Approval

Name: Dany Doiron

Degree: Master of Public Policy

Title of Project: Destinations Matter: Increasing Walking Rates in a Richmond, BC Neighbourhood

Examining Committee:

___________________________________________
Kennedy Stewart
Senior Supervisor
Assistant Professor, Public Policy Program, SFU

___________________________________________
John Richards
Supervisor
Professor, Public Policy Program, SFU

___________________________________________
Patrick Smith
External Examiner
Professor, Department of Political Science, SFU

Date Defended/Approved: February 27, 2009
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Abstract

This study explores the effect of built environment characteristics on the walking habits of local residents using data obtained from the 2006 British Columbia Health and Wellness Survey. Regression analysis of 375 questionnaires collected from a random sample of residents in a Richmond, BC neighbourhood indicates that spatial access to retail establishments and recreational facilities are positively associated with walking. Given the study’s findings, it is suggested that the City of Richmond move forward with the implementation of key components of the new City Centre Area Plan that address retail and recreational space accessibility. On a broader scale, this study’s findings indicate that in order to create a built environment that is supportive of physical activity, municipal governments should provide easily accessible walking destinations such as retail and recreational spaces when planning new communities and when redeveloping existing areas.

Keywords: Walking; built environment; physical activity; public health; urban planning

Subject Terms: City planning -- Health aspects; Urban health; Transportation -- Health aspects; City Planning British Columbia Richmond; Health Behavior Canada
Executive Summary

Physical inactivity is an important public health issue in Canada. Three in five Canadians are not active enough to generate the long-term health benefits of physical activity. Observational studies have shown that by engaging in moderate forms of physical activity, namely walking, individuals are less likely to develop chronic diseases such as Type-2 diabetes, obesity, cardiovascular diseases, and certain cancers. To address this problem, all levels of government are now considering policy interventions aimed at making Canadians more physically active. A growing body of evidence suggests that our physical environment influences walking rates and general levels of physical activity. This study investigates the relationship between walking and the neighbourhood environment. The objective is to provide recommendations for the creation of physical environments that support increased levels of walking.

Logistic regression analysis of 375 questionnaires collected from a random sample of residents in a Richmond, BC neighbourhood is used to explore the relationship between self-reported walking rates and eight neighbourhood environment variables: residential density, retail proximity, access to transit, sidewalk availability, access to recreational facilities, neighbourhood aesthetics, and the presence of crime and traffic. Data used in this study was collected in the Provincial Health Services Authority’s 2006 British Columbia Health and Wellness Survey (BC-HWS). Statistical analysis results show that walking is positively associated with spatial accessibility of both retail establishments and recreational facilities.

Using these findings, policy options addressing walking rates in Richmond’s City Centre neighbourhood are presented. These options are developed in light of the current Richmond City
Centre Area Plan (CCAP) update. Three options are considered: (1) Status Quo; (2) CCAP Implementation; and (3) Modified CCAP. The Status Quo is presented as an option to be pursued by the City of Richmond and as a base for comparing the other two options. The second policy option is the implementation of key features of the CCAP update that address accessibility of retail establishments and recreational facilities. The third option entails modifying the CCAP to further improve retail and park space accessibility for all residents of the City Centre area. Each option is assessed according to its effectiveness in increasing walking rates, cost of implementation, stakeholder acceptability, administrative simplicity and equity. Based on multi-criteria policy analysis, this study recommends that the City of Richmond move forward with the implementation of key components of the CCAP in order to increase walking rates in the area.

The broader implications of this study are that providing retail and recreational facilities within easy walking distance from residences can help integrate moderate physical activity into the daily routine of urban residents by making regular walking more appealing and practical. Recreational and utilitarian destinations within reasonable walking distance from residences can therefore contribute to achieving recommended levels of physical activity. In light of these findings, municipalities should consider the public health benefits of mixing residential and retail land uses and ensuring that park spaces are easily accessible when planning new communities or redeveloping existing areas. Further collaborations between urban planning and public health professionals may also help identify appropriate guidelines and practices to create healthy and active communities.
Dedication

À mes parents,

Merci pour votre soutien inconditionnel et votre affection.
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I would first like to thank Dr. Kennedy Stewart for his guidance and helpful feedback throughout this research project. His input has been invaluable during the researching and writing process. I would also like to thank Dr. Paddy Smith for his insightful comments and questions during my defence.

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1: Introduction

Sixty-three percent of Canadians do not exercise at a level sufficient to achieve the health benefits associated with physical activity (PHAC, 2003). In British Columbia, the most physically active province in the country, only 57 percent exercise at or above recommended levels (Statistics Canada, 2005). Physical inactivity is a leading risk factor for a variety of health problems and chronic diseases including heart attacks, strokes, hypertension and diabetes. It is also linked to increasing levels of obesity in the Canadian population (HSFC, 2007). As a result, finding ways to increase physical activity is considered a priority by all three levels of government in Canada (SIHLN, 2005; ActNow BC, 2006; BCRPA, 2009). In June 2003, the federal government along with every province and territory in Canada set a goal of increasing physical activity by 10 percentage points by the year 2010 (SIHLN, 2005). The Public Health Agency of Canada (PHAC) recommends that Canadians engage in 30 to 60 minutes of daily moderate physical activity as a means to generate long-term health benefits (PHAC, 2003). A review of physical activity promotion strategies found that interventions which encourage walking are the most likely to increase overall physical activity and meet public health recommendations (Hillsdon and Thorogood, 1996). This study investigates the relationship between walking and the built environment.

Regression analysis is performed on data from a Richmond, BC neighbourhood in which walking rates are relatively low compared to other communities in the province. The objective of this study is to identify what influence, if any, individual neighbourhood characteristics have on the likelihood that residents walk less than the 30 minute level recommended by PHAC on a typical day. Results show that accessibility of retail and recreational facilities is positively
associated with walking behaviour. Based on these findings, policy options are proposed to address retail and recreational space accessibility in Richmond’s City Centre.

The study is organised as follows. Section 2 establishes the situational context of the policy problem. A description of the methodology employed in this study is provided in Section 3. This includes a description of the British Columbia Health and Wellness Survey (BC-HWS), the main data source used for this study, a presentation of the sample community selected for analysis, and a review of literature investigating the relationship between walking rates and explanatory variables included in this study. Section 4 presents descriptive statistics, outlines the results of statistical analysis and identifies some of the study’s limitations. The three policy options considered in this study are described in Section 5, along with the criteria and measures used to assess them. In Section 6, policy options are evaluated and recommendations are made. Finally, concluding remarks are provided in Section 7, as well as comments on the broader implications of the study’s findings.
2: Policy Problem and Background

This section outlines the health risks of physical inactivity and discusses these risks in a public policy context. It also provides background information on the association between the built environment and physical activity, and describes the role that municipalities have in creating walking-friendly environments. The purpose is to provide the context in which this study is conducted.

2.1 Policy Problem

The general policy problem addressed by this study is physical inactivity among Canadians. According to the Public Health Agency of Canada, three in five Canadians are currently not active enough to generate the long-term health benefits of physical activity. Observational studies have shown that by engaging in moderate forms of physical activity such as walking, individuals reduce their risk of developing a number of chronic diseases, lower their blood pressure, reduce high cholesterol, enhance their mental well-being, and control their body weight (Bouchard, et al. 1994).

Although all levels of government have acknowledged the importance of increasing physical activity, much of the effort to date has gone into public education campaigns with respect to the benefits of leading a physically active lifestyle, as opposed to environmental measures to encourage active living. Green and Kreuter (1991) claim that successful health promotion programs combine “education and environmental supports for actions and conditions of living conducive to health.” A growing concern among public health practitioners is that our physical environment is not conducive to regular physical activity such as walking. Research evidence demonstrating the connection between the built environment and physical activity levels
has warranted a reorientation of transportation and land use patterns to create an urban environment that is supportive of physical activity (Frank et al., 2006; Hoehner, et al., 2003).

Interventions aimed at increasing walking rates are often viewed as the best way to increase physical activity (Hillsdon and Thorogood, 1996). Compared to most other forms of physical exercise, walking has no barrier to participation, can be easily incorporated into the daily routine of individuals, and is more likely to be adopted over the long term (Frank et al., 2003). Walking is also the most popular form of physical activity among Canadians of all ages (Statistics Canada, 2005), making it a prime target for interventions aimed at increasing overall physical activity levels.

This study focuses on the role urban land-use planning plays in creating walking-friendly environments. The decisions that municipal governments make regarding integration of residential, commercial, institutional and recreational land uses, the development of compact communities, and the provision of sidewalks and walking trails can encourage active living by making it easier and more appealing for people to walk for daily chores or for recreational purposes. Some authors suggest that people are generally more physically active and have lower incidences of health problems if they live in pedestrian-oriented communities with moderate to high residential densities, a well-connected street network, well-maintained pedestrian infrastructure such as sidewalks and trails, and a diversity of destinations at easy walking distance from their residences (Cervero and Radisch, 1996; Saelens, et al. 2003; Ewing, et. al. 2003; Lopez, 2004; Frank et al. 2004). In addition to having positive health implications, providing opportunities to increase walking rates in urban areas can lead to significant environmental and economic benefits for society by reducing air pollutants and greenhouse gases related to motorized travel, and by lessening the economic burden associated with physical inactivity, air pollution and traffic accidents. The following subsection gives a brief overview of the health implications of increasing walking rates in Canadian urban centres.
2.2 Health Implications

As noted earlier, increased levels of walking for recreational or utilitarian purposes bring significant public health benefits by increasing overall physical activity and thereby reducing the risk of preventable health problems such as obesity, cardiovascular diseases, Type-2 diabetes, and certain cancers. According to the Canadian Community Health Survey 2004, half of Canadians are currently overweight. Between 1979 and 2003, obesity (Body Mass Index ≥ 30) grew almost 10 percentage points: from 14 per cent to 23 percent. Obesity is the second leading preventable cause of premature death after tobacco use (Coleman, 2001). Between 1985 and 2000, deaths related to obesity almost doubled, growing from 2,514 to 4,321 (Heart and Stroke Foundation, 2004). The growing incidence of obesity and its negative public health repercussions are linked to the lack of physical activity in the Canadian population (HSFC, 2005). Research suggests that for every additional kilometre walked per day, the risk of obesity can decline by five percent (Frank et al., 2004). Sedentary lifestyles and obesity also increase the risk of cardiovascular diseases, which accounted for 34 percent of all deaths in Canada in 2004 (Statistics Canada, 2004). Evidence shows that people leading an inactive lifestyle can reduce their heart attack risk by 35 to 55 percent by becoming physically active (HSFC, 2006). Type-2 diabetes is one of the fastest growing diseases in Canada with over 60,000 new cases reported each year. This drastic increase is due to a number of factors, which include increasing rates of obesity and reduced physical activity levels. Type-2 diabetes can be postponed or prevented entirely when appropriate preventative measures are taken. The Canadian Diabetes Association estimates that people at risk can reduce their risk of developing the disease by up to 58 percent by exercising moderately for 30 minutes per day and reducing their body weight by 5 to 7 percent. For people aged 60 and over, these same preventative measures will reduce their risk by 71 percent (CDA, 2005).

Physical inactivity represents a considerable economic burden on society through lower productivity, premature death, and public health care expenditures. The total economic cost of
physical inactivity in Canada is estimated at $5.3 billion, with the economic cost related solely to obesity estimated at $4.3 billion (Katzmarzyk and Janssen, 2004). These costs represent 2.6 percent and 2.2 percent of total Canadian health care costs, respectively. A study conducted in 2000 in Canada also shows that an increase of 10% in the prevalence of physical activity could lead to $150 million in yearly health care cost savings (Katzmarzyk et al., 2000). In British Columbia alone, the cost of obesity-related diseases to the economy is between $730 and $830 million per year, representing 0.8 percent of the province’s GDP (Coleman, 2001). These studies provide strong evidence that increasing moderate physical activity rates through walking could yield considerable social benefits.

2.3 Policy Background

The relationship between the built environment and levels of walking and physical activity has attracted much attention from urban planners and public health professionals in the past decade. Many public health experts now acknowledge that the built environment has an important effect on physical activity patterns and ensuing population health outcomes. This association is supported by systematic literature reviews conducted by the Transportation Research Board and Institute of Medicine (2005) and by the Centers for Disease Control and Prevention’s Task Force on Community Preventive Services (Heath et al., 2006). Studies on environmental and social determinants of physical activity have shown that residential density, street connectivity, land use mix, availability of pedestrian facilities and paths, transit access, and aesthetic features of a neighbourhood can have a significant impact on levels of walking and overall physical activity. In addition, some authors have assessed the relationship between walking behaviour and social characteristics such as crime, traffic and vehicle ownership. In light of the findings of some of these studies, Canadian and British Columbian health authorities have recently begun raising awareness about the effects of the built environment on physical activity and public health (HSFC, 2007; PHSA, 2007a; Bray et al., 2005). Research findings showing a
relationship between urban land use patterns and physical activity warrant strong support for making changes to the way communities are planned and developed so as to promote physical activity and improve public health. The federal and provincial governments have both recently identified urban planning and design as a key area of intervention to increase opportunities for people to engage in regular physical activity (ActNow BC, 2006; SIHLN, 2005). To date however, public education remains the main policy tool used by governments to promote physically active lifestyles.

Across Canada, non-motorized transportation makes up only 12 percent of all trips made to the store, to work or to school. Although this rate is higher than that found in the United States (seven percent), it is much lower than in countries such as the Netherlands (46 percent) and Denmark (41 percent) (HSFC, 2007). There is evidence however that Canadians want more opportunities for active transportation. In a 1998 survey of 1,500 adults across Canada, eight in ten respondents stated that they would like to walk more than they already do (Go for Green, 1998). Although a number of factors contribute to physical inactivity in the Canadian population, providing opportunities for more walking in urban environments through appropriate community design could increase physical activity.

2.4 Summary

Physical inactivity represents a public health priority for all levels of government in Canada. Evidence shows that physical inactivity is a preventable risk factor for many of the chronic diseases that Canadians face. This warrants actions to increase levels of regular physical activity. Recent research in the fields of urban planning and public health suggest that a number of changes to the built environment can help create healthier, more active communities. In the following two sections, the relationship between walking behaviour and physical environment characteristics in a Richmond, BC neighbourhood is investigated. Section 3 provides an overview of the methodology used to conduct this research project. Information on the primary data source
used for this study and the sample community is presented. The dependent and independent variables used for statistical analysis are also described. Lastly, a review of literature provides an overview of significant findings concerning the effect of individual neighbourhood environment characteristics on walking behaviour.
3: Methodology

This study examines the impact of previously discussed physical environment characteristics on walking in a Richmond, British Columbia neighbourhood. The data used comes from the Provincial Health Services Authority’s (PHSA) 2006 British Columbia Health and Wellness Survey (BC-HWS). Firstly, the BC-HWS’s purpose, content and methodology are described. The Richmond Centre sample population is then presented. A description of the dependent and independent variables follows, along with the predicted relationships between each explanatory variable and individual walking behaviour. Lastly, data recoding conducted on independent variables to facilitate data analysis is reported.

3.1 British Columbia Health and Wellness Survey (BC-HWS)

In 2006, the PHSA administered the first British Columbia Health and Wellness Survey (BC-HWS) as part of its “prevention, promotion and protection” mandate (PHSA, 2007b). Modelled after Ontario’s Rapid Risk Factor Surveillance System (RRFSS), the 17-minute telephone survey gathered information concerning the health-related lifestyle patterns of British Columbians in 26 communities/regions within all five regional health authorities in the province.¹ Using random digital dialling (RDD) methodology, 10,485 total participants were selected - approximately 400 respondents in each of the 26 communities/regions. Using 2001 Statistics Canada Census data, a demographic profile of each community/region surveyed was developed by the PHSA. Weighting for each community/region was constructed based on this profile and the sampling ratio by gender and age groups. Individual weights therefore ensure correct representation of gender and age groups of each community/region surveyed. The sample used

¹ For a complete description of BC-HWS geographical coverage and sample areas, refer to the descriptive report (PHSA, 2007b).
for this study offers estimates of the larger population accurate within +/- 5 percent, 19 times out of 20. The BC-HWS survey includes questions about the respondent’s socio-demographic characteristics, height and weight, general health, diabetes, high blood pressure, other chronic diseases, reproductive health, physical activity level, sedentary activities, fruit and vegetable consumption, tobacco use, alcohol consumption, environment for physical activity, and food access and security.

3.2 The Richmond Case: Selection Justifications and Overview

The BC-HWS Descriptive Report (PHSA, 2007b) outlines the median walking minutes per week of respondents in each of the 26 community/region surveyed (See Appendix A). In most communities, the median self-reported time spent walking was near or above moderate intensity activity levels recommended by the Public Health Agency of Canada (PHAC). The Richmond Centre community stands out among the 26 province wide sample areas in terms of the walking rates of its residents because the median minutes walked per week is half those of the top ranked community and considerably lower than the minimum level of moderate physical activity recommended by PHAC (210 minutes per week or 30 minutes per day). As the community with the lowest median minutes walked per week among those surveyed in the BC-HWS, Richmond Centre has the most potential for improvement and would seem the best candidate for municipal intervention. Based on this assumption, the Richmond Centre sample population is selected for this study.

Appendix B provides an approximate map of the Richmond Centre sample area. The sample area is bounded to the north and west by the Fraser River and the Straight of Georgia, while Granville Avenue and General Currie Road make up the southern boundary. The eastern limits of the sample area are Number 3 Road and Garden City Road. The Richmond Centre sample area also includes the Sea Island community of Burkeville, near Vancouver International
Airport. The BC-HWS collected 404 responses within the sample area, which has a total population of 25,861.

### 3.3 Dependent Variable

The BC-HWS survey collects information on the amount of time respondents spent being physically active and the time spent walking in the seven-day period prior to answering the survey.² Participants reported the number of days that they had walked for at least 10 continuous minutes in the past week and the usual amount of time spent walking during one of those days. Lastly, survey respondents estimated the total amount of time spent walking in the past seven days. The dependent variable measure chosen for this study is if survey respondents reported usually walking 30 minutes or more per day in the past seven days.³

Firstly, day minutes are recoded into two categories to obtain a binary response variable: “walking less than 30 minutes per day” and “walking 30 minutes or more per day”.⁴ The 30-minute division is based on the minimum amount of moderate-intensity physical activity recommended by the PHAC. Eight of the 404 total BC-HWS Richmond Centre respondents did not answer the dependent variable question, leaving a final study sample of 396. This study attempts to predict the likelihood of those surveyed being in the walking under 30 minutes category (coded as “1”) versus being in the walking 30 minutes or more category (coded as “0”), with the hope of devising policies to shifting ‘underwalkers’ into the ‘overwalkers’ category.

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² Physical Activity and walking measures were collected using the 11-question International Physical Activity Questionnaire (IPAQ), which is available at: http://www.ipaq.ki.se. A working group of the World Health Organization and the Centres for Disease Control and Prevention developed the IPAQ to provide an instrument for measuring internationally comparable estimates of physical activity. In 2000, the survey went through extensive reliability and validity testing in 12 different countries (Craig et al., 2003).

³ A time measure of individuals’ walking rate was needed in order to test the relative influence of social and environmental variables on walking behaviour. I opted for the average walking minutes per day rather than walking minutes per week measure because of the inherent difficulty of estimating the total amount of minutes walked per week.

⁴ Since the distribution of minutes walked on a typical day is heavily skewed, least squares regression is not employed. For this reason, walking times are recoded to create a binary dependent variable.
3.4 Independent Variables

The following subsections present the six demographic and eight neighbourhood environment variables considered in this study. Relevant literature in the fields of urban planning and public health is used to determine the hypothesized effect of each explanatory variable on walking under 30 minutes per day. Table 1 identifies all independent variables, their respective hypothesized relationship with walking behaviour and supporting sources.

Table 1: Independent Variables and Hypothesized Effect

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Hypothesized Effect</th>
<th>Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (Male)</td>
<td>(+)</td>
<td>Lovasi (2008); CFLRI (2006)</td>
</tr>
<tr>
<td>Age</td>
<td>(+)</td>
<td>Addy et al. (2004)</td>
</tr>
<tr>
<td>Income</td>
<td>(+)</td>
<td>Owen et al. (2007)</td>
</tr>
<tr>
<td>General Health</td>
<td>(-)</td>
<td>N/A</td>
</tr>
<tr>
<td>Education</td>
<td>(-)</td>
<td>Addy et al. (2004); CFLRI (2006)</td>
</tr>
<tr>
<td>Motorized Vehicles (no vehicle)</td>
<td>(-)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Neighbourhood environment variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing density</td>
<td>(-)</td>
<td>Frank and Pivo (1995); Kitamura et al. (1997); Frank et al. (2005)</td>
</tr>
<tr>
<td>Retail</td>
<td>(-)</td>
<td>Frank and Pivo (1995); Giles-Corti and Donovan (2003); Foster et al. (2004); Frank et al. (2005)</td>
</tr>
<tr>
<td>Transit</td>
<td>(-)</td>
<td>Kitamura et al. (1997); De Bourdeaudhuij et al. (2003); Besser and Dannenberg, (2005)</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>(-)</td>
<td>Giles-Corti and Donovan (2003); Addy et al. (2004); De Bourdeaudhuij et al., (2003)</td>
</tr>
<tr>
<td>Recreational Facilities</td>
<td>(-)</td>
<td>Giles-Corti and Donovan (2003); Foster et al. (2004); Frank et al. (2005)</td>
</tr>
<tr>
<td>Neighbourhood aesthetics</td>
<td>(-)</td>
<td>Carnegie et al. (2002); Eyler et al. (2003); Humpelel et al. (2004)</td>
</tr>
<tr>
<td>Crime</td>
<td>(+)</td>
<td>N/A</td>
</tr>
<tr>
<td>Traffic</td>
<td>(+)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

3.4.1 Demographic Variables

This group of variables tests whether the walking behaviour of survey respondents is affected by gender, age, household income, general health, education, or the availability of a

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5 The selection of explanatory variables thought to influence walking behaviour was limited to the questions included in the BC-HWS.
motorized vehicle in the household. A positive relationship is expected between walking under 30 minutes and the age and income of respondents. Male participants are also expected to be more likely to walk less than 30 minutes on an average day. Lastly, general health, education level and not having access to a motorized vehicle are expected to be negatively associated with walking under 30 minutes per day.

**Gender:** The majority of studies reviewed find no statistically significant relationships between walking behaviour and gender. However, Lovasi et al. (2008) suggest that women are more likely to report walking for exercise than males. Overall, Canadian women are also shown to be more likely to report walking than men (CFLRI, 2006). It is therefore hypothesized that being a male would be positively associated with walking under 30 minutes per day.

**Age:** Increased walking rates have also been positively associated with younger age (Addy et al., 2004). Because of health problems and reduced mobility often associated with older age, one would expect older survey respondents to be more likely to walk less than 30 minutes per day than respondents in the younger categories.

**Income:** Owen et al. (2007) find that higher household income is associated with lower rates of walking for transportation but find no statistically significant relationship between income and walking for recreation. Because of the evidence of lower walking rates for utilitarian purposes among wealthier individuals, a positive relationship is hypothesized between higher household incomes and walking for less than 30 minutes per day.

**General Health:** Survey respondents with superior self-reported general health are expected to be less likely to be in the walking under 30 minutes category since they are not as likely to face barriers to physical activity as their counterparts.

**Education:** Increased walking rates have been associated with respondents reporting higher levels of education (Addy et al., 2004). In Canada, leisure time walking is also more
common among individuals with higher education (CFLRI, 2006). It is therefore hypothesized that education will be negatively associated with walking less than 30 minutes per day.

**Vehicle Ownership**: Lastly, not having access to at least one motorized vehicle is expected to increase the likelihood that individuals will walk to their destinations and is consequently expected to be negatively associated with walking less than 30 minutes per day.

### 3.4.2 Neighbourhood Environment Variables

Because of the growing interest in exploring the relationship between levels of physical activity and the built environment, the International Physical Activity Prevalence Study Environment Module was included in the BC-HWS to collect information about environmental and social factors thought to influence people’s walking habits (See Appendix C; Sallis, 2003). The Environment Module was specifically developed to accompany the IPAQ in order to assess environmental factors related to walking at the neighbourhood level. Environment Module questions incorporated in the BC-HWS include variables that have been shown to affect levels of physical activity and walking in cities around the world. The following eight variables were selected for this study in order to measure their relative effect on the walking rates of Richmond Centre residents:

- the type of housing in the neighbourhood\(^6\),
- the availability of shops, stores, markets and other retail establishments within walking distance,
- being 10-15 minutes from a transit stop,
- the availability of sidewalks in the neighbourhood,
- the availability of free or low-cost recreational facilities such as parks, walking trails, recreational centres, playgrounds, etc.,
- perceived neighbourhood aesthetics,

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\(^6\) The type of housing variable is used as a proxy for housing density in this study, with single-family housing representing relatively low residential density and all other housing forms representing higher dwelling densities.
Based on the literature reviewed below, it is assumed that all neighbourhood environment variables will be negatively associated with walking less than 30 minutes on an average day with the exception of crime and traffic.

**Housing Density:** Density can influence transportation choices by determining the distance that individuals need to travel to reach various destinations and the diversity of destinations within walking distance. Higher concentrations of households and employment have been associated with lower vehicle modal shares and increased levels of walking, cycling and transit usage. Frank and Pivo (1995) suggest that increasing employment density and population density positively affects the percentage of walking to work trips and walking for shopping trips. These authors also find that in areas where density is lower than 13 persons per acre, almost all trips are done by single occupancy vehicle. Above this threshold, both walking and transit modal shares significantly increase. By dividing survey respondents into groups of varying residential density, Frank et al. (2005) assert that every quartile increase in housing density increases the likelihood that residents walk for non-work purposes by 23 percent. Kitamura et al. (1997) also find a positive relationship between housing density and levels of physically active transportation.

**Retail Accessibility:** High residential density alone does not necessarily increase the likelihood that people will walk to and from their destinations. For walking to be a viable alternative to motorized transport, a variety of attractions and services must be located relatively close to residences. Increasing land use mix and spatial access to retail enhances walking opportunities by reducing the distance people have to travel to and from daily destinations. A higher integration of residential, commercial, institutional and recreational uses is associated with lower levels of automobile use and higher walking rates. Specifically, incorporating commonly used services such as retail stores within convenient distance from residences encourages walking.
on a daily basis. By exploring the social and physical environmental correlates to walking behaviour, Giles-Corti and Donovan (2003) show that people with shops on their street are 25 percent more likely to achieve recommended levels of walking than those living on streets with no retail amenities. Frank and Pivo (1995) find a positive association between a bigger variety of retail, office, entertainment, recreational, and residential uses and walking for work trips. In a separate study, logistic regression results show that each 25 percent increase in the number of retail establishments increases survey participants’ likelihood of walking for non-work purposes by 19 percent (Frank et al., 2005). The results from this study also suggest that the actual number of retail establishments exerts a much more important influence on walking behaviour than retail square footage. Lastly, a study conducted by Foster et al. (2004) shows that women who do not have shops within walking distance of their residence are 28 percent less likely to report walking for at least 15 minutes per week than those living near retail amenities.

*Transit Accessibility:* Given that almost all public transportation trips include links made by walking, an efficient and accessible transit system can be effective in increasing walking rates and physical activity. A study of the walking habits of American transit users shows that, on average, people who use public transit spend 19 minutes walking to and from transit stops every day (Besser and Dannenberg, 2005). The same study also reveals that 29 percent of public transportation users achieve the recommended 30 minutes of daily physical activity solely by walking to and from transit stops. De Bourdeaudhuij et al. (2003) suggest that a greater ease of walk to a public transportation stop is related to higher number of walking minutes among women surveyed. Similarly, Kitamura et al., (1997) find non-motorized trips negatively associated with distance to the nearest bus stop while automobile trips are positively associated with transit stop distance.

*Sidewalk Availability:* The availability and quality of pedestrian infrastructure can also influence a person’s decision to walk for transportation or recreation. Good pedestrian
infrastructure that includes sidewalks and crossing lights improves pedestrian safety and can thereby encourage walking. Among the environmental correlates considered by De Bourdeaudhuij et al. (2003), the availability of sidewalks on most streets in a survey respondent’s neighbourhood is the only variable that shows a statistically significant relationship with the walking behaviour of men surveyed. In this study, sidewalk availability was found to be related to a higher number of minutes walked. Giles-Corti and Donovan (2003) also conclude that the availability of sidewalks is related to higher walking rates. The study’s findings show that the presence of sidewalks on both sides of the street increases the likelihood that people reach recommended levels of walking by approximately 25 percent. Addy et al. (2004) used multivariable modelling to assess the effect of perceived environmental and social factors on physical activity and walking. Results show that the presence of sidewalks in the neighbourhood is positively associated with walking 30 minutes or more per day.

Accessibility of Recreational Facilities: Having parks, walking trails, and recreational facilities within walking distance from residences is an effective way to encourage walking as a means of transportation and recreation, and improve the likelihood that physical activity requirements will be achieved. Parks and other recreational facilities give people a place to walk to and provide opportunities to integrate physical activity in their daily lives. After dividing survey participants into four categories according to spatial access to public open spaces, Giles-Corti and Donovan (2003) suggest that the odds of walking at recommended levels is 47 percent higher for the top quartile of access to public open spaces than the bottom quartile. In a study conducted on the walking behaviour of individuals in England, Foster et al. (2004) find that having a park or open space at walking distance is the only significant environmental factor positively associated with walking for more than 150 minutes per week. Frank et al. (2005) also suggest walking rates are positively associated with access to public parks. While controlling for socioeconomic characteristics, logistic regression shows that the odds of walking increase by 20
percent for each additional park within a kilometre distance from residences. As in the case of retail amenities, the number of parks rather than their size is most important in increasing walking rates. This suggests that a larger number of smaller parks might be more effective in promoting physical activity than creating large parks or expanding existing ones.

**Neighbourhood Aesthetics:** Although often difficult to quantify, aesthetic features of a community can influence the walking behaviour of its residents. Neighbourhoods that are perceived as aesthetically pleasing can yield public health benefits by encouraging residents to spend time walking. Results obtained in a US-wide study conducted by Eyler et al. (2003) show that respondents who never walk are 1.5 times more likely to report no enjoyable scenery in their neighbourhood than regular walkers. Humpel et al. (2004) also suggest that aesthetically pleasing environments help promote walking behaviour. Results from their study show that men with a positive perception of the aesthetic nature of their neighbourhood are over seven times more likely to report high levels of walking for all purposes combined and four times more likely to report high levels of walking for exercise. Lastly, Carnegie et al. (2002) find that survey respondents walking less than 20 minutes per week report a more negative perception of the aesthetic environment than those walking over 20 minutes per week.

**Crime and Traffic:** Given that the presence of crime or traffic in a survey respondent’s neighbourhood generally represents a barrier to walking, it is assumed that both of these variables will be positively associated with walking under the minimum recommended benchmark.

### 3.5 Data Recoding

For the purpose of statistical analysis, data recoding had to be conducted. The following subsection describes how neighbourhood environment and demographic variables obtained from the BC-HWS were rearranged to facilitate regression analysis.
From the twelve categories collected in the original survey, household income data was recoded into three groups (less than $30,000; between $30,000 and $99,999; and $100,000 or over). Approximately 30 percent of respondents (n=117) in Richmond Centre did not know or refused to report their income. In order to conserve this large number of cases, they were included in the median category for this variable ($30,000 to $99,999). Given the large number of imputed responses, results relating to household income should be interpreted with caution. The five general health categories were recoded into three groups by combining “poor” with “fair” and “very good” with “excellent”. The four possible responses to the education variable were recoded to create a binary variable distinguishing between post-secondary graduates and individuals with no post-secondary degree. Lastly, respondents were categorized as either not having a motorized vehicle in the household or having access to at least one. All of the gender and general health responses were valid, while 18 participants failed to report their age and one respondent did not report the education level attained. Four people failed to answer the question relating to motorized vehicle availability.

All responses to the physical environment questions were originally coded on a four-point ordinal scale (strongly disagree to strongly agree), with the exception of the question relating to the type of housing, which was measured by five different housing categories. For this study, responses relating to the type of housing in the sample community were divided between detached single-family housing and all other housing forms (townhouses, condos, row houses, apartments). Housing type therefore consists of a proxy to test the effect of residential density on walking behaviour. For all other neighbourhood environment variables included in the study, “strongly disagree” and “disagree” were grouped together as disagreement and “strongly agree” and “agree” were grouped together as agreement. In addition, all people responding “don’t
know” to any of the disagreement/agreement questions were included in the disagreement category. This is based on the assumption that if a person is unaware of the availability of specific amenities at walking distance or the presence of crime or traffic, the factor is most likely not significant or present in an individual’s immediate environment.

The number of “don’t know” responses are as follows: retail at walking distance (n=0), transit at walking distance (n=5), sidewalk availability (n=0), recreational facilities (n=2), traffic a barrier (n=3), crime a barrier (n=17), and neighbourhood aesthetics (n=6)
4: Statistical Findings

This section begins by presenting descriptive statistics of the dependent and independent variables listed in the previous section. Logistic regression models used to estimate each independent variable’s effect on walking behaviour are then described. Results obtained from regression analysis are reported and compared to the hypotheses set out in Section 3. Finally, some of the key limitations of this study are underlined. The descriptive data of all variables used in the analysis is summarized in Table 2, while Table 3 outlines the regression models employed for statistical analysis.
Table 2: Frequencies

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variable Categories</th>
<th>% walk 30 minutes and over</th>
<th>% walk under 30 minutes</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
<td></td>
<td>61.5</td>
<td>38.5</td>
<td>100</td>
</tr>
<tr>
<td>Demographic Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>42.4</td>
<td>52.3</td>
<td>46.2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>57.6</td>
<td>47.7</td>
<td>53.8</td>
</tr>
<tr>
<td>Age</td>
<td>18-34</td>
<td>33</td>
<td>24.1</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td>35-54</td>
<td>39.5</td>
<td>49.7</td>
<td>43.4</td>
</tr>
<tr>
<td></td>
<td>55+</td>
<td>27.5</td>
<td>26.2</td>
<td>27</td>
</tr>
<tr>
<td>Income</td>
<td>Less than $30,000</td>
<td>9.4</td>
<td>13.2</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>$30,000 to $99,999</td>
<td>75.8</td>
<td>71.1</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>$100,000 and over</td>
<td>14.8</td>
<td>15.8</td>
<td>15.2</td>
</tr>
<tr>
<td>General Health</td>
<td>Poor/Fair</td>
<td>7</td>
<td>11.1</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>34.6</td>
<td>39.2</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td>Very good/excellent</td>
<td>58.4</td>
<td>49.7</td>
<td>55.1</td>
</tr>
<tr>
<td>Education</td>
<td>No post secondary degree</td>
<td>42.8</td>
<td>28.8</td>
<td>37.4</td>
</tr>
<tr>
<td></td>
<td>Post secondary graduate</td>
<td>57.2</td>
<td>71.2</td>
<td>62.6</td>
</tr>
<tr>
<td>Motorized vehicles</td>
<td>None</td>
<td>9.5</td>
<td>9.4</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>1 or more</td>
<td>90.5</td>
<td>90.6</td>
<td>90.6</td>
</tr>
<tr>
<td>Neighbourhood Environment Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of housing</td>
<td>Detached single-family</td>
<td>37</td>
<td>35.9</td>
<td>36.6</td>
</tr>
<tr>
<td></td>
<td>All other types of housing</td>
<td>63</td>
<td>64.1</td>
<td>63.4</td>
</tr>
<tr>
<td>Retail at walking distance</td>
<td>Disagree</td>
<td>11.5</td>
<td>22.9</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>88.5</td>
<td>77.1</td>
<td>84.1</td>
</tr>
<tr>
<td>Transit at walking distance</td>
<td>Disagree</td>
<td>7.4</td>
<td>5.9</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>92.6</td>
<td>94.1</td>
<td>93.2</td>
</tr>
<tr>
<td>Sidewalks available</td>
<td>Disagree</td>
<td>6.6</td>
<td>10.5</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>93.4</td>
<td>89.5</td>
<td>91.9</td>
</tr>
<tr>
<td>Recreational Facilities</td>
<td>Disagree</td>
<td>6.6</td>
<td>15.1</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>93.4</td>
<td>84.9</td>
<td>90.2</td>
</tr>
<tr>
<td>Neighbourhood Aesthetics</td>
<td>Disagree</td>
<td>25.8</td>
<td>31.4</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>74.2</td>
<td>68.8</td>
<td>72</td>
</tr>
<tr>
<td>Crime a barrier</td>
<td>Disagree</td>
<td>71.2</td>
<td>69.9</td>
<td>70.7</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>28.8</td>
<td>30.1</td>
<td>29.3</td>
</tr>
<tr>
<td>Traffic a barrier</td>
<td>Disagree</td>
<td>68.9</td>
<td>68.4</td>
<td>68.7</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>31.1</td>
<td>31.6</td>
<td>31.3</td>
</tr>
</tbody>
</table>

4.1 Dependent Variable: Walking In Richmond Centre

Although the BC-HWS found that the Richmond Centre neighbourhood had the lowest median walking minutes per week out of all 26 communities surveyed, the number of people
walking for at least 30 minutes on an average day is higher than expected. As shown in Table 2, out of the 396 valid responses, 61.5 percent of BC-HWS participants in Richmond Centre report usually walking at least 30 minutes per day. This demonstrates that walking is already a relatively popular activity for the majority of people in this community. Yet, approximately 40 percent of residents are in the walking under 30 minutes per day category. This suggest that municipal intervention could help a considerable amount of individuals meet and surpass the 30-minute benchmark, thereby helping them achieve the minimum 30 to 60 minutes of daily moderate physical activity recommended by the PHAC.

4.2 Independent Variables

This subsection discusses the demographic and neighbourhood environment variable frequencies listed in the last column of Table 2.

**Demographic Variables:** As previously mentioned, weighting is applied to the sample to ensure appropriate representation of gender and age groups. Women make up just over half of respondents (53.8 percent) while 43 percent of the sample is between the age of 35 and 54. Since a large number of missing cases (n=117) for the income variable were imputed to the median category, the vast majority (74 percent) of individuals fall within the $30,000 to $99,999 annual household income group. The majority of respondents report being in very good or excellent health (55.1 percent) and having completed post secondary education (62.6 percent). Approximately 90 percent of survey participants have access to at least one motorized vehicle in the household.

**Neighbourhood Environment Variables:** The majority of respondents live in an area characterized by housing other than detached single-family homes (63.4 percent). A high

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8 It is important to note that this does not represent the proportion of people not meeting minimum daily exercise through walking. Respondents who report usually walking 30 minutes or over per day do not necessarily do so every day of the week.
proportion of respondents also live near retail establishments (84.1 percent), transit stops (93.2 percent), and recreational facilities (90.2 percent). Sidewalks are also reported on most streets in the sample area (91.9 percent), while about 3 out of 4 residents find their neighbourhood aesthetically pleasing (72 percent). Lastly, about a third of the sample report crime (29.3 percent) and traffic (31.3 percent) as barriers to walking in their neighbourhood.

4.3 Logistic Regression Analysis

Multivariate logistic regression is used in this study to identify how likely a Richmond Centre resident is to walk under 30 minutes per day on a typical day. Holding all other variables constant, logistic regression determines the significance of a particular independent variable and its relative effect on the likelihood that a person will walk under 30 minutes per day. Logistic regression is also used to assess the independent contribution of different types of variables (demographic and neighbourhood environment) on walking behaviour by holding all other variables constant. Diagnostic tests on all independent variables demonstrate no multicollinearity in the statistical model.
As shown in Table 3, two separate models are used to assess the effect that different sets of variables have on walking behaviour and how these different sets interact. Regression Model 1 contains only demographic variables as predictors of walking less than 30 minutes per day. Because of the missing responses for the age and motorized vehicles questions, the initial case count dropped from 396 to 375. The predictive ability of this model is weak, as demonstrated by a Nagelkerke pseudo-$R^2$ value of .079, with 60.8 percent of the cases being correctly predicted.
Model 2 contains demographic variables as well as the eight neighbourhood environment variables. These additions raise the Nagelkerke pseudo-$R^2$ value to .145. Variables in Model 2 correctly predict 67.7 percent of those surveyed as walking under 30 minutes per day. The increase in the Nagelkerke pseudo-$R^2$ indicates environment variables nearly double the predictive power of the statistical model. Moreover, adding environmental variables in Model 2 has no effect on what demographic variables are shown to be significant in Model 1. The significant variables in each model are discussed in detail below.

### 4.3.1 Education

The education level variable is the only demographic variable included in this study showing statistical significance. The effect of post secondary education on walking rates was in the opposite direction than predicted. Using results from Model 2, those surveyed with no post-secondary degree are 53 percent \[100(.472-1)\] less likely than post-secondary graduates to walk less than 30 minutes on an average day. In other words, those with more education walk less. This result was unexpected because it is assumed that individuals with higher education have more knowledge about the long-term health benefits of physical activity and walking. This finding is also surprising given the fact that, generally speaking, as education levels increase, Canadians are more likely to be at least moderately active (CFLRI, 2007). In Canada, leisure time walking is also more frequently reported by individuals with higher education (CFLRI, 2006). However, some studies did find statistically significant negative relationships between education levels and walking rates. For example, De Boudeaudhuij et al. (2003) found that women having completed

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9 Out of the 396 valid responses, 18 do not include values for the age variable and 4 do not include values for the number of motorized in the household. In addition, approximately 30 percent of the sample population did not report their income (n=117). As per common practice (see Zenk et al., 2009) missing responses for the household income question are imputed as being from the median income category ($30,000 to $99,999). All survey participants answering “don’t know” to neighbourhood environment variables - transit at walking distance (n=5), recreational facilities (n=2), traffic a barrier (n=3), crime a barrier (n=17), and neighbourhood aesthetics (n=6) - are imputed as ‘disagreement’.
higher education reported lower walking rates than women having completed vocational or technical training. The authors did not speculate as to why this might be.

4.3.2 Retail Accessibility

As expected, the presence of many shops, stores, and markets within easy walking distance of residences increases the odds that people walk at least 30 minutes per day. Richmond Centre residents living farther away from retail establishments are 128.9 percent \(100(2.289-1)\), or approximately 1.3 times, more likely to walk under 30 minutes on a typical day than those living near retail establishments. In other words, those living closer to stores and shops walk more. This finding mirrors several other studies described in Section 3 of this study. Having shops and stores within easy walking distance encourages neighbourhood walking by giving individuals more destinations in proximity of their homes and increasing the likelihood that people walk for shopping trips instead of using motorized transportation. Communities where residential areas and retail areas are distinctly separate have higher automobile dependency and less walking as a means of transportation, while shorter trips between destinations in mixed-use developments encourage walking as the main mode of transportation for everyday needs. It would appear that mixing residential and retail uses helps achieve recommended levels of physical activity through walking (Frank et al., 2003; Frank and Engelke, 2001).

4.3.3 Accessibility of Recreational Facilities

As predicted, the presence of recreational facilities such as parks, walking trails, recreational centres, and playgrounds in a person’s neighbourhood is also positively associated with walking rates. Survey respondents who self-report living in an area with fewer free or low cost recreational facilities are 165.5 percent \(100(2.655-1)\), or approximately 1.7 times, more likely to walk less than 30 minutes per day than those having better access to such facilities. Community amenities such as parks, walking trails and recreational centres therefore fulfil a role
beyond offering recreational spaces to citizens. As in the case of retail establishments, when they are relatively close to residences, recreational facilities offer neighbourhood destinations for pedestrians. As described in Section 3, statistical significance between recreational site proximity and walking behaviour is found in a number of other studies exploring the association between the built environment and physical activity. A few studies show that the proximity of parks and green spaces is especially important in providing opportunities for older residents to lead active lives (Li et al., 2005; King et al., 2003). Given Canada’s ageing population, these results should be taken into consideration when assessing appropriate interventions to increase physical activity.

4.3.4 Non Significant Variables

Many of the hypothesized relationships described in Section 3 are not supported by logistic regression results. With regards to the demographic factors, the lack of statistical significance between walking rates and vehicle ownership is somewhat surprising. Although it is fair to assume that people who do not have access to a motorized vehicle would walk more that their counterparts, vehicle ownership is not statistically related to walking less than 30 minutes per day among Richmond Centre residents. The lack of statistical significance between general health status and walking behaviour is also somewhat surprising. Contrary to expectations, healthier respondents are not more likely to regularly walk at least 30 minutes per day.

While two of the neighbourhood characteristics tested are shown to have an influence on walking behaviour, six built environment variables did not prove to be statistically significant predictors of walking in this study. Most surprising is the lack of statistical significance between housing type and walking behaviour. A number of studies have shown that density is one of the most important predictors of walking rates (Frank et al., 2006). The assumption is that people living in compact communities tend to walk more because trip origins and destinations are generally closer to one another compared to low-density developments. The lack of a statistically significant relationship between housing type and walking behaviour in this case could be
explained by a few factors. Firstly, the use of housing type as a proxy for residential density might not have provided an accurate measure of actual residential density (residents per area). Results might have been different if an objective measure of residential density had been used rather than the self-reported variable distinguishing between single-family homes and all other types of housing. A second explanation for the lack of significance of the housing variable could be that although an area has more residents per acre, daily destinations are not necessarily more easily accessible on foot. For example, a medium to high-density residential area characterized by townhouses and condos does not necessarily have more workplaces, shops or recreational facilities within walking distance than single-family neighbourhoods.

### 4.4 Limitations

This subsection outlines some of the limitations of this study. Firstly, the use of self-reported walking rates and neighbourhood environment characteristics raises concerns about the accuracy and reliability of the data used to conduct analysis. In order to improve the accuracy of walking rates, objective measures have been obtained using pedometers in similar studies (King et al., 2003). The accuracy of self-reported proximity to neighborhood amenities such as retail stores, transit stops, and parks in surveys such as the BC-HWS has also been disputed (Macintyre et al., 2008). As an alternative to self-reported proximity values, objective measures of neighbourhood destinations have been gathered using GIS technology. Using either pedometers or GIS technology to obtain objective measurement for variables used in this study could improve their accuracy.

Secondly, a number of neighbourhood environment characteristics shown to significantly influence walking behaviour in other studies were not part of the BC-HWS and could therefore not be included in regression models. Among these, the size of city blocks and building setbacks, and the connectivity of the pedestrian network have been cited by the City of Richmond as important barriers to creating a ‘walkable’ community (City of Richmond, 2007). Inclusion of
these factors as explanatory variables in regression models could have revealed additional significant findings.

Finally, measuring walking for recreation and walking for transportation separately could improve the accuracy of the response variable while providing a better understanding of what interventions are most appropriate to increase overall walking rates. As other studies have shown, some policy interventions can better address walking for transportation while others target walking for exercise or recreation (Sallis, 2008). Separate measures for transport and recreational walking could prove especially useful in this study given that accessibility of retail establishments and accessibility of recreational facilities probably account for walking trips made for different purposes.

4.5 Summary

The analysis conducted on the BC-HWS data generates policy-relevant results: destinations matter when considering interventions aimed at encouraging neighbourhood walking. High levels of spatial access to retail establishments and recreational facilities are positively associated with walking among Richmond Centre residents. Providing a cluster of destinations relatively close to residences could therefore contribute to achieving recommended levels of physical activity (Sallis, 2008). Although accessibility of retail and recreational facilities are associated with walking behaviour, the remaining six built environment characteristics included in regression models do not significantly predict walking. Most notably, residential density, a common correlate of walking in other regression models, is not associated with walking in the Richmond Centre sample population. As noted earlier, the education variable is the only demographic characteristic showing statistical significance with walking rates but its impact is contrary to what was expected. Statistical analysis suggests higher educated Richmond Centre residents are less likely to report walking at least 30 minutes per day than individuals with no post secondary degree.
5: Policy Options and Criteria for Measurement

This section presents policy options that address walking rates in the Richmond Centre community. Based on findings from regression analysis, specific attention is given to the expected impact that policies will have on the accessibility of retail and recreational amenities. The City Centre Area Plan (CCAP) update – a major planning initiative approved by Richmond City Council in 2008 - provides the context for the policies proposed in this study.10 This section begins by describing each policy option and its relative effect on accessibility of retail and recreational facilities. The criteria and measurements used to assess each option in Section 6 are then described.

5.1 Policy Options

As mentioned above, the policy options outlined in this section are presented in light of the current Richmond City Centre Area Plan (CCAP) update. With this in mind, three options are evaluated in terms of increasing walking rates in Richmond Centre: (1) Status Quo; (2) CCAP Implementation; and (3) Modified CCAP. The Status Quo is presented as a valid option to be pursued by Richmond and as a base for comparing the two other options. CCAP Implementation includes key features of the area plan update that address accessibility of retail establishments and recreational facilities. Modifying the CCAP entails revising the retail and recreational space proximity guidelines proposed in the new CCAP in order to further improve the accessibility of walking destinations for residents of the area. As the findings in Section 4 demonstrate, good spatial access to neighbourhood destinations such as shops, stores, parks and walking trails has a

10 Although the Richmond Centre sample area used for statistical analysis and the area covered by the City Centre Area Plan do not perfectly overlap, policy options specifically apply to the City Centre planning area (See Appendix E).
positive influence on the walking rates of individuals. Each option is therefore considered for its contribution to improving spatial access to retail and recreational facilities.

### 5.2 Status Quo

The City of Richmond recognizes the relationship between urban form and walking behaviour and has shown interest in fostering an environment that is more supportive of walking. The goal of creating a “walkable city” expressed in official planning documents has however taken time to be implemented on the ground. The following subsections describe the current state of retail and recreational space accessibility in the City Centre neighbourhood, which is considered as the Status Quo policy option in the analysis.

**Accessibility of Retail:** The City’s Official Community Plan (OCP) recommends reinforcing “the establishment of mixed-use areas that provide special retail focal points and promote pedestrian activity in the City” (City of Richmond, 1999). However, since the OCP’s adoption in 1999, areas where residences and retail mix remain sparse. With poor spatial access to shops, stores and markets, alternative modes of transportation such as walking are not competitive with automobile travel in terms of time and convenience. Motorized travel for most trips therefore becomes a necessity rather than an option for many Richmond residents. The BC-HWS reveals that while the majority of Richmond Centre residents feel that they are relatively close to retail establishments, almost half of respondents do not entirely agree that retail is at easy walking distance. Out of the 396 respondents in the Richmond Centre sample area, 27 percent somewhat agree and 16 percent either somewhat disagree or strongly disagree that many shops, stores and markets are at easy walking distance from their home.

**Accessibility of Recreational Facilities:** The BC-HWS reveals that residents generally feel that recreational facilities are well distributed in the Richmond Centre area. In total, 65 percent of respondents strongly agree that there are several free or low cost recreational facilities
such as parks, walking trails, and playgrounds in their neighbourhood while 25 percent somewhat agree and 10 percent either disagree or strongly disagree. The City has built its green space network on a park hierarchy that integrates larger citywide parks, mid-sized community parks, and smaller neighbourhood parks in the urban fabric. Richmond has ensured relatively good access to recreational space by requiring that neighbourhood parks be located within 800 meters of homes and that residents not need to cross a major artery to reach the closest neighbourhood park. There are currently 76.5 hectares of open space in the City Centre area, most of which is located in its southeast neighbourhoods (Appendix E).

5.3 City Centre Area Plan (CCAP) Implementation

The City of Richmond is divided into 15 planning areas (see Appendix D). Most of these areas have an Area Plan, which is a legal document that defines the permitted land uses within the area. Whenever it deems it desirable or appropriate, the municipal government can modify land use designations identified in Area Plans through an area plan update. Facilitating the mix of retail and residential land uses and creating new recreational space in Richmond are therefore primarily accomplished by revising one or more of the City’s Area Plans. The Richmond Centre sample area used in this study encompasses most of the Thompson, City Centre and Sea Island planning areas.11

To fully take advantage of the opportunities offered by the soon-to-be completed rapid-transit line and to concentrate demographic growth in the downtown area, municipal staff began the process of updating the 1995 City Centre Area Plan (CCAP) in 2006. Adopted by City Council in 2008, the revised CCAP’s goal is to accommodate an increase of the City Centre population from 40,000 to 120,000 by 2100, as well as an increase in the number of jobs in the area from roughly 30,700 to 80,000 by 2100. The CCAP update is of particular interest to this study and its main objective of increasing walking rates in Richmond Centre. It proposes

11 No area plan has been created for the Sea Island planning area.
establishing *Urban Villages* and increasing pedestrian-oriented retail in the City Centre area. It also proposes developing additional parks and open spaces in the area over the next 20 years. The establishment of mixed-use zones and the expansion of park space are the two key components of the CCAP that are expected to have an impact on walking rates. The following gives a description of these City Centre Area Plan initiatives.

**Accessibility of Retail:** The current pattern of land use segregation typical of North American suburban communities is a result of zoning ordinances that require strict separation of residential, commercial, recreational, and institutional land uses. Improving the accessibility to stores, markets or shops requires that the mix of retail and residential land uses be permitted and encouraged. If successfully implemented, the new CCAP will be an important step in increasing the mix of retail and residential uses in the City Centre area. The plan introduces the concepts of *Urban Villages* and *Pedestrian-Oriented Retail Precincts* as ways to reduce the travel distance between residences and retail establishments and encourage residents to walk for their day-to-day needs. These two concepts are outlined below:

- Six *Urban Villages* are proposed to be located along the soon-to-be completed Richmond-Airport-Vancouver (RAV) rapid transit line and next to the Richmond Olympic Oval (See Appendix E). The size of each village ranges from 57 to 141 hectares. Their purpose is to “break the City Centre into identified pedestrian-scaled communities” and to provide accessible retail and services for village residents and workers.

- In order to provide “retail continuity” at ground level, the plan recommends that a network of *Pedestrian-Oriented Retail Precincts* be established along primary and secondary streets and located within 200 meters of each *Urban Village* centre. By offering a substantial amount of ground-floor frontages and a diversity of activities (shops, services, and restaurants) at close proximity to urban village residents, these areas will provide a focus for retail activity in the City Centre and encourage people to walk for their shopping needs.

Given that one of the CCAP’s development principles is to “retain and enhance existing residential neighbourhoods” (City of Richmond, 2008a), the *Urban Villages* and *Pedestrian-Oriented Retail Precincts* would play a significant role in achieving this goal.
Oriented Retail Precinct concepts were not applied to the southeast area of the City Centre. The southeast neighbourhoods are medium-density residential areas covering over one third (320 hectares) of the City Centre and home to approximately 50 percent of its population (See Appendix E). Although the CCAP anticipates a substantial population increase in this area over the next century, commercial floor area will remain negligible after the plan has been implemented. The commitment to retain the residential character of the City Centre’s southeast district therefore makes it virtually impossible to improve retail accessibility for a very significant proportion of the population currently living in the area.

**Accessibility of Recreational Facilities:** The second general area of intervention expected to increase walking rates and help people integrate physical activity in their daily lives is improving the accessibility of free or low cost recreational facilities such as parks and walking trails. The presence of a coordinated and accessible network of recreational spaces is an important planning component for any municipality. A 2007 survey of Richmond residents found that additional parks and trails would encourage 55 percent of respondents to be more physically active (Discovery Research, 2007). Recreational facilities such as parks not only provide places where people can gather, play and relax but also encourage neighbourhood walking by providing destinations for pedestrians.

Through the CCAP, municipal officials have proposed adding 42 hectares of parks and open space to the existing 76.5 hectares in the City Centre area by 2031. The amount of additional land dedicated to park space under the new CCAP is determined by using a ratio of 3.25 acres per 1000 residents and is based on projected population increases in the area.\(^{12}\) This minimum standard will be met through land acquisition and legal agreements with property owners as the area’s population increases. The intention of the CCAP is “to ensure an equitable distribution of parks and open spaces” in the City Centre (City of Richmond, 2008a). However,\(^{12}\)

\(^{12}\) A ratio of 7.66 acres per 1000 residents is used outside of the City Centre area.
the plan does not establish a maximum distance that any residence must be from a park. While it underlines that neighbourhood open spaces are *meant to serve* residents within a 400-meter radius, all dwellings are not required to be within 400 meters of a neighbourhood park. Open space distribution standards are only established as maximum distances from the centre of each *Urban Village*. Under the CCAP, neighbourhood parks are required or highly desirable within a 3 to 5-minute walk (200-400 meters) from *Urban Village* centres.

### 5.4 Modified CCAP

This option entails applying two revisions to the current CCAP in order to further improve the accessibility of retail and recreational amenities in the City Centre area.

**Accessibility of Retail:** While the population of the southeast section of the City Centre is expected to grow by 39 percent by 2100, no additional retail space is planned for the area in the CCAP. To further improve retail accessibility, the Modified CCAP would expand pedestrian-oriented retail beyond current *Urban Village* boundaries. A new round of public consultations would be required to identify the areas most desirable for neighbourhood retail in the southeast neighbourhoods. New retail or mixed-use zones would be integrated in the CCAP through revisions of the four sub-area plans[^13] that define the permitted land uses in the southeast. Special attention would be given to the type and form of new neighbourhood retail to ensure its compatibility with the existing character of this residential area.

**Accessibility of Recreational Facilities:** To strengthen the City’s commitment to the equitable distribution of park space, the Modified CCAP would require that all residences be within a maximum distance of 400 meters from a park. Using GIS technology, municipal officials would locate areas that do not meet this guideline. Where necessary, additional land would be acquired and parks developed to ensure that the standard is met. Other North American municipal

[^13]: The St-Albans, Acheson-Bennett, McLennan North, and McLennan South Sub-Area Plans specify permitted land uses in the southeast portion of the City Centre.
jurisdictions have set similar standards for mid- to high-density neighbourhoods (Harnik and Simms, 2004). For example, the City of Seattle has established an ambitious goal of providing park space at a maximum distance of 1/8 of a mile (200 meters) from all residents in its urban villages. Currently, approximately 60 percent of urban village dwellings in Seattle meet the standard (Harnik and Simms, 2004).

5.5 **Criteria and Measures**

The policy options outlined above are assessed and compared using the following five criteria: effectiveness, cost, stakeholder acceptability, administrative simplicity and equity. Policies are ranked high (score = 3), medium (score = 2), or low (score = 1) according to their performance on each criterion. This framework is used to evaluate each policy option in Section 6. Table 4 summarizes the criteria and measures, which are described in more detail below.
### Table 4: Criteria and Measures

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effectiveness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effectiveness of the policy in increasing walking rates</td>
<td>How successful will the policy be in increasing walking rates?</td>
<td>Highest increase…</td>
<td>3. High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate increase…</td>
<td>2. Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No increase…</td>
<td>1. Low</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>Implementation cost required of the policy</td>
<td>&lt;$35.7 Million…</td>
<td>3. High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$35.7 Million…</td>
<td>2. Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;$35.7 Million…</td>
<td>1. Low</td>
</tr>
<tr>
<td><strong>Stakeholder Acceptability</strong></td>
<td>Acceptability among residents</td>
<td>Generally support….</td>
<td>1.5. High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mix support and oppose…</td>
<td>1. Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Generally oppose….</td>
<td>0.5. Low</td>
</tr>
<tr>
<td>Acceptability among developers</td>
<td>Would developers generally support or oppose the initiative?</td>
<td>Generally support….</td>
<td>1.5. High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mix support and oppose…</td>
<td>1. Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Generally oppose….</td>
<td>0.5. Low</td>
</tr>
<tr>
<td><strong>Administrative simplicity</strong></td>
<td>Administrative simplicity of developing and implementing the policy</td>
<td>No change to existing policies or staff needed…</td>
<td>3. High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate change to existing policies and/or some staff needed…</td>
<td>2. Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major changes to existing policies and major staff commitment needed…</td>
<td>1. Low</td>
</tr>
<tr>
<td><strong>Equity</strong></td>
<td>Differential impact of the policy according to geographical area</td>
<td>No differences according to geographic location…</td>
<td>3. High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some difference according to geographic location…</td>
<td>2. Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major differences according to geographic location…</td>
<td>1. Low</td>
</tr>
</tbody>
</table>

**Effectiveness:** This criterion is used to assess a policy option’s relative effectiveness in increasing walking rates of residents. Based on regression results from Section 4 of this study, the more a policy improves residents’ spatial access to retail and parks, the more effective it will be in increasing walking rates. An option that provides good spatial access to retail and recreational spaces in virtually all areas of the City Centre area is ranked high for efficiency. An option that improves spatial access to retail or recreational facilities for some portions of the City Centre Area is ranked medium. Lastly, a policy option that does not improve retail or recreational space accessibility is ranked low in terms of its effectiveness in increasing walking rates.
**Cost:** With limited resources, the City of Richmond must insure responsible expenditure of public revenues. The cost criterion refers to the municipal infrastructure expenditures needed to implement a policy option. Although Development Cost Charges (DCC)\(^{14}\) cover most of the costs needed to build utilities and transportation infrastructure in new developments, as well as those required to acquire and develop new parkland, a portion of these costs will be born by the City. The medium benchmark used for this criterion is the monetary resources needed to implement the approved CCAP for the municipality, which is $35.7 Million over the next 23 years (City of Richmond, 2008b). An option that requires a higher municipal contribution is given a low ranking while one that requires a smaller municipal commitment is ranked high.

**Stakeholder Acceptability:** This criterion refers to the levels of support or opposition for a policy option among two key groups of stakeholders: residents and private developers. The main sources of information used to assess the acceptability of policy options are documents produced as a result of the CCAP update public consultations in 2006 and 2007. Literature is used to supplement this data. Where there is general support for an option among a stakeholder group, a high ranking is attributed. Where there is a general mix of support and opposition, a medium ranking is given to an option. Where a stakeholder group generally opposes an option, it is given a low performance ranking. Each option has a maximum acceptability value of 1.5 per stakeholder group and a maximum overall stakeholder acceptability value of 3.

**Administrative Simplicity:** This criterion refers to the relative ease by which a policy option can be developed and implemented by municipal officials at the City of Richmond. Options that require significant staff resources and/or major changes to current policy framework are given a value of 1, while options that require little additional staff and/or change in policy framework are attributed a value of 3. Where moderate administrative commitment and/or change in policy framework is required, the option is attributed a value of 2.

\(^{14}\) DCCs are charges paid to the municipal government by developers.
Equity: A policy that benefits residents differently according to their geographical location is less desirable than one that has a relatively equal effect for all of the population. This criterion assesses an option’s geographical distribution of retail and recreational amenities. Particular attention is given to the differential impact a policy will have on residents living in the southeast portion of the City Centre compared to those living outside this area. An option that results in relatively no differences in retail and recreational amenity accessibility between City Centre areas is given a high ranking for equity, whereas one that results in noted spatial disparities is ranked low. A medium ranking is attributed where moderate differences in spatial access to amenities result.
6: Policy Analysis

This section evaluates the policy options using the set of criteria described above. Comparative ranking scores are given to each option across criteria, with a maximum score of three for each criterion. Table 5 displays the evaluation in the form of a matrix for easy comparison of the benefits and drawbacks of each option. As shown, the Status Quo ranks highest for cost and administrative simplicity, but lowest for effectiveness, stakeholder acceptability and equity in distribution of amenities. Secondly, the CCAP Implementation option ranks highest in terms of stakeholder acceptability and has a medium ranking for all other criteria. Lastly, the Modified CCAP option ranks highest for effectiveness in increasing walking rates and equity, but lowest in terms of cost to the municipality and administrative simplicity. Justification for the values attributed to each option is discussed in more detail in the subsections below. Lastly, recommendations are made based on each option’s overall ranking.
Table 5: Policy Option Assessment

<table>
<thead>
<tr>
<th></th>
<th>Status Quo</th>
<th>CCAP Implementation</th>
<th>Modified CCAP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effectiveness</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Low Effectiveness (1)</td>
<td>No improvement of retail or recreational space accessibility</td>
<td>Moderate Effectiveness (2)</td>
<td>High Effectiveness (3) Most improvement of retail and recreational space accessibility throughout the City Centre</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Low Cost (3)</td>
<td>No additional cost for the municipality</td>
<td>Medium Cost (2)</td>
<td>High Cost (1) Requires infrastructure and parkland investments beyond what is estimated for the CCAP implementation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$35.7 million over 23 years required to implement the CCAP</td>
<td></td>
</tr>
<tr>
<td><strong>Stakeholder Acceptability</strong></td>
<td>1.5</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>Acceptability among residents</td>
<td>Low Acceptability (0.5)</td>
<td>Residents show strong support for change to the Status Quo</td>
<td>High Acceptability (1.5) Medium Acceptability (1) Ensuring access to recreational facilities strongly supported, while integration of retail in southeast might be objected. 'Consultation fatigue' might also reduce residents’ acceptability</td>
</tr>
<tr>
<td>Acceptability among developers</td>
<td>Medium Acceptability (1)</td>
<td>Support for new vision for the City Centre and more development opportunities. Favourable to current level of public amenities.</td>
<td>Medium Acceptability (1)</td>
</tr>
<tr>
<td><strong>Administrative simplicity</strong></td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>High Admin Simplicity (3)</td>
<td>No additional administrative procedures required</td>
<td>Medium Admin Simplicity (2)</td>
<td>Low Admin Simplicity (1) In addition to the administrative commitment for the CCAP option, requires additional public consultations, land use planning, and bylaw amendments.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Equity</strong></td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Low Equity (1)</td>
<td>Retail more easily accessible for residents beyond the southeast area. Parkland is concentrated in the southeast region.</td>
<td>Medium Equity (2) Improved accessibility to retail and recreational amenities for Urban Village residents. Retail accessibility not improved for residents in southeast section.</td>
<td>High Equity (3) Residents in all sections of the City Centre have virtually equal access to retail and recreational facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Score</strong></td>
<td>9.5/15</td>
<td>10.5/15</td>
<td>10/15</td>
</tr>
</tbody>
</table>
6.1 Status Quo (9.5)

*Effectiveness:* It is unlikely that the Status Quo will increase walking rates in the City Centre area. Without any changes to existing municipal planning policies, walking rates are expected to remain similar to those reported in the BC-HWS in 2006. The Status Quo is therefore ranked low in terms of effectiveness in increasing walking rates.

*Cost:* The Status Quo is assigned high ranking for the cost criterion based on the fact that no new municipal expenditures are required as no new policies are implemented and no changes made to the built environment.

*Stakeholder acceptability:* In the public consultation sessions regarding the City Centre Area Plan (CCAP) update, a number of residents expressed their discontent with a current lack of amenities and a high reliance on the automobile in the City Centre. Residents also expressed support for more opportunities for walking in the City Centre. A survey conducted during the public consultations revealed that “attractive, pedestrian-friendly streets” in the City Centre was the most important feature to be addressed by the City of Richmond (City of Richmond, 2007c). Survey results also showed that walking would be the preferred mode of travel for work, shopping, entertainment and recreation among participants if they were to live in the City Centre in 2021. The following is a sample of written comments submitted during the first open house consultation that specifically addressed issues related to pedestrian mobility, retail accessibility, and recreational facilities in relation to the Status Quo (City of Richmond, 2006):

- “More people walking, less cars”
- “Promote culture of walking”
- “Walking. Less car use - Excellent”
- “Plan so that services and facilities available by walking on foot”
- “Commercial street level rent will be a good investment”
• Unique boutiques, more like “main street”. More 1 of a kind “mom and pop” shops and businesses”
• “Live/work small business (arts, design, etc.) Retail – cafes, small boutique stores, light furniture manufacturing”
• “Outdoor terraces should be incorporated in low traffic areas”
• “Density with amenities – Now we only have density”
• “People gathering places are critical to a vibrant community”
• “No parks in Richmond, only a few scruffy baseball fields”

Although some residents submitted comments that showed wariness of the changes proposed in the CCAP, most objections were related to increasing density in the area. Based on the public consultation comments, residential acceptability for the Status Quo is ranked low.

Developers were generally pleased that a new vision was being proposed for the City Centre. In a letter received by the City as part of the CCAP update consultation process, the Urban Development Institute (UDI)\textsuperscript{15} stated that it “strongly supported” plans for the City Centre that will allow more people to live and work near the newly constructed transit hubs. This shows that there is some support for changes to the Status Quo. However, some changes proposed in the CCAP were not as well received by the UDI, indicating that the Status Quo was preferred in certain areas. Particular objections were raised concerning the provision of additional amenities in the City Centre. Given the mix of support and objection to the changes proposed in the CCAP, the Status Quo is ranked medium in terms of the development community’s acceptability. A value of 1.5 is attributed for overall stakeholder acceptability of the Status Quo.

**Administrative simplicity:** Since the Status Quo will not result in additional administrative procedures or changes in the existing policy framework, it ranked high for administrative simplicity.

**Equity:** Compared to the other two options considered, the Status Quo is given a low ranking in terms of equity considerations. This is justified based on current unequal distribution

\textsuperscript{15} The UDI is a national association of the real estate development and building industry.
of retail and recreation space throughout the City Centre area. Whereas park space is currently
concentrated in neighbourhoods located in the southeast portion of the planning area, retail
establishments are more readily accessible to residents closer to the downtown core.

6.2 CCAP Implementation (10.5)

Effectiveness: The successful implementation of the Urban Villages and Pedestrian-
Oriented Retail Precincts concepts defined in the CCAP would increase the mix of residential
and retail uses in the City Centre and thereby improve retail accessibly. Additional park space
proposed in and near the CCAP’s Urban Villages would also increase the accessibility of
recreational facilities for many residents. A large proportion of the City Centre area (the southeast
region) will however remain almost exclusively residential. Accessibility of shops and stores for
residents in the southeast neighbourhoods will therefore generally not be improved by the CCAP.
In relations to the other two policy options considered in this study, implementing the current
version of the CCAP is expected to moderately increase walking rates.

Cost: Development Cost Charges (DCCs) will provide the majority of funds necessary
for acquiring and developing new park spaces, and providing transportation and utilities
infrastructure needed to support new development. The City will however need to cover part of
the $1.05 Billion required to implement the CCAP. Initial estimates have set the City’s
contribution at $35.7 Million (City of Richmond, 2008b). Compared to the Status Quo and to the
Modified CCAP options, the cost of implementing this option is ranked medium.

Stakeholder acceptability: During the public consultation period for the CCAP update,
residents had the opportunity to express their support or opposition to the plan’s proposed
increase in mixed-use zoning and park space. A July 2006 survey revealed that additional retail
space ranked second immediately after offices and live/work spaces in terms of the type of
business opportunities that residents thought should be created in the City Centre (City of
Richmond, 2006). In a March 2007 public meeting, survey participants revealed that ‘more street-fronting shops and restaurants’ was the second most preferred feature that Richmond should prioritize to make the downtown more attractive and interesting, and its streets more pedestrian friendly (City of Richmond, 2007c). Immediately after improved transit services, ‘street-fronting shops and restaurants’ and ‘a mix of uses’ were reported as the two most important things to provide in each of the City Centre’s proposed Urban Villages. The consultation process also revealed that residents are generally very supportive of the new parks and open spaces proposed in the CCAP. Participants reported that new parks were the preferred public amenity to be provided in the City Centre (City of Richmond, 2006). Survey results showed that 59 percent of residents highly approved or approved the CCAP’s framework for open space and public amenities, while 31 percent disapproved or highly disapproved (City of Richmond, 2007b). Almost all negative comments related to the open space framework raised concerns that too little park space was planned for the area. Residents were also worried about the reduction in parks space-per-resident requirement proposed in the plan.\footnote{A minimum ratio of 3.25 acres of parks space per 1000 residents has been established under the revised City Centre Are Plan. This ratio is considerably lower than the typical citywide requirement of 7.66 acres per 1000 residents. However, using the citywide rate, 45 percent of the City Centre would have to be parks when it reaches its targeted population of 120,000 residents by year 2100. Because this percentage of park space dedication would be unaffordable and inconsistent with the City’s densification objectives, municipal officials opted to reduce park space requirements.} Based on these consultation results, acceptability of the retail and recreational space framework proposed in the CCAP is ranked high amongst resident.

The development industry sees mixed-use developments as having benefits and drawbacks. Although they are usually more expensive to develop than conventional single-use projects, mixed-use developments offer advantages to real estate developers in terms of their flexibility to respond to market changes and their marketability to potential occupants (Schmitz and Scully, 2005). With mixed-use developments, when the market for one use weakens, another can more easily fill the space than in single-use developments. There is also evidence that there is...
an increasing demand for mixed use projects from consumers and that people are willing to pay more to live in mixed-use pedestrian-friendly communities (Schmitz and Scully, 2005). Support for additional recreational facilities among private developers comes with certain reservations. While the real estate industry recognizes that parks and trails increase the desirability and marketability of developments and thereby improve the uptake of nearby residential and commercial properties, it has expressed some concerns related to the cost of providing new parks and other recreational facilities. In a letter to the City of Richmond regarding the CCAP concept plan, the Urban Development Institute expressed its concerns that the public amenities proposed in the CCAP were “quite extensive” and that “a significant portion of the costs for these amenities would be borne by new development” (City of Richmond, 2006). Because of a mix of support and objections for mixed-used development and additional recreational facilities from the development community, the option is ranked medium for developer acceptability. Overall stakeholder acceptability of the CCAP option is therefore given a value of 2.5.

**Administrative simplicity:** Even though Council has adopted the new CCAP, implementation of the plan will require some administrative commitment from city staff. This will involve negotiating development proposals with developers, processing development applications and permits, negotiating land acquisition and administrating additional maintenance and operating activities for new park space. Nonetheless, with much of the planning work already completed for the retail areas and recreational facilities proposed in the CCAP, the bureaucratic commitment needed to implement this option will not be as great as that required for the Modified CCAP option. When compared to the other two options considered in this study, the relative administrative simplicity of implementing this option gives it a medium ranking.

**Equity:** The addition of considerable amounts of parks and open space as proposed in the CCAP improves the general distribution of parks in the City Centre area. Current and future residents living outside the southeast region, where little park space is currently available, will
benefit the most from the CCAP’s implementation. However, under this option, City Centre residents living within one of the six Urban Villages will have a much greater level of access to retail amenities that those living outside the Urban Village boundaries. Participants in the July 2006 public consultations noted this inequitable distribution of amenities between Urban Villages and outlying areas. When asked to comment on Urban Village attributes, one participant noted that villages were “needed away from downtown” while another stated that the CCAP was good for village residents but less so for Richmond residents living outside village boundaries (City of Richmond, 2006). This option is ranked medium for equity.

6.3 Modified CCAP (10)

*Effectiveness*: The Modified CCAP would provide retail and recreational facilities at easy walking distance for virtually all residents in the City Centre area. Inclusion of retail-precincts beyond Urban Village boundaries would ensure that residents in the southeast portion of the City Centre could walk for their daily shopping needs. Implementing the 400-meter park proximity standard would also ensure that every resident in the City Centre can easily reach recreational space by foot. The Modified CCAP is ranked high given that it is the best option among those considered in terms of its effectiveness in increasing walking rates.

*Cost*: The financial cost of revising the current version of the CCAP will be high compared to the other two options considered in this study. Firstly, additional retail districts in the southeast region will require that the municipal government help finance transportation and utilities infrastructure beyond the $16.7 Million estimated for the CCAP implementation (City of Richmond, 2008b). New proximity standards for recreational space under the Modified CCAP option might also require that additional land be acquired to make way for neighbourhood parks. In turn this would result in the need for municipal funding for parkland acquisition and development beyond the $19 Million budgeted under the CCAP option (City of Richmond,
This option is ranked low for cost given that its financial impact on the municipality will be significantly higher than the Status Quo and CCAP options.

**Stakeholder acceptability:** Although CCAP update surveys showed general support for the Urban Villages and Pedestrian-Oriented Retail Precinct concepts, objection to the inclusion of neighbourhood retail in residential areas has been reported elsewhere “because of close proximity of non-residential uses to residential uses, close proximity of rental homes, noise, traffic congestion, insufficient parking, higher density and too much height and massing” (Tombari, 2005). However, if appropriate types of shops and stores are well located, residents in the southeast portion of City Centre could see retail as a community amenity rather than a nuisance. The Modified CCAP might also create ‘consultation fatigue’ amongst residents. Cynicism about the planning process could be expected given that additional rounds of public consultations would be required to establish neighbourhood retail in the southeast. The two-year public consultation process needed to develop the current CCAP might seem like a waste of time given the need for more revisions under the Modified CCAP option. Strong support from residents would however be expected in relation to the park-proximity guidelines proposed by the Modified CCAP. This policy is ranked medium for overall resident support.

The real estate development community is expected to look favourably upon the additional retail development opportunities proposed in the Modified CCAP. If the new parkland proximity guidelines require that additional parks be developed, opposition from developers should be expected given their important contribution to new public amenities. Developers’ acceptability is therefore also ranked as medium for the Modified CCAP option. Total stakeholder acceptability is given a value of 2.

**Administrative simplicity:** Since the Modified CCAP option proposes establishing additional retail zones in the southeast portion of the City Centre planning area, and, where necessary, developing new parks to ensure that all residents have equal access to recreational
spaces, considerable administrative effort will be required from City staff. Revising the CCAP to further improve retail accessibility will require municipal resources to administer public consultations, bylaw amendments, mapping, implementation strategies, and other managerial and regulatory tasks. Operating and maintenance costs of new parks will also require long-term administrative commitment from municipal officials. Compared to the other two options considered in this study, the administrative simplicity of the Modified CCAP option is low.

**Equity:** By integrating retail amenities in the southeast region and aiming to ensure that all residents are within a 5-minute walk (400-meter) from parks, the Modified CCAP ranks highest in terms of equitable distribution of retail and recreational amenities in the City Centre area.

### 6.4 Recommendations

Based on the evaluation of the three policy options considered in this study, it is recommended that the City of Richmond move forward with the implementation of the CCAP in order to improve walking rates in the City Centre area. Implementing the *Urban Villages* and *Pedestrian-Oriented Retail Precinct* concepts will lead to considerable progress in terms of mixing retail and residential land uses, thereby improving spatial accessibility of retail establishments for City Centre residents. New parkland proposed in the CCAP will increase walking rates by providing additional recreational walking destinations. Although it will not favour neighbourhood walking to the same extent as the Modified CCAP, implementation of the CCAP provides a more moderate policy option for the City in terms of cost and administrative simplicity. This section outlines some things to consider when implementing the CCAP.

In order to maximize the effectiveness of the CCAP in improving walking rates and its equity in the distribution of new amenities, new retail zones and parks proposed in the plan should be prioritized in or near areas where they are currently lacking. For example, *Pedestrian-
Oriented Retail Precincts planned for the southernmost Urban Village should be phased-in first as a means to improve access to shops and stores for residents in the southeast neighbourhoods of the City Centre. Likewise, neighbourhoods currently lacking accessible recreational facilities should be prioritized for the development of new parks anticipated in the CCAP.

In order to maximize the benefits of additional parks and open spaces and ensure their equitable distribution, distance from residences has to be a key factor in park planning and development. Proximity rather than total size is arguably more important when considering a park’s impact on walking behaviour (Frank & Co. et al., 2005). While large parks help preserve important natural amenities in a community, they are often located farther away from most residents, making them impractical to reach by foot. Smaller parks generally offer recreational spaces that are closer to residents and act as important destinations for recreational walking. As Pollard (2003) points out, “smaller neighbourhood parks and connected greenways within walking distance of most residences are critical to help people integrate physical activity into their daily lives and improve the quality of life in communities.”

Lastly, once the Urban Villages proposed in the CCAP begin to take shape, the integration of neighbourhood-oriented retail in other parts of the City should be considered. Beyond the City Centre area, Richmond neighbourhoods remain primarily residential. Integrating shops and stores into residential areas would require that area plans be updated to allow a mix of neighbourhood retail and residential land uses in targeted areas. To initiate this process, neighbourhood questionnaires could be distributed to assess the desirability of local shops and stores among residents of different neighbourhoods. The public’s input would also help in determining the appropriate type and location of new retail establishments and ensure their compatibility with the existing neighbourhood character.
7: Conclusion

To date, educational approaches have been the key focus of governmental policy in addressing physical inactivity. At all levels of government, communication campaigns are being used to raise awareness about the health benefits of walking and of leading a physically active lifestyle. Given the growing amount of evidence linking the built environment with walking behaviour and overall physical activity, decision makers should put more emphasis on providing a supportive environment for regular physical activity. Evidence from this study and other similar investigations shows that destinations matter when considering strategies to increase neighbourhood walking and help create healthy and active communities. A growing literature supports the idea that “communities should be built to support physical activity for both transportation and recreational purposes” (Sallis, 2008). Accessible utilitarian destinations such as shops or stores encourages walking for transportation and can reduce automobile dependency. Recreational destinations such as parks support leisure time walking and physical activity. Providing both of these amenities in a neighbourhood makes overall walking more appealing and practical for residents. Hence, although education campaigns are a valuable component of a physical activity promotion strategy, municipally based land use decisions should also be considered as central to address this public health priority. Until neighbourhood environments provide ample opportunities for people to engage in regular walking, the success of media campaigns encouraging neighbourhood walking will be limited (Sallis, 1998).

This research project was applied to the City of Richmond: a largely built out municipality where the supply of new land for development is very limited. The findings are all the more relevant for municipalities that are planning new communities on previously undeveloped land. While conventional urban design in North America is characterized by
sprawling land use patterns that generally increase the distance between residences and destinations, pedestrian-oriented developments integrating a mix of destinations in walking range from homes are growing in popularity. Providing neighbourhood-scale retail establishments and easily accessible recreational spaces in new developments can help promote regular physical activity through pedestrian mobility. Municipalities should therefore consider the public health benefits of mixing residential and retail land uses and ensuring park spaces are easily accessible in new communities. Planning for pedestrian-oriented communities would avoid the infrastructure costs and administrative burden related to integrating retail or developing additional parks in established communities. While research to date has provided important insights on the relationship between community design and physical activity, further collaborations between urban planners and public health professionals may help to identify appropriate guidelines and practices to create healthy and active communities.
Appendices
Appendix A: Median Minutes Walked Per Week, BC-HWS Communities

<table>
<thead>
<tr>
<th>Community</th>
<th>Median minutes walked per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberni</td>
<td>298</td>
</tr>
<tr>
<td>Windermere-LHA</td>
<td>277</td>
</tr>
<tr>
<td>Port Hardy/Port McNeil</td>
<td>273</td>
</tr>
<tr>
<td>Golden-LHA</td>
<td>258</td>
</tr>
<tr>
<td>Mackenzie</td>
<td>240</td>
</tr>
<tr>
<td>Vancouver Island North</td>
<td>239</td>
</tr>
<tr>
<td>Robson Valley/McBride/Valemont</td>
<td>233</td>
</tr>
<tr>
<td>Kimberly-LHA</td>
<td>212</td>
</tr>
<tr>
<td>Smithers/Moricetown</td>
<td>212</td>
</tr>
<tr>
<td>Fernie-LHA</td>
<td>208</td>
</tr>
<tr>
<td>Grandview-Woodlands</td>
<td>208</td>
</tr>
<tr>
<td>Cranbrook-LHA</td>
<td>207</td>
</tr>
<tr>
<td>Hope</td>
<td>207</td>
</tr>
<tr>
<td>Mission</td>
<td>207</td>
</tr>
<tr>
<td>Prince Rupert-LHA</td>
<td>207</td>
</tr>
<tr>
<td>Port Alberni</td>
<td>206</td>
</tr>
<tr>
<td>Fort Nelson/LHA</td>
<td>205</td>
</tr>
<tr>
<td>Sooke</td>
<td>205</td>
</tr>
<tr>
<td>Creston-LHA</td>
<td>204</td>
</tr>
<tr>
<td>South Surrey/ White Rock</td>
<td>204</td>
</tr>
<tr>
<td>Port Moody</td>
<td>204</td>
</tr>
<tr>
<td>Richmond Blundell</td>
<td>203</td>
</tr>
<tr>
<td>North Vancouver</td>
<td>201</td>
</tr>
<tr>
<td>New Westminster</td>
<td>191</td>
</tr>
<tr>
<td>South Vancouver</td>
<td>191</td>
</tr>
<tr>
<td><strong>Richmond Centre</strong></td>
<td><strong>148</strong></td>
</tr>
</tbody>
</table>

*Source: PHSA (2007b)*
Appendix B: Richmond Centre Study Area Map

Source: Google Maps (2009)
Appendix C: International Physical Activity Prevalence Study Environment Module

1. What is the main type of housing in your neighborhood?
   - Detached single-family housing
   - Townhouses, row houses, apartments, or condos of 2-3 stories
   - Mix of single-family residences and townhouses, row houses, apartments or condos
   - Apartments or condos of 4-12 stories
   - Apartments or condos of more than 12 stories
   - Don’t know/Not sure

2. Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home. Would you say that you...
   - Strongly disagree
   - Somewhat disagree
   - Somewhat agree
   - Strongly agree
   - Don’t know/Not sure

3. It is within a 10-15 minutes walk to a transit stop (such as bus, train, trolley, or tram) from my home. Would you say that you...
   - Strongly disagree
   - Somewhat disagree
   - Somewhat agree
   - Strongly agree
   - Don’t know/Not sure

4. There are sidewalks on most of the streets in my neighborhood. Would you say that you...
   - Strongly disagree
   - Somewhat disagree
   - Somewhat agree
   - Strongly agree
   - Don’t know/Not sure
5. There are facilities to bicycle in or near my neighborhood, such as special lanes, separate paths or trails, shared use paths for cycles and pedestrians. Would you say that you...

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree
- Don’t know/Not sure

6. My neighborhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc. Would you say that you...

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree
- Don’t know/Not sure

7. The crime rate in my neighborhood makes it unsafe to go on walks at night. Would you say that you...

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree
- Don’t know/Not sure

8. There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood. Would you say that you...

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree
- Don’t know/Not sure
9. I see many people being physically active in my neighborhood doing things like walking, jogging, cycling, or playing sports and active games. Would you say that you...
   - Strongly disagree
   - Somewhat disagree
   - Somewhat agree
   - Strongly agree
   - Don’t know/Not sure

10. There are many interesting things to look at while walking in my neighborhood. Would you say you...
    - Strongly disagree
    - Somewhat disagree
    - Somewhat agree
    - Strongly agree
    - Don’t know/Not sure

11. How many motor vehicles in working order (e.g., cars, trucks, motorcycles) are there at your household?
    - ____ Motor Vehicles
    - Don’t know/Not sure
Appendix D: City of Richmond Planning Areas Map

Source: City of Richmond (1999)
Appendix E: City Centre Villages and Southeast Area Map

Source: City of Richmond (2008a)
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**Interviews**

Two key informant interviews were conducted on February 6, 2009. Both informants are City of Richmond municipal officials. Names are withheld for confidentiality purposes.

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