HEALTHY COMMUNITY DEVELOPMENT:
CREATING AND ASSESSING TOOLS FOR PLANNING AND
DESIGNING HEALTHY COMMUNITIES IN BRITISH COLUMBIA

By

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ABSTRACT

The health of our communities is of increasing concern to professionals and various health organisations. The design of our built environment influences most of our daily activities which in turn influence our health. This thesis explores the impacts of planning on the health of the community.

Health organisations such as WHO, PHSA, etc. have created frameworks which relate design to health but these frameworks are quite general in nature. This thesis focuses on the relationship of health to neighbourhood planning with a focus on two neighbourhoods in Nanaimo. This thesis aims to help in gaining a more complete understanding of the various factors present in these neighbourhoods and what can be improved in terms of the existing policies and guidelines for developing a healthier future.

The approach used here is mainly secondary data collection and the analysis of the collected data to help design an improved healthy community framework. This thesis specifically deals with providing an updated framework for planning which can be easily used by professionals such as planners, developers, municipal officials and health officials. The proposed framework aims to commence a guiding structure for the future of planning and design guidelines.

Keywords: Healthy built environments; neighbourhood planning; community well-being
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LIST OF ACRONYMS

BC – British Columbia

BCHC – BC Healthy Communities Society

WHO – World Health Organization

PHAC – Public Health Association of Canada

PHSA – Provincial Heath Services Authority

SDOH – Social Determinants of Health

CPHA – Canada’s Public Health Leader

CDC – Center for Disease Control and Prevention

CMA – Canadian Medical Association

PHA – Public Health Association

RDN – Regional District of Nanaimo

OCP – Official Community Plan

ON – Ontario

SES – Socio-economic Status

VIU – Vancouver Island University

HAbD – Healthy Active by Design

HIA – Health Impact Assessment

PlanH – Planning Health

MOTI – Ministry of Transportation and Infrastructure, BC

BREEAM - Building Research Establishment Environmental Assessment Method
CHAPTER 1:

Introduction

This thesis is focused on creating a framework for designing healthy neighbourhood communities in British Columbia. My long-term interest in neighbourhood planning drew me towards this topic of research. Coming from a design background, the need for taking neighbourhood and community designs to the next level was the ultimate goal. Sustainable healthy designs were the next step in pursuing this interest, and the idea to combine two important aspects of our daily lives – health and design was even more exciting. Understanding the need for greater public and community health is crucial in the 21st century. Increasing rates of chronic diseases and obesity have been a growing concern for decades. The healthy neighbourhood tools that currently exist have formed a good foundation for proposing a new tool and this framework and tool draws on many aspects of other healthy community frameworks and tools.

This research is especially focused on the health and design factors related to neighbourhoods of a general suburban density (less than 10 units/acre). Much healthy community work is focused on urban neighbourhoods with higher levels of density and mixed use, but many communities in Canada and BC are suburban in nature.

“Planners helping to develop and implement urban policy find themselves caught in a love/hate relationship with the suburbs. On the one hand, through their training and via professional organisations, planners learn planning principles that encourage mixed use, a vibrant urban realm, intensification, compact form, walkability, and transit-oriented development. On the other hand, planners practice in local contexts within which the suburbs are highly valued as desirable landscapes full of prized real estate commodities. The reality being constructed therefore may bear little relationship to the rhetoric of the planning discipline” (Grant, 2009).
While this framework has been created with the suburban neighbourhoods of Nanaimo in mind, it can be adapted to other small-medium sized communities in BC.

The relationship between the health of an individual and how a neighbourhood is designed has ripple effects on the whole community. This framework focuses on helping professionals incorporate health objectives within neighbourhood planning, assessment and design processes.

Overview:

This section includes the following subsections:

- Purpose
- Research Problem and Justification
- Research Question and Sub-questions
- Theoretical Orientation
- Scope of Research

1.1 Purpose

The purpose of this thesis is to create and test a framework which can be applied to communities in British Columbia for assessing, planning and designing current and future neighbourhoods. This tool will help identify direct links between health and community design which can then lead to better designs in the future.

The health of an individual is related to their lifestyle and environmental conditions (access to healthcare). It not only includes good eating habits and exercising regularly (physical health) but also includes factors such as mental, emotional, social and spiritual well-being. Healthy communities support a healthy lifestyle simply by how they are designed. The health of the community is an increasing concern in Canada. As per Statistics Canada (2013-2014), the health of the population has been deteriorating in British Columbia with respect to certain chronic diseases (such as diabetes), health
conditions, lifestyle and social conditions, mental health and emotional well-being. This updated framework aims to connect these factors to neighbourhood planning policies.

![What makes Canadians sick?](image)

Figure 1: What makes Canadians sick?¹

1.2 Research Problem and Justification

The rise of chronic diseases in Canada that are lifestyle-based is considered to be a major challenge to both the health and planning policy communities. “Direct links have been established between urban form and resident behaviour that impact the health of residents” (WHO). Many factors are to be considered in this issue including land-use patterns, accessibility to facilities such as grocery stores and clinics, social spaces for interaction and recreational facilities. The Center for Disease Control (CDC) notes that research suggests “…personal biology (genetics etc.) and behavior may only account for 25% of the causes of one’s health, and the larger socioeconomic and political context in which one lives may account for 75% of the factors driving health” (CDC). The Canadian

¹ CMA- https://www.cma.ca/En/Pages/health-equity.aspx
Medical Association goes further to suggest that “…85% of your health has core social determinants outside your biology” (CMA).

![Figure 2: World Chronic Disease Surveillance](image2)

![Figure 3: Canadian Chronic Disease Surveillance](image3)

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2 Public Health Agency of Canada (July 2011)
3 Public Health Agency of Canada (July 2011)
Figure 2, shows that Canada is the third highest country among a selection of countries around the world in terms of population affected by chronic diseases such as diabetes, whereas Figure 3 illustrates the rise in chronic conditions with respect to age group and gender. Further studies have shown that the probability of suffering from obesity and chronic diseases has a direct correlation to how long one spends in a vehicle every day (Papas M et al. 2007); especially with regards to commuting since people spend a good amount of time commuting by private vehicles. A healthy community must encourage physical mobility in all ways possible. It calls for a change in lifestyle and that is a key factor that brings neighbourhood design into the picture.

Figure 4: Variation in Obesity across Canadian Provinces

Neighbourhood planning and design significantly impact our health by affecting exercise, diet, social interaction and other health factors depending on how it is designed and what the neighbourhood supports. In particular, the built environment can shape travel behaviour, including the ability and desirability to walk and cycle, together with opportunities to drive (Kent & Thompson, 2014). Various models of neighbourhood plans and designs exist and showcase different health performances within communities. This research focuses on health issues generated due to certain types of neighbourhood planning and design patterns. It identifies how they are linked to each other by assessing the health impacts of various types of neighbourhood development plans and recommending alternate designs to maximise resident’s health benefits. Since the existing tools and rating systems are either expensive or relatively general in nature, communities and agencies across B.C are looking for an effective solution to link health performance to the level of neighbourhood design. Therefore, there is a need for an assessment tool for planning and design which is easy to use as well as cost effective.

1.3 Research Questions and Sub-questions

The main research question that will be addressed here is- What can be done to propose a new assessment and planning tool for creating healthier neighbourhoods in British Columbia?

The main research question includes the following sub-questions:

**Sub-question 1:** How is public health impacted by planning and design?

**Sub-question 2:** What other planning and design tools/systems exist those are relevant to this project? What are their strengths and weaknesses and what lessons can be learned from them to inform the creation of a new planning and design tool?

**Sub-question 3:** What are the aspects of neighbourhoods and communities that should be addressed in order to contribute to a healthier lifestyle and what would the elements of an effective tool be to enhance the implementation of healthy community planning and design principles in BC?
Sub-question 4: What are the existing design guidelines typically applied in the construction of traditional neighbourhoods and those of conventional neighbourhoods and how do they relate to a healthy community planning and design framework?

Sub-question 5: How does the new design framework perform in comparison to the conventional neighbourhood or traditional neighbourhood?

1.4 Theoretical Orientation

The Ottawa Charter for Health Promotion states, “Health is created and lived by people within the settings of their everyday life; where they learn, work, play, and love” (WHO 1986). These settings have become increasingly important to public health. Many determinants of health are specific to those everyday settings, and health is created in the relationship between individuals, groups, and communities with their environment. Individuals cannot be treated in isolation from their environments (Green, Poland, and Rootman, 2000). “Decisions about housing, food, water, energy, transport, social services, and health care will profoundly affect the health, wellbeing, and safety of growing and ageing urban populations. With the world’s population estimated to reach 10 billion people by 2050, and 75% of this population living in cities, city planning is now recognised as part of a comprehensive solution to tackling adverse health outcomes” (Giles-Corti et al., 2016). Health and community design are a growing concern for planners, health practitioners and professionals today. This can be addressed by providing communities with healthier environments.

The suggested tool in this thesis is expected to continuously evolve over time through review and refinement by stakeholders such as planners, developers and health organisations. This tool is also designed for use in different settings such as design guidelines for new neighbourhoods or as an evaluation tool for existing ones. It will lend itself to being adapted to various situations or areas. It can be used by developers and planners as a checklist to identify where their proposed plans may not meet the conditions for creating a healthy community.
“Canadians generally enjoy better health than Americans but do not do as well compared to other nations that have developed public policies that strengthen the social determinants of health. The World Health Organization sees health-damaging experiences as a result of ‘a toxic combination of poor social policies, unfair economic arrangements, and bad politics’” (Mikkonen & Raphael, 2010). A great example is Toronto where almost a quarter of a million adults are diabetic. The highest rates of diabetes were found in its 13 poorest and most sprawled neighbourhoods. Interestingly, the researchers found that these neighbourhoods were often low income, were under-serviced for health services, had high immigrant populations, had poor access to public transit, had less proximity to food outlets selling fresh fruits and vegetables; and had lower rates of resident walking and cycling trips per day. These factors contribute to lower levels of physical activity and poorer nutritional habits among residents, which influence the higher rates of diabetes (Williams & Wright, 2007). “First, the question of health and physical activity is fundamentally an issue of magnitudes, as public health recommendations suggest a minimum of thirty minutes of moderate-intensity physical activity per day (U.S. Department of Health and Human Services 1996). Second, from a policy perspective, planners will need to know how the health benefits produced by a particular intervention—for example, sidewalk infrastructure, mixed land uses, or rail transit—compare with the cost of those projects” (Boarnet, Greenwald, & McMillan, 2008). This particular study done in Portland, Oregon, addresses the relationship between walking and urban design. But walkability isn’t the only way to promote healthy living as discussed in the previous sections hence in the new framework other modes of active transit have been included.

“In a neighborhood-based study, Kitamura et al. (1994) regressed socioeconomic and urban form attributes such as density, a mixture of uses, street patterns, transit access, and sidewalk availability on mobility. Although the study showed that urban form variables influenced vehicular and non-motorized travel, the authors found that attitudes toward environmental issues, transit, and automotive mobility explained the highest proportion of data” (L. D. L. Frank & Engelke, 2001).
This study showed that urban form is a critical but not the only factor affecting lifestyle choices and their impacts on health.

1.5 Scope of Research

The scope of literature and information linking health factors to environmental or urban form factors is significant. Since this thesis is focused on an applied framework and tool to impact planning, the literature review and research focus was on the existing frameworks and tools for use in planning healthy communities.

The focus of this research is restricted in particular to the existing healthy toolkits provided by BC health agencies such as PHSA, HBE toolkit, LEED-ND, etc. Other toolkits such as the Ontario Rural Toolkit, New York Active Design Guidelines have not been considered as they are not in the scope of this research, although they can be used to refine the updated framework in the future. A toolkit such as the Well Building Checklist mainly concentrates on the interior structures and materials on constructions whereas the focus here is on the physical environment of neighbourhoods. Therefore, it has not been used in this research.

Frameworks and tools have been created recently to link health and urban form due to the recognition of the potentially significant role urban form can play in addressing the health and well-being of a community.

“In this coming and fourth revolution, we need to reclaim the city space for people. City planners and policy makers, together with health professionals and citizens themselves, need to maximise the opportunities of cities to create health and wellbeing alongside economic and business opportunities by making them people-centered, livable, equitable, sociable, and enjoyable. By encouraging and enabling an active and participatory city life, many of the current concerns, such as physical inactivity, overweight and obesity, mental ill health, exclusion of economically and socially disadvantaged people, and exclusion of older people, will see a positive effect too. Cities could become our next greatest assets in achieving sustainable health and development” (Kleinert & Horton, 2016).
The scope of this research paper is to identify and assess what frameworks and tools exist today that is relevant to a city like Nanaimo and in what context are they being used. This thesis aims to include many relevant aspects of public health (mentioned in Table A.1) including the mental and social well-being of communities which can be easily left out while designing the community.

The proposed framework aims to be used by professionals such as planners, developers, municipal officials and health officials at comparatively little or no cost to the existing toolkits and rating systems. The healthy design framework has been developed with Nanaimo neighbourhoods in mind, as they are representative of many cities with both traditional and more suburban neighbourhoods.

Two neighbourhoods in Nanaimo have been chosen for this research. One is a traditional neighbourhood (the Old City) and the other is a conventional suburban neighbourhood (Dover Bay), and both are assessed using the new proposed framework. The assessment conducted is preliminary in nature which can be explored further in the future. Similar or smaller towns and cities can be assessed as well using the proposed framework.
CHAPTER 2:

Literature Review

Starting with reviewing the history and background of health and design, this chapter will further elaborate on their relationships with each other to help in formulating the new framework. A number of toolkits exist which have been used to relate health and planning professionals and these will be addressed and discussed further while shaping the tool proposed in this thesis. This chapter will follow the structure of the sub-questions noted above leading to the main research question.

Literature review for this research is focused on healthy community systems with some focus on relating health to urban form. The existing frameworks and toolkits that are explored here are in the context of BC and relate to physical settings/environments rather than interior environments or materials of structures (WELL Building Checklist).

2.1 History

One of the major contributions to this thesis is the paper by Megan Williams and Myrna Wright (2007), which lays out the historical background and perspective relating the impact of the environment on public health.

The relationship between health and planning goes back to the Industrial Revolution where the outbreak of epidemics and influence of the physical environment started seriously affecting individuals’ health. “At that time, cities were unplanned. Most services were provided privately and land use decisions were dictated primarily by market forces. The result was the growth of large, disjointed urban areas where a majority of the population lived in crowded, unsafe and filthy conditions” (Williams & Wright, 2007). It later expands into the Canadian and American contexts.

Researcher’s state that over the past 150 years, connections have been made relating public health to the built environment but more serious research on this topic
only started relatively recently. In 2001, Dr Richard Jackson, director of the Centers for Disease Control’s National Center for Environmental Health, wrote: “The built environment influences public health as much as vaccines or water quality” (Williams & Wright, 2007). Therefore, these links establish that public health is affected by the way we plan our everyday surroundings. Canada has an increasing prevalence of chronic diseases such as obesity, diabetes, respiratory problems, and others. It is the third highest in the world (from a selection of countries) for certain chronic diseases (Figure 1: PHAC). “The researchers noted that: ‘…many factors which influence health are not within our control; however, we are convinced that certain features of urban and suburban environments could be altered for the long-term health benefits of local residents’” (Williams & Wright, 2007).

We are aware the Canadian population is ageing. “The proportion of Canadians aged 65 and over more than doubled between 1881 and 1981, rising from 4.1 percent to 9.7 percent. Since then, the percentage of the population aged 65 and over has increased steadily, to reach 12.5 percent of the population in 2000” (Kirby & LeBreton, 2002). This calls for actions in the future to create more inclusive communities which support a healthy lifestyle for seniors. Proactive action needs to be taken now as a precaution for the future. Along with increased senior populations, a younger population is growing as well, including the many immigrants whom Canada welcomes every year.

“Car-dominated transport, reduced opportunities for physical activity, increased fast-food availability, and lack of social connection are all implicated. As a result, health professionals increasingly recognise the importance of the built environment indirectly affecting people’s health” (Kent & Thompson, 2014). According to Kent and Thompson, the built environment can address health in three ways – physical activity, community interaction and accessibility to healthy food. This research addresses the integration of these three. One of the most visible examples of how urban form impacts activities are the urban spaces devoted to supporting mobility. “Although a roadway widening may improve vehicular flow, it also can reduce the space allocated to non-motorists, reduce
streetscape amenities, and increase hazards associated with higher vehicle travel speeds” (L. D. L. Frank & Engelke, 2001).

2.2 Definitions and Frameworks
For clarity in the following sections, a few concepts need to be explored and defined.

Health:

The definition of health used here is the one used by WHO – “Health is defined as the physical, social and mental well-being of an individual and not only the absence of disease”. Therefore, incorporating all these factors of health in the new framework is necessary.

Public Health is defined as “…the organised efforts of society to keep people healthy and prevent injury, illness and premature death. It is a combination of programs, services and policies that protect and promote the health of all Canadians” (PHAC).

To address the concept of public health completely, I have identified four factors with reference to an on-going development project (New Monaco Project) which has been addressed later in this section. Public health has four factors to it as described in Table A.1. Physical well-being is the most common factor that comes to mind when thinking about healthy lifestyles and active living. But there are other three additional factors which need to be discussed when designing for a healthy environment. They are social well-being, mental well-being and spiritual well-being.

Physical well-being consists of providing for everyone’s daily requirements of commuting, work and recreation.

Social and mental well-being is connected with the factor of social interaction which contributes to relieving stress and avoiding depression in all age-groups. These components are further explored in Chapter 4.
Spiritual well-being is somewhat difficult to address in this research since this research concentrates on the physical setting, and therefore the focus will be primarily on the physical, social and mental dimensions of health.

**Built Environment:**

Health Canada defines the built environment as “…part of our physical surroundings that includes the buildings, parks, schools, road systems, and other infrastructure that we encounter in our daily lives” (Health Canada, Division of Childhood and Adolescence 2002, Natural and Built Environments). This includes land use patterns, density allocations, street design, transit systems, food systems, and much more. A similar definition is provided by PHSA at the start of their toolkit (Healthy Built Environment Linkages Toolkit). “The phrase ‘built environment’ refers to the human-made or modified physical surroundings in which people live, work and play. These places and spaces include our homes, communities, schools, workplaces, parks/recreations areas, business areas and transportation systems, and vary in size from large-scale urban areas to smaller rural developments” (PHSA, 2014). As we know communication and collaboration are extremely important in achieving goals for the community, this is a perfect example provided by Williams & Wright (2007) where there needs to be a collaboration between all levels of government to create a healthy built environment.

“Land developments and transportation investments interact with each other and collectively have a tremendous influence in shaping the built environment…the location of new land development impacts where the transportation investments are made. The nature of that land development, whether it is transit- and pedestrian-friendly versus auto- oriented, determines the feasibility of transportation scenarios. In order for alternative transportation to be possible, it needs to be supported by both land use and transportation infrastructure decisions” (Williams & Wright, 2007).

**Local Government Leadership:**
There are several existing healthy community toolkits which provide the professional world with guidelines for creating healthier neighbourhoods. The issue identified by some of the existing guides is the lack of involvement by the local governments in the process of building healthier communities. While non-profit organisations can promote healthy communities, support and involvement from the local government are important to successful healthy community development as they govern many aspects of the urban form that impact health outcomes.

**Health Institution Involvement:**

Health institutions are a part of this process. As defined by PHAC, it has to be a combined effort from all levels of society and health institutions to prevent individuals from getting sick as well as for creating awareness among individuals. As noted by Dr Patricia Daly, Chief Medical Officer from Vancouver Coastal Health, “Addressing the social determinants of health to ensure the best health possible for all people in our communities is a shared responsibility. While the health care system is designed to treat people once they are sick, it requires a collaborative effort to address the factors which keep us well. No one sector, agency or public can tackle these issues alone but we must collectively ensure that all levels of public policy support healthy lives” (October, 2008).

Socio-economic conditions play an important role in the aspect of healthy living. These include the distribution of certain resources which are dependent on social and economic policies. However, since this thesis is focused on urban form, the socio-economic conditions and policies related to health outcomes are not explored in depth.

**Social Determinants of Health (SDOH):**

As per defining the social determinants of health, the Centers for Disease Control and Prevention have described it as, “Social determinants of health are economic and social conditions that influence the health of people and communities. These conditions are shaped by the amount of money, power, and resources that people have, all of which are influenced by policy choices” (Centers for Disease Control and Prevention). “At every stage of life, health is determined by complex interactions between social and economic factors, the physical environment and individual behaviour. These factors are
referred to as 'determinants of health'. They do not exist in isolation from each other. It is the combined influence of the determinants of health that determines health status” (Williams & Wright, 2007).

SDOH influences the health of the community in various ways. “Extreme differences in income and wealth, for example, have negative health consequences for those who are living in poverty and these effects are magnified when these people are congregated in poor regions. In contrast, those who are well-off and living in well-off regions have better overall health” (Canada’s Public Health Leader). This variation among individuals and groups due to income is referred to as the ‘social gradient’. “The social gradient illustrates that higher income levels result in better health outcomes, where lower income levels result in poorer health outcomes. Even in affluent countries such as Canada the social gradient exists but is often masked by the high levels of overall population health status” (Mikkonen & Raphael, 2010). According to Canada’s Public Health Leader social gradient represents the importance of income in terms of gaining social determinants of health (food, housing, recreational activities) and not only the effects of income on the health of the community.

It is a vital aspect of healthy living. People with higher wages have more access to healthy options and medication while the lower income groups can struggle to meet basic needs. “At all levels of income, health and illness follow the social gradient: the lower the socioeconomic position, the worse the health” (Marmot, et al, 2008). All factors which lead to healthy living are interconnected. Variances in income can lead to stress, unhealthy but cheaper food options and similar socioeconomic scenarios which can affect a person’s mental well-being tangibly and intangibly (Raphael, 2004).

The factors that are included in the SDOH are (Figure 5) include income and income distribution, education, unemployment and job security, employment and working conditions, early childhood development, food security, housing, social exclusion, social safety network, health services, Aboriginal status, gender, race, and disability. These fourteen factors of SDOH have been provided by the Canada’s Public Health Leader (CPHA).
Diversity is another concern and is an important factor for the development of a healthy community. It depends on the socio-economic inequalities in planning which affects neighbourhood planning (Odoi A et al, 2005).

All of the factors identified above can influence our daily activities which in turns impacts our health. SDOH performance can be impacted by planning for a community such as a diversity of land-use in an area or provisions of grocery stores at walkable distances. Not every land use can be incorporated in every area, but greater diversity can be planned and designed for, thereby creating better environments for the community.

Figure 5: Social Determinants of Health Conceptual Framework\textsuperscript{5}

\textsuperscript{5} WHO, 2007
Figure 6: Estimates of how each of the five major determinants influences population health.

Figure 6 includes the five major determinants that influence public health, displaying the strongest social characteristics influencers of the community.

The CMA (Canadian Medical Association) believes that “the social determinants of health can have a larger impact on individual and population health than the health care system”. “Any actions to improve health and tackle health inequity must address the social determinants and their impact on daily life of the community” (Canada’s Public Health Leader). (Figure 7)

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6 Centres for Disease Control and Prevention, 2007
Dennis Raphael, in his book *Social Determinants of Health: Canadian Perspectives* mentions that Canadians concentrate attention mainly on income, especially poverty and its impacts on health. By which he means that people with more income can have a better lifestyle, with better living conditions including a secure home. These factors contribute to the well-being of individuals. However, he argues that little attention is given to the social, cultural and political exclusions of individuals from mainstream society. By this, he means that not much effort is put into discussing societal exclusions within a community. In this paper, I am not concentrating on social inclusion by itself, but it is important to recognise that urban form can have an impact on social patterns and as such, it plays a role in planning for community health and mental well-being.

The study of social determinants deals with two main questions, “What are the societal factors (e.g., income, education, employment conditions, etc.) that lead to health inequalities?” and “what are the societal forces (e.g., economic, social and political policies, etc.) that shape the quality of these societal factors” (Raphael, 2004). As

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7 CMA, July 2013
mentioned earlier in this paper, other Canadian organisations such as the Ottawa Charter and Health Canada have various other determinants of health which can also be included as social determinants. For this paper, because of its focus on urban form, the determinants that will be listed as major categories include housing, education, food, income, ecosystems, equity, employment, health services, and several others.

2.3 Existing Disciplines and Toolkits

Similar to SDOH, there are two other disciplines which have been considered for the purpose of this research. They are the frameworks related to public health and urban development (Thompson S and Kent J 2014) (Appendix A). The first framework is that of public health, including the physical, social and mental well-being of the individual. The second is a framework for urban development which includes land-use patterns, employment, open and green spaces.

A number of studies have been completed on individual planning and design factors that affect health. For example, the city of Hamilton, ON, focused on three health outcomes (chronic conditions, health status, and emotional distress) in relation to neighbourhood planning. The dominance of physical environmental concerns arose from the industrial nature of Hamilton (Wilson, et al, 2003). This example is further explored in the following section. A similar study was carried out in Toronto in relation to chronic diseases and design (Ronald G et al, 2015). Other papers that relate to planning, address either one or two issues such as transit, population density, and daily physical activity in the community. The trend in most of the studies referenced here is the connection of health components of to the level of physical activity in communities. However, no framework has been identified that speaks the whole concept of health protection and leads to designing new neighbourhoods or improving existing neighbourhoods. Here, we propose such a framework and then test it as an evaluation tool for two different neighbourhoods. The categories created in the suggested framework include active transportation, housing, land-use, zoning, economic opportunities, and food security.
This section is focused on exploring how existing toolkits have been used in certain Canadian contexts. Each type of study focused on one or more factors that affect the health of the community on a whole but not all the factors that have been incorporated into the new framework. Canadian examples include Montreal and Hamilton which have been progressive in addressing the concept of healthy design. The existing frameworks discussed here are the toolkits provided by LEED-ND, Healthy Built Environment Linkages Toolkit created by PHSA and a non-Canadian toolkit from Australia called Healthy Active by Design.

**Healthy Built Environment Toolkit:**

The Healthy Built Environment Toolkit was created in collaboration with a number of advisory groups such as the Neighbourhood Design and Transportation, the Natural Environment, a Food System and a Housing Advisory group in BC. The advisory groups were comprised of professionals such as planners, academics and health professionals who collaborated to create this document. The aim of this document was to create awareness and help in the decision-making processes that are ongoing in BC municipalities. The methodology used was initial literature review along with looking at existing planning principles which work towards the goal of this paper.
As outlined in Figure 8 above, the focus in this framework has been put on the five factors – Healthy Neighbourhood Design, Healthy Transportation Networks, Healthy Food Systems, Healthy Natural Environments, and Healthy Housing. These factors have been analysed via literature reviews and additional analysis to contribute towards creating the Toolkit. Healthy Neighbourhood Design has been considered as one of the factors for the Toolkit as well as other factors (Healthy Transportation Networks, Healthy Food Systems, Healthy Natural Environments, and Healthy Housing). All of these factors are

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8 (PHSA, 2014)
addressed as components of health and design for existing and future neighbourhood plans.

The analysis consists of a grading system and not a general rating system. Not having a typical grading system has made this toolkit unique. It addresses each element according to its workability in a certain context which makes it more evidence based. Figure 8 is the final legend that was adopted to analyse the evidence. This made it simpler than having an extensive list as a legend.

![Grading Evidence Legend](image)

Figure 9: Grading Evidence Legend\(^9\)

Figure 10: Summary of Legend Approved for the Toolkit\(^{10}\)

\(^9\) (PHSA, 2014)
\(^{10}\) (Design, 2014)
In the HBE Toolkit, each factor includes a vision and several principles for planning healthier communities. It is important to remember while planning or assessing a certain neighbourhood or subdivision that these factors are “general” planning principles and not tailored to a specific community. This thesis endeavours to help bridge the gap between planning principles and specific design guidelines.

11 (PHSA, 2014)
LEED ND:

This framework has heavily influenced this research with its high level of design specificity. LEED-ND’s sustainable neighbourhood elements cater to not only whole neighbourhoods but also parts of neighbourhoods. The main benefit of this toolkit is that it can identify rather quickly, what is needed to build a healthy neighbourhood. The Citizen’s Guide to LEED-ND defines a neighbourhood as “more than territory within a boundary drawn on a map. At best, it is a place with its own unique character and function, where people can live, work, shop, and interact with their neighbours. The most sustainable neighbourhoods tend to exhibit high levels of walkability, a sense of place, social cohesion and stability, and neighbourhood resiliency amidst changing economic and sociopolitical conditions” (Welch, Benfield, & Raimi, 2011).

Figure 12: Sustainability described by LEED

Due to the nature of the LEED certification being an expensive solution, we often see developers follow a few elements of LEED-ND, which are often used to increase sales promotion. Criticisms have been levelled at the LEED-ND due to the inconsistent relationship between the actions required and the recognition for those actions given in the rating system. Another disadvantage identified is the adaptation of the checklist to smaller communities like Nanaimo, where many of the factors are not applicable due to a context of lower density and more suburban urban form. In response to these criticisms,

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12 (Welch et al., 2011)
the toolkit proposed in this thesis aims to help bridge the gap between the general nature of the Healthy Built Environment Linkages Toolkit and the overly detailed or prescriptive toolkit provided by LEED-ND.

![Diagram of LEED Certification Process](image)

**Figure 13: Process for LEED Certification**

**Healthy Active by Design:**

The second checklist that has influenced this research is the Healthy Active by Design Checklist (HAbD). This Australian toolkit was founded by the Australian Heart Foundation over a span of 20 years with a vision to help urban planners and other professionals design walking communities. “The Heart Foundation works to create healthy neighbourhoods that are planned to promote walking, cycling, physical activity and public life. Healthy and Livable neighbourhoods are places where people can easily walk, or cycle to schools, employment, sports facilities, shops, green spaces, parks, and public transport. This means the residents have opportunities to be socially connected and live in neighbourhoods that provide health, economic and environmental benefits” (HAbD).

The seven components identified in this framework are; Public open space, Community facilities, Destinations, Buildings, Movement networks, Housing Diversity and Sense of Place. Each component is divided and discussed in a systematic style

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13 (Welch et al., 2011)
similar to the Healthy Built Environment Toolkit, including evidence of the linkages between health and urban form, case studies of best practices, a checklist for open space planning and design, and suggested policies, as noted in Figure 14.

Figure 14: Each Component being addressed in similar method

Figure 15: Example of one component with evidence (Public Open Space)

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14 HAbD Website
The HAbD checklist is at par with the LEED checklist in most ways. It is more detailed than the Healthy Built Environment toolkit with respect to what they want to see in the design of the city. The challenge with this checklist was the adaptability of the seven components to a city like Nanaimo. Like LEED-ND, it leans more towards higher density urban environments, while Nanaimo is more suburban.

PlanH and Other Existing Guidebooks:

PlanH has been a useful tool in understanding the health perspectives within the Canadian planning context. With examples taken from a BC planning context, it has helped inform the perspective on initiatives related to planning for health performance. “PlanH supports local government engagement and partnerships across sectors for creating healthier communities and provides learning opportunities, resources, and leading-edge practices for collaborative local action” (PHAC, 2014). It was implemented by BCHC (BC Healthy Communities Society) a not-for-profit organisation in 2005.

Did you know...

- Only 58% of adults in B.C. get the recommended 30 minutes of physical activity per day.
- The most recent Canadian Health Measures Survey found that only 7% of Canadian children and youth get the recommended amount of physical activity.
- The risk of obesity goes up 6% for every hour spent in a car each day, while the risk of obesity goes down by almost 5% for every kilometre walked each day.
- Young teenagers are 2.5 times more likely to walk if there is a recreation destination within one kilometre of their home.
- Studies show sedentary Canadians are more likely to suffer from depression than physically active Canadians.

Figure 16: Evidence in BC

There are current health statistics as well as direct links provided on the PlanH website to policies, bylaws and guidelines for various cities and towns which have similar initiatives for providing a healthy lifestyle for their communities. While reviewing these policies and extracts from bylaws, it was evident that the application of a healthy lifestyle initiative has been segregated. In order for this toolkit to be an effective solution for

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15 HAbD Website
16 PlanH Website
communities, it has to be considered from a macro level as well as addressing details for each component.

![Figure 17: Extract from the Healthy Communities Guidebook](image)

**Creating Healthy Communities Guidebook:**

Another existing toolkit with respect to having a BC context is the *Creating Healthy Communities Guidebook* which informs this research about the process to be taken to create healthy communities. It addresses the factors that need to be catered to when trying to design such communities. Similar to PlanH, it includes recent and relevant policies adopted by various cities and local government in BC in achieving similar goals. A criticism of this tool is that the process seems to be somewhat fragmented and a holistic approach is missing. It provides the examples in terms of BC context but an ideal framework or city which complies with the factors of healthy living is missing.

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17 (Miro, Alice and Sui, 2009)
Health Impact Assessment:

A tool which is often used for assessment is the *Health Impact Assessment* process with the help of guidebooks which concentrate on land-use planning and transit activities. This is the Guidebook used for Metro Vancouver with respect to maintaining the BC context for this research. This is a great tool for assessing communities as it is designed more for assessment than as a design guide. Planners have been using this tool to evaluate neighbourhood level plans. The assessment is qualitative in nature and there are not many numerical values or statistics provided to look for in communities. However, it can be quantitative in certain aspects when used appropriately by skilled professionals which make it similar to the LEED-ND checklist. HIA typically covers the aspect of physical health as the other factors are hard to address in many ways.

Figure 18: Linkage between Activities and Health Outcomes

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18 (ti, 2014)
HIA is a lengthy process and requires an adequate amount of time to use it to access neighbourhoods. Although it has been identified here for reference, it has not been central to the scope of this research.

**Sustainability:**

The focus of sustainability includes attention to environment, community, and economics. A sustainable design might prioritise environmental or economic objectives and therefore, not be as effective in providing a healthy life for individuals as desired. A sustainable framework is a part of a healthy community framework (Figure 19), however, it has many goals versus a healthy community framework that focuses on human health. “The language of ‘sustainability’ appears widely in North American urban development is a course (Berke & Conroy, 2000; Grant, 1994a). A study of suburban practice, however, shows that these ideals may have limited impact: even proponents of the concepts acknowledge significant challenges to implementing the vision” (Grant, 2009).

A sustainable community framework mainly consists of issues relating to transportation, energy conservation, and economics, which are the physical aspects of development (Table A.2). In contrast, a healthy development framework would be a combination of two frameworks – a framework of Public Health and that of Urban Development. They also can also include intangible factors (Table A.1) such as the emotional and spiritual well-being of communities which are impacted by the living environment.
Smart Growth and other principles:

Smart Growth and New Urbanist principles have been developed over the past decades to address sustainable growth goals in cities. The principles are reviewed below as they present an important survey of key principles and patterns where sustainable and healthy community goals and practices overlap.

Smart Growth Principles

- **Mix Land Uses** – “Mixed land uses can contribute economic benefits. For example, siting commercial areas close to residential areas can raise property values, helping increase local tax receipts. Meanwhile, businesses recognise the benefits associated with locations that attract more people, increasing economic activity” (Smart Growth Principles).

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19 (Ronald G et al, 2015)

• **Take Advantage of Compact Building Design** – Saves transportation costs and provides a variety of transit options. “Research has shown that well-designed, compact New Urbanist communities that include a variety of house sizes and types command a higher market value on a per-square-foot basis than do those in adjacent conventional suburban developments. Increasing numbers of developments are successfully integrating compact design into community building efforts. This is happening despite current zoning practices that discourage compact design – such as those that require minimum lot sizes or prohibit multi-family or attached housing – and other barriers, such as negative perceptions of ‘higher density’ development” (Smart Growth Principles).
• **Create a Range of Housing Opportunities and Choices** – “Providing quality housing for people of all income levels is an integral component in any smart growth strategy. Housing is a critical part of the way communities grow because it constitutes a significant share of new construction and development” (Smart Growth Principles).

• **Create Walkable Neighbourhoods** – “…walkable communities make pedestrian activity possible, thus expanding transportation options, and creating a streetscape for a range of users – pedestrians, bicyclists, transit riders, and drivers. To foster walkability, communities must mix land uses and build compactly, as well as ensure safe and inviting pedestrian corridors” (Smart Growth Principles).
• Foster Distinctive, Attractive Communities with a Strong Sense of Place

• Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas – “Open space preservation supports smart growth goals by bolstering local economies, preserving critical environmental areas, improving community quality of life, and guiding new growth into existing communities” (Smart Growth Principles).
• **Strengthen and Direct Development towards Existing Communities** – “Smart growth directs development towards existing communities already served by infrastructure, seeking to utilise the resources that existing neighbourhoods offer, and conserve open space and irreplaceable natural resources on the urban fringe. Development in existing neighbourhoods also represents an approach to growth that can be more cost-effective and improves the quality of life” (Smart Growth Principles).

• **Provide a Variety of Transportation Choices** – “In response, communities are beginning to implement new approaches to transportation planning, such as better coordinating land use and transportation; increasing the availability of high-quality transit service; creating redundancy, resiliency and connectivity within their road networks; and ensuring connectivity between pedestrian, bike, transit,
and road facilities. In short, they are coupling a multi-modal approach to transportation with supportive development patterns, to create a variety of transportation options” (Smart Growth Principles).

- **Make Development Decisions Predictable, Fair and Cost Effective**

- **Encourage Community and Stakeholder Collaboration in Development Decisions** – “Key actions in encouraging collaboration include developing an inclusionary process and a common understanding among diverse stakeholders, using effective and appropriate communication techniques, and working with local authorities” (Smart Growth Principles).
Smart Growth and New Urbanist principles correctly state the relationship between factors of health, planning and urban design. The potential for these principles to turn into policies exists and has been adopted in many Canadian cities. These principles are close to achieving the aspect of health in planning.

Examples of toolkits from specific cities:

Montreal, Quebec:

Quebec was dealing with significant income and poverty issues which motivated them as a province to create objectives relating to public health related to city planning. Six strategies were identified for increasing health, including, developing personal skills, creating supportive environments, building healthy public policy, working with high-risk groups, poverty reduction, and improving life conditions (Raphael, 2004). This plan was completed in 1992 and later developed into the National Health Program which includes environmental health, domains of chronic diseases and workplace health to name a few.

Hamilton, Ontario:

Another example in the Canadian context is the city of Hamilton, ON.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Characteristics of survey neighbourhoods in Hamilton, Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighbourhood (1996 census population)</td>
<td>Characteristics</td>
</tr>
<tr>
<td>Downtown Core (24523)</td>
<td>High proportion of recent immigrants and a non-English or French speaking population, high levels of mobility, low levels of education and income, high unemployment, and a high proportion of visible minorities</td>
</tr>
<tr>
<td>Low income</td>
<td></td>
</tr>
<tr>
<td>High diversity</td>
<td></td>
</tr>
<tr>
<td>Northeast Industrial (12135)</td>
<td>Lies adjacent to the city’s industrial area, contains a low recent immigrant population, low levels of education and income, fairly high unemployment, and a small visible minority population</td>
</tr>
<tr>
<td>Low income</td>
<td></td>
</tr>
<tr>
<td>Low diversity</td>
<td></td>
</tr>
<tr>
<td>Chedoke-Kirkendall (10403)</td>
<td>Moderately high proportion of recent immigrants, a mainly English or French speaking population, high levels of education and income, low unemployment, a moderate visible minority population presence, and high income inequality</td>
</tr>
<tr>
<td>High income</td>
<td></td>
</tr>
<tr>
<td>High diversity</td>
<td></td>
</tr>
<tr>
<td>Southwest Mountain (15917)</td>
<td>Located within a rapidly expanding suburban location, fewer recent immigrants, high education and income levels, low unemployment, and a large visible minority population most of whom are able to speak either English or French</td>
</tr>
<tr>
<td>High income</td>
<td></td>
</tr>
<tr>
<td>Low diversity</td>
<td></td>
</tr>
</tbody>
</table>

Figure 20: Neighbourhood survey characteristics in Hamilton, ON

21(Wilson et al., 2004)
The goal of the study conducted in Hamilton, ON was “To investigate the association between perceptions of neighbourhood physical and social characteristics and three health outcomes (self-assessed health status, chronic conditions, and emotional distress)” (Wilson et al., 2004). The outcome of this study highlighted the link between health and design; “… (The) results demonstrate the importance of neighbourhood perceptions as a determinant of health, as well as conventional factors such as low income, lifestyle, and age. The dominance of physical environmental concerns may have arisen from the industrial nature of Hamilton, but this result merits further investigation” (Wilson et al., 2004).

The method used for this study was a cross-sectional health survey. The survey was conducted in various neighbourhood types in Hamilton. With the help of this survey, they were able to determine and identify the difference in health outcomes in diverse neighbourhood settings. The Downtown core showed more emotional distress with a higher number of social dislikes whereas it performed well in terms of chronic diseases. Compared to what was analysed, the physical setting of the neighbourhoods was given priority.
New Monaco Neighbourhood Development Project:

The purpose of including this project is that it is being developed in Peachland, BC and has been important in providing the base concepts around health (physical, social, mental and emotional). This project is in the development phase and aims to be the healthiest neighbourhood in Canada once completed. “The premise behind this goal is that a strong future for healthcare and well-being in Canada is dependent on not solely focusing on acute care priorities, but also including a priority on disease prevention – through healthy lifestyles and communities” (Jensen, 2013). The main focus here was to design a community which supports and promotes a healthy lifestyle. This is the study

22 (Wilson et al., 2004)
which gave the two base frameworks (Framework for Public health and Urban development – Appendix A) to work with for further research in this paper.

**Spatial Design Considerations**

Creating a healthy community involves integrating the priorities of health for each age group into the physical design of every part of the community.

The following provides ideas for how to design each element of the community to optimize the health of all who live and work in the neighbourhood.

![Glimpse of the Conceptual Design](image)

**Figure 22: Glimpse of the Conceptual Design**

Although this project is still in progress it captures the entire concept of creating a healthy neighbourhood community. The drawback is that it is still under construction and cannot show performance results yet. The project includes a health strategy with four cornerstones:

- Providing an integrated healthcare clinic for residents;
- Designing the neighbourhood to support a healthy lifestyle;
- Creating a culture of healthy living in the neighbourhood; and
- Monitoring performance over time and pursuing refinements.

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23 (Jensen, 2013)
This project is unique because of the private sector developer’s commitment to creating a healthy community in contrast to the public sector toolkits explored earlier. The awareness of the necessity of good design in the neighbourhood is visible in this project.

As noted earlier, the framework and toolkit proposed in this thesis are drawn from many of the aspects of the frameworks, toolkits and examples described above. This tool aims to find a hybrid framework that addresses areas of concern in line with many other frameworks but focuses on elements that will work within a relatively suburban community and that can be readily used by both professionals and laypersons.
CHAPTER 3:

Methodology

This chapter explains the type of approach taken to further develop the integrated framework. It provides an overview of the neighbourhood assessment framework and speaks to the context in which it will perform. According to the sub-questions listed in Chapter 1, this chapter describes how each question is answered and analysed in order to address the main research question for this paper. The worldview used for this research is described as well in the following sections. Each sub-question is addressed in three parts. First, how the question has been answered i.e. by using what methods; second, how it has been analysed to inform the new framework, and lastly, the expected outcome and what has been achieved with this research.

3.1 Research Approach

The research approach adopted is pragmatic in nature. A pragmatic worldview focuses on exploring what has been done and looking for solutions for what is not working well. Section 2.3 provides an understanding on the workability of existing toolkits in various contexts.

The use of secondary data is used to compare the physical aspects of the built environments from the point of view of the existing toolkits in selected neighbourhoods. However, the existing toolkits may not apply easily to every setting. This means that further amendments may be required to the toolkit, to make it more applicable to any unique setting. The method used here is mainly secondary data collection and analysing that data to create the integrated framework for planning healthy environments.

The evaluation method involves creating metrics using Microsoft Excel which need to be addressed in order to determine a neighbourhood performance level that will deliver a healthy community. This research has a mixed-method approach - involving
both qualitative and quantitative methods (statistics) of research. The mixed-method approach is outlined further in Chapter 4.

### 3.2 Research Design

This research is looking at existing neighbourhoods in Nanaimo, BC as a venue to develop and test the new system. The neighbourhoods selected here are the Old City which consists of a traditional design characteristic, and Dover Bay which is a conventional suburban neighbourhood. Both neighbourhoods are accessible by public transit, have access to an almost equal number of schools, green spaces/parks, shopping areas and consist of varied demographics. The neighbourhoods have been explored based on available secondary data such as current population, the health of the population, and income groups. The data has been obtained via Census Canada. Guidelines relating to the design of the neighbourhoods have been obtained from the City website.
Figure 23: City of Nanaimo Neighbourhoods\textsuperscript{24}

Figure 24: Traditional Neighbourhood Type - Old City, Nanaimo\textsuperscript{25}

Figure 25: Conventional Suburban Neighbourhood - Dover Bay, Nanaimo\textsuperscript{26}

\textsuperscript{24} City of Nanaimo
\textsuperscript{25} City of Nanaimo
\textsuperscript{26} City of Nanaimo
3.3 Data Gathering Methods

Each sub-question is addressed in three parts. First, the method of data collection has been discussed for each sub-question. Second, the analysis of the collected data is discussed. Lastly, the expected outcome for each sub-question has been stated. These sub-questions intend to lead to answering the main research question for this paper.

Sub-question 1: How is health impacted by planning and design?

This question has been answered through literature review which has addressed the concepts of health and community development, some data linking urban form and healthy lifestyles, as well as a range of Healthy Community toolkits and frameworks developed by various organisations. This contributes towards understanding the broader perspective of what is required to creating healthier built environments.

The data collected has been analysed with the help of evaluation matrices (Microsoft Excel).

Outcome: The aim of this first step is to identify the main aspects of the built environment that impact the key dimensions of health. This has been discussed further in Chapter 4 when addressing each component involved in creating healthier built environments.

Sub-question 2: What other planning and design tools/systems exist those are relevant to this project? What are their strengths and weaknesses and what lessons can be learned from them to inform the creation of a revised planning and design tool?

This question has been answered by reviewing existing principles and toolkits which have been proposed by different health institutions (WHO, Public Health Agency of Canada, Canadian Medical Association). The secondary data sources had available statistics from Statistics Canada, Public Health Association that were obtained from these organisations and have contributed towards informing an integrated tool.
For example, the social health determinants proposed by Public Health Agency of Canada are, (PHSA)

- Income and Social Status
- Social Support Networks
- Education and Literacy
- Employment/Working Conditions
- Social Environments
- Physical Environments
- Personal Health Practices and Coping Skills
- Healthy Child Development
- Biology and Genetic Endowment
- Health Services
- Gender
- Culture

The data on physical, social and mental health has been considered as primary data in order to form the new assessment framework for testing the selected neighbourhoods in Nanaimo. The data collected has been analysed with the help of existing evaluation software like Microsoft Word and Microsoft Excel (Appendix D). Common, repetitive principles and factors from various toolkits have been combined and considered as evidence in the integrated toolkit.

Outcome: This step focused on summarising the existing tools and their analysis with respect to their usability and relevance to more detailed factors for planning and designing healthier neighbourhood communities.

Sub-question 3: What are the aspects of neighbourhoods and communities that should be addressed in order to contribute to a healthier lifestyle and what would the elements of an effective tool be to enhance the implementation of healthy community planning and design principles in BC?

The secondary data used to address this issue includes population demographics of each neighbourhood, open space ratios, and the number of people suffering from
different health conditions. These were obtained from various sources including Statistics Canada, OCP, and Local Health Area Profile.

The data collected from this step is qualitative and quantitative in nature and has been analysed using Microsoft Word and Microsoft Excel again with listing the common principles and statistics used in BC toolkits.

Outcome: The outcome of this step has summarised planning principles, targets and potential standards which can be used to optimise health performances through design and planning. This has been discussed further in detail in the following chapters.

**Sub-question 4:** What are the existing design guidelines typically applied in the development of traditional neighbourhoods and those of conventional neighbourhoods and how do they relate to a healthy community planning and design framework?

The data on conventional and traditional neighbourhood design has been obtained through academic papers and literature reviews. This also included field research in terms of design such as land-use patterns, the width of sidewalks or proximity to certain areas, the number of transit stops, access to public transit, the number of intersections to name a few. This process has been used to further deduce the design guidelines for those neighbourhoods. Census data has been used to measure health and design components such as diversity in income and age groups to understand the socio-economic and employment conditions in the neighbourhood areas.

The data collected from this step has been analysed using Microsoft Excel and Microsoft Word for understanding diversity in terms of income and housing. Census data acts as a source to identify the same for Nanaimo. Appendix D provides with columns which identify the source and evidence for respective factors which have later been combined to create the integrated framework.

Outcome: The result of this step has helped summarise the planning and design requirements that are applied to traditional neighbourhoods versus conventional neighbourhoods based on the issues relevant to health.
**Sub-question 5:** How does the new design framework perform in comparison to the conventional neighbourhood or traditional neighbourhood?

The new healthy design framework has been generated using the analysed literature reviews, analysed secondary data from various health organisations along with the quantitative and qualitative analysis conducted through field research in the selected neighbourhoods. This helps in understanding various design factors that exist such as the width of sidewalks, bike lanes, and natural areas around residences. It also highlights what more needs to be addressed or what is missed to create healthier built environments.

The data collected from this step is again both qualitative and quantitative in nature and has been analysed using Microsoft Word and Microsoft Excel. Based on the proposed combined/integrated healthy development toolkit the neighbourhoods have been assessed. Microsoft Excel is used for the assessment as well to check their performance which is easy to understand for the community as well. The neighbourhoods are assessed simply based on how they perform with respect to the elements outlined in the integrated toolkit.

Outcome: The expected result of this step is to have a comparative assessment of a conventional and a traditional neighbourhood in Nanaimo based on the new proposed health and design framework. It has been discussed further in Chapter 5.

### 3.4 Data Analysis

The secondary data has been compiled and analysed using Microsoft Word and Excel. The informal discussions with professionals have mainly been for identifying how to adapt large setting frameworks to a smaller setting such as Nanaimo. The field research information has been recorded and transcribed again with the help of Microsoft Word and Excel.

A new rating system has been developed for the purpose of evaluating existing or upcoming neighbourhoods. It performs similar to existing frameworks like LEED-ND or HAbD but on a smaller scale. This aims to be used by both professionals and the
community to evaluate the neighbourhood’s relative support for a healthy lifestyle. The data from existing toolkits and frameworks have been considered as evidence for proposing the integrated framework. As the name suggests, it is ‘integrated’ because the proposed toolkit is created with reference to the existing frameworks in the context of BC. Microsoft Excel is used to address each factor with evidence and the source of that evidence (Appendix D). Later each factor has been altered to fit the context of Nanaimo and to make it easy for communities to read. This step has made the toolkit more concise in nature.

3.5 Ethics

The main focus for my paper is secondary data collection. I carried out a literature review of academic journals, articles, and existing health and design frameworks. No human interaction has taken place except for informal discussions with my supervisor and committee member. These discussions have not been recorded or transcribed. It was solely for the purpose of understanding various disciplines and application of the assessment framework. Therefore, no ethics approval was required to perform this research as no humans or animals were involved.

3.6 Challenges

Every research has its own challenges. Here are a few that were encountered during this research.

Secondary data collection and analysis is the main core of this research and since there is a significant amount of information available on the topic, it was challenging to organise a large amount of information explored and to structure it for an assessment, design or rating system. Another challenge was that of combining both the frameworks of public health (Table A.1) and of urban development (Table A.2) to create a new unified framework. To consider every factor in both these frameworks has been the most demanding part of this process. This was addressed with a literature review and analysis to understand what and how the factors of health and design can be combined to create this new framework. The literature review in Chapter 4 helps in addressing this factor in this research.
My lack of familiarity with Canadian cities could hinder the framework process but the gap has been filled in with the help of my supervisor and the company of my colleagues. Through coordination amongst the team, we have been able to address this concern sufficiently for this thesis. Further studies might be required to be done to better understand factors as complicated as the social diversity of the neighbourhood.

3.7 Expected Outcomes and Discussions

The integrated assessment tool aims to be used as an evaluation tool for both assessing how existing neighbourhoods support health and also how new neighbourhoods can be redesigned to perform better on health objectives. The planning and design aspect of the tool will help those directly involved in urban planning, architecture, and development to maximise health.

This research will be beneficial to communities in BC by providing them with a way to guide planning and development to achieve healthier environments. The tool can be incorporated by the local government into their existing land-use policies, zoning bylaws or OCPs. Due to constraints on time and resources, several types of research were not undertaken, including interviews with residents in the neighbourhoods studied, planning and health professionals or assessing more than the two neighbourhoods.
CHAPTER 4:

Results and Findings

The research highlighted a number of key factors (land-use, transit, food, housing, building design, economic opportunities and infrastructure) to consider in the design of a neighbourhood. To enhance the health of the community, and the following explores those factors further.

4.1 Factors for Proposed Framework

As mentioned earlier, the base two frameworks for the new toolkit are the framework for public health which includes physical, social, mental and spiritual well-being and urban development that includes land-use patterns, building design, active transportation, housing, food, economic opportunities, and infrastructure.

The focus in this section is on the framework of urban development and it addresses the factors in detail and proposes guidelines for development which address public health objectives. This section outlines how physical design and planning conditions influence the health and well-being of the community in various ways. Each urban form component has been addressed in three steps. The first is an introduction to the component relating it to public health (Part 1). The second step explores suggestions on how the current urban form component can be changed to improve public health (Part 2). Lastly (Part 3), observations are provided on the expected improvement to community health by following the guidelines from Part 2. Examples of best practices in planning and design have been referenced.
4.1.1 Land-use

Most parcels of land are zoned to regulate what activity can be conducted on it. The focus in this component of land-use will be zoning of plots/land that governs the various uses in the neighbourhood.

Part 1- Introduction

Land-use is a main component of planning because it defines the activities that can happen in a neighbourhood/city/town. Individual health is affected by what surrounds us and this depends on how designers provide for a health-promoting physical, social and economic environment. The “physical environment is an important determinant of health” (Barton, 2009) and that is the main focus of this research as it governs our daily activities (work, live and play).

It was in the planning era immediately after the industrial revolution when the concept of spatial planning was introduced for planning cities/towns/villages. “The idea of zoning and much of the seminal public health legislation came of age at approximately the same time in many American and European cities” (Maantay, 2001). At that time, sanitation and other forms of infrastructure were also beginning to be considered as essential for new developments or cities. Figure 25 illustrates how the determinants of health and well-being work in our daily settlements. This figure shows the relationship between urban ecosystems and the social determinants of health. “The built environment layer is the sphere where land use planning has a direct impact. A change in the structure of the built environment alters the natural environment and the social and economic environment” (Barton, 2009). Through zoning and modern day urban planning, the built environment is initially decided by land-use policies before anything is constructed. This impacts future development and affects the health of the community. The sequence in the Figure 26 works from the innermost ring (lifestyle) to the outer ring (the earth):

- “Lifestyle: physical activity – active travel and recreation, with an emphasis on the neighbourhood planning level.
- Lifestyle: diet – retail and local food production.
• Community: mental well-being – local social networks and neighbourhood planning.
• Local economy and income – the general influence of planning
• Activities, space, and networks (linking two spheres of the health map) – social inclusion and health inequalities, with a strategic planning emphasis
• The natural environment: air pollution – transport and urban form.
• Global eco-system: climate change – mitigation and adaptation” (Barton, 2009).

A lot of attention is given to transportation planning whereas the first aspect that needs to be addressed is land-use planning which then influences transportation systems and transit routes. Barton in his paper has specifically and correctly pointed out the health factors that directly or indirectly relate to land-use planning. “Social networks and social cohesion are affected by the broader environment. Unfortunately, urban planning came late to the recognition that zoning policy has a social impact. In many cities urban renewal dismantled long-standing social structures and organisation, paving the way for a range of social and health problems”(Adler & Newman, 2002).

In addition, the provision of green space such as parks and greenways is important for the creation of a healthy neighbourhood. There is a growing body of research that points to the benefits to our physical and mental well-being of both seeing and being in green space, especially natural landscapes. As such, a healthy neighbourhood needs to plan accessible greenspace throughout the neighbourhood.
“In practice, land-use planning proved to be one of the most important areas in which conceptions of sustainable development are contested. Here, more than anywhere else, it has become clear that trying to turn the broad consensual principles into policies, procedures, and decisions tend not to resolve conflicts, but to expose tensions inherent in the idea of sustainable development itself” (Godschalk, 2004).

Land use planning occurs at several scales of government. Figure 27 below, outlines what each level of government addresses with respect to land use planning. The process is usually divided into two parts – long range planning which is mainly at the regional level and Official Community Plans (OCPs) which are at the city level. For land-use, an OCP will usually be city or small-area level planning unless the size of the city is significant and therefore needs to be further divided into neighbourhoods, each with a neighbourhood plan. As seen in Figure 27 all levels of planning (local, provincial and

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27 Barton, 2009
national) need to address health in order to have the most effective outcome. In the case of Denver, it is addressed at the regional, city and small-area level.

![Figure 27: Illustrative ecology of plans for Denver Metropolitan Region](image)

For this paper, the concentration is on city-level authorities and the focus of its recommendations is at the neighbourhood scale. The integration of land uses is an important factor to create an inclusive neighbourhood plan. The primary planning tool to achieve this is through the zoning processes.

Zoning defines what uses can occur on any piece of land. “Planning policy in Canada has generally promoted mixed-uses, yet studies of practice suggest that relatively little mixed-use occurs” (Grant, 2002; Tomalty and Alexander, 2005; Grant & Perrott, 2011). There are various reasons for this such as… (cost, political climate, others) but an understanding of the health impacts of zoning may encourage more municipalities to pursue mixed-use zoning in more areas.

**Part 2 – Land use and health**

The impact of land-use planning on health is critical. Land-use planning is the way in which local governments define the uses that need to be provided for a healthy

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28 (Godschalk, 2004)
community including housing, types of housing, commercial activities and open spaces to name a few. The types of land use in a neighbourhood and their proximity to each other define how much people have to travel to meet their daily needs. It also can influence what mode they will use to travel, thereby impacting the amount of physical activity they get in a day, and possibly the nature of their social interactions.

Accessibility to clinics or availability of medications within a reasonable distance from where an elderly person lives is a factor which can be addressed through the planning and design process. It is not always possible to have access to a hospital within a walkable distance but to provide the neighbourhood with a nearby pharmacy is not difficult. The location of a clinic is a design solution that can be included in the bylaws for providing a pharmacy in a neighbourhood. The location of a clinic will be a decision of the local Health Authority. Due to cost constraints in the public health system, clinics are usually located to serve two to three neighbourhoods. To assess health performance, existing zoning can be analysed to ensure it supports necessary uses. For new developments, analysing rezoning applications could be another way to understand the probable future health performance of that area.

Part 3 – Potential health outcomes

With inclusive zoning processes, there can be support for space for all of the uses which will benefit the community in terms of having access to all of their daily needs in a relatively local area. This will increase walkability which is good for the health of the community along with reducing air and noise pollution. Inclusivity promotes more social equity amongst the community which reduces stress and promotes mental well-being. It could also promote local businesses to provide employment and services. Adequate green spaces and park areas could contribute towards the physical and mental well-being of the community.

Land-use and travel patterns are closely linked (Frumkin, 2002). Frumkin notes that “If the distances between them are great, and if roads are more available than sidewalks and paths, then people shift from walking and bicycling to driving” (Frumkin,
2002). Netherlands has 30% trips on bicycles and 18% by walking whereas the figures for England are 8% and 12% respectively. This is mainly due to provisions of proper infrastructure, sufficient public transit options and more importantly diversity in land-uses.

Compact neighbourhood design results in people walking or biking to their home or workplace. To achieve health objectives, the aim in community planning should be to pursue mixed-use zoning along with compact neighbourhood planning to achieve a healthy built environment. Compact cities and neighbourhoods promote walkability, more density, accessibility to daily needs, lesser air and noise pollution and a decent public transit system for far off places (Sallis et al., 2016). And this depends on how the land-uses are distributed in a town or city. “Both architectural features of communities (plazas, shops, recreation centres) and institutions (clubs, parent-teacher groups, churches, crime control) may promote social integration that in turn improves health. Policymakers accustomed to thinking about these investments in community infrastructure as costs may also want to consider them as benefits if they lower morbidity and mortality” (Adler & Newman, 2002). Density plays an important role in achieving the goals of compactness and diversity in land-use. As the density of Nanaimo is still growing, this may result in moving away from it being known as a suburban city to a denser and more urban one.

**Examples from other cities:**

Figure 28 below outlines several examples of objectives in community plans to support healthy community goals through land use planning.
4.1.2 Economic Opportunities

The component of economic development is considered to emphasise the importance of access to employment opportunities and having a secure income via planning solutions which as a result affects the health of the individual.

Part 1 - Introduction

As mentioned in chapter 2, income plays an important role in choices and opportunities to live a healthy life. In an integrated and inclusive neighbourhood with access to commercial space, economic opportunities will increase, thereby offering jobs and business opportunities. The economic aspects include access to jobs, shopping for daily needs including healthy food, and a potential reduction in the cost of transportation. “Health draws together all the main policy themes: it is closely tied to economic health because of the importance of jobs and income; it relies on the reduction of inequality,
building inclusive and supportive communities, and it helps drive the need for environmental sustainability” (Barton, 2009).

A comparison study was done between major Canadian cities, based on data from Statistics Canada, including Ottawa, Toronto, Winnipeg, Calgary, and Vancouver. Amongst these cities, Montreal performed comparatively low (as described in chapter 2) in terms of poorest households, lowest life expectancy in a city and significant socio-economic discrepancies (Raphael, 2004). The link between income and health can be divided into two types; “those pertaining to absolute income per se and those pertaining to relative inequality of income” (Raphael, 2004). Inequality of income is based on many issues including gender inequality and the difference between skilled or unskilled labour.

For those experiencing the first type, possibly linked to unemployment or homelessness, the results can be inadequate housing, food or healthcare.

The theories that connect inequality of income in an area to health do so through arguing that there is a chain reaction, where income inequality leads to social inequality resulting in stress on an individual’s mental well-being. This then reduces social cohesion. It not only affects the mental and emotional well-being of an individual but also can result in adverse physical conditions. “Socioeconomic status (SES), whether assessed by income, education, or occupation, is linked to a wide range of health problems, including low birth weight, cardiovascular disease, hypertension, arthritis, diabetes, and cancer. Lower socioeconomic status is associated with higher mortality, and the greatest disparities occur in middle adulthood (ages 45–65)” (Adler & Newman, 2002).

The components of SES are three-fold – education, income and occupation. Early childhood education is important in developing the minds of children and leading them towards healthy living. Higher levels of education are also associated with better adult health outcomes. Income is the second component for SES. Income is important to provide for better education, healthcare, housing, good food and other recreational
activities. It is not that individuals with a good income do not suffer from health problems, but typically the reasons for their health problems are different. Individuals with lower income can suffer due to the inadequacy of food and other basics, while people with higher income can suffer from physical problems such as obesity due to excess of food and a lack of physical activity. But this is always not the case. Stress is another condition that everyone in the current generation suffers from. It can be for multiple reasons – work related stress, unemployment or running a business. “A randomised trial in Canada for single parents on income assistance who began working full time shows how complex the effects can be. These monetary supplements did help to increase employment and income in the experimental group. To date, no health data have been reported on the adults, but children in the experimental group who were three to eight years old at baseline were subsequently reported to have fewer health problems and better cognitive functioning.” (Adler & Newman, 2002).

Occupation is the third component of the SES framework. Although it is not explored here in depth, one’s workplace affects one’s physical and emotional well-being. This is further explored in Section 4.3.5 of this paper in the form of building design. It is also important when thinking about job opportunities that we also consider economic issues for seniors and people with disabilities. In many cases, their health will be impacted by their ability to have job security and a healthy workplace where they can progress and earn a living by themselves in a manner that meets their needs. Equal job opportunities to give them a secure and healthy life need to be made available. For people with disabilities, there are non-profits that can take part in helping them to lead a normal life.

**Part 2 – Economic policy and health**

Quebec has been doing extensive work in the areas of income and health. With respect to Montreal, in 2002 the government of Quebec adopted a Bill 112 which was a law to combat poverty and social exclusion. The key areas of the Bill included –“1. Prevention of poverty, with a focus on developing the potential of individuals; 2. Strengthening social and economic safety nets; 3. Promoting access to employment; 4.
Promoting the involvement of society as a whole; and 5. Ensuring intervention at all levels” (Raphael, 2004). Poverty elimination is a key step towards addressing the component of community health. It is a complex process and needs to be dealt with in various ways to achieve the required economic outcome. Individuals making minimum wage also need proper nutrition, food and sufficient healthcare for themselves and their families. Another issue to consider is job security. A lack of job security can impact mental well-being as it creates tension and stress in an individual. For families, policies that support maternity leave for either gender can also help provide greater income security.

Part 3 – Potential health outcomes

Economic opportunities that lead to sufficient income can help an individual to meet their daily needs and other requirements. Current urban form tends to require that individuals own and use a car to meet their daily needs. After housing and transportation costs, many can be challenged to meet their other basic needs. The stress in this situation can further undermine their health. Thus, policies and practices that can enhance income security and provide a more stable base for a healthy lifestyle are desirable.

There is a link between the economic and the land use components. Inclusive zoning that offers more diversity of employment, housing and amenities within a local area can increase economic security through providing a greater choice of employment, housing and shopping.
Figure 29: Conceptual Analysis Model

Figure 29 above is a conceptual model that was generated by analysing data collected for a study on neighbourhood economics and self-rated health in Texas. The framework identified the factors deemed important for analysing and addressing the areas of health and the urban environment. For example, “Social processes pertaining to children, such as social cohesion and trust in children, have been investigated as potential factors in explaining children’s health outcomes” (Franzini, Caughy, Spears, & Fernandez Esquer, 2005). There is a reciprocal relationship between economics and health: strong economies providing good incomes can support healthy lifestyles while healthy lifestyles contribute to the ability of individuals to earn a good income and support the larger economy. Reduced stress in the workplace can also enhance creativity. This is beneficial for the overall economy, investors and the city. Creative ideas and innovation are more easily generated when the mind is not preoccupied with anxieties of employment, housing, and driving in traffic.

30 (Franzini et al., 2005)
4.1.3 Active Transportation

Active transportation is a term used to describe the forms of mobility that involve exercise – such as walking, cycling and taking transit. Physical health is the first element to consider when thinking about active or healthy living and thus, active transportation is a central component of a healthy neighbourhood. Here active transit is linked to planning and suggestions are provided with examples of achieving the best environments for communities.

Part 1 - Introduction

Active transportation plays a major role in how the urban environment can support leading a healthy lifestyle. The aspect of active transit has been mentioned in many journals and articles relating to health, sustainability, and urban planning. “Through the lens of our car culture, city planning and its allied professions have become unaware of the health impacts that our land use and transportation decisions have on the ability to walk and bike, the most common forms of physical activity” (L. D. L. Frank & Engelke, 2001). Figure 30 below illustrates the linkages between built environment, activity and public health.
Figure 30: Linkage between Land-use, Transportation and Public Health

Figure 31 outlines the objectives which the US Department of Health and Human Services created in 2000 for their communities. “The amount of physical activity performed is related to opportunities for individuals to use active transportation in order to get to places where they can work, shop, visit friends, etc. This is affected by the proximity between the place of residence and such destinations” (Bernard et al., 2007).

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**TABLE 1. Healthy People 2010 Objectives for Physical Activity Consistent with Surgeon General Recommendations for Regular, Moderate Physical Activities**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-1</td>
<td>Reduce the proportion of adults who engage in no leisure-time physical activity</td>
</tr>
<tr>
<td>22-2</td>
<td>Increase the proportion of adults who engage regularly, preferably daily, in moderate physical activity for at least thirty minutes per day</td>
</tr>
<tr>
<td>22-6</td>
<td>Increase the proportion of adolescents who engage in moderate physical activity for at least thirty minutes on five or more of the previous seven days</td>
</tr>
<tr>
<td>22-14</td>
<td>Increase the proportion of trips made by walking</td>
</tr>
<tr>
<td>22-15</td>
<td>Increase the proportion of trips made by bicycling</td>
</tr>
</tbody>
</table>

---

(L. D. L. Frank & Engelke, 2001)

(L. D. L. Frank & Engelke, 2001)
Fraser Health has provided clear connection between land-use and transportation planning by saying that “Complete, compact, and connected’ communities (with mixed land-use, high density, and networks for efficient transportation by vehicles, walking, and cycling) have significant health benefits and improve the use of active transportation and public transit” (Fraser Health Authority, 2014). In addition, they note the links between health and cycling. “Switching from driving to cycling is linked to increased life expectancy, with physical activity producing much more benefit than the negative effects of inhaled air pollution or traffic accidents. A public bicycle sharing initiative with 180,000 Barcelona participants was estimated to avoid 12 deaths a year due to improved physical activity. Reducing the risks of air pollution and injury are therefore major goals of community planning” (Fraser Health Authority, 2014).

Transit-oriented developments (TOD) are one way for cities to be planned and developed to support people needing to use their cars less and use the modes of public transit or active transportation instead. TODs create more compact designs and compactness creates more density and density creates more opportunities for businesses. “Transit-oriented development/design involves coordinating land use and transportation planning to concentrate development around transit nodes and improve linkages between key areas of development” (Fraser Health Authority, 2014). Hence, this can profitable for property owners and developers. This would also contribute towards a lower carbon footprint and help prevent pollution from private vehicles. Figure 32 taken from HIA of Metro Vancouver is interesting as it illustrates the health outcomes of TODs in the way they affect daily activities. Active transportation and land-use options, when planned together, can create a wide range of improvements in modern cities.
Part 2 – Active transportation policy and health

Safer and active streets call for more people to be outside and create a higher level of activity, social interaction and trust in their neighbourhood. This contributes towards the physical, mental and social well-being of the community. For example having more youth and seniors in the same area can create more opportunities for interaction for both age groups. This can help develop a culture of respect through interaction amongst them. Mental well-being can improve since communicating with others can e.g. reduce social isolation.

(iii, 2014)
Street designs need to be comfortable. Shade and shelter are important elements of street design to provide protection on hot sunny days or on rainy days. Traffic calming elements such as traffic circles, narrow roads, crosswalk bulges, and crosswalks not only contribute to reducing the speed of vehicles but also create the environment for more individuals in the public realm and hence more eyes on the street, which in turn increases safety. It is recommended that vehicle speed can be reduced to 30km/hr. from 50km/hr. by the Provincial Health Officer’s Report on Road Safety if safety objectives are paramount.

Street art (positive in nature) can also contribute to positively impacting the mental and social well-being for many. It creates a sense of belonging in the community. It can also eliminate the alienating atmosphere caused by large blank walls in some neighbourhoods. Certain street lighting can assist as well.

There are many reasons why the developments of significant active transportation networks face challenges. A few reasons are listed below in Figure 33 by Frank and Engelke in their article on ‘The Built Environment and Human Activity Patterns: Exploring the Impacts of Urban Form on Health’. Planning can be effective in helping promote active transportation, especially in shaping the urban form.
Additional factors which might be difficult to change include habits, attitudes and values which are personal choices of the individual – but these are also impacted by the urban environment. The choice to walk instead of drive will be heavily influenced by the potential walking experience.

“Local governments play a role in providing proper sidewalks, walking/cycling paths, and traffic safety. They differentially allocate to neighbourhoods resources that encourage walking such as leisure facilities and parks, and determine proximity to attractive facilities such as museums, libraries, post offices, etc. (Addy et al., 2004; King, Belle, & Brach, 2005). Local sociability also plays a role in shaping the physical environment through providing a safe environment that is hypothesised to encourage outdoor physical activity” (Parkes & Kearns, 2006; Bernard et al., 2007).

34 : (L. D. L. Frank & Engelke, 2001)
“A wide range of detailed design features in the built environment allow people to feel safe, confident, and comfortable when walking or cycling. Our review confirmed a strong evidence base that such feelings increase people’s propensity to walk and cycle as a form of travel. For cyclists, secure bicycle parking, end of trip facilities including showers and lockers, together with a supportive culture of cycling acceptance, are all positive enhancements. For walkers, the research indicates that well-maintained footpaths are a significant and positive correlate to walking” (Kent & Thompson, 2014). It also promotes safety and provides the infrastructure required for active transportation amongst communities.

The active transportation performance of a neighbourhood is linked to other factors such as economic capacity and density. Smart growth principles are one way to provide direction for inclusive planning and many of the components relating to a healthy lifestyle. “Single-use development, low densities, disconnected street networks, and automobile-friendly urban design cues are therefore anathema to non-motorists” (L. D. Frank & Engelke, 2005). Furthermore, “The evidence suggests that the same basic set of neighbourhood design strategies—compact development, a mix of land uses, and an interconnected street network—may have positive benefits for health and climate change goals” (L. D. Frank, et al, 2010). “Public health will depend on transportation engineers and urban planners to execute community design changes. Likewise, transportation and urban planning will need public health practitioners to assist in justifying relevant policies” (Hoehner, et al, 2003).

Part 3 – Potential health outcomes

The main outcomes from this component are physical, mental and social in nature. Physically, active transportation can support the reduction in obesity rates which is of significant concern today. If an individual is obese, they are easily susceptible to many related diseases (co-morbidities). “Globally, physical inactivity ranks second only to tobacco as a behavioural risk factor contributing to the burden of disease, and is a major risk factor for numerous chronic diseases (e.g. cardiovascular disease, diabetes, colon and breast cancer and mental health)” (Giles-Corti, Foster, Shilton, & Falconer,
Another benefit of active transportation is a reduction in noise pollution, which in turn reduces ambient stress in urban living.

Active transportation not only affects the physical conditions of the community but also affects the environmental conditions for the town and city. Non-motorized ways of transportation reduce CO (Carbon Monoxide) and CO₂ (Carbon Dioxide) emissions among other dangerous gas emissions, e.g. Volatile Organic Compounds (VOCs), fine particulates, the formation of ground-level ozone, - which results in less air pollution overall. “Numerous studies have been conducted showing that high ozone concentrations aggravate existing asthma conditions” (L. D. Frank & Engelke, 2005). Active transportation can reduce the impact of motorised vehicles which in turn reduces the need for more fossil fuels. “Over-reliance on fossil fuels is a concern because of its impact on greenhouse gas emissions and because it is a diminishing energy source” (Giles-Corti et al., 2010). Figure 34 below provides us with a simplified model of how the two can complement each other and provide for a sustainable environment.

Active transportation increases urban safety because it results in more people on the street. “Jane Jacobs asserted that urban environments with diverse land uses would increase public safety and minimise fear by creating lively streets, monitored by local business proprietors and residents” (Giles-Corti et al., 2010). Designing for active transportation can create a safer and a more social environment for the community.

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35 (L. D. Frank et al., 2010)
resulting in all types of individuals coming together and interacting with each other. This can also lead to increased trust amongst neighbours contributing to the mental and social well-being of the community. Figure 34 below is a simplified model to help explain the characteristics of transportation-related stress which affects both physical and mental well-being of an individual.

![Diagram of Individual characteristics and Health Outcomes](image)

Figure 35: Model for traffic stress in a neighbourhood context

At the same time, there are economic benefits to active transportation. With the increase in non-motorized transportation, the community can save money usually spent on private vehicles and fuel. That saving can be used for other more important purposes such as providing healthier food options for the family. Since public transit or modes of non-motorized transportation do not require the same amount of money as is usually spent on private vehicles (insurance, etc.) there is a definite positive increase in savings of one’s income.

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36 (Song, Gee, Fan, & Takeuchi, 2007)
4.1.4 Housing

Housing is not often considered when thinking about healthy environments. It is mainly considered in terms of their internal settings, materials used for construction and design/orientation of structures. This is challenging to address in planning as it is more of an architectural design issue. This component is included mainly for the factors of mental well-being, social well-being and it also dwells into the income aspect when considering diversity.

Part 1 - Introduction

The issue of the housing is complex but it is directly related to health. As pointed out by Dennis Raphael in his book, ‘Social Determinants of Health: Canadian Perspectives’, the housing problem is mainly divided into three parts – Homelessness, poor housing conditions that impact health and the implications of when a disproportionate amount of an individual’s income is spent on housing leaving little money to address other determinants of health (Raphael, 2004).

Homelessness is the first issue, and like all housing issues, it is especially complex. People become homeless for many reasons, but once homeless, many other factors can undermine their health. Homelessness can lead to a lack of access to good food and proper health care which can result in being more prone to diseases. It also affects the mental and emotional well-being which can lead to suicide or other psychological outcomes. “In Toronto, homeless people die at a younger age than the general population” (Raphael, 2004).

Poor housing conditions is the second issue which can influence health. Housing must be maintained in order to lead a suitable healthy lifestyle. The core needs include:

- “Affordability – where tenants pay more than 30% of their gross income on housing.
- Suitability – where tenants live in overcrowded conditions.
- Adequacy – where tenants’ homes lack full bathroom facilities or require significant repairs.” (Raphael, 2004)
The quality of the building in which a person lives can impact their health. For example, poor housing conditions can result in rodent infestations, mould, or other problems that create airborne particles that undermine health. In addition, the perception that one’s home or neighbourhood is substandard can impact the mental and emotional well-being by triggering feelings of being socially excluded and not being accepted by society.

The third housing issue that can impact health is affordability. “In 1996, 43% of Canadian tenant households spent more than 30%, and 21% of Canadian households spent more than 50% of their income on rent. By 2000, the situation improved slightly with 40% spending more than 30% of gross income on rent (Statistics Canada, 2004)” (Raphael, 2004). The cost of housing has a direct effect on the expenditure of other relevant health determinants such as food, medication, etc. Poor eating habits due to low income often lead to obesity due to the high-calorie, low nutrition food that is cheaply available. In addition to physical concerns, housing affordability can impact the mental and emotional aspect of well-being through increased stress levels, insecurity, etc. With money invested in homes, vehicles, vehicle insurance, and other monthly bills, not much income can be left to provide for healthy food or other requirements. Insufficient income can also restrict individuals from being involved in recreational activities which are beneficial for healthy living.

Part 2 – Housing policy and health

Housing as a health concern needs to be dealt with in terms of policies and design. “A healthy housing sector should have four components: a rental housing; ownership housing; social housing with mixed incomes; and support for people with special needs to enable them to live independently” (Raphael, 2004). These four components are extremely important to consider when designing a neighbourhood. Each component can be dealt with in the design process by consciously including many housing types – for both ownership and rental.

The components of social housing and housing for people with special needs can be included as well. This not only creates a sense of social diversity but also can support social inclusion and safety. This solution also affects the other determinants of health.
such as transportation, building design, infrastructure, and land-use. “The extent of socioeconomic segregation may be influenced by the provision of socially assisted housing and local planning policies as well as factors outside the remit of local government, such as local population demographics and the private housing market” (Stafford, Martikainen, Lahelma, & Marmot, 2004). “Social status and especially low income are strongly associated with increased exposure to environmental risks in the private home or related to residential location” (Braubach & Fairburn, 2010).

Diversity in housing types is the main component to be addressed when assessing the neighbourhoods. “Many studies dealing with social inequities related to housing and residential conditions focus on the ecological level analysis of neighbourhoods by social deprivation level and often fail to deeper investigate

![Diagram](image)

Figure 36: Model informing policy change process for housing

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37 Raphael, 2004
environmental inequities—especially those related to the dwelling” (Braubach & Fairburn, 2010). These studies are often done for European cities but the concept is same for what an individual requires for leading a healthy lifestyle anywhere. Figure 36 above offers a model of policy change that can inform strategies for increasing housing diversity and health.

Part 3 – Potential health outcomes

The effect of housing patterns and policies can impact community health for a long period.

A case study of the impact of unaffordable housing is unfolding in Vancouver, BC. Vancouver is said to be one of the best cities to live in but it is also one of the most expensive. The cost of housing has skyrocketed in the past decade. This makes it increasingly difficult for individuals, especially youth, to live in a healthy environment

Figure 37: Descriptive results of completed survey done in Vancouver, BC

A case study of the impact of unaffordable housing is unfolding in Vancouver, BC. Vancouver is said to be one of the best cities to live in but it is also one of the most expensive. The cost of housing has skyrocketed in the past decade. This makes it increasingly difficult for individuals, especially youth, to live in a healthy environment

38 (Dunn, 2002)
without significant concern around housing. The result of a study in housing in Vancouver noted that the “Mean length of residence in the dwelling was 7.18 years while mean length of residence in the current neighbourhood was 10.1 years. Roughly 42% of respondents reported that they spend more than 30% of their monthly income on housing costs and a similar proportion reported that they found it somewhat or extremely difficult to meet their monthly housing costs. For each of the survey questions designed to assess housing demand, control and meaning, between 10% and 20% assessed their housing situation negatively. In terms of health status measures, 10.5% of respondents rated their health as fair or poor, while 11.2% reported feeling downhearted and blue ‘a good bit of the time’ or more in the past two weeks. Finally, 26.3% reported feeling ‘constantly under stress’ ‘fairly often’ or more in the past two weeks, while 7.8% reported that they had a disability, although no further information about the nature of individuals’ disability was sought” (Dunn, 2002).

Vancouver might gain the name for being the ‘Greenest City’ in the world but it still has work to do to be the healthiest. Affordable and integrated housing options can help create a sense of belonging and social inclusion amongst communities. Providing convenient public transit systems can reduce the amount of money spent on private vehicles and their associated costs. Moreover, having well designed walkable neighbourhoods can reduce the need for vehicles at all if the daily requirements are met in a distance which can reach either by foot or on the bike. This creates a positive outcome of increased physical health as well as social and mental well-being. Social well-being is relevant because if you bike or walk you are more prone to talk to people around you than when you are in a car. Public transit can create a sense of belonging in a community since you may see the same faces often on a regularly travelled route. This can correspond to a positive impact on the mental well-being of individuals. Active transit not only contributes towards physical health but also reduces the probability of stress, depression and other health risks.
4.1.5 Building Design

Similar to housing building design is mainly considered with respect to their internal structure and layout. Here is an attempt to link building design to planning and design to have a healthier physical setting/environment for communities.

Part 1 - Introduction

When thinking about planning, we often tend to think first about land uses, green spaces, public spaces, active transportation, etc. and we can miss a key aspect, that being the buildings in which we spend most of our time, including workspaces or our own homes. We spend most of our lives in buildings – up to 90% of our lives according to a study from Cornell University and therefore, the characteristics of these structures can have an impact on our health. Therefore, good building design is beneficial in supporting a healthy lifestyle.

The analysis of this component of a healthy community is divided into two parts. The first being the interior of the building which is related to the physical design and the materials used for construction. The second part is the exterior structure - urban form. This affects the people who are outside of the building. Both conditions affect human health and well-being. This paper mainly focuses on the external forms of structures but that does not make the internal form and materials any less important when addressing health factors. This is a planning project and the tool it is creating is for use at a neighbourhood level. Healthy buildings are more the purview of the architecture and interior design professions thus these aspects were addressed in a very limited manner as they were largely beyond the scope of this research.

There are many aspects of a building to consider, including how it supports activity. “Recent research on the harmful effects of sitting for hours every day and the importance of movement, especially frequent periods of aerobic activity, to maintain physical and cognitive health has prompted companies to rethink their office spaces and routines” (Fox, 2003). And this is not only related to workplaces but schools as well. “School siting is critical, as schools located near busy roads have been found to have high
levels of indoor pollutants. Designs for new school buildings are featuring operable windows and skylights. Students who studied in classrooms with more natural light scored up to 25 percent higher on standardised tests. Buildings with improved air quality reduced asthma incidence in students by nearly 40 percent” (Fox, 2003).

Figure 38: Example from the US explaining the importance of Health

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39 (Fox, 2003)
Since the focus of this work is neighbourhood planning, the external element of buildings is our main focus here, and in particular, how the exteriors of buildings for the functional, aesthetic and cognitive context for urban living. “Coherence refers to the clarity or comprehensibility of building elements and form. Ambiguity, disorganisation, and disorientation are major impediments to coherence. Coherence enables users to make reasonable deductions about the identity, meaning and location of objects and spaces inside or outside of buildings. Coherence is inversely related to complexity and directly related to the clarity of thematic or underlying patterns of stimulation. Multiple, repetitive features, underlying expression of rules, and thematic continuity, all contribute positively to coherence (Lynch, 1960; Kaplan & Kaplan, 1982)” (Evans & McCoy, 1998).

Buildings serve as landmarks in our environment and can be important for wayfinding – which can increase a sense of being “found”, associated with lower environmental stress. How a building fits in the urban landscape can create a sense of order, meaning and coherence, and can reduce the experience of urban stress. People want to make a sense out of the spaces or structures around which they live, “Ambiguity can also be caused by vague or missing cues for use or too many competing cues. When a building user cannot see what or how something in the space functions or when confronted with cues about the purpose or use which are vague or in conflict, human reactions are likely to encompass frustration, annoyance, and, on occasion, even hostility or helplessness (Norman, 1989). Design features that provide little or no feedback about the consequences of their use can also evoke negative reactions” (Evans & McCoy, 1998). This goes more towards the psychological aspect of the individual but it is helpful in understanding and looking at the structure and its form with the user’s viewpoint. These issues play an important part in the individual's emotional and mental well-being hence they need to be considered when thinking about the health of the community.

Part 2 – Building policy and health

Pursuing policies that ensure that interiors of new buildings or retrofits of existing buildings are designed with healthy environments and air quality in mind is key. Likewise, design can encourage or discourage positive social interaction in the building.
With regard to the design of building exteriors, creating design guidelines can be a way where planners, designers and the community can collaborate to shape the place where they live and work. Increasing the sense of order and coherence in building forms and urban design can reduce stress and increase health. In addition, ensuring buildings can support a fine-grained mix of land uses and active transportation infrastructure can also increase the health performance of a neighbourhood.

**Part 3 – Potential health outcomes**

While working or living in a space, the character of the surrounding area can affect the individual. For example, office spaces with a view of green space like a park or community garden can reduce stress levels. Another example is seniors housing near schools or community centres, which can be beneficial for seniors’ health. This would benefit various age groups in terms of physical activities. Seniors would also get their share of social interaction as they are often neglected and feel left out. Interacting with different age groups can also increase the level of confidence, communication and sense of belonging among individuals. Recently, in Sweden, a program was enacted that allowed university students to stay at a seniors housing area without paying rent if they interacted with the seniors regularly. This is an effective way for eliminating a number of issues such as housing for students, social conditions for the elderly, social and emotional well-being for both age groups, etc.

The form of the built environment, incorporating residential and commercial density, land use mix, connectivity, and accessibility, influences the way we move and what we do within that environment. The built form can promote community interaction by providing opportunities for conversations and general social interaction through design such as outside seating for cafes, more connectivity to the streets and sidewalks.

“Restorative elements of design represent a theoretically distinct category. Rather than directly producing stress, restorative elements provide resources that can attenuate stress. Thus design can function as a coping resource that can help building occupants alter the balance between environmental demands and personal resources. Restorative design elements include retreat, fascination, and exposure to nature” (Evans & McCoy, 1998).
Building design and urban form, therefore, contribute towards the mental and emotional well-being of the community.

4.1.6 Infrastructure

Infrastructure that is required to create a healthy community is considered in this section.

Part 1 - Introduction

The infrastructure component of a healthy community includes water supply systems, sanitary and stormwater management systems, and road infrastructure.

“Historically, many major planning initiatives grew out of health-related concerns. Haussmann’s radical plans for Paris in the 1850s were intended in part to improve air flow and abate unhealthy sanitary conditions (Saalman 1971)” (L. D. L. Frank & Engelke, 2001). “High-quality infrastructure is an essential component for community growth and development, and it is critical for quality of life preservation. As facilities and services deteriorate or become inadequate, growth is deterred, and quality of life is adversely affected. A viable health sector is a major component of a community’s infrastructure” (Doeksena, Johnson, Biard-Holmes, & Schott, 1998).

The need for access to clean drinking water is a requirement for healthy community, but is still an issue in many communities. The provincial government works with local governments, developers and homeowners to ensure that water supplies are adequate and safe to consume. Recently, the provincial government enacted the Water Sustainability Act in BC to deepen the legislation and access to a safe water supply. Likewise, healthy management of both sanitary flows and stormwater is important for a healthy community.

Sanitary flows are heavily regulated by the provincial government in BC – either through septic systems or through local or district treatment systems. Minimising exposure to potential chemicals, bacteria, pathogens or other contaminants associated with sanitary waste is a high priority for government regulations and enforcement.
The management of stormwater flows is also important; to both minimise the possibility of flooding and to protect groundwater health. “Negative impacts on water supply occur through reductions in groundwater recharge from the presence of less permeable streets and parking lots; while adverse impacts on water quality occur through pollution resulting from the construction and subsequently accelerated runoff from these facilities (Brabec, Schulte, and Richards 2002; Gaffield et al. 2003)” (L. D. Frank & Engelke, 2005).

The transportation component of infrastructure was discussed in the “active transportation” section earlier, however, a few additional comments are offered here. Road design impacts health, both through how it creates safe environments for travel, and also how it encourages or discourages active transportation. Road infrastructure is what links each land use to the others in a neighbourhood. The roads, sidewalks, etc. provide the connectivity between various uses and define the route that one must take to reach their destination. This makes it an important component along with the other six components of health and design. Convenient public transportation, sidewalks and road designs that promote biking and walking are a few examples of how to achieve the goals of creating an attractive active transportation environment for the community. When health initiatives encourage the community to use public transport or bike and walk inside of using private means of transport, it is important to provide the infrastructure which helps the community to do so conveniently and safely.

Figure 39 outlines a substantial list of requirements in terms of infrastructure that goes into achieving active transportation options such as walking and cycling. It also shows how they would influence other factors such as safety and using the amenities at our destinations. “Safe designs of streets, using traffic calming and separated bike lanes, for example, are essential to encouraging active transportation choices and preventing injuries and accidents. 82% of Canadians are willing to walk more if there is better infrastructure” (PlanH, year).
Figure 39: Physical Factors that influence active transit options\(^\text{40}\)

\(^{40}\) (Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003)
Public infrastructure is generally the responsibility of the provincial and federal governments. They maintain and update the infrastructure based on the population increase and demand. Within regulations and guidelines established at the provincial level, safe water supply, wastewater and stormwater must be managed. So long as these are managed in accordance with the approved health and safety regulations, there is not much additional that is required to achieve higher levels of human health in neighbourhoods. One additional consideration regarding water supply and stormwater management is the future implications of climate change, including increased droughts and floods. Current standards need to be adapted to ensure health and safety responsibilities are met in the future in light of these changes (Fox, William F., 1990).

Policies for road infrastructure to support a healthy neighbourhood need to start with modal priority, including prioritising pedestrians, cyclists and transit over the private automobile. In reality, all need to share much of the same space, but the health and safety of pedestrians need to be paramount. There are several agencies responsible for road

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41 (Pikora et al., 2003)
infrastructure including the municipality within its limits, the regional district in some rural areas, and MOTI everywhere else.

Pedestrian and cyclist-oriented streets include sidewalks, traffic calming, street art, pedestrian infrastructure (benches, bike racks), narrower road widths, safety measures, signage, lighting and low-speed limits are a few things that need to be considered in terms of providing appropriate city infrastructure. If these aspects of infrastructure are met, it would help bring more people on the streets since the streets are now a safer place to be. Of particular importance to a healthy neighbourhood is making the public realm safe for children. Pedestrian-oriented streets encourage children to be outside, biking, playing and interacting. When there are people on the street, social connectivity increases among various individuals. This contributes towards a well-balanced physical, social and mental environment.

Part 3 – Potential health outcomes

The provision of safe water, sanitary and stormwater management system ensures residents remain safe from water-borne illnesses and avoid the health and safety problems caused by flooding. The benefits of healthy community infrastructure that support pedestrians, cyclists and transit, in addition to the automobile have been outlined earlier, and include, more active lifestyles for residents and children, better social relationships in the neighbourhood, reduced air pollution and create a more desirable place to live.
4.1.7 Food

Nutrition is the key to healthy living and avoiding most diseases. Hence linking food systems to planning is necessary.

**Part 1 - Introduction**

Food is a basic human need and therefore, to have access to healthy food is a basic requirement for a healthy lifestyle. The quality and amount of food required by an individual depend on various factors. The term used to describe the lack of proper food or hunger in developed countries is food insecurity. Food insecurity as defined in the book ‘Social Determinants of Health’ by Dennis Raphael, is “the inability to acquire or consume an adequate diet quality or sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so” (Raphael, 2004).

“Community food security is compatible with the larger set of goals that planners pursue in creating healthy, livable, environmentally sustainable, and economically vital communities” (Campbell, 2004).

Food insecurity involves a number of factors including a lack of accessibility to healthy and fresh food, and a lack of income sufficient to provide for healthier food options, and others. “A recent study examined the food insecurity and hunger of 141 low-income single mothers with children in Atlantic Canada. Virtually every household had experienced food insecurity over the past year (96.5%)” (Raphael, 2004). It is understood that low-income households will often have higher levels of food insecurity which can further lead to depression and other chronic conditions caused by lack of nutrition. This can affect the physical and mental well-being of those households. Figure 40 below illustrates the results of a survey done almost two decades ago. It shows the differences between food secure and food insecure households in Canada during 1998 to 1999.

In contrast to low-income households who struggle with the basic food supply, those with ample incomes can make unhealthy food choices. Medium or higher income households may not prioritise the purchase and consumption of the healthiest food options available to them. This is can be for many reasons. Stress from intensive work schedules, depression due to lack of social activities, not enough time to spend with
friends and family, lack of time spent outdoors in the natural environment, etc. can be a few reasons that can disrupt a person’s appetite and motivation to eat healthily (Raphael, 2004). Consuming junk or fast foods (high in fats, carbohydrates, sugar or salt) on an everyday basis can be quite dangerous for health, often leading to obesity that can result in chronic health conditions such as, heart conditions, high blood pressure, etc.

Table 12.1: Numbers and proportions of Canadian population living in food-secure and food-insecure households, NPHS, 1998–1999

<table>
<thead>
<tr>
<th>Category, n (%)</th>
<th>Food Secure</th>
<th>Food Insecure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Anxious</td>
</tr>
<tr>
<td>Total Canadian population</td>
<td>26,458 (89.8)</td>
<td>3,015 (10.2)</td>
</tr>
<tr>
<td>Adults</td>
<td>20,470 (90.7)</td>
<td>2,098 (9.3)</td>
</tr>
<tr>
<td>Children (0–7)</td>
<td>5,988 (86.6)</td>
<td>924 (13.4)</td>
</tr>
</tbody>
</table>


Figure 41: Proportions of Canadian Population living in food-secure and insecure households

Figure 42: Odds of individuals in food insufficient households reporting poor general, physical, mental and social health

(Raphael, 2004)

(Raphael, 2004)
Figure 42 above is a review of poor health conditions in low-income households and households that find it difficult to obtain healthy options based on a study that was done in 1996/97. “The observed associations between food insecurity and health may be an extension of the income-health gradient” (Raphael, 2004).

Locally grown and supplied food products generally provide the healthiest and most sustainable source of nutrition to a community and that fact raises the issue of community planning. Through guidelines and land-use policies, areas can be zoned and designated for community gardens which can be used to grow food. It can also be included in the agricultural land regulations which are meant to maintain the green environments, agricultural lands and ecosystems of the city. As discussed in the land use section, it is important to ensure residents can meet their daily needs close to where they live and work – and this includes access to a food store. Areas without a food store are known as “food deserts”. In food deserts, people have to typically travel a long distance to access a reasonable or healthy source for food including food stores or restaurants. Alternatively, with the prevalence of corner stores and fast food outlets, many will eat unhealthy food from these sources. This is of particular concern in low-income neighbourhoods. “Low-income neighbourhood residents find themselves with few healthful food options and are at increasing risk for diet-related health problems such as diabetes, hypertension, and obesity” (Campbell, 2004). This happens due to lack of accessibility to healthy, affordable food options and opting for the cheaper and unhealthy options which do not involve a long travel time.

Unhealthy food is also of particular concern for children, as it can lead to obesity. “Within adolescents’ school surroundings, close proximity to convenience stores and fast-food outlets and high density of fast-food outlets are associated with low diet quality scores. The implications of these findings highlight the importance of adolescents’ home and school neighbourhoods in providing opportunities for unhealthy food choices” (He et al., 2012). “Low-income, minority communities are particularly at risk for obesity, the very same communities that have limited access to grocery stores and supermarkets and increased access to fast-food stores” (Galvez et al., 2009). Obesity plays a major role in
child’s life, mainly on the mental and social well-being factors and not only the physical well-being factors. This again is unique to every neighbourhood, town or city. Education needs to be provided to customers on the calorie count and contents of unhealthy food. This can make people more cautious and conscious about their health along with the health of their families (Galvez et al., 2009). It leads to awareness which then leads to planning for more healthy options and wanting more healthy options in the neighbourhood/town/city.

Part 2 – Food policy and health

The response to food insecurity and dietary health concerns can take several forms, including food-related programs, and neighbourhood design policies. There are many programs in existence to deal with food insecurity including food banks, subsidised food through meal programs and others. Campbell in her paper has correctly described the role of a planner with respect to food systems. “Community food security is compatible with the larger set of goals that planners pursue in creating healthy, livable, environmentally sustainable, and economically vital communities. Planners in both professional practice and academia are ‘in a unique position to engage the community in a dialogue about the meaning and goals of a food secure community’ (Pothukuchi and Kaufman 2000, 121), although they engage the community in slightly different ways. Borrowing from what Scott Campbell (1996, 305) say is the task for planners regarding sustainable development, the challenge for resolving local-level food system tensions is ‘(1) to manage and resolve conflict; and (2) to promote creative technical, architectural, and institutional solutions’ to yield a common vision of a sound, secure, and just community food system. Planners can play a strong facilitative and mediating role in the evolving community food security discourse and spur concrete action” (Campbell, 2004).

As mentioned earlier, the cross-sectional survey conducted in Ontario, derived the following conclusion. “A close proximity to convenience stores from an adolescent’s home … were also associated with poor nutritional intake” (He et al., 2012). This helps relate the importance of proximity of stores, fast-food joints which are a result of zoning to the availability of healthy food options. Unfortunately, the survey failed to mention the
results relating to the proximity of supermarkets or local food stores with healthy eating habits. But another study in the US noted that “Supermarket availability and proximity has been identified as influencing eating behaviours in adult populations. A recent national-level data analysis based on the Behavioural Risk Factor Surveillance System in the USA showed that the odds of consuming fruits and/or vegetables five times or more daily decreased as distance to supermarkets increased in metropolitan areas, but not in non-metropolitan areas” (He et al., 2012).

The focus of this research is community planning and design, and as such, the food policy issues to focus on include, provision of community gardening space, preservation of agricultural and food production lands and ensuring land plans supports access to food banks, healthy food stores and restaurants.

Part 3 – Potential health outcomes

To summarise this component, food insecurity has to be addressed at a community scale with design guidelines, land use controls and collaboration and involvement from both the private sector and local and provincial government bodies. An example provided by Campbell in her paper ‘The Role for Planning in Community Food Systems’, involves a Canadian city which has accomplished quite a remarkable benefit with including food policies in their bylaws. “The advisory nature of most FPCs is the Toronto Food Policy Council (TFPC), created in 1991 as a subcommittee of the Toronto Board of Health, from which it receives staff support and a modest budget. Now over ten years old, the TFPC has an impressive track record of accomplishments (Borron 2003; see especially Welsh and MacRae 1998). Finally, FPCs have also developed local-level food systems projects (Borron 2003; Welsh and MacRae 1998). In particular, they can help codify, institutionalise, and stabilise local projects by placing their work in a broader framework of food system policies (Feenstra 2002). The most successful FPCs are those that have a dynamic leadership and a secure funding base, most often provided by local government (Borron 2003; Campbell, 2004).

Examples:

- Zoning for amenities such as food share facilities;
• Design guidelines to provide community gardens or space to grow food for the community;
• Locally grown food supply and sale;
• Farmers market in each neighbourhood or that can be accessed via public transit.

4.2 Evaluation of Neighbourhoods

The seven components of health and design that have been discussed above form the basis for the neighbourhood evaluation step in this thesis. The neighbourhoods selected for this process are two types of neighbourhoods in Nanaimo. One is a traditional type of neighbourhood – the Old City neighbourhood. The second type is a newer and conventional neighbourhood which was developed more recently – the Dover Bay neighbourhood. A table format was created to analyse both these neighbourhoods and see how they perform based on the proposed framework of health and design.

**Initial framework**

The initial framework is drawn from elements of existing frameworks and toolkits that have been addressed in this paper. Each component of health and design is addressed with several columns that link the primary planning component to health based implications, including noting sources for supporting information.

Table 1 provides information on the first component addressed (Land-use) with the initial three columns. The next dimension of this framework looks to more detailed design and what to measure in order to assess performance. Table 2 provides us with an example of those columns. Each of the existing frameworks and toolkits explored in this thesis has their own way of displaying their content. This framework has been modified to fit the Nanaimo context and the metrics selected are based on information that was accessible.
Table 1: Initial Evaluation Table for Land-use Part I

<table>
<thead>
<tr>
<th>Components of Healthy Design</th>
<th>Design-based Connections</th>
<th>Health Impact</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land-use</strong></td>
<td>Mixed uses - density and compactness</td>
<td>&quot;Mixed land use developments can enhance the economic vitality and perceived security of an area by increasing the number of people on the street and in public spaces (Smart Growth, no date)” (Healthy Spaces and Places).</td>
<td>Healthy Spaces and Places, LEED ND, CDC, Healthy Active by Design (HAbD), Census</td>
</tr>
<tr>
<td>Housing and commercial diversity</td>
<td>Provides for employment, physical activity along with safety and surveillance in the neighbourhood.</td>
<td></td>
<td>Healthy Spaces and Places</td>
</tr>
<tr>
<td>Health and wellness services</td>
<td>Services support the health and wellness needs of individuals and families in a neighbourhood.</td>
<td></td>
<td>VIHA, PHSA</td>
</tr>
<tr>
<td>Community recreation facilities</td>
<td>&quot;Studies find that people who live within 800 metres of a park get 50% of their vigorous physical activity while at the park. People who live just 800m further away get just 16% of their physical activity while at the park” (PlanH).</td>
<td></td>
<td>PlanH, HAbD</td>
</tr>
<tr>
<td>Facilities for seniors</td>
<td>Seniors’ facilities provide a range of support services and an important social hub.</td>
<td></td>
<td>Ageing in Place Toolkit</td>
</tr>
<tr>
<td>Commute distance between different uses</td>
<td>&quot;Active adults have lower rates of obesity -35% lower risk of unhealthy weight by population and lower rates of chronic disease. People with the best access to a variety of built and natural facilities are 43% more likely to be active 30 minutes on most days than those with poor access” (PlanH).</td>
<td></td>
<td>LEED-ND, PlanH</td>
</tr>
</tbody>
</table>
Table 2: Initial Evaluation Table for Land-use Part II

<table>
<thead>
<tr>
<th>Components of Healthy Design</th>
<th>What to measure? How?</th>
<th>How to report?</th>
<th>How can we measure?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land-use</strong></td>
<td>A number of land uses present in the neighbourhood range between 4-6 (residential, commercial, mixed-use, civic, institutional, industrial, etc.).</td>
<td>Report via mapping the radius to all existing uses along with the existing land uses in the neighbourhood.</td>
<td>Zoning allowed/proposed</td>
</tr>
<tr>
<td></td>
<td>Are mixed-use developments present within 5-10mins walking distance - 400-800m radius?</td>
<td>Reporting the data in plans to gain a visual understanding of the existing scenario. A sketch showing the existing and possible best practice situation for the neighbourhoods.</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td>How accessible (time required to get there, types of transit to commute) is the nearest emergency clinic or hospital?</td>
<td>Mapping is possible GIS maps to understand the time required to reach them (not the scope for this research). Google Earth distance measure.</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td>Parks, natural areas (natural parks), other recreational and community centres accessible within an 800m radius? Do open spaces, recreational spaces exist near schools, workspaces, etc.? (Parks = 5% of development according to Nanaimo bylaws)</td>
<td>Mapping in plan view</td>
<td>Same as above - mixed with &quot;what is there&quot;</td>
</tr>
<tr>
<td></td>
<td>Senior facilities with respect to housing and recreation exists</td>
<td>Mapping in plan view</td>
<td>Zoning allowed/proposed</td>
</tr>
<tr>
<td></td>
<td>In the following section (Economic Opportunities)</td>
<td></td>
<td>Zoning allowed/proposed</td>
</tr>
</tbody>
</table>

The other components of healthy neighbourhood design with their associated tables are provided in the Appendix section.
Neighbourhood Assessment Framework

The assessment framework is a compilation and consideration of the core elements that need to be included in a neighbourhood setting for creating healthier neighbourhood environments. A new column ‘Minimum Targets’ has been created which can serve as the benchmark for the neighbourhood to identify a threshold for a good level of performance. Similar to existing frameworks as discussed in section 2.3, most toolkits have a rating or a grading system. The rating sheet is provided in the Appendix for further review.

Table 3: Neighbourhood Assessment Framework Initial Columns

<table>
<thead>
<tr>
<th>Components of Healthy Design</th>
<th>Design-based Connections</th>
<th>What to look for?</th>
<th>What can we measure?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land-use</td>
<td>Incorporating mixed land uses in the neighbourhood</td>
<td>Mixed-use developments; Residential and Commercial diversity; Health and wellness services, Community centres, Recreational areas (natural/designed); Facilities and options for seniors.</td>
<td>The list of land uses that the zoning permits for the neighbourhood area within an 800m radius of the study centre point.</td>
</tr>
<tr>
<td>Economic Opportunities</td>
<td>Social capital and diversity in terms of economic opportunities for employment and businesses</td>
<td>Mixed-use developments that allow diversity in employment opportunities possibly within a walkable radius of 800m,</td>
<td>Zoning that allows commercial, retail, industrial, educational or cultural uses that offer jobs.</td>
</tr>
<tr>
<td></td>
<td>Access to a larger network of commercial service areas.</td>
<td>Access to public transit to commute to various other economic opportunities in surrounding areas/locations.</td>
<td>Transit maps to understand what linkages exist from study area to other key commercial areas.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Facilities that support walking and wheelchair access</td>
<td>Cycling infrastructure</td>
<td>Transit systems</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------------------------</td>
<td>------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Sidewalks on one or both sides of the road; Dedicated bike paths, wheelchair access to sidewalks (curb cuts); The number of intersections and crosswalks that support pedestrian permeability and access; Benches; Water fountains and washrooms in public areas; Slower traffic speed limits.</td>
<td>Cycle routes and bicycle lanes; Multi-modal connections for bikes; Bike racks and other cycling supportive facilities.</td>
<td>Public transit lines; Bus stops - the distance between each stop must be in walkable limit - 400-800m from the centre point of the study.</td>
<td>Covered and prominent transit stops; Transit routes and bus stops – transit maps.</td>
</tr>
</tbody>
</table>
| **Infrastructure** | Water, sanitary and stormwater management | Safe water supply  
Emergency water supply (hydrants)  
Sanitary systems  
Stormwater management systems (various) | Water supply plan – service areas  
Sanitary management plan – service areas  
Stormwater drainage plan – service areas |
|-------------------|------------------------------------------|----------------------------------------------------------------------------------|
| **Housing**       | Diversity of housing types – by size, type and income level, for both ownership and rental, including special housing for seniors and other marginal groups. | Various types of housing included in area (SF, townhouses, duplex, apartments, rentals)  
Do they include options for youth, students, seniors, or other marginal groups, etc.? | Housing types supported by zoning.  
Housing types in existence now (city data or stats can).  
Rental % of units (city data or Stats Canada)  
Average costs of housing – purchase and rental. (MLS, rental sites, other) |
| **Building Design** | Positive building character and urban fabric and support for safety. | A qualitative review of neighbourhood built form – quality, the state of repair, a general sense of fit and attractiveness in the area, others.  
The level of permeability and eyes on the street along the street (doorways, windows, etc.…). | General evaluation of quality, repair, fit, etc.…  
Check for # doorways per length  
#front facades / entries per length. |
| **Food**          | Access to healthy food options and the ability to grow food. | Grocery stores available in the walkable radius or accessible via public transit  
Farmers markets within the neighbourhood.  
Community gardens in the neighbourhood. | Zoning review - Distance from various food stores (Convenience store, supermarket, speciality store) to transit stops.  
Farmer's market held in the neighbourhood? (How many times a week or month)  
Community garden programs in the neighbourhood? |
Table 4: Neighbourhood Assessment Framework (contd.) with the Assessed Nanaimo Neighbourhoods

<table>
<thead>
<tr>
<th>How can we measure it?</th>
<th>Minimum Targets</th>
<th>Old City</th>
<th>Dover Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4-6 uses in a range of 0.5km.</td>
<td>1. 4-6 Uses - Yes (Residential, Commercial, Mixed-use, Parks, Community service, Corridor);</td>
<td>1. 5 land-uses (Mainly Residential, some Commercial, Corridor, Parks, Community service);</td>
</tr>
<tr>
<td>1. Look at existing zoning maps and lists of allowable uses</td>
<td>800m radius around commercial areas to check if they can cater to the whole community in the neighbourhood. A larger radius can be considered with respect to hospitals and wellness centres but check if it can be accessed with the use of public transit.</td>
<td>2. Accessible commercial centres (800m radius) - Yes;</td>
<td>2. Accessible commercial centres (800m radius) - 50% of the neighbourhood;</td>
</tr>
<tr>
<td>2. Google maps to look for businesses that are there now, such as clinics and wellness centres, etc.</td>
<td></td>
<td>3. Accessible clinics and presence of wellness centres (zoning) with access to public transit – Yes</td>
<td>3. Accessible clinics and presence of wellness centres (zoning) with access to public transit – No</td>
</tr>
<tr>
<td></td>
<td>800m walkable radius or access to public transit within a reasonable distance (400-500m) from each dwelling/use.</td>
<td>Transit is consistent and transit stops are in reasonably walkable distance from commercial and various other uses.</td>
<td>Public transit is only along the main road and not along the majority of interior roads.</td>
</tr>
<tr>
<td>Economic Opportunities</td>
<td>1. Site plan/google maps for intersections.</td>
<td>1. Intersections - Yes;</td>
<td>Transit exists along main commercial centres which are not many in the neighbourhood.</td>
</tr>
<tr>
<td></td>
<td>Intersections per area (min. 140 every square mile);</td>
<td>2. Sidewalks, curb-cuts, crosswalks - Yes;</td>
<td>A number of cul-de-sacs exist which restricts transit movement.</td>
</tr>
<tr>
<td>1. Existing land-use and zoning maps.</td>
<td>Percentage of streets (90% min.) with each - bike lanes, sidewalks, curb-cuts, crosswalks.</td>
<td>3. Bike lanes – No</td>
<td></td>
</tr>
<tr>
<td>2. Google maps</td>
<td></td>
<td></td>
<td>1. Intersections - Yes;</td>
</tr>
<tr>
<td>Active Transit</td>
<td></td>
<td>2. Sidewalks, curb-cuts, crosswalks - Yes;</td>
<td>2. Sidewalks, curb-cuts, crosswalks - Yes;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Bike lanes - Present on some streets.</td>
<td></td>
</tr>
<tr>
<td>1. Site plan / google maps.</td>
<td># Lanes - bike, pedestrian, vehicular;</td>
<td>1. Lanes present - mainly pedestrian and vehicular, bike lanes absent;</td>
<td>1. Lanes present - mainly pedestrian and vehicular, bike lanes present on some streets;</td>
</tr>
<tr>
<td>2. Transit plan for speed limits.</td>
<td>Surface widths - sidewalk width, road widths;</td>
<td>2. On-street parking options exist on most streets;</td>
<td>2. On-street parking options mainly absent (exists in mainly schools areas);</td>
</tr>
<tr>
<td>3. Site visit</td>
<td>On-street parking - 70% of street length; 50% of sidewalk (min.) landscaping for noon-time shade.</td>
<td>3. Landscaping present on most pedestrian streets;</td>
<td>3. Landscaping present on most pedestrian streets;</td>
</tr>
<tr>
<td>4. Speed limit – 30 - 50km/hr.</td>
<td></td>
<td></td>
<td>4. Speed limit – 30-50km/hr.</td>
</tr>
</tbody>
</table>

| 1. Site plan / google maps for intersections. | Intersections per area (min. 140 every square mile); | 1. Intersections present and meet the min. requirement; | 1. Intersections present and meet the min. requirement (comparatively bigger than the old city); |
| 2. Transit plan for stops. | Transit stops in walkable radius - 400-800m. | 2. Transit stops in walkable radius from most uses/dwellings | 2. Transit stops only on the main road from most commercial centres. |

| 1. Site plan. | The distance between stops - same as above. | 1. Sidewalks with trees - Yes; | 1. Sidewalks with trees - Almost all; |
| 2. Parks plan. | | 2. With furniture - 50%; | 2. With furniture - No; |
| 3. Site visit. | Typology of sidewalks - basic, with trees, with furniture, and with bioswales. | 3. With bioswales - No; | 3. With bioswales - No; |
| | | With landscaping - 90%; | With landscaping - 90%; |

<p>| 1. Zoning review. | Diversity per neighbourhood (Gradient) - SF, Townhouses, Strata lots, Multiple housing or apartments, Specialized housing types, and Mixed-use developments. | 1. Diversity in Housing types - Yes; | 1. Diversity in Housing types - Little; |
| 2. Site plan review. | | 2. Dwellings per acre - 6-8; | 2. Dwellings per acre - 6-7; |
| 3. Site Visit. | | 3. Diversity in costs for different housing type – Yes | 3. Diversity in costs – No / little |
| 4. MLS/Kijiji for costs. | At least 7 dwellings per acre for | | |</p>
<table>
<thead>
<tr>
<th>Building Design</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Site plan.</td>
<td>1. Farmer's market options - Yes; Farmer's market options - No; Farmer's market options - Not in the neighbourhood but exists in the nearby area (Pleasant Valley);</td>
</tr>
<tr>
<td>2. Site visit.</td>
<td>2. Food share programs - Yes; Food share programs - No;</td>
</tr>
<tr>
<td>3. Google Earth</td>
<td>3. Schools with access to community garden space and Education - Yes; Schools with access to community garden space and Education - Yes;</td>
</tr>
<tr>
<td>4.</td>
<td>4. Research to look up community programs promoting food security and education in the neighbourhood;</td>
</tr>
</tbody>
</table>
CHAPTER 5:

Discussion

5.1 Summary of findings

The following summarises the conclusions from the assessment of the two neighbourhoods in Nanaimo and their relative ability to support a healthy lifestyle. Each component is addressed individually to make it easier when the neighbourhoods are compared. The components of urban design that have been addressed throughout this research are:

- Land-use;
- Economic Opportunities;
- Active Transportation;
- Infrastructure;
- Housing;
- Building Design, and
- Food.

Preliminary Neighbourhood Assessment

Old City Neighbourhood Analysis:

The Old City Neighbourhood Plan is the type of traditional neighbourhood which can be well accessed from the Downtown core.

Land-use: As seen in Table 4, it consists of more than four land-uses which make it diverse in terms of zoning. The zoning is critical as it encompasses all types of land-use which make it extremely diverse in nature. The entire neighbourhood is in an 800m walkable radius as seen in the Figure below with access to commercial, recreational,
institutional, residential, industrial and civic amenities. Access to local food services includes food stores, restaurants, and a farmers market. There are social support facilities for the community as well including the Salvation Army and a Community Center.

Figure 43: Land-use Plan for Old City Neighbourhood with 800m radius, Nanaimo

**Economic Opportunities:** The entire Old City neighbourhood is in an 800m walking radius. That and the access to a number of transit stops which provides access to various other neighbourhoods in Nanaimo make this location highly accessible. This supports a variety of groups and a number of employment opportunities (from professional to unskilled).

**Active Transportation:** The topography of the neighbourhood was steep in parts and that could make it difficult for creating walkable conditions. This has the potential to impede the pedestrians/residents mobility within the community, who might have difficulty with ascending inclines. There is significant access to transit. Having transit stops at almost every 500-800m has made the neighbourhood accessible and walkable. Almost all areas have bus routes, which connects the neighbourhood to the rest of

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Nanaimo. As a result, the majority of the neighbourhood’s main roads are used as active bus routes thereby providing residents with enhanced connectivity with the rest of the municipality, relative to less transit-oriented neighbourhoods within the city.

**Infrastructure:** The infrastructure with respect to active transportation is present in the neighbourhood in most aspects. Although the narrow roads can be an issue in providing bike paths on most roads but increasing bike paths is one recommendation for the aspect of active transit. The narrow roads with the presence of on-street parking serve the purpose of traffic calming. Landscaping on streets is present mainly everywhere which contributes to the vibrancy of the neighbourhood. The neighbourhood is well serviced by municipal water, sanitary and stormwater management systems.

**Housing:** The figure below explains the housing diversity in the Old City neighbourhood along with certain commercial areas and mixed-use developments. The presence of housing diversity makes the neighbourhood more affordable for families, students and seniors. Access exists to clinics (health, dental, and wellness) and recreational activity areas (parks, playgrounds, restaurants, cafes) which promote mental and social well-being along with the physical well-being of the community.

**Building Design:** Having a number of uses with compact neighbourhood designs, having continuous commercial activities and being close to the downtown core makes this neighbourhood relatively active. Having frequent building entries whether commercial or residential provides more eyes on the streets. This contributes towards safety and thereby to the mental and social well-being of the residents. One recommendation to enhance safety would be to promote development or reuse of the derelict or rundown structures. Thus potentially reducing the presence of crime and increasing the safety of the neighbourhood.
Food: The presence and convenient access to local food stores (grocery stores) are other unique features about this neighbourhood. Infrastructure for active transit is present almost everywhere (95% of the neighbourhood) which makes the stores extremely accessible.
Dover Bay Neighbourhood Analysis:

The second neighbourhood assessed is Dover Bay which is a more recent neighbourhood. It is a conventional neighbourhood type including cul-de-sacs and less of a grid form.

Figure 45: Land-use Plan for Dover Bay Neighbourhood, Nanaimo

**Land-use:** It qualifies for the land-use component of a healthy community in that it has more than four uses in the neighbourhood. But it is a much bigger neighbourhood when compared to Old City. As seen in the figure above, the neighbourhood mainly consists of residential lots – to be specific SF (single family) lots. While almost half of the neighbourhood falls within the radius of the Woodgrove mall area which provides access to a grocery store and clinics, the rest of the neighbourhood shows a lack of mixed-use developments which promotes diversity of public and civic amenities. Not having access to clinics and wellness centres restricts the expansion of diversity in the neighbourhood. Although the Woodgrove mall area provides an access to a walk-in clinic, it can be difficult to access. The lack of integrated uses promotes the use of private vehicles to

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reach other destinations. Access to parks and the sea edge are the best aspects of this neighborhood since they exist in the walkable radius which allows the community to walk to them rather than drive.

**Economic Opportunities:** The lack of commercial or mixed uses in the neighbourhood reduces the employment potential for the residents. Not having consistent and multiple public transit options attract certain population groups to the neighbourhood. The groups consist of mainly individuals and families who can afford the use of private vehicles to access their shopping, recreation and workplaces.

**Active Transportation:** Unlike the Old City, in Dover Bay, the majority of residences do not fall into the 800m walkable radius to neighbourhood commercial services (smaller circle in the figure below). Currently, there is only one bus route which caters to the whole neighbourhood (Dover Road to Downtown Nanaimo). To get to many destinations, bus transfers are required which make it time-consuming and this results in private vehicles being preferred over public transit. A key characteristic of Dover Bay is a large number of cul de sacs. Cul de sacs in certain areas are preferred as they restrict the use of private vehicles but too many increase the uses of private vehicles and reduce the number of roads that are accessed via public transit. This also affects vehicular movements in times of emergencies. A recommendation would be to provide bike lanes as the increased road widths can accommodate them easier than on the streets in the Old City. A further factor to be noted is the presence of the highway-scale streets around the mall; this reduces walkable aspects by quite a large scale. This again promotes the use of private vehicles rather than active transit options.

**Infrastructure:** Being a vehicle-oriented neighbourhood, the pedestrian feature of the streets (sidewalks) is missing in most places. This restricts pedestrian activities and promotes vehicular use. It also affects wheelchair access on the roads. This affects the aspect of safety as well. On-street parking and landscaping contribute to traffic calming where sidewalks exist in the neighbourhood. Other landscaping is mainly private and depends on the owner of the individual properties.
Housing: Diversity of housing is lacking since the neighbourhood mainly consists of single family lots and leaves few options for other social or income groups to live in the neighbourhood. Another factor that restricts lower income groups is the cost of existing housing in this neighbourhood (including rentals). The more mixed-use development would promote housing diversity and commercial activity which would increase employment opportunities in the area. This, in turn, could contribute towards increased mental and social well-being of the residents. More inclusivity needs to be considered for improving the current conditions.

![Map of Woodgrove Mall](image)

Figure 46: Active Radius - 800m from commercial centres

Building Design: As there are mainly residential lots and single family homes in the neighbourhood, the aspect of blank walls is minimal. In contrast to the diversity of the Old City neighbourhood, there is a distinct sense of “sameness” in Dover Bay as the majority of the urban fabric is similar single-family homes.

Food: Dover Bay lacks in local food production capacity. It has one convenience store (7Eleven) in the neighbourhood. Other than that only one local food store is available again located near the mall. The mall itself has a big-box store (Walmart).

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5.2 Conclusion
A summary of the above comparison leads to the following conclusions:

- Both neighbourhoods have access to schools, parks, and natural areas. Both neighbourhoods have similar performance in the number of land-uses but as mentioned in the sections above Dover Bay is bigger in size than Old City. This affects the number of people living in the neighbourhood along with their transit activities.

- The Old City Neighbourhood outperforms Dover Bay in most of the components of health and design. It performs extremely well on the active transit component since Old City is more accessible with respect to public transit. There is an evident lack of commercial and mixed-use developments in Dover Bay. The proximity and compact nature of various land-uses bring a sense of belonging in the neighbourhood with the potential for higher economic and employment opportunities. Diversity in housing types and costs makes the neighbourhood more inclusive in nature. This affects the mental and social well-being of the community in a positive way.

In Dover Bay, the presence of sidewalks is inconsistent, restricting pedestrian and wheelchair access. This forces people to walk on the roads and increases the risk of being hit by a vehicle. Lack of permeability is a major concern for Dover Bay, increasing the risk of adequate emergency access during emergencies.

The two neighbourhoods were selected because they represent two typical types of neighbourhoods found in many cities – an older grid-based model and a newer cul-de-sac-based model. This assessment has concluded that the older grid-based model can offer a healthier neighbourhood environment due to its easy pedestrian permeability, a greater diversity of housing and commercial land uses.
Table 5: Proposed Integrated Framework with Guidelines and their contribution to Community Well-being

The final product of this research is the integrated framework/toolkit (below) for designing and assessing neighbourhoods in BC.

<table>
<thead>
<tr>
<th>Component of Healthy Planning</th>
<th>Design Principles</th>
<th>Minimum Targets (Guidelines)</th>
<th>Health Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land-use</strong></td>
<td>Incorporating various uses in the neighbourhood - Mixed-use developments, Residential and commercial diversity, Health and wellness services, Community centres, Recreational areas (natural/designer), and Facilities/options for seniors</td>
<td>4-6 uses in a range of 0.5km; 800m radius around commercial areas to check if they can cater to the whole community in the neighbourhood. A larger radius can be considered with respect to hospitals and wellness centres but check if it can be accessed with the use of public transit.</td>
<td>Increases diversity in types of uses and attracts all age groups and income groups – Increase in social well-being and mental well-being with reducing stress, depression and chronic conditions.</td>
</tr>
<tr>
<td><strong>Economic Opportunities</strong></td>
<td>Social capital and diversity in terms of economic opportunities for employment and businesses - Mixed-use developments that allow diversity in employment opportunities possibly within a walkable radius of 800m, access to public transit to commute to various other economic opportunities in surrounding areas/locations</td>
<td>800m walkable radius or access to public transit within a reasonable distance (400-500m) from each dwelling/use.</td>
<td>Diversity in employment and increase in mixed development leads to increase in better social connectivity contributing to social well-being. Better physical and mental well-being as well.</td>
</tr>
<tr>
<td><strong>Active Transportation</strong></td>
<td>Active transit facilities for walking, cycling and wheelchair access which promotes street connectivity - Check for connected sidewalks</td>
<td>Intersections per area (min. 140 every square mile); Percentage of streets (90% min.) with each - bike lanes, sidewalks,</td>
<td>Contributes towards safety, reduction in pollution with active transit methods and</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td>Amenities for active transit and recreational activities - Provisions for dedicated lanes for cycling, walking (sidewalks) and driving with green design in mind. Provisions for covered bike racks, bus stops, benches, water fountains and washrooms in public areas.</td>
<td>The distance between stops - same as above or might increase due to variation in topography or context (Must restrict to 800m). Typology of sidewalks - basic, with trees, with furniture, and with bioswales.</td>
<td>Contributes in providing the required infrastructure for active transit hence promoting physical, mental and social well-being. Reduction in pollution and health hazards.</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td>All income housing with diversity (SF, Townhouses, Apartments, Duplexes, etc.) and density options to accommodate all types of</td>
<td>Diversity per neighbourhood (Gradient) - SF, Townhouses, Strata lots, Multiple housing or apartments, Specialized housing</td>
<td>Promotes the factor of inclusivity with accepting different income and age</td>
</tr>
<tr>
<td><strong>Encouraging Transit Oriented Developments</strong> - Provisions for public transit is provided - bus stops - distance between each stop must be in walkable limit - 400-800m</td>
<td>Intersections per area (min. 140 every square mile); Transit stops in walkable radius - 400-800m.</td>
<td>Provides for better physical and social health which indirectly contributes towards mental health.</td>
<td></td>
</tr>
</tbody>
</table>

- Traffic calming and safety measures on all transit routes with green infrastructure provisions - Relevant signs, curbs, on-street parking (70% of street length) opportunities exists.
- # Lanes - bike, pedestrian, vehicular; Surface widths - sidewalk width, road widths; On-street parking - 70% of street length; 50% of sidewalk (min.) landscaping for noon-time shade.
- The increase in physical activity with the use of active transit methods provides for better physical health.

- on either side of the road, dedicated bike paths, on-street parking conditions, wheelchair access to sidewalks, the number of intersections and crosswalks.
- curb-cuts, crosswalks.
- appropriate landscaping. This provides for better mental and physical health.
<table>
<thead>
<tr>
<th>Building Design</th>
<th>Provide optimum design solutions by incorporating scale, character and creating a sense of safety (external design solutions)</th>
<th>Public-facing building entries (onto any public space except a parking lot) on 90% of building frontage. Frequent building entries (at least every 75 feet). No blank walls more than 50 feet along sidewalks.</th>
<th>Contributes to safety, social activity and connectivity. Aesthetics often influences how we feel affecting our mental health. Promotes the mental and social health of the community as a whole.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>Access to healthy food options; Education via food programs in schools and the community; Food security</td>
<td>Farmer's market - one per week in the neighbourhood or nearby areas with access to public transit; Stores close to transit stops - 400-500m radius; Community/Schools programs in the neighbourhoods with access to community garden space and creating awareness via education with promoting healthy local food options.</td>
<td>Contributes towards providing the required nutrition along with local income to the community. Also, promotes physical activity and social connectivity which contributes to the mental health of the community.</td>
</tr>
</tbody>
</table>
5.3 FuturePossibilities ofResearch

Along with the social determinants of health which has been my main focus for this research paper, there are other factors that play a major role in helping to achieve the social determinants of health in a neighbourhood. One major factor is the role of political determinants which contribute to the social determinants of health. For example, equality and diversity play an important part in contributing towards the social aspect of the community.

One of the other factors which has not been addressed here is the social and cultural aspect of community planning. It would be interesting to further explore the relationship between urban form and mental illnesses because it is both important and currently lacking in most of our existing toolkits and design frameworks due to limited evidence and hard to link casual factors (lifestyle, upbringing, others).

Factors such as social exclusion and the access to healthcare systems have also not been explored at length. These factors are related to the social and emotional well-being of an individual and impact their well-being and health. Another factor to explore is how individuals and families experience and live life in the neighbourhoods differently. Surveys from individuals of the selected neighbourhoods to compare their daily routines or maybe even the number of times they walk or not use private vehicles for their daily commute would help make this study more accurate.

This research project has endeavoured to review existing toolkits and perspectives on health and community design and create a streamlined framework for assessing the relative support a neighbourhood will provide its residents for living a healthy lifestyle. The tool can both be used to assess and existing neighbourhood or a proposed new neighbourhood plan. Since its content has been drawn and adapted from credible healthy community planning tools from various sources, it should be readily usable by planners, designers, municipal officials and Health Authority staff as a tool to help assess and guide community development to create healthier communities.
References


http://doi.org/10.1016/j.acap.2009.05.003


http://doi.org/10.1080/01944360408976334

http://doi.org/10.1080/14649350802661683


http://doi.org/10.1017/S1368980012000584


Websites and Toolkits:

Canada Green Building Council – Neighbourhood Development -
https://www.cagbc.org/CAGBC/Programs/LEED/CommercialInstitutional/RatingsSystems/Neighbourhood_Development.aspx

PlanH - http://planh.ca/

BREEAM - http://www.breeam.com/

Healthy Build Environments Linkages Toolkit – PHSA


Provincial Health Officer’s Report on Road Safety (March 2016)
Appendices

Appendix A – Framework for Public Health and Urban Development

Table A.1 - **Framework of Public Health** (Jensen, 2013)

- **Physical Health and well-being**
  - Supporting everyone’s ability to meet daily physical needs.
  - Minimising serious threats to personal physical safety.
  - Enhancing and stimulating exercise every day for all ages and abilities.
  - Ensuring access to an affordable supply of healthy food.

- **Social Health and well-being**
  - Stimulating social interaction that leads to longer term relationships.
  - Providing a place for a broad diversity of cultures and subcultures to feel at.
  - A sense of acceptance of diversity.

- **Mental Well-being**
  - Access to relevant learning opportunities at all ages.
  - The ability to express one's inner ideas and feelings visible.
  - Facilities and programs responding to situations involving mental distress or illness.

- **Spiritual Well-being**
  - Access to places of beauty.
  - A sense of resilience, aspirations, and empowerement to address life’s challenges and opportunities.
  - Access to facilities and communities of diverse positive religious and spiritual practices.

Table A.2 - **Framework of Urban Development** (Jenson, 2013)

- **Land-use patterns**
  - Mixed uses
  - Housing and commercial diversity
  - Education access
  - Health care access
  - Density and open space

- **Shopping areas**

- **Open spaces and public spaces**
  - Pedestrian networks
  - Social interaction in open spaces or on sidewalks.
  - Community spaces
  - Wayfinding
  - Spiritual values
  - Natural areas for parks and
- Accessibility to services
- Social diversity
- Sense of civic and community
- Health facilities
  - Health and wellness services
  - Fitness services
  - Medical services
- Infrastructure Systems
  - Supply and management
- Recreation facilities
  - Community recreation facilities
  - Facilities for seniors
  - Art and culture
- Food Facilities
  - Access to healthy food
  - Food security
  - Education and celebration of food
- Health Programs
  - For adults
  - Youth
  - Seniors
  - Parents and children
  - Special needs
  - General health promotion
  - Early childhood development
  - Trails.
- Building form and design
  - Non-toxic materials
  - Adaptable interiors
  - Natural light and fresh air
  - Accessibility to recreational areas and natural areas
- Pets
  - Pet-friendly public realm
- Streets and transportation
  - Active transportation and cycling facilities
  - Traffic calming
  - Street dimensions
  - Transit
  - Vehicular impacts
  - Pedestrian/green street designs
- Employment and Economic Development
  - The diversity of stable economic opportunities for employment, businesses, and investment.
  - Working conditions and job security.
  - Income distribution
Appendix B – Health Neighbourhood Design
Healthy Linkages Toolkit – Healthy Neighbourhood Design
### Appendix C – Proposed Neighbourhood Rating System

Table A.3 - New proposed Rating System

<table>
<thead>
<tr>
<th>Components of Healthy Design</th>
<th>Land-use</th>
<th>Economic Opportunities</th>
<th>Active Transportation</th>
<th>Housing</th>
<th>Building Design</th>
<th>Infrastructure</th>
<th>Food</th>
<th>Final Outcome</th>
<th>Neighbourhood Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring Factors for Neighbourhoods</td>
<td>Mixed use options available</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
</tr>
<tr>
<td>Old City Neighbourhood</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
</tr>
<tr>
<td>Dover Bay Neighbourhood</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
<td>10</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Ratings**

- Highly recommended: 10
- Recommended: 7
- Moderately recommended: 5
- Recommended but may allow some leavage depending on context: 3

<table>
<thead>
<tr>
<th>Total</th>
<th>247</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>70%</td>
</tr>
</tbody>
</table>
Appendix D – Evaluation Tables Part I

Other components that have been analysed using existing toolkits

Table A.4: Economic Opportunities

<table>
<thead>
<tr>
<th>Component</th>
<th>Design-based Connections</th>
<th>Health Impact (Evidence)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Opportunities</td>
<td>Diversity of economic opportunities for employment and businesses</td>
<td>&quot;Healthy design includes spaces that help people to interact and build these social connections. Having social ties within the community is associated with lower stress, improved overall health status, lower mortality rates, and longevity&quot; (PlanH).</td>
<td>LEED ND</td>
</tr>
<tr>
<td></td>
<td>Working conditions and job security</td>
<td></td>
<td>The Well Building Standard</td>
</tr>
<tr>
<td></td>
<td>Income distribution</td>
<td></td>
<td>Healthy Spaces and Places</td>
</tr>
<tr>
<td></td>
<td>Social capital</td>
<td></td>
<td>PlanH</td>
</tr>
</tbody>
</table>

Table A.5: Food

<table>
<thead>
<tr>
<th>Food</th>
<th>Access to healthy food</th>
<th>&quot;41% of British Columbians eat at least five servings of fruits and vegetables per day. There is evidence to show that even a one-serving-per-day increase is linked to a 20% reduction in chronic disease related mortality&quot; (PlanH).</th>
<th>PlanH, Community Health Atlas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Education and celebration of food – community food programs</td>
<td>&quot;Community gardens are shown not only to facilitate access to healthy food but also to improve mental health by reducing stress and building networks that span generations and cultures&quot; (PlanH).</td>
<td>PlanH, HAbD, LEED-ND</td>
</tr>
<tr>
<td></td>
<td>Food security</td>
<td></td>
<td>PlanH, HAbD, LEED-ND</td>
</tr>
</tbody>
</table>
Table A.6: Active Transportation

<table>
<thead>
<tr>
<th>Active Transportation</th>
<th>&quot;Active transportation is one of the most cost-effective ways for an individual to become more physically active and remain healthy in the long-term. If all Canadians engaged in 60 minutes of physical activity per day, 33% of all deaths related to coronary heart disease, 25% of deaths related to stroke, 20% of deaths related to Type 2 diabetes, and 20% of deaths related to hypertension could be avoided&quot; (PlanH).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active transportation facilities – cycling, walking and wheelchair access</td>
<td>Traffic calming and safety – traffic circles and curbs, intersections, road widths and on-street parking options</td>
</tr>
<tr>
<td>Relevant signs for purposes of wayfinding, safety and speed limits</td>
<td>Street connectivity – having cul de sacs has been proven to restrict the driver from reaching their destination, in terms of connectivity grid patterns prove to be successful</td>
</tr>
<tr>
<td>Transit access – TOD – increased density leads to increased transit</td>
<td>Vehicular impacts – pollution</td>
</tr>
<tr>
<td>Pedestrian/green street designs – determines transit and land-use patterns – how you want people to move around</td>
<td></td>
</tr>
</tbody>
</table>
Table A.7: Housing

<table>
<thead>
<tr>
<th>Housing</th>
<th>All income housing</th>
<th>HAbD, LEED-ND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversity</td>
<td>in types of housing options – youth, seniors and differently-abled</td>
<td>Census</td>
</tr>
<tr>
<td>Density</td>
<td>higher residential density and smaller block sizes creates more walkable environments – infill developments prove to be successful in achieving density</td>
<td>LEED ND</td>
</tr>
</tbody>
</table>

Affordable options

| Social housing options   | "Research shows that supportive and supported housing can lead to fewer hospitalisations and less time spent in jail among homeless people with severe mental health issues. The resulting cost savings in these areas significantly offset the cost of the programs" (PlanH). | PlanH         |
### Table A.8: Building Design

<table>
<thead>
<tr>
<th>Building Design</th>
<th>Scale of the structures – to support the human scale – relatable environments</th>
<th>&quot;A minimum 'building-height-to-street width-ratio' of 1 to 3 (1 foot of building height for every 3 feet of street width) along at least 15% of the street length&quot; (LEED-ND).</th>
<th>Healthy Spaces and Places, LEED ND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building character</td>
<td></td>
<td></td>
<td>Healthy Spaces and Places, Building Healthy Places Toolkit, LEED ND</td>
</tr>
<tr>
<td>Natural areas around buildings/structures for parks and trails.</td>
<td>&quot;Physical benefits can also be derived simply from viewing nature. Patients in hospital rooms with a view of nature generally recover more quickly, require less pain medication, and have fewer post-surgical complications than patients in rooms with urban views&quot; (PlanH).</td>
<td>PlanH, Building Healthy Places Toolkit</td>
<td></td>
</tr>
<tr>
<td>Natural light and fresh air (ventilation)</td>
<td>&quot;Optimise daylighting through site design, building orientation, larger windows, and programming of interior spaces. Use glass partitions in interior offices&quot; (Building Healthy Places Toolkit).</td>
<td>LEED-ND, Building Healthy Places Toolkit</td>
<td></td>
</tr>
<tr>
<td>Non-toxic materials for construction</td>
<td>BREEAM- Building Healthy Places Toolkit</td>
<td>BREEAM, LEED, The Well Building Standard</td>
<td></td>
</tr>
<tr>
<td>Accessibility to recreational areas and natural areas</td>
<td>&quot;Avoid development that is more than 400 metres (a five-minute walk) from any dwelling to an area of appropriate public open space that meets the population’s needs (particularly children) in terms of scale and activities&quot; (Healthy Spaces and Places).</td>
<td>Healthy Spaces and Places, LEED ND</td>
<td></td>
</tr>
</tbody>
</table>
Table A.9: Infrastructure

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amenities for active transportation - dedicated paths, benches, bus stops, etc.</td>
<td>&quot;Safe design of streets, using traffic calming and separated bike lanes, for example, is essential to encouraging active transportation choices and preventing injuries and accidents. 82% of Canadians are willing to walk more if there is better infrastructure&quot; (PlanH).</td>
<td>PlanH, Building Healthy Places Toolkit</td>
</tr>
<tr>
<td>Amenities for recreation - Benches, water fountains, washrooms, etc.</td>
<td></td>
<td>Healthy Spaces and Places, Building Healthy Places Toolkit</td>
</tr>
<tr>
<td>Supply and management – increased density to increased traffic to increased need for better infrastructure</td>
<td>&quot;Quality of life: poor air and water conditions make a community less enjoyable to live in and can tarnish a community’s reputation as a great place to live&quot; (PlanH).</td>
<td>PlanH, LEED ND</td>
</tr>
<tr>
<td>Green infrastructure</td>
<td>&quot;Managing rainwater infiltration and stormwater with green infrastructure (e.g. swales, permeable landscapes) can be more effective and less costly than traditional hard infrastructure (e.g. pipes in the ground)&quot; (PlanH).</td>
<td>PlanH, Healthy Spaces and Places, Building Healthy Places Toolkit, LEED ND</td>
</tr>
</tbody>
</table>
## Appendix E – Evaluation Tables Part II

### Other components that have been analysed using existing toolkits

Table A.10: Active Transportation

<table>
<thead>
<tr>
<th>What can we measure?</th>
<th>How to report?</th>
<th>How can we measure?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active Transportation</strong></td>
<td>Check for connected sidewalks on either side of the road, dedicated bike paths, on-street parking conditions, wheelchair access to sidewalks, the number of intersections and crosswalks.</td>
<td>Excel table presenting all the relevant data</td>
</tr>
<tr>
<td></td>
<td>Sidewalk and road widths (Sidewalk must allow 2 wheelchairs to pass at the same time, road width for traffic calming purpose must allow one or at the most two vehicles to pass in the same direction).</td>
<td>Relevant sections to demonstrate what exists and what the aim to achieve is. Precedent images may be used to represent best practices.</td>
</tr>
<tr>
<td></td>
<td>Signs exists for speed limits and wayfinding purposes</td>
<td>Table format</td>
</tr>
<tr>
<td></td>
<td>What type of street layout exists - Grid, etc.? Cul de sacs at certain points to encourage people to use active transit routes. Is there access to various uses via active transit (bus, bike, and walk - 400-800m radius) methods? The distance between bus stops must be in the walkable range of 400m from most dwellings.</td>
<td>Plan view</td>
</tr>
</tbody>
</table>
Vancouver Island University

<table>
<thead>
<tr>
<th>Section 15</th>
<th>Not measured for this research - Considered in road widths - Section 15</th>
<th>NA</th>
<th>see road widths above</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green design solutions - Connections to pathways, sidewalks via trails, natural areas. Appropriate street landscaping is provided.</td>
<td>Plan view with precedent images</td>
<td>Sidewalk widths; % sidewalks w street trees; # of benches or seating items; others?</td>
</tr>
</tbody>
</table>

Table A.1: Economic Opportunities

<table>
<thead>
<tr>
<th>Economic Opportunities</th>
<th>Depending on the commercial uses available in the neighbourhood - assuming the scope for job diversity</th>
<th>In plan format</th>
<th>Zoning allowed/proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Depending on the full-time work possibilities in the neighbourhood - contributing towards job security</td>
<td>In plan format - combined with the above section</td>
<td>Cannot measure at this scale</td>
</tr>
<tr>
<td>Diversity in lot sizes exists to provide for all income groups</td>
<td>Plan view</td>
<td>Zoning allowed/proposed - for housing diversity; MLS listings of least/most expensive sales in the area?</td>
<td></td>
</tr>
<tr>
<td>A number of social spaces (parks, cafes, public squares, etc.) in the neighbourhood. A number of drive-thru for various food joints.</td>
<td>Plan view</td>
<td>Zoning for social uses - coffee/café/etc….; parks and open spaces</td>
<td></td>
</tr>
</tbody>
</table>
### Table A.12: Food

<table>
<thead>
<tr>
<th>Food</th>
<th>Daily grocery stores accessible within the 10-15mins walking radius or near public transit stops (bus-stops)</th>
<th>Plan view</th>
<th>Zoning review; % of area within a gradient of distance to a food store for all area and for transit stops; (need several classes of food store - eg: big food floor, speciality food, corner/convenience store)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farmers market site exists in the neighbourhood and is accessible by schools and for other community awareness events</td>
<td>Plan view</td>
<td>Farmers markets held within the area - at least 1 day/week for at least 5mo / yr.?</td>
</tr>
<tr>
<td></td>
<td>Lots include scope for growing your own food - backyards, patios, etc.</td>
<td>Plan view</td>
<td># Community gardens in the study area.</td>
</tr>
</tbody>
</table>

### Table A.13: Housing

<table>
<thead>
<tr>
<th>Housing</th>
<th>Different types of housing - Townhouses, SF, Duplex, etc. exist.</th>
<th>Plan view with an excel table for reference</th>
<th>Diversity allowed in zoning; diversity built</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Various types of housing that exist who are they suitable for? Do they include options for youth, students, seniors, etc.?</td>
<td>Column to be included in the above section</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td>Depending on the types of houses and lot sizes, is there scope for infill projects? (Different for different context)</td>
<td>Mention in the report</td>
<td>Same as above - difficult/minor to measure</td>
</tr>
<tr>
<td></td>
<td>Similar to the above section - Affordability depending on types of housing and lot sizes</td>
<td>Mention in the report</td>
<td>Same as housing price / rental price spread noted above</td>
</tr>
</tbody>
</table>
Opportunity for social housing exists in the neighbourhood or surrounding neighbourhoods. (Different for different contexts)

<table>
<thead>
<tr>
<th>Mention in the report</th>
<th>Can't measure this easily</th>
</tr>
</thead>
</table>

Table A.14: Building Design

<table>
<thead>
<tr>
<th>Building Design</th>
<th>Look for scales of existing structures to the street width - mainly mixed-use developments and commercial spaces (if they exist in the neighbourhood).</th>
<th>Provide existing and proposed in the form of sections</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>No blank facades - transparency contributes to safety and creating more active spaces providing surveillance</td>
<td>Section format</td>
<td># Doorways per length? # Front facades/entries per length?</td>
<td></td>
</tr>
<tr>
<td>Green spaces (natural or designed) present around workspaces, residences, schools, etc. - 400-800m walkable radius (commute time = 5-10mins)</td>
<td>Plan and section view (possible GIS study)</td>
<td>See above for park space/area; could measure urban forest canopy too; can't measure green space per site/parcel unless it's a new master planned community.</td>
<td></td>
</tr>
<tr>
<td>The orientation of buildings on an east-west axis to maximise on natural air and light.</td>
<td>Plan view</td>
<td>Not sure if it’s possible at neighbourhood scale</td>
<td></td>
</tr>
<tr>
<td>Use of locally available non-toxic materials present</td>
<td>Not reported for this study</td>
<td>Not neighbourhood scale</td>
<td></td>
</tr>
</tbody>
</table>
Table A.15: Infrastructure

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Check for prominent and covered bus stops, bike racks at the main centres, dedicated paths for various modes of transit, street lights for safety.</th>
<th>Table format</th>
<th>See above - mostly all covered - maybe add bike racks to what's measured; street lighting is not easy to deal with (dark skies on one hand - engineers standards on the other)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Check for benches, water fountains, washrooms, lighting on trails for safety, disposal bins, bike parking near recreational areas - parks, lakes, community centres, etc.</td>
<td>Table format</td>
<td>This is a parks measurement thing - not sure if worth measuring? Could identify washrooms, bike parking, picnic tables and potentially a list of amenities in the park spaces to rate that.</td>
</tr>
<tr>
<td></td>
<td>Supply can be met if there is density increase</td>
<td>Mention in report</td>
<td>We need to presume there is clean water and sanitary - nothing is built without it. We can look at storm water separately. Mainly not in the scope of this research.</td>
</tr>
<tr>
<td></td>
<td>Provisions exist for green infrastructure - covered seating areas and bus-stops, non-slip surfaces to prevent accidents, appropriate landscaping - bioswales, permeable surfaces.</td>
<td>Mention in report with precedent images and sections</td>
<td>Preliminary assessment can be done but not in depth.</td>
</tr>
</tbody>
</table>
### Appendix F – Local Area Profiles of Assessed Neighbourhoods

#### Old City Neighbourhood Nanaimo

#### Planning Area Profile

- **Planning Area:** Old City / VIU
- **Area of Land:** 460 ha
- **Neighbourhood Associations:**
  - Harewood Community Association
  - Western Neighbourhood Association

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#### Census Data

<table>
<thead>
<tr>
<th></th>
<th>1996 Old City / VIU</th>
<th>1996 Old City / VIU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Population</strong></td>
<td>5440</td>
<td>5335</td>
</tr>
<tr>
<td><strong>2001</strong></td>
<td>6305</td>
<td></td>
</tr>
<tr>
<td><strong>2006</strong></td>
<td>78690</td>
<td></td>
</tr>
</tbody>
</table>

| **0-4 years**        | 405 (7%)            | 355 (7%)            |
| **5-9 years**        | 1250 (23%)          | 1290 (20%)          |
| **20-24 years**      | 340 (6%)            | 695 (11%)           |
| **25-34 years**      | 880 (16%)           | 885 (14%)           |
| **35-44 years**      | 895 (16%)           | 815 (13%)           |
| **45-54 years**      | 570 (10%)           | 905 (14%)           |
| **55-64 years**      | 375 (7%)            | 460 (10%)           |
| **65-74 years**      | 350 (7%)            | 440 (9%)            |
| **75-84 years**      | 175 (3%)            | 250 (4%)            |
| **85 years and over**| 40 (1%)             | 81 (1%)             |
| **Average age of population** | 33.6 | 35 | 36.9 |
| **Change in population** | n/a | -105 | 520 |
| **% Change in population** | n/a | -2.0% | 9.0% |

| **Total Population by 5 year mobility status** | 5040 | 4985 | 5950 | 74160 |
| **Non-movers (same address five years ago)** | 2115 (42%) | 2315 (46%) | 2400 (39%) | 34945 (45%) |
| **Movers** | 2930 (58%) | 2670 (54%) | 3550 (57%) | 36215 (51%) |
| **Non-migrant movers** | 1500 (30%) | 1875 (38%) | 2065 (33%) | 21350 (28%) |
| **Migrant movers** | 1430 (28%) | 790 (16%) | 1485 (24%) | 17865 (23%) |

| **Households** | 2050 | 2135 | 2670 | 33525 |
| **Persons in private households** | 5440 | 5335 | 6160 | 76790 |
| **Persons per household** | 2.7 | 2.5 | 2.3 | 2.3 |
| **Average household income** | 34936 | 37690 | 43197 | 56744 |
| **Median household income** | 29725 | 31226 | 33873 | 46460 |
| **Low Income Families** | 445 (31%) | 410 (27%) | 450 (26.7%) | 2698 (12%) |
| **% of all renter households who paid 30% or more of their gross household income on rent.** | 55 | 47 | 55 | 49 |

| **Families** | 1450 | 1540 | 1695 | 22580 |
| **Persons per family** | 3 | 2.9 | 2.7 | 2.7 |
| **Two-parent families** | 1090 (75%) | 1050 (68%) | 1205 (71%) | 18785 (83%) |
| **Two-parent families with no children at home** | 470 (32%) | 565 (37%) | 635 (37%) | 10715 (47%) |
| **Two-parent families with children at home** | 620 (43%) | 485 (31%) | 570 (34%) | 8070 (36%) |
| **Lone-parent families** | 360 (25%) | 495 (32%) | 490 (29%) | 3795 (17%) |
| **Total children at home** | 1825 | 1810 | 1745 | 20110 |

| **Occupied Dwellings** | 2050 | 2135 | 2670 | 33525 |
| **Owned dwellings** | 1235 (63%) | 1360 (64%) | 1545 (68%) | 23635 (70%) |
| **Rented dwellings** | 755 (37%) | 775 (36%) | 1120 (42%) | 9890 (30%) |
| **Single-detached house** | 1235 (60%) | 1315 | 1235 (46%) | 19115 (57%) |
| **Semi-detached/row/duplex** | 530 (26%) | 285 (13%) | 835 (31%) | 5780 (17%) |
| **Apartments** | 195 (10%) | 290 (14%) | 560 (21%) | 7755 (23%) |
| **Moveable dwelling** | 85 (4%) | 245 (11%) | 40 (1%) | 870 (3%) |

| **Age of Dwelling** | 220 (11%) | 170 (8%) | 345 (13%) | 2370 (7%) |
| **Built 1946-1960** | 340 (17%) | 355 (17%) | 545 (20%) | 3635 (11%) |
| **Built 1961-1970** | 260 (13%) | 290 (14%) | 355 (13%) | 4110 (12%) |

---

48 Census
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years</td>
<td>570 (28%)</td>
<td>620 (29%)</td>
<td>535 (20%)</td>
<td>6465 (19%)</td>
</tr>
<tr>
<td>10 years</td>
<td>410 (20%)</td>
<td>405 (19%)</td>
<td>410 (15%)</td>
<td>6285 (19%)</td>
</tr>
<tr>
<td>15 years</td>
<td>245 (12%)</td>
<td>160 (7%)</td>
<td>265 (10%)</td>
<td>5020 (15%)</td>
</tr>
<tr>
<td>20 years</td>
<td>n/a</td>
<td>135 (6%)</td>
<td>215 (8%)</td>
<td>5635 (17%)</td>
</tr>
</tbody>
</table>

**Total Population 15 years and over by Labour Force Activity**

<table>
<thead>
<tr>
<th>Category</th>
<th>1955</th>
<th>1940</th>
<th>2870</th>
<th>34465</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the labour force</td>
<td>2560 (65%)</td>
<td>2525 (61%)</td>
<td>3450 (66%)</td>
<td>40440 (62%)</td>
</tr>
<tr>
<td>Employed</td>
<td>2165 (53%)</td>
<td>2070 (50%)</td>
<td>3120 (60%)</td>
<td>37525 (57%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>460 (11%)</td>
<td>360 (7%)</td>
<td>330 (6%)</td>
<td>2915 (4%)</td>
</tr>
<tr>
<td>Not in the labour force</td>
<td>1320 (35%)</td>
<td>1620 (39%)</td>
<td>1765 (34%)</td>
<td>25255 (38%)</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>18.4%</td>
<td>18.2%</td>
<td>9.7%</td>
<td>7.2%</td>
</tr>
</tbody>
</table>

**Total Employed Labour Force 15 years and over by Mode of Transportation**

<table>
<thead>
<tr>
<th>Mode of Transportation</th>
<th>1955</th>
<th>1940</th>
<th>2870</th>
<th>34465</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car, truck van as driver</td>
<td>1505 (77%)</td>
<td>1530 (79%)</td>
<td>2045 (71%)</td>
<td>27125 (79%)</td>
</tr>
<tr>
<td>Car, truck van as passenger</td>
<td>215 (11%)</td>
<td>140 (7%)</td>
<td>320 (11%)</td>
<td>2460 (7%)</td>
</tr>
<tr>
<td>Public transit</td>
<td>32 (2%)</td>
<td>35 (4%)</td>
<td>170 (6%)</td>
<td>1165 (3%)</td>
</tr>
<tr>
<td>Walked to work</td>
<td>100 (5%)</td>
<td>125 (6%)</td>
<td>235 (8%)</td>
<td>2450 (7%)</td>
</tr>
<tr>
<td>Bicycle</td>
<td>50 (3%)</td>
<td>50 (3%)</td>
<td>60 (2%)</td>
<td>695 (2%)</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>10 (1%)</td>
<td>0</td>
<td>140 (0%)</td>
<td>30 (0%)</td>
</tr>
<tr>
<td>Taxi cab</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other method</td>
<td>30 (2%)</td>
<td>20 (1%)</td>
<td>35 (1%)</td>
<td>410 (1%)</td>
</tr>
</tbody>
</table>

**Total Population 20+ years and over by Educational Attainment**

<table>
<thead>
<tr>
<th>Education</th>
<th>1955</th>
<th>1940</th>
<th>2870</th>
<th>34465</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than grade 9</td>
<td>390 (10%)</td>
<td>270 (7%)</td>
<td>1230 (24%)</td>
<td>12665 (19%)</td>
</tr>
<tr>
<td>Grades 9 to 13</td>
<td>1655 (41%)</td>
<td>1455 (39%)</td>
<td>1665 (32%)</td>
<td>53030 (81%)</td>
</tr>
<tr>
<td>Trades certificate or diploma</td>
<td>175 (4%)</td>
<td>630 (17%)</td>
<td>725 (14%)</td>
<td>18950 (29%)</td>
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<tr>
<td>Other non-university education</td>
<td>1245 (30%)</td>
<td>720 (19%)</td>
<td>720 (14%)</td>
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<tr>
<td>University</td>
<td>585 (14%)</td>
<td>660 (18%)</td>
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**Dominant Demographics**

<table>
<thead>
<tr>
<th>Category</th>
<th>English</th>
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<td>Western Europe</td>
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<td>Grades 9 to 13</td>
<td>Grades 9 to 13</td>
<td>Grades 9 to 13</td>
<td>Grades 9 to 13</td>
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<td>Labour by Industry</td>
<td>Health and social service</td>
<td>Retail trade</td>
<td>Retail trade</td>
<td>Retail trade</td>
<td>Retail trade</td>
<td>Retail trade</td>
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<tr>
<td>Labour by Occupation</td>
<td>Sales and service</td>
<td>Sales and service</td>
<td>Sales and service</td>
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</table>

**Please Note**
The census tract boundaries may have been different between 1996 & 2001.
* This number was 15 in the 1996 Census.
** This area formerly known as Five Acres

G:\CommPlan\Neigh Planning\2006 CensusData\2006Neighbourhood Statistics Chart_16_OldCity_VIU.doc
### Dover Bay Neighbourhood Nanaimo

<table>
<thead>
<tr>
<th>Planning Area Profile</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Planine Area: Dover • Area of Land: 380 ha • Neighbourhood Association(s): None</td>
<td></td>
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</tbody>
</table>

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<table>
<thead>
<tr>
<th>Census Data</th>
<th>1996 Dover</th>
<th>2001 Dover</th>
<th>2006 Dover</th>
<th>2006 City of Nanaimo</th>
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<tbody>
<tr>
<td>Total Population</td>
<td>5170</td>
<td>5800</td>
<td>6610</td>
<td>78690</td>
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<tr>
<td>0-4 years</td>
<td>310 (6%)</td>
<td>215 (4%)</td>
<td>230 (3%)</td>
<td>3455 (4%)</td>
</tr>
<tr>
<td>5-19 years</td>
<td>1270 (25%)</td>
<td>1370 (24%)</td>
<td>1300 (20%)</td>
<td>13880 (18%)</td>
</tr>
<tr>
<td>20-24 years</td>
<td>205 (4%)</td>
<td>285 (5%)</td>
<td>375 (6%)</td>
<td>5520 (7%)</td>
</tr>
<tr>
<td>25-34 years</td>
<td>620 (12%)</td>
<td>425 (7%)</td>
<td>415 (6%)</td>
<td>8255 (10%)</td>
</tr>
<tr>
<td>35-44 years</td>
<td>1010 (20%)</td>
<td>900 (16%)</td>
<td>800 (12%)</td>
<td>10435 (13%)</td>
</tr>
<tr>
<td>45-54 years</td>
<td>720 (14%)</td>
<td>1035 (18%)</td>
<td>1165 (18%)</td>
<td>12495 (16%)</td>
</tr>
<tr>
<td>55-64 years</td>
<td>430 (8%)</td>
<td>570 (10%)</td>
<td>940 (14%)</td>
<td>10505 (13%)</td>
</tr>
<tr>
<td>65-74 years</td>
<td>415 (8%)</td>
<td>545 (9%)</td>
<td>670 (10%)</td>
<td>6915 (9%)</td>
</tr>
<tr>
<td>75-84 years</td>
<td>175 (4%)</td>
<td>370 (6%)</td>
<td>540 (8%)</td>
<td>5240 (7%)</td>
</tr>
<tr>
<td>85 years and over</td>
<td>25 (0%)</td>
<td>90 (2%)</td>
<td>175 (3%)</td>
<td>1990 (3%)</td>
</tr>
<tr>
<td>Average age of population</td>
<td>36.2</td>
<td>39.5</td>
<td>44.0</td>
<td>42.0</td>
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<tr>
<td>Change in population</td>
<td>n/a</td>
<td>630</td>
<td>807</td>
<td>5693</td>
</tr>
<tr>
<td>% Change in population</td>
<td>n/a</td>
<td>10.9%</td>
<td>13.9%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Total Population by 5 year mobility status</td>
<td>4855</td>
<td>5510</td>
<td>6210</td>
<td>74160</td>
</tr>
<tr>
<td>Non-movers (same address five years ago)</td>
<td>1300 (27%)</td>
<td>2980 (54%)</td>
<td>2835 (44%)</td>
<td>34945 (45%)</td>
</tr>
<tr>
<td>Movers</td>
<td>3555 (73%)</td>
<td>2535 (46%)</td>
<td>3380 (53%)</td>
<td>39215 (51%)</td>
</tr>
<tr>
<td>Non-migrant movers</td>
<td>1395 (29%)</td>
<td>1260 (23%)</td>
<td>1655 (26%)</td>
<td>21350 (28%)</td>
</tr>
<tr>
<td>Migrant movers</td>
<td>2155 (44%)</td>
<td>1275 (23%)</td>
<td>1725 (27%)</td>
<td>17865 (23%)</td>
</tr>
<tr>
<td>Households</td>
<td>1840</td>
<td>2140</td>
<td>2505</td>
<td>33525</td>
</tr>
<tr>
<td>Persons in private households</td>
<td>5165</td>
<td>5730</td>
<td>6440</td>
<td>76790</td>
</tr>
<tr>
<td>Persons per household</td>
<td>2.8</td>
<td>2.7</td>
<td>2.6</td>
<td>2.3</td>
</tr>
<tr>
<td>Average household income</td>
<td>56115</td>
<td>66283</td>
<td>78033</td>
<td>56744</td>
</tr>
<tr>
<td>Median household income</td>
<td>56307</td>
<td>59681</td>
<td>69143</td>
<td>46460</td>
</tr>
<tr>
<td>Low Income Families</td>
<td>55 (4%)</td>
<td>100 (6%)</td>
<td>135 (6.7%)</td>
<td>2698 (12%)</td>
</tr>
<tr>
<td>% of all renter households who paid 30% or more of their gross household income on rent.</td>
<td>46</td>
<td>34</td>
<td>38</td>
<td>49</td>
</tr>
<tr>
<td>Families</td>
<td>1515</td>
<td>1736</td>
<td>2030</td>
<td>22580</td>
</tr>
<tr>
<td>Persons per family</td>
<td>3.1</td>
<td>3</td>
<td>2.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Two-parent families</td>
<td>1395 (92%)</td>
<td>1560 (90%)</td>
<td>1825 (90%)</td>
<td>18785 (83%)</td>
</tr>
<tr>
<td>Two-parent families with no children at home</td>
<td>585 (39%)</td>
<td>750 (43%)</td>
<td>960 (47%)</td>
<td>10715 (47%)</td>
</tr>
<tr>
<td>Two-parent families with children at home</td>
<td>805 (53%)</td>
<td>815 (47%)</td>
<td>865 (43%)</td>
<td>8070 (36%)</td>
</tr>
<tr>
<td>Lone-parent families</td>
<td>120 (8%)</td>
<td>170 (10%)</td>
<td>205 (10%)</td>
<td>3795 (17%)</td>
</tr>
<tr>
<td>Total children at home</td>
<td>1755</td>
<td>1845</td>
<td>1925</td>
<td>20110</td>
</tr>
<tr>
<td>Occupied Dwellings</td>
<td>1845</td>
<td>2135</td>
<td>2510</td>
<td>33525</td>
</tr>
<tr>
<td>Owned dwellings</td>
<td>1490 (81%)</td>
<td>1745 (82%)</td>
<td>2185 (87%)</td>
<td>23635 (70%)</td>
</tr>
<tr>
<td>Rented dwellings</td>
<td>355 (19%)</td>
<td>395 (19%)</td>
<td>320 (13%)</td>
<td>9890 (30%)</td>
</tr>
<tr>
<td>Single-detached house</td>
<td>1330 (72%)</td>
<td>1535 (72%)</td>
<td>1695 (68%)</td>
<td>19115 (57%)</td>
</tr>
<tr>
<td>Semi-detached/row/duplex</td>
<td>205 (11%)</td>
<td>265 (12%)</td>
<td>440 (18%)</td>
<td>5780 (17%)</td>
</tr>
<tr>
<td>Apartments</td>
<td>305 (17%)</td>
<td>340 (16%)</td>
<td>375 (15%)</td>
<td>7755 (23%)</td>
</tr>
<tr>
<td>Movable dwelling</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>870 (3%)</td>
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<table>
<thead>
<tr>
<th>Age of Dwelling</th>
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<tbody>
<tr>
<td>Built before 1946</td>
<td>10 (0%)</td>
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<tr>
<td>Built 1946-1960</td>
<td>10 (0%)</td>
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---

49 Census
<table>
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<tr>
<th></th>
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<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Pop.</td>
<td>10 (0%)</td>
<td>10 (0%)</td>
<td>25 (1%)</td>
<td>4110 (12%)</td>
<td>n/a</td>
<td>65695</td>
</tr>
<tr>
<td>Employed</td>
<td>110 (6%)</td>
<td>165 (8%)</td>
<td>140 (6%)</td>
<td>6465 (19%)</td>
<td>6285 (19%)</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>815 (44%)</td>
<td>800 (37%)</td>
<td>810 (32%)</td>
<td>5020 (15%)</td>
<td>5635 (17%)</td>
<td></td>
</tr>
<tr>
<td>Not in labour force</td>
<td>890 (48%)</td>
<td>800 (37%)</td>
<td>715 (28%)</td>
<td></td>
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</tr>
<tr>
<td>Unemployment rate</td>
<td>6.6%</td>
<td>8.2%</td>
<td>6.4%</td>
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**Total Population 15 years and over by Labour Force Activity**

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</thead>
<tbody>
<tr>
<td>In the labour force</td>
<td>2655 (67%)</td>
<td>2975 (64%)</td>
<td>3225 (59%)</td>
<td>40440 (62%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>2485 (62%)</td>
<td>2730 (58%)</td>
<td>3025 (55%)</td>
<td>37525 (57%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>175 (4%)</td>
<td>245 (5%)</td>
<td>205 (4%)</td>
<td>2915 (4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in the labour force</td>
<td>1320 (33%)</td>
<td>1705 (36%)</td>
<td>2245 (41%)</td>
<td>25255 (38%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>6.6%</td>
<td>8.2%</td>
<td>6.4%</td>
<td></td>
<td></td>
<td>7.2%</td>
</tr>
</tbody>
</table>

**Total Employed Labour Force 15 years and over by Mode of Transportation**

<table>
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<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Car, truck van as driver</td>
<td>1965 (86%)</td>
<td>2050 (85%)</td>
<td>2270 (82%)</td>
<td>27125 (79%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car, truck, van as passenger</td>
<td>165 (7%)</td>
<td>125 (5%)</td>
<td>135 (5%)</td>
<td>2460 (7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public transit</td>
<td>45 (2%)</td>
<td>30 (1%)</td>
<td>55 (2%)</td>
<td>1165 (3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walked to work</td>
<td>70 (3%)</td>
<td>135 (6%)</td>
<td>210 (8%)</td>
<td>2450 (7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td>10 (0%)</td>
<td>35 (1%)</td>
<td>25 (1%)</td>
<td>695 (2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motorcycle</td>
<td>10 (0%)</td>
<td>0</td>
<td>20 (1%)</td>
<td>140 (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxi cab</td>
<td>0</td>
<td>0</td>
<td>10 (0%)</td>
<td>30 (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other method</td>
<td>15 (1%)</td>
<td>30 (1%)</td>
<td>30 (1%)</td>
<td>410 (1%)</td>
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</tbody>
</table>

**Total Population 20+ years and over by Educational Attainment**

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Less than grade 9</td>
<td>110 (3%)</td>
<td>140 (3%)</td>
<td>800 (15%)</td>
<td>12665 (19%)</td>
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</tr>
<tr>
<td>Grades 9 to 13</td>
<td>1355 (34%)</td>
<td>1155 (28%)</td>
<td>1625 (30%)</td>
<td>53030 (81%)</td>
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<tr>
<td>Trades certificate or diploma</td>
<td>170 (4%)</td>
<td>550 (13%)</td>
<td>620 (11%)</td>
<td>18950 (29%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other non-university education</td>
<td>1195 (30%)</td>
<td>1035 (25%)</td>
<td>985 (18%)</td>
<td>8730 (13%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>1150 (29%)</td>
<td>1245 (30%)</td>
<td>1435 (26%)</td>
<td>13225 (20%)</td>
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**Dominant Demographics**

<table>
<thead>
<tr>
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<th>English</th>
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<td>Official home language</td>
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<tr>
<td>Non-official home language</td>
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<tr>
<td>Immigrant Place of Birth</td>
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<tr>
<td>Ethnic Origin</td>
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<tr>
<td>Religion</td>
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<tr>
<td>Educational Attainment</td>
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<td></td>
</tr>
<tr>
<td>Labour by Industry</td>
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<tr>
<td>Labour by Occupation</td>
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</tbody>
</table>

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* This number was 15 in the 1996 Census.