were implemented during the Olympics such as details of road closures. These reports also helped to establish expectations for travelling during the Olympics and provided a source for projections and targets related to Olympic transportation. Secondly, these media reports were instrumental in providing information about what travelling during the Olympics was actually like including delays that commuters might have faced and changes to the general travel conditions in the downtown. Lastly, media reports aided in assessing the resulting transportation experience by providing valuable viewpoints on the experience and about potential transportation lessons for Vancouver.

4.3.2 Travel Survey

Two online surveys sent out by TransLink provided data on mode share and reductions of trips during the Olympics from residents in Metro Vancouver. These surveys were sent out to TransLink Listens participants who are a group of

residents that have signed up to take TransLink's online surveys¹²⁰. One important issue about this data source is that it may not be as representative of Metro Vancouver residents as other sources such as a telephone survey¹²¹. Typically, it appears that those who answer TransLink's online surveys are more aware of transportation issues and more amenable to taking transit. Thus, caution should be exercised when interpreting and projecting the findings onto the general population. Summaries of findings from these surveys were made available to TransLink Listens participants¹²².

The first survey was completed from October 27th to November 1st, 2009¹²³. This survey collected data on people's expectations and plans in relation to travelling during the Olympics. The second survey was completed from March 15th to March 22nd, 2010¹²⁴. This survey collected data on people's travel experience in Metro Vancouver during the Olympics. Findings from these two surveys provided useful quantitative data, which I used to gain an understanding of the travel experience of residents during the Olympics and to evaluate the overall Olympic downtown transportation experience.

4.3.3 Data Describing Driving Conditions

Traffic counts for downtown Vancouver were collected by the City of Vancouver, which helped to provide an idea of the changes in traffic volumes and

¹²⁰ An incentive of being entered into a draw for cash prizes is provided.

¹²¹ This issue is noted among findings released from TransLink Listens surveys.

¹²² The author is a participant in the TransLink Listens panel and thus able to access the findings.

¹²³ Synovate, TransLink Olympic Travel Survey – Final, (TransLink, 2009)

¹²⁴ NRG Research, Transit Service Quality During the Olympics, (TransLink, 2010)

traffic congestion levels that occurred in the downtown. Statistics on traffic accidents during the Olympics in the downtown were also released by ICBC.

4.3.4 Data Describing Transit Conditions

With the use of automatic passenger counters, TransLink collected data on the number of riders that boarded buses and SkyTrain. To aid in the interpretation of changes to transit use, I made structured observations about travel conditions on SkyTrain. These observations were made during the AM peak and PM peak periods of two Wednesdays in October 2009. I observed passengers and trains heading towards downtown Vancouver from platform 3 at Commercial-Broadway SkyTrain station and passenger and trains heading out of downtown Vancouver from platform 2 at Waterfront SkyTrain station. These stations were chosen because they were identified as being the busiest stations during the AM and PM peak periods respectively¹²⁵.

The goal of my observations was to provide a snapshot of the travel conditions faced by transit users who took SkyTrain into and out of the downtown. In attempting to establish baseline conditions, I was able to stand on the platforms of the two stations where I collected data on the type of train that arrived at the station to determine changes in capacity; the time of arrival, which I used to determine the frequency of trains; and the presence of line-ups outside of the platform, which were used to get a rough idea of the wait times that a transit user might have faced.

¹²⁵ City of Vancouver, "Central Waterfront Hub: Transit", (City of Vancouver) Available: <http://vancouver.ca/commsvcs/currentplanning/whitecaps/pdf/Board3_Transportation%20sm.pdf>

During the Olympic period, I was not able to get permission to be on the platform due to security reasons. Thus, I had to slightly alter my observation strategy but I was still able to collect enough data to provide satisfactory results. On the first Wednesday of the Olympic period, I stood outside Commercial-Broadway station in a location where I could clearly see the trains leaving the station for downtown Vancouver during the AM peak and trains arriving to the station from downtown Vancouver during the PM peak. I was able to note the type of trains being operated and the frequency of service. I made adjustments to the times that I noted down so that they reflected the times that the trains would have left Commercial-Broadway station during the AM peak period and Waterfront station during the PM peak period.

To determine whether commuters had to face significant changes in wait times, I also rode SkyTrain during the second Wednesday of the Olympic period. I took the SkyTrain from Commercial-Broadway station to Main Street station and then back again over the course of the AM peak period. Similarly, I took the SkyTrain from Waterfront station to Burrard Station over the course of the PM peak period. During these times, I made notes regarding the presence of line-ups, the times that trains arrived, and difficulty of boarding trains. In addition, I made general observations about the presence of crowd control.

4.3.5 Data Describing Walking and Cycling Conditions

The City of Vancouver collected pedestrian and cycling counts, which provided information about changes to the volume of pedestrians and cyclists downtown. As well, I made structured observations during the Olympics about

the pedestrian and cycling environments. I took note of changes that were made to the public realm, which was mentioned in the OTP. To do this, I walked along the four Olympic pedestrian corridors and listed the amenities that were located on each block of the corridors in January and again during the Olympics. These amenities included signage, wayfinding, street furniture, and public art.

4.3.6 Interviews with Experts

After completing a large portion of my Olympic data collection and analysis, I was able to get a good sense of what occurred during the Olympics. This was the time when I began contacting planners and experts. Getting their input and opinions was valuable for helping to get a comprehensive perspective on the transportation issues raised in the project. They were also able to speak about some items that were not featured in the media and provided stories about the process of developing and implementing the OTP.

In total, six experts were interviewed. The interviewees were Mike Madill who is Vice President of Olympic Transportation at TransLink and was responsible for assembling the team at TransLink for the Olympics; JoAnn Woodhall who is a Transportation Demand Management Officer at TransLink and chaired the working group that created the Olympic Transportation Plan; Dale Bracewell, who is the Director of Olympic Transportation at the City of Vancouver and spent approximately 4 years working on the Olympic Transportation Plan; Kevin Wallinger, who is Director of Emergency Management at the City of Vancouver and previously worked with the provincial Integrated Public Safety Unit; Charles Gauthier, who is Executive Director of the Downtown Vancouver

Business Improvement Association; and Clark Lim, who is Manager of Data and Methodology for the Olympics Games Impact research team at the University of British Columbia and previously had roles at what is now Metro Vancouver and TransLink.

Through semi-structured interviews, I was able to seek their individual expert views on evaluating the outcome of the Olympic downtown transportation experience and the OTP itself. As well, I sought their opinions on what they thought worked well and did not work as well during the Olympics. Furthermore, I attempted to get their views on the parallels they saw between the challenges experienced during the Olympics and the challenges identified in the literature review.

Then, I attempted to get their views on what they thought would be some possible transportation lessons that can be taken away from the Olympic experience. Lastly, I attempted to obtain their advice on how future host cities could leverage mega-events to generate relevant transportation lessons for their localities. This involved asking about their satisfaction with the data and information that has been collected in Vancouver.

5: OLYMPIC TRANSPORTATION ANALYSIS

5.1 Pre-Olympic Expectations, Issues, and Targets

Public reaction to the OTP and public expectations regarding travel during the Olympics were summed up in the media by one word: gridlock. Major traffic disruptions and gridlock conditions appeared to be the primary theme of reports from the local media. For example, one report on the closing of the Cambie Street bridge for the opening and closing ceremonies of the Olympics began with the exclamation, “Let the gridlock begin!”¹²⁶ These reports suggested that an influx of tourists, media, and officials would bring 30% more vehicles onto downtown streets¹²⁷. As noted in the media, one implication was that buses would struggle¹²⁸. As well, experts contacted by one media outlet projected that traffic accidents would rise by 30% during the Olympics in the downtown¹²⁹.

The target set in the OTP was to achieve “a minimum 30 percent reduction in vehicle traffic”¹³⁰ in the downtown. Leading up to the start of the Olympics, the prospect of achieving this target appeared bleak. A series of pre-Games trial runs took place for four weeks in January 2010. For the first week, the City of Vancouver set a goal for a 5% reduction in vehicle use but results indicated only a 2.5% reduction was achieved. For the second week, a 10% goal was set but

¹²⁶ Damian Inwood, “Expect bridge closures on Cambie St. in Feb., March”, The Province, Jan 13, 2010

¹²⁷ Kelly Sinoski, “Drivers alerted as viaducts set to close”, Vancouver Sun, Feb 3, 2010

¹²⁸ The Province, “Tip to avoid the all-day rush hour”, The Province, Feb 10, 2010

¹²⁹ CBC News, “Olympics could boost insurance costs”

¹³⁰ VANOC, Fact Sheet

only a 4% reduction was achieved. In the final week, the City aimed for a 20% reduction but only a 4% reduction in vehicle use was achieved¹³¹. There was also media attention given to drivers who were taking chances in restricted Olympic lanes despite potential fines.

During the Games, transit ridership was projected to increase by 33% from 750,000 riders daily to 1 million riders¹³². Early reports from TransLink suggested that commuters could face high wait times of two to three hours during peak periods. This projection was later revised to be only one hour. Expectations from TransLink were that transit use would be heavy but smooth.

In the months leading up to the Games, media reports suggested that there was confusion among some spectators over transit service during the Olympics including routes and service hours. There was also some confusion regarding SkyTrain station closures due to incorrect information circulating that King George SkyTrain station and Stadium-Chinatown SkyTrain station would be closed during the Games. In response, TransLink had to make it clear that those stations would indeed stay open.

While the goal of gradually reducing vehicle use prior to the Games was not achieved, there were some encouraging signs. There were indeed more people using transit and more pedestrians and cyclists were counted crossing the Burrard, Granville, and Cambie bridges. Nevertheless, a mass exodus of Vancouverites was still expected due to concerns over gridlock conditions during

¹³¹ Sinoski, "Drivers alerted"

¹³² VANOC, Fact Sheet

the Olympics. One survey indicated that approximately 12% of people in Metro Vancouver were planning to leave the region for either all or some parts of the Games period¹³³. Moreover, travel agents stated that there was a 30% jump in the number of trips booked during the month of February¹³⁴. Reasons for this were linked to reports about traffic tie-ups and chaos during the Olympics and the incentive to rent homes to Olympic visitors.

The travel survey conducted by TransLink in late-October¹³⁵ revealed that 83% of respondents thought that it would be 'somewhat difficult' or 'very difficult' to get around downtown Vancouver during the Olympics. This was mostly because of road closures (43%) and crowds (31%). However, responses suggested that 55% of SOV downtown trips during the weekday would be changed for the Olympics. 6% of those trips would be eliminated because respondents would work from home and 13% would simply be eliminated. The rest would switch to alternative modes including transit, walking, cycling, and carpooling.

5.2 Olympic Downtown Transportation Experience

5.2.1 Transportation Initiatives

Many details of transportation initiatives were revealed after the release of the OTP. As part of their effort to help businesses prepare for the Olympics, the OPTT and organizations like the DVBIA created various documents such as

¹³³ Mustel poll in Jim Goddard, "Poll: Twelve per cent of people in Greater Vancouver planning to leave town during Olympics", News1130, Jan 19, 2010

¹³⁴ The Province, "Lots of Vancouverites making plans to escape Winter Olympics", The Province, Nov 5, 2009

¹³⁵ Synovate, TransLink Olympic Travel Survey

checklists that helped to encourage and support changes to travel behaviour. These changes include using sustainable modes of transportation and modifying work hours to avoid peak travel times. Also, businesses that committed to the TravelSmart Olympic Pledge to help reduce vehicle traffic were entered into a weekly draw for two packages of 50 tickets to the Victory Ceremonies as an incentive. By January, over 200 companies had signed up¹³⁶. It was also revealed that the disincentive for disobeying Olympic lanes was a fine of \$121 and 2 demerit points. For stopping or parking in the lanes, drivers received \$100 fines and an automatic tow¹³⁷.

During the Olympics, a special train was operated between Waterfront and Commercial-Broadway SkyTrain stations to ease loads on the system¹³⁸. There was also an extra bus being operated between Denman and Davie to Pacific Boulevard¹³⁹. Efforts were made to keep transit users entertained and comfortable over the Olympic period. Free hot chocolate and water were being given out at select SkyTrain stations by the Salvation Army. As well, additional buskers were employed by TransLink to play music at SkyTrain stations. To improve communication, changes to announcements on the SkyTrain network were made with transit service hours of SkyTrain and venues nearby SkyTrain stations also being announced. Lastly, there were transit hosts stationed in and

¹³⁶ Sheila Scott, "VANOC TravelSmart Challenge hopes to reduce traffic leading up to Olympics", News1130, Jan 6, 2010

¹³⁷ Cheryl Rossi, "Tow trucks report no Games increase", Vancouver Courier, Feb 10, 2010

¹³⁸ Kelly Sinoski, "Record weekend expected for transit as Vancouver Olympic fever deepens", Vancouver Sun, Feb 20, 2010

¹³⁹ Jhenifer Pabillano, "New reroutes for the 5, 6, and N6 during the Olympics", The Buzzer Blog, Feb 16, 2010, <<http://buzzer.translink.ca/index.php/2010/02/new-reroutes-for-the-5-6-and-n6-during-the-olympics/>>

around all SkyTrain stations in the downtown to provide assistance and direct crowds.

While Canada Place Way was closed to vehicles during the Olympics, pedestrians were not excluded from the street. Free bike valet services were set up near LiveCity sites and Olympic venues to encourage people to use their bikes. By storing their bikes at the valet, people would not have to worry about their bikes being stolen. However, bikes were not allowed onboard SkyTrain during the Olympic period.

5.2.2 Driving Experiences

In comparison to the pre-Games expectations, many have described the Olympic travel experience as a success and not the commuter nightmare that was predicted. Evidence that the transportation plans were working came from many areas. First and foremost, the 30% reduction in vehicle traffic was achieved on the day of the opening ceremonies and appeared to have persisted throughout the Games. In the end, compared to the normal average morning weekday, traffic into the downtown was down by 35%¹⁴⁰. As well, for trips to and from the downtown, the average vehicle occupancy increased by 14%¹⁴¹.

In addition, there were no major traffic problems reported in the media. In contrast to gridlock conditions, it appeared that some drivers experienced near-congestion free conditions during their commutes. Numbers from ICBC suggest that accidents were not up by 30% but were actually down by 20% compared to

¹⁴⁰ VANOC, "2010 Olympic Transportation Plan a success", VANOC, Mar 3, 2010

¹⁴¹ Dale Bracewell, Host City Olympic Transportation Plan: A Sustainable Legacy for Vancouver, (Vancouver, Olympic Transportation Branch, 2010)

the same time last year¹⁴². This has been attributed to fewer people driving in the downtown and more people using transit.

5.2.3 Transit Experiences

Transit use was a big story during the Olympics. Over the 17 days, boardings on transit totalled more than 26 million¹⁴³. In terms of weekday transit use, a 31% increase was documented with an average of 1,579,185 weekday riders up from 1,205,438 (see Table 3 for a breakdown of these changes).

Table 3: Breakdown in Changes to Transit Ridership¹⁴⁴

Mode	Total Boardings (17 day)	Olympic Weekday Average	Percent change from normal weekday
Bus	13,938,000	896,000	8%
SeaBus	757,700	43,780	119%
Canada Line	3,880,950	228,190	118%
Expo and Millennium Lines	7,223,000	393,800	64%
West Coast Express	236,725	17,415	58%
HandyDART	57,175	4,590	10%
Total System	26,095,000	1,583,775	31%

Ridership data indicates there was a dramatic increase in transit use during the Olympics.

¹⁴² Alex Lyons, “Fewer ICBC claims than normal during Vancouver Winter Games”, [News1130](#), Mar 4, 2010

¹⁴³ TransLink, “TransLink tops 26 million riders”, [TransLink](#), Mar 23, 2010

¹⁴⁴ Ibid.

The length of queues for transit appeared to be uneven throughout the Games. It was noted that at times, line-ups started up suddenly as if from nowhere¹⁴⁵. However, most line-ups for the Expo and Millennium Lines, if there were any, were no more than 40 minutes long¹⁴⁶. For the Canada Line, Jason Chan, Manager of Communications for ProTrans BC¹⁴⁷ states that the average line-up for boarding a train averaged only 5 minutes and the longest wait was approximately 20 minutes. Regardless of the length, many have spoken about how orderly the line-ups were.

For some travellers, rush hours were surprisingly quiet. There have been descriptions of the conditions as being “dead” and “it was like normal”¹⁴⁸. My own observations were consistent with this view. Compared to my baseline observations, the Olympic experience did not appear to be any worse but if anything, lighter conditions were experienced by travellers. During my observations, there were no line-ups to get onto the Expo and Millennium Lines. Waterfront station, however, was a very crowded place. To deal with the crowds, TransLink used directed travellers to different entrances. Those wanting the West Coast Express or SeaBus were allowed through the main entrance of Waterfront station; those wanting the Expo and Millennium Lines were directed to the Howe Street entrance; and those wanting the Canada Line were directed to

¹⁴⁵ Lena Sin, “1:45 pm at Waterfront station”, The Province, Feb 21, 2010

¹⁴⁶ Stated by Doug Kelsey, CEO of BC Transit, in Kelly Sinoski, “TransLink takes stock after Olympics”, Vancouver Sun, Mar 1, 2010

¹⁴⁷ Jason Chan, “Delivering operations excellence”, 2010 APTA Rail Conference, Vancouver, Jun 6, 2010

ProTrans BC is the private operator for the Canada Line.

¹⁴⁸ Tiffany Crawford, “Transit runs smoothly despite influx of travellers on busiest Games day yet”, Vancouver Sun, Feb 17, 2010

the side entrance of Waterfront station (see Figure 5 for an illustration).

Volunteers and transit personnel were very active in directing commuters with megaphones and placards. A similar queue management plan was in place for Stadium-Chinatown SkyTrain station.

Figure 5: Queue Management Strategy for Waterfront Station¹⁴⁹



The queue management strategy at Waterfront station involved directing passengers to certain entrances based on the service they were taking. Similar strategies were implemented at other SkyTrain stations.

In terms of service changes, the goal was to have longer trains running at the same frequency as before. My observations confirm that this was achieved with trains running at similar headways¹⁵⁰ during the Olympics compared to baseline conditions. As well, the average load of each train during the morning

¹⁴⁹ Base map: © 2010 Google – Map data © 2010 Google, Sanborn

¹⁵⁰ Headways are a measurement of the time between transit vehicles.

peak of the Olympics was calculated to be 423 people compared to the combined average of 345 people from baseline observations. The load of the total trains over the AM peak hour during the Olympics was 15,220 people, which was up from 13,285 during the baseline observations. Similarly, the average load of trains during the Olympic PM peak hour was calculated to be 423 people compared to the combined average of 337 people from the baseline observations. The total load of the trains over the peak hour during the Olympics was 16,080 people, which was up from 11,450 during the baseline observations.

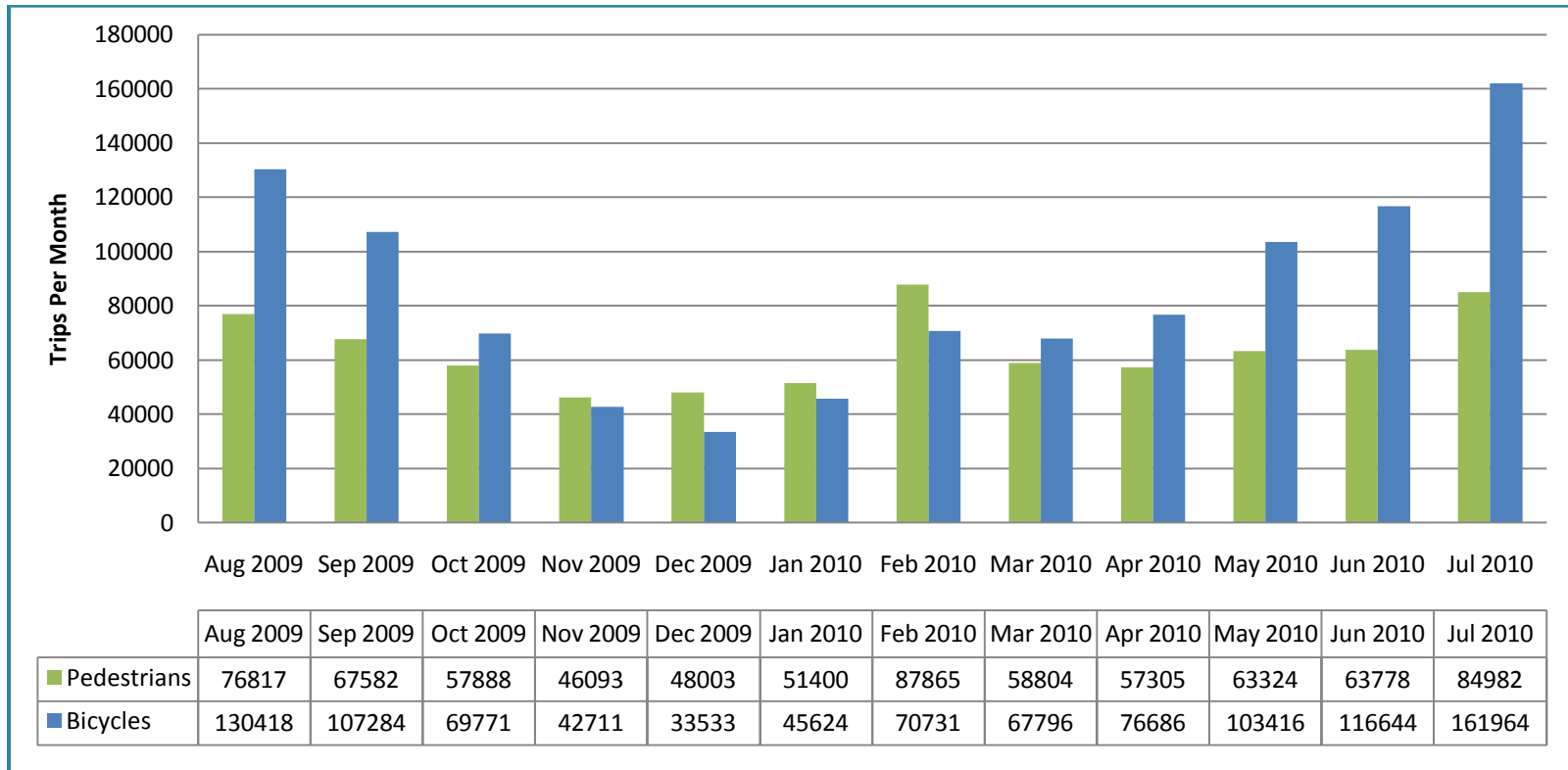
5.2.4 Walking and Cycling Experiences

Pedestrian and cyclist volumes were also up during the Olympics. An average of 3,669 pedestrians were counted going over the Burrard Bridge into and out of downtown Vancouver daily during the Games. This was 2,011 more than was counted in January. There was also an average of 2,696 cyclists who crossed the three bridges daily during the Olympics compared to 1,472 in January¹⁵¹ (see Figure 6 for graphical representations of these changes for the Burrard Bridge). Overall, it appeared that pedestrian volumes were exceeding summertime levels throughout the Games while cyclist levels saw a more modest increase. Screenline counts for walking and cycling across downtown also revealed an increase in trips per day from 20,000 in November 2009 to 65,000 during the Olympics¹⁵².

¹⁵¹ Data downloaded from City of Vancouver, "Burrard Bridge Statistics", City of Vancouver, <<http://vancouver.ca/projects/burrard/statistics.htm>>

¹⁵² Bracewell, Host City Olympic Transportation Plan

Figure 6: Burrard Bridge Monthly Pedestrian and Bicycle Volumes¹⁵³



Pedestrian and bicycle volumes on the Burrard Bridge increased with the former exceeding summertime levels during the Olympics.

¹⁵³ Data source: City of Vancouver, “Burrard Bridge Statistics”, City of Vancouver, 2010, <<http://vancouver.ca/projects/burrard/statistics.htm>>

Along Granville Street, new amenities were installed as the Granville Street Redesign project was completed at about the same time as the start of the Olympics. One of the goals of the project was to enhance the street for pedestrians and transit users. These enhancements included the addition of benches, bike racks, and streetlights. Temporary public art in the form of lighted totem poles, cut outs of athletes, and wooden trees were installed along one block of Granville Street. This appeared to be a very attractive installation. While I noticed a tendency of people to keep to the sidewalks of other pedestrian corridors and only use the middle of the street to cross from one side to another, the presence of public art along that block of Granville Street helped to attract people towards using the entire street. As well, I noticed many people were enjoying the interactive nature of the wooden trees with many people stomping and jumping along the wooden platforms to make noise.

Along the Robson Street corridor, there was one additional water fountain installed, six information kiosks, and one sign near BC Place Stadium pointing to SkyTrain. Along Beatty Street, there were two information kiosks and larger signs with directions to hotels, SkyTrain, BC Place Stadium, and Canada Hockey Place. Finally, along the Hamilton/Mainland corridor, two information kiosks and three bike valet signs were put up.

In addition to those changes, clear plastic bags for garbage were installed throughout the downtown and additional signs directing people to points of interest such as celebration sites and venues were installed. I counted 29 signs installed along the four pedestrian corridors. However, aside from bike valets,

there were no additional bike facilities. Signs at intersections appeared to have small fonts and information kiosks were not lit for viewing at night. Beyond Granville Street, there was no additional street furniture installed. As for bus shelters, they were occupied by families looking for a place to sit and some were occupied by pin traders who set up their pins on the benches.

Overall, the streets in the downtown were animated and full of energy. There were lines of people outside of pavilions throughout the downtown. There were also events and activities that took place on the streets themselves. These included videos that were projected onto walls, pin trading, ticket scalping, street performances, and live music.

6: ANALYSIS OF THE DOWNTOWN TRANSPORTATION EXPERIENCE

6.1 Post-Games Assessment

When compared to the expectations prior to the Games, the Olympic downtown transportation experience has been considered a success by many commentators. The gridlock and major traffic disruptions that were conceived of in local media reports were, for the most part, non-existent. Those who drove were said to have experienced lighter driving conditions. More importantly, the target for reducing vehicle traffic by a minimum of 30% was met. Those who took transit did not, for the most part, have to face hour-long waits. In fact, it appeared that people using transit during peak hours experienced lighter than usual conditions although line-ups did appear to be a slightly unpredictable at times. Transit use surged considerably and pedestrian and cyclist volumes increased with numbers reaching summertime levels for the former.

The positive assessment of the Olympics was expressed by planners and experts who I interviewed. Charles Gauthier, Executive Director of the DVBIA, stated that the Plan went “better than expected”. For example, he noted that transit was able to meet the extra travel demand from residents who were encouraged to make the switch to transit. As a result, large numbers of people were seen taking transit, walking, and cycling in the downtown during the Olympics. He also stated that generally, it appeared that people were not

inconvenienced during the Olympics and this resulted in positive media attention that also reflected well on the Olympic Games itself.

For Dale Bracewell, Director of Olympic Transportation at the City of Vancouver, this increase in transit, walking, and cycling trips was also a very important indicator of the success of the OTP. This is because although the target was to reduce vehicle volumes in the downtown by a minimum of 30%, which was exceeded with reductions of 35%, achieving that target would not have signalled a successful Olympic Games by itself. The reason is that the reduction in vehicles could have meant that people were avoiding trips to the downtown and this was not a goal of the OTP. Rather, the goal was to ensure that people who wanted to go downtown to enjoy the festivities, attend events, work, shop, or play would be able to do so.

This goal appeared to have been achieved with the dramatic rise of transit, walking, and cycling levels, which indicates that overall trips to the downtown went up considerably. These two changes, a reduction in vehicle traffic and an increase in overall trips, represented key signals of success to Dale Bracewell. Similarly, Mike Madill, Vice President of Olympic Transportation at TransLink, pointed out, “What made it successful was trying to make sure everyone got to where they needed to get to, when they needed to get to or before.”

Another factor that indicated success according to interviewees was feedback from the public about their overall transportation experience. This feedback was expressed in media outlets such as local news reports, which

lauded Vancouver's ability to ensure that residents, tourists, and members of the Olympic family were able to travel easily throughout the downtown¹⁵⁴. Members of the media visiting from Seattle and London also commended Vancouver for their positive transportation experience¹⁵⁵. As well, TransLink received awards at the annual Canadian Urban Transit Association conference for their role in providing exceptional transit service during the Olympics¹⁵⁶.

Positive feedback from the public was also seen throughout Vancouver's transportation network. The presence of people who were joyous and who filled the streets of the downtown was one indicator of success that was suggested by JoAnn Woodhall, TDM officer at TransLink. As well, there were numerous accounts of people who were singing and giving each other high-fives on transit. The joyous nature of people on transportation represented a great indicator of success because it signalled that getting around during the Games was not a burden.

In addition, positive responses were received from the survey conducted by TransLink after the Olympics¹⁵⁷. This customer survey represented an important piece of feedback as stated by JoAnn Woodhall. Results indicated a very high rating for the performance of transit during the Olympics. 69% of respondents gave a 'good' to 'excellent' rating with a mean value of 8/10. This

¹⁵⁴ For example, see Daniel Foutaine, "Traffic congestion eases while transit system over capacity", CityCaucus, Feb 21, 2010, Available: <<http://www.citycaucus.com/2010/02/traffic-congestion-disappears-as-transit-system-taxed-to-the-max>>

¹⁵⁵ For example, see Ian Farrell, "Learning to navigate downtown Vancouver", The Seattle Times, Feb 15, 2010 and Adrian Warner, "Can London 2012 succeed on transport like Vancouver?", BBC, Feb 18, 2010, Available: <http://www.bbc.co.uk/blogs/adrianwarner/2010/02/can_vancouver_transport_succe.html>

¹⁵⁶ TransLink, "Accolades for TransLink Olympic efforts", TransLink, May 25, 2010

¹⁵⁷ NRG Research, Transit service quality during the Olympics

was compared to a survey conducted in the fourth quarter of 2009 where 54% gave a 'good' to 'excellent' rating and a mean value of 7.3/10. Moreover, the survey that was conducted after the Olympics showed that 73% of respondents indicated that service exceeded their expectations.

Lastly, success was indicated by the high degree of engagement reached between partners of the OPTT, organizations such as the DVBIA, and individual businesses. As indicated through interviews, partners of the OPTT were successful in being able to disseminate information to businesses and generate a dialogue about preparing for the Olympics. This was achieved through presentations that were made by partners of the OPTT as well as organizations like the DVBIA who the OPTT also engaged. In addition, tools and resources were developed and given to businesses. The combination of presentations and resources helped enable businesses to create Games-time travel plans.

While many things did go well during the Olympics, there were a few items I tracked down that may not have gone as well. The process of planning for crowd management outside of transit stations was one item that was brought up in an interview. It was noted that planning for crowd management began relatively late and led to the need to assemble a team for crowd management very quickly. People had to be pulled from different organizations to help control crowds, which led to some management issues; however, none of these issues were seen by the public. In terms of public feedback, respondents from TransLink's survey after the Olympics¹⁵⁸ suggested some items that failed to

¹⁵⁸ Ibid.

meet expectations were 'more crowding', 'less frequency service', and 'more waiting and delays'. Lastly, some businesses expressed concern over the lack of on-street parking during the Games, which they say adversely affected their business. However, for some, this lack of on-street parking probably would have helped business so there likely was mixed assessments about this aspect of the transportation experience.

6.2 Factors Contributing to the Outcome of the Olympic Downtown Transportation Experience

While the transportation experience can be viewed as an overall success and there are discussions to have some components of the OTP implemented permanently, it is important to point out there were many factors during the Olympic period that contributed to the positive experience. Some of these factors could be replicated in future situations but others may be unique to the Olympic period. Thus, when thinking about the success of the Olympic downtown transportation experience, the impact of the implementation of the OTP on travel behaviour, and lessons that can be learned, it is important to consider these factors and to understand their contribution to the overall outcome. With the diverse range of transportation strategies employed during the Olympics and with money, power, and words all being used, it is important to examine structural, psychological, and random factors as discussed in the literature review¹⁵⁹.

¹⁵⁹ Structural factors can include the quantity of goods and services available and the user cost of travel; psychological factors can include people's beliefs, attitudes, and values; and random factors can include media coverage and initial conditions.

6.2.1 Structural Factors

The cost of parking was one factor that may have played a role in the outcome of the Olympic downtown transportation experience. It was noted in the media that higher parking rates were being charged by some privately owned parking lots. One lot near the Olympic venues of BC Place Stadium and Canada Hockey Place charged an Olympic rate of \$12.50/hour during the Olympic period compared to their normal event rate of \$10/hour and usual rate of \$4.50/hour. The daily rate was \$95 compared to its usual rate of \$17 a day. Some cheaper rates could still be found though; for example, at Pacific Centre mall, the daily rate was \$12.50/day¹⁶⁰. In addition, on January 1st, 2010, the off-street parking tax in Metro Vancouver rose from 7% to 21% and the City of Vancouver extended parking meter hours from 9am-8pm to 9am-10pm. These increases were not part of the OTP but could have had an impact on people's travel behaviour.

Additional funding that allowed for improvements in transit service levels was another factor that may have contributed to the success of the Olympics downtown transportation experience. Media reports stated that TransLink was supplied with \$17 million from VANOC. Mike Madill elaborated on this arrangement by breaking down the figures. He stated that VANOC had purchased advertising space from TransLink for approximately \$14 million, which VANOC then resold to Olympic sponsors. A cash contribution of approximately \$3 million was made by VANOC, which was collected through ticket sales. As

¹⁶⁰ Kelly Sinoski, "Impark ups parking rate to \$95 a day at two lots", Vancouver Sun, Feb 13, 2010

well, there were value-in-kind contributions from VANOC where some services provided by sponsors such as CP Rail were turned over to TransLink to offset costs.

In addition, it appeared that existing policies that allowed the transit system to adapt to the changing needs of the Olympics was also important as was the dedication and capabilities of transit personnel. Dale Bracewell indicated that the ability of the BC Rapid Transit Company (BCRTC) and ProTrans BC to step up and increase the frequency of SkyTrain by keeping trains running at capacity was an important part of the success of the Olympics. Jason Chan of ProTrans BC¹⁶¹ stated that original service plans for the Canada Line were to run 16-18 trains during the Olympics. However, that plan went out the window three hours into the first day when it became apparent that they had to put their full fleet into service with 20 trains in operation all day. Jason Chan stated that being able to get all the trains back into the maintenance centre after service and then back onto the tracks for the first train was a real testament to the field staff. Similarly, BCRTC was able to put every Expo and Millennium Line train into service at times to meet demand.

As for bus transit, Michael Shiffer¹⁶², Vice President of Planning, Strategy, and Technology at TransLink stated that one of the keys to success was maintaining an effective and young fleet so that many buses were available for the Olympics. Charlotte Boychuk from CMBC's employee communications team

¹⁶¹ Chan, "Delivering operations excellence"

¹⁶² Michael Shiffer, "It Takes a Region: Integrating rail investment in multimodal plans and programs", 2010 APTA Rail Conference, Vancouver, Jun 6, 2010

illustrated the commitment and effort of maintenance crews who ensured the bus fleet was ready every day. Mechanics and staff at the Oakridge Transit Centre worked around the clock to ensure that they were “ready to fix any of the Olympic fleet that comes in for minor repairs such as broken lights, mirrors, or other ‘quick fixes’ under two hours”¹⁶³.

In addition to the personnel who were maintaining the transit network, there were dedicated volunteers and personnel on the streets and in the transit stations of the downtown. These included personnel from TransLink, the City of Vancouver, and the Vancouver Police Department and volunteers from VANOC who were instrumental in providing excellent customer service. They took on the task of directing people to transit services, answering questions about Olympic sites and transportation, and helping out in any way possible. The response from people in Vancouver to these changes was very positive. Survey respondents noted train frequency, bus frequency, and TransLink’s employee service were some of the top items that were done well¹⁶⁴.

6.2.2 Psychological Factors

The coordinated messaging that took place leading up to the Olympics was one of the keys to success that was suggested in an interview. It began with messages that stated that travelling during the Olympics was going to be different and that people are advised to come up with a Games-time travel plan.

¹⁶³ Charlotte Boychuk, “Maintaining our extra Olympic buses during the Games”, The Buzzer Blog, Mar 3, 2010 <<http://buzzer.translink.ca/index.php/2010/03/maintaining-our-extra-olympic-buses-during-the-games/#more-8690>>

¹⁶⁴ NRG Research, [Transit service quality during the Olympics](#)

Then, the messaging suggested how people could do that – by shifting modes to transit, walking, and/or cycling; shifting travel times; and/or not commuting at all (i.e. telecommuting). It was this coordinated messaging that was reinforced by all partners that worked very well and contributed to the success of the Games. As well, JoAnn Woodhall stated that the timing of the messaging was also appropriate because the messaging was not put forth to the public too early or too late. Similarly, Doug Kelsey, CEO of BCRTC, credited the TravelSmart campaign for contributing to the success of the Games. He notes that the campaign helped people to prepare ahead of time for queues or delays on the system¹⁶⁵.

Travellers themselves played an important role in the success. Ian Jarvis, CEO of TransLink, highlighted the collective effort and role of citizens who left their cars home and decided to take transit¹⁶⁶. People in Vancouver were noted to have been friendly, engaging, willing to help out, patient, and orderly especially on transit. The transportation system was also animated. In transit stations and on the streets, there was singing, music playing from the addition of more buskers, and performing artists, which were factors that engaged and entertained travellers. This culture, fever, or buzz has been contrasted to Vancouver's normally reserved individualism by one commentator¹⁶⁷.

¹⁶⁵ Sinoski, "TransLink takes stock after Olympics"

¹⁶⁶ In TransLink, "Moving the world record numbers ride transit in Olympic week 1", [TransLink](#), Feb 20, 2010

¹⁶⁷ Lorena Dexter, "The New Canada Line Culture: more urban, more engaged", [VPSN](#), Feb 19, 2010

Other keys to success that have been pointed out include simply closing down roads to cars and opening them up to pedestrians in order to provide the space for activities that otherwise couldn't take place. On SkyTrain, the modified announcements were praised for keeping transit users informed. The announcements provided instructions about transit etiquette and provided travel information such as service changes and the location of Olympic venues.

6.2.3 Random Factors

Many people were said to have left Vancouver during all or part of the Olympic period. Leading up to the Olympics, media reports stated that bookings for trips for the month of February were up¹⁶⁸ as many people were looking to leave town. While comments such as “mass exodus” and “residents ready to flee city”¹⁶⁹ were seen in local news reports to describe the number of people who were expected to leave town, JoAnn Woodhall noted that when the expected gridlock conditions did not emerge, some people changed their minds and decided to stay or not take a leave from work. Findings from the survey by TransLink after the Games suggested 9% of Metro Vancouver residents might have left town, which may have contributed to the travel conditions experienced during the Olympics¹⁷⁰.

As well, it is important to remember that universities and colleges were on an extended holiday during the Olympic period. This would have reduced bus

¹⁶⁸ Sheila Scott, “Vancouverites booking tickets out of town during Olympics”, [News1130](#), Nov 3, 2009

¹⁶⁹ Vancouver Sun, “Residents flee city to avoid Olympic chaos”, [Vancouver Sun](#), Nov 5, 2009

¹⁷⁰ NRG Research, [Transit service quality during the Olympics](#)

ridership and vehicle traffic significantly because bus transit and driving are two of the main ways that students, faculty, and staff travel to and from campuses. This can be seen from screenline data obtained in 2008 for trips to and from UBC. Data indicates that in the period of September to December 2008, 51,000 trips were made on a typical weekday by transit and 61,000 trips were made in a typical weekday by SOVs or ridesharing (see Table 4). As well, a demonstration streetcar line was in operation just outside of downtown Vancouver, which could have had an effect in decreasing both vehicle use and bus ridership.

As well, as suggested by Kitamura et al,¹⁷¹ the media and initial conditions are two chance factors that could play a role in changes to travel behaviour. In the case of the Olympic downtown transportation experience in Vancouver, both appear to have contributed to the overall outcome. The media painted a bleak picture of what driving would be like during the Olympics with the image of gridlock conditions. They were consistent in their reporting and really sent home the message about the importance of leaving vehicles at home and making other plans such as taking transit.

¹⁷¹ Kitamura, "Self-reinforcing motorization"

Table 4: Person Trips to and from UBC on a Typical Weekday in Fall 2008¹⁷²

Mode	Person trips in Fall 2008
Single occupant vehicle (SOV)	43,100
Rideshare	17,900
Transit	51,000
Bicycle	1,600
Pedestrian	1,000
Truck and motorcycle	1,600
Total	116,200

The impact of extending holidays for UBC can be seen by the large number of trips to and from the campus on a typical weekday.

Initial support for using sustainable transportation was also likely quite high. This is because many residents already take transit, walk, or cycle on a regular basis. As well, as noted by Dale Bracewell, sustainable forms of transportation are usually taken by many people travelling to and from major events in the downtown. These travel characteristics can be seen in counts collected prior to the Olympics. These counts produced mode share of people who attended a hockey game at GM Place in 2007 and a concert at BC Place Stadium in 2006. The counts indicate that 44.1% and 59.9% of attendees at those events respectively used sustainable forms of transportation to get to the event (see Table 5).

¹⁷² Taken from the UBC, Fall 2008 Transportation Status Report, (UBC, Feb 2009)

Table 5: Summary of Stadium Event Transportation Survey Mode Split¹⁷³

Travel Mode	GM Place Thursday, March 15, 2007	BC Place Saturday November 25, 2006
<i>Event</i>	<i>Hockey Game</i>	<i>Concert</i>
<i>Crowd Size</i>	18,325	47,182
Car	55.9%	40.1%
Transit	27.4%	35.3%
Charter bus/taxi/limousine	5.2%	14.0%
Bike/Walk	11.6%	10.7%
Total	100.0%	100.0%

These counts collected prior to the Olympics suggest that many people typically use sustainable modes of transportation to travel to and from major events in the downtown.

Lastly, the presence of the Olympic Games themselves was another factor. There was Olympic fever and a large number of sporting events, cultural events, and activities taking place in downtown Vancouver. For example, every day throughout the Olympic period, pavilions were free and open to the public. As a result, people crowded the streets and spaces of downtown Vancouver every day during the Olympics. This is not the case normally. For example, events do not normally take place for extended periods at Robson Square or at David Lam Park. The number of events and the buzz on the streets was likely one significant factor that helped to get people onto the streets walking, cycling, or taking transit and contributed to the good attitude and spirit of travellers. As

¹⁷³ Taken from Dale Bracewell, "The Road to the 2010 Olympic and Paralympic Games – Transportation Findings of Large Public Events in Downtown Vancouver", 2008 Annual Conference of the Transportation Association of Canada, Toronto

well, many people may not have made the daily trips they would have made normally had the Olympics not been in town. Certainly, many would have continued with their everyday activities downtown but many were also able to eliminate or push back some trips during the 17 days.

When interpreting the success of the Olympic downtown transportation experience, it is important to take into consideration the structural, psychological, and random factors outlined above. As noted by Charles Gauthier, it would be “foolhardy” to believe that the result of the Olympics could be replicated without considering the impact that these factors had on the outcome. This was also pointed out after the Olympic Games with regard to the suggestion of permanently closing the Dunsmuir and Georgia Viaducts. Although the Olympics “demonstrated what the city could look like without them”¹⁷⁴, a development consultant suggested that the “Olympics might not be the best real demonstration of what life without the viaducts might be like”¹⁷⁵ because enough residents left town during the Olympics to reduce traffic on the viaducts.

When thinking about potential transportation lessons for Vancouver, interviewees noted that the presence of these factors does not mean that important and relevant lessons for future transportation planning cannot be generated. They pointed out that it simply means that the structural, psychological, and random factors noted earlier should be included in future discussions.

¹⁷⁴ Derrick Penner, “Vancouver contemplates life without the viaducts”, Vancouver Sun, Mar 22, 2010

¹⁷⁵ Ibid.

7: TRANSPORTATION LESSONS

7.1 Applicability of Olympic Lessons

7.1.1 Long Term Transportation Planning

Interviewees suggested that long term transportation planning was the area where there might be many opportunities for lessons learned from the Olympics. Mike Madill suggested that although the Olympics occurred for a specific defined period, the road capacity issues and transportation issues that were raised during the Olympics did give an indication of what it might be like in the future when there are more people. For example, it indicated the higher level of transit that would be needed to accommodate the additional travel demand.

Dale Bracewell also stated that there were opportunities for lessons learned for long term transportation planning but cautioned that it was important not to stretch the learning. For example, he noted the need to acknowledge that people did leave town during the Olympics. Charles Gauthier pointed out that residents were asked to make travel changes for a short period of time. He cautioned that it would be more challenging to replicate the results on a more sustained basis. Clark Lim also weighed in by saying that there could be some limits on extrapolating the lessons learned in the city to more suburban areas. He suggested that in the city and especially in downtown Vancouver, transit is a mode that could be leveraged to encourage sustainable travel. However, this may not be the case in more suburban areas where transit may not be a realistic

option for travellers. Therefore, lessons relating to transit may not be very relevant to these areas. However, he adds that there are still opportunities for encouraging walking and cycling in the suburbs and this could be the area where lessons would be relevant.

7.1.2 Planning for Episodic Events

In terms of episodic events, interviewees noted many limitations for generating lessons learned. When thinking about emergency situations, Kevin Wallinger, Director of Emergency Management at the City of Vancouver, stated that during the Olympics, everything was working properly. The road network was intact and transit system was working with minimal delays on SkyTrain. In fact, one of the points made by Jason Chan¹⁷⁶ of ProTrans BC was that for the entire 17 days, there was only one minor delay on the Canada Line and that was due to a door fault, which was the most minor delay a transit system could have. Similarly, a news release from TransLink noted that there were “[n]o significant train failures or operational problems” for the Expo and Millennium Lines.

However, this would not be the case during certain episodic events when parts of the transportation system could be damaged. Furthermore, people in Vancouver were given a lot of time to prepare for the changes that were going to happen during the Olympics. As indicated earlier, the public was given advance notice about the staging of the Olympics and details about road closures and transit service changes. As well, they were given time and resources to prepare and make plans for the event. This luxury would not be available in disasters or

¹⁷⁶ Chan, “Delivering operations excellence”

even in energy crises. In fact, Kevin Wallinger noted the potential difficulty of getting information out to people during emergencies.

As well, Charles Gauthier stated that the presentations made to businesses were focused on the preparation of business-readiness plans, which are different from preparing crisis plans. These presentations focused on getting businesses to plan and do things differently from a business perspective such as scheduling employees for work and getting supplies to the worksite. Businesses were encouraged to adjust their schedules where possible by, for example, ordering their supplies weeks in advance¹⁷⁷ and helping staff to avoid travel during peak times.

Dale Bracewell also weighed in by stating that there were limited lessons for dealing with the transportation challenges posed by episodic events. He stated that the OTP was customized in respect to where the security closures and competition sites were located as well as the time of day that people were expected to travel. He noted, “In all types of natural disasters, you don’t know what remaining part of your transportation network you’re going to have left.”

This is not to say that there are not any opportunities for lessons. Clark Lim pointed out the potential for the Olympics to validate plans and models that have been developed for responding to and recovering from events like natural disasters. He noted that methodology and techniques for modelling and planning for normal circumstances need to be modified when it comes to high-level

¹⁷⁷ Interview in Linda Solomon, “Charles Gauthier: Preparing business for the Olympic Games”, Vancouver Observer, Jun 8, 2009, Available: <<http://www.vancouverobserver.com/2009/06/08/charles-gauthier-preparing-businesses-olympic-games>>

intense events. As well, he stated the Olympics might represent an opportunity to learn more about the flows of crowds and what can cause jams at transit stations. These are potential lessons that could be integrated into contingency plans for future episodic events.

7.2 Transportation Lessons for Vancouver

In reflecting on the Olympic experience, many commentators have noted how the two-week period was a good test for our transportation system. Comments have been made about how the Olympics were a “cool experiment”¹⁷⁸ and perhaps the largest traffic trial ever in North America¹⁷⁹. It has been pointed out that the thing on everyone’s minds in Vancouver after the Games was what did we learn?

Using input obtained from experts in interviews, insight from media reports, and personal analysis of data and observations, ten lessons for Vancouver have emerged from the Olympic downtown transportation experience (Table 6 summarizes these lessons and their applications). This is not an exhaustive list but rather a list of lessons that have emerged from my research that captures a lot of the discussions and ideas that have been generated. As well, although TDM was a core component of the OTP, the lessons generated here do not apply exclusively to TDM initiatives but potentially could be applied to all areas of transportation planning.

¹⁷⁸John Calimente, “Vancouver becomes a transit city for 17 days”, re:place magazine, Mar 31, 2010 Available: <<http://regardingplace.com/?p=8014>>

¹⁷⁹Brent Toderian, “Vancouver Olympics a Living Laboratory for Urbanism!”, Planetizen, Feb 25, 2010 Available <<http://www.planetizen.com/node/43096>>

When it comes to building a more resilient city and transportation system, which can continue to function in the face of changes such as those associated with peak oil and natural disasters, I think there are two lessons that are particularly valuable. Lesson number one about the possibility of achieving higher than current levels of sustainable mode use is valuable because it provides a vision of resilience that is powerful and shared among people in Vancouver. This vision is useful for informing transportation discussions and guiding planning decisions. The second is lesson number five about the effectiveness of working together. I think this lesson is critical for the success of transportation planning in Vancouver because working together is not necessarily easy to do under normal circumstances away from the Olympic Games.

Another question is whether lessons have been learned from the Olympics? I think a proper assessment of this question should be done in 2-3 years (i.e. at the end of 2012 to beginning of 2013). This is the period when a number of plans and reports that are currently being developed could be completed. For example, 2011 is when the new Regional Growth Strategy by Metro Vancouver is expected to be adopted. As well, the Olympic Games Impact study for Vancouver is expected to be completed in 2013 and the City of Vancouver is in the process of working on a long-term transportation plan that looks beyond the year 2021. The completion of these initiatives could lead to transportation changes in the coming years and I think this would be a good time to determine whether Vancouver has actually learned from its Olympic experience.

Table 6: List of Transportation Lessons for Vancouver

Lesson	Planning for Sustainable Transportation	Planning for Episodic Events
1. It is possible to achieve higher than current levels of sustainable mode use	●	
2. Transit has the potential to attract almost anyone	●	●
3. Minimizing the space that transportation takes up can create valuable public spaces	●	
4. Our transportation system is resilient but could be improved with some additional TDM strategies	●	●
5. We are effective when we work together	●	●
6. Set a date for change and celebrate	●	
7. Define what 'normal' travel conditions will be like	●	●
8. Modelling changes to the transportation system provides valuable insight	●	
9. There are many ways of disseminating travel information	●	●
10. We gained improved operational knowledge for our transportation system		●

7.2.1 It is Possible to Achieve Higher than Current Levels of Sustainable Mode Use

There were many initial worries noted in the local media that having more people in the city and having more trips being made would lead to congestion for all modes and gridlock conditions on the road. What the Olympics showed is that this equation is not always true. It is possible to not increase road capacity while accommodating more trips and greater travel demand from a larger population.

For long term transportation planning, this can be seen as confirmation of the possibilities of achieving higher than current levels of sustainable mode use and encouragement for governments, businesses, and local agencies to continue to encourage and provide sustainable modes of transportation.

Ian Jarvis, CEO of TransLink, summed up this view for transit by stating that “[w]hile the Games themselves were unique in terms of the impact on the transit system, the Olympics proved that our ultimate vision for Metro Vancouver’s transportation system [as described in Transport 2040] is achievable”.¹⁸⁰ He elaborates by pointing out that “there were a number of conditions present during the Games that contributed to transit’s overall performance, and with those same elements in place across the region, TransLink will be able to deliver the same people-moving capacity as it did throughout the Olympics.”¹⁸¹

As well, the experience sets a benchmark and helps set a target that we can aim for. Clark Lim suggested that the Olympics established an upper bound for sustainable mode use while current conditions represent a lower bound. For long term transportation planning, Vancouver can use those bounds to establish a goal somewhere in between.

For the entire transportation system, the Olympics helped to provide a vision of what Vancouver’s future could be like. As Jarrett Walker puts it, the Olympics provided “an imperfect but vivid glimpse of what “normal” might be like

¹⁸⁰ TransLink, “TransLink tops 26 million riders”

¹⁸¹ Ibid.

10, 20, 30 years in the future, when there will be that many people moving every day.”¹⁸² This vision can be described as one involving increased use of sustainable modes and continuing mobility for travellers. During the Olympics, many automobile and bus operators noted how pleased they were about driving conditions. Reduced vehicle traffic meant that buses were able to move faster, more smoothly, and more efficiently. The conditions were so good that according to John Calimente¹⁸³, bus operators constantly had to slow down because their schedules had traffic delays built into them.

When planning for the future of Vancouver, the data gathered about the Olympics could become useful in forecasting change. Jarrett Walker elaborates by saying, “When planning the city of the future, people can say “we’ll have 1.7 million people on transit every day,” and it won’t be just a number. Everyone will remember what that looked like, how it felt, and the effort required to achieve it.”¹⁸⁴ Similarly, Clark Lim and Dale Bracewell have stated that the mode share during the Olympics sets a precedent for what can be achieved in the future in terms of sustainable mode use. The impact of TDM during the Olympics also suggests the importance of considering TDM at the front end of the planning process for transportation. This is because, as noted in Transport 2021, the use of TDM can modify or postpone investment needed for transportation supply.

¹⁸² Jarrett Walker, “Vancouver: Olympic transit payoffs”, Human Transit, Mar 1, 2010, Available: <<http://www.humantransit.org/2010/03/vancouver-olympic-transit-payoffs.html>>

¹⁸³ Calimente, “Vancouver becomes a transit city for 17 days”

¹⁸⁴ Walker, “Vancouver: Olympic transit payoffs”

7.2.2 Transit Has the Potential to Attract Almost Anyone

With record numbers of people on transit throughout the Olympics, many Vancouverites certainly decided to make the switch to transit. The survey from TransLink indicated that regardless of the main mode of transportation used normally, the majority of residents used transit with 79% of Metro Vancouver residents saying that they used transit during the Olympics¹⁸⁵. JoAnn Woodhall stated that this experience suggests that transit in Vancouver has the ability to attract “more than just the low hanging fruit” and for Dale Bracewell, this high level of transit use sets a benchmark regarding what could be achieved in future scenarios. It showed that it is not just a subset of people who are willing to adapt and make changes to their transportation decisions at least during special circumstances.

It also showed what was needed to attract riders including noticeable improvements in the level of service provided. Charles Gauthier made the point that during the Olympics, travelling on transit was comfortable and enjoyable. The Olympic level of service involved increased frequency throughout the day and longer hours of service. Charles Gauthier states that it would be unrealistic to expect the same level of transit use without the same level of service provided. However, currently that level of service may not be warranted because of the size of the population in Metro Vancouver.

While some may not be willing to make the switch to transit for all 52 weeks of the year, they may consider doing it for some trips they regularly do by

¹⁸⁵ NRG Research, [Transit service quality during the Olympics](#)

automobile. With transit being a mode that could play an important role in long-term and short-term scenarios, this lesson has applicability to many transportation challenges. It shows that for episodic events, people are willing to switch to transit if that service is available. For long term transportation planning, it illustrates the potential mode share for transit that could be targeted.

One commentator also raised a view about the positive feedback of having more people riding transit. John Calimente suggested, “When everyone is riding transit, it becomes more acceptable to the average person. The crowds on the SkyTrain lines didn’t discourage people from riding. On the contrary, it may have actually encouraged more riders. Regardless of what people often say, we like being around other people. But people need to feel comfortable on transit, especially those that rarely take it. Since the transit system was surging with middle-class folks going to Olympic events, it became acceptable for more people to ride.”¹⁸⁶ This view links back to ideas in the literature review that suggests there is a relationship between changing values and attitudes and attracting people to transit and supporting sustainable mode use.

7.2.3 Minimizing the Space That Transportation Takes Up Can Create Valuable Public Spaces

One of the points made by Mike Madill was that the process of closing down roads to traffic also had the effect of creating spaces where exchanges between individuals and between individuals and businesses could take place. Closing down major sections of streets like Granville Street to vehicle traffic

¹⁸⁶ Calimente, “Vancouver becomes a transit city for 17 days”

allowed for successful spaces to be created that contributed to the activity, the buzz, and gathering of people noted by Brent Toderian who referred to the spaces as “the best example of great urbanism”¹⁸⁷. This view highlights the value of minimizing the amount of space that transportation takes up and using that space for exchanges. According to Mike Madill, a good way to do that while still preserving mobility is to utilize transit, walking, and cycling.

This is an idea that the DV BIA is already exploring through discussions with the City of Vancouver to have Granville Street converted into a pedestrian space on weekends. As well, City Councillor David Cadman has suggested that something similar be done to Robson Street¹⁸⁸. Of course, what the Olympics also showed is that simply having the space available will not necessarily make it successful. This is a point made clearly by Dale Bracewell. He stated that it takes a critical mass of people out on the streets enjoying the festivities to make a space successful. He adds that certainly, people enjoy food and having the vendors out there adds value. The same can also be said about having improved wayfinding, washrooms, and public art, which were present during the Olympics. However, simply having those features is not enough. He continues by pointing out that it is important to also have a generator, which was the role played by the competition venues and live sites. This is a good point because there were not drastic improvements to the public realm during the Olympics according my observations especially relative to the dramatic increase in

¹⁸⁷ Toderian, “Vancouver Olympics a Living Laboratory for Urbanism!”

¹⁸⁸ Lori Culbert, “Councillor wants city to consider closing down Robson Street on summer weekends”, Vancouver Sun, Apr 2, 2010

pedestrian activity. It was the presence of Olympic venues, pavilions, and scheduled activities that appeared to be key to getting people to use the streets and public spaces in the downtown.

Minimizing the space taken up by transportation is a good first step in that process though. In line with this is Dale Bracewell's point that having a generator is also not enough. It is important to make sure that people do not simply find all the parking they need in and around the downtown. For example, getting a mass of people to travel to and from a site and from transit stations is also valuable. This lesson has relevance for planning over the long term. For example, minimizing space taken up by vehicles could create successful public spaces during weekends and holidays when typically there are more events taking place, which could encourage more travel by sustainable modes.

7.2.4 Our Transportation System is Resilient but Could Be Improved With Additional TDM Strategies

The experience during the Olympics allowed Vancouverites and local planners to evaluate the region and city's transportation system under the crunch of Olympic travel demand. The result appears to be a passing grade. The experience appears to help confirm that the transportation system that has been developed is a resilient one meaning that it was able to "to accommodate variable and unexpected conditions without catastrophic failure"¹⁸⁹. Many commentators noted how well the system performed under pressure and how well it handled the large numbers of travellers over the Olympic period. One

¹⁸⁹ Definition of resilience taken from Todd Litman, "Evaluating Transportation Resilience", Victoria Transport Policy Institute, 2010 Available: <<http://www.vtpi.org/tdm/tdm88.htm>>

commentator noted that “the transit system is amazingly efficient. The 31% jump in ridership was handled as smoothly as could be expected. Of course there were delays and waits, but considering the huge strains put on the system, there were no major failures.”¹⁹⁰

Although the transportation system performed admirably according to many, the Olympic experience also suggests possible improvements and additions that can be made to incrementally improve the system. For example, for TransLink, it has shown that linking transit fares with events could be effective in encouraging transit use to events. As such, an initiative is currently being tried by TransLink for BC Lions games during the 2010 season. This initiative involves offering a discounted transit pass to BC Lions season ticket holders that provides holders with unlimited transit use on game days.

The Olympic experience has also raised and highlighted issues that might be important to address in the future as the region and city continue to grow. For example, at Waterfront station, travellers were directed by transit hosts using placards and megaphones to multiple entrances of the station depending on which transit service they were looking for. This was done to better manage the flow of passengers. While that strategy worked during the Olympics, getting people to walk around the building to side entrances in order to manage the flows of passengers may not be a long-term solution for the future.

It has also been suggested that the routing of buses in Vancouver might be too complicated for some to understand. John Calimente noted, “When

¹⁹⁰ Calimente, “Vancouver becomes a transit city for 17 days”

people are unfamiliar with transit, they overwhelmingly chose the easiest systems to understand, which were the rail-based systems. Bus ridership was up only a few percentage points. TransLink staff at the SkyTrain stations said that many people only wanted to hear options that involved SkyTrain. The routing of buses was often seen as too complicated, or unappealing for longer distances.”¹⁹¹

As well, praise was given to the instructional public announcements that were made on the SkyTrain system throughout the Games. These announcements provided information such as operating changes to SkyTrain during the Olympics and information about Olympic venues. Improved announcements and better information is one initiative that could be considered on a more permanent basis.

7.2.5 We Are More Effective When We Work Together

Dale Bracewell emphasised that the OPTT was a partnership and that it was this feature that led to the eventual success of the OTP. This success of this partnership was consistently reiterated by interviewees who were part of the development and implementation of the OTP. Mike Madill stated that the success of the Games demonstrated “how effective we can be when we’re working together” and this is an important lesson because we “all have a lever to pull in the transportation machine.” He continues, “If we’re all working in concert together, we’re a lot better than if we’re just doing our own thing.” Similarly, Kevin Wallinger states that the Olympic experience illustrates the level of

¹⁹¹ Ibid.

integration required in planning between sectors such as transportation and police to deal with different situations. Thus, the experience has demonstrated the need to come together to get things done.

However, it is important to highlight the different institutional environment that was present during the planning process for the OTP. There was arguably a larger spotlight and greater media attention given to the performance of transportation during the Olympics compared to normal circumstances.

Essentially, the world was watching and judging Vancouver with any negative transportation event potentially becoming a black eye for the city and the region. This Olympic environment is described by Giuliano et al. in their study¹⁹² of the Los Angeles Games. Giuliano et al. explain that there was an atmosphere of cooperation and leadership present for the Olympics, which brought people together and helped to implement successful transportation strategies. A similar sentiment about the level of cooperation that was achieved for the Games was expressed by interviewees who worked on the Vancouver's OTP.

For Los Angeles, this environment did not appear to last beyond the Games. Giuliano et al. described the institutional environment as being "unique" and characterized by an "unusual level of consensus"¹⁹³. They continue that when the problems posed by the Olympics were over, the planning environment that was experienced did not continue. I think this speaks to the importance of needing to make an effort to preserve this cooperative environment for Vancouver. One suggestion for doing this is to embed transportation

¹⁹² Giuliano, Evaluation of 1984 Los Angeles Summer Olympics

¹⁹³ Ibid., pg. 142

experiences and stories from the Games and/or lessons learned from the Games into some of the planning documents currently being developed in the region.

Next, the Olympic experience generated many internal lessons for organizations that were involved with the OTP. For instance, through the process of working together, members were able to better understand the roles and responsibilities of each other. This was true for members who were part of different organizations as well as members within the same organization. This was an important lesson as noted by Kevin Wallinger and JoAnn Woodhall. The result was that the Olympics helped to improve understanding and respect for one another, which is a lesson that can be brought back to the workplace for future projects.

Relationship building is another important lesson. This is because the Olympics helped to generate the knowledge that different organizations can count on one another during different episodic events. This is what Kevin Wallinger refers to as building trust-based relationships, which he describes as being “able to pick up the phone and get things done that need to be done.” For Kevin Wallinger, having these trust-based relationships is “probably more important than any plan you would have on the shelf”.

In addition, the Olympic downtown transportation experience highlighted the importance and value of engagement and consultation. The City of Vancouver tracked approximately 160 stakeholder meetings that they attended. These meetings took place over the course of planning the OTP and included consultation and dissemination of information to stakeholders from business

associations to truckers' associations. Consultation with stakeholders and meetings with partners were very successful and helped to generate good conversations that contributed to the success of the OTP. Dale Bracewell illustrated this point with one story about a successful meeting between planners from the City of Vancouver and members of the Integrated Security Unit (ISU). For this meeting, poker chips and maps of transportation routes into downtown Vancouver were brought in. These poker chips represented the number of trips that are made on each of the different bridges and routes into the downtown. Dale Bracewell explained that as each of the bridges or streets were closed down one by one, these poker chips were reallocated to other routes. This reallocation helped members of the ISU to understand the planner's world.

Furthermore, JoAnn Woodhall stated that during the Olympics, staff who might usually be doing deskwork were allowed to get out on the ground to interact and connect with residents and visitors. These included personnel from all levels such as senior management from the partner Olympic organizations. JoAnn Woodhall stated that staff really enjoyed the opportunity and that it gave them a chance to gain a fresh perspective from a customer lens. In particular, the experience allowed them to get more direct feedback about what is working well with the system and what could be improved.

In summary, working together is an important lesson to come out of the Olympic experience, especially given common goals in the region to promote sustainable transportation in the long term and minimize disruptions caused by

future episodic events. In fact, one of the lessons from Dale Bracewell is to “engage and partner with everyone”.

7.2.6 Set a Date for Change and Celebrate

The opening ceremony for the XXI Olympic Winter Games not only marked the start of the Games but the start of a dramatic shift towards sustainable transportation in Vancouver. Dale Bracewell stated that one of the reasons why the OTP was effective was that everything absolutely had to be ready by February 12th, 2010 – the date of the opening ceremony for the Olympics. This was a date that could not be changed and the Olympics were going to take place regardless of what happened with the OTP. Thus, having the opening ceremony forced a commitment among organizations for action.

This is a lesson that Dale Bracewell suggests could be valuable and has direct applicability for future long term planning. The specific lesson put forth by Dale Bracewell was “commit to an opening ceremony.” While setting goals and targets for mode share is important, it is also useful to set a date. This date would represent something for people to reach for and could create a sense of urgency. Dale Bracewell suggested that, for example, if a 50% mode share for transit, walking, and cycling is a goal then set a date and commit to it now. Before setting the date, I think it is also valuable to have proper workplans in place to ensure that there is sufficient time to plan for these changes. This is important because there could be consequences in rushing to meet a deadline including cutting corners on projects.

Another aspect of the opening ceremony is that it is a celebration that is meant to make people feel good and excited about something. Clark Lim highlighted the benefits of also celebrating a transportation achievement. He notes that celebrating and recognizing an achievement like meeting a target for sustainable mode use can boost morale and make people feel like they have accomplished something important. This is significant because it can further support and encourage the change towards higher levels of sustainable mode use.

7.2.7 Define What ‘Normal’ Travel Conditions Will Be Like

One of the key messages prior to the Olympics was for people in Vancouver to get ready for the unusual. The transfer of knowledge programme¹⁹⁴ from the International Olympic Committee helped the OPTT recognize that during the staging of the Olympics, there were not going to be any weekdays or weekends. It was going to be a 24-hour operation for 17 days. Consequently, effort was put into defining what it was going to be like during those 17 days and helping people and businesses to prepare for travel conditions that were going to be ‘unusual’.

On the Host City website¹⁹⁵, a section was devoted to the question of what to expect? It was clear what conditions commuters and businesses had to adapt to: “Residents, businesses and visitors can expect rush hour conditions and

¹⁹⁴ The transfer of knowledge program was set up “to contribute to maintaining the unique value and success of the Games product and experience through transferring knowledge and expertise from one edition of the Games to the next”. Source: International Olympic Committee, Factsheet: OKGM and the Vancouver 2010 debrief, (IOC, 2010).

¹⁹⁵ City of Vancouver, “What to expect”, City of Vancouver, 2010, <<http://olympichostcity.vancouver.ca/gettingaround/whattoexpect.htm>>

parking restrictions in Downtown Vancouver 24 hours a day during Games time. We encourage everyone coming Downtown during Games time to walk, cycle, take public transit or carpool rather than drive alone. This will not only ease traffic pressures at Games time, but will be faster and easier for everyone to get around the city.”¹⁹⁶

For the Olympics, Dale Bracewell noted that through the process of defining the unusual, it became clear that pedestrian corridors would be needed but not for the entire 24 hours each day. These corridors only needed to be in operation for 12 hours for the LiveCity sites and this allowed the roads to be open the rest of the time for deliveries. That was part of the redefinition of normal conditions for businesses. For commuters, it was stated through messaging that people could have a difficult time driving downtown and that high levels of congestion could be a reality during the Olympics. These conditions were conveyed through presentations to businesses to ensure that they understood what the reality of the Olympics would be like. This communication ensured that businesses would be prepared and ready for the changes once they came. Similarly, many messages were delivered to the public through media like advertisements and brochures to encourage residents to modify their travel behaviour and help prevent potentially congested travel conditions.

For Dale Bracewell, “redefine business as usual” is one lesson that can be used to help shape the processes for planning for Vancouver’s long term transportation. He notes that especially as the downtown and the city continue to

¹⁹⁶ Ibid.

grow, businesses and commuters may have to adapt and make changes to their transportation decisions. Like the Olympics, in order to properly prepare for this change, it is important to define what 'normal' will be like in the future.

Developing different scenarios of future conditions could be one approach that is used for this process of defining the normal.

7.2.8 Modelling Change to the Transportation System Provides Valuable Insight

As illustrated in the literature review, there exists an abundance of strategies and plans that have been developed for cities to handle transportation challenges. The success and effectiveness of these strategies are dependent on numerous factors and variables with random factors also playing a role. One of the reasons why the OTP worked so well according to Dale Bracewell was the amount of modelling that was done to help inform the development of the OTP. He noted that the City did data collection prior to the Olympics during sporting events in downtown Vancouver to understand how people usually travel to and from those events. From the analysis of data, the City was able to develop vehicle, transit, and pedestrian models that were customized for the Olympics.

It was out of these models that the target for a minimum 30% reduction in vehicle traffic for the downtown was born. Dale Bracewell stated that without the aid of the model, they might have guessed a 20% reduction would be sufficient and that would have led to a misdirected information campaign. Similarly, the models that were developed showed that approximately 14,300 pedestrians would use Robson Street during the Olympics and thus, space had to be freed

up for them which took the form of the pedestrian corridor. To help evaluate the model, counts were conducted during the Olympics for Robson Street. The counts totalled approximately 14,000, which was not far off from the projections. Similarly, the modelling showed that arriving in downtown before 7am and leaving by 2pm would allow downtown workers to avoid the busiest times on the transportation network.

Dale Bracewell suggests that “engineering for success” is an important lesson to come out of the Olympic experience. Dale Bracewell states that it is important when developing transportation strategies to do it in a way that is robust and measurable. Modelling provides an important tool that can be used to produce an image of what the city might be like in the future. This helps to foresee difficulties as accurately as possible. For long term planning, this lesson points to the importance of not simply taking transportation strategies that appear to be successful in other cities, implementing them in Vancouver, and then expecting similar results.

7.2.9 There Are Many Ways of Disseminating Travel Information

The 2010 Olympic experience was characterized by a heightened use of the Internet for travel information. For the Olympics, a number of different tools were created for commuters to make informed travel decisions. These tools provided information about different travel modes and the travel conditions that travellers might face. Made available on websites of TransLink, the City of Vancouver, and VANOC was information such as routes to take, levels of service to expect, and potential delays. Information was also made available on

TransLink's Buzzer Blog and on several twitter accounts of TransLink representatives. As well, special websites like the travelsmart2010.ca website provided additional sources for travel information. JoAnn Woodhall remarked that these were tools that people felt comfortable using and that the take up of these tools was "incredible".

The response and uptake of these tools suggests the value of continuing to develop social media and finding ways to connect with customers as well as the value of providing travel information in real-time for travellers. It was also suggested during interviews that mobile alerts were a good way of getting the word out because people could be moving away from traditional sources like the radio. As well, having transit hosts in and around transit stations was also effective and helped to boost customer service and improve communication and trust with customers. This is an initiative that TransLink will plan for during large and special events. As well, the significant increase in calls to customer service¹⁹⁷ at TransLink exemplifies the important role of communications to travellers.

Furthermore, there were many rumours about travelling during the Olympics that were simply not true. These rumours included a ban on driving in the downtown, the shutting down of Stadium-Chinatown and King George SkyTrain Stations, and the belief that everyone using SkyTrain would be required

¹⁹⁷ As described in Tyler Heshka, "Our customer call centre sets their own Games records", The Buzzer Blog, Feb 25, 2010, Available: <<http://buzzer.translink.ca/index.php/2010/02/our-customer-call-centre-sets-their-own-games-records/>>

to go through security checks¹⁹⁸. As such, another important role played by communications to the public was for dispelling these rumours and ensuring that everyone had proper information about travel conditions.

Lastly, exploring different ways of communicating amongst staff could be valuable too. Ken Hardie pointed out that “having a central communications centre during the Games, where complaints from the public could be forwarded and checked out, allowed TransLink to address problems such as bus delays or tie-ups on certain routes fairly quickly. The use of social media such as Twitter also enabled TransLink to move staff where they were needed.”¹⁹⁹

As Kitamura et al.²⁰⁰ suggested, information can play a potentially powerful role in shaping people’s beliefs, attitudes, and values regarding transportation and ultimately, shaping people’s travel behaviour. One of the keys to success of the Olympic transportation experience was the ability of the OPTT to give commuters clear information about travel conditions. This suggests that continuing to ensure that travel information is disseminated properly to residents and transportation staff may be valuable for future transportation planning in Vancouver.

¹⁹⁸ Jhenifer Pabillano, “TransLink’s Olympic Story, part 4: reducing car traffic and offering travel options”, The Buzzer Blog, Feb 2, 2010, Available: <http://buzzer.translink.ca/index.php/2010/02/translinks-olympic-story-part-4-reducing-car-traffic-and-offering-travel-options/>

¹⁹⁹ Sinoski, “TransLink takes stock”

²⁰⁰ Kitamura, “Self-reinforcing motorization”

7.2.10 We Gained Improved Operational Knowledge of Our Transportation System

There were a number of operational lessons learned during the Olympics. Mike Madill suggested that the Olympics provided a playbook of some contingency plans that were developed for the Olympics but could be utilized in other applications in the future. One example of this contingency plan that was implemented was on the last day of the Olympics. This was when crowds were so huge downtown that it would have been ineffective to keep sending buses into the area. As such, buses simply made it to the edge of the downtown, dropped off passengers, and then turned around so that they did not get caught in the gridlock. In addition, Mike Madill stated that there has been an improved knowledge of how to handle large crowds.

Dale Bracewell noted that the Olympics showed what was necessary to close down a road and turn it into a pedestrian street. He noted that the Olympic experience showed that it does not take much signage or many traffic cones to close roads to vehicles. As crews were setting up the corridors everyday, they also became better operationally at the task and gained a better understanding of the effort needed to complete the task. This could be beneficial if and when conversion to pedestrian streets becomes a necessary strategy such as in response to the disruptions brought on by episodic events.

7.3 Transportation Lessons for Future Host Cities

7.3.1 Generating Transportation Lessons

The Olympic transportation experience in downtown Vancouver exemplifies the valuable lessons that could be generated from the hosting of mega-events like the Olympics. The lessons from the analysis above show the potential that exists for generating lessons about many aspects of transportation planning that could be useful and relevant to the future planning of cities.

For Vancouver and its residents, the implementation of the various transportation strategies allowed the public, planners, and politicians to see how those strategies in the OTP worked in real life. The Olympics helped to demonstrate the workings of the strategies and the effects on mode share. It has allowed us to see what happens when roads are closed to vehicles and transit service is improved. The data collected also appears to be valuable but so too is the potential change in people's perceptions and attitudes regarding transportation changes.

As well, the Olympic experience has helped planners assess Vancouver's transportation system and illustrated what might be valuable additions to the transportation system. Also important, the Olympic experience has provided the public with a glimpse of what future travel conditions in Vancouver could be like and has spurred discussions about the future of the city and region's transportation system. These discussions may not simply revolve around just projections and numbers but could also involve memories and experiences that people will draw upon from the Olympics.

However, these lessons did not simply appear out of nowhere. Data collection, documentation of events, and insightful discussions from many commentators contributed to the lessons that have been generated in this paper. For future host cities that wish to leverage mega-events to generate transportation lessons that are valuable for their locality, it will be important to develop their own monitoring plan to understand their respective experiences.

In particular, it will be important both to collect sufficient data of good quality and to develop strong evaluation criteria beforehand. Having one without the other would not be of much value. In illustration, Clark Lim compared data collection and evaluation criteria to two components that complete a wheel. If one were missing, a circle would not be formed and in turn, the wheel would not be able to go very far. In the case of the 2010 Olympics, the City of Vancouver made a commendable effort to collect data throughout the Games through counts on vehicles, pedestrians, and cyclists. There were also intercept surveys and screenline surveys. TransLink was also active in collecting and presenting data about transit use during the Olympics. This data collection provided valuable empirical evidence about what actually occurred during the Olympics including changes to vehicle traffic, changes to transit ridership, and changes to the number of people walking and cycling over the Burrard Bridge.

Overall, it appears that there is satisfaction in Vancouver with the data collected. However, given additional funding and resources, some interviewees have suggested that it would have been valuable to do some things slightly differently. Charles Gauthier has suggested that a survey sent out to businesses

would be valuable in understanding the impact of the Olympics on businesses. In the past, this type of business-oriented survey has been conducted for the 1984 Olympics in Los Angeles²⁰¹. This survey was designed to examine all aspects of work trip travel and was valuable in determining how the Olympics travel experience of workers compared to normal conditions. Similarly, Dale Bracewell has suggested that it would have been valuable to conduct a resident and work specific travel diary during the Olympics but such a travel diary could cost several million dollars.

In terms of improving the data collection process, Clark Lim adds that if additional funding were available, he would have made a few improvements. He suggested possibly replacing human data collectors with automatic counters in some areas to improve data quality. As well, resources to support students who were out in the field collecting data would have been beneficial. In particular, resources to help keep students warm, safe, and dry were suggested.

One area where I think there could have been improvement was the evaluation criteria. There did not appear to be many metrics or detailed criteria developed beforehand to formally evaluate the outcome of the OTP and the overall transportation experience. One target was the reduction in vehicles, which was set out early in the development of the OTP. Certainly, many other indicators of success were noted in my conversations with experts. However, many of these indicators did not appear to be explicitly established beforehand. One of the reasons for this lack of criteria is probably the fact that Vancouver has

²⁰¹ Giuliano, Evaluation of 1984 Los Angeles Summer Olympics

never hosted the Olympics before and may not have known what exactly to expect. As well, JoAnn Woodhall noted a lack of transfer of knowledge in this area from previous Olympics.

Thus, I think setting out a strong set of criteria will be an important step for future host cities in generating their own transportation lessons. As Hensher and Brewer²⁰² point out, it is important to have criteria so that transportation performance can be properly assessed, which can help determine the level of success. One suggestion is contained in an article by Timo Finke and Eric N. Schreffler²⁰³. The article presents a toolkit that has been developed for evaluating TDM projects and could provide some insight into the development of useful criteria for analyzing future TDM projects.

In developing the monitoring plan, cities should make sure that the results that will be generated would be useful and relevant to the locality. The plan should take into consideration the context including the types of infrastructure and land use that characterize the city. Just because one city uses certain indicators does not necessarily mean they are appropriate for another.

7.3.2 Transportation Planning for the Olympics

In terms of actually planning for transportation for the Olympics Games, interviewees have suggested a few items. One was that it might have been valuable to start some stages of planning earlier to allow for more time to prepare

²⁰² Hensher, "Going for Gold at the Sydney Games"

²⁰³ Timo Finke and Eric N. Schreffler, "Using Multiple Assessment Levels for Evaluating Transportation Demand Management Projects: Monitoring and Evaluation Toolkit", Transportation Research Record: Journal of the Transportation Research Board, 1864, 2004, 135-143

and iron out details. However, this does not necessarily mean going to the public earlier because if that happens, planners and communicators might not be able to get their attention.

Dale Bracewell offers up the advice of leaving no mode unexplored when developing an Olympic transportation plan. He stated that he never felt comfortable ignoring a mode because it could turn into the Achilles heel of the plan. As a result, he thought about everything from trucking to armoured cars to doctors on call and how they would all play into the mix. While it is important to consider these different modes of transportation, Dale Bracewell stated that planning for these modes does not have to be comprehensive, meaning that every mode does not necessarily have to be modelled or studied extensively. Rather, just ensure that they are considered and explored.

Charles Gauthier has suggested having a lot of consultation and engaging with stakeholders. It was this consultation that helped to ensure that no businesses represented by the DVBIAs were behind the security zone and that businesses and the public were well notified about the transportation changes in advance. According to Charles Gauthier, being repetitive and getting the word out was key to the success of the Olympics.

Lastly, Clark Lim suggested that making the link explicitly with disasters could be an opportunity that could be leveraged during the Olympics. He noted that the Olympic period could be a time to get businesses and the public to think, experiment, and create an emergency preparedness strategy for dealing with other episodic events.

8: CONCLUSION

This research project has illustrated the potential of generating lessons from the Olympic downtown transportation experience that could be useful to future transportation planning in Vancouver. It has also suggested that other host cities could be able to leverage mega-events like the Olympics to improve their transportation system and learn lessons that are directly applicable to their localities. There is the potential for lessons that provide insight into long term transportation planning as well as planning for episodic events. As well, there are lessons at both macro and micro levels, lessons internal to organizations, and lessons for operations. However, the types of lessons generated will be determined by the commitment of governments to putting in resources to collect necessary data and to document events and experiences.

The value of learning from the Olympics is important given the many challenges facing cities. As Transport Canada puts it, “learning from past experience is often one of the best ways to move forward”²⁰⁴. For Vancouver, it appears that the Olympics did have an effect in building on the existing momentum previous to the Olympics by spurring some transportation changes. As outlined earlier, some initiatives during the Olympics are being considered by the City of Vancouver and TransLink for permanent implementation.

²⁰⁴ Transport Canada, “TDM Strategies”

As well, following the Olympics, there appears to be momentum for increased transit use and increased programming of public activities in downtown Vancouver. A lot of summer programming was developed for Granville Street to keep it a pedestrian-active space including hosting broadcasts of the World Cup.²⁰⁵ While buses have returned to Granville Street²⁰⁶ as originally planned, they are now rerouted off Granville Street after 9pm on Fridays, Saturdays, Sundays, holidays, and evenings before holidays to create an “appropriate balance between transit corridor and entertainment district.”²⁰⁷

In addition, a release from TransLink in May 2010 presented statistics on transit use²⁰⁸ after the Olympics. It stated that transit use prior to the Olympics in January 2010 rose 3.1% from January 2009. After the Olympics, transit use rose by 19.3% in March 2010 compared to March 2009 (see Table 7). It remains to be seen how long that momentum can be sustained and whether initiatives in the OTP will be implemented permanently. Regardless, I think the Olympics were valuable in at least showing what successful transportation could look like and providing insight into how successful transportation can be achieved.

²⁰⁵ Graeme Wood, “Crowds gather for World Cup and ‘car free’ events on Granville”, Vancouver Sun, Jul 10, 2010

²⁰⁶ They were originally taken off in April 2006 for the construction of the Canada Line.

²⁰⁷ Jhenifer Pabiliano, “Trolley service returns to Granville Mall on Tue Sept 7”, The Buzzer Blog, Aug 11, 2010 <<http://buzzer.translink.ca/index.php/2010/08/trolley-service-returns-to-granville-mall-on-tue-sept-7>>

²⁰⁸ TransLink, “Transit ridership post-Olympics”, TransLink, May 25, 2010

Table 7: Comparing First-Quarter Revenue Ridership (First Time One Boards a Transit Vehicle) 2009 versus 2010²⁰⁹

Service	March 2009	March 2010	Percent Change
Bus	10,965,169 (YTD-33,391,391)	11,241,212 (YTD-33,581,535)	2.5% (YTD-0.6%)
SkyTrain	3,660,561 (YTD-11,020,502)	6,243,160 (YTD-21,479,832)	70.6% (YTD-94.9%)
SeaBus	233,206 (YTD-674,739)	277,305 (YTD-1,049,614)	18.9% (YTD-55.6%)
West Coast Express	213,632 (YTD-686,377)	226,628 (YTD-693,862)	6.1% (YTD-12.3%)
Total	15,072,568 (YTD-45,704,373)	17,988,305 (YTD-56,804,843)	19.3% (YTD-24.3%)

²⁰⁹ Ibid.

REFERENCE LIST

- Adams, John. "The social implications of hypermobility." in The Economic and Social Implications of Sustainable Transportation: Proceedings from the Ottawa Workshop. (OECD, 2000)
- BC Hydro. "Press Release: Report released on downtown Vancouver power outage." BC Hydro. Sept 29, 2008, <http://www.bchydro.com/news/articles/press_releases/2008/report_released_on.html>
- Boychuk, Charlotte. "Maintaining our extra Olympic buses during the Games." The Buzzer Blog. Mar 3, 2010 <<http://buzzer.translink.ca/index.php/2010/03/maintaining-our-extra-olympic-buses-during-the-games/#more-8690>>
- Bracewell, Dale. Host City Olympic Transportation Plan: A Sustainable Legacy for Vancouver. (Vancouver, Olympic Transportation Branch, 2010)
- Bracewell, Dale. "The Road to the 2010 Olympic and Paralympic Games – Transportation Findings of Large Public Events in Downtown Vancouver." 2008 Annual Conference of the Transportation Association of Canada, Toronto
- Calimente, John. "Vancouver becomes a transit city for 17 days." re:place magazine. Mar 31, 2010 Available: <<http://regardingplace.com/?p=8014>>
- Cambridge Systematics Inc. and Eastern Research Group Inc. Evaluate the Interactions between Transportation-Related Particulate Matter, Ozone, Air Toxics, Climate Change, and Other Air-Pollutant Control Strategies. (National Cooperative Highway Research Program, 2010)
- CBC News. "Olympics could boost insurance costs." CBC. Sept 30th, 2009
- Chan, Jason. "Delivering operations excellence." 2010 APTA Rail Conference, Vancouver, Jun 6, 2010
- City of Vancouver. "[3] Principles, Policies and Priorities." (City of Vancouver, Engineering Services, 2010) Available: <<http://vancouver.ca/engsvcs/transport/plan/1997report/3-1.htm>>
- City of Vancouver. "Background to the Downtown Transportation Plan." (City of Vancouver, 2010) Available: <<http://vancouver.ca/dtp/transportationchallenge.htm>>

- City of Vancouver. "Burrard Bridge Statistics." City of Vancouver, 2010, <<http://vancouver.ca/projects/burrard/statistics.htm>>
- City of Vancouver. "Central Waterfront Hub: Transit." City of Vancouver. Available: <http://vancouver.ca/commsvcs/currentplanning/whitecaps/pdf/Board3_Transportation%20sm.pdf>
- City of Vancouver. Downtown Transportation Plan. (City of Vancouver, 2002) Available: <<http://vancouver.ca/dtp/dtpfinalplan.htm>>
- City of Vancouver. Transportation Trends – 2006 Census and Central Business District Counts. (City of Vancouver, 2008)
- City of Vancouver. Vancouver Transportation Plan, Progress Report. (City of Vancouver, 2006)
- City of Vancouver. "What to expect." City of Vancouver, 2010, <<http://olympichostcity.vancouver.ca/gettingaround/whattoexpect.htm>>
- Crawford, Tiffany. "Transit runs smoothly despite influx of travellers on busiest Games day yet." Vancouver Sun. Feb 17, 2010
- Culbert, Lori. "Councillor wants city to consider closing down Robson Street on summer weekends." Vancouver Sun. Apr 2, 2010
- Dexter, Lorena. "The New Canada Line Culture: more urban, more engaged." VPSN, Feb 19, 2010
- Dhariwal, Rajan. "Downtown Vancouver Blackout 2008: Assessing Disruptions to Businesses." UBC Centre for Human Settlements. March 16th, 2010
- Dill, Jennifer and Erin Wardell. "Factors affecting worksite mode choice: findings from Portland, Oregon." Transportation Research Record: Journal of the Transportation Research Board. 1994, (2007) 51-57
- Farrell, Ian. "Learning to navigate downtown Vancouver." The Seattle Times, Feb 15, 2010
- Federation of Canadian Municipalities. Improving Travel Options with Transportation Demand Management (TDM). (FCM, 2008)
- Finke, Timo and Eric N. Schreffler. "Using Multiple Assessment Levels for Evaluating Transportation Demand Management Projects: Monitoring and Evaluation Toolkit." Transportation Research Record: Journal of the Transportation Research Board, 1864, 2004, 135-143
- Fontaine, Daniel. "Traffic congestion eases while transit system over capacity." CityCaucus, Feb 21, 2010, Available: <<http://www.citycaucus.com/2010/02/traffic-congestion-disappears-as-transit-system-taxed-to-the-max>>

- Frank, Lawrence D., Martin A. Andresen, and Thomas L. Schmid. "Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars." American Journal of Preventive Medicine. 27.2, (2004) 87-96
- Fujii, Satoshi. "Retrospectives and Perspectives on Travel Behavioural Modification Research: A report of the "Behavioural Modification" Workshop." in The expanding sphere of travel behaviour research and selected papers from the 11th International Conference on Travel Behaviour Research, edited by Ryuichi Kitamura, Toshio Yoshii, and Roshiyuki Yamamoto, (UK: Emerald Group Publishing Limited, 2009)
- Gärling, Tommy and Satoshi Fujii. "Travel behaviour modification: theories, methods, and programs." in The expanding sphere of travel behaviour research and selected papers from the 11th International Conference on Travel Behaviour Research, edited by Ryuichi Kitamura, Toshio Yoshii, and Roshiyuki Yamamoto, (UK: Emerald Group Publishing Limited, 2009)
- Gärling, Tommy, Anita Gärling, and Peter Loukopoulos. "Forecasting Psychological Consequences of Car Use Reduction: A Challenge to an Environmental Psychology of Transportation." Applied Psychology: An International Review. 51.1, (2002) 90-106
- Gärling, Tommy and Geertje Schultema. "Travel demand management targeting reduced private car use: effectiveness, public acceptability, and political feasibility." Journal of Social Issues. 63.1, (2007) 139-153
- Gifford, Robert and Linda Steg. "The impact of automobile traffic on quality of life." in Threats from Car Traffic to the Quality of Life edited by Tommy Gärling and Linda Steg, (Netherlands: Elsevier, 2007)
- Gilbert, Robert and Anthony Perl. Transport revolutions: moving people and freight without oil. (Sterling: Earthscan, 2008)
- Giuliano, Genevieve. "Transportation Demand Management: Promise or Panacea?" Journal of the American Planning Association. 58.3, (1992) 327-335
- Giuliano, Genevieve and Jacqueline Golob. "Impacts of the Northridge earthquake on transit and highway use." Journal of Transportation and Statistics. 1.2, (1998) 1-20
- Giuliano, Genevieve, Kevin Habolan, Joseph Prashker, and Will Recker. Evaluation of 1984 Los Angeles Summer Olympics Traffic Management. (Institute of Transportation Studies, University of California, 1987)
- Goddard, Jim. "Poll: Twelve per cent of people in Greater Vancouver planning to leave town during Olympics." News1130. Jan 19, 2010
- Greater Vancouver Regional District. Greater Vancouver Region Transportation Demand Management Project: Final Report. (GVRD, 1996)

- Greater Vancouver Regional District. Livable Region Strategic Plan. (Burnaby: Policy and Planning; 1999)
- Greater Vancouver Regional District and the Province of BC. A Long-Range Transportation Plan for Greater Vancouver: Transport 2021 Report. (GVRD and Province of BC, 1993)
- Harcourt, Mike, Ken Cameron, and Sean Rossiter. City Making in Paradise: Nine Decisions that Saved Vancouver. (Vancouver: Douglas & McIntyre, 2007)
- Hensher, David A. and Ann M. Brewer. "Going for Gold at the Sydney Olympics: how did transport perform?" Transport Reviews. 22.4, (2002) 381-399
- Heshka, Tyler. "Our customer call centre sets their own Games records." The Buzzer Blog, Feb 25, 2010, Available: <<http://buzzer.translink.ca/index.php/2010/02/our-customer-call-centre-sets-their-own-games-records/>>
- Inwood, Damian. "Expect bridge closures on Cambie St. in Feb., March." The Province. Jan 13, 2010
- International Olympic Committee. Factsheet: OKGM and the Vancouver 2010 debrief. (IOC, 2010)
- Kassens, Eva. Transportation Planning for Mega-Events: A model for urban change. PhD. Thesis, Massachusetts Institute of Technology, 2009
- Kitamura, Ryuichi, S. Nakayama, and T. Yamamoto. "Self-reinforcing motorization: can travel demand management take us out of the social trap?" Transport Policy. 6, (1999) 135-145
- Kitamura, Ryuichi, T. Yamamoto, and Satoshi Fujii. "Impacts of the Hanshin-Awaji earthquake on traffic and travel." in S. Cairns, C. Hass-Klau, and PB Goodwin, Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence. (London: Landor, 1998)
- Litman, Todd. "Evaluating Transportation Resilience." Victoria Transport Policy Institute. 2010 Available: <<http://www.vtpi.org/tm/tm88.htm>>
- Litman, Todd. "Special Event Transport Management." Victoria Transport Policy Institute. 2010 <<http://www.vtpi.org/tm/tm48.htm>>
- Litman, Todd. "Success stories: Examples of TDM Programs that work." Victoria Transport Policy Institute, 2010, <<http://www.vtpi.org/tm/tm71.htm>>
- Lyons, Alex. "Fewer ICBC claims than normal during Vancouver Winter Games." News1130. Mar 4, 2010
- Meyer, Michael D. "Demand management as an element of transportation policy: using carrots and sticks to influence travel behaviour". Transportation Research Part A. 33, (1999) 575-599

- Munro, Harold. "Replace old trolley buses, officials say: They recommend replacing Vancouver's fleet of 244 by 2006, at a cost of more than \$300 million." Vancouver Sun. Jun 16, 2000
- Newman, Peter, Timothy Beatley, and Heather Boyer. Resilient Cities: Responding to Peak Oil and Climate Change. (Washington: Island Press, 2009)
- Noland, Robert B., William A. Cowart, and Lewis M. Folton. "Travel demand policies for saving oil during a supply emergency." Energy Policy. 34 (2006) 2994-3005
- NRG Research. Transit Service Quality During the Olympics. (TransLink, 2010)
- OECD, Towards Sustainable Transportation, (OECD, 1996)
- Office of the Premier. "U-Pass BC to save students on transit fares". Ministry of Transportation and Infrastructure. June 9, 2010
- Pabillano, Jhenifer. "How we manage the SkyTrain lineups at Waterfront Station." The Buzzer Blog, Feb 18, 2010
<<http://buzzer.translink.ca/index.php/2010/02/how-we-manage-the-skytrain-lineups-at-waterfront-station>>
- Pabillano, Jhenifer. "New reroutes for the 5, 6, and N6 during the Olympics." The Buzzer Blog, Feb 16, 2010,
<<http://buzzer.translink.ca/index.php/2010/02/new-reroutes-for-the-5-6-and-n6-during-the-olympics/>>
- Pabillano, Jhenifer. "TransLink's Olympic Story, part 4: reducing car traffic and offering travel options." The Buzzer Blog, Feb 2, 2010,
<<http://buzzer.translink.ca/index.php/2010/02/translinks-olympic-story-part-4-reducing-car-traffic-and-offering-travel-options/>>
- Pabillano, Jhenifer. "Trolley service returns to Granville Mall on Tue Sept 7." The Buzzer Blog, Aug 11, 2010
<<http://buzzer.translink.ca/index.php/2010/08/trolley-service-returns-to-granville-mall-on-tue-sept-7>>
- Pathman, Karthick. Urban change and transportation vulnerability to earthquakes: the case of metro Vancouver. Masters thesis, University of British Columbia, Vancouver, 2010
- Penner, Derrick. "Vancouver contemplates life without the viaducts." Vancouver Sun, Mar 22, 2010
- Poudenx, Pascal. "The effect of transportation policies on energy consumption and greenhouse gas emission from urban passenger transportation." Transportation Research Part A. 42, (2008) 901-909

- Robbins, Derek, Janet Dickinson, and Steven Calver. "Planning transport for special events: A conceptual framework and future agenda for research." International Journal of Tourism. 9, (2009) 303-314
- Robinson, Russ. "Transportation demand management in Canada: an overview." Energy policy. 25, (1997) 1189-1191
- Rossi, Cheryl. "Tow trucks report no Games increase." Vancouver Courier, Feb 10, 2010
- Saleh, Wafaa. "Success and failure of transportation demand management: Is congestion charging the way forward?" Transportation Research Part A. 41, (2007) 611-614
- Scott, Sheila. "VANOC TravelSmart Challenge hopes to reduce traffic leading up to Olympics." News1130. Jan 6, 2010
- Scott, Sheila. "Vancouverites booking tickets out of town during Olympics." News1130, Nov 3, 2009
- Senft, Graham. U-pass at the University of British Columbia: Lessons for Effective Demand Management in the Campus Context. 2005 Annual Conference of the Transportation Association of Canada, Calgary, 2005
- Shiffer, Michael. "It Takes a Region: Integrating rail investment in multimodal plans and programs." 2010 APTA Rail Conference. Vancouver, Jun 6, 2010
- Sin, Lena. "1:45 pm at Waterfront station." The Province. Feb 21, 2010
- Sinoski, Kelly. "Drivers alerted as viaducts set to close." Vancouver Sun. Feb 3, 2010
- Sinoski, Kelly. "Impark ups parking rate to \$95 a day at two lots." Vancouver Sun, Feb 13, 2010
- Sinoski, Kelly. "Nine major downtown Vancouver traffic routes to close for the Olympics." Vancouver Sun. Oct 14, 2009
- Sinoski, Kelly. "Record weekend expected for transit as Vancouver Olympic fever deepens." Vancouver Sun, Feb 20, 2010
- Sinoski, Kelly. "TransLink expecting nearly a million passengers a day during 2010 Games." Vancouver Sun. Mar 3, 2009
- Sinoski, Kelly. "TransLink takes stock after Olympics." Vancouver Sun. Mar 1, 2010
- Solomon, Linda. "Charles Gauthier: Preparing businessse for the Olympic Games." Vancouver Observer, Jun 8, 2009, Available: <<http://www.vancouverobserver.com/2009/06/08/charles-gauthier-preparing-businesses-olympic-games>>

- Souche, Stéphanie. "Measuring the structural determinants of urban travel demand." Transport Policy. 17, (2010) 127-134
- Statistics Canada, Employed labour force by mode of transportation, both sexes, percentage distribution, for Canada, census metropolitan areas and census agglomerations, and component census subdivisions (municipalities) of residence - 20% sample data, 2006 Census, Ottawa, 2009, Available from <<http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/hlt/97-561/T603-eng.cfm?SR=1>>
- Steg, Linda and Robert Gifford. "Sustainable transportation and quality of life." Journal of Transport Geography. 13, (2005) 59-69
- Synovate, TransLink Olympic Travel Survey – Final, (TransLink, 2009)
- The Province. "Tip to avoid the all-day rush hour", The Province, Feb 10, 201
- The Province. "Lots of Vancouverites making plans to escape Winter Olympics", The Province. Nov 5, 2009
- Toderian, Brent. "Vancouver Olympics a Living Laboratory for Urbanism!" Planetizen, Feb 25, 2010 Available <<http://www.planetizen.com/node/43096>>
- TransLink. "Accolades for TransLink Olympic efforts". TransLink, May 25, 2010
- TransLink. "Moving the world record numbers ride transit in Olympic week 1". TransLink, Feb 20, 2010
- TransLink. "Transit ridership post-Olympics". TransLink. May 25, 2010
- TransLink. "TransLink tops 26 million riders". TransLink. Mar 23, 2010
- TransLink. Transport 2040, (TransLink, 2008)
- TransLink. "TravelSmart Pilot Project." TransLink. <<http://www.translink.ca/en/Plans-and-Projects/Urban-Showcase/Travel-Smart-Pilot-Project.aspx>>.
- Transport Canada. "TDM definition, overview, and rationale." Transport Canada, 2010. <<http://www.tc.gc.ca/eng/programs/environment-utsp-tdmintro-1039.htm>>
- Transport Canada. "TDM strategies during transportation disruptions and episodic events". Transport Canada, 2010, <<http://www.tc.gc.ca/eng/programs/environment-utsp-casestudy-cs75etdmstrategies-890.htm>>
- Transport Canada. "Targeted marketing and outreach." Transport Canada. <<http://www.tc.gc.ca/eng/programs/environment-utsp-tdm-prj49e-953.htm>>

- Transport Canada. "Transportation Demand Management (TDM) Resource Centre." 2010, <<http://www.tc.gc.ca/eng/programs/environment-utsp-tdmresources-1051.htm>>
- UK Sport. "The Economic Impact of Major Events". Staging Major Events: The Guide, UK Sport, 2005
- Ungemiah, David and Casey Dusza. "Transportation Demand Management Benchmark: Results from 2008 TDM Program Survey." Transportation Research Record: Journal of the Transportation Research Board. 2118, (2009) 55-66
- University of British Columbia. Fall 2008 Transportation Status Report. (UBC, Feb 2009)
- Vancouver Sun. "Pattullo Bridge Closed". Vancouver Sun. Jan 19, 2009
- Vancouver Sun. "Power outage causes chaos downtown". Vancouver Sun. Aug 26th, 2006
- Vancouver Sun. "Residents flee city to avoid Olympic chaos". Vancouver Sun. Nov 5, 2009
- VANOC. Fact Sheet: Transportation Planning for the 2010 Olympic Winter Games. (VANOC, 2009)
- VANOC. "2010 Olympic Transportation Plan a success". VANOC. Mar 3, 2010
- Wachs, Martin. "Policy Implications of Recent Behavioural Research in Transportation Demand Management." Journal of Planning Literature. 5, (1991) 333-341
- Walker, Jarrett. "Vancouver: Olympic transit payoffs." Human Transit. Mar 1, 2010, Available: <<http://www.humantransit.org/2010/03/vancouver-olympic-transit-payoffs.html>>
- Warner, Adrian. "Can London 2012 succeed on transport like Vancouver?" BBC, Feb 18, 2010. Available: <http://www.bbc.co.uk/blogs/adrianwarner/2010/02/can_vancouvers_transport_succe.html>
- Williams, M.E. and K.L. Petrait. "U-Pass: A model transportation management program that works." Transportation Research Record. 1404, (1993) 73-81
- Winters, Philip L. "Transportation Demand Management." Transportation Research Board. (2000)
- Wood, Graeme. "Crowds gather for World Cup and 'car free' events on Granville." Vancouver Sun. Jul 10, 2010