How are pedestrians in Vancouver being impacted by separated bike lanes?

by

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Abstract

This research evaluates the impacts that Vancouver’s downtown separated bike lanes have on pedestrians. Within Downtown Vancouver, there are more trips taken as pedestrians than via vehicle, transit, and bicycle combined. Walking is also the City of Vancouver’s highest transportation priority because it is the most sustainable mode, and the most vulnerable to collision injuries. In this research, interviews and content analysis of separated bike lane documents found evidence of positive impacts on pedestrians’ safety, but also insufficient data to conclusively determine the extent of suspected impacts on the pedestrian environment. Therefore a pedestrian impact survey explored impacts to the pedestrian environment using necessary, optional and social activity indicators, which highlighted further potentially positive impacts. This research concludes by recommending that the pedestrian impact survey forms the basis for a standardized survey tool, which would compare and track changes to any pedestrian environment.

Keywords: Pedestrian indicators; walkability; active transportation; separated bike lane; transportation hierarchy
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Pedestrians interacting with the separated bike lane

Source: S Jay (2013). Dunsmuir 500 block at lunchtime.
1. Introduction

The City of Vancouver brands itself as a green, sustainable city, partly as a result of its transportation policies, such as the dense walkable downtown, bikeable seawall, and visible public transit (City of Vancouver, 2012c). Worldwide cycling is seen as an indicator of a city’s sustainability, so the City of Vancouver has built separated bike lanes downtown in order to increase the popularity of cycling and improve the City’s sustainability image. However the focus of this research is on walking and the research question asks: How are pedestrians in Vancouver being impacted by separated bike lanes?

Table 1. Downtown trip diary mode share figures (2004)

<table>
<thead>
<tr>
<th>Mode shares</th>
<th>Walking</th>
<th>Cycling</th>
<th>Transit</th>
<th>Car total (driver)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All trips to and around downtown¹</td>
<td>27%</td>
<td>3%</td>
<td>30%</td>
<td>39% (30%)</td>
</tr>
<tr>
<td>Trips within downtown²</td>
<td>60%–69%</td>
<td>1%–5%</td>
<td>8%–14%</td>
<td>13%–24% (7%–13%)</td>
</tr>
</tbody>
</table>

The data precedes the creation of the separated bike lanes.

Walking is the majority transportation mode within downtown (Table 1) where Vancouver’s separated bike lanes have been constructed, and walking is also a major mode of transportation to and around Downtown Vancouver. Increasing cycling at the expense of walking does not advance sustainability, as walking is already the most sustainable transportation mode. Therefore to understand how sustainable transportation has been impacted by the separated bike lanes, consideration of how both pedestrians and cyclists have been impacted is required. However less is known about the impacts of the separated bike lanes on pedestrians, than the impact on cyclists and drivers. To date three Vancouver surveys have asked pedestrians about the separated bike lanes’ impacts, with just one asking about impacts on pedestrians.

¹ City of Vancouver (2006, pp. 18-19)
² City of Vancouver (2006, p. 20)
Instead most research to date on impacts has focused on vehicle volume, speed, access and parking, which all relate to a minority transportation mode within downtown, and the lowest priority mode in the City of Vancouver’s hierarchy.

Walking has been considered the highest transportation priority by the City of Vancouver since at least 1997 (City of Vancouver, 1997). To directly quote the City of Vancouver’s most recent transportation plan, Transportation 2040:

The City’s transportation decisions will generally reflect a “hierarchy of modes” for moving people, as prioritized below.

1. Walking
2. Cycling
3. Transit
4. Taxi / Commercial Transit / Shared Vehicles
5. Private Automobiles (City of Vancouver, 2012i, p. 16)

The City of Vancouver transportation hierarchy puts the two active transportation modes, walking and cycling, as the highest priority modes to be considered when planning or implementing transportation policy in Vancouver. Prioritizing active transportation, at the highest policy level, should help ensure Vancouver is working towards a more sustainable, safer, healthier, cheaper and livelier city. Removing street space designated for cars, and reallocating it for separated cycling infrastructure, appears to be an example of implementing the transportation hierarchy policy, but is the hierarchy’s highest priority also being considered? Specifically, what is known about the impact on pedestrians? Have pedestrian volumes and mode shares been impacted by the separated bike lanes? Has pedestrian safety been improved? How has pedestrian access and crossing been affected? How has the pedestrian environment and experience been impacted? Have the separated bike lanes created a more pleasant, more comfortable place to walk and spend time? Have the separated bike lanes changed pedestrians’ perceptions of other transportation modes and the space allocated to them? What other problems and opportunities have been identified?

To answer these questions, the research explores whether the transportation hierarchy was followed: making pedestrians the highest priority in the objectives, design, consultation and monitoring phases. Were all suspected pedestrian impacts measured?
Or do the impacts currently publicized reflect what is valued most, and have these impacts shaped what is valued? The research also asks what a focus on the hierarchy of modes could look like. For example how would a change in focus explore the impacts pedestrians experienced, and would pedestrian impacts be at the top of people’s minds? Plus would optional and social activities be noticed by pedestrians, and could they be used as pedestrian environment indicators?

Exploring the impact of all the separated bike lanes, on all pedestrians, was not possible within the research scope. Pedestrians, like drivers and cyclists, will have reacted to the new bike lane infrastructure and selected new routes accordingly, so the impact on pedestrians will also be felt on streets without bike lanes. The research concentrates on pedestrian impacts within the Dunsmuir and Hornby separated bike lanes corridors using existing data, document analysis and interviews. The research also includes a pedestrian impact survey which specifically focuses on sections of the Dunsmuir separated bike lane. The Burrard Bridge and Dunsmuir Viaduct separated bike lanes, and Vancouver’s wider cycling network, have only been included as context.

1.1. What are separated bike lanes?

*Figure 1. Picture comparison of separated (left) and painted (right) bike lanes*

Source: S Jay (2013)
As there has previously been confusion in the literature regarding the use of bike lane terms (Reynolds, 2009), clarification of what is meant by a ‘separated bike lane’ is required. ‘Separated bike lanes’ refer to the terminology used by the City of Vancouver. Similar infrastructure is called a ‘cycle track’ in the City of Copenhagen (2013b) and City of Toronto (2012), and a ‘protected bicycle path’ in the City of New York (2013).

The distinction between separated bike lanes and painted bike lanes is perhaps the best way of highlighting what a separated bike lane is, as seen in Figure 1. Both separated bike lanes and painted bike lanes are designated street spaces for bikes only, and not for pedestrians, transit or vehicles. However, separated bike lanes cannot be accessed by vehicle traffic because of a physical street barrier, such as a concrete blockade, planters, a raised curb, pylons and/or parked vehicles. Painted bike lanes do not have the same physical barrier and consequently do not offer the same protection to cyclists, and are often used by vehicles as a traffic lane or for short term parking.

Although the whole bike route is called a separated bike lane, the physical barrier separation only occurs on the block sections, and not at intersections. At intersections the route is visibly highlighted by green road markings, but the separation is only by time and vehicle restrictions, as controlled by traffic signals.

1.2. Who are pedestrians?

At some point in any given day, we are all pedestrians. Pedestrians are people walking, or using mobility aids at walking speed. People are not pedestrians when they are not walking, but become pedestrians when they exit a vehicle, transit, or get off a bike. All customers enter and exit businesses as pedestrians, unless the business is a drive through (which does not exist in Downtown Vancouver). Hence a pedestrian is not a lifestyle identity, nor is it a declaration that walking is a person’s most common form of transportation.
2. Literature Review

The literature review was undertaken to help answer three broad questions:

1. Why is the separated bike lanes' impact on pedestrians important?
2. Why should walking be the highest transportation priority in cities?
3. Why has the impact on cars so far been considered more important?

The first subsection on the ‘importance of urban walking and its historical neglect in planning’ highlights why walking is now understood to be a priority transportation mode, and why Downtown Vancouver’s majority walking modal share can be seen as an advantage. The ‘active transportation similarities and differences, and the relationship to motor vehicles’ subsection explores why walking and cycling are often grouped together, and why the assumption that walking and cycling are complementary can be problematic. The subsection ‘the rise of urban cycling and the role of separated bike lanes’ explores reasons why separated bike lane infrastructure is being used downtown to increase cycling, and why increased cycling is desirable. Finally the last literature theme, ‘why are the pedestrian impacts of the separated bike lanes important?’ forms the basis for the research. The subsection argues that what we measure should be what we care about, because what we measure is also what we come to care about.

2.1. Importance of urban walking and its historical neglect in planning

In ‘Cities for People’, Jan Gehl (2010) explains the important role that pedestrians play in cities. Gehl shows that when cities are designed for walking, they are designed for humans. Human scale cities are safer, healthier, livelier and more sustainable places. The design of a city’s streets and built environment determines how people navigate a city and how they interact with it, and with each other. More road space for motor vehicles leads to more motor vehicle traffic, and this leads to a greater
demand for even more road space. Designing a city for cars leads to a more spread out
city, and to a city dependent on cars. Cities designed for, and dependent on, cars are
not compatible with pedestrians, and so pedestrian numbers drop. When dominated by
cars, cities become unhealthier, less safe, less sustainable and less lively.

how this spiraling process of car dominance grew, with increasing influence on both
transportation and land use throughout the 20th century, and what the impact of this has
been on alternative modes of transportation. Norton (2008), Hall (2002) and Jacobsen
(2006) show how dedicated transportation engineers, and engineering guidelines, came
to change the focus of urban street planning to the efficiency, speed and volume of
motorized vehicles, and how this marginalized other street users, including pedestrians.
Norton (2008) in particular looks at the early 20th century’s urban conflict between cars
and pedestrians and the succession of policies needed to first accommodate, and then
increase the influence of cars in cities. Policies increasingly focused on restricting
pedestrians’ use of the streets to reduce pedestrian deaths and injuries, which had
escalated with the growth of cars in cities. As policies changed the streets and how
people used them, people’s perceptions of what streets were for also changed to reflect
the pedestrian restrictions.

Cervero (1998), Gilbert and Perl (2010) and Hass Klau (1990) have looked at
ways to reverse these negative automotive trends and turn to a more sustainable
transportation future. Pasanen & Salmivaara (1993) and Leaf (1999) show pedestrian
safety is strongly related to speed, with pedestrian deaths reduced as vehicle speeds
are reduced. This correlation was widely understood at the start of the 20th century, but
since had been largely forgotten (Norton 2008). Gehl (2010) shows that by reducing car
speed and space, and instead planning for pedestrians, cities can return to the 5 km/h
pedestrian city. Low speed, and the resulting short travel distances, will invite
pedestrians back to the streets, and make the city a more pleasant place to live in and
navigate.

The well documented history of automobile dominance, especially in North
American cities, and the neglect of other street users, including pedestrians and cyclists,
is retold to acknowledge that this history forms the background to my study, as well as
the parameters in which today’s transportation policies are judged. Safety still dominates pedestrian policy, such as the City of Vancouver’s (2012b) ‘People Are Fragile’ campaign, and is not surprising because City of Vancouver (2012i) traffic collision figures show pedestrians are still disproportionately impacted, accounting for 45% of fatalities while involved in less than 2% of traffic collisions. Pedestrian safety is therefore important, and is a basic condition for encouraging people to walk, but there are pedestrian measurements which venture beyond safety.

The walkability (Southworth, 2005) of cities and neighbourhoods is measured by a walkability index in Frank et al. (2006), which determines how easy it is to do daily tasks via walking. Walk Score (2013) is a similar commercial walkability index which designates locations with a maximum score of 100 as a “Walker’s Paradise”. Thornton et al. (2013), Kelly et al. (2011), and Appleyard & Lintell (1972) have used surveys and interviews as a primary method for measuring the pedestrian environment. Thornton et al. (2013) have developed internationally used guidelines for measuring walking, both quantitatively and qualitatively, using a standardized survey tool. The online or phone survey asks about walking accessibility and barriers, perceptions of the walking environment, and motivation for walking. The survey standardization helps provide benchmarks for walkability, and also allows for comparison between neighbourhoods and cities. Comparing survey methods to assess the pedestrian environment from a pedestrian’s perspective, Kelly et al. (2011) found that onsite survey methods produced a more in depth understanding of the pedestrian experience, than an online version did.

Pedestrian volume is also considered an important pedestrian measure, which is why the City of Vancouver (2009a) conducts pedestrian counts. However it is worth noting that volume, as well as speed, is related to movement. Yet Gehl (2010) shows that people stopping, or dwelling as he calls it, is a more important indicator of a successful pedestrian environment than people moving. Moving is a necessary activity that people will do almost regardless of the conditions, but people will only dwell in a space when the quality of the physical environment is good enough to warrant it, and this requires at a minimum the space to be safe. Dwelling is also determined by interaction between the space, and the space’s edges such as buildings and roads. Soft edges that can be interacted with, including doors, open windows, and displays that offer a connection to the street create a place in which pedestrians will slow down and dwell.
Separated bike lanes do not soften the building edges, but they do soften the road edge by buffering pedestrians from faster vehicle traffic, and provide a more interactive edge with cyclists that are closer to a pedestrian’s speed.

People dwell in a space by standing, sitting, eating, watching and playing, and Gehl calls these optional activities. People stopping and engaging in optional activities make a space look busier and livelier, and this attracts more people, because people attract people. When people dwell with other people, it inevitably leads to social activities, as people make eye contact, smile, recognize others and start conversations. So the cycle of people attracting people continues, as people choose to walk on lively streets where there is activity and the chance of watching and meeting other people. Or as Whyte (1990) says, people “self-congest” (p.77) and enjoy doing so. Therefore walking is not just about transportation, and only measuring pedestrian safety, volume and necessary activities misses the overall importance of walking to city streets. Therefore to determine how the separated bike lanes have impacted pedestrians, indicators of optional and social activity should also be used.

2.2. Active transportation similarities and differences, and the relationship to motor vehicles

Walking and cycling are commonly referred to as modes of active transportation and under this term are grouped and discussed together. But is it valid to assume that separated bike lanes also improve pedestrian conditions, as the City of Vancouver’s (2012f) separated bike lane status report implies when it says “… pedestrians have benefited from an improved walking environment” (p. 1). Do cycling and walking automatically complement one another?

Cycling, like walking, has been defined by its relationship to motor vehicles. Cyclists are vulnerable to traffic collisions as bikes often share the same road space as faster and bulkier motorized vehicles. When collisions between bikes and vehicles occur, cyclists suffer more frequent and more serious injuries than the vehicle occupants do,

3 For example Reynolds et al. (2010)
which leads to cycling being seen as unsafe (Reynolds et al., 2009). Cycling and pedestrian injuries that occur during these collisions are often called ‘accidents’. Neira & Bosque (2004) highlight that using the term ‘accident’, for traffic collisions, suggests that these events happen by chance and are unpredictable. This connotation removes motor vehicles’ responsibility, especially the connection between safety and vehicle speed, and hides the frequency of traffic collisions. Similarly the term ‘jaywalk’ was developed to place the responsibility of collisions between pedestrians and the faster and bulkier vehicles, on pedestrians breaking street rules made to prioritize the motor vehicle (Norton 2008). Both ‘accident’ and ‘jaywalk’ are therefore terms which help hide that motor vehicles are the danger, not cyclists or pedestrians. Therefore this research, whenever possible, uses the term mid-block crossing instead of jaywalking, and collision instead of accident, though quotes have not been amended.

However in a review of cycling injury studies (Reynolds et al., 2009) it was found that the underreporting of cycling injuries and collisions was still a significant issue, and that,

[The underreporting] may create bias in infrastructure-specific risk calculations, since collisions involving motor vehicles may be more likely to be reported to police for insurance reasons and to hospitals because they are more severe, as compared to collisions that happen with non-motorized users (which may happen more frequently on off-street paths). (Reynolds et al., 2009, p.47)

Conflict between pedestrians and cyclists occurs when the two modes compete for space, such as on shared paths, and when pedestrians cross cyclists’ path. Conflicts
also increase as the volume and speed differential increases (Pharoah, 2003). Although cycling speeds of about 18 km/h are much more comparable to pedestrian speeds of 5 km/h, than vehicle speed limits (Gehl, 2010), cycling speeds can still be more than three times the speed of walking. In Vancouver the Burrard Bridge used to have shared walking and cycling sidewalks, until the City of Vancouver (2009d) concluded the arrangement was dangerous for both, and installed a separated bike lane. The shared path was particularly dangerous for cyclists who risked being knocked off the sidewalk into faster moving vehicle traffic, which highlights that vehicles posed the biggest danger. Even for collisions at the same speed, the greater mass of a vehicle produces more kinetic energy than a bike does, and therefore causes greater damage to the lighter pedestrian. The greater mass differential, combined with greater structural stiffness and size, therefore means vehicles pose a much greater injury and fatality risk to pedestrians than cyclists do (Wegman & Aarts, 2006).

The faster speed of cycling than walking is probably why cycling is seen more as an alternative to cars, and why cycling is compared more to cars. For example it has been argued that cycling has a similar personal mobility and autonomy identity as motor vehicles, and even paved the way for motor vehicles (Furness, 2010). Also as the transportation authority for Metro Vancouver explicitly says, increasing cycling is seen as a way of reducing car travel:

Cycling is typically the fastest mode for trips less than 5 km. Since around 50% of all trips made in Metro Vancouver are less than 5 km, cycling is a time-competitive alternative to the automobile for about half of all trips made in the region. (Translink, 2011, p.12)

Being compared to cars has disadvantages too, as cycling is treated as traffic, and unlike walking, requires parking spaces. In North American cities pedestrians had their own dedicated sidewalk space before motor vehicles arrived (Loukaitou-Sideris & Ehrenfeucht, 2009), but motor vehicles took over the road space cyclists, horses and trams had historically used (Furness, 2010). Therefore today cyclists often have to share street space with vehicles, causing safety issues for cyclists (Reynolds et al., 2009). Separated bike lanes provide cyclists with their own space, but are far from as ubiquitous as sidewalks. The lack of cycling infrastructure hints at how neglected cycling has been. In Canada there are no national cycle facility and infrastructure funding
Cycling and walking are called active transportation as human energy generates movement, which benefits the participants’ health. Studies such as Reynolds et al. (2010), US Department of Health and Human Services (1996), Saelens et al. (2003), and Teschke et al. (2012b) highlight the health benefits of physical activity gained by walking and cycling. Research by Janssen (2012, p. 805) estimates the physical inactivity cost for Canadian adults was $6.8 billion in 2009, and therefore that the promotion of walking and cycling could also save governments vast amounts of money.

Cycling and walking can also be defined as sustainable modes of transportation (Tolley, 2003) because the human energy used for movement is renewable. Increasing walking and cycling are ways of working towards sustainability goals and targets that include reducing our carbon footprint (Wackernagel et al., 1999; Rees, 1996; Rees, 2008), reducing our dependence on a finite supply of oil (Gilbert & Perl, 2010), and avoiding irreversible climate change (Intergovernmental Panel on Climate Change, 2007). Cycling is not as sustainable as walking though because of additional embodied energy involved in the manufacture and disposal of bikes. Walsh et al. (2008) found the energy required over the lifespan of bikes still made them more sustainable than cars, though not as sustainable as some modes of transit on a per km basis. However both cycling and walking produce no direct greenhouse gas or polluting emissions (Walsh et al., 2008), so if the amount of motor vehicle usage is reduced by increasing cycling and walking, this could reduce such emissions and air pollution (Frank et al., 2005).

2.3. The rise of urban cycling and the role of separated bike lanes

Cycling is an economical mode of transportation compared to the car. Pucher & Buehler (2008) show that cycling costs less than any motorized mode of transportation, for the user and in terms of infrastructure, and requires a fraction of the space needed for car movement and parking. Kenworthy and Laube (1999) also show the most auto-dependent cities have much higher road construction and maintenance costs, spend the
highest proportion of their wealth on transportation, and have much longer trip distances. It is therefore not surprising that cities, such as Vancouver, are promoting cycling as an alternative to the car. However it is really important to be explicit about increasing cycling as an alternative to car travel, as it is where the sustainability benefits are found. If this purpose is not explicit, increased cycling numbers can be at the expense of transit use or walking, and this substitution provides little or no sustainability gains (Pharoah, 2003).

World sustainability concerns have increased interest in urban cycling, and particularly in how European cities such as Amsterdam and Copenhagen have implemented cycling policy and infrastructure. North American cities are keen to replicate the 27% cycling mode share in Amsterdam and the 29% cycling mode share in Copenhagen (Pucher & Buehler, 2008) to enhance their cities’ sustainability claims. Pucher et al. (2011) showed there has been a renaissance in cycling in North America over the last two decades, with national growth in both the USA and Canada that has been particularly focused in the centres of a small number of cities, including Vancouver.

The construction of separated bike lanes has been a cycling incentive policy pursued by a number of North American cities (Pucher & Buehler, 2008). Of all types of cycle routes, separated bike lanes have been found to have the lowest injury risk for cyclists, having about one-ninth the risk of the non-bike lane reference street with parked cars (Teschke et al., 2012a). Winters et al. (2011) found the major cycling deterrents were streets with high speed or high volume traffic, or where cyclists were at risk from motorists, while bike routes separated from traffic were found to be a major cycling motivator. Therefore the separated bike lanes encourage more cycling by making it safer and more appealing, which increases cycling awareness, as do the visible dedicated street spaces. Pucher & Buehler (2008) also highlight that the share of women cycling is an indicator of how safe and developed cycling conditions are in a city, and this indicator has been used by the City of Vancouver (2013c) to celebrate the success of cycling improvements.

Separated bike lanes are only a small part of the fully integrated policy package of incentives required to develop a successful cycling city, which also includes a focus on developing a comprehensive bike network (Pucher & Buehler, 2008). It should therefore be noted that although this research is focused on the separated bike lanes in
Downtown Vancouver, they are only a small part of Vancouver’s growing and comprehensive citywide cycling network (Appendix A).

The study by Teschke et al. (2012a) shows that the European model, of quiet side streets and separated bike lanes on busier vehicle traffic streets, produces the safest cycling conditions. To protect cyclists from motor vehicles Godefrooij (2003) and Nelson & Scholar (2006) highlight that separated bike lanes are required on high speed and heavy volume vehicle streets. They also show that separation can be detrimental to cyclists on slower or quieter streets, because it restricts movement, and can reduce the attentiveness of vehicle drivers. So although separated bike lanes improve cyclists’ safety, the separation also allows vehicle speed and volume to remain the same on separated bike lane routes. If vehicle volume and speed are not reduced, Appleyard & Lintell (1972) and Gehl's (2010) research suggest the compatibility with pedestrians will not be improved, as social interaction and reasons to dwell will not be enhanced.

Pucher & Buehler (2008) highlight a combination of incentive and disincentive policies is the most successful way to increase cyclist numbers. Disincentive policies include decreasing vehicle space and increasing vehicle restrictions, to make vehicle travel less convenient and more expensive, which will increase the attractiveness of cycling in comparison (Pucher et al., 2011). Therefore substituting motor vehicle space for a separated bike lane is a driving disincentive, but maintaining vehicle speed is not, and so does not maximize cycling volumes, or benefit pedestrians.

2.4. Why are the pedestrian impacts of the separated bike lanes important?

Not only do we measure what we value, we also come to value what we measure. The Dow-Jones index arose from the information needs of stockholders, but now the general public sees it as an indicator of national economic health. No one cared about a blood cholesterol level over 200 until doctors started including it in our annual checkups. Opponents of the Vietnam War made converts by creating an indicator: the nightly body count. (Meadows 1998, p. 2)
Although we try to measure what we care about, we also come to care about what we are measuring, and a cyclical process occurs (Meadows, 1998). Transport engineers who measure whether motor vehicle traffic is uncongested and free flowing with standards and criteria, want to remove barriers to traffic speed and volume. Businesses that think their customers drive to their store measure (perhaps informally) how many nearby parking spaces are available, and care about maintaining or increasing parking space numbers.

The impacts of the separated bike lanes measured by the City of Vancouver and other groups are what promoters, opponents and interested observers will come to care about. Pedestrians are the majority mode share group within Downtown Vancouver (Table 1), and the City of Vancouver’s (2012) transportation hierarchy puts pedestrians as the highest priority user group, and cars at the lowest priority group. If the City of Vancouver seeks to make pedestrians the highest priority group in practice, as well as in theory, impacts on pedestrian activity need to be measured to ensure we come to care about pedestrian impacts, more than the impacts on other transportation modes.

Measuring the impact on pedestrians is important, but it is also important which pedestrian impacts are measured. In terms of the separated bike lanes, measuring pedestrian impact could highlight that pedestrians are being positively impacted, negatively impacted, or a combination of the two. Positive impacts on pedestrians would enhance the environment for both active transportation modes, and therefore would increase the separated bike lanes’ sustainability credentials. Negative impacts on pedestrians though could detract from how much the bike lanes encourage sustainable transportation. Knowledge of both positive and negative impacts will lead to more informed planning decisions, which better consider downtown’s majority street user.

Measuring pedestrian volume is more difficult than measuring vehicle or bike volume, because of less precise automated counting tools. Lucerne (Scherer, 2013), Munich (Buchberger, 2013), Dublin and Nantes (Eco-Counter, 2014) are recent examples of cities experimenting with improving infrared technology to count pedestrians, and developing best practice to increase accuracy. Alternatively Raford & Ragland (2005) and Liu & Griswold (2009) discuss why sophisticated modelling techniques have been developed to provide reliable pedestrian volume data, and where
other potential solutions could be found. Teschke et al. (2012a) also show that pedestrian safety is more difficult to measure, because fewer pedestrian collisions and injuries are referred to insurance companies and hospital emergency rooms. However by only measuring pedestrian volume and safety, only necessary activities and the barriers to them are measured. But Gehl (2010) shows that optional and social activities are better indicators of the quality of the pedestrian environment than necessary activities, so optional and social indicators need to be measured too. Therefore this research uses Gehl’s (2010) necessary, optional and social activity indicators to determine whether the separated bike lanes have improved pedestrian conditions.

Few direct examples of the pedestrian impacts of separated bike lane being measured were found in literature that go beyond volume and safety, even where the impacts on cycling are well documented. Prospect Park’s protected bicycle path and traffic calming scheme, in New York, did specifically include ongoing pedestrian consultation, which resulted in recommendations for additional pedestrian crossing improvements after the project implementation (New York City Department of Transportation, 2011). However the City of Copenhagen’s (2009, 2013a) annual “Bicycle Account” survey, which is a comprehensive guide to cycling trends in the city including surveys, best practice, benefits and challenges, does not include a pedestrian element.

Air pollution monitoring in New York’s Time Square pedestrian plazas, which include some protected bicycle paths, is an example of pedestrian impact monitoring that exceeds volume and safety. The New York City Community Air Survey (NYCCAS) monitoring showed that nitrogen oxide levels decreased by 63%, and nitrogen dioxide levels decreased by 41%, after the pedestrian plazas were created, and also that both vehicle related pollutants decreased (by an unspecified percentage) in other nearby monitoring locations (New York City Department of Health and Mental Hygiene [NYC Health], 2011b). This was as a result of an 11% increase in pedestrians moving through Times Square, and a 35% decline in vehicle volume between 7:00am and 8:00pm. Therefore the monitoring showed that more pedestrian space improved air quality by reducing vehicles volumes, and this not only benefited pedestrians, but also the health of everyone in the area. (NYC Health, 2011a).
3. Vancouver’s separated bike lane context

The City of Vancouver’s (2011b) administrative report on the status of the separated bike lanes was commissioned to look at the impacts of the separated bike lanes. The report places the separated bike lanes in the wider context of the City of Vancouver’s (2012c, 2012i) broader Transportation Plan and the Greenest City initiatives, and therefore highlights that the City of Vancouver sees the separated bike lanes as one way of pursuing its sustainability goals.

Figure 2. Map of downtown Vancouver and the separated bike lanes

To encourage cycling the City of Vancouver has produced a city wide cycling network (Appendix A), and since 2008 has constructed separated bike lanes within the downtown. Vancouver’s separated bike lanes can be categorized as Burrard Bridge,
Dunsmuir Viaduct, Dunsmuir and Hornby, after the bridges and main streets on which they are found. A timeline in Appendix B shows the key separated bike lane dates, and the map in Figure 2 shows the separated bike lane locations. It is these separated bike lanes that this research relates to, not the wider cycling network.

Although no pre-construction bike volumes are available, City of Vancouver (2013d) figures for the separated bike lanes have shown that bike volumes have gradually increased since construction of the separated bike lanes, when comparing the same month (e.g. January 2011 and January 2013). However cycling in comparison to walking is a minority transportation mode, with less than 5% of trips in Vancouver and Downtown Vancouver (Tables 1 and 2).

**Table 2. Modal share of trips originating in Vancouver, from Translink’s trip diary data**

<table>
<thead>
<tr>
<th></th>
<th>2008 mode share</th>
<th>2011 mode share</th>
<th>Percentage increase in number of trips between 2008 and 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>15.4%</td>
<td>17.0%</td>
<td>19.4%</td>
</tr>
<tr>
<td>Bike</td>
<td>2.9%</td>
<td>3.8%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Transit</td>
<td>21.8%</td>
<td>23.3%</td>
<td>15.0%</td>
</tr>
<tr>
<td>Motor vehicle</td>
<td>57.9%</td>
<td>54.3%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

Figures from City of Vancouver (2013c, p.10, Table A1) are based on Translink’s trip diary data. Percentage increase calculations are the authors. For trip diary methodology, reliability and comparability see Ipsos Reid (2012). The total number of trips for all modes increased from 2008-2011 by 7.9%.

Within downtown, walking is the majority mode share (Table 1), while car and transit trips together account for about a third of trips. For trips to and around downtown walking, transit and car drivers make up very similar transportation mode shares. Unfortunately figures in Table 1 are nine years old, as it is the most recent data extrapolated from trip diaries for Downtown Vancouver available. There is updated trip diary data for the whole of Vancouver (Table 2), which shows trip volumes per mode for both 2008 and 2011. Table 2 uses this City of Vancouver (2013c) data to calculate the city’s changing mode shares and highlights a growth in walking, cycling and transit, and a shift towards these modes away from driving. Although there is no data to confirm the same trend is happening in Downtown Vancouver, Figure 3 strongly suggests it is.
Figure 3 shows over the last 15 years the number of vehicles entering downtown has been decreasing, while the number of people in Downtown Vancouver is increasing because of rapid population and employment growth. The most recent figures show that Downtown Vancouver has a population of 99,230 (City of Vancouver 2013b) and an estimated working population of 145,000 (Stantec 2011a, p. 10).

**Figure 3. 15 year trends for Downtown Vancouver**


The walking mode share, and the combined walking and cycling mode share, figures in Table 2 show Vancouver is moving towards more sustainable transportation. The impact of infrastructure projects, such as the separated bike lanes, on active transportation would also be an indicator of how successful these projects are at pursuing the switch to more sustainable transportation. However this level of detail is not possible with the mode share data available. Table 2 shows Vancouver’s cycling mode share and number of cycling trips have both increased significantly between 2008 and

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4 Data is from Statistics Canada’s 2011 census, and incorporates the areas ‘Downtown’ and ‘West End’
The 2008 Vancouver cycling data was pre-construction of the first downtown separated bike lane (Burrard Bridge), and the 2011 Vancouver data was post-construction of the last downtown separated bike lane (Hornby) (Appendix B). However causation between the separated bike lanes and the increased number of cyclists in Vancouver cannot be claimed, because the cycling increases are for the whole of Vancouver and would be determined by many factors including improvements to the wider cycling network (Appendix A). Similarly the walking mode share increase cannot be attributed to cycling policies such as the construction of the separated bike lanes.

Impacts of Vancouver’s separated bike lanes have been discussed in City of Vancouver documents, and in a business impact study that was conducted in conjunction with the Vancouver business community. The business impact study resulted in three business impact reports (City of Vancouver 2011c, Stantec 2011a, Stantec 2011b). There have also been consultations, surveys, and monitoring of separated bike lane impacts and concerns (Appendix O).

This research explores these separated bike lane documents and studies, in addition to interviews, to determine what pedestrian impacts of the separated bike lanes have been found. The research also explores whether the known pedestrian impacts reflect what is valued, and what should be valued if pedestrians are the highest priority. The research therefore goes beyond the pedestrian volume and mode share indicators of sustainability, and looks at impacts on pedestrian safety, environment and experience too, as these should be valued if pedestrians are the highest priority and will also contribute towards an increased walking mode share.
4. Methodology

To examine how pedestrians are being impacted by separated bike lanes, a number of interlinked research methods were used. Content analysis of City of Vancouver documents, related to the separated bike lanes, and data, including impact studies and volume figures, framed and narrowed the scope of the study. Semi structured interviews of policy makers and stakeholders explored what pedestrian impacts had been identified, considered, monitored and addressed. This background, and potential impacts identified in pedestrian literature, informed pedestrian impact surveys and observations. The surveys and observations focused on those directly impacted by the separated bike lanes, in the locations where the impact occurs. In doing so the research provided pedestrians a voice that had been absent, especially in the separated bike lane documents, and helped determine whether the impacts on pedestrians matched those that were considered on their behalf.

4.1. Content analysis of documents related to Vancouver's separated bike lanes

Content analysis formed the basis of the research framework, on how and why the City of Vancouver implemented the separated bike lanes, what impacts were published, considered, designed for, consulted about, or monitored. Therefore the background content analysis helped indicate the City of Vancouver’s interest and concern for pedestrian impacts, especially in relation to other impacts.

Content analysis also helped identify current pedestrian impacts, and looked at potential pedestrian impacts considered before, during and after the implementation of the separated bike lanes, and what measures were taken to mitigate these potential and real impacts. Pedestrian volume data was used to select locations for onsite surveys and
observations. It was collected from the City of Vancouver’s (2012d, 2012e, 2009b) VanMap, Open Data Catalogue and 2008 pedestrian volume and opinion survey.

4.2. Semi-structured interviews

Table 3. Interview Schedule

<table>
<thead>
<tr>
<th>Interview Date</th>
<th>Interview Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-Dec-12</td>
<td>In person</td>
</tr>
<tr>
<td>21-Dec-12</td>
<td>Email</td>
</tr>
<tr>
<td>6-Feb-13</td>
<td>Phone</td>
</tr>
<tr>
<td>13-Feb-13</td>
<td>In person</td>
</tr>
<tr>
<td>28-Jun-13</td>
<td>In person</td>
</tr>
</tbody>
</table>

Semi-structured interviews (Table 3) were used to gain further insight into the scale of interest and concern for pedestrian impact from the separated bike lanes. Interviews were conducted with people involved in the design, consultation and monitoring phases of the separated bike lanes. All interviews were anonymous with no permission sought from organizations that employed participants. In person and telephone interviews were audio recorded and relevant parts transcribed within 24 hours of the interview. Initial interview questions were formulated from content analysis of policy documents, but questions also followed up on interview information received. The interviews of policy makers helped fill in rationale and information gaps in policy documents, as well as clarifying and correcting assumptions. Interviews therefore brought up new ways of considering and analyzing policy documents.

4.3. In person written pedestrian impact surveys

If the City of Vancouver’s transportation decisions are supposed to reflect a “hierarchy of modes for moving people” (City of Vancouver, 2012i, p16), then a hierarchy of consulting and monitoring for street projects should be implemented, with walking then cycling as the highest priorities.
Transit, when people get out of their car, they all become pedestrians. Even cyclists when they lock up their bike... everyone ends up being a pedestrian. That last leg of their journey to the store is as a pedestrian. So it’s important to recognise that. (Vancouver engineer 1, personal communication, 12 December 2012)

However, people are not pedestrians all the time, and may not consider themselves to be a pedestrian when they are not walking. Surveys about walking filled in online, by phone (Thornton et al., 2013, Kelly et al., 2011) or at a community centre, may survey people that have recently been pedestrians, but not people who were pedestrians at the time. At a distance surveys also cannot distinguish between people that walk along the separated bike lane corridor, from those who drive or cycle through it, or those who do not visit the area at all. Therefore the only way to guarantee obtaining pedestrian impact insight, from people who walk along the separated bike lane corridor, is to ask pedestrians on location.

Three surveys have asked pedestrians on the separated bike lanes, about the impacts of the separated bike lanes. However only one of these, the customer exit survey (Stantec 2011b), asked pedestrians a question which could be related to the impact on pedestrian access. The other two pedestrian surveys, the Hornby intercept study (City of Vancouver 2010c) and the Hornby street visitor survey (City of Vancouver 2011b) asked pedestrians their opinions about the separated bike lane corridor, but did not ask anything that could be related to pedestrian impacts. There is therefore a shortage of pedestrian data and opinions, especially those on how pedestrians’ perceive their experience and environment have changed, and how they have been impacted by these changes.

To judge the pedestrian experience in a UK city, Kelly et al. (2011) conducted two types of onsite pedestrian surveys. A stationary written survey and an on the move recorded interview, both of which asked pedestrians how they were being impacted as pedestrians. The main benefit of the walking interview was that it provided a real life multi-sensory experience that could not be capture in a questionnaire, with the interviewer also experiencing the challenges and obstacles, and so allowing a more in depth discussion about events and situations to take place. However a walking survey is about moving, not about dwelling, and discussion about the route focused on obstacles,
comfort and safety. Therefore the more structured onsite survey method was chosen as a better fit, also because when delivered in a self administered form the onsite written survey could obtain a much larger sample of pedestrian views, and on a larger number of pedestrian issues (Babbie & Benaquisto, 2010). The stationary survey was also seen as a better platform to extend beyond pedestrian safety, to also consider optional and social activities that require dwelling in a space.

The onsite written pedestrian impact survey provides a suggestion of the form consulting and monitoring could take to reflect the hierarchy of transportation modes. Using a standardized comparison format similar to Thornton et al. (2013), the survey was designed to provide insight of pedestrians’ perception at each location, but gain greater insight by comparing locations. A copy of both sides of the pedestrian impact survey, used as part of this research, can be found in Appendix C. The participants only filled out side one, which was designed to be easy to follow, with one question or statement per line, space between questions, no abbreviations, and clear response boxes. The survey was pre-tested on volunteers, who did the survey onsite (Babbie & Benaquisto, 2010). Other decisions, steps and processes needed to produce the pedestrian impact survey are discussed in the subsections below.

4.3.1. **Surveys highlighting location specific impacts**

In the appendices of the Vancouver separated bike lane business impact study (Stantec 2011b, Appendices G, I and J) there are over 300 consultation comments on the separated bike lanes, some of which relate to pedestrian impacts. The comments come from an online commuter questionnaire, stakeholder interviews and a workshop, so are not from people who were pedestrians when they responded, and may also be from people who have never been pedestrians along the separated bike lane corridors. The comments only recall a general impression, reflecting many types of impact, and are not representative of pedestrians in the vicinity of the separated bike lanes. However the non-pedestrian comments in Stantec’s (2011b) report highlight that different impacts, or different levels of impact, occur at different sites along the separated bike lanes. Comments made in informant interviews conducted for this research project also highlight site specific impacts, such as the noticeable increase in pedestrians crossing mid-block on Dunsmuir 600 block outside Granville Skytrain Station (Vancouver
engineer 1, personal communication, 12 December 2012). Therefore being able to identify location specific impacts would add something to the discussion, which is otherwise reliant on mostly general separated bike lane pedestrian impacts obtained through the informant interviews and document content analysis.

Using precise locations for the surveys is an inevitable outcome of conducting onsite pedestrian surveys, as logistically it would be difficult to give all pedestrian events on the separated bike lane routes an equal probability of being selected. However limiting questions and statements to the survey locations limits the scope of the survey’s potential findings, and how representative the finding are of all pedestrian impacts.

### 4.3.2. Volume data to inform survey locations

Pedestrian volume data per block is available from the City of Vancouver’s (2009b) pedestrian survey and ‘Intersection Count Data’ which includes pedestrian counts is available from the City of Vancouver’s (2012d) web based application VanMap. However a Vancouver engineer highlights pedestrian data problems.

Are people more or less inclined to walk along Dunsmuir or Hornby Street because the bike lanes are there? First of all getting the baseline data is difficult. It is something we have been challenged with from a cycling, driving and walking perspective.

What were the numbers five years ago? We don’t know. Because we weren’t thinking five years ago we were going to do all this, and therefore understanding what the original conditions were. (Vancouver engineer 2, personal communication, 6 February 2013)

The available pedestrian and vehicle traffic data for both blocks and intersections are discrete one day figures which do not account for irregular disruptions that may occur on the count day. For example buildings, on or near potential survey locations, may have changed use, been filled or vacated, or even been built or demolished since the last count, which would have impacted movement and volume. Therefore the data is not reliable enough to attribute additional or fewer pedestrians to the construction of separated bike lanes, and volume figures were only used in this research as a guide for selecting survey locations.
VanMap intersection data (City of Vancouver 2012d) counts the intersection volume of vehicles, bikes and pedestrians in all directions. Most separated bike lane intersections had some pre-implementation data and half had post-implementation data available, however only 7 of the 26 intersections had before and after data that was within 5 years of each other. The Dunsmuir and Hornby intersection counts show that at high pedestrian volume intersections such as Robson, Georgia and Granville Streets, more pedestrians were counted crossing the Dunsmuir and Hornby separated bike lane routes than walking along them, so intersections may capture more impacted pedestrians. However on other sections, such as near Stadium Skytrain Station there were more pedestrians walking along the separated bike lane route than crossing it.

City of Vancouver (2009b) pedestrian survey counts provide pedestrian volume data on most of Vancouver's downtown separated bike lane blocks. The pedestrian survey data for the separated bike lane blocks was collected between May and September 2008, which was pre-implementation of the separated bike lanes. So it should be acknowledged that the baseline pedestrian volume figures used in this research were all from before the separated bike lanes were implemented, and volumes could have changed because of the separated bike lanes or other factors, and this could have impacted the research analysis. More recent pedestrian count figures were not available for this research as they were still being conducted by the City of Vancouver for their 2013 pedestrian survey (Vancouver engineer 1, personal communication, 12 December 2012).

Some intermittent 'directional volume auto counts' for vehicle traffic are available from the City of Vancouver's (2012d) VanMap, but post separated bike lane implementation vehicle data was not available for all separated bike lane blocks, and no vehicle data was available for five central Hornby Street blocks. The lack of data limited possible survey locations and also meant accepting the City of Vancouver's (2012f) assumption, that vehicle volumes figures had not changed because of the implementation of the separated bike lane.
4.3.3. **Surveying blocks or intersections**

When describing separated bike lane design Nelson & Scholar (2006) split up their typologies for streets and intersections, providing distinct analysis and examples for each. Street blocks and intersections function differently and have different impacts on pedestrians, cyclists and vehicle traffic. For the pedestrian impact survey surveying just blocks was favoured over surveying intersections, or blocks and intersections because of both the research aims and the availability of data.

Separated bike lanes’ physical separation from vehicle traffic on the street and from pedestrians on the sidewalk, is found only on blocks. At intersections physical separation is not possible without restricting cross street vehicle traffic. At intersections the sidewalks and separated bike lanes end, and pedestrians, bikes and vehicle traffic use the same street space. Therefore intersections are where pedestrians’ and cyclists’ safety are most at risk. So if the research focus was on pedestrian safety, intersections would be the best survey location choice. However this research aims to go beyond what Gehl (2010) terms necessary activities and look also at optional and social activities which require pedestrians to slow down, stop and dwell. On the separated bike lane routes, pedestrian stopping is restricted to sidewalks and public spaces found on blocks. Stopping is not allowed at intersections, even though intersections were the traditional location of plazas and squares. Therefore as blocks are where optional and social activities were more likely to be observed, blocks were favoured for the survey.

Reliable data was not available for either blocks or intersections that covered both before and after the implementation of the separated bike lanes, so meaningful change in pedestrian volume figures could not be calculated for either blocks or intersections. For baseline pedestrian figures, to compare locations, the data for blocks was more reliable than the data for intersections. Block data was collected in 2008, at similar times of the year, and with similar dry weather conditions. Intersection data was collected in different years, at many different times of the year, and with no rain measurements given. Although vehicle traffic volume counts were not as reliable for blocks as the pedestrian data, pedestrian data was a more important indicator for this research. Ideally in order to look at the widest range of impacts, comparing both blocks and intersections would be the best way forward. However, block and intersection
figures for the separated bike lane corridors do not compare well, because of different monitoring locations, times, and criteria. Therefore only blocks were chosen as potential survey locations.

4.3.4. **Pedestrian impact survey statements**

No template for onsite written pedestrian surveys was found in the literature reviewed, which would help answer how pedestrians are being impacted by separated bike lanes. Instead a combination of existing ideas was used to develop a targeted survey. Although the standardized pedestrian survey tool developed by Thornton *et al.* (2013) did not provide any specific onsite questions, the two categories, ‘activities in the public realm’ and ‘perceptions of pedestrian environment’, were used as starting points for the type of information the survey aimed to discover.

The survey framework used the conditions actually required for a good public realm. For this Gehl’s (2010) necessary, option and social activities, were combined with the City of Vancouver’s (2012i) “feelings of safety, comfort, and delight” (p.20). To ensure a wide range of pedestrian impacts were accounted for the number of statements related to necessary activities and safety were limited, as Gehl (2010) shows that optional and social activities are better indicators of a good pedestrian environment. This led to the survey framework consisting of 5 statements based on necessary activities and feelings of safety, 5 more statements on optional activities and comfort, and another 5 on social activities and delight.

Statements were chosen to make up the majority of the survey, in a Likert style matrix format, because statements are space efficient, faster for respondents to answer, and increase comparability for both respondents and for analysis (Babbie & Benaquisto, 2010). The purpose of each of the 15 statements was to judge pedestrians’ perception of the pedestrian environment’s quality, which like the standardized survey tool (Thornton *et al.*, 2013) could be compared with other locations, or compared over time.

Gehl (2010) does not provide any actual questions or statements within his framework, which could be used in a survey. Therefore each of the survey statements
was based on Gehl’s (2010) examples and definitions of necessary, optional and social activities, while also taking inspiration from other sources where possible.

To tailor the pedestrian impact survey to pertinent separated bike lane impacts, available open question comments were sought to produce statements within the survey framework, in conjunction with pedestrian literature. Appendix D lists the sources of comment found, but unfortunately very few of these sources were collated, reported on, or available for analysis. One collated online commuter access survey provided 290 open comments about the separated bike lanes, some of which were about impacts on pedestrians (Stantec, 2011b). As the survey was conducted online the pedestrian impact comments were from non pedestrians, and were not representative of pedestrians’ views, but due to a lack of a better source the comments did offer insights worth exploring. Most of the pedestrian issues raised in the comments related to safety, and formed the basis for the pedestrian impact survey’s five necessary/feelings of safety statements. ‘This block is very peaceful’ was the only comfort or optional activity pedestrian impact survey inspired by the same collated comments.

To produce the other comfort and optional activity statements concepts that had been tested in literature and other studies were used. The statement ‘This street block is very polluted’ aimed to test whether pedestrians thought the separated bike lanes improved the air quality, such as the pedestrian plazas had in New York. Appleyard & Lintell (1972) found that vehicle dominated streets felt longer, and the statement ‘This block is too long’ aimed to test whether the separated bike lanes had reduced pedestrians’ perception of vehicle dominance.

The distinction between the statements about comfort, and optional activities, and the statements about delight, and social activities, is slightly blurred. The purpose of the delight and social activity statements was to test how interaction and communication had been impacted by the separated bike lanes, and so all statements asked about the presence of other people. As no social activity questions were found in the literature reviewed, all the statements were based entirely on observations by Gehl (2010) and Whyte (1990).
Another three statements were added to find out if people walking along the separated bike lane route would be more likely to consider cycling themselves, and whether cycling was more appealing to these pedestrians than driving or walking. These three modal choice statements were added in response to an interview with a cycling advocate, who considered pedestrians walking along the Dunsmuir and Hornby separated bike lanes as potential future cyclists.

I think people do what they see… I think if you are walking up Dunsmuir every day because that is your route to work and you are seeing people [cycling in the separated bike lane] every day, and you are starting to see people [cycling] that you relate to, that kind of look like you, it will start getting into your subconscious… (Cycling activist, personal communication, 13 February 2013)

<table>
<thead>
<tr>
<th>Safety / Necessary Statements</th>
<th>Comfort / Optional Statements</th>
<th>Delight / Social Statements</th>
<th>Influence on modal choice Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel safe as a pedestrian on this block</td>
<td>This street block is overcrowded</td>
<td>This is a stimulating block</td>
<td>Seeing people driving cars on this street makes me want to drive</td>
</tr>
<tr>
<td>It is safe crossing this street</td>
<td>This street block is very polluted</td>
<td>People talk to other people on this block</td>
<td>Seeing people riding bikes on this street makes me want to cycle</td>
</tr>
<tr>
<td>The vehicular traffic on this block is dangerously fast</td>
<td>This block is too long</td>
<td>I like to watch other people on this block</td>
<td>Seeing people walking on this street makes me want to walk</td>
</tr>
<tr>
<td>Cars are more dangerous than bikes on this street block</td>
<td>This block is very peaceful</td>
<td>People linger (stop, stay, browse) on this block</td>
<td></td>
</tr>
<tr>
<td>Sometimes I do not see or hear cyclists when I cross this street</td>
<td>I would sit here if seats were provided</td>
<td>I have seen people eating their food here</td>
<td></td>
</tr>
</tbody>
</table>
of some of the statements ideally would have been amended further, despite being
tested beforehand. The pedestrian impact survey statements were deliberately related to
the survey location site, asking pedestrians about the impacts pedestrians were
experiencing on that block only.

4.3.5. Pedestrian impact survey questions

Survey questions, including on demographic data, were asked to contextualize
the survey statements. Just as with the statements, there was a lack of example
questions, that would help answer how pedestrians are being impacted by separated
bike lanes. So again existing ideas were combined and modified.

Surveys which only allow people to state their primary mode of transportation,
such as the Canadian census (Statistics Canada 2006), underestimate walking trips, as
trip diary data highlights that people use more than one transportation mode, even with a
single journey. The purpose of the transportation mode use question in the pedestrian
impact survey was therefore to elicit that participants used multiple transportation
modes, but also highlight how regularly the respondent walked in relation to the other
modes. Unlike trip diary data, which tracks people’s daily usage, a once off survey is an
unreliable way of obtaining actual transportation usage. Instead asking people’s
perceptions of their everyday transportation use was asked to provide an indication of
how the participants view their everyday usage. Everyday usage where the participant
lived was asked, as it was assumed this would have a greater impact on the participants’
opinions than just the journey they took that day.

The survey question asked respondents to rank the modes in the order they
mostly frequently used them, additional instructions were supplied, and a different format
was presented to highlight a different response was required (Babbie & Benaquisto,
2010). The transportation modes were also put in alphabetical order to remove any
modal bias. Unfortunately though, this survey question did not work as intended, as
discussed in Section 4.3.9.

What is seen in a space indicates what mode and speed the street was designed
for (Gehl, 2010), and in the past people’s perceptions of what the street was for changed
as street space allocation changed (Norton, 2008). Some comments in the online non-pedestrian commuter access comments (Stantec, 2011b), which were used to inform some of the survey statements, also suggested that people’s perception of the street space allocation had changed because of the separated bike lanes. Therefore a series of street space allocation questions was included in the pedestrian survey, to test whether pedestrians’ perception of street space allocation had changed.

The questions ‘In your opinion, what is the best thing about this block?’ and ‘the worst thing about this block?’ were inspired by similar questions in Appleyard & Lintell’s (1972) environmental awareness study. The purpose of the questions was to get pedestrian comments about walking, specifically related to the separated bike lane survey block, which could be used to identify extra impacts and provide context for survey statement analysis.

One open ended, general separated bike lane question was included at the end of the survey, to mitigate any participant frustration about the narrowness of the statements and questions (Babbie & Benaquisto, 2010). The open ended question was especially needed because the online non-pedestrian commuter access comments (Stantec, 2011b), used to inform the statements, showed there was a wide range of opinions expressed on the separated bike lanes, including whether they were good for cyclists, vehicles and businesses. For the responses generated by this open ended question, there can be no guarantees they actually relate to pedestrian experiences. Instead the responses could relate to secondary experiences, to driving or cycling. However, apart from the one open ended question, participants were not asked to recall general pedestrian impacts at other separated bike lane locations during the survey. Therefore actual pedestrian experiences were maximized, which allows for comparison between sites.

4.3.6. Survey locations

To identify and compare pedestrian impacts of the separated bike lanes, separated bike lane sites, and comparison sites, were selected using location criteria (Appendix F). The criteria identified potential survey blocks, from which five blocks were selected (Appendix G). The final selection was two separated bike lane blocks;
Dunsmuir 100 and 800, plus the opposite side of Dunsmuir 800 block, and two non-separated bike lane blocks; Dunsmuir 900 and Nelson 700.

Separated bike lane survey locations were constrained by missing City of Vancouver (2012d) data for five Hornby blocks and insufficient pedestrians. The only remaining Hornby block was 160 metre long, while the other Dunsmuir blocks were all 100 metre. Selecting only Dunsmuir blocks and comparable 100 metre non-separated bike lane blocks added some uniformity to block conditions. Having the same length also allowed the inclusion of a survey statement about pedestrians’ perception of block length, but limited selection to east west blocks.

Dunsmuir 100 block (Figure 4) is between Cambie and Beatty Streets. Dunsmuir 100 block had a high volume of vehicles on a wide stretch of street. The ratio between pedestrian and vehicle volumes was one of the lowest for the separated bike lanes, while still having enough pedestrians to meet the survey criteria. Vehicle parking spaces and a painted buffer form most of the separation between the bike lane and moving vehicle traffic. The penetrable painted buffer allows drivers of parked cars to reach the sidewalk. There is also a planter buffer section, so pedestrians could experience a different level of separation at different parts of the block.

Dunsmuir 800 block (Figure 5) is between Hornby and Howe Streets, and has an almost complete planter barrier separation between the bike lane and vehicle traffic. Dunsmuir 800 block provided the best contrast to Dunsmuir 100 block as it had the second highest pedestrian block total of all the separated bike lane blocks, and the third highest separated bike lane side pedestrian total. Comparing Dunsmuir 800 block to Dunsmuir 100 block, Dunsmuir 800 block had fewer traffic lanes, but a similar traffic volume. Dunsmuir 800 also had wider sidewalks, but with much higher pedestrian volume and pedestrian to vehicle ratios.
Figure 4. Dunsmuir 100 block separated bike lane survey site

Source: S Jay (2013)
Figure 5. Dunsmuir 800 block separated bike lane survey sites (separated bike lane site and opposite site)
Source: S Jay (2013)
Figure 6. Dunsmuir 900 block painted bike lane survey site

Source: S Jay (2013)
The deciding factor for choosing Dunsmuir 800 block was that data for the opposite side of the block was comparable, on most criteria, to the separated bike lane side of the street. With perhaps the biggest difference between the two sides of the street being whether pedestrians were walking next to the separated bike lane or next to moving vehicle traffic. Surveying both sides of Dunsmuir 800 block could therefore help show if the separated bike lane acts as a buffer from traffic for pedestrians, or not.

Dunsmuir 900 block (Figure 6) between Burrard and Hornby Streets is a 100 metre painted bike lane block, and was chosen to help show whether pedestrian impacts differed between a separated bike lanes and a non-separated bike lane. Other potential painted bike lane blocks considered were on sections of Richards, Melville, Homer, Beatty and Smithe Streets. Dunsmuir 900 block was the best painted bike lane comparison as it was one of the few comparison blocks that had a comparable pedestrian volume, comparable vehicle volume and no major criteria drawbacks.

Nelson 700 block (Appendix H) between Howe and Granville Streets does not have a bike lane. Finding a comparison block without a bike lane was a challenge, and Nelson 700 block was not ideal as it did not meet the minimum pedestrian volume criteria. However Nelson 700 block was one of the few potential blocks that had one-way vehicle traffic, was the correct length, and had pedestrian and vehicle volume data available. Other potential blocks were considered on Nelson, Seymour, Howe, and Smithe Streets, but many of these blocks were missing key data. Observing the Nelson 700 block site before surveying, the volume of pedestrians was noticeably lower than at other survey sites. During the pedestrian surveys there were times when the volume at the Nelson site was very quiet so recruitment was severely restricted. Ultimately not enough surveys were collected to warrant analyzing Nelson 700 block’s findings.

Exact survey locations were considered prior to conducting surveys at these sites, and no locations were changed after the surveys commenced. None of the blocks are homogenous along their length, but all survey locations were chosen to be as close to the centre of the block as possible. At four sites, an alley with vehicle access marked the middle of the block, so a site beside the alley became necessary. The site’s distance from the alley was dependent firstly on safety. Then consideration was given to not obstructing pedestrian flow, or a store or underground parking entrance, and the
availability of something to lean a recruitment board against. The location of the signage board was mostly opposite the survey site, but at the Dunsmuir 800 block separated bike lane side site the signage board was in front of the survey recruiter leaning against the raised ledge.

All survey sites were located at wider parts of the sidewalk, created by building setbacks, and therefore provide a place for storing survey equipment and filing surveys, away from the main flow of pedestrians. Some locations also had places to sit (Appendix J). The sidewalk widths given in the City of Vancouver (2009b) pedestrian study only account for basic sidewalk widths, and so do not include these building setbacks. Hence the sidewalk widths given in Appendix G do not provide a full representation of the sidewalk widths at the survey sites. Appendix J also includes details from onsite observations, and shows that Walk Score (2013) gave all five sites a maximum 100 score, and therefore considered them all to be a “Walker’s Paradise”, due to the close proximity of a wide range of shops and services.

4.3.7. Survey procedure

Surveys were conducted in shifts between 9am and 6pm for each of the five sites, over a period of two or more days. All midweek days were treated as the same, but no weekend surveys were carried out. Appendix I has a full schedule of the shift dates, times and locations. All surveys were conducted when it was dry, mostly still and with similar recorded temperatures (Appendix K), although survey observations show the chill factor and amount of sun differed in part due to building heights (Appendix J). As observations also suggested that warm and sunny conditions increased the number of survey participants, buildings blocking the sun could have reduced survey participation.

The study population for the survey was defined by pedestrian events on the selected bike lane block, which meant individuals could have accounted for more than one pedestrian event. The unit of analysis for the sample frame was each act of walking observed along the side of the bike lane surveyed that passed the survey location. Self-administered written surveys allowed multiple simultaneous participants, unless a survey participant indicated they required help. Five of the 266 survey respondents required the survey to be read aloud and have their responses filled out. Interviewer filled out
responses were strongly discouraged, but were required in these few circumstances to gain people’s views. Four interviewer filled out surveys were due to participants without reading glasses, and the other participant had a hand injury. When written comments were recorded, the comments were confirmed with the participant. Even though the surveys were mostly self-administered and unmonitored, clarification was given when asked for (Appendix E).

In order to estimate the sample accuracy, pedestrian events at the survey locations had an equal probability of being selected. The fifth pedestrian event that passed, from either direction, was approached where possible to remove interviewer selection bias. When selected pedestrians stopped, they were provided with written informed consent details, and a separate self-administered one page written survey attached to a clipboard. Both the survey and the informed consent were anonymous, with no contact details asked for. Therefore all survey quotes were anonymous, and no participant’s responses were shared with other participants.

The survey and the consent forms were paired with a unique number, and the date, the time, and the direction the participant departed in were recorded on the back of the survey. Counting towards the fifth person continued once participants started filling out the survey. When pedestrians declined to participate, at any stage of the recruitment process, they were thanked for their time, and counting towards the fifth person continued again. Sampling problems were encountered because, even though attempts were made to gain people’s attention by first looking at them, smiling and saying hello, sometimes it was difficult to get the fifth person’s attention. When a large wave of pedestrians passed, judging who the fifth person was, and gaining their attention even when they were at the back of a crowd, was sometimes not possible. When possible a quick sales pitch was aimed at the fifth pedestrian in the hope of getting them to stop and participate. Sometimes the sales pitch caught the attention of other people in the group of pedestrians passing, who then stopped to participate in the survey instead. People who had heard the sales pitch were given a survey to complete, but doing so added an element of self-selection to the survey sampling.

Asking people to participate also interrupts social activities, such as phone and in person conversations, so consistently conversations in full flow were treated as
rejections, if attempts to gain attention garnered no reaction. The full sales pitch was aimed at the fifth pedestrian if they were not in full conversation, regardless if they had ignored being looked at, smiled at or being said hello to. Survey sample data, in Appendix L, shows that the majority of survey participants were walking alone, with few people in groups, in pairs or with children participating. Although it is difficult to determine with any level of accuracy, observations suggest people in groups and in pairs were underrepresented in the survey sample. When a pair or group stopped, only one person was asked to participate in the survey, but if another person asked to do the survey too, they were also given a separate survey to complete independently. Doing so meant the survey response was an individual rather than a group effort, and allowed the participant to complete the survey without being hurried to finish. However, it again added an element of self-selection to the survey sampling.

With hindsight the sample was also probably skewed by the signage board, which read “SFU Research. Pedestrians and separated bike lanes.” The signage board was extremely helpful for recruiting participants and increasing the response rate, and conducting the survey without it would have been much more difficult to do. However the signage board skewed the sample towards people who read the sign, and then were either interested in academic research; participating in research; had something to say about separated bike lanes or pedestrian issues; or felt sorry for the surveyor maybe as they had also conducted surveys. It can be assumed that the samples were skewed at all sites. Appendix L also shows the sample quality in terms of age, sex, downtown workers and residents.

4.3.8. Survey sample analysis

A total of 266 surveys were completed at the five sites, in a sampling period of 45 hours, conducted over one month (April 2012). For each statement an overall mean, and a mean score for each site, was calculated using the coding values in Table 5.

Higher values reflect more agreement with the statement, and lower negative values reflect more disagreement. The statement participants agreed with the most was “I feel safe as a pedestrian on this block”. The statement participants disagreed with the most was “Seeing people driving cars on this street makes me want to drive”. Values for
all statements can be found in Appendix P, and analysis of statements that highlight potential pedestrian impacts can be found in Section 7. Survey impact findings are presented separately from more general impact findings (in Sections 5 and 6), because the questions and statements were limited to the survey location sites, which limits how representative the findings are of all separated bike lane pedestrian impacts.

**Table 5. Coding used to calculate statement means**

<table>
<thead>
<tr>
<th>Code</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>+2</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>+1</td>
<td>Agree</td>
</tr>
<tr>
<td>0</td>
<td>Neither agree or disagree</td>
</tr>
<tr>
<td>-1</td>
<td>Disagree</td>
</tr>
<tr>
<td>-2</td>
<td>Strongly disagree</td>
</tr>
</tbody>
</table>

**4.3.9. Survey sample issues**

Every attempt was made to make the survey rigorous; however the survey cannot claim to be statistically significant, because of the small sample size, the low response rate, and a skewed sample. To statistically analyze and compare the sites with a sampling error less than 5%, 19 times out of 20, a minimum of 400 total surveys, with at least 40 at each location was required (Babbie & Benaquisto, 2010). The overall survey sample size of 266 has a margin of error of less than 5% 18 times out of 20, or less than 6% 19 times out of 20. Only 38 surveys were conducted at Dunsmuir 900 block, and 27 at Nelson 700 block (Appendix I). Nelson 700 block was dropped from data analysis, because the sample size was not close to being statistically significant. Although Dunsmuir 900 block’s sample size of 38 was also lower than 40, the Dunsmuir 900 block data has been analyzed to help provide some comparison to the separated bike lane sites. Therefore statistical tests have not been carried out on the data, with only trends explored, and all survey findings are subject to further review and research.

Gaining a sample of over 400 was deemed possible due to samples gained by the City of Vancouver (2010e, 2011b) for the two Hornby pedestrian studies. By making the survey self-fill it was thought that having only one surveyor would not significantly decrease recruitment. However gaining a significant sample did not account for people participating in clusters, or that significant time was taken away from recruiting
participants as a result of thanking participants, listening to participants’ feedback, answering questions, completing the back of surveys, filing surveys, and setting up new surveys.

A low response rate suggests response bias, and problems of self-selection (Babbie & Benaquisto, 2010). Rough estimates of the response rate for the pedestrian survey can be found in Appendix M, with an overall response rate of approximately 6.5% or 1 in 15 people. The estimates were calculated by multiplying the number of pedestrian surveys for each location by the nth person approached to participate, and then dividing by the pedestrian count figures (City of Vancouver 2009b) used to select the locations. These calculations provide an indication of the response rate, but assume pedestrian count volumes have not changed. The calculations also do not account for additional off peak hours for the pedestrian survey, however these are the same at all sites.

4.3.10. Recommendations for future surveys

With hindsight one surveyor trying to get a statistically significant sample of pedestrian impact surveys, was overly optimistic. Recruiting participants was very time consuming, was weather dependant, had a low response rate and so was challenging for morale, and occurred in clusters. Having more than one surveyor could have greatly increased recruitment, especially at the sites with a high footfall. On the basis that one surveyor collected 266 surveys in 45 hours, it is reasonable to assume two surveyors working together, and benefitting from the clustering, could have collected over 400 surveys over the same time period. Adding an extra five hours for survey set up time each (equaling 50 hours), it is believed that two people could have collected a statistically significant sample in 100 hours of survey time between them. Conducting a before and after survey, so each location could be compared with itself over time, was not possible because the separated bike lanes had already been constructed. However if before and after studies were possible, it would improve the validity of findings, and would double the survey hours needed.

For data input a rate of 30 surveys an hour, or one survey every two minutes, has been estimated. Therefore to input 400 surveys would take approximately thirteen hours. Conducting the onsite pedestrian surveys on computer tablets could virtually
eliminate data input time, and also allow for instant analysis. Therefore for two surveyors to survey at least 400 participants, at five sites between 9am and 6:00pm, before and after street changes, would take approximately 226 hours if using paper, or 200 hours using computer tablets. At a nominal rate of $30 an hour\(^5\) this would equate to $6000 to $6780 to collect the pedestrian survey data. If two teams of researchers conducted surveys at different sites simultaneously, the surveys could also be conducted over fewer days, rather than the month it took for this research, and for the same price. In short what was too much for one researcher would be very achievable for a small team of researchers.

Some pedestrian impact survey questions and statements did not work as anticipated and would require rethinking for any further research. Only 70% of participants answered the survey transportation mode share question as intended, and the samples were too small to compare between sites. The rest of participants ticked one or multiple transportation modes, rather than numbering them in priority order. The question design had tried to highlight the ranking question was different with instructions, different shape boxes (Babbie & Benaquisto, 2010), and numbers inside the boxes, but ultimately although the question worked when tested, it did not work in the field. Perhaps the question did not work because it was too complicated, the numbers inside the boxes were too faint on the printed surveys, it was not tested on enough people, or more unique formatting or more prompts were needed. Therefore further experimentation and testing for this question would be needed.

Other survey statements that did not work and would need to be reconsidered were ‘This block is too long’ and “I feel safe as a pedestrian on this block”. Although the statement on the block being too long was back up by literature, the concept was too confusing for participants. For feeling safe as a pedestrian a more precisely worded statement may have provided clearer results, because the statement made no distinction between traffic safety and personal safety.

\(^5\) At the time of writing, an advertised starting rate for an assistant planner III, at the City of Vancouver, was $29.00 an hour.
4.4. Semi structured public observation

Public observations have been used extensively in pedestrian literature to study, explain and model pedestrian behaviour, patterns and experience, including Gehl (2010), Jacobs (1961), Whyte (1990) and Helbing et al. (2001). However methods and criteria for conducting observation were not clear and Whyte (1990) warned that observations were extremely time intensive to conduct and analyze. Instead of observing people’s behaviour Appleyard & Lintell’s (1972) research focused on interviewing people to gain their opinions. Asking people’s opinions matched better with the City of Vancouver’s existing consultations and surveys used to gain input and feedback on the separated bike lanes. Asking pedestrians directly about their perspective on how they were being impacted by the separated bike lanes, was also the focus of this research. So even though there was a precedent for using public observations, public observations were not used as the primary mode of data collection for this research. However they were still used to provide context on pedestrian impacts which were not possible to gain through literature, policy, or policy makers.

The observations were conducted before, during and after the pedestrian survey shifts to provide complementary context. Observations were noted on site, such as the weather, the volume of pedestrians and vehicle traffic, the layout and environment of the site, and where optional and social activities occurred, such as people dwelling, watching, eating, meeting and talking as described by Gehl (2010). Observations were also intended to help judge whether optional and social activities occurred more due to the separated bike lanes.

Detailed semi-structured notes were written up at the end of each survey shift, some of which is included in Appendix J. Weather observations in the notes were supplemented with data from the Weather Network (2013), and are included in Appendix K. Digital photographs were taken to provide context and highlight the pedestrian environment. People observed and photographed were on a public street, but did not directly know they were participating in the research unless they saw the research sign or asked what the research was about.
5. Documentary and interview evidence of separated bike lane impacts on pedestrians

This section concentrates on document analysis and interviews. The onsite pedestrian survey will be discussed in Section 7.

Documentary analysis and interview comments have only been related to their original scope, so for example Dunsmuir impacts have been highlighted as relating to only Dunsmuir, and have not been applied to other separated bike lanes. However, where general pedestrian impacts were discussed, these have been highlighted as applying to all separated bike lanes, and not any separated bike lane in particular.

5.1. Pedestrian experience

The City of Vancouver’s (2012f) separated bike lane status report said “… pedestrians have benefited from an improved walking environment” (p. 1), which seems to echo a general sentiment.

... our observations and our expectations that it might have made it a little nicer if you are walking along, and anecdotally we heard that, some people said... it’s nicer to walk down there because now there’s no moving cars, and because of the greenery we put in, so a little bit more of a pleasant buffer between me and the moving cars. (Vancouver engineer 2, personal communication, 6 February 2013)

The separated bike lanes have created a buffer between moving vehicle traffic and pedestrians on the adjacent sidewalk. A drop in retail vacancies (from 12% to 2% on Hornby Street) has likely also enhanced the pedestrian environment. Some surveyed Hornby and Dunsmuir store customers noted both [sic] a more pleasant walking environment. (City of Vancouver 2011b, p. 3)

Gehl (2010) agrees that less empty units would enhance the pedestrian environment. However attributing the decrease in vacancies to the separated bike lane
is not possible, which is highlighted by a research interview with a business spokesperson that revealed the drop in retail vacancies was only temporary:

… anecdotally what I have noticed is that there appears to be some additional vacancies along Hornby Street. I think that is just the natural thing, leases come up all the time right depending on the terms and business will then make a decision that we couldn’t move out when the lanes were being installed, but when our lease comes up for renewal we won’t renew it, and we’ve seen some of that. I wouldn’t say it’s a marked increase in vacancies, but there has been. Whether or not this is part of the usual market forces or as a result of the bike lanes or a combination of both, I couldn’t answer that. But anecdotally there appears to be more vacancies. (Business spokesperson, personal communication, 28 June 2013)

Therefore attributing either the decrease or the increase in retail vacancies to the separated bike lanes is not possible.

Other possible improvements to the pedestrian experience include the planters adding greenery to the bike lane corridors. Feedback provided by the general public, online and at a City of Vancouver information session, found that the planters were a popular part of the Dunsmuir separated bike lane (City of Vancouver 2010c). The planter barriers were a City of Vancouver experiment in response to business concerns, that the highway style concrete separated bike lane barriers used on Burrard Bridge and Dunsmuir Viaduct, would not fit Dunsmuir’s streetscape (Vancouver engineer 1, personal communication, 12 December 2012). Therefore the decision to use planter barriers was to keep the streetscape design attractive to people using the street, and therefore was influenced by what impact the type of separation would have on the pedestrian experience.

Anecdotal comments were also found in the business impact study (Stantec 2011a) and appendices (Stantec 2011b). Beyond the anecdotal comments, the customer exit survey was one of the six surveys in the business impact study (Stantec 2011a), and the only separated bike lane survey that consulted impacted pedestrians about the impacts on pedestrians. The survey (Stantec 2011b) found 4% of respondents on Hornby Street and 7% on Dunsmuir thought the separated bike lanes had made the area “more pleasant to walk” (p. 116), when responding to the question “have the
separated bike lanes affected your ability to access the area in any positive ways?” (p. 116). To actually gauge how many people agree that the separated bike lanes have made it more pleasant to walk, a follow up question is needed.

The pedestrian impact survey conducted for this research asked the level of agreement with pedestrian experience statements including, “This is a stimulating block” and “This block is very peaceful”. These statements allowed comparison between sites with different bike lane infrastructure, and analysis (Sections 7.4.3 and 7.5.1) for both survey statements suggested the separated bike lane has caused a positive pedestrian impact. No statement was included in the pedestrian impact survey for whether the separated bike lane made it more pleasant to walk, because doing so would have involved comparing before and after at the same location, rather than comparing different sites.

A cycling activist interviewed as part of the research also agreed with the general feeling that the separated bike lanes have had some positive impact on pedestrians. However the cycling activist went further by implying that the increased volume of cyclists, brought to the street by the separated bike lane, also provides a spectacle for pedestrians, even if the cyclists were not stopping to take part in the optional and social activities themselves.

I do think the separated bike lanes have made it a more walkable and more bikeable city here… I think it improves the pedestrian quality and experience. It gives [pedestrians] a buffer from traffic. It also enlivens the street more, there are more people whose faces you can see and say hi to or recognize or people watch. The most exciting pedestrian areas and public spaces are where you can sit and be entertained by people around you, which is not really possible by watching cars. People do not sit at a busy freeway and watch cars go by. It’s not interesting, you cannot see people’s expressions, you can’t see what they are wearing, you can’t see any of the things at that instinctive human draw… So on a bike you get all of that, you are moving slightly faster but I think it’s quite interesting for pedestrians to see [cyclists] and to have that closer to human speed of people closer to them than the fast moving cars, or the parked cars which are just inanimate and boring. (Cycling activist, personal communication, 13 February 2013)

The cycling activist’s comments correspond with Gehl (2010), that travelling at human speeds enables people to interact, and human interaction enlivens the street,
and so also suggests the separated bike lane is acting like a softer edge. Also the pedestrian experiences, people watching and interactions, described by the cycling activist, are examples of optional and social activities, which the pedestrian impact survey (Sections 7.4 and 7.5) explored as a focus.

Optional and social activities were not discussed in separated bike lane design documents, and pedestrian experiences were not monitored or explicitly consulted about, for either the Dunsmuir or Hornby separated bike lanes. Therefore most of the pedestrian impacts found via data, document analysis, and interviews and included in the subsections below relate to necessary pedestrian activities, not optional or social pedestrian activities.

5.2. Pedestrian safety and collisions

Feedback provided by the general public online, and at a City of Vancouver information session, found that safety was one part of the Dunsmuir separated bike lane that people liked the best (City of Vancouver 2010c). The feedback probably related primarily to cyclists’ safety, because it was in contrast with the business impact study customer exit survey. The customer exit survey (Stantec 2011b) found 10% of Hornby Street respondents, and 9% on Dunsmuir, thought the separated bike lanes had “pedestrian safety concerns”, in response to “have the separated bike lanes affected your ability to access the area in any negative ways?” (p. 115). However a later City of Vancouver (2012f) separated bike lane status report, using insurance claim collision data (from ICBC) shows, “Collisions of all types (involving vehicles, bicycles and pedestrians) are down 19% on Dunsmuir Street and down 18% on Hornby Street (2008 and 2009 vs. 2011).” (p. 6)

Some caution needs to be taken with insurance claim data as it only relates to motor vehicle insurance claims, and is unlikely to include collisions between cyclists and pedestrians (Reynolds et al., 2009). Therefore even though reported collisions have decreased, actual collisions could have increased which would help explain why there were pedestrian safety concerns in the survey. But even if the separated bike lanes had increased collisions between pedestrians and cyclists, whether the separation has
improved safety would also need to account for the severity of collision injuries. Hospital record analysis, as suggested by Reynolds et al. (2009) and Teschke et al. (2012a) could have provided a good indication of whether the separated bike lanes had decreased the severest injuries, but no baseline data was available. However Teschke et al. (2012a) and Wegman & Aarts’ (2006) findings both suggest that having fewer collisions involving vehicles would also result in fewer injuries requiring emergency room treatment.

Complaints, although anecdotal, could also be an indicator of pedestrian safety. Individual separated bike lane related complaints are forwarded from the City of Vancouver call centre, but there was no available data on the number of separated bike lane related pedestrian and cyclist complaints, or what percentage these complaints were as a total of all separated bike lane complaints (Vancouver engineer 1, personal communication, 12 December 2012).

The most complaints that we get in terms of conflicts of walking and cycling is sidewalk riders, or at a crossing that is not marked as shared for bike and pedestrian… all along the separated bike lane cyclists have their own crossing, separated from pedestrians. So there shouldn’t be any conflicts. [At the intersection of Dunsmuir and Hornby] we do have cyclists cut around the corner to get into the next separated facility. So I have seen pedestrians and cyclists conflict there. (Vancouver engineer 1, personal communication, 12 December 2012)

5.3. Reducing cyclists riding on sidewalks

One pedestrian impact celebrated in the separated bike lane documents was the decline in sidewalk ridership on both Dunsmuir and Hornby Streets. The City of Vancouver (2012f) report says, “Cycling on sidewalks has been reduced 80% with less than 1% of cyclists now using the sidewalks on Hornby and Dunsmuir Streets.”

We measured [the sidewalk ridership]. I don’t think we really thought there would be any difference. Maybe a slight difference. Not 80%, that’s huge, so significant. (Vancouver engineer 1, personal communication, 12 December 2012)

We were very happy when we saw an 80% decrease in the number of cyclists that were on the sidewalk after we built the separated bike lanes. (Vancouver engineer 2, personal communication, 6 February 2013)
Reducing sidewalk ridership was a design phase target for the separated bike lanes, even though it was not mentioned in the City of Vancouver (2010b) report to council, recommending the construction of the Dunsmuir separated bike lane. Designing two way separated bike lanes on one way streets was to reduce people cycling the wrong way in the bike lane, or cycling on the sidewalk. The design acknowledged this made the sidewalks safer and more comfortable for pedestrians. The two way design was as a result of Nelson and Scholar’s (2006) Copenhagen study, and talking directly to City of Copenhagen staff (Vancouver engineer 1, personal communication, 12 December 2012). However cyclists were the focus of monitoring sidewalk ridership.

Before we built [the separated bike lanes] we went out. We were counting bikes on the street entirely. Basically we had people out there for 8 hours a day for several days counting the number of cyclists on the street. On Hornby Street previously we had a north bound painted bike lane. So we were measuring cyclists in the painted bike lanes and cyclists on the two sidewalks and I guess cyclists that were in the other lanes that were all purpose vehicle lanes. Then after the fact we did the same thing… In that same study we were also observing the gender and the sort of age of people. Basically were they children or were they adults? So we were also able to measure the change in the gender balance of people who using the bike facilities, and how many kids were there… That’s just cyclists. From the pedestrian point of view we were observing how many cycles were on the sidewalk and counting them, and then doing the same thing again after the bike lanes were in. (Vancouver engineer 2, personal communication, 6 February 2013)

A number of pedestrian impact survey comments, related to sidewalk cyclists, were thankful that occurrences had been reduced.

It’s nice not to have cyclists on the sidewalk. It feels safer for pedestrians. (Pedestrian impact survey 29, personal communication, 3 April 2013)

…keeps cyclists off sidewalks… (Pedestrian impact survey 56, personal communication, 8 April 2013)

Better than dealing w/ bikes on sidewalks (Pedestrian impact survey 249, personal communication, 30 April 2013)

Despite the reduction in sidewalk riders, cycling on sidewalks still generates the most complaints in terms of conflicts between walking and cycling (Vancouver engineer 1, personal communication, 12 December 2012), probably because of the faster speed
of bikes compared to pedestrians. Pedestrian impact survey comments also highlighted that not everyone agreed that cyclists no longer use the sidewalk.

Biggest problem for pedestrians is cyclists who don’t use lanes but sidewalks (Pedestrian impact survey 119, personal communication, 16 April 2013)

They do not get bikes off sidewalk. Tickets should be issued for any bike on sidewalk in downtown core. (Pedestrian impact survey 84, personal communication, 16 April 2013)

The second survey comment also suggests the issue impacts the downtown not just the separated bike lanes corridors. The presence of sidewalk riders in other areas is also mentioned in another pedestrian impact survey comment, “Godsend! I have felt endangered by cyclists on sidewalks, and still do when there is no separate path for them. Same as when I drive!” (Pedestrian impact survey 33, personal communication, 4 April 2013) Therefore the pedestrian impact survey comments suggest the reduced sidewalk ridership is limited to the separated bike lane corridors on Dunsmuir and Hornby Streets. Finding out whether sidewalk ridership had increased or decreased on non-separated bike lane streets was not within the scope of this research. However the pending 2013 pedestrian study may provide some data, and therefore would provide a good starting point for further research.

5.4. Pedestrian safety when crossing the separated bike lanes

A particular pedestrian safety concern resulted from the decision to have two way separated bike lanes, on one way traffic streets.

[Some surveyed Hornby and Dunsmuir store customers] had concerns about pedestrian safety, presumably because pedestrians crossing the separated bike lanes now deal with two-way bicycle traffic and more bicycles. (City of Vancouver 2011b, p. 3)

A City of Vancouver (2010c) summary of feedback, provided by the general public online and at a City of Vancouver information session, found that the bidirectional bike lane was one of the parts of the Dunsmuir separated bike lane which people liked
the best. There is no way of verifying if these comments were only from people who appreciated the increased cycling access on Dunsmuir, or if people who usually walked or drove by also liked the bidirectional bike lane. The same feedback also revealed that signage and conflicts at intersections between motor vehicles, cyclists and pedestrians were parts of the Dunsmuir bike lane that people felt needed improvement. Again it is not possible to verify whether the complaints related to walking, cycling, driving, other modes, or a combination. However some comments could suggest pedestrians are not seeing cyclists when crossing, but no monitoring of this potential pedestrian impact has been conducted. Also verification of how worried pedestrians are about not seeing or hearing cyclists was not possible, because other pedestrian comments are not available (Appendix D).

The impact on pedestrians of having a two way bike lane, on a one-way vehicle street, was not considered during the design phase because,

Our streets have been designed with pedestrians directly next to vehicles, so if they step out onto a crosswalk, if there is a turning vehicle there is a conflict between the pedestrian and the vehicle. Now we have introduced kind of a buffer [the separated bike lane]. Now it is the cyclists and the vehicles in direct conflict and the pedestrians have this space that kind of buffers them. (Vancouver engineer 1, personal communication, 12 December 2012)

Therefore the design of the separated bike lanes was seen to improve pedestrian safety, because pedestrians were now located next to slower bikes and away from faster and more dangerous vehicles. Therefore understandably the higher safety priority was ensuring cyclists’ safety against fast vehicle traffic, especially from the right hook.

There's a term, the right hook, when the cyclist is going straight through and the car turns right across. So that was something that we were very much aware of when we were doing the intersection design. We wanted to prevent that as much as possible. (Vancouver engineer 1, personal communication, 12 December 2012)

Although less dangerous than vehicle traffic, cyclists do have to be more aware of pedestrians when riding in the separated bike lane. The separated bike lanes provide “almost a false sense of security for [pedestrians], because we aren't going as fast and we aren't as noisy, they don't always look.” “I guess that perception that pedestrians are
not paying as much attention as they should be is increased, as before I noticed that not nearly as much.” (Cycling activist, personal communication, 13 February 2013)

To gauge whether seeing cyclists was an issue for pedestrians crossing, the pedestrian impact survey in this research specifically asked pedestrians their level of agreement with the following statement: “Sometimes I do not see or hear cyclists when I cross this street” (Section 7.4.2). The pedestrian survey responses were mostly from Dunsmuir Street, though the design and street placement of the separation on Hornby Street is very similar to Dunsmuir Street, so the comments may apply to both separated bike lanes. In addition to the pedestrian survey statement, opportunity was also given in the pedestrian survey for people to make extra comments, mostly in what the worst thing about the block was or in the additional comments section.

5.5. Pedestrians crossing mid-block

How the separated bike lanes are impacting pedestrians should include how mid-block crossings have been impacted, such as whether mid-block crossings have increased or not, but this thesis was unable to provide any definitive answers. Pedestrians crossing mid-block, where there are no designated pedestrian crossing facilities, is officially illegal in Vancouver. Therefore for ethics purposes this research did not try to gauge, via surveys or observations, whether the separated bike lanes had increased or decreased pedestrian mid-block crossings. The City of Vancouver also does not monitor mid-block crossings (Vancouver engineer 1, personal communication, 12 December 2012), nor has the City of Vancouver announced in any of their reports they plan to do so. The only evidence is anecdotal, but shows that there are some suspected impacts.

...we have seen more jaywalking. Pedestrians now feel like it is now a lot more narrow than it used to be and can wait in the cycle track. Thankfully the planter space is wide enough for someone to wait without being in the cycle track. Most of the areas along both Dunsmuir and Hornby a pedestrian can wait, or a couple of pedestrians can wait and not really interfere with the bike path. (Vancouver engineer 1, personal communication, 12 December 2012)
However two anonymous comments, from the pedestrian impact survey, thought that the separated bike lanes made mid-block crossings more dangerous.

The planter guarding the bike lane make [sic] it dangerous for pedestrians crossing the street (Pedestrian impact survey 220, personal communication, 24 April 2013)

Cyclists are harder to notice when you jaywalk (Pedestrian impact survey 32, personal communication, 3 April 2013)

The anecdotal comments suggest it would be worthwhile monitoring the impact of the separated bike lanes on mid-block crossings, perhaps via observations and comparisons between different crossing conditions.

5.6. Pedestrian travel times

To answer how the separated bike lanes have impacted pedestrians should include whether pedestrian travel times have increased or decreased. However this thesis was unable to provide any answers, because no pedestrian travel time studies have been conducted for pedestrians and no baseline data was collected before the separated bike lanes were implemented (Vancouver engineer 1, personal communication, 21 December 2012).

This is in contrast to vehicle and bus travel time monitoring which was carried out on both Dunsmuir and Hornby Streets, before and after the implementation of the separated bike lanes. Travel time studies were conducted for buses on Dunsmuir and for rerouted buses on Hornby Vehicle. Travel time studies are also routinely conducted by the City of Vancouver for all street realignment projects, to see the impact on vehicle commute times, and to see if vehicle speeds have been maintained (Vancouver engineer 1, personal communication, 21 December 2012).

The total change in travel time for the Hornby corridor between Pacific and West Hastings has ranged from a reduction of 5 seconds to an increase of one minute and 37 seconds, of which the latter is equivalent to missing one traffic light. (Stantec 2011a, p. 35)
[However] when examining the upper floor employee's survey, the results show that the perception is that commute travel time has increased on average by 5 minutes as a result of the Hornby separated bike lane. (Stantec 2011a, p. 37)

It could be therefore be argued that the travel time studies were carried out for vehicles, because of concerns and complaints about the perceived impact the separated bike lanes had had. However there have been no travel time studies for cyclists despite complaints. Anecdotally engineers have heard from friends and family that it is slower to bike south on Hornby compared to Burrard which was the previous option, and east on Dunsmuir since the separated bike lanes were put in. (Vancouver engineer 1, personal communication, 21 December 2012).

“The signals are timed for vehicles, and since the streets are one-way, counter-flow bikes do not have priority” (Vancouver engineer 1, personal communication, 21 December 2012).

Some comments in the pedestrian impact survey also allude to cyclists unhappy with signal timings such as

Dislike the Howe [sic] St. bike lane as its [sic] too much stop + start at every single red light along the entire street (Pedestrian impact survey 203, personal communication, 24 April 2013)

Too many lights (Pedestrian impact survey 165, personal communication, 22 April 2013)

Love them! Need more like Seattle has for faster pace bikes (Pedestrian impact survey 179, personal communication, 23 April 2013)

By collecting only vehicle travel times, and not pedestrian and cycling travel data, it highlights that the impacts of the separated bike lanes have not been prioritized in line with the hierarchy of transportation modes. To be able to answer how pedestrians travel times had been impacted, pedestrian data would have to be manually gathered, as would cycling travel time data which would take extra resources. However it should be pointed out that vehicle travel time data is also gathered manually.

Vehicle travel time… data was collected by driving the full length of Hornby Street, recording the time of day as vehicles passed selected
intersections. Data was collected in September and October 2010 on 5 individual weekdays prior to construction, and in January, February and March 2011 on 8 individual weekdays after construction. (City of Vancouver 2011b, p. 8)

5.7. Pedestrian volumes

We have permanent bike counting equipment installed. We are counting bikes. There is unfortunately not as good technology for measuring pedestrians... The only mechanism we have is sending people out there and having them sit there for hours on end counting things. (Vancouver engineer 2, personal communication, 6 February 2013)

Raford & Ragland (2005) and Liu & Griswold (2009) agree that collecting pedestrian volume data is more challenging than collecting bike or vehicle volume data, but also highlight the importance of collecting reliable data. Initially this research tried to compare the available City of Vancouver (2012d) intersection count data, for both before and after the implementation, as well as with City of Vancouver (2009b) pedestrian study data. However, initial attempts to do so suggested that the pedestrian volume samples were too infrequent and statistically weak, which was confirmed by a Vancouver engineer interviewed (Vancouver engineer 2, personal communication, 6 February 2013). Therefore the results of these initial comparisons have not been included as part of this research. The same engineer also explained the issues of using existing data to measure pedestrian volume changes.

We did a 2008 pedestrian study downtown, so it gives us some information about how many pedestrians were on a block sidewalk at a particular time of day [and] ...we did a similar measurement in 2011... [Comparing these two sets of data], the best that we can conclude is there didn't appear to be any change. The actual number of pedestrians seems about the same as it was in 2008... At least, it's not a negative. (Vancouver engineer 2, personal communication, 6 February 2013)

Using the available data, the City of Vancouver's (2011b) separated bike lane status report concluded that “The volume of pedestrians on Hornby Street and Dunsmuir Street has not changed in comparison to numbers observed during the City's 2008 Pedestrian Survey” (p. 2). Therefore unchanged pedestrian volumes were seen as an acceptable and not a negative outcome, even though only maintaining pedestrian
volumes does not seek to increase all types of active transportation. The City of Vancouver does not have a specific target to increase pedestrian volumes, in either Vancouver or Downtown Vancouver, though there is a publicized combined bike, public transit and pedestrian target.\textsuperscript{6} The City of Vancouver’s (2009a) last pedestrian survey also sidesteps whether increasing pedestrian volumes is a target.

A key strategy of both City and regional transportation, climate change and land use plans is to increase walking as a desirable mode of travel in itself as well as being an integral part of every trip. (p.14)

In contrast a cycling activist (personal communication, 13 February 2013) thought the available cycling volume data, from the monitoring of the separated bike lanes, was invaluable to show the before and after impact of the separated bike lanes on cycling, especially to show that the City of Vancouver was achieving the cycling goals they had set themselves.

\textit{…the city has put so many counters out, I think definitely more than your average North American city … to collect the proper data. They are very interested. They want it to work and if it’s not working they want to change it so it does.} (Cycling activist, personal communication, 13 February 2013)

Although more difficult to collect, tracking a combined active transportation volume could be just as invaluable to show if total active transportation volumes are increasing and improving sustainability. However only cycling, and not the combined modes of active transportation, was prioritized in the separated bike lanes’ objectives.

The objective of the bike lane is to make it easier and more convenient for people to cycle and absolutely not compromising pedestrian convenience, comfort and safety and similarly transit. We don’t want to make cycling better at the cost of walking or transit. The impacts on vehicular traffic at city policy level is a little less definitive, we don’t have an objective to make it more difficult to drive. From a pragmatic point of view it is easier for us if we can say we didn’t really change things for drivers. (Vancouver engineer 2, personal communication, 6 February 2013)

\textsuperscript{6} The City of Vancouver’s (2012c) Greenest City Action Plan has a 2020 target for “over 50% of trips by foot, bicycle, and public transit” (p. 29). In 2008 the share was 40%.
Consequently the design goals and the monitoring objectives of the separated bike lanes, had cyclists as the highest priority, but did not also prioritize pedestrians. Increasing pedestrian volumes was not an objective or a target, so increased pedestrian volumes were also not planned for or monitored. Therefore no data is available to judge how the separated bike lanes have impacted pedestrian volumes, or to inform what designs increase or impede desired pedestrian outcomes. Pucher and Buehler (2008) would also suggest that increases to cycling volumes will be limited, as disincentives to driving were not included. There is therefore the risk of swapping walking for cycling which does not increase sustainability. The pedestrian impact survey’s mode choice statements (Section 7.2), explore the substitution of active transportation modes further.

5.8. Pedestrians’ mode share

The combined mode share of walking and cycling is also an indicator of how successfully Vancouver is switching to sustainable transportation. How active transportation mode share changes in areas where active transportation projects are implemented, should be a high level indicator of whether projects have increased sustainability. Comparing trip diary data for Downtown Vancouver should indicate if the separated bike lanes have helped increase walking and active transportation trip mode shares in downtown, or if only cycling has increased. Unfortunately although trip diary data was collected independently of the separated bike lane objectives, the Downtown trip diary data for this important indicator has not been published, and was not available.

The Hornby intercept study conducted as part of the separated bike lane impact studies, did confirm that pedestrians were the majority mode share users on Hornby Street pre-implementation of the separated bike lane. For the question “How did you travel here today?”, with only one mode choice accepted, the resulting modal share was, “44% walking, 27% transit, 22% vehicle/motor bike and 7% bicycle” (City of Vancouver 2010c, p. 27). However a follow-up post-implementation ‘Hornby Street Visitor Survey’ accepted multiple choice answers, so the data was not comparable (City of Vancouver 2011b). The validity of comparing the two surveys was also questioned:

I’d like to see another customer intercept survey done now... All of that stuff was so rushed, because [the City of Vancouver] were under so much
pressure to get something out, but I felt like none of it was very, it wasn’t as valid as it could have been because it was too short a time frame… [The post-implementation survey needed to be] a year minimum [later] to be able to go through all of the seasons. (Cycling activist, personal communication, 13 February 2013)

5.9. Pedestrian and customer access

In terms of customer access, the separated bike lane business impact reports (City of Vancouver 2011c, Stantec 2011a, Stantec 2011b) concentrate on reduced vehicle access. However as part of the business impact report, a customer exit survey asked pedestrians’ opinions on Dunsmuir and Hornby Streets. The survey found that “79% of respondents on Dunsmuir St. and 76% of respondents on Hornby St. had not changed their shopping patterns as a result of the separated bike lanes” (Stantec 2011a, p. iv). The survey also found that the majority of people thought their access to the area had not been impacted by the separated bike lanes. 26% of respondents on Dunsmuir and 38% on Hornby thought the separated bike lanes had negatively affected their ability to access the area, while 25% on Dunsmuir and 23% on Hornby thought the separated bike lanes had positively affected their access. Most negative access feedback mentioned decreased vehicle access, and most positive feedback focused on improved bike access and safety. The majority of comments did not relate to pedestrians, even though they were by pedestrians. For the few pedestrian access impacts mentioned, there were slightly more negative than positive comments (Stantec 2011b).

The ratio of pedestrian access comments from the customer exit survey did not reflect how people accessed the area, and nor did the rest of the business impact reports. The Hornby intercept study (City of Vancouver 2010c) found that 44% of people accessed the separated bike lane corridors on foot, which was twice as much as by vehicle, and access by vehicle was also lower than by transit. Also as the business impact reports acknowledges:

The percentage of customers travelling downtown by automobile was estimated by at-grade businesses to be roughly double the percentage determined by the customer surveys…Thus, there is a potential that issues such as the availability of parking and vehicle access to businesses may not necessarily be as critical as other issues such as
visibility, pedestrian access and environment, and goods delivery. (Stantec 2011a, p. 25)

Figure 3 also shows that vehicles entering the downtown have been consistently declining, at the same time downtown population, employment and transit riders have all been increasing. So why is the impact on access focused on vehicles and not pedestrians?

Retailers clearly want to ensure that they can capture the most number of customers, and if we are basically saying that we are going to make it more difficult for people to come to their stores by car, more challenging, then they don’t like that. It’s already enough of a challenge to be competing in the market that we are in, where the shopping malls offer free parking and free access. (Business spokesperson, personal communication, 28 June 2013)

Increasing access for everyone, and not restricting anyone’s access, would maximize the number of customers. However focusing on improved customer access, for the majority of customers in Downtown Vancouver, would require improving walking and transit access, before vehicle access. In general though the impact on pedestrian access by the separated bike lanes was not monitored, consulted about or planned for (see exceptions in Section 5.10) despite being the majority mode share. Pedestrian access was therefore not acknowledged by the business impact report, or by pedestrians exiting businesses, which would appear to reflect Meadows’ (1998) point that what we come to care about is what is monitored. It should be acknowledged though that customer access is more nuanced, as the type of good or service provided by the business may require vehicle access. There could also be the implicit assumption by businesses that vehicle customer access is more valuable, because businesses view vehicle owners as richer and more profitable customers. To verify or challenge the importance of vehicle access to Downtown Vancouver businesses, however requires additional research, which falls outside this project’s scope.
5.10. Specific pedestrian groups

Some pedestrian impacts identified were aimed at people who were only pedestrians after they accessed the area by another mode of transport. For example, access problems between vehicles and the sidewalk were identified as pedestrian impacts that needed to be considered, in the separated bike lane design, especially for people with disabilities.

The design for Hornby [separated bike lane was taken] to a city subcommittee for people with disabilities… a lot of them had been on Dunsmuir and tried it out and had a lot of valuable information to offer for Hornby.

On Dunsmuir where there is parking next to the bike lane we left it at grade… [so] a person in a wheelchair or with mobility issues … had to walk half a block [on the street] to get to the curb ramp and get up onto the sidewalk. (Vancouver engineer 1, personal communication, 12 December 2012)

As a result of the consultation with the city subcommittee for people with disabilities about the Dunsmuir separated bike lane, the design on Hornby was changed to “have parking next to the separated bike lane, so it’s the same surface. There’s a refuge space [where people exiting vehicles] can use to get to a marked crossing where they have a legal right of way to cross the bike lane.” (Vancouver engineer 1, personal communication, 12 December 2012)

[When people exit] transit, when people get out of their car, they all become pedestrians. Even cyclists when they lock up their bike…everyone ends up being a pedestrian. That last leg of their journey to the store is as a pedestrian. So it’s important to recognize that. (Vancouver engineer 1, personal communication, 12 December 2012)

Before people get on transit they are pedestrians, and on exiting transit they are also pedestrians. So the region’s public transit provider, Translink, was consulted about how a bus stop on Dunsmuir 200 block would interact with the separated bike lane, and therefore Translink were consulted about transit users’ comfort and safety (Vancouver engineer 1, personal communication, 12 December 2012). The design proposal for the Dunsmuir separated bike lane said buses had previously stopped “at the curb to load
and unload passengers. A separated bike lane next to the curb would prohibit busses from stopping at the curb and require transit users to cross the bike path” (City of Vancouver 2010b, p.6). For the bus stop on Dunsmuir, “We had looked at Copenhagen for that design. But we had a lot of design constraints in how much refuge space we could provide.” (Vancouver engineer 1, personal communication, 12 December 2012)

We were striving to create the separated bike lane within the existing street space, that is not reconstructing the curb on either side of the street, because it was a trial. So, we only had the existing street space to use. We have minimum widths we need to meet for parking and vehicle travel lanes (as per transportation design standards), so what was leftover was for the refuge area and the bike lane. We had in mind a minimum width for the bike lane (since there is not a standard), but wanted to go through options with Translink/West Vancouver Transit for the amount of refuge space they envisioned. We showed them what other cities had done (e.g. Copenhagen). After some field tests with buses, we decided on what is there today. There was agreement that it was a trial and we would learn from it and could change it in the future. (Vancouver engineer 1, personal communication, 21 December 2012)

The Dunsmuir 200 block bus loading and waiting area is separated from the bus shelter on the sidewalk by the bike lane (Appendix N). Therefore passengers exit the bus onto a ‘refuge median’ between the separated bike lane and the vehicle traffic section of the street. The passengers then cross the separated bike lane to get to the sidewalk or the bus shelter (City of Vancouver 2010b). When designing the bus loading area, pedestrian comfort and safety was specifically considered.

In Copenhagen and other cities they have actually installed railings so that the pedestrians who are coming off of the bus cannot jaywalk across traffic. So it kind of feels like you are in this corralled area between moving vehicles or a stopped bus, so we tried not to do that sort of thing. We wanted to see if we could just leave it more of a free flowing area. Anecdotally being out there and watching it I think it works well. Some people chose to stay in the shelter and cross when the bus comes. (Vancouver engineer 1, personal communication, 12 December 2012)

These are all valid, and important, pedestrian impacts of the separated bike lanes, which were considered during the design, consultation and implementation stages, and focus on pedestrian safety, access and comfort. However, although the bus stop is on a separated bike lane route, it is only one of many transit options in the
vicinity. The Hornby intercept study (City of Vancouver 2010c, pp. 27-29) identified 27% of people accessed the area by transit, but as there is no transit stop on Hornby Street, none of these transit users would have exited onto the separated bike lane. Similarly in the same study, 22% of people arrived by vehicle/motor bike, but only 31% of these people parked on their destination block, which means less than 7% of people surveyed on Hornby Street would have been impacted by access to and from their vehicle.

Consideration of impacts on specific pedestrian groups should supplement, not replace, consideration of the impacts on the vast majority of pedestrians, who accessed the separated bike lane corridors as pedestrians. However the business impact report appears to use the examples, of modified pedestrian access from vehicles, to represent all pedestrian access being negatively impacted.

Businesses that rely on easy pedestrian and auto parking access and good visibility are impacted more by the separated bike lanes than those where these factors are secondary. (Stantec 2011a, p. 9)

5.11. Pedestrian impacts related to the hierarchy of transportation modes

The above analysis highlights that the hierarchy of transportation modes was selectively applied as part of the Dunsmuir or Hornby separated bike lane process. Overall consideration of pedestrian impacts was not a prominent part of the separated bike lane design, consultation, or monitoring process, and there was more consideration of vehicle impacts. Positive pedestrian impacts were not an outcome that was planned for, with the separated bike lane process focused on maximising the positive impacts on cyclists and minimizing perceived negative impacts on vehicle traffic.

Before ultimately selecting Hornby Street for a north-south separated bike lane, the City of Vancouver (2012g, 2010c) choose the best location using location criteria. The criteria prioritized maximizing the perceived positive impacts on cycling and minimizing perceived negative impacts for cars, parking, loading, trucks, and transit. One factor “good safety” was the only impact that could have been related to pedestrians as part of general safety, but as no further explanation was given the statement could also have been only related to cyclists’ safety. Therefore noticeably absent from the location
criteria was any specific mention of potential pedestrian impacts, and how positive pedestrian impacts could be maximized, or negative pedestrian impacts minimized.

The City of Vancouver’s (2010c) criteria for choosing the side of the street the separated bike lane was constructed on, concentrated on minimizing negative impact, by prioritizing the “less challenging factors” (City of Vancouver 2010c, p. 7). Eight of nine criteria were related to maintaining vehicle volume and access, though cyclist safety, cost and business feedback may have informed these criteria too. The one pedestrian criterion was minimizing the “number of front door business accesses” (City of Vancouver 2010c, p. 7) impacted. The 46 front doors impacted on the east side of Hornby Street were lower and less challenging than the 71 front doors on the west side. Businesses were worried that by restricting parking in front of their businesses’ front doors, it would restrict customer access. This highlights that businesses thought their customers mostly arrive by car, which is discussed in Section 6.2, or perhaps that their most valuable customers do. But as everyone accesses businesses’ front doors as a pedestrian, it implies a negative pedestrian impact of the separated bike lane, even if it was not intended.

The same report recommends Hornby Street as the best separated bike lane route, but warns that the construction of the Hornby separated bike lane required “reallocation of street space from either a travel lane or a parking lane” (p. 8). It was recommended that one lane of parking was removed, as the removal of a travel lane was deemed to have a larger impact.

The removal of a travel lane… would significantly impact the capacity of the corridor… The remaining parking lane can be located on either the east or the west side of the street… on the side that responds best to the needs of the businesses and institutions and where loading or passenger zones currently exist on the street. (City of Vancouver 2010c, p. 8)

The transportation hierarchy of modes was therefore selectively applied to the separated bike lane projects, even though the projects were meant to increase cycling to redress the transportation modal imbalance. The impacts on vehicles may have been prioritized due to more restrictions on vehicle space and access than for other modes. But if pedestrians and active transportation are to be considered the highest priorities,
the impacts on them should be the highest priorities in the design, consultation and monitoring phases.

The City of Vancouver (2012i) Transportation 2040 plan calls for reduced car ownership, reduced car trips, and reduced distances travelled by car, to be accommodated by walking, cycling and transit. Here the alternatives to vehicles are grouped together as more sustainable transportation modes and are not ordinally spaced. At a policy or project level the substitution of vehicle trips, or vehicle space, for alternative modes could therefore require prioritizing sustainable or active transportation. However in these cases, to maximize sustainability, the individual modes should also be separately considered in hierarchical order. This was not the case with the Dunsmuir and Hornby separated bike lane projects which prioritized active transportation, but not walking.

If pedestrians and cyclists were the highest two priorities in the design and consultation phase, then the volumes of pedestrians and cyclists in the project corridors would be acknowledged at the forefront. Walking then cycling access would be prioritized, and evidence that the separated bike lanes benefit pedestrians as well as cyclists would be required. However what would the process look like, would the project design and consultation change and what would the implications of such an approach be? Would improving safety focus on reducing vehicle speed and volume, or would safety also focus on collisions between cyclists and pedestrians? Would only safety and access be raised during consultations and therefore still be the focus? Or would improving the pedestrian environment also be a concern of people and stakeholders consulted? Would people have to be explicitly consulted about how the pedestrian environment could be improved, and would people think that the environment, comfort, safety and volume of walking and cycling required monitoring? Would people question the allocation of street space or whether on street vehicle parking was necessary for businesses? The pedestrian impact survey and observation findings (Section 7) explore and help provide some answers to these questions.
6. Trends for recognizing and prioritizing pedestrian impacts

6.1. City of Vancouver’s awareness of pedestrian impacts

There is evidence of some progression on how pedestrian impacts have been included and considered in the City of Vancouver’s design, consultation, monitoring and dissemination of information, related to the separated bike lanes. For the Dunsmuir separated bike lane there was not “exceptional public engagement, even within our stakeholder groups” (Vancouver engineer 1, personal communication, 12 December 2012). Pedestrian impacts considered were the use of planter separation, consultation about bus stop waiting conditions, and getting cyclists off sidewalks. For the Hornby separated bike lane there was considerably more consultation and engagement with stakeholders and the general public (Appendix O), but there was not a representative increase in pedestrian impact awareness during either the design or consultation. Pedestrian volumes were not monitored (Section 5.7), and only the ‘customer exit survey’ asked pedestrians about pedestrian impacts (Section 5.9). Additional Hornby separated bike lane pedestrian impacts considered mostly issues related to the minority of pedestrians exiting vehicles, and not the majority of pedestrians walking by (Section 5.10).

There were fewer acknowledgements of pedestrian impacts for the Hornby and Dunsmuir separated bike lanes, than there was for Vancouver’s first separated bike lane on the Burrard Bridge, perhaps because pedestrian space was lost on Burrard Bridge but was not on Dunsmuir or Hornby Streets.

The Burrard Bridge separated bike lane was installed in July 2009, and pedestrian impacts were mentioned because previously the bridge had provided a shared space for cyclists and pedestrians, while the new layout separated the two modes to provide “a safer alternative” (City of Vancouver 2009d, p. 13).
The shared space on that bridge before was really tight and quite busy. So all of those pedestrians and cyclists had to share the space and go at totally different speeds and pedestrians going two ways… There was the risk that [cyclists] would fall off a very high sidewalk into traffic (Cycling activist, personal communication, 13 February 2013)

The pedestrian impacts of the separated bike lane were acknowledged in the objective, design and consultation because the new Burrard Bridge layout restricted pedestrians to just one sidewalk. The old east sidewalk has become a cycle lane heading north, while a traffic lane was converted for the bike lane heading south.

Before and after the construction of the Burrard Bridge separated bike lane, telephone surveys were conducted to gauge support for the bike lane project. Open comment feedback found “pedestrians and cyclists feel safer and more comfortable” (City of Vancouver 2009d, p. 4), and “most feedback from pedestrians has been positive” (City of Vancouver 2009d, p. 2). However “some pedestrians remain opposed to being prohibited from the east sidewalk” (City of Vancouver 2009d, p. 5)

Volume counts for pedestrians, bicycles, and vehicles on Burrard Bridge were also collected between June 2009 and December 2010 (Stantec 2011b), and found

Pedestrian volumes were higher in July 2010 than July 2009, but then dropped slightly below 2009 levels in the ensuing months. This may be due to more people cycling instead of walking, the changes in bridge access for pedestrians, and/or because it was a wetter December than usual. (Stantec 2011b, p. 206)

For the Burrard Bridge project pedestrians were consulted because space was taken away from pedestrians, but for the Dunsmuir and Hornby projects there was less pedestrian acknowledgement because no pedestrian space was lost. A policy of prioritizing the impacts on modes that lose space, for separated bike lane projects, will not benefit pedestrians. Pedestrians are not prioritized when they lose space, neither are they when not consulted. In general prioritizing the impacts on modes that lose space will prioritize the impacts on vehicle traffic, as there is an oversupply of vehicle space in relation to the amount of people being moved.
One improvement was the design of the Dunsmuir and Hornby separated bike lanes used planter barriers, instead of the highway style concrete separators used for the Burrard Bridge and the Dunsmuir Viaduct separated bike lanes. The planter barriers were deemed to fit the streetscape design better than the concrete barriers, and to be more attractive to people using the street, including pedestrians (Vancouver engineer 1, personal communication, 12 December 2012).

Dunsmuir viaduct was the second separated bike lane, installed in March 2010 before either the Dunsmuir or Hornby separated bike lanes (timeline in Appendix B). There is more evidence of including and considering pedestrian impacts for the Dunsmuir and Hornby separated bike lanes, than the earlier Dunsmuir viaduct separated bike lane. Unlike the Burrard Bridge separated bike lane, the pedestrian space did not change for the Dunsmuir viaduct separated bike lane, so pedestrian impacts were not considered. A highway style concrete barrier was retained to form the separation between the sidewalk and the bike lane. The 800 metre long, 1.2 metre wide sidewalk on the viaduct which can accommodate one wheelchair at a time (City of Vancouver 2010a) was not amended. No width, improved access, extra crossings or alternative routes were added. Another highway style concrete barrier was added as the separation between the bike lane and vehicle traffic. The administrative report which recommended the construction of the Dunsmuir viaduct separated bike lane (City of Vancouver 2010a), did not mention any pedestrian benefits or impacts the Dunsmuir viaduct separated bike lane was expected to bring, and there has been no evidence of monitoring pedestrian impacts.

There is also evidence of progression on how pedestrian impacts have been included and considered since the implementation of the Dunsmuir and Hornby separated bike lanes. After there was not much consideration of pedestrians during the planning process, the City of Vancouver (2011d) website then included a section on how the separated bike lanes affected pedestrians. Also the City of Vancouver's (2012f) report recommending keeping both the Dunsmuir and Hornby separated bike lanes, explicitly mentioned pedestrians in both the report summary and conclusion.

With respect to other travel modes, pedestrians have benefited from an improved walking environment and there has been no impact on transit operations and minimal impact on vehicular traffic. Consequently, staff
recommend that the separated bicycle lanes on Hornby Street, Dunsmuir Street and the Dunsmuir Viaduct and connecting streets remain in place as part of the City’s regular street infrastructure. Further, staff will pursue modifications to the lanes with the goals of further improving safety, accessibility and pedestrian and cyclist comfort. (City of Vancouver 2012f, p. 1)

The three Hornby pedestrian studies, and in particular the Hornby intercept study which found that 44% of respondents had accessed the area on as pedestrians (City of Vancouver 2010c), appear to be the trigger for acknowledging more pedestrian impacts.

“I think it was surprising for the businesses to see how many people are actually walking along... [The Hornby studies] were really clear that people were walking in the downtown, and they weren't driving at all. They were taking transit. We learned a lot. (Vancouver engineer 1, personal communication, 12 December 2012)

Projects since the Dunsmuir and Hornby separated bike lanes, which have included separated bike lanes to improve cycling conditions, have been called ‘Greenways’ and ‘Active Transportation Corridors’. Section one of the Comox-Helmcken Greenway was completed in June 2013 (City of Vancouver 2013a). Section two of the Comox-Helmcken Greenway and the Point Grey-Cornwall active transportation corridor were under consultation at the time of writing this research, so monitoring and pedestrian impacts were not available. However it is clear that these projects are seen as successors to separated bike lanes, and that pedestrians are being considered a higher priority, in part as a result of learning from past separated bike lane projects.

We are definitely working to learn from our experience. Each time we do a project hopefully we get a little better than we did before. (Vancouver engineer 2, personal communication, 6 February 2013)

[Comox-Helmcken is] being seen as an active transportation corridor, not as a separated bike lane or as walking corridor, it’s both. There was so much engagement that went on. There are walking clinics, where staff would go out and walk with seniors and other people in the community to actually have a hands on feel. (Vancouver engineer 1, personal communication, 12 December 2012)

[For the Comox-Helmcken and Point Grey-Cornwall active transportation corridors] the explicit objective is to improve the corridors for walking and cycling... The goal, although it is more difficult to measure, is to [measure the] subjective experience as well... We want people to be more inclined
to choose walking and cycling, and for that experience to be more positive. So those that are walking and cycling, we would want to have the environment to be more pleasant.

The objectives of projects that include separated bike lanes, since Dunsmuir and Hornby, explicitly mention improving pedestrian conditions as desired project outcomes, whereas the objectives of the Dunsmuir and Hornby separated bike lanes did not. So the project design and consultation has changed, because the pedestrians are being prioritized more in line with the transportation hierarchy. The next step to ensuring a virtuous cycle, of caring that the active transportation goals are achieved, is to measure what is valued, and set targets towards those goals (Meadows, 1998). For this to happen, ways of monitoring the impact on pedestrians and the pedestrian environment need to be found.

For the Point Grey-Cornwall project … [the City of Vancouver is] saying we need to make it better for walking and for cycling. That’s a stated project goal that’s different [from the downtown separated bike lane’s project goals] (Vancouver engineer 2, personal communication, 6 February 2013)

A lot of this was very new. So we were talking to other cites about what they had done, but in a some cases they had never come up to the same issues as we did here and so that gives us a unique experience. So we are still learning. Maybe there are things that haven’t even been explored yet in terms of pedestrian improvements for these types of streets. (Vancouver engineer 1, personal communication, 12 December 2012)

6.2. Pedestrian awareness by business community

There is ample evidence to show that the Vancouver business community strives to measure what they value. Many of the separated bike lane impacts are known because of the business community’s involvement as a stakeholder, which resulted in the business impact reports (City of Vancouver 2011c, Stantec 2011a and Stantec 2011b) that have been frequently referred to in this research.

Business associations have also suggested adding locations for the City of Vancouver’s (2009b) pedestrian study counts. The business spokesperson interviewed for this research described pedestrian count data as “critical information for us to have” (Personal communication, 28 June 2013), which is why a prominent Vancouver business
association supplements the City of Vancouver count data with their own pedestrian counts, for priority streets. The supplemental counts check on the impact of initiatives such as creating attractions and trying to extend linger times, but unfortunately the data is not published. The same business association has identified sidewalk and pedestrian environment improvements required downtown, has tried to increase linger time in a number of locations, is looking at ways to improve street life culture, and is exploring widening sidewalks by narrowing traffic lanes (Business spokesperson, personal communication, 28 June 2013). These examples highlight that the pedestrian experience is important to businesses, which is why the City of Vancouver addressed business concerns, about adding highway style concrete separated bike lane barriers, by experimenting with planter barriers to better fit the streetscape (Vancouver engineer 1, personal communication, 12 December 2012).

However as this research has already identified, there were very few pedestrian references in the separated bike lane business impact reports, mainly because very few pedestrian impacts were surveyed or monitored. Business concern over negative impact, losing existing business and adding access barriers were common sentiments in the separated bike lane business impact studies, and the surveys (Appendix O) contained within these studies. Also the studies and surveys themselves were prompted by business concerns, about the Dunsmuir separated bike lane that had already been installed, and the then forthcoming Hornby project (Timeline in Appendix B).

After [businesses] had seen what had happened for Dunsmuir Street, and to some extent got caught off guard, we pushed the city to ensure that there was going to be sufficient consultation and making sure that we can mitigate the negative impacts as much as possible. (Business spokesperson, personal communication, 28 June 2013)

What was monitored and included in the business impact studies highlights what the business community valued. For example the “grade-level business survey” (answered by businesses with street level entrances) attributed a net decline in 2011 businesses sales, of -10% for Hornby Street and -4% for Dunsmuir Street, due to the separated bike lanes (Stantec 2011a, p. iii). The reliability of these business survey figures is open to doubt because of a 32% response rate, and because they represent self-reported businesses values that were not verified using actual financial data.
(Stantec 2011a, p. 17). Using these and other figures, the business impact study concluded:

[Overall] the [Vancouver separated bike lane business impact] study identified that the Hornby St. bike lanes, in place for six months at the time of the survey, had greater business impacts than those on Dunsmuir St., in place about a year at the time of the survey. This may be due to the fact that the business make-up of the two streets is quite different, with a much larger amount of retail space on Hornby St. (Stantec 2011a, p. ii).

As highlighted in the quote above, and throughout the business impact report, the term ‘impacts’ is synonymous with negative impacts. As shown throughout this research, the majority of the negative transportation impacts described in the business impact reports related to the separated bike lanes reducing vehicle access and vehicle parking. The focus of the concerns indicates vehicle access and vehicle parking were businesses’ priority transportation issues. This could be because businesses assumed the majority of their customers arrived by car, or that their most valuable customers did. However the Hornby intercept study (City of Vancouver 2010c) and the Hornby street visitor survey (City of Vancouver 2011b), which were part of the business impact studies, alerted businesses and the City of Vancouver that vehicles were not the primary access modes to the separated bike lane corridors. This was acknowledged in a business impact report, and is discussed in Section 5.9. The business spokesperson agreed that

There is a bit of a disconnect where retailers think their customers, or how their customers are getting to them, versus reality… It has been ingrained in [the retail community] by a variety of different organizations like the International Council for Shopping Centres (ICSC) what’s the formula to make a successful retailer, and in that formula is free parking.

Shopping malls tend to have tons and tons of data, street level retail and independent, if you are on your own and not within a shopping mall environment, you’re kind of data poor… It goes even further financiers, banks, they are going to look at your pro forma, and they’re going to look at things, and those alarm bells are going to ring for them.

So there are all these barriers that get put up, so seeing the on street parking disappear is kind of like the straw that broke the camel’s back. (Business spokesperson, personal communication, 28 June 2013)
The acknowledgement that vehicle access and parking are not as important in downtown as businesses thought they were, has perhaps softened the business response to the separated bike lanes. So have longer term business impacts.

[Anecdotally] if anything the impacts have been, post we’re like now two years in, neutral so businesses are saying my customers are still coming and [the separated bike lanes are] not much of an issue. Even though there hasn’t been a major hit to their business or their bottom line, they still don’t like the fact that [the separated bike lanes] are there because they think they are a hindrance. (Business spokesperson, personal communication, 28 June 2013)

Businesses in some locations “are still quite bitter” [where] “they have the double whammy of the no right hand turn and they have also lost some on street parking” (Business spokesperson, personal communication, 28 June 2013). However other businesses have publically supported the separated bike lanes, highlighting opportunities and positive impacts. For example a prominent cycling advocacy group showcased downtown businesses who thought the separated bike lanes brought economic benefits (Cycling activist, personal communication, 13 February 2013).

It can be seen as a win win situation, if the separated bike lanes allow additional customers access via bikes, without discouraging customers from driving.

[If the separated bike lanes] convince more people that live within 8 kilometers of downtown not to take their car… it frees the road space for those who don’t have a choice (Business spokesperson, personal communication, 28 June 2013)

Implicit with the acknowledgement that there could be positive cycling or pedestrian impacts, is that maximizing customers arriving by car is still prioritized, even though prioritizing car access does not reflect how customers actually get to downtown businesses. Businesses “want it all”, so they want to increase access for all, but without adding any barriers to existing access (Business spokesperson, personal communication, 28 June 2013).

From my perspective it’s about choice and enhancing that choice, but I think we have reached kind of the limit downtown for separated bike lanes (Business spokesperson, personal communication, 28 June 2013)
Although businesses see the impacts on them from the separated bike lanes as neutral, they think adding more separated bike lanes would further reduce vehicle access, require another period of adjustment and increase the perceived hindrance on them. Although businesses are now generally less opposed to separated bike lanes, they are not fully converted to the separated bike lanes as an opportunity, and are cautious, perhaps because the suspected benefits for the majority of customers, who arrive as pedestrians, have not been tested.

I don’t think the separated bike lanes do have an impact on the pedestrian environment, other than I think it may even make it better, because you are now creating another separation from moving vehicles. (Business spokesperson, personal communication, 28 June 2013)

The potential positive impacts, on cyclists and pedestrians, are second to the known negative impacts on vehicle access. The contrast between what is known, and what is only suspected, reflects Meadows’ (1998) assertion that what is measured is then also what is valued. It again highlights that the lack of pedestrian data marginalizes rather than prioritizes pedestrians, and that the lack of pedestrian data becomes a vicious cycle. If pedestrian data is not collected because it is not considered the highest priority, there will be no pedestrian data to prove that pedestrians are the highest priority.

In Vancouver, there is already enough pedestrian data to break this vicious cycle, including trip diary data and the mode share data found by the business impact studies which show pedestrians are the majority. But to actually change the vicious cycle into a virtuous cycle, suspected pedestrian impacts need to be tested, to yield known pedestrian impacts. Although there are well documented challenges to collecting pedestrian data, the pedestrian impact survey (Sections 4.3 and 7) demonstrates a potential way of exploring the impacts on pedestrians and the pedestrian experience.
7. **Onsite pedestrian impact survey and observation findings**

Sections 5 and 6 found pedestrian impacts at a wide range of separated bike lane locations. The survey findings presented in the following section are specific to three pedestrian impact survey blocks on Dunsmuir Street. Survey methods, procedure and limitations can be found in Section 4.3.

Statement averages in Appendix P show that the painted bike lane site, Dunsmuir 900 block, had more negative than average pedestrian impacts for all survey statements. In contrast the three separated bike lane sites, the two sides of Dunsmuir 800 block and Dunsmuir 100 block, were more positive than average for most statements. Dunsmuir 800 block and Dunsmuir 900 are adjacent blocks and have very similar traffic and pedestrian counts, which suggests the separated bike lane could have produced positive pedestrian impacts, and not just for necessary activities, but also for optional and social activities too.

7.1. **Pedestrian impact survey response rate**

The two sites adjacent to a separated bike lane, at Dunsmuir 100 and Dunsmuir 800 blocks, had much higher estimated survey response rates than the other sites (Appendix M), which suggest the separated bike lanes have increased survey response rates.\(^7\) As stopping to fill out a survey is a social activity, the higher response rates suggest the separated bike lanes have increased social activity desirability. A potential explanation was provided by a survey observation, that vehicle traffic felt closer and

\(^7\) The response rate calculations assume pedestrian volumes have not changed since implementation (See Section 4.3.2.)
noisier when there was a vehicle lane adjacent to the survey site, or it could be that the separated bike lanes are something to talk about.

The response rate at the opposite Dunsmuir 800 block site was noticeably lower than on the separated bike lane side of the same block, despite very similar block conditions (Appendices G and J). The lowest response rate was at the Dunsmuir 900 block painted bike lane site, where pedestrians were observed hurrying and ignoring the researcher more. Appendices G and J suggest pedestrians may have been less willing to stop because of narrower sidewalks, nowhere to sit, and no other reason to stop or slow down, such as ground level businesses, office entrances, or a green space. However the higher response rate at Dunsmuir 100 block, than at the separated bike lane side of Dunsmuir 800 block, indicates there are other determining factors, which could include Dunsmuir 100 block having less shade (Section 4.3.7), lower vehicle volumes (Appendix G), or more greenery and green space (Appendix J). Further research would be needed to test these initial interpretations.

7.2. Pedestrian impact survey findings for influence on modal choice

The pedestrian impact survey asked participants their level of agreement with three mode choice statements, the results of which are shown in Table 6. The three statements were worded almost identically in order to compare pedestrians’ responses.

**Table 6. Mode choice responses by block**

<table>
<thead>
<tr>
<th>Modal choice statements</th>
<th>Survey Block Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All blocks</td>
</tr>
<tr>
<td>Seeing people driving cars on this street makes me want to drive</td>
<td>.91</td>
</tr>
<tr>
<td>Seeing people riding bikes on this street makes me want to cycle</td>
<td>.21</td>
</tr>
<tr>
<td>Seeing people walking on this street makes me want to walk</td>
<td>.43</td>
</tr>
</tbody>
</table>

The figures range from 2 for strongly agreeing with the statement, to -2 for strongly disagreeing with it
Comparing the three mode choice statements shows, that at all the survey sites, pedestrians wanted to continue to be pedestrians more than they wanted to be cyclists, and that pedestrians wanted to be cyclists more than they wanted to be vehicle drivers. This highlights positive pedestrian and active transportation impacts. The valid data also shows higher levels of agreement for the statements “Seeing people walking on this street makes me want to walk” and “Seeing people riding bikes on this street makes me want to cycle”, at the three separated bike lane block sites than at the painted bike lane site. This suggests the separated bike lanes make pedestrians want to walk more, which is a positive optional pedestrian impact. However comparing the two Dunsmuir 800 block sites suggests there are other factors involved. Participants on the separated bike lane side of the block agreed noticeably less with the walking statement than participants on the opposite side of the same block. Comparing the statement data with Appendices G and J does not highlight a probable explanation, so further research is required.

The results for the statement “Seeing people riding bikes on this street makes me want to cycle”, suggest that pedestrians seeing cyclists in the separated bike lanes may make pedestrians more likely to want to cycle themselves, agreeing with the cycling activists’ comments that inspired the statement (Section 4.3.4). The results could be seen as a positive active transportation finding because people are more inspired to cycle. However the separated bike lanes also appear to be encouraging pedestrians to cycle, which is substituting one mode of active transportation for another. Also worth noting is there were a number of negative survey comments about cyclists (Section 7.4.3), which suggest the separated bike lanes may have also negatively impacted some pedestrians’ views of cyclists.

For the statements ‘Seeing people riding bikes on this street makes me want to cycle’ and ‘Seeing people driving cars on this street makes me want to drive’, the survey results do not show a clear distinction between the separated bike lane sides of the street, and the opposite side of the street. This suggests the proximity of pedestrians’ to either bikes or vehicles, on the same block, does not decrease their agreement.

On average survey participants disagreed with the statement “Seeing people driving cars on this street makes me want to drive”, more than any other survey statement. Comparing the statement with Appendix G participants disagreed with the
statement the least at the sites with three traffic lanes or more, suggesting pedestrians want to drive more when there are more lanes of uncongested traffic, and driving unimpeded seems like the normal behaviour.

Ideally the modal choice statement data would have been cross referenced and cross tabulated with gender and mode share data from the same survey. However the sample sizes were also not large enough to find out if women were more inspired to cycle at separated bike lane sites, than at non-separated bike lane sites. Nor were they large enough to see if people who indicated cycling was a low priority mode, were inspired to cycle because of the separated bike lanes, or whether people who usually drove were more likely to want to be driving.

7.3. Pedestrian impact survey findings for allocation of street space

All the valid sites had a bike lane, and Appendix Q shows that more than 50% of participants at these sites thought there was the correct allocation of cycling space. The results also show that being adjacent to a separated bike lane made respondents agree more with the allocation of cycling space on the block. There was more criticism of bike lanes from pedestrians on the opposite side of the street from the separated bike lane, and respondents at the painted bike lane site. Therefore separated bike lanes next to the sidewalk may have increased pedestrians’ acceptance of cycling space, and increased questions about the allocation of street space. Or perhaps pedestrians who are uncomfortable with the separated bike lanes have crossed the street.

Comparing Appendix Q with Appendix G shows a higher percentage of participants at both Dunsmuir 800 block sites thought there was not enough space for vehicle traffic. Dunsmuir 800 block has the fewest traffic lanes, so the separated bike lanes on this block may have caused pedestrians to think there was not enough vehicle space. Appendix Q also shows that for the allocation of pedestrian space, there was no significant variation between sites, with at least 84% of respondents deeming the allocation to be correct.
At all sites over 52% of respondents thought there was the correct parking space allocation, but Dunsmuir 100 block was the only valid site with street parking. Dunsmuir 100 block also had the highest percentage of respondents who said there were not enough vehicle parking spaces, even though very few vehicles were observed using the allocated parking spaces, and a parking lot was located directly opposite the site. Therefore more visible parking could make pedestrians think more parking is required. If on street parking is removed for a separated bike lane, pedestrians’ may think less on street parking is needed.

The allocation of cycling and parking space findings suggest the people surveyed are ascribing value to what they see, which is influencing what they think the street should look like, which reflects Meadows (1998) arguments, as well as Norton’s (2008) historical examples. Other similar examples are pedestrians wanting to cycle more when they are next to separated bike lanes (Section 7.2), and the idea that people are inspired to cycle by seeing cyclists like them (Section 4.3.4). Together the examples suggest that the separated bike lanes are changing people’s perceptions about street use.

7.4. Pedestrian impact survey findings for necessary activities and feelings of safety

Table 7. Necessary activities and feelings of safety by block

<table>
<thead>
<tr>
<th>Necessary activities and feelings of safety statements</th>
<th>Survey Block Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All blocks</td>
</tr>
<tr>
<td>It is safe crossing this street</td>
<td>0.63</td>
</tr>
<tr>
<td>Sometimes I do not see or hear cyclists when I cross this street</td>
<td>0.40</td>
</tr>
<tr>
<td>Cars are more dangerous than bikes on this street block</td>
<td>0.55</td>
</tr>
<tr>
<td>The vehicular traffic on this block is dangerously fast</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

The figures range from 2 for strongly agreeing with the statement, to -2 for strongly disagreeing with it

ICBC figures suggest the separated bike lanes have increased pedestrian safety (Section 5.2), however not all pedestrian survey participants agreed, such as the
comment, “The separated bike lanes are dangerous for pedestrians, cyclists & autos – ridiculous” (Pedestrian impact survey 192, personal communication, 23 April 2013). The following section analyzes survey participants’ responses to pedestrian safety statements (summarized in Table 7), and includes participants’ safety related comments.

7.4.1. “It is safe crossing this street”

Survey participants on average agreed with the statement “It is safe crossing this street” at all survey sites (Table 7). However there was a stronger level of agreement at all three separated bike lanes sites, than at the painted bike lane site. The results suggest that the separated bike lanes have a positive impact on pedestrians’ perception of safety when crossing the street. The data also shows the opposite side of Dunsmuir 800 block has a slightly higher agreement with the statement than the separated bike lane side of the same block, so the benefits of the separated bike lane are felt by pedestrians crossing the street from both sides. Pedestrians could feel safer crossing at the intersections of separated bike lanes, because the separated bike lanes make the crossings seem shorter, which would also suggest pedestrians have enough time to cross the street.

It should be noted that all participants responded to the statement while mid-block. Plus the definition of ‘crossing the streets’ was left to participants, so some participants, at any of the sites, may have decided this included mid-block crossings. The survey data could therefore suggest that it is safer to cross mid-block at the separated bike lane sites. However non-quantifiable observations suggested that mid-block crossings were not the normal way to cross at any site, and contrary to interview perceptions (Section 5.5) mid-block crossings were also not noticeably more popular at the separated bike lane sites. The planter barriers restricted and channeled the mid-block crossings to the gaps in the separation, and the gaps allowed pedestrians to wait. Pedestrians at all sites timed crossings to coincide with breaks in the flow of one way traffic, but mid-block crossings at non-separated bike lane sites took place all along the block. Further research would be required to test these observations and ideas, but illegal mid-block crossings occur because legal crossing places are not provided where people want to cross (Gehl, 2010; Norton, 2008). Implementing legal mid-block crossing sites, where pedestrians desire to cross, could be a way of acknowledging pedestrian
impacts highlighted by the separated bike lanes, as well as prioritizing pedestrians in line with Vancouver’s transportation hierarchy.

7.4.2. “Sometimes I do not see or hear cyclists when I cross this street”

Survey participants on average agreed with the statement “Sometimes I do not see or hear cyclists when I cross this street”, at all sites (Table 7). The data shows more agreement with the statement at the three sites with a bike lane, painted or separated, next to the survey sidewalk. The only valid site without a bike lane adjacent to the sidewalk was the opposite side of Dunsmuir 800 block, and there was less agreement with the statement at this site. The data suggests bike lanes increase agreement with the statement, not specifically separated ones, because pedestrians agreed they did not see or hear cyclists in the painted bike lane either. Therefore additional pedestrian safety concerns when crossing the two way separated bike lanes, as outlined in Section 5.4, do not appear to be a significant issue.

Comparing the statement data with Appendix G suggests there are other determining factors. There was more agreement with the statement at the adjacent bike lane sites with more vehicle traffic lanes. If vehicle traffic dominates the street in terms of space allocation, pedestrians may be less aware of cyclists, perhaps due to increased background noise. Further research would be needed to test these initial ideas.

Regardless of whether pedestrians seeing or hearing cyclists is reduced by separated bike lanes, or by all bike lanes, it was a concern raised by a number of survey participants relating to the worst thing about the block. The comments could have been prompted by the related survey statement (Babbie & Benaquisto, 2010), so it is not possible to tell if the issue would have been top of people’s minds otherwise.

Single bike lane for both way cycling (Pedestrian impact survey 65, personal communication, 8 April 2013)

Bike traffic coming in both directions – the street is one way (Pedestrian impact survey 80, personal communication, 16 April 2013)

2 way bike traffic → dangerous! S/b one way like vehicular traffic (Pedestrian impact survey 81, personal communication, 16 April 2013)
These comments do not mention pedestrians in particular, but other pedestrian survey comments specifically blamed pedestrians.

Impact is more by pedestrians on cyclists. Oblivious pedestrians walking in bike lanes (Pedestrian impact survey 96, personal communication, 16 April 2013)

I see pedestrians almost get hit by bikes a lot but it is their fault – they don’t seem to notice the lanes (Pedestrian impact survey 120, personal communication, 16 April 2013)

It’s good as long as pedestrians understand they shouldn’t walk in the bike lane (Pedestrian impact survey 243, personal communication, 30 April 2013)

Other pedestrian impact survey comments were more sympathetic to not seeing or hearing cyclists, which suggests the pedestrian impact should be acknowledged.

Pedestrians tend to look for cyclists in bike lanes less often than they look for cars. (I think this is largely habitual though because they aren’t as used to bike lanes) (Pedestrian impact survey 212, personal communication, 24 April 2013)

Decreased traffic but more dangerous to pedestrians. Some close calls. Pedestrians do not seem to be able to notice bikes as well as cars (Pedestrian impact survey 221, personal communication, 24 April 2013)

Crossing the street + checking for cars + bikes + its [sic] always busy with traffic (Pedestrian impact survey 137, personal communication, 17 April 2013)

Can’t always see cyclists (Pedestrian impact survey 10, personal communication, 3 April 2013)

Bikes are hard to hear/see (Pedestrian impact survey 151, personal communication, 22 April 2013)

Do not hear bikes (Pedestrian impact survey 218, personal communication, 24 April 2013)

Other pedestrian impact survey comments put the blame on cyclists. “Still in danger as a pedestrian by bikes that don’t yield” (Pedestrian impact survey 249, personal communication, 30 April 2013) and “Cyclists don’t stop” (Pedestrian impact survey 19, personal communication, 3 April 2013). Regardless of who is blamed, there
seems to be pedestrian agreement that not seeing or hearing cyclists when crossing the street is a current negative bike lane impact. Whether it is a negative separated bike lane impact though cannot be proved, and could become a non-issue with more cyclists, less lanes of traffic, and more time for people to adjust to the street layout.

7.4.3. “Cars are more dangerous than bikes on this street block”

There was a general agreement with the statement “Cars are more dangerous than bikes on this street block” at all sites (Table 7). Respondents mostly agreed with evidence (Pasanen & Salmivaara, 1993, Leaf, 1999) that pedestrian safety is related to speed, and so faster cars are more dangerous. The opposite side of Dunsmuir 800 block is the only site not directly adjacent to a bike lane, but otherwise is very similar to the Dunsmuir 800 block separated bike lane side site (Appendices G and J). For the five safety statements, this statement provided the biggest difference between the means for the two Dunsmuir 800 block sites. The differential suggests the separated bike lane buffers pedestrians from vehicle traffic, and the proximity of bikes may have an impact on pedestrians’ perceptions of whether cars or bikes are more dangerous.

Respondents at Dunsmuir 900 block, which has a painted bike lane next to the sidewalk, thought bikes were more dangerous in comparison with cars than the average response. However participants at the separated bike lane Dunsmuir 100 site agreed the most with the statement that cars are more dangerous. Dunsmuir 100 block’s more permeable separation or more traffic lanes (Appendix G) could explain participants perceiving cars to be more dangerous. There could also be a connection to participants’ responses to the statement “The vehicular traffic on this block is dangerously fast”, as Dunsmuir 100 block participants on average agreed with this statement the most.

Despite the data showing participants found bikes to be less dangerous than cars, some pedestrian impact survey comments explicitly mentioned cyclist behaviour.

Bike people are angry + have some kind of chip on their shoulder that makes them aggressive + unpleasant (Pedestrian impact survey 75, personal communication, 11 April 2013)

Bicycles don’t obey signals (Pedestrian impact survey 100, personal communication, 16 April 2013)
Cyclists feel entitled (Pedestrian impact survey 113, personal communication, 16 April 2013)

Re-teach cyclists rules of the road (Pedestrian impact survey 141, personal communication, 17 April 2013)

Slow down cyclists! Don’t give yourselves a bad name. Cyclists need to be respectful of laws and traffic regulations (Pedestrian impact survey 142, personal communication, 17 April 2013)

The bikes need to follow traffic signs – they don’t always do that – have seen them run the red lights! (Pedestrian impact survey 162, personal communication, 22 April 2013)

It is not possible to determine if these general comments relate to cyclists seen in the survey block’s separated bike lane, cyclist in any of the separated bike lanes, or cyclists’ behavior in general. Also not clear is whether the increase in cyclists, caused by the implementation of the separated bike lane, is increasing some pedestrians’ negative view of cyclists. Another pedestrian impact survey comment suggests a subset of cyclists could be a cause of negative pedestrian views. “Bike couriers need to observe cycling rules – complete disregard for pedestrians (i.e. spitting & hitting people with their gob)” (Pedestrian impact survey 171, personal communication, 22 April 2013). There were also numerous pedestrian impact survey comments about the worst thing about the block being the speeding, noisy, or heavy car traffic. It is not clear whether the separated bike lane has increased pedestrians’ negative view of car drivers, though a number of comments about the dangers imposed by cars on this block specifically relate to the bike lanes.

Cars turning on bike lanes. Bikers don’t stop (Pedestrian impact survey 17, personal communication, 3 April 2013),

Cars turning right as a hazard to bikes (Pedestrian impact survey 18, personal communication, 3 April 2013),

Thoughtless drivers + cyclists (Pedestrian impact survey 34, personal communication, 4 April 2013),

Fast moving cars, right turns without looking for bike/pedestrian traffic (Pedestrian impact survey 51, personal communication, 8 April 2013),

Cars turning where they are not to [sic] (Pedestrian impact survey 130, personal communication, 17 April 2013),
Cars that don’t respect pedestrian/cyclists (Pedestrian impact survey 131, personal communication, 17 April 2013)

Cars really don’t like to stop for pedestrians. I wish the lights gave one more time to cross (Pedestrian impact survey 150, personal communication, 22 April 2013)

If pedestrians then cyclists were the highest priorities, it would lead to discussion and monitoring of potential conflicts between cyclists and pedestrians, though safety would still focus on vehicles, due to the greater danger posed by vehicles’ faster speed and greater mass.

7.4.4. “The vehicular traffic on this block is dangerously fast”

Overall there is a very slight disagreement with the statement “The vehicular traffic on this block is dangerously fast” (Table 7). The data suggests neither the bike lane buffer, nor the separated bike lane, have changed pedestrians’ perception of dangerously fast traffic. There is therefore no indication that consulting pedestrians, about the impacts of separated bike lanes, would result in pedestrians requesting reduced vehicle speeds.

However comparing the data with Appendix G shows participants perceived the vehicle traffic to be more dangerous where there were three lanes of moving traffic, than two lanes. As the installation of the separated bike lanes reduced a lane of traffic, the separated bike lanes could have reduced the actual speed of traffic, especially at Dunsmuir 800 block. The Dunsmuir 800 site had the highest vehicle volumes, and according to the City of Vancouver’s (2012f) downtown separated bike lanes status report volumes have not changed. If these vehicle volume assumptions are correct, the Dunsmuir 800 block would now have the same volume of vehicle traffic confined to two vehicle lanes instead of three. The increased vehicle density and congestion could have reduced traffic speeds, and therefore also had an impact on how dangerous pedestrians surveyed perceived vehicle traffic to be. Further research using actual vehicle speed measurements would be required to test these ideas, but there is no vehicle speed data available, and reducing vehicle speeds was not a target or objective mentioned in any of the separated bike lane documents.
7.5. Pedestrian impact survey findings for optional activities and comfort

The pedestrian impact survey tried to compensate for the lack of known optional and social impacts, by focusing on these indicators just as much as necessary activities. This section looks at optional activities, which Gehl (2010) believes a good pedestrian environment needs. A number of pedestrian impact survey comments make reference to environmental factors that could either increase or hinder optional activities at the survey site. Positive comments for the best thing about the block mentioned views, trees, greenery, stores, restaurants and wide sidewalks. Negative comments for the worst thing about the block included too much traffic, loud traffic, dumpsters, garbage, nothing special about the block and too much shade. However very few of the survey comments made reference to the separated bike lanes improving optional activities. The few that did were;

- I prefer to walk down streets with separated bike lanes → it keeps cyclists off sidewalks and give [sic] more space between me and cars (Pedestrian impact survey 56, personal communication, 8 April 2013)
- Bike lanes make downtown less crowded with cars, thus making it more enjoyable as a pedestrian (Pedestrian impact survey 94, personal communication, 16 April 2013)
- Planters create great atmosphere! (Pedestrian impact survey 140, personal communication, 17 April 2013)
- …divider breaks up monotony of asphalt (Pedestrian impact survey 183, personal communication, 23 April 2013)
- [The separated bike lane] Makes walking more pleasant (Pedestrian impact survey 189, personal communication, 23 April 2013)

A worst thing about the block comment said, “Used by all to get through from east to west in downtown most are looking to quickly pass through” (Pedestrian impact survey 195, personal communication, 23 April 2013). For this participant the addition of the separated bike lane has not changed their perception that the block was for necessary activities only. Perhaps this participant’s comment captures why survey comments about optional activities were not common.
Five statements asked participants to reflect specifically on optional activities and comfort. Some of the statement results suggest there has been impact on optional pedestrian activities and pedestrian comfort, because of the proximity of bike lanes, and because of the buffer the separated bike lane provides. The survey statement findings contrast the few comments people made about optional activities, which suggests optional activities were not at the top of people’s minds. Table 8 shows average responses per site, and each statement is analyzed further in the subsections below.

Table 8. Optional activities and comfort by block

<table>
<thead>
<tr>
<th>Optional activities and comfort statements</th>
<th>Survey Block Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All blocks</td>
</tr>
<tr>
<td>This street block is very polluted</td>
<td>-.38</td>
</tr>
<tr>
<td>This street block is overcrowded</td>
<td>-.49</td>
</tr>
<tr>
<td>This block is very peaceful</td>
<td>-.28</td>
</tr>
<tr>
<td>I would sit here if seats were provided</td>
<td>-.09</td>
</tr>
</tbody>
</table>

The figures range from 2 for strongly agreeing with the statement, to -2 for strongly disagreeing with it.

7.5.1. “This street block is very polluted”

On average survey participants disagreed with the statement “This street block is very polluted” at all sites (Table 8). Some participants verbally said they perceived the site to be no more polluted than the rest of the city. However participants perceived the three separated bike lane sites to be less polluted than the painted bike lane site. The results also show pedestrians perceived the Dunsmuir 800 block separated bike lane side site to be less polluted than the site on the opposite side of the block. Appendices G and J do not highlight any obvious explanation, which suggests the proximity of the separated bike lane planter barrier may reduce pedestrians’ concerns about pollution.

The type of bike lane separation could also explain why participants at the Dunsmuir 100 separated bike lane site thought the block was more polluted than Dunsmuir 800 block participants. At Dunsmuir 800 block a planter barrier forms the whole separation, while at Dunsmuir 100 block a planter barrier only makes up part of the separation, and the separation in front of the survey site is parked vehicle spaces. Comparing the data with Appendix G suggests another explanation could be that the
most polluted blocks are those with the most vehicle traffic lanes, so the separated bike lane replacing a lane of vehicle traffic may have also reduced pedestrians’ perceptions of pollution. Although there are a number of potential variables that need to be isolated and tested, a hypothesis is that separated bike lanes have reduced vehicle lanes, added a shrubbery barrier, and increased the number of cyclists, which combined have caused pedestrians to perceive the street to be less polluted.

Also worthy of future research would be comparing pedestrians’ perceptions of pollution with actual pollution levels. Actual pollution levels could be determined using methods similar to those used in New York City’s community air survey (NYC Health, 2011a), by measuring air quality at separated bike lane sites, before and after implementation, and at non-separated bike lane sites too. Measuring air quality would be a more precise indicator of how much pollution pedestrians are exposed too, and whether the separated bike lanes and planter barriers reduce pollution. As the City of Vancouver’s (2012f) downtown separated bike lanes status report said vehicle volumes had not decreased since the implementation of the separated bike lanes, emissions and therefore air pollution will likely not have decreased. If the actual pollution levels do not decrease then additional research would be warranted, including whether additional greenery and cyclists reduce pedestrians’ perception of pollution.

### 7.5.2. “This street block is overcrowded”

At all sites there was a general disagreement with the statement “This street block is overcrowded”, which seems to match participants’ general perception that there was the correct amount of street space for cars, bikes and pedestrians at these sites (Section 7.3). The statement results (Table 8) show pedestrians adjacent to a bike lane, painted or separated, perceived the street to be less overcrowded than pedestrians on the opposite side of the street from a separated bike lane. Survey participants thought the same Dunsmuir 800 block was more crowded from the opposite side of the street, even though it was the same street block with the same street space and traffic volumes. Appendix G shows the two sites also had very similar sidewalk widths and pedestrian volumes too.
Participants adjacent to a separated bike lane also thought the block was less overcrowded, than participants next to the painted bike lane. The separated bike lane side of Dunsmuir 800 block was deemed the least overcrowded of the valid sites, despite Dunsmuir 800 block having the highest pedestrian volumes, and the highest vehicle volume in the least number of vehicle lanes (Appendix G). Further research is required to isolate additional overcrowding variables (Appendices G and J), such as narrower sidewalks, more parked vehicles, the presence of sidewalk carts, or increased business visibility.

7.5.3. “This block is very peaceful”

Participants at the painted bike lane site disagreed with the statement “This block is very peaceful” more than participants at the three separated bike lane sites (Table 8), suggesting the separated bike lane may have impacted participants’ responses. However the slightly lower than average mean for the separated bike lane side of Dunsmuir 800 block suggests there are other important factors. Comparing the data with Appendix G does not highlight any obvious explanation, but Appendix J shows sites with more green space and trees agreed with the statement more. The shrubbery in the separated bike lane planter barrier could therefore have increased pedestrians’ perception of peacefulness on the block, which would be a positive impact of the separated bike lane on pedestrians. Further research would be required to test this theory, and to accurately measure noise levels which will also likely be a determinant of peacefulness.

7.5.4. “I would sit here if seats were provided”

On average the painted bike lane site had more negative responses to the statement “I would sit here if seats were provided”, than the separated bike lane sites (Table 8), which may suggest the separated bike lanes have impacted participants’ responses. The lower than average mean for the separated bike lane side of Dunsmuir 800 block suggests there are other important factors. For example, participants on the opposite side of Dunsmuir 800 block agreed with the statement more than participants on the separated side of the same block, even though the rest of the data provided no indication that the proximity of a bike lane reduced agreement with the statement.
Comparing the statement data with Appendices G and J does not highlight any explanations. There could be some connection to other optional and social survey statements, but the sample size of the pedestrian impact survey is not large enough to run statistically significant cross tabulations between statements. Therefore further research would be required to determine whether the separated bike lanes do increase pedestrians’ desire to find a place to sit.

### 7.6. Pedestrian impact survey findings for social activities and delight

**Table 9. Social activities and delight by block**

<table>
<thead>
<tr>
<th>Social activities and delight statements</th>
<th>Survey Block Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All blocks</td>
</tr>
<tr>
<td>This is a stimulating block</td>
<td>-.13</td>
</tr>
<tr>
<td>I like to watch other people on this block</td>
<td>.03</td>
</tr>
<tr>
<td>People linger (stop, stay, browse) on this block</td>
<td>-.27</td>
</tr>
<tr>
<td>People talk to other people on this block</td>
<td>.44</td>
</tr>
<tr>
<td>I have seen people eating their food here</td>
<td>.34</td>
</tr>
</tbody>
</table>

The figures range from 2 for strongly agreeing with the statement, to -2 for strongly disagreeing with it.

This section continues to search for pedestrian impacts beyond necessary activities, by now focusing on social activities.

Some pedestrian survey comments made positive social activity references, saying people or people’s behaviour were the best thing about the block. Most references to people though were in response to the worst thing about the block, and included complaints about people doing dangerous things and a visible homeless population. All the survey comments which referenced social activities in relation to the separated bike lanes, such as the behaviour of cyclists and pedestrians, were related to safety and were mostly negative (see comments in Section 8.2). These comments suggest that if the separated bike lanes have increased human interaction, it is in terms
of increased awareness of other people’s perceived dangerous behavior, which could be seen as beneficial if it helps change behaviour in the longer term.

Five survey statements also asked participants to reflect specifically on social activities and delight, and some of the statement results suggest there were additional impacts that had not been reflected in the survey comments. This suggests that the impacts on social activities, like optional activities were not at the top of people’s minds, and so need to be specifically elicited. Table 9 shows average responses for each statement per site, then each statement is analyzed further in the subsections below.

7.6.1. “This is a stimulating block”

On average survey participants disagreed with the statement “This is a stimulating block”, but there was a higher level of disagreement at the painted bike lane site (Table 9). At the three separated bike lane sites participants’ responses were more positive, and also similar to each other, which suggest the separated bike lanes make the blocks more stimulating for pedestrians.

Comparing data in Appendices G and J, such as pedestrian volumes, vehicle traffic volumes, the number of lanes of traffic, the ratio of pedestrians to vehicle traffic and the number of businesses, does not appear to explain the different site results. Although further research, and more vigorous statistical analysis, is needed to confirm whether separated bike lanes make the block more stimulating for pedestrians, a plausible explanation for the survey results was given during a research interview. A cycling activist suggested that a separated bike lane “enlivens the street more”, because pedestrians can see cyclists’ faces and expressions, recognize cyclists, watch cyclists and see what cyclists are wearing (Cycling activist, personal communication, 13 February 2013). These examples of pedestrians watching cyclists, and potentially engaging with cyclists, are example of communication between people that Gehl (2010) describes as social activities. If these increased social interactions are true they are indicators of an improved pedestrian environment, and so should be seen as positive pedestrian impacts of the separated bike lane.
Appleyard & Lintell (1972) found more liveable streets with higher levels of social interaction had lower levels of vehicle intensity, such as volume, noise and stress. The City of Vancouver’s (2012f) downtown separated bike lanes status report said vehicle volumes had not decreased since the implementation of the separated bike lanes, even though the separated bike lane replaced a vehicle movement lane in some cases. So the lower levels of vehicle intensity, that Appleyard & Lintell (1972) suggest raises social interaction, would not be caused by lower volume, but could be caused by lower vehicle speeds (see Section 7.4.4), or by the separated bike lane’s planter buffer.

7.6.2. "I like to watch other people on this block"

Participants at the painted bike lane block disagreed with the statement “I like to watch other people on this block”, more than participants at the three separated bike lane blocks (Table 9). The valid survey data therefore suggest the separated bike lanes may help facilitate people watching. However Appendices J and G suggest there are other important factors, such as Dunsmuir 900 block has the fewest visible businesses, with large, blind and passive units that Gehl (2010) says make a block inactive. Dunsmuir 900 blocks’ inactive building edges, combined with narrower sidewalks, act as barriers to optional and social activities, such as people watching.

Appendix G also shows the sites with the most traffic lanes have the most negative responses, so the number of vehicle lanes may be making it more difficult, or less pleasant, to watch other people. Congestion reducing speed could also explain higher levels of agreement at Dunsmuir 800 block, if it can be assumed Dunsmuir 800 block has more congestion than the other blocks, as discussed in Section 7.4.4.

Observations also found the Dunsmuir 900 block was the most difficult site to get pedestrians’ attention, and where pedestrians seemed to hurry past the most. Appendix L shows Dunsmuir 900 block had the highest percentage of workers and the lowest percentage of residents, which could suggest more commuters in a rush that have less time to watch people. Further research would be required to isolate and test these ideas, before it could be concluded that the separated bike lanes increase people watching.
7.6.3. “People linger (stop, stay, browse) on this block”

On average survey participants disagreed with the statement “People linger (stop, stay, browse) on this block”, at all sites (Table 9). The results show there was more disagreement with the statement at the painted bike lane Dunsmuir 900 block site, than at the three separated bike lane sites. Observations also found the Dunsmuir 900 block was the most difficult site to get pedestrians’ attention, and where pedestrians seemed to hurry past the most. The valid data therefore suggests blocks with a separated bike lane on them may provide an attraction for people to linger. Lingering involves slowing down and stopping to conduct optional and perhaps social activities, so if people are happier to linger it indicates the pedestrian environment and experience has improved. Which is why Vancouver a business association has been measuring linger times at non-separated bike lane locations (Section 6.2).

Comparing the statement data with Appendices J and G shows Dunsmuir 900 block has the fewest visible businesses and the narrowest sidewalks, both of which Gehl (2010) lists as barriers to optional and social activities, including dwelling or lingering. Plus Appendix L suggests Dunsmuir 900 block could have more commuters in a rush. The results do not show a connection between the statement and the proximity of a bike lane to the survey site and other variables, including those in Appendices G and J, could be needed to explain the different levels of agreement with this statement so more research is required.

7.6.4. “People talk to other people on this block”

On average survey participants agreed with the statement “People talk to other people on this block” at all sites (Table 9). The results do not show a connection between the statement and the separated bike lanes, even though the highest level of agreement with the statement was at the two Dunsmuir 800 block sites. Nor did the results show a connection between the statement and the proximity of a bike lane to the survey site.

Comparing the statement data with Appendix G shows higher pedestrian volume sites have higher levels of agreement with the statement. Therefore if separated bike lanes increased pedestrian volumes they maybe could have increased agreement with
the statement. However the City of Vancouver’s (2011b) separated bike lane status report concluded that pedestrian volumes had not changed since the construction of the separated bike lanes.

The number of pedestrians in groups or pairs could also be a potential determining factor, however neither the survey data collected or the observations gave any indication that there were more groups at sites with a higher level of agreement. The City of Vancouver (2009b) pedestrian count data also does not provide pedestrian group counts either. Therefore with the available data, there is no indication that the number of people in groups was impacted by either separated bike lanes, or by the proximity to a bike lane.

7.6.5. “I have seen people eating their food here”

On average survey participants agreed with the statement “I have seen people eating their food here”, at all sites (Table 9). The results for the statement did not show a connection between the statement and either the separated bike lanes, or the proximity of a bike lane to the survey site. Noticeable however was the difference between the two Dunsmuir 800 block sites, with participants on the opposite side agreeing with the statement more. Comparing the survey data with Appendix J suggests higher agreement levels with the statement were a result of greater access to and visibility of cafés, restaurants and eating spaces. This potential explanation is not within the scope of this research, and would also require further research to test it.
8. Conclusion

Answering the research question, how are pedestrians in Vancouver being impacted by separated bike lanes, was not easy to do well with existing documents and data. Hopefully acknowledging this problem is the first step to solving it. For example, even though walking accounts for the majority of trips within Downtown Vancouver, there are no reliable pedestrian volume figures for before and after the implementation of the separated bike lanes. The lack of data is in part because increased pedestrian volumes were not an outcome considered for the separated bike lanes, but also because pedestrian volumes have been counted manually, which is more resource intensive than counting vehicles or bikes.

Better coordination, sharing and publishing of existing pedestrian data could provide better volume and mode share figures. Downtown Vancouver trip diary data should be extrapolated and published, so the trends for downtown’s trip mode share can be targeted and tracked, and changes in sustainable transportation mode share can be celebrated and discussed. Valuable business association pedestrian counts and data should be made widely available, so they can be tested, adapted, built on, and challenged. Other opportunities to collect pedestrian data within existing monitoring and consultation should also be identified.

The damaging lack of available pedestrian data needs to be addressed, not just for volume, mode share, access and safety, but also for pedestrian environment, experience, comfort and delight. Definitive pedestrian impacts found by this research were documented, monitored, researched and planned for. It is therefore known that the separated bike lanes have significantly reduced the number of sidewalk bike riders, and have also reduced serious collisions between pedestrians, cyclists and motor vehicles. It is also known that the separated bike lanes increased vehicle travel times slightly, reduced some vehicle access, removed some vehicle parking, and that there was a backlash against the separated bike lanes which focused on these vehicle impacts. The
focus on customer vehicle access, and pedestrians exiting vehicles, was despite twice as many people accessing the separated bike lane corridors as pedestrians than by vehicle, and that vehicle access was also less than by transit. Nor does the focus reflect that vehicles entering downtown have been consistently declining, while downtown’s population, employment and transit riders have all been increasing. If the goal is to maintain and improve the majority of customer access within downtown, then instead the focus should be on walking, and transit, before vehicles.

All of which highlights the relevance of Meadows’ (1998) assertion that what is monitored, is what is cared about, and what is cared about is monitored. We should care about impacts on pedestrians the most, because pedestrians are not a subset of the population. Whether we cycle, drive, or take transit, we all end up being pedestrians.

Walking is also the City of Vancouver’s highest transportation priority, but this research found pedestrians were not prioritized for either the Dunsmuir or Hornby separated bike lane projects, even though active transportation was. There had not been follow up to obtain data and opinions on suspected pedestrian impacts, such as an improved pedestrian environment, or conflicts between pedestrians and cyclists. Neither had pedestrians been consulted about how they were being impacted by the separated bike lanes. This appears to have resulted in the separated bike lanes encouraging pedestrians to cycle, not drivers, which does not improve sustainability, or reduce costs. Therefore when prioritizing the combined active or sustainable transportation modes, the individual modes still need to be considered separately and in the transportation hierarchy order, to avoid making them compete with each another. The hierarchal order should also be followed in the objectives, design, consultation, target setting, and monitoring of projects so that active transportation impacts are highlighted and discussed.

The pedestrian impact survey aimed to partially fill the pedestrian data void, and has provided some useful insights into the impacts pedestrians are experiencing. The findings of the survey only have a sampling error less than 6%, 19 times out of 20, and a non-bike lane comparison site was excluded from the site analysis, because the researcher misjudged how much one researcher could accomplish. Therefore the
pedestrian impact survey findings are exploratory, and require additional research, including more rigorous testing.

The pedestrian impact survey highlighted that pedestrians have the most to say about safety issues, even though pedestrian optional and social impacts are better determiners of a good quality pedestrian environment. It is therefore essential to specifically elicit the impacts on optional and social activities. The survey findings also suggest the separated bike lanes are influencing how people perceive street conditions and the allocation of street space, not just next to the separated bike lane, but for the whole block. Initial, and more tentative, survey findings could also suggest that the separated bike lanes may have made pedestrians perceive the block to be less polluted, less overcrowded, more stimulating, and more peaceful. These are potentially positive impacts, which would indicate that the separated bike lanes benefit everyone, and not just people who use a currently minority transportation mode.

With a few amendments, the survey design is a template for judging changes the separated bike lanes have made to the quality of the pedestrian environment. Conducting a similar survey would be very achievable for a small research (or municipal) team, using resources similar to manually counting pedestrian volumes. The survey would provide more detailed and contextual data than pedestrian volumes, and could be enhanced by conducting both before and after surveys. The pedestrian impact survey is also the beginning of a broader template for judging pedestrian environmental quality after the implementation of any street project. If an improved version of the survey was standardized, it could be repeated to highlight differences between street projects, allowing lessons to be learned and best practices developed.

On site surveys are not the only way of collecting pedestrian impact data. Additional methods that would generate supplemental data include monitoring air and noise pollution, monitoring vehicle speeds and pedestrian linger times, and conducting observations and walking interviews.

Although this research highlights there are challenges to collecting pedestrian data, the research also highlights significantly more resources were spent on consulting and monitoring the separated bike lanes’ impacts on vehicle access, volume, travel time
and parking. Additional costs of pedestrian monitoring would also be well spent, if it helps increase pedestrian and active transportation mode shares. Increased active transportation lowers transportation, infrastructure and health costs, and therefore saves people and governments’ money. Increased active transportation also increases safety, reduces dependence on finite fuels, improves sustainability and increases the liveliness of the urban environment.

This research shows what a focus reflecting the transportation hierarchy could look like. It presents a case study of a city with favourable active transportation conditions, in terms of transportation mode share, support and investment for active transportation projects, and policies that put walking, and then cycling, as the highest transportation priorities. If walking cannot be a priority for active transportation projects in these favourable conditions, then the challenges for making walking and active transportation priorities in less favourable conditions, elsewhere in the city and the wider region, would appear to be very demanding.
References


Appendix A.

City of Vancouver cycling network map

## Appendix B.

### Timeline for key separated bike lane events

Sourced from City of Vancouver (2012f)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2009</td>
<td>Burrard Bridge separated bike lane trial approved by council</td>
</tr>
<tr>
<td>July 2009</td>
<td>Burrard Bridge separated bike lane trial opened</td>
</tr>
<tr>
<td>January 2010</td>
<td>Dunsmuir Viaduct separated bike lane trial approved by council</td>
</tr>
<tr>
<td>March 2010</td>
<td>Dunsmuir Viaduct separated bike lane constructed</td>
</tr>
<tr>
<td>May 2010</td>
<td>Dunsmuir Street separated bicycle lane approved by council</td>
</tr>
<tr>
<td>June 2010</td>
<td>Dunsmuir Street separated bike lane constructed</td>
</tr>
<tr>
<td>July 2010</td>
<td>Recommendation that Burrard Bridge separated bicycle lanes become permanent</td>
</tr>
<tr>
<td>October 2010</td>
<td>Hornby Street separated bike lane trial approved by council</td>
</tr>
<tr>
<td>December 2010</td>
<td>Hornby Street separated bike lane constructed</td>
</tr>
<tr>
<td>July 2011</td>
<td>Separated bike lane impact reports released</td>
</tr>
<tr>
<td>June 2012</td>
<td>Recommendation that Hornby Street, Dunsmuir Street and the Dunsmuir Viaduct separated bike lanes become permanent</td>
</tr>
</tbody>
</table>
Appendix C.

Pedestrian impact survey sample

This street block is: 100 Dunsmuir (Beatty to Cambie) 900 Dunsmuir (Burrard to Hornby)

Survey on the impact of separated bike lanes on pedestrians
1. Are you? (Please chose the most appropriate answer for each of the following)
   a. A downtown resident [ ] A downtown worker [ ] Both [ ] Neither [ ]
   b. Male [ ] Female [ ] Other [ ]
   c. 18-34 [ ] 35-49 [ ] 50-65 [ ] Over 65 [ ]
   d. Walking in a group [ ] Walking in a pair [ ] Walking with children [ ] Walking alone [ ]

2. What is your opinion about the allocation of street space on this block, for each of the following?
   a. Road space for moving vehicular traffic Too much [ ] Correct [ ] Not enough [ ]
   b. Road space for parked vehicular traffic Too much [ ] Correct [ ] Not enough [ ]
   c. Bike lane space for cycling Too much [ ] Correct [ ] Not enough [ ]
   d. Sidewalk space for pedestrians Too much [ ] Correct [ ] Not enough [ ]

3. For the following statements select your level of agreement for the street & sidewalk on this block
   (++ strongly agree, + agree, +/- neither agree or disagree, – disagree, – – strongly disagree)
   a. I feel safe as a pedestrian on this block ++ + +/- – –
   b. People talk to other people on this block ++ + +/- – –
   c. The vehicular traffic on this block is dangerously fast ++ + +/- – –
   d. I like to watch other people on this block ++ + +/- – –
   e. This street block is overcrowded ++ + +/- – –
   f. Sometimes I do not see or hear cyclists when I cross this street ++ + +/- – –
   g. Seeing people driving cars on this street makes me want to drive ++ + +/- – –
   h. I would sit here if seats were provided ++ + +/- – –
   i. This is a stimulating block ++ + +/- – –
   j. This street block is very polluted ++ + +/- – –
   k. Seeing people walking on this street makes me want to walk ++ + +/- – –
   l. It is safe crossing this street ++ + +/- – –
   m. This block is very peaceful ++ + +/- – –
   n. People linger (stop, stay, browse) on this block ++ + +/- – –
   o. Cars are more dangerous than bikes on this street block ++ + +/- – –
   p. This block is too long ++ + +/- – –
   q. I have seen people eating their food here ++ + +/- – –
   r. Seeing people riding bikes on this street makes me want to cycle ++ + +/- – –

4. In your opinion, what is
   a. the best thing about this block?
   b. the worst thing about this block?

5. Which transportation modes do you use for trips within the region you live (e.g. Metro Vancouver)? Please rank the following modes in the order you most frequently use them.
   (1 for the most often, 2, 3, 4 in decreasing order of use, and 5 for the least often)

6. Is there anything else you would like to say about the impact of Vancouver’s separated bike lanes on pedestrians in general?
Reverse side of survey – checks and information for each survey

1. Delete irrelevant street block location at top of survey

2. Informed consent number

3. Date DD / APR / 2013

4. Time

5. Direction approached from (indicate with arrow on sidewalk)

---

Sidewalk on bike lane side

Bike lane

---

ROAD

---

Sidewalk on reverse side
Appendix D.

Sources of potential separated bike lane pedestrian impact comments

The following sources of comments tries to be as comprehensive as possible, though cannot guarantee all sources of separated bike lane comments have been included.

Collate comments (all from post-implementation of the Hornby separated bike lane)
• 290 comments from 437 online “Open Acesss Surveys - Commute Version” (Stantec 2011b, Appendix G, p. 156). No exact dates for when the survey was conducted are given though the survey was conducted in the second quarter of 2011 (Stantec 2011a)
• 3 “Stakeholder interviews on mitigation” from May 12, 2011 (Stantec 2011b, appendix I, p. 195)
• 16 general public and business workshop comments from May 12, 2011 (Stantec 2011b, appendix J)

Other restricted comments which have been coded and analyzed
• Burrard Bridge lane reallocation study, September 2009 (City of Vancouver 2009d)
• 514 Hornby “customer exit survey” comments conducted between May 24-30 (Stantec 2011b, p. 103)
• 254 Dunsmuir “customer exit survey” comments conducted between May 24-30 (Stantec 2011b, p. 103)

Comments not collated

Uncollated comments from post-implementation of the Dunsmuir separated bike lane, but pre-implementation of Hornby
• Approximately 200 comments from August 11, 2010 open house at Pacific Centre on “Learning from the Dunsmuir trial for Hornby Street” (City of Vancouver 2010c, p. 23)
• Approximately 200 emails between the implementation of the Dunsmuir separated bike lane and September 2010 (City of Vancouver 2010c)
• Unknown number of responses to August 2010 mail out survey (City of Vancouver 2010c)

Uncollated comments from post-implementation of the Hornby separated bike lane
• 557 “Upper level tenant” surveys (employees of impacted buildings) conducted between May 18-21, 2011 (Stantec 2011b, p. 142)
• 77 “grade level business” surveys conducted between May 18 and June 12, 2011 (Stantec 2011b, p. 10)
• 34 “Commercial property owners and property managers” surveys conducted between May 23 and June 14, 2011 (Stantec 2011b, p. 61)
Appendix E.

Clarification on survey questions and statements

- For question 1) 'Downtown' relates to the Downtown Peninsula, separated by water and Main Street, and 'Walking alone' relates to that moment, not a comment on life.
- For question 2) if there was no 'Road space for parked vehicular traffic' or 'Bike lane space for cycling' was this arrangement satisfactory, or was there not enough designated space?
- Statement a) 'I feel safe as a pedestrian on this block', relates to perceptions of safety in general, not just road safety.
- Statement b) 'People talk to other people on this block', relates to conversations as well as meeting and talking to people passing.
- Statement e) 'This street block is overcrowded', relates to the road, parking, cycle lane and sidewalk on this block.
- Statement i) 'This is a stimulating block' and Statement j) 'This street block is very polluted', both relate to the block in comparison with other blocks.
- Statement k) 'Seeing people walking on this street makes me want to walk' related to whether the participant was content to be walking, or whether for example they wished they were moving through the space in another way, like riding a bike or driving a car.
- Statement l) 'It is safe crossing this street', relates to crossing the street at any point the participant wants to cross the block.
- Statement n) 'People linger (stop, stay, browse) on this block', relates to what participants may consider good and bad lingering. The term 'dwell' as used by Gehl (2010) was considered instead of linger for this survey statement. However dwell was not understood by everyone the survey was tested on, while linger was understood even though the connotation of linger seems to be negative for many people. The bracketed words tried to clarify what linger could be with more positive word associations to try and counter the negative connotation.
- Statement p) 'This block is too long', relates to whether the block felt longer than other street blocks.
- Statement q) 'I have seen people eating their food here', relates to eating outside, whether on the street, on a seat, a ledge, the grass or a café patio.
- If the participant could not think of anything, nothing had to be written for question 4) 'the best thing about this block?' and 'the worst thing about this block?', or question 6) 'Is there anything else you would like to say about the impact of Vancouver’s separated bike lanes on pedestrians in general?'
Appendix F.

Survey site location criteria

1. Blocks must have available data from the City of Vancouver's (2009b) last pedestrian study

2. Blocks must have a sufficient number of pedestrians recorded in the City of Vancouver’s (2009b) last pedestrian study, to be able to collect a significant sample of surveys. A sufficient number of pedestrians is somewhat arbitrary, but after comparing volume figures to real street conditions, it was determined that a count of more than 3000 pedestrians on the survey sidewalk in the City of Vancouver’s (2009b) last pedestrian study was sufficient. The City of Vancouver’s (2009b) study counted pedestrians between 10am and 6pm, with an hour break from 2pm to 3pm. Therefore 3000 pedestrians in this time period would be about 430 pedestrians an hour, or more than 7 pedestrians a minute.

3. Blocks must have City of Vancouver’s (2012d) vehicle volume data

4. Blocks must be on one way traffic streets, with sidewalks on both sides

5. Select at least two separated bike lane blocks with different pedestrian and traffic conditions, so potential separated bike lane impacts can start to be identified. One of these sites should have an opposite side with comparable pedestrian and traffic data and conditions, to contrast the impact of the separated bike lane on the buffered sidewalk with the non-buffered sidewalk.

6. Select some non-separated bike lane sites to compare with the separated bike lane sites. The sites should have comparable pedestrian and traffic data and conditions to at least one of the separated bike lane block survey locations. A painted bike lane site would provide a bike lane infrastructure contrast, and a non-bike lane block could provide a contrast with a block were cycling was not provided with a dedicated space.

To ensure the two separated bike lane blocks were different from one another, the following additional criteria was used

7. Some variation in type of bike lane separation design, if possible comparing an impenetrable planter barrier with more porous separation such as pedestrian islands or vehicle parking

8. Some variation in the number of vehicle lanes and the City of Vancouver (2012d) volume of vehicle traffic

9. Some variation in the ratio of pedestrians to vehicle traffic, calculated using City of Vancouver (2009b and 2012d) data

10. Some variation with the side of the street people walked on in City of Vancouver (2009b) pedestrian data

11. Some variation in City of Vancouver (2009b) pedestrian volume peak hour
### Appendix G.

#### Selection data for final survey sites

<table>
<thead>
<tr>
<th></th>
<th>Dunsmuir 100 block</th>
<th>Dunsmuir 800 block SBL</th>
<th>Dunsmuir 800 block opposite</th>
<th>Dunsmuir 900 block painted</th>
<th>Nelson 700 block</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Street side</strong></td>
<td>Bike lane side (North)</td>
<td>Bike lane side (North)</td>
<td>Opposite side (South)</td>
<td>Bike lane side (North)</td>
<td>No bike lane (South)</td>
</tr>
<tr>
<td><strong>Block length</strong></td>
<td>100m</td>
<td>100m</td>
<td>100m</td>
<td>100m</td>
<td>100m</td>
</tr>
<tr>
<td><strong>Alleys</strong></td>
<td>No alleys on either side</td>
<td>Alleys on both sides</td>
<td>Alleys on both sides</td>
<td>Alley on bike lane side</td>
<td>Alleys on both sides</td>
</tr>
<tr>
<td><strong>Separation</strong></td>
<td>Half planter barrier, half parking with painted markings</td>
<td>Planter barrier with gap in the middle for traffic alley access</td>
<td>Bike lane and planter barrier on opposite side of the street</td>
<td>Painted bike lane, with no separation between bikes and traffic</td>
<td>No separation and no bike lane</td>
</tr>
<tr>
<td><strong>Sidewalk</strong></td>
<td>2.3m</td>
<td>3.3m</td>
<td>3.3m</td>
<td>1.7m</td>
<td>2.0m</td>
</tr>
<tr>
<td><strong>Block pedestrian total</strong></td>
<td>3940</td>
<td>10875</td>
<td>10875</td>
<td>8039</td>
<td>4074</td>
</tr>
<tr>
<td><strong>Survey side pedestrian total (% block)</strong></td>
<td>3215 (82%)</td>
<td>5200 (48%)</td>
<td>5675 (52%)</td>
<td>4012 (50%)</td>
<td>2227 (55%)</td>
</tr>
<tr>
<td><strong>Traffic lanes</strong></td>
<td>4 total. 2 for through traffic. 2 for parking and turning</td>
<td>2 total. Both for through traffic. No parking</td>
<td>2 total. Both for through traffic. No parking</td>
<td>3 total. 2 for through traffic. 1 for turning. No parking</td>
<td>4 total. 2-4 for through traffic. 0-2 for parking dependent on time</td>
</tr>
<tr>
<td><strong>Traffic flow</strong></td>
<td>One way</td>
<td>One way</td>
<td>One way</td>
<td>One way</td>
<td>One way</td>
</tr>
<tr>
<td><strong>Traffic volume 10am-6pm</strong></td>
<td>8053</td>
<td>8958</td>
<td>8958</td>
<td>7984</td>
<td>7454</td>
</tr>
<tr>
<td><strong>Block pedestrians as % of traffic flow (10am-6pm)</strong></td>
<td>49%</td>
<td>121%</td>
<td>121%</td>
<td>101%</td>
<td>55%</td>
</tr>
<tr>
<td><strong>Pedestrian peak hour</strong></td>
<td>3-4pm on bike lane side, 5-6pm for block</td>
<td>12-1pm for both sides of block</td>
<td>12-1pm for both sides of block</td>
<td>12-1pm for both sides of block</td>
<td>5-6pm for both sides of block</td>
</tr>
</tbody>
</table>

Table sources: were used for ‘Alleys’, ‘Separation between bike lane and vehicle traffic’ and ‘Traffic lanes’, came from personal observations and Google Maps. ‘Block length’ came from Google Maps. ‘Traffic flow’ and ‘Traffic volume 10am-6pm’ came from City of Vancouver (2012d). ‘Sidewalk’ (width), ‘Block pedestrian total’, ‘Survey side pedestrian total’ and ‘pedestrian peak hour’ came from City of Vancouver (2009b). Survey side pedestrian total as a % of the block was calculated using City of Vancouver (2009b) data. ‘Block pedestrians as % of traffic flow (10am-6pm)’ was calculated using City of Vancouver (2009b) and City of Vancouver (2012d) data.
Appendix H.

Nelson 700 block separated bike lane survey site

Source: S Jay (2013)
Appendix I.

Survey schedule

<table>
<thead>
<tr>
<th>Survey Date</th>
<th>Survey times</th>
<th>Dunsmuir 100 Block SBL</th>
<th>Dunsmuir 800 Block SBL</th>
<th>Dunsmuir 800 Block Opposite</th>
<th>Dunsmuir 900 Block Painted</th>
<th>Nelson 700 Block No Bike Lane</th>
<th>Total Surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td>03.04.13</td>
<td>13:00 -16:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>04.04.13</td>
<td>09:15 -10:30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>08.04.13</td>
<td>09:00 -9:15, 10:30 -13:00 &amp; 16:00 -18:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>11.04.13</td>
<td>10:00 -11:50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>16.04.13</td>
<td>11:50 -14:00 &amp; 16:00 -18:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>17.04.13</td>
<td>09:00 -10:00 &amp; 14:00- 16:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>22.04.13</td>
<td>11:30 -13:30 &amp; 16:00 -18:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>23.04.13</td>
<td>09:00 -11:30 &amp; 13:30 -16:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>24.04.13</td>
<td>12:00 -14:00 &amp; 16:00 -18:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>25.04.13</td>
<td>09:00 -12:00 &amp; 14:00 -16:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>30.04.13</td>
<td>12:00 -14:00 &amp; 16:00 -18:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>01.05.13</td>
<td>09:00 -12:00 &amp; 14:00 -16:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>66 77 58 38 27</td>
</tr>
</tbody>
</table>
## Appendix J.

### Additional block information from survey observations

<table>
<thead>
<tr>
<th></th>
<th>Dunsmuir 100 block</th>
<th>Dunsmuir 800 block SBL</th>
<th>Dunsmuir 800 block opposite</th>
<th>Dunsmuir 900 block painted</th>
<th>Nelson 700 block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sidewalk setback</td>
<td>Additional ramp sidewalk</td>
<td>Cut through setback with planters</td>
<td>Large building setback</td>
<td>Parkade entrance setback</td>
<td>Large building setback</td>
</tr>
<tr>
<td>Green space / planters</td>
<td>Large raised grassy area</td>
<td>Raised planter area</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Potential places to sit</td>
<td>Some participants sat on grassy area ledge</td>
<td>Some smokers + participants sat on ledge of the planters</td>
<td>Some participants sat on restaurant entrance steps</td>
<td>One participant sat on the sidewalk</td>
<td>Some participants sat on the steps</td>
</tr>
<tr>
<td>Trees on survey sidewalk (total trees on block)</td>
<td>14 (35)</td>
<td>4 (6)</td>
<td>2 (6)</td>
<td>2 (6)</td>
<td>4 (4)</td>
</tr>
<tr>
<td>Building height on survey side (and opposite)</td>
<td>13 floors + 1 floor (ground level parking)</td>
<td>14 floors + 13 floors (14 floors + 9 floors)</td>
<td>14 floors + 9 floors (14 floors + 13 floors)</td>
<td>7 floors + 1 floor (35 floors)</td>
<td>12 floors + 1 floor (2 floors + ground level parking)</td>
</tr>
<tr>
<td>Survey side ground floor businesses and doors</td>
<td>2 businesses and 3 doors</td>
<td>5 businesses and 7 doors</td>
<td>5 businesses and 5 doors (doors exclude food + flower carts)</td>
<td>2 businesses and 3 doors</td>
<td>7 businesses and 8 doors</td>
</tr>
<tr>
<td>Survey side food enterprises (and block total)</td>
<td>2 (2)</td>
<td>1 (4)</td>
<td>3 including food cart (4)</td>
<td>2 (2)</td>
<td>6 (7)</td>
</tr>
<tr>
<td>Other survey side entrances</td>
<td>Office tower</td>
<td>2 office towers</td>
<td>Office tower</td>
<td>Parkade</td>
<td>Storage</td>
</tr>
<tr>
<td>Peds crossing mid-block?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Additional information</td>
<td>Charity canvassed on block for two hour shift</td>
<td>Some participants hindered pedestrian flow</td>
<td>Pedestrians hurried and ignored surveyor more</td>
<td>Restaurant's covered seating area encroaching onto sidewalk</td>
<td>Next block construction caused two hour traffic jam</td>
</tr>
<tr>
<td>Walk Score (2013)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Survey Date</td>
<td>Survey times</td>
<td>Weather from survey observations</td>
<td>Daily Vancouver Harbour Weather from The Weather Network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------</td>
<td>----------------------------------</td>
<td>------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03.04.13</td>
<td>13:00 - 16:00</td>
<td>Sunny, odd cloud break, felt warm, breeze</td>
<td>Max 14.2°C, Min 6.9°C, Mean 10.6°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04.04.13</td>
<td>9:15 - 10:30</td>
<td>Cloudy and not sunny, felt cold, still, rain stopped surveys</td>
<td>Max 12.5°C, Min 6.0°C, Mean 10.8°C, Precip 22mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>08.04.13</td>
<td>9:00 - 9:15, 10:30 - 13:00 &amp; 18:00 - 18:00</td>
<td>Morning: Cloudy, some sun at end, felt cold, still / Commute: Sunny, felt warm</td>
<td>Max 13.5°C, Min 7.5°C, Mean 10.5°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.04.13</td>
<td>10:00 - 11:50</td>
<td>Sunny, but half the time in shade, felt very cold, very windy. Abandoned surveys because of wind gusts</td>
<td>Max 12.5°C, Min 7.0°C, Mean 9.8°C, Precip 0.2mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.04.13</td>
<td>11:50 - 14:00 &amp; 16:00 - 18:00</td>
<td>Lunchtime: sunny, with odd shade break, breeze / Commute: sunny, second half in shade, warm though cooler in shade, breeze</td>
<td>Max 14.1°C, Min 4.1°C, Mean 9.1°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.04.13</td>
<td>9:00 - 10:00 &amp; 14:00 - 16:00</td>
<td>Morning: shade, breeze / Afternoon: shade and cloudy at end, still</td>
<td>Max 15.5°C, Min 6.7°C, Mean 11.1°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.04.13</td>
<td>11:30 - 13:30 &amp; 16:00 - 18:00</td>
<td>Lunch: Reflected sun, shade, felt cold, breeze with odd gusts / Commute: Shade, felt cold, breeze</td>
<td>Max 14.1°C, Min 2.6°C, Mean 8.3°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.04.13</td>
<td>9:00 - 11:30 &amp; 13:30 - 16:00</td>
<td>Morning: Sunny, reflected sun and shade, warm in sun, cold in shade, still Afternoon: reflected sun, shade, warm in sun, windy with swirling gusts</td>
<td>Max 15.5°C, Min 6.6°C, Mean 11.1°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.04.13</td>
<td>12:00 - 14:00 &amp; 16:00 - 18:00</td>
<td>Lunch: sunny, felt very warm, sheltered from breeze / Commute: reflected sun, shade, little direct sun, felt warm, sheltered from breeze</td>
<td>Max 15.9°C, Min 6.1°C, Mean 11.0°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.04.13</td>
<td>9:00 - 12:00 &amp; 14:00 - 16:00</td>
<td>Morning: reflected sun, shady, direct sun, sheltered then open to breeze, air quality issues in direct sun / Afternoon: shade, felt warm, mostly still</td>
<td>Max 18.1°C, Min 7.2°C, Mean 12.7°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.04.13</td>
<td>12:00 - 14:00 &amp; 16:00 - 18:00</td>
<td>Lunch: Sunny, felt warm, breeze, some air quality issues / Commute: Shade, breeze</td>
<td>Max 12.8°C, Min 3.5°C, Mean 8.1°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.05.13</td>
<td>9:00 - 12:00 &amp; 14:00 - 16:00</td>
<td>Morning: Sunny, felt warm, breeze with gusts / Afternoon: Sunny, shade, felt warm, breeze</td>
<td>Max 14.5°C, Min 5.2°C, Mean 9.8°C, Precip 0mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix L.

Quality of pedestrian impact survey sample

<table>
<thead>
<tr>
<th></th>
<th>Dunsmuir 100 Block SBL</th>
<th>Dunsmuir 800 Block SBL</th>
<th>Dunsmuir 800 Block Opposite</th>
<th>Dunsmuir 900 Block Painted</th>
<th>All blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents who were walking alone</td>
<td>91.7%</td>
<td>81.3%</td>
<td>100.0%</td>
<td>93.9%</td>
<td>90.5%</td>
</tr>
<tr>
<td>Downtown worker respondents</td>
<td>53.2%</td>
<td>69.9%</td>
<td>67.2%</td>
<td>75.7%</td>
<td>62.9%</td>
</tr>
<tr>
<td>Downtown residents respondents</td>
<td>33.9%</td>
<td>27.4%</td>
<td>25.9%</td>
<td>24.3%</td>
<td>30.1%</td>
</tr>
<tr>
<td>Respondents who were under 50 years old</td>
<td>82.8%</td>
<td>72.9%</td>
<td>67.3%</td>
<td>75.0%</td>
<td>74.5%</td>
</tr>
<tr>
<td>Male respondents</td>
<td>56.7%</td>
<td>52.9%</td>
<td>60.4%</td>
<td>67.6%</td>
<td>57.0%</td>
</tr>
</tbody>
</table>
### Appendix M.

#### Estimated survey response rate by location

<table>
<thead>
<tr>
<th>Location</th>
<th>Survey sample</th>
<th>City of Vancouver (2009b) pedestrian count</th>
<th>Response rate per location</th>
<th>1 in how many pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Dunsmuir</td>
<td>66</td>
<td>3215</td>
<td>10.26%</td>
<td>10</td>
</tr>
<tr>
<td>SBL 800 Dunsmuir</td>
<td>77</td>
<td>5200</td>
<td>7.40%</td>
<td>14</td>
</tr>
<tr>
<td>Opposite 800 Dunsmuir</td>
<td>58</td>
<td>5675</td>
<td>5.11%</td>
<td>20</td>
</tr>
<tr>
<td>900 Dunsmuir</td>
<td>38</td>
<td>4012</td>
<td>4.74%</td>
<td>21</td>
</tr>
<tr>
<td>700 Nelson</td>
<td>27</td>
<td>2227</td>
<td>6.06%</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>266</strong></td>
<td><strong>20329</strong></td>
<td><strong>6.54%</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

Estimates were calculated by multiplying the survey sample by the nth person approached to participate, which was the fifth person. Then dividing by the pedestrian count figures (City of Vancouver 2009b) used to select the locations, and multiplying by 100 to produce a percentage.
Appendix N.

Separated bike lane at Dunsmuir 200 block bus stop

Source: S Jay (2013)
Appendix O.

Documented consultations, surveys, and monitoring of separated bike lane impacts and concerns

Pre-completion of Dunsmuir separated bike lane (Before June 2010)

<table>
<thead>
<tr>
<th>Monitoring/surveys/ consultations and date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burrard Bridge pedestrian volumes (June 2009 to December 2010)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Burrard Bridge bike volumes (Ongoing since July 2009)</td>
<td>City of Vancouver (2011a, 2013d)</td>
</tr>
<tr>
<td>Burrard bike lane telephone survey before implementation (June 18-29, 2009)</td>
<td>City of Vancouver (2009d)</td>
</tr>
<tr>
<td>Burrard bike lane telephone survey post-implementation (September 23-28, 2009)</td>
<td>City of Vancouver (2009d)</td>
</tr>
<tr>
<td>Dunsmuir Viaduct bike volumes (Ongoing since March 2010)</td>
<td>City of Vancouver (2013d)</td>
</tr>
</tbody>
</table>

After Dunsmuir but before Hornby separated bike lane (June 2010 to December 2010)

<table>
<thead>
<tr>
<th>Monitoring/surveys/ consultations and date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximately 200 emails about Dunsmuir separated bike lane (June to September 2010)</td>
<td>(City of Vancouver 2010c)</td>
</tr>
<tr>
<td>Dunsmuir bike volumes (Ongoing since July 2010)</td>
<td>City of Vancouver (2013d)</td>
</tr>
<tr>
<td>“Learning from the Dunsmuir trial for Hornby Street” - Open house public information session at Pacific Centre attended by approximately 700 people (August 11, 2010)</td>
<td>City of Vancouver (2010c, p. 23)</td>
</tr>
<tr>
<td>Mail-out survey to approximately 4000 businesses and residents along and near Hornby Street (August 2010)</td>
<td>City of Vancouver (2010c)</td>
</tr>
<tr>
<td>Individual stakeholder meetings with business associations and businesses along Hornby Street (July and September 2010)</td>
<td>City of Vancouver (2010c)</td>
</tr>
<tr>
<td>Hornby vehicle travel times before separated bike lane implementation (September and October 2010)</td>
<td>City of Vancouver (2011b), Stantec (2011b)</td>
</tr>
<tr>
<td>Hornby cyclists riding on sidewalks pre implementation (Fall 2010)</td>
<td>City of Vancouver (2011b)</td>
</tr>
<tr>
<td>Monitoring/surveys/ consultations and date</td>
<td>Reference</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Hornby bike volumes (Ongoing since Jan 2011)</td>
<td>City of Vancouver (2013d)</td>
</tr>
<tr>
<td>Hornby vehicle travel times after separated bike lane implementation (January to April 2011)</td>
<td>City of Vancouver (2011b), Stantec (2011b)</td>
</tr>
<tr>
<td>Separated bike lanes economic impact study stakeholder workshop (May 12, 2011)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Stakeholder interviews (May 12, 2011)</td>
<td>(Stantec 2011b)</td>
</tr>
<tr>
<td>Omnibus telephone survey of 500 metro Vancouver residents (May 4-15, 2011)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Hornby street visitor survey (May 14-19, 2011)</td>
<td>City of Vancouver (2011b)</td>
</tr>
<tr>
<td>Grade level business surveys of 77 surveys of businesses on Hornby and Dunsmuir (May 18 and June 12, 2011)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Upper level tenants’ survey of 557 employees on Dunsmuir, Hornby and comparator streets (May 18-21, 2011)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Dunsmuir and Hornby - 34 Commercial property owners and property managers’ surveys, on Dunsmuir, Hornby and comparator streets (May 23 - June 14, 2011)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Dunsmuir Customer exit survey - 254 pedestrians between Homer and Hornby Streets (May 24-30, 2011)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Online open access surveys of 437 commuters (second quarter of 2011)</td>
<td>Stantec (2011a, 2011b)</td>
</tr>
<tr>
<td>Dunsmuir cyclists riding on sidewalks (Summer 2011)</td>
<td>City of Vancouver (2011b)</td>
</tr>
<tr>
<td>Hornby cyclists riding on sidewalks post implementation (Summer 2011)</td>
<td>City of Vancouver (2011b)</td>
</tr>
<tr>
<td>Cyclists gender split on the Burrard, Dunsmuir and Hornby separated bike lanes (June to August 2011)</td>
<td>City of Vancouver (2012f)</td>
</tr>
<tr>
<td>Dunsmuir and Hornby after implementation vehicle access consultation (Spring 2012)</td>
<td>City of Vancouver (2012f)</td>
</tr>
</tbody>
</table>
Background and baseline data which was not collected specifically for the separated bike lanes

<table>
<thead>
<tr>
<th>Monitoring/surveys/ consultations and date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hornby vehicle volumes before separated bike lane implementation (2005 and 2006)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Dunsmuir vehicle volumes before separated bike lane implementation (2006 and 2008)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Pedestrian volume and opinion survey (May to October 2008)</td>
<td>City of Vancouver (2009b, 2009c)</td>
</tr>
<tr>
<td>Dunsmuir vehicle volumes after separated bike lane implementation (August 2010)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Hornby vehicle volumes after separated bike lane implementation (2011)</td>
<td>Stantec (2011b)</td>
</tr>
<tr>
<td>Dunsmuir and Hornby ICBC collision data (2011)</td>
<td>City of Vancouver (2012f)</td>
</tr>
</tbody>
</table>

Separated bike lane data with unknown collection dates

<table>
<thead>
<tr>
<th>Monitoring/surveys/ consultations and date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunsmuir travel time post-implementation of the separated bike lane</td>
<td>City of Vancouver (2012f)</td>
</tr>
<tr>
<td>Dunsmuir travel time post-implementation of the separated bike lane</td>
<td>City of Vancouver (2012f)</td>
</tr>
<tr>
<td>Pedestrian volumes on Hornby post-implementation of the separated bike lane</td>
<td>City of Vancouver (2011b)</td>
</tr>
<tr>
<td>Pedestrian volumes on Dunsmuir post-implementation of the separated bike lane</td>
<td>City of Vancouver (2011b)</td>
</tr>
</tbody>
</table>
### Appendix P.

**Pedestrian impact survey statements variance from mean**

<table>
<thead>
<tr>
<th>Statements</th>
<th>All blocks mean</th>
<th>Survey block variance from mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dunsmuir 100 SBL</td>
</tr>
<tr>
<td>I feel safe as a pedestrian on this block</td>
<td>1.48</td>
<td>-.22</td>
</tr>
<tr>
<td>It is safe crossing this street</td>
<td>.63</td>
<td>.15</td>
</tr>
<tr>
<td>Cars are more dangerous than bikes on this street block</td>
<td>.55</td>
<td>.16</td>
</tr>
<tr>
<td>People talk to other people on this block</td>
<td>.44</td>
<td>-.11</td>
</tr>
<tr>
<td>Seeing people walking on this street makes me want to walk</td>
<td>.43</td>
<td>.09</td>
</tr>
<tr>
<td>I have seen people eating their food here</td>
<td>.34</td>
<td>.28</td>
</tr>
<tr>
<td>Seeing people riding bikes on this street makes me want to cycle</td>
<td>.21</td>
<td>.16</td>
</tr>
<tr>
<td>I like to watch other people on this block</td>
<td>.03</td>
<td>-.10</td>
</tr>
<tr>
<td>I would sit here if seats were provided</td>
<td>-.09</td>
<td>.25</td>
</tr>
<tr>
<td>This is a stimulating block</td>
<td>-.13</td>
<td>.17</td>
</tr>
<tr>
<td>People linger (stop, stay, browse) on this block</td>
<td>-.27</td>
<td>.03</td>
</tr>
<tr>
<td>This block is very peaceful</td>
<td>-.28</td>
<td>.30</td>
</tr>
<tr>
<td>Sometimes I do not see or hear cyclists when I cross this street</td>
<td>.40</td>
<td>.22</td>
</tr>
<tr>
<td>The vehicular traffic on this block is dangerously fast</td>
<td>-.05</td>
<td>.18</td>
</tr>
<tr>
<td>This street block is very polluted</td>
<td>-.38</td>
<td>.17</td>
</tr>
<tr>
<td>This street block is overcrowded</td>
<td>-.49</td>
<td>-.05</td>
</tr>
<tr>
<td>This block is too long</td>
<td>-.65</td>
<td>.23</td>
</tr>
<tr>
<td>Seeing people driving cars on this street makes me want to drive</td>
<td>-.91</td>
<td>.15</td>
</tr>
</tbody>
</table>

**Number of statements which indicate pedestrian impacts that were more positive than average**

<table>
<thead>
<tr>
<th></th>
<th>Dunsmuir 100 SBL</th>
<th>Dunsmuir 800 SBL</th>
<th>Dunsmuir 800 Rev</th>
<th>Dunsmuir 900 Paint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of statements</td>
<td>10</td>
<td>13</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>which indicate pedestrian impacts that were more negative than average</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>18</td>
</tr>
</tbody>
</table>
Positive pedestrian impact statements have been divided from negative pedestrian impact statements, and for each sites the statement’s variance from the overall mean has been calculated.

Green numbers in the table represent positive pedestrian impacts, which are either higher than average agreement with positive pedestrian impact statements, or lower than average agreement with negative pedestrian impact statements.

Red numbers in the table represent negative pedestrian impacts, which are either lower than average agreement with positive pedestrian impact statements, or higher than average agreement with negative pedestrian impact statements.
Appendix Q.

Pedestrian impact survey cycling allocation of space and allocation of space per mode

<table>
<thead>
<tr>
<th></th>
<th>Too much space for cycling</th>
<th>Correct space for cycling</th>
<th>Not enough space for cycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunsmuir 100 Block SBL</td>
<td>18.2%</td>
<td>66.7%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Dunsmuir 800 Block SBL</td>
<td>23.7%</td>
<td>71.1%</td>
<td>Sample too small</td>
</tr>
<tr>
<td>Dunsmuir 800 Block Opposite</td>
<td>31.0%</td>
<td>58.6%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Dunsmuir 900 Block Painted</td>
<td>28.9%</td>
<td>57.9%</td>
<td>13.2%</td>
</tr>
<tr>
<td>All blocks</td>
<td>23.0%</td>
<td>60.8%</td>
<td>16.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Correct space for pedestrians</th>
<th>Correct space for moving vehicles</th>
<th>Not enough space for moving vehicles</th>
<th>Correct space for parked vehicles</th>
<th>Not enough space for parked vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunsmuir 100 Block SBL</td>
<td>84.6%</td>
<td>76.6%</td>
<td>14.1%</td>
<td>52.4%</td>
<td>41.3%</td>
</tr>
<tr>
<td>Dunsmuir 800 Block SBL</td>
<td>96.1%</td>
<td>64.5%</td>
<td>30.3%</td>
<td>60.3%</td>
<td>35.6%</td>
</tr>
<tr>
<td>Dunsmuir 800 Block Opposite</td>
<td>87.9%</td>
<td>67.2%</td>
<td>29.3%</td>
<td>54.4%</td>
<td>38.6%</td>
</tr>
<tr>
<td>Dunsmuir 900 Block Painted</td>
<td>84.2%</td>
<td>67.6%</td>
<td>24.3%</td>
<td>65.7%</td>
<td>25.7%</td>
</tr>
<tr>
<td>All blocks</td>
<td>87.1%</td>
<td>69.3%</td>
<td>24.5%</td>
<td>58.9%</td>
<td>34.0%</td>
</tr>
</tbody>
</table>

Sample sizes were too small for categories not shown. Categories not shown are 'not enough space for pedestrians', 'too much space for pedestrians', 'too much space for moving vehicles', and 'too much space for parked vehicles'.