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Activating the City

Exploring the Application of Best Practice Active Living in Dunedin

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Abstract

The built environment has been pinpointed as a significant influencing factor in determining choice of travel to work. Characteristics of the built environment can either hinder or enhance opportunities for active living. Current low active living mode shares within New Zealand and the health problems associated with a sedentary population has resulted in research into interventions to reverse vehicle dominated transport systems. This research investigates the influence of the built environment on active living through comparing provisions for active living in Dunedin's statutory and non-statutory planning documents with international best practice cities. Key Informant interviews expand on the findings of this document analysis. A literature review details five characteristics of the built environment that are common across those cities, and describes methods that are used to improve active transport rates, thus encouraging active living.

This research concludes that current provisions within the Dunedin planning framework with respect to active living are positive and encouraging. However several changes could help the city improve its active travel mode share rates to levels seen in international best practice cities. In particular, walking and cycling infrastructure requirements for new developments and filling in missing connections in the walking and cycling network are two possible changes to the Dunedin planning framework to achieve better active living mode share rates. The research concludes by providing recommendations for changes to the Dunedin planning framework with respect to the five built environment characteristics. Dunedin is well poised to become a successful active living city and through recommended changes to the planning framework, the city could develop comparable active living mode share rates to successful international best practice cities.

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Chapter One: Introduction

“While the cost of overcoming barriers to walking and cycling may be high, the costs of not doing so are likely to be much higher” (Mackett, 2011, p.25).

Walking, cycling, and other active forms of travel represent healthy, economically viable, and environmentally sustainable modes of transport. However current transport trends in New Zealand show a small proportion of the population utilise active travel while transport systems are dominated by provision for vehicles. The costs of these systems to personal and environmental health far out-weigh any benefit from quick and comfortable forms of travel (Zhang, 2006). Ways to alleviate growing concerns over car-use and to encourage greater use of walking and cycling have been sought. This research introduces one area where significant improvements can be made to encourage and promote active living, known as walking and bicycling as a part of daily travel (Cradock et al., 2009). This area for improvement is the urban built environment.

1.1 Context

Global travel to work through the twentieth and early twenty-first century has seen the dominance of one form of travel; the private automobile. To many people the private car has afforded a convenient, fast, reliable and comfortable mode of transport and has become the mode of choice for travel. Sales (1980) stated that policy makers have therefore planned and operated the transport system with one single goal in mind: to move people and goods into and around cities as rapidly and efficiently as possible, with speed as the ulterior objective (as cited in Khitsy & Ayvalik, 2003, p.54). Urban transport systems have been designed to accommodate private vehicle use often at the expense of other modes, perceived as slow and cumbersome methods of transport.

Yet with the perceived benefits of the automobile (namely speed and comfort) come a raft of concerns ranging from global sustainability to personal health (Zhang, 2006). At a global level, the automobile has been well established as a major contributor to environmental degradation through reduced air quality (Williams, 1987; Faiz, 1993; Krzyzanowski, Kuna-Dibbert & Schneider, 2005), depletion of energy resources (Black, 1996; Litman, 1999), vehicle emission

runoff (De Langen & Rustica, 2001; Pitt, 2001), and environmental destruction through infrastructure development (Newman & Kenworthy, 1989). At the individual level, automobile dependence is blamed for inducing a sedentary lifestyle that contributes to chronic diseases and conditions such as obesity, diabetes, and heart disease (Frank & Engelke 2005; Jackson & Kochtitzky, 2001; Bull et al., 2004).

To address the negative environmental impacts of vehicle use, policy initiatives in the United States claimed that the development of more efficient vehicles and lower-carbon fuels such as biodiesel would offset the harmful impacts of vehicle use (Ewing et al., 2008). However with increasing vehicle ownership rates and longer miles travelled, technological advances still remain well behind the current problems of car use (Ewing et al., 2008). These findings are unlikely to be different in the New Zealand context given the country's dispersed population (4.3 million people spread over 268,680 km²), low density cities, and automobile centred transportation system (Tin Tin, Woodward, Thornley & Ameratunga, 2009, p.8).

These concerns about the environmental impacts of vehicle use coupled with an increased awareness of environmental sustainability have lead to alternative transport modes being encouraged worldwide (Cox, 2010). In particular, there has been growth in the promotion of active transportation; understood as walking, cycling and other non-motorised forms of transport (Cox, 2010). Considering how populations can be encouraged or assisted in converting to active forms of travel is an issue that has received significant attention in the literature. Behaviour-based research interventions that focus on psychological influences on travel behaviour have produced some positive results in modal shift to walking and cycling (Ajzen, 1985; Biddle & Mutri, 2008). However a recent focus on the built environments influence on transport choice has indicated the way that our urban environments are designed can have a significant influence on our activity choices (Garrard, 2009). It is this aspect of the literature that is further explored in Chapter Two and which is the focus of this research.

The features of both the built environment and characteristics of the perceived environment have been found to be associated with transport related physical activity at the population level (Armorim, Azevedo & Hallal, 2010). Planning, community design, and health behaviour studies consistently find that the way communities are built influences whether people drive, take transit, walk, or bicycle to get where they are going (Active Living Research, 2005, p.1). Current city, neighbourhood and transportation designs often discourage walking, cycling and other active activities due to the automobile centred focus of transportation systems. Handy,

Boarnet, Ewing and Killingsworth (2002) state that because of the natural focus on car travel when planning transport, much of what is known about the built environment and travel behaviour has been learned in this context (p.70). Giuliano and Small (1991) consider that urban planners need to understand the role played by the urban structure on the journey to work in order to mitigate the negative effects on mobility. This research focuses less on journeys to work and more on characteristics of the built environment that contribute to increasing active living through active transportation, which may or may not include journeys to work.

A growing body of evidence confirms that neighbourhoods characterised by low density, poorly connected street networks, and poor access to shops and services are associated with low levels of walking (Giles-Corti, 2006, p.1). Efforts to increase the pedestrian orientation of the built environment through mixed-use development, street connectivity, and good urban design among other strategies, can enhance both the feasibility and the attractiveness of walking and bicycling by reducing physical and psychological barriers (Handy et al., 2002, p.72). The built environment has therefore been pinpointed as a major influencing factor for promoting and encouraging active living. If the built environment can be enhanced to create active-friendly environments, this would help to substantially improve the health and quality of life of most people (Handy et al., 2002, p.72). New Zealand and Dunedin could substantially benefit from built environment changes with the aim of creating a more active and healthier population. Understanding the international lessons learnt will be the starting point for this research.

1.2 Understanding the Issue

It appears many European countries are experiencing the positive benefits of an active population through a rapid increase in the mode share of people walking and cycling. Car dependency has shown a steady decline over the past two decades while walking and cycling make up at-least one-fourth of all urban trips in Europe (Pucher & Dijkstra, 2000). The Netherlands currently experience the highest mode share of active travellers in Europe with 45% of the population choosing active transport modes (Pucher, Dill & Handy, 2010). Pucher and Buehler's (2008) research also shows that Denmark and Germany are making significant improvements in walking and cycling mode shares and this has largely been attributed to the provision and improvement of appropriate infrastructure. Tin Tin et al. (2009) notes that European countries have adopted policies specifically designed to place walking and cycling as

priority areas for transport and urban planning. This may explain why European countries are leading the way in active living statistics. The policies to which Tin Tin et al. (2009) refer have a focus on urban planning policies which control and encourage built environments to become more active-friendly.

New Zealand's population could learn from these European examples given its current transport trends. New Zealand is among the countries with the highest rate of car ownership in the world (The Economist, 2008; as cited in Tin Tin et al., 2009). In a study carried out by Tin Tin et al. (2009) analysing journey to work Census data from 1996 to 2006, they found that more than four-fifths of New Zealanders used a private motor vehicle to travel to work on Census day in 2006 while only one in fourteen people walked to work and one in forty cycled. Increased car use from 1991 to 2006 occurred at the expense of active travel with travel mode shares for cycling and walking steadily decreasing in New Zealand from 4% and 21% respectively in 1989 to 1% and 16% respectively in 2006 (Ministry of Transport (MOT), 2007).

Further confirming New Zealanders dependence on the automobile are the short distances travelled by vehicle. Tin Tin et al. (2009) states that one-third of trips less than two kilometres and two-thirds of trips less than six kilometres are taken by vehicle (p.2). Research shows that residents are also resistant to changing their travel patterns to more active-friendly modes when covering short distances (Sullivan & O'Fallon, 2006). This is, perhaps, a reflection of the under-investment in walking and cycling friendly environments and is an issue that this research seeks to explore.

Dunedin experiences high rates of car ownership with extremely low active travel participation rates as indicated through Census data. The 2006 New Zealand Census found that 2.7% of Dunedin's resident's cycle to work, 11% walk, while 78% drive. As the 2010 New Zealand Census was cancelled, it is difficult to establish the recent trend in active travel. Nevertheless the 2006 Census data for Dunedin is comparable to the rest of New Zealand; showing little decline in automobile use and low rates of walking and cycling which forms a basis for this research. It is not known whether Dunedin's planning policies or strategies are enhancing or limiting the opportunity for changes in the built environment to improve active living. Based on international best practice, as determined through the literature review, an analysis of plans and strategies has been undertaken to help identify where and what changes can be made to Dunedin policy documents in order to encourage active living.

1.3 Research Aim

The aim of this research is to make recommendations based on international best practice on how Dunedin's planning framework, relating to the built environment, could be amended to allow local authorities to improve conditions conducive to walking and cycling for transport.

To achieve the above aim, a primary research question aided by several objectives has been developed to guide the research process.

Research Question:

How can examples of best practice in active living planning inform the Dunedin planning framework to meet any deficiencies in active living planning in Dunedin?

To assist with achieving the aim of this research and to answer the above research question, several objectives have been developed.

Objectives:

1. To review international literature and planning documents on best practice active living.
2. To identify key characteristics of the built environment that influence active living.
3. To identify key methods used to assist the characteristics of active living.
4. To identify Dunedin's current state of active living based on the identified key characteristics and methods.
5. To develop a planning framework for improving active living in Dunedin.

This chapter has established the aim of the research, the research question, and the objectives.

Chapter Two presents an international literature review detailing previous research and identifying characteristics and methods of active living from best practice cities. Chapter Three provides background information on active living in New Zealand and Dunedin. Chapter Four details the methodology used for this research. Chapter Five presents the results and discusses the results in light of the relevant literature followed by recommended changes to the Dunedin planning framework. Chapter Six provides conclusions of this research and outlines direction for future research.

Chapter Two: Literature Review

2.1 Introduction

The last 20 years has yielded a growing body of literature on the influence that the built environment plays in assisting physical activity levels. This movement has been aligned with growing concerns regarding public health and an upward trend in physical inactivity and sedentary behaviour. Communities that provide healthy places for people to live and work will realise the social and economic benefits of a healthier, happier, and more productive population (Hudson, 2009). Many cities have subsequently recognised the potential for city-wide changes through projects designed to encourage active travel. Yet many of the worlds highly developed cities lack the infrastructure in terms of its built environment and local policies to achieve changes in transport towards more active forms of travel. Alternatively, they have basic infrastructure to support active living but fail to generate greater modal shift. Identifying what features represent good active living and which planning methods have been used to promote active living will allow other local authorities to move towards a greater proportion of their population using active travel. Dunedin, and New Zealand in general, could benefit substantially from urban planning changes towards a focus on active living as a key component of planning policies.

This chapter reviews the current literature relating to active living and the built environment to establish a detailed understanding of why our cities need to pursue active living priorities in planning. It begins by establishing what is meant by the term 'active living' followed by an explanation of why active living is so important to a city and its inhabitants in section two. Section three elaborates on the link between the built environment and active living by focussing on the characteristics that are typical of good active living environments, with international case studies used as examples. This section will also highlight the methods that have proven to be successful in incorporating active living into city environments – and these are highlighted as 'best practice'. Overall this chapter establishes the criteria against which to assess Dunedin's planning framework, and against which the results can be assessed.

2.2 Active Living

Active living is a key concept to define in order to understand not only which characteristics of the built environment influence active living, but also to identify city-wide methods or strategies that can be adopted to specifically target areas that promote active living. This section also reviews the literature specific to active living, and summarises the health, economic and social benefits of active living.

2.2.1 Definition of Active Living

Active living has primarily been described in the literature as simply the act of incorporating physical activity into daily life. Richards, Murdoch, Reeder and Amun (2011) refer to active living as “forms of physical activity that can be built into everyday living...which includes walking, cycling, skating and self propelled wheelchairs” (p.1). Similarly, Cradock et al. (2009) refer to active living as “encouraging walking and bicycling as a part of daily travel” (p.39). These definitions put a large focus on transporting oneself via active means, therefore active living appears to be primarily concerned with forms of active travel.

The Institute of Public Health in Ireland (2011) define active living as journeys that use physical activity such as walking and cycling, generally understood as travel for work, shopping and visiting friends. Fitness Canada (1991) goes further by defining active living as “a concept in which physical activity is valued and integrated into daily life” (p. 8). This definition highlights the importance of active living not just being about physical activity but actually valuing it as a crucial part of daily life. However some researchers define active living as a much broader concept. Sallis et al. (2006) define active living as a “broader concept that incorporates exercise, recreational activities, household and occupational activities, and active transportation” (p. 298). Health Canada (2011) defines active living as simply integrating physical activity into everyday life; at home, at school, at work, at play and on the way. These definitions provide a general overview of what active living is. However for the purposes of this research, a more refined and specific definition is required to understand the role of local authorities in encouraging active living. Local authorities have little input into ‘household and occupational activities’ or ‘integrating physical activity at home’ as mentioned in the previous definitions.

From a planning perspective, active living takes on a more place-based definition. Hoehner, Brennan, Brownson, Handy and Killingsworth (2003) define active living as “the creation of places that support and promote physical activity for people of all ages and abilities” (p.17). A

combination of the above examples provides the following definition of active living for the purposes of this research:

‘Active living is valuing and incorporating forms of physical activity into daily life, through the creation of places that support active transport modes such as walking and cycling’.

2.2.2 Benefits of Active Living

Public health professionals and researchers recognise the positive effects of physical activity on physical and emotional health (Alaimo et al., 2008). Yet the benefits of active living extend beyond health and wellbeing as it also provides economic and social benefits. Active living contributes to better quality of life and the economic sustainability of active living as an alternative transport mode is also extremely attractive. The following section will outline the benefits of active living that pertain to individual and city-wide concerns. This will provide a background on why active living should be incorporated into urban planning.

2.2.2.1 Health Benefits

Transport policies and systems that prioritise walking, cycling and public transport have been identified as one of the best investments for physical activity (Global Advocacy for Physical Activity, 2011). Incorporating physical activity into daily life has correlated benefits to the health of individuals and the city in which they live. These health benefits are significant as they include lower mortality rates by reducing the risk of premature death, an improved quality of life; it helps develop and maintain good mental health, and has shown to be an excellent curative tool for many diseases (United States Department of Health and Human Services (USDHHS), 2000; Bize, Johnson & Plotnikoff, 2007; Fox, 1999; Pate et al., 1995). Physical inactivity is largely responsible for the growing obesity problems and their associated diseases currently plaguing many societies throughout the world. The four major chronic diseases indicated from physical inactivity are: cardiovascular disease (CVD); cancer; diabetes; and chronic obstructive pulmonary disease (Vojnovic, Jackson-Elmoore, Holtrop & Bruch, 2005). Furthermore, the World Health Organisation (WHO) named four risk factors that are responsible for approximately 80% of deaths worldwide: tobacco, physical inactivity, harmful use of alcohol and unhealthy diets (WHO, 2011). While local authority provisions for active living may impart little influence on altering three of these categories (tobacco, harmful use of alcohol and unhealthy diets), the primary area it can aid is physical inactivity.

Walking, cycling and other forms of active transport provide practical and inexpensive opportunities for physical activity via methods that can be easily integrated into everyday life.

They are also tangible and achievable alternatives to sport and exercise for which important positive health effects have been demonstrated (Cavill, Kahlmeier, Rutter, Racioppi & Oja, 2008). The promotion of active commuting has been demonstrated to be an important and effective intervention to increase physical activity at a population level (Department of Health, 2009). Studies have shown that workers who actively commute have significant health benefits compared to automobile transport users including lower blood pressure, less likely to be overweight, physically fitter, and have lower triglyceride and insulin levels (Gordon-Larsen et al., 2009). In a study by Cooper et al. (2008) which investigated the longer term benefits of active transport to school in adolescents, it was found that after a six year follow up, cardio-respiratory fitness (CRF) was positively associated with cycling to school in children and adolescents of both sexes. This finding highlights the potential long-term health benefits of active living, particularly at a young age level where activity habits may influence future transport and health statuses.

The potential health benefits of active living may also present a viable and effective solution to New Zealand's health problems. Badland, Duncan and Schofield (2009) used Census data from 1981 to 2006 to document the work-related travel behaviours of New Zealanders over time to identify the link between travel type and public health. They identified the consequences of private automobile use were reduced physical activity, poor air quality, increased injury risk, infrastructure costs, traffic congestion, and social inequalities (Badland et al., 2009). They also drew upon previous research showing a large proportion of the adult working population recognise they are able to commute to work via walking or cycling but choose not to (Badland et al., 2009). The Census data revealed fluctuations in private vehicle and public transport use due to changes in world fuel prices. Despite this, the private vehicle dominated statistics with a low of 54.8% in 1991 to its highest mode share of 79.9% in 2001 (Badland et al., 2009). Walking and cycling were extremely low across all time points and has fallen over time with 25% of all work commutes in 1981 to 17% in 2006 (Badland et al., 2009). No Census data is available for 2010 which prevents analysis of current travel trends. However based on the study by Badland et al. (2009), it is evident that New Zealanders are showing little sign of changing travel behaviours and therefore will not be experiencing the mentioned health benefits of active living.

2.2.2.2 Economic Benefits

The health benefits of active living would be the most prominent advantage of incorporating active living into everyday life. The economic gain accrued from active living also proposes an

attractive argument for its inclusion within urban environments. Improving economic conditions through active living assists central and local authorities in achieving economic wellbeing provisions through the Resource Management Act (1991) and the Local Government Act (2002) in New Zealand. A change from travel by car to cycling or walking means reduced health costs, reduced external costs (e.g. air pollution and noise) from motorised traffic, and reduced parking costs (Saelensminde, 2004). In a critical review of the economic evidence concerning environmental infrastructure interventions for walking and cycling, Powell et al. (2010) found most studies concluded the net benefit of infrastructure for walking and cycling outweighed the cost. As an example, a cost-benefit analysis of walking and cycling infrastructure in three Norwegian towns carried out by Saelensminde (2004) concluded that investment in such projects is far more beneficial, economically speaking, than any other transport investment. Saelensminde (2004) estimated the average economic saving accrued from employees who become more physically active was 2500 Norwegian Krone (\$528 NZD) per person per year due to health improvements. Additional benefits primarily came from savings in bus transport fares, reduced costs from small and severe disease and ailments, reduced external costs from modal shift away from road transport, and reduced workplace parking costs (Saelensminde, 2004).

The literature suggests that the greatest economic benefit from walking and cycling infrastructure comes from the health savings to the individual and city (Davis, 2009; Powell et al., 2010). Wang et al. (2005) carried out a cost-benefit analysis of walking and cycling tracks in Lincoln, Nebraska, which revealed the resource costs of constructing and maintaining cycling and walking tracks may be completely outweighed by the direct health benefits alone. This was before such factors as reduced automobile use or reduced parking costs are even considered when projected over a 30 year period. Their total annual economic cost per person was calculated at \$192.12 USD (\$235.81 NZD) for construction and maintenance of tracks and travel equipment while the annual economic benefit in direct medical savings alone was calculated at \$561.41 USD (\$692.76 NZD) per person. Similarly Cavill, Cope and Kennedy (2009) calculated the annual economic cost of six Cycle Demonstration Towns (CDT'S) in England was £6.23 million (\$12.31 million NZD) for construction and maintenance while the annual economic benefit solely from mortality savings was £8.9 million (\$17.58 million NZD). The literature has revealed that the economic benefits to the health sector alone are significant and coupled with other potential savings including reduced automobile use and parking costs provide an extremely compelling investment. Numerous other examples of health economic savings from active living investment have also been shown worldwide (Jones & Eaton, 1994;

Katzmarzyk, Gledhill & Shephard, 2000; Stephenson, Bauman, Armstrong, Smith & Bellew, 2000; Swales, 2000).

Economic benefits of active living can also be significant across various city-wide sectors. Active living has been shown to support economic development through industry and construction (Garrett-Peltier, 2010), retail bike shops and tourism (Beeton, 2003; Grabow, Hahn & Whited, 2010), and real estate through developments that promote liveability (National Bicycle and Pedestrian Clearinghouse (NBPC), 1995; League of American Bicyclists (LAB), 2009). Litman (2011) presents a suite of benefits and costs of non-motorized transport modes such as walking and cycling where several city-wide economic benefits are evident. Identified benefits included reduced city wide roadway construction, reduced maintenance and operating costs, reduced parking problems and parking facility cost savings, and economic and environmental benefits from reduced energy consumption and pollution (Litman, 2011). A key area of economic benefit that Litman (2011) covered which has limited mention in transport planning research is improved productivity and employment. Physical activity as a method to generate greater workplace productivity and therefore greater employee output has been well established in the literature through other disciplines such as health and business (Pronk & Kottke, 2009; Burton, McCalister, Chen & Edington, 2005).

2.2.2.3 Social Benefits

Banister (2002) claims that the social benefits of having a more active population are substantial. There are several benefits associated with an active community, particularly as it increases social capital. Social capital, defined as “the social networks and interactions that inspire trust and reciprocity” (Putnam, 2000, as cited in Leydon, 2003, p.1546), incorporate various social interactions such as knowing neighbours, trusting others, and being socially engaged (Leyden, 2003; Skjaeveland & Gärling, 1999). Having places to walk to, public spaces, mixed land uses, and residential density improves social capital. Yet many current transportation and land use policies reduce social capital through the provision for automobile travel which consequently undervalues alternative transport modes (Victoria Transport Policy Institute, 2005, as cited in Litman, 2006).

Early research into the design and layout of neighbourhoods suggested pedestrian, cycle and transit-friendly neighbourhoods bring life to streets by providing opportunities for social interaction and community cohesion (Jacobs, 1961; Appleyard, 1981). This appears to be because the characteristics of good active living planning create social capital within

neighbourhoods. For example Leydon (2003) sought to examine whether neighbourhoods designed for pedestrians improve individual levels of social capital. Leydon (2003) found, through survey questionnaires distributed to differently designed neighbourhoods, that mixed use, well connected, pedestrian-oriented streets contained residents with higher social capital. A limitation of note in this study was the city used for this analysis may not allow generalisation throughout the world and especially in New Zealand. The town used was Galway in Ireland, described as fast growing (indicating new residential developments were occurring) however also contained neighbourhoods that were established centuries before the automobile. Given many of New Zealand's built environments will be significantly younger than this, the findings, although illuminating, may not be transferable to the New Zealand context. Furthermore, socio-economic status was not taken into account in this study and it should be noted that these factors could determine individual levels of social capital.

Nevertheless Leydon's (2003) findings are also supported by other studies that correlate automobile use with poor social interaction (Besser, Marcus & Frumkin, 2008; Putnam, 2000, as cited in de Nazelle et al., 2011).

Long commute times have shown to be associated with lower civic participation (Poulsen & Svendsen, 2005; Scaff, 1952; Martin, 1956). Commute times of greater than 20 minutes have been found to be significantly associated with poor access to social capital, with trips longer than 90 minutes showing the strongest association (Besser et al., 2008). In contrast, more active-friendly modes of travel have been associated with improved social networks. Appleyard (1981) analysed three streets in San Francisco attempting to determine the effects of vehicle traffic on social interaction. Appleyard (1981) found streets with higher volumes of vehicle traffic had less people attempting to cross the street which resulted in fewer people knowing their neighbours on the other side of the street. Those streets with lower vehicle traffic resulted in more people reporting they had friends and acquaintances within their neighbourhood (Appleyard, 1981). This research highlights that even the physical barrier of too many vehicles using a road can negatively affect social interaction.

The physical barrier of vehicle traffic also highlights the documented social benefits of a safer and more attractive living environment. Those who walk and cycle through neighbourhoods are more likely to interact with their surroundings compared to automobile users, which concurrently gives residents a sense of pride and responsibility in taking care of their surroundings (Appleyard, 1981; Untermann & Vernez-Moudon, 1989). A safer and more open

neighbourhood environment as a result of fewer vehicles has also been shown to deter crime and reduce fear of criminal activity (Mair & Mair, 2003). This informal social surveillance has been diminished through the arrival of the private automobile (Cox, 2010). Cox (2010) suggests greater numbers of residents walking and cycling provide safer and crime-free communities. Less vehicle traffic has also been associated with safer street environments allowing children to play outdoors and interact with others (Handy, Cao & Mokhtarian, 2008; Carver, Timperio & Crawford, 2008). In an analysis of active travel patterns in school children, Inchley and Cuthbert (2007) questioned school children on the reasons why they choose to travel via active modes to school. Social benefits of active living were the most popular reason why children used active forms of travel, with 40% of children citing this as their main reason (Inchley & Cuthbert, 2007). Social benefits included being able to spend time with friends and family and also making new friends (Inchley & Cuthbert, 2007). Therefore, on the basis of this literature, it would follow that environments which are active-friendly and promote non-motorised forms of transport are conducive to greater social interaction.

2.2.2.4 Summary of Benefits of Active Living

The identified benefits of active living present a compelling argument for their inclusion in cities today. The literature has shown that health benefits portray the greatest benefit of investment in active living. However with the rising cost of automobile use and the costs associated with construction and maintenance of roading networks, active living has presented itself as economically affordable. The dominance of the automobile has also seen community networks and social interaction disappear. Active living has been shown to reverse this trend by providing safe and open spaces for social interaction and community cohesion. The benefits of active living provide firm reasoning behind the goals of this research in terms of including more active living provisions in urban planning. Urban planning that prioritises active living will result in residents and cities collectively experiencing the benefits this type of transport provides.

2.3 Characteristics of Environments which Promote Active Living

In order to answer the research question, 'how can examples of best practice in active living planning inform the Dunedin planning framework to meet any deficiencies in active living planning in Dunedin', it is necessary to identify the characteristics of successful active living environments. Identifying these characteristics is essential to understand what features are typical of successful active living environments and to discover methods required to improve

city-wide active living in other communities. Characteristics and methods identified in the literature that are typical of active living environments will be outlined in the following section with international examples provided as evidence of their success. Taking examples from international best practice, Dunedin can direct its urban planning efforts to mirror those applied throughout the globe. Frank, Kavage & Raine (2007) identified neighbourhoods that encourage walking, cycling and overall active living typically feature five key characteristics:

- Transport infrastructure;
- Street connectivity and accessibility;
- Funding;
- Streetscape design and safety (urban design), and;
- A mix of land uses

Not one of these categories can exist without influence from others; for example a mix of land uses would not be conducive to active living without well-connected corridors to access different areas. As such the following categories will be reviewed individually however it should be noted that the case studies may contain a combination of these categories, even when not explicitly mentioned.

2.3.1 Transport Infrastructure

Active living infrastructure is a major characteristic determining walking and cycling mode shares. Building new infrastructure for walking and cycling results in an increase in overall physical activity which has the potential to produce a range of health and economic benefits (Tight & Givoni, 2010). For example, more and better quality sidewalks are associated with adults having a higher likelihood of walking, using transit, and driving less (De Nazelle et al., 2010). Improved transport infrastructure may be in the form of cycle lanes or dedicated cycle and walking trails, increased footpath connectivity and car-free pedestrian boulevards, safe and free-flowing methods of crossing roads and arterials, or safe and accessible storage infrastructure for cycle parking. Several Canadian cities have seen significant growth in the amount of people cycling after major investments were made in bicycle infrastructure; for example after the completion of the Vancouver's Adanac Bikeway in 1993, bicycle volumes increased by 225% (Provincial Health Services Authority, 2007).

Walking and cycling infrastructure has received moderate research attention in relation to transport choice. Hess, Moudon, Snyder, and Stanilov (1999) observed pedestrian volumes

into 12 neighbourhood commercial centres in Puget Sound, Washington. These neighbourhoods were matched for population density, land use mix, income, block size, and sidewalk completeness. Urban sites with small blocks and extensive sidewalk systems were found to have on average three times the pedestrian volumes of suburban sites with large blocks and short, incomplete sidewalk systems. Hess et al. (1999) recommended completing sidewalk networks, creating walkways to connect all building entrances to public sidewalks, and increasing the opportunities for pedestrians to cross streets safely. These features would dramatically improve active living in neighbourhoods (Hess et al., 1999). Improved cycling infrastructure in the form of bicycle paths and lanes with a high degree of separation from motor traffic has also been shown to increase cycle travel in women (Garrard, Rose & Lo, 2008). The authors found that due to gender differences with regards to risk aversion, females prefer the safest possible cycle routes and this is where investment in cycle infrastructure is important (Garrard et al., 2008).

Creating a supportive environment like this appears necessary to encourage bicycling for everyday travel, allowing more adults to achieve active living goals (Dill, 2009). However this can be difficult to achieve as implementing such infrastructure requires a comprehensive and long term plan, adequate and ongoing funding, and local and/or national political backing. For example in a review of bicycle infrastructure carried out by Dill (2009), she mentioned that Oregon State law requires both bicycle and pedestrian infrastructure be built whenever roads are built or rebuilt (with few exceptions). The law also stated that cities, counties, and the state spend a reasonable share of their state highway funds on pedestrian and bicycle features. Similarly, Pucher (1997) describes how Germany improved its mode share of cyclists by 50% through public policy decisions. These decisions resulted in greater investment in cycle routes, reducing speed limits in central business districts, and giving priority to cyclists and pedestrians. Therefore with local or central authorities taking charge, active living infrastructure can be made a reality through adequate funding and support, and this is an aspect that will be further explored as part of this research.

Yet as highlighted by Provincial Health Services Authority (2007), the initial problem is that many municipalities lack facilities and infrastructure supporting walking and cycling meaning there is little impetus to initiate or improve infrastructure. Lunday (2003) attributes this to a continuum of city development over the last few centuries. Pre-industrial revolution cities were considered highly walkable but this changed to a focus on transit cities and eventually to automobile cities. This evolution has had the effect, for western urban populations, of

gradually reducing or removing transport-related physical activity (Ryks, 2008). It is crucial therefore that infrastructure is somehow made available through existing roads, footpaths and trails in existing cities. Copenhagen, Denmark is an example of how an existing city can be tailored to achieve high rates of active living through investment in, and implementation of, active living infrastructure.

2.3.1.1 Case Study: Copenhagen, Denmark

Copenhagen, Denmark is known as the 'City of Cyclists' (The City of Copenhagen, 2011). Currently there is over 350km of dedicated cycle tracks or lanes which has resulted in 1.2 million kilometres travelled per working day by 36% of the population who cycle (The City of Copenhagen, 2011). This is a significant proportion of the population who travel by active means given that pedestrians would add on top of this bike mode share to improve the overall percentage of active travellers (see Figures 1 and 2, The City of Copenhagen, 2011, p. 8 and 9). Copenhagen wants to increase this mode share of people commuting to work and education facilities by bicycle to 50% by 2025, up from 36% in 2010 (The City of Copenhagen, 2011). To achieve this target, ambitious and extensive improvements in current transport infrastructure will be required (The City of Copenhagen, 2011). The city has already recognised the benefits of good transport infrastructure and the shortfalls of poor infrastructure. For example, the Bryggebroen is a bicycle and pedestrian bridge in Copenhagen that crosses over the harbour and has been recognised as a significant piece of infrastructure by users (The City of Copenhagen, 2011). The users identified the shorter trips, increased sense of security, and greater comfort of the bridge as critical in their choice to cycle to work (The City of Copenhagen, 2011).

Yet a single intersection that does not feel safe can be enough to break the fluidity of a good cycle network and provide a deterrent for residents who are hesitant about cycling (The City of Copenhagen, 2011). If the numbers of cycling citizens are to increase, it is all about making the bicycle the fastest and easiest way to get around for even more citizens than today (The City of Copenhagen, 2011). This will be achieved through strong prioritising of bicycle friendly infrastructure and a will to think out of the box (The City of Copenhagen, 2011).

	0 - 2 km	2 - 4.9 km	5 - 9.9 km	10 - 14.9 km	> 15 km	ALL
WALK	30,000	6,000	0	0	0	36,000
BICYCLE	35,000	67,000	43,000	9,000	1,000	155,000
CAR	3,000	18,000	27,000	23,000	67,000	138,000
BUS	1,000	9,000	14,000	3,000	1,000	29,000
TRAIN	1,000	4,000	13,000	13,000	43,000	74,000
OTHER	0	0	1,000	1,000	4,000	6,000
ALL	70,000	105,000	98,000	49,000	116,000	438,000

Figure 1: Total number of Copenhagen's population travelling by different modes of transport.

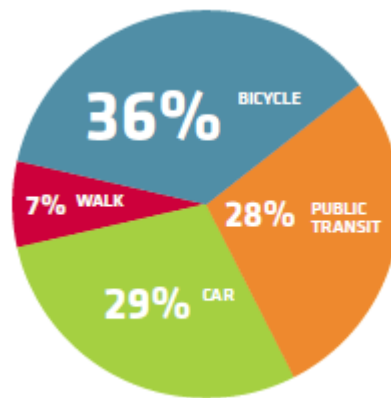


Figure 2: Percentages of mode share in Copenhagen, Denmark.

To achieve the target of 50% of the population commuting via cycling, The City of Copenhagen Council has implemented a bike strategy focussing on investment over the next 24 years. Future improvement and additions to the bicycle infrastructure network include the following:

Planned infrastructure additions to Copenhagen

- Several main arterials contain missing links which create unnecessary stops for pedestrians and cyclists. Eliminating these missing links is a key priority leading to 2025, for example a new bicycle ramp connecting Dybbolsbro to Fisketorvet has created greater flow and reduced travel times.
- Partnerships between workplaces, shops and public transport providers to improve bicycle parking spaces for commuters and by 2025 the number of bicycle parking will exceed car parking spaces.
- 17% of families have a cargo bike, a traditional bicycling with an attached 'front boot' for carrying children, groceries, etc. Requirements for cargo bike parking for new buildings are being implemented in an effort to increase capacity for bicycles and promote greater travel to retail areas via cargo bikes.

- An Intelligent Traffic System (ITS) which is currently being piloted. Light Emitting Diode (LED) lights are placed in the asphalt and signal which transport mode has priority and when. The system will change throughout the day depending on different traffic mode volumes with more room being allocated for cycling during early morning rush hour for example.
- Current one-way streets designed for vehicles cause cyclists to take cumbersome detours. Contra-flow cycle tracks have been implemented in Bremerholm and Gothersgade with further funding designed to eliminate all one-way streets for cyclists by 2025.
- A commitment to increase the number of cycle lanes and tracks has been implemented to improve access to different parts of the city and create new routes over water, rail and squares. Bicycle connections along water and through green areas is also a priority as these routes offer increased security and open up new ways to enjoy the cities green areas.
- Increasing cycle lane width is underway to accommodate the different types of riders in Copenhagen. Currently, wider cycle tracks on Norrebrogade and Store Kongensgade are being constructed in order to reduce congestion on these routes.

Box 1: Proposed infrastructure provisions in Copenhagen to improve cycling rates. Source: The City of Copenhagen (2011).

Key to Copenhagen's current success and ambitious future infrastructure development has been several strategies. Firstly, in 2000 its first bike strategy was published which outlined the cities quantitative goals for bicycle planning over the next 11 years (The City of Copenhagen, 2011). Following its publication, bicycling became integrated with the entire transport network and planning, giving it one third of the city road construction budget (The City of Copenhagen, 2011). As with other case studies, promotion of the policies and ambitions of the bike strategy was essential in getting public and private support for the goals of the strategy. Promotion campaigns in conjunction with other city authorities such as the Copenhagen Health and Care Administration were a feature of gaining support for the strategy. Campaigns and promotions included the 'we bike to work' campaign which saw free snacks and bike safety gear handed out to workers cycling to work and incentives for employees to get fellow colleagues to bike to work for the chance to win an exotic holiday (The City of Copenhagen, 2011). A key characteristic of successful cycling in Copenhagen has been ongoing research and monitoring

of the bicycle network and its users. A biannual bicycle survey for example is carried out to identify strengths and weaknesses of the bicycle network and also gauge how many people are using the network (The City of Copenhagen, 2011).

Copenhagen's early investment in cycle infrastructure appears to have paid off as, through the infrastructure, promotion, and monitoring of its cycle network, the city has developed into one of the most active commuter populations in the world. Some of these ideas are further explored throughout this research, in particular the provision of cycle lanes, tracks and facilities in combination with monitoring and promotion and education programmes.

2.3.2 Connectivity/Accessibility

As mentioned above, investment in infrastructure such as tracks and paths not only creates safe passageways for active travellers but also improves connectivity and accessibility. Street connectivity refers to the directness of links and density of connections (i.e. intersections) in street networks (Mecredy, Pickett & Janssen, 2011). Highly connected street networks make it more efficient and easier to walk or bicycle from one place to another (Mecredy et al., 2011). How well streets are connected is crucial to determining what type of travel mode people choose to take (Mecredy et al., 2011). Structural variables such as street connectivity and shorter block lengths are consistently associated with higher levels of active transportation (Li et al., 2005; Huang, Stinchcomb, Pickle, Dill, & Berrigan, 2009). Contemporary suburban developments which contain too many winding streets and cul-de-sacs, blocks that are too big, and road networks that lack connectivity, have the effect of deterring active forms of travel and promote automobile use due to the greater distances needed to travel (Song, 2005).

Better connectivity within cities can lead to more walking and biking, fewer vehicle miles travelled, higher air quality, and greater sense of community among residents (Benfield, Raimi, & Chen, 1999). Good street connectivity has also been correlated with 30 minutes of walking for transportation each week (Saelens, Sallis, & Frank, 2003) and more total physical activity (Frank, Schmid, Sallis, Chapman, & Saelens, 2005; Saelens, Sallis, Black, & Chen, 2003), compared to those who live in neighbourhoods with less walkable suburban designs (Rodriguez, Khattak, & Evenson, 2006). This is because, according to Frank and Engelke (2000) travel by foot, bike, or other active means is easier due to shorter block distances and a variety of available routes, giving choice to the traveller.

Frank et al. (2006) examined the link between the built environment and opportunity for active transportation in Washington. They discovered connected streets, a key feature of walkable neighbourhoods, directly contributes to more walking and biking for transportation and thus significant positive associations with lowering body mass indexes (BMI's). Song (2005) investigated five Smart Growth measures across three counties in the United States to measure how well their urban development patterns meet Smart Growth measures. Song (2005) stated that one of these measures was connectivity, which could be broken down into four categories. These categories included internal connectivity (number of street intersections compared to cul-de-sacs), blocks perimeter (median perimeter of blocks), cul-de-sac length (median length of cul-de-sacs) and external connectivity (median distance between access points). He found that neighbourhoods in the USA are becoming better connected internally, probably due to subdivision regulations that promote compact growth and discourage sprawling development (Song, 2005). However he also found neighbourhoods are becoming less externally connected, that is, access points into and out of neighbourhoods from the arterial network are limited. This is thought to be as a result of transport engineers perceiving access points as creating safety concerns, deteriorating traffic flow, and leading to vehicle conflict (Song, 2005).

The Provincial Health Services Authority (2007) in Canada emphasises that transit-oriented neighbourhoods (defined as having grid street networks) have higher average walking and bicycling rates than auto-oriented neighbourhoods (with random street or cul-de-sac patterns). A grid-like street layout is hypothesised to make travel between two points - 'as the crow flies' - shorter and more direct than a cul-de-sac type layout (Ryks, 2008). Figure 3, from Safe Routes (n. d.), represents these two patterns showing a visual display of high connectivity through grid-like street patterns and low connectivity through random street patterns or cul-de-sacs.

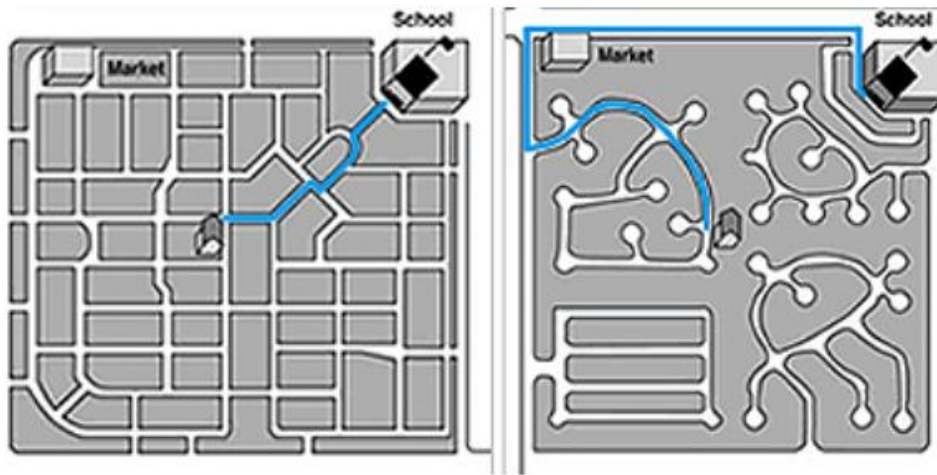


Figure 3: Grid street pattern showing a more direct route to destinations compared to cul-de-sac or random street patterns.

Unfortunately as a result of expanding city residential areas leading to newer housing and subdivisions, many cities are experiencing greater construction of random street layouts and cul-de-sacs (Vojnovic et al., 2005). Vojnovic et al. (2005) state random street layout construction is due to an emphasis placed on privacy which has replaced the grid-like pattern of the traditional walkable city. The poor connectivity and the discontinuous road networks of these developments; characterized by curvilinear streets, cul-de-sacs, and loop street patterns, increase trip lengths within and between neighbourhoods (Vojnovic, et al., 2005). However communities with this development pattern can be altered to enhance connectivity and accessibility. Randall and Baetz (2001) highlighted that well connected streets were identified as a crucial element in creating sustainable and pedestrian-friendly environments however given a majority of city streets have been well established around designs for automobile use, pedestrian connectivity is poor. To remedy this, they implemented street retrofitting in the form of added sidewalks and pathways that bypass road networks and create shorter routes to destinations such as bus stops, schools, and commercial areas (Vojnovic et al., 2005). The results saw 87% of the resident population satisfied with the new connections and access for pedestrians compared to 47% prior to any retrofitting (Vojnovic et al., 2005). Street retrofitting shows that existing neighbourhoods can be re-designed with little effort and cost to improve street connectivity and thus create corridors for active living.

Yet connectivity has not always been found to promote active living amongst communities. Many studies have focussed on adult populations and their connections with work or shopping facilities. A study by Mecredy et al. (2011) found street connectivity is negatively associated

with physical activity outside of school for youth between grades 6 and 10 (10-16 year olds) across 180 Canadian schools, citing risk and neighbourhood safety as attributable factors. Furthermore Norman et al. (2006) and Boone-Heinonen and Gordon-Larsen (2009) found that street connectivity measures were negative correlates of moderate-to-vigorous activity for girls, with no associations present for boys. Fitzhugh, Bassett and Evans (2010) further claimed that enhanced pedestrian connectivity does not increase active transport to school in children and adolescents. They claim that changes in the built environment alone are unlikely to lead to increased active travel as these need to be reinforced with education and promotion (Fitzhugh et al., 2010). Therefore researchers should be hesitant about labelling connectivity as a faultless intervention for increasing physical activity levels, particularly with regard to youth. However given the positive associations it has shown in a majority of the research on adult populations, and its likelihood of success accompanied with education and promotion, improved street connectivity does show significant benefit by encouraging active living.

2.3.2.1 Case Study: Portland, Oregon

The city of Portland was economically and culturally poor up to the 1970's prior to planning policies being implemented which dramatically revived the city (Dobson & Gilroy, 2009). A group named Active Living by Design (ALbD) was created whereby community-led changes are achieved through collaboration with local and national partners to enhance the built environment to create a culture of active living (Dobson & Gilroy, 2009). ALbD is based on studies of successful design and physical education interventions, adopting an evidence-based approach to community-led changes (ALbD, n.d.). This project was a significant contributor to reviving Portland through changes in the built and socio-political environment (Dobson & Gilroy, 2009). Two pilot projects for ALbD were carried out, one of which is in the community of Damascus in Portland. Damascus was a spread-out community whereby residents relied heavily on vehicles for almost all transportation and recreation while walking and cycling were perceived as very unsafe on the community roads (Dobson & Gilroy, 2009).

Damascus was previously a rural-urban fringe community however in 2003 it was recognised by local and regional stakeholders as a community where significant development was needed to address growing population numbers (Dobson & Gilroy, 2009). As such, the area was seen as an opportunity to conceptualise a complete community with a policy direction towards supporting active living and healthy communities (Dobson & Gilroy, 2009). Through a concept planning process, the Damascus/Boring Concept Plan was developed and subsequently adopted in 2007 (Dobson & Gilroy, 2009). Adler, Dobson, Fox and Weigand (2008) reviewed

this concept plan in an in-depth analysis of the politics of incorporating such plans into municipal documents to promote active living. They identified among other things that key to this concept was the identification by community residents and metro planners of a need for interconnected street systems to provide transportation choice for bicyclists, pedestrians and transit riders (Adler et al., 2008). Health experts also advocated for greater choice in transport modes due to the benefits of residents incorporating physical activity into their daily lives (Adler et al., 2008). Ultimately, their objective was a future Damascus that would provide an interconnected system that offered safe and convenient cycling, pedestrian, and transit options to a variety of community destinations (Adler et al., 2008).

Community based consultation was key to developing the strategies and concepts of the Damascus/Boring Concept Plan. Community forums involving active living advocates informed residents of the importance of a connected community street system (Adler et al., 2008). Health benefits associated with greater bicycle, pedestrian and transit networks were the main features advertised (Adler et al., 2008). Strong community support prompted councillors on the Damascus Advisory Committee (DAC) to support a well-developed local transportation network instead of a freeway focus. As a result, new development in Damascus contained grid street patterns with bicycle boulevards that allowed easier access to destinations for cyclists (Adler et al., 2008). Figure 4, from Docstoc (2011), shows a series of grid-like street patterns with well connected neighbourhoods (light orange) feeding into direct access points into the retail zone (red) in Damascus.

The case site of Damascus shows how well connected street patterns can lead to greater opportunities for active living, achieved through community consultation and education on the health benefits of a more active population.



Figure 4: Damascus Concept Plan showing good street connectivity from residential areas (light orange) to retail and work areas (red).

2.3.3 Funding

Funding for active living projects is critical if changes to peoples travel behaviour are to be achieved. The Provincial Health Services Authority (2007) claims that there are many methods to ensure funding for active living projects, yet little research has been conducted on ways to generate funding for active living. Sallis et al. (2006) state that obtaining funding for multilevel research and interventions to promote active living are a central challenge to the health and planning disciplines. One of the most frequently mentioned barriers to promoting active living is lack of funding (Edwards & Tsouros, 2008). In particular, the biggest challenge is securing a sustainable funding stream to support long-term initiatives (Provincial Health Services Authority, 2007). Currently the primary source of funding revealed in the research has come from national institutes and organisations. Banister (2005) identifies that central funding is where the big government dollars are and could, therefore, have the biggest effect on assisting

modal shift promotion. State or Federal government subsidisation for the provision of infrastructure is available through funding programs to assist local governments in the design and implementation of cycling infrastructure (Queensland Transport, 2006). Funding from a dedicated local government infrastructure budget can be another way to source funding for projects however the provision of such funds is often limited due to revenue and spending constraints (Sallis et al., 2006).

In America, funding for walking and cycling infrastructure has come from the ALbD group, an organisation established by the Robert Wood Johnson Foundation as part of the Public Health Institute. The organisation works with local and national partners to generate support for active living initiatives. Through the ALbD organisation, more than one million dollars was secured for community-based projects to improve cycle and pedestrian safety and create a more pleasurable environment for active travellers in Lents and Damascus, Portland (Dobson & Gilroy, 2009). Similarly, although monetary values were not revealed, ALbD helped fund one third of an active living project in Logan Square, Chicago through a grant, while its community-action model covered the rest of the cost through private sector support (Gomez-Feliciano et al., 2009).

A more creative source of funding has been London's Congestion Charging scheme which has proven to be a successful source of funds to implement sustainable transport strategies including active living. The scheme charges users for travelling into a central business zone by vehicle between 7:00am and 6:30pm on all working days. The revenues from the congestion charge are then re-invested into projects and infrastructure associated with public and active transport (Blow, Leicester & Smith, 2003). However, the theme here is the local and central government support of congestion charging, which could not be achieved without their policy changes.

These examples show how organisations and governments can facilitate initiatives to provide funding for active living projects however it is the existence of such organisations or support from government that appears crucial to the process of obtaining active living funding.

Wherever the funding initially comes from, the crucial factor in determining future funding is developing successful projects. Thomas, Sayers, Gordon and Reily (2009) highlighted the importance of planning for multiple strategies or projects because these can leverage off policy successes. Focusing on building early successes is an essential part in ongoing funding

and resourcing of projects to support active living (Thomas et al., 2009). If decision-makers and the public can see the successes of projects there will be a greater impetus to develop further projects that will in turn create greater benefits for communities.

However when this does not occur, funding for other projects that promote active living are jeopardised. Cradock et al. (2009) examined bicycle and pedestrian orientated investments between 1992 and 2004 in 3140 counties in the United States. Their findings were twofold. The proportion of residents who took active modes of travel to work was positively associated with per capita funding for bicycling and pedestrian improvements and the number of projects implemented. These findings highlighted the importance of initial successful projects that generate more funding for further projects (Cradock et al., 2009). Secondly, they found that areas that had been less successful in implementing projects to support active living received little future federal funding for further projects (Cradock et al., 2009). These findings highlight the need for different strategies to promote active living which can re-enforce the opportunities that physical infrastructure provides. Cradock et al. (2009) suggest the sharing of best practices for promoting travel-related active living among regional planning agencies may assist in helping other counties develop and implement successful active living projects. Hence, this research will apply best practices to Dunedin in order to improve funding for active living projects

2.3.3.1 Case Study: Jackson, Michigan

TenBrink, McMunn and Panken (2009) reported on the Project U-Turn active transportation initiative in Jackson, Michigan. Project U-Turn was designed to increase the number of short trips via active transport modes in Jackson (TenBrink et al., 2009). The reasons for this were twofold. Firstly, one in five Jackson residents were obese, two thirds of the population were overweight, and its population mirrored levels of obesity at the Michigan State level, which consistently ranks near the top of national obesity per state rankings (TenBrink et al., 2009). Secondly, all Jackson residents live within five miles (eight kilometres) of schools, churches, parks, entertainment, and shopping destinations therefore it was established as a feasible town for walking and biking distances that could achieve the recommended 30 minutes of exercise per day (TenBrink et al., 2009).

An existing collaboration between health and community development leaders, called the Walkable Communities Task Force, spearheaded the project (TenBrink et al., 2009). The Fitness Council of Jackson was also established as the lead agency as part of the Task Force, as they

had proven experience of implementing city-wide bike and fitness routes (TenBrink et al., 2009). Furthermore, the ALbD 5P's Community Action Model provided the foundation to develop and implement changes to the city (TenBrink et al., 2009). Tailored to Jackson's context, this plan included a series of stages (TenBrink et al., 2009).

The first focus was on the development of partnerships from a diverse array of disciplines (TenBrink et al., 2009). The Task Force included a wide range of community leaders in transportation, health, education, and community development (TenBrink et al., 2009). Although holding little political power, this group was acknowledged by the city council as an advisory group on walking and cycling which allowed them to have input on the development of policies and construction of infrastructure (TenBrink et al., 2009). The two parties met frequently and resulting policies and physical projects would often require inter-organisational coordination (TenBrink et al., 2009).

The Fitness Council implemented programs and policies as part of the project which included Smart Commute Day, the Walking School Bus and a Safe Routes initiative in schools (TenBrink et al., 2009). These programs were designed to showcase the benefits and ease of incorporating active living into everyday life and also highlight areas of policy focus where barriers presented themselves. Combined with this strategy, the Fitness Council used a variety of methods to promote active modes of transport as "healthy, viable and fun" (TenBrink et al., 2009, p.330). These included newsletters of anecdotes from residents who had converted to active living, press releases showcasing the popularity of new trails and lanes, and advertisement of the Fitness Council website which contained links to health and economic benefits of active travel (TenBrink et al., 2009). Another key part of the promotion process was the attention from organised events such as Smart Commute Day and Safe Routes in schools. Inter-business competition, prizes, and free breakfasts enticed people to try a more active commute and generated interest in the long-term (TenBrink et al., 2009). Overall the promotion stage resulted in a positive message of community change.

As mentioned above, programs were a key feature of promoting active travel. The Safe Routes program, Walking School Bus, Smart Commute Day, Foot Energy program and Community Bikes program were designed to reach across all ages and socio-economic levels (TenBrink et al., 2009). These programs allowed participants to discover the overall goal of the Task Force: to implement change in policies and create physical projects that encourage active living (TenBrink et al., 2009). From a financial perspective, Project U-Turn did not directly fund

infrastructure projects. Instead the Task Force focused on building community support and educating decision makers on the benefits of policy and physical projects that support active transportation (TenBrink et al., 2009). The Task Force did receive a small grant from ALbD which it then used to leverage further grants and financial backing (TenBrink et al., 2009). However its main method of intervention was in collaboration between its professional members (such as members of planning and engineering organisations) and members of council (TenBrink et al., 2009). For example, the Task Force collaborated with city engineering to incorporate pedestrian and bike facilities in road projects whenever possible (TenBrink et al., 2009).

Overall, Project U-Turn was deemed a resounding success as evidenced by a 63% increase in people using active transportation from 2005 to 2006 and also doubling in the number of students walking to school between 2003 and 2008 (TenBrink et al., 2009). More funding and grants have been secured as local, city and state authorities have recognised the widespread benefits of active living (TenBrink et al., 2009). As a result, the city has added approximately six miles (9.6km) of bike lanes, 50 new zebra-striped crosswalks, a 10.5 mile (17km) Falling Waters walking and cycling trail, and securing further funding for more physical projects is currently in progress (TenBrink et al., 2009). Key to Project U-Turns success was three features:

- Focussing on a variety of small-scale programs allowing the message of active living to transcend age and socio-economic boundaries;
- Widespread collaboration between schools, businesses, healthcare professionals and government offices leading to an integrated approach when directing the population towards active living, and;
- Community awareness which built support for projects and allowed issues to be heard and directed toward decision makers.

Source: TenBrink et al. (2009).

Jackson provides a model example of how city-wide projects and programmes can improve active living without significant funding or resources. Small changes to transport infrastructure achieved through collaboration and public support can have large benefits to residents who are well-informed and knowledgeable on the benefits that active living provides. Where funding or support is limited in Dunedin for the purposes of this research, a focus on small-scale active living projects with a combination of education, promotion, and collaboration, could ensure improvements to active living are achieved.

2.3.4 Urban Design

A key characteristic of urban environments is the quality and vibrancy of routes and spaces that help promote active living. Other factors beyond infrastructure and connectivity that have been associated with walking and cycling include the traffic environment, aesthetics, safety, and pedestrian amenities which form the face of urban design (Lin & Moudon, 2010). Urban design can be described as “the design of the buildings, places, spaces and networks that make up our towns and cities, and the ways people use them” (Ministry for the Environment (MfE), 2005, p. 7). Amenities such as street trees, sidewalks, crosswalks and bike paths make walking and biking more pleasant while traffic speeds and volumes influence safety concerns for active commuters (Provincial Health Services Authority, 2007). Street design can have an influence on different modes of travel for example areas that are attractive and free from crime have been linked to higher rates of physical activity (Frank et al., 2007). Building orientation, intensification, architectural detail, and street and sidewalk standards that promote pedestrian safety and comfort have all been shown to promote physical activity (Vojnovic et al., 2005). Larco, Steiner, Stockard and West (2012) state that people are more likely to use active modes of travel such as walking and biking where routes to desired destinations are visually attractive, free of crime, are well maintained, and contain illuminated pathways.

For efficient pedestrian travel, Vojnovic et al. (2005) highlighted several characteristics of good urban streetscape design:

- Fine-grained street systems with short blocks and many intersections to ensure connectivity while straight streets reduce distance;
- Minimal pedestrian barriers such as expansive parking lots and wide intersections;
- Small building setbacks from the street;
- Bringing visually interesting features closer to the street;
- Reducing distances between buildings;
- Increasing pedestrian surveillance; and
- Streetscape texture – the structure and composition of built surfaces such as street furniture, building types and colours, architectural styles and public art.

Source: Vojnovic et al. (2005)

Vojnovic et al. (2005) highlights that the built environment will determine what type of transport most people take. A pedestrian rich environment should be interesting and inviting

to maintain visual and sensory attention as people travelling at slower speeds have the time to notice and appreciate the built environment (Vojnovic et al., 2005). In contrast, a lack of detail and bland street colours and design makes automobile travel more inviting as there is little visual and/or sensory pleasure of active forms of travel (Vojnovic et al., 2005). The importance of this is highlighted in Copenhagen's Bicycle Strategy which claims that on a bicycle a city can be experienced spontaneously and up close and personal which makes trips feel shorter and makes cycling more attractive (The City of Copenhagen, 2011). A suburb in which urban design features are a key aspect of active living is Chippendale in Sydney where numerous urban design initiatives have resulted in a greater proportion of residents walking and cycling.

2.3.4.1 Case Study: Chippendale, Sydney

The inner city suburb of Chippendale is an example of a street environment that encourages walking and cycling (New South Wales Government (NSWG), 2011). Chippendale is located to the southwest of Sydney's Central Business District (CBD) and has recently undergone urban renewal which has attracted CBD office workers to an area once characterised by warehouse and factory working class residents (NSWG, 2011). The pedestrian-friendly suburb has been achieved through the use of proven traffic management and urban design techniques (NSWG, 2011). The application of these techniques has resulted in housing conversion and efforts to reduce automobile traffic which have been essential to Chippendale's success as a walking and cycling friendly suburb.

These improvements and additions to the built environment include road closures and footpath extensions which have created an open public space to deter traffic and provide incentive for active living such as car-free shortcuts through street networks (NSWG, 2011). Traffic calming methods such as roundabouts, speed platforms, one-way streets, stop signs, and line marking have also been implemented to create safe streets and encourage active living (NSWG, 2011). Footpath renewal to reflect the heritage of the area was carried out including planting trees and garden beds on extended footpaths (NSWG, 2011). These garden beds are maintained by residents to give a sense of ownership and pride (NSWG, 2011). Street frontages are encouraged to reflect community values such as a footpath on Myrtle Street decorated with pavement mosaics from local artists (NSWG, 2011). Parking restrictions on new developments also discourage vehicle use however many businesses recognise the area is well-served by public transport so there is little need for on-site car parks. Cafes and local retail have been encouraged at ground level especially when former warehouses are

converted. This increases the level of street activity, provides social and retail destinations that can be reached on foot, and gives a level of lighting at night (NSWG, 2011).

This case study may not be applicable in other cities given that Chippendale had an existing grid street layout and laneways which provided a prerequisite for retrofitting to form a pedestrian friendly environment (NSWG, 2011). It must also be noted that these changes occurred over three decades through gradual implementation of policies and plans (NSWG, 2011). However as stressed by Brockman and Fox (2011), it usually takes several years to realise the full effect of strategies to promote active living. Nevertheless, Chippendale does provide a good example of how older, established urban areas can be retro-fitted with features that increase safety and convenience for pedestrians and cyclists. As a result, the area has developed a strong sense of place, it has enabled greater community interaction, and active living is inherently encouraged through well developed and well implemented urban design strategies.

2.3.5 Land Use Mix

There is widespread consensus that land use plays a major role in determining physical activity levels and active living (Shilling & Linton 2005; Vorhees et al., 2010; Frank et al., 2006; Frank et al., 2007). Land use mix in particular is a crucial element in promoting active living environments and refers to the close proximity of a variety of different living and working activities within a neighbourhood (Ryks, 2008). People are more inclined to travel via foot, cycle, and other forms of active travel when they reside close to retail hubs, workplaces, schools and other amenities. The American Planning Association (1998) claims that greater mixing of facilitates used for walking and biking lowers vehicle miles travelled, improves air quality, and enhances urban aesthetics (as cited in Song, 2005). Meanwhile mixed use developments encourage active transportation behaviour because distances between origins and destinations are reduced (Frank & Engelke, 2000).

Unfortunately cities have predominantly been designed with single-use zoning, a design which is supported by the private automobile. The emergence of zoning over the past 80 years has contributed to the creation of single-use developments and the spatial separation of the home from almost all other activities which people are required to undertake on a daily basis (Arbury, n.d., p.24). Shilling and Linton (2005) state that local zoning codes and related land use regulations have made it difficult to create vibrant, mixed use neighbourhoods with well connected streets and more compact development. People have had the freedom and ability

to live in suburban areas away from amenities given the availability of the private car for travel to desired locations (shopping, schools, and work). Due to the greater distances between points of interest, active living has become inherently discouraged as the time and effort needed to reach these destinations is counter-acted by the ease of use of the private automobile.

Nevertheless, the general consensus in the literature as represented by Saelens et al. (2003) is that mixed land use appears related to increased walking and cycling among residents. However there are several exclusions to this general finding. Brand-Zook, Lu, Glanz and Zimring (2011) in their analysis of a large urban Smart Growth development in Atlanta, Georgia, revealed that residents did not realise the potential of their suburb to be a highly walkable and an active-friendly environment. The mixed land uses of the development still saw residents using vehicles to access a nearby shopping mall, despite the new outdoor street mall encouraging walking. Rodriguez et al. (2006) investigated whether new urbanist neighbourhoods (characterised by mixed land use, office spaces within walking distance, and amenities for pedestrians and cyclists) contain residents who are more physically active than conventional neighbourhoods characterised by single-zones and large distances to amenities and retail centres. They found no significant differences between the two neighbourhoods in terms of physical activity overall. The reasons for this was that new urbanist residents commute to work more via active modes of travel while conventional neighbourhood residents partake in physical activity as part of leisure, therefore both neighbourhoods were on an even par for overall physical activity.

It may be pertinent to state that further measures are required for residents to realise the ease of active living in mixed use environments. Possible methods may include promotion and information about opportunities for active living for residents in mixed use developments. This highlights the need for combining several characteristics and methods to achieve successful active living at a community level. Sandnes in Norway is one such city that has combined mixed use development provisions in local planning documents with a suite of methods to achieve a greater proportion of the city's population travelling via active modes.

2.3.5.1 Case Study: Sandnes, Norway

Sandnes provides an excellent example of how mixed use environments can encourage active living among residents, re-enforced by promotion and education strategies. As a member of the WHO Healthy Cities initiative, Sandnes developed a project to reduce car dependency and

encourage more active forms of transport (Barton, Mitcham & Tsourou, 2003). Key to their success was focusing sustainable development through land use and restricting urban sprawl (Barton et al., 2003). Such measures came as a direct result of the introduction of a Municipal Comprehensive Plan, detailing what needs to be done to develop a more active friendly city (Barton et al., 2003). Some extracts from the plan pertaining to mixed land use changes and objectives include:

- To provide growth opportunities inside and near existing built up areas using existing infrastructure while preserving valuable agricultural land, natural recreation areas and areas important to biological diversity;
- To contain expansive land use by promoting high density in new development areas and regenerating existing areas e.g. industrial districts near the old centre;
- New dense development alongside existing and future public transport routes to prevent further increase in car traffic;
- Develop strong and continuous regional green space networks to link different parts of the town for access via non-motorised transport.

Source: Barton et al. (2003).

As a result, new residential housing and workplaces were purposely located along high capacity and high frequency public transport arteries. Approximately 70 kilometres worth of cycle lanes were constructed both as individual routes and feeders to public transport along with associated facilities including bicycle parking spaces, bicycle stands in high density areas and a free bike service at designated locations (Barton et al., 2003). Sandnes is now recognised as one of the best cycling towns in Europe (Barton et al., 2003). The city is also a leader in participating with other towns and municipalities in Scandinavia to share experiences and develop evidence-based guidelines (Barton et al., 2003). The Municipal Plan further outlined what was needed to be done in order to achieve the above objectives. Some selected strategies from the plan which explains how Sandnes has become a successful active living city are included in Box 2.

Selected Municipal Plan strategies and methods

- Integrating health, well-being and environmental protection as central principles for the municipality's service delivery and achieving this through continual monitoring and development of tools, methods and cooperation;
- Continuing efforts to promote health, well-being and environmental protection through the involvement and participation of all parts of the municipal organisation;
- Actively participating in cooperative projects with other towns and municipalities in Scandinavia and Europe to share experiences and to encourage efforts to promote health and environment protection;
- Continuing cooperation with municipalities in central and eastern Europe to strengthen democracy both there and in Norway; and
- Actively assisting other European municipalities with experience about improving cycling in towns.

Box 2: Selected strategies and methods from the Municipal Plan. Source: Barton et al. (2003).

The strategies and methods described in Box 2 are typical of most case studies on active living. Cooperation and community engagement are key components to achieve environments conducive to active living. Mixed land use is by no means the only key component of successful active living environments but does go a long way in achieving smaller distances in otherwise large-scale cities, which has a positive association with active living patterns.

2.4 Summary of Built Environment Characteristics

By identifying the aspects of the built environment that facilitate active living, other cities such as Dunedin can be assessed in order to increase the number of residents who incorporate active living into their daily lives. The identification of methods that have been implemented to achieve these changes also highlights methods for councils, advocates, and the public to ensure successful implementation and development of active living environments.

It is clear from the literature that each of the above characteristics do not exist singularly. A combination of several or even all the characteristics is typical of active living environments. The case studies have also revealed multiple methods accompany the built environment characteristics and as such will be explored throughout this research. Box 3 summarises the

key characteristics and methods to provide a set of criteria against which to assess Dunedin's active living planning.

<p>Characteristics</p> <ul style="list-style-type: none"> • Transport Infrastructure • Connectivity/Accessibility • Funding • Urban Design • Mixed land use <p>Methods</p> <ul style="list-style-type: none"> • Education and promotion • Consultation and collaboration • Monitoring • Evidence-based planning • Integration between plans and organisations

Box 3: Characteristics and methods underlying best practice active living.

2.5 Conclusion to Literature Review

Outlining the definition and the health, economic and social benefits of active living has provided justification for greater provision of active living in urban environments. By recognising the characteristics of successful active living environments, this literature review has revealed strategies and methods to assist Dunedin in becoming a successful active living city. The following chapter presents a background to active living in New Zealand followed by a refined focus on Dunedin as a context for this research.

Chapter Three: Background

3.1 Introduction

It is necessary to identify current active living and health statistics in New Zealand and Dunedin to establish the importance of improving active living rates while providing justification for doing so. Active living in New Zealand will now be explored followed by a refined focus on the Dunedin context in order to determine why active living needs to be incorporated into New Zealand and Dunedin city planning.

3.2 Active Living in New Zealand

On the basis of MOT and New Zealand Census data, the current state of active living in New Zealand is poor. New Zealanders are walking and cycling less than they have done in the recent past (Ryks, 2008). Road networks have been designed to accommodate the automobile which has had the effect of limiting alternative methods of transport such as walking and cycling. Eley (2003) noted that those distances that are easy to walk or cycle (distances of less than two kilometres) comprise almost 30% of New Zealand's motor vehicle trips. Figure 5 from MOT (2011) shows walking and cycling trends over the last 22 years with mode share of all household trips falling from a peak of 26% in 1989/90 to 19% in 2007-11.

The most recent statistics as represented in Figure 6 indicate walking makes up 13% of total time travelled while cycling makes up 2% of total time travelled (MOT, 2011). New Zealanders also spend 78% of all travelling time either driving or as a passenger in a vehicle (MOT, 2011). Primary school-aged children have seen the largest drop in walking and cycling over the past 22 years with a decrease from an average of two hours and ten minutes per week in 1989/90 to one hour and ten minutes per week in 2007-2010 (MOT, 2011). However caution must be applied when interpreting this data as the data source used involved interviews with 4600 households throughout New Zealand, a small percentage of total households in New Zealand therefore it may not reflect the wider trends in active living.

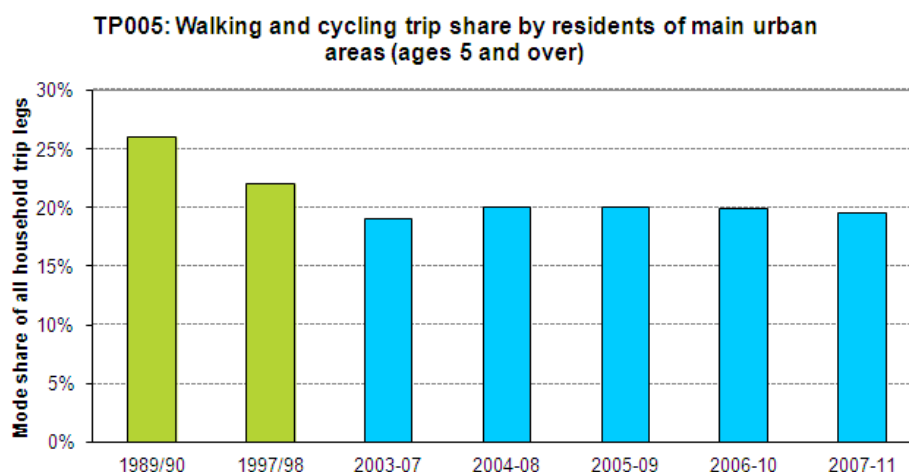


Figure 5: Trend in mode share of walking and cycling trips over last 22 years. Green bars represent 12 month figures, blue represent four year averages.

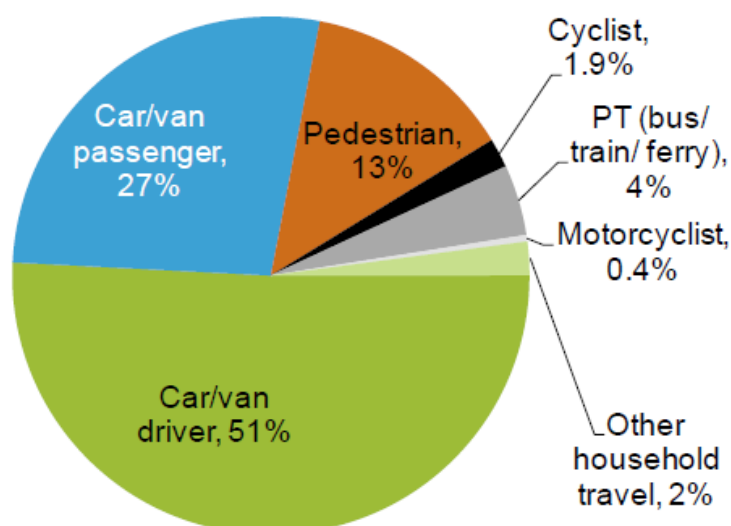


Figure 6: Percentage share of total travel time per mode in New Zealand.

Nevertheless a particular concern in New Zealand is the lack of children walking and cycling to school. The Committee on Environmental Health (2009) states that physical activity for children, which can be achieved through walking and cycling for transport, is associated with children's organisational and social skills while promoting self-esteem and higher grade achievement (p. 1592). This association highlights the link between active living and social capital. Physical activity habits formed in childhood have also been found to predict physical activity levels later in life (Bilinski, Semchuk & Chad, 2005).

Mackie (2009) found that there is significant demand for cycling in schools in New Zealand with only 8.6% of school children currently cycling to school and 22.2% of students saying they

would like to cycle to school. The reasons cited by parents who would not let their children cycle or walk to school is the lack of infrastructure and the safety of routes to schools. This is not surprising as an average of 10 cyclists per year have been killed in New Zealand in motor vehicle crashes between 2006 and 2010 while 817 have been injured in motor vehicle crashes (MOT, 2011). The most well represented age group within these statistics are 10-14 year olds while most deaths and injuries for children occur before and after school and on major or minor urban roads. Unfortunately improvement in the safety, quality and quantity of cycle infrastructure to address these statistics is unlikely to be implemented as the current New Zealand transport system sees active modes of travel as subordinate to automobile and transit modes (Mackie, 2009).

The New Zealand National Land Transport Programme 2009-2012 outlined the amount of funding given to transport activities between 2009 and 2012. This document highlights the lack of priority given to active living. Walking and cycling funding is given a total of \$51 million over the four year period while new, renewal, maintenance and operation of the roading network is given well over \$5 billion over the four year period. Public transport is given \$900 million however given that public transport mode share is currently at 4% of total travel time, this funding pool may seem appropriate to improve this share. Given the relatively low share of active travel modes (15% pedestrian and cycling) compared to vehicle trips (78%), it is arguable that a greater share of funding should be directed towards active travel, given the greater benefits of this mode compared to vehicle transport.

The high level of funding given to the roading network and public transport also appears to contradict the former Land Transport New Zealand report on best practice guidelines for walking and cycling (MacBeth, Boulter & Ryan, 2005). The report states walking and cycling are “the most sustainable modes of transportation that are more affordable than public and vehicle transport, is easily integrated, and is responsive and adaptable to changes such as fuel shortages and price increases” (MacBeth et al., 2005, p.10). Therefore although active travel has been identified as more desirable, road transport has been given a much greater share of funding than walking and cycling.

Richards et al. (2011) identified local governments as holding key functions in supporting or impeding participation in active transport. Yet spending is currently very low at a city council level throughout New Zealand. Macfie (2009) comments that Auckland City Council has not budgeted new cycle spending in its 10-year plan, and Christchurch City Council has allocated only \$24 million of its \$800 million roading and transport spend over 10 years to cycling

infrastructure (as cited in Public Health Advisory Committee (PHAC), 2010). These figures may have changed due to the adoption of a new Long Term Plan and Annual Plan by the Auckland City Council while the Christchurch City Council figures were pre-earthquake. Despite the low active travel statistics and recorded lack of funding in major cities for walking and cycling infrastructure, it appears smaller regional towns are leading the way in active living projects in New Zealand.

Nelson has incorporated an accessibility plan into the city planning framework that was in response to safety and access concerns regarding traffic and cycle parking. Cycle lanes were improved, cycle parking was implemented in the CBD with sufficient lighting, and funding was made available for cycle designs to be included in design engineer education. Since the implementation, Nelson recorded its lowest annual pedestrian injury rate (New Zealand Transport Agency (NZTA), 2009). Changes to Kapiti Coasts District Councils Code for Subdivision Development resulted in placing active living as a priority. Requirements for new subdivisions having increased density, housing which faced the street, a well connected road network, close proximity to a planned railway station and an extensive open space area were incorporated into the Code for Subdivision Development (MfE, 2008).

Other cities within New Zealand are currently in the process of significant improvements to walking and cycling. The NZTA selected the cities of New Plymouth and Hastings to receive \$7.28 million in funding to become New Zealand's first walking and cycling model communities (NZTA, 2010). These cities were selected from a pool of proposals as they demonstrated the leadership and commitment to best integrate walking and cycling as an integral part of their communities (NZTA, 2010). Dunedin was not selected based on the complexity of the transportation networks within larger metropolitan areas however it is hoped that lessons learnt from the walking and cycling model cities project, currently in progress, will assist other centres with improving active living.

The PHAC (2008) has recognised characteristics, including urban density, connectivity, mixed land use and streetscape environment, as being responsible for improving active living and physical activity in New Zealand. Street connectivity has particularly been shown to improve active living in New Zealand. Badland, Schofield and Garrett (2008) found respondents who commuted through the most connected streets in Auckland were more likely to engage in transport-related physical activity (TPA) to access their occupation compared to those who travel via poorly connected streets.

The PHAC has also recognised the benefits of active living. They suggest that 116 premature deaths from ill health would be prevented at a saving of \$193 million per year “if 5% of urban trips involving a distance of up to seven kilometres were cycled rather than driven” (PHAC, 2010).

Irrespective of the current active living statistics in New Zealand, changes could be implemented to influence or reverse the general national health statistics. Table 1 highlights selected time periods of statistics relating to specific or general medical conditions. The overall conclusion shown by these statistics is that health problems are showing little sign of reducing. It could be inferred that the lack of active living across the adult population in New Zealand is contributing to higher rates of disease. Active transport has been proven to contribute to the lowering of population diseases (USDHHS, 2000). Therefore a case for increased active transport infrastructure could be made to reverse the health statistics in New Zealand.

Table 1: *New Zealand Health Statistics for Five Conditions over Selected Time Periods.*

Health Status	Year of statistic	Total adult population	Source	Year of statistic	Total adult population	Source
High blood pressure	2002/03	10.2%	MOH (2006/07)	2006/07	11.0%	MOH (2006/07)
Obesity (excludes overweight)	2002/03	20.9%	MOH (2002/03)	2008/09	27.8%	MOH (2011)
Diabetes	2002/03	4.3%	MOH (2002/03)	2006/07	5.0%	MOH (2006/07)
Chronic Obstructive Pulmonary Disorder	2002/03	5.5%	MOH (2002/03)	2006/07	6.6%	MOH (2006/07)
Physical activity	2002-03	73.4%	MOH (2002/03)	2006/07	52.1%	MOH (2006/07)

Note. From Ministry of Health (MOH, 2006; 2011).

3.2.1 Summary of Active Living in New Zealand

The literature and statistics suggest that New Zealand has an urgent need to incorporate active living in urban environments to increase the number of physically active residents and subsequently reduce health complications and associated diseases. Dunedin will now be established as the context for active living in New Zealand and will help outline the specific case study for the focus of this research.

3.3 Active Living in Dunedin

Dunedin reportedly has one of the highest populations of active travellers in the whole country with 25% of walking and cycling share of total journeys to work (MOT, 2011). This ranks 5% above the national average and is second only to Wellington on 27% (refer Table 2). Yet it is difficult to establish the exact percentage of mode share for walking and cycling due to limitations in interpreting the MOT's data. For example the MOT states Dunedin's cycle mode share to work is 3% and walking to work is 13% (only making 16% of active travel, not 25%). Walking in combination with public transport or car use is measured separately meaning the 13% of people who walk represents walking as the single mode to get from home to work (therefore walking plus public transport may be counted as active travel in the total 25% share).

Table 2: *Walking and Cycling Share of Total Trips by Residents of Main Urban Areas (Ages 5 and over) over Selected Time Periods.*

City	2003-07	2004-08	2005-09	2006-10	2007-11
Auckland metropolitan area	17%	18%	17%	17%	16%
Wellington (incl Kapiti)	23%	25%	26%	26%	27%
Christchurch	23%	25%	26%	26%	25%
Hamilton	13%	13%	13%	16%	14%
Dunedin	20%	20%	21%	23%	25%
Tauranga	13%	13%	13%	14%	14%
Other	17%	17%	18%	18%	18%
New Zealand	19%	20%	20%	20%	20%

Note. From MOT (2011).

An issue with these statistics is that walking from a public transport stop to work may only make up a small percentage of the total journey. This raises questions about whether the 25% of active travellers in Dunedin solely walk or cycle without the use of a car or public transport at any stage of the journey. In fact the New Zealand Household Travel Survey for Dunedin reveals only 4% of mode share of distance for walking only, and 1% for cycling only.

This indicates that total active transport rates for Dunedin may actually be very low with regards to walking and cycling to work.

Nevertheless the Dunedin Cycling Strategy (Dunedin City Council (DCC), 2004) was the city's first attempt at prioritising cycling as an integral part of its transportation system. The strategy was born out of community feedback on the Draft Strategic Plan in 2001 calling for alternative modes of transport. The strategy's purpose is "to encourage participation in cycling and address cycling safety...this will require taking steps to overcome the challenges that inhibit more Dunedin people from choosing to cycle and make it a more attractive option" (DCC, 2004, p.2). Through its implementation, the strategy aims to increase the proportion of people who cycle to work "from 2.9% in 2001 to 3.8% by 2006 and to 4.9% by 2011" based on Census travel to work data (DCC, 2004, p.2).

Unfortunately Census data is not available for 2011 however by 2006 Dunedin's mode share of cyclists travelling to work stood at 1.47%. Current travel to work data for 2011 comes from the New Zealand Household Travel Survey suggesting this number has doubled to 3%, but nearly 2% below the objective of 4.9%. It should be noted that this survey only contained 630 participants, a significant reduction on the 56,134 participants in the 2006 Census for Dunedin; therefore interpretation of this comparison should be treated with caution. Although strategy outcome and monitoring on the Dunedin Cycling Strategy and its progress is unknown, more needs to be done for Dunedin to improve its mode share of cyclists to achieve the stated target goals.

3.3.1 Summary of Active Living in Dunedin

Dunedin appears to have a relatively high share of active travellers compared to a national level however the reliability of the available statistics is questionable. Dunedin along with the rest of New Zealand fall well behind other cities in terms of mode shares of active travellers. European countries are showing statistics between one-third and one half of residents travelling to work via walking or cycling. Even considering the highest reported statistics of

active travel in Dunedin, these do not come close to those reported internationally. In order to improve active mode share rates in Dunedin, changes to the current planning framework are required.

3.4. Background Summary

The low active travel statistics within New Zealand along with the national health statistics and the inability for Dunedin to achieve its desired active travel targets has resulted in a necessity to change the contents of the current planning framework. Through examining Dunedin's planning framework in light of international examples of best practice, Dunedin maybe able to learn from and improve its share of active living. This will enable the city to experience the health, economic and social benefits of physical activity through active living. The following section details the methodology used in this research in order to achieve built environment changes within the Dunedin planning framework.

Chapter Four: Methodology

4.1 Introduction

The purpose of this research is to understand the role of urban planning as it relates to active living in Dunedin. The research also aims to provide recommendations to the Dunedin planning framework to guide future planning processes towards greater inclusion of active living. The literature review (Chapter Two) identified characteristics of the urban environment that have proven to be successful indicators of active living. These characteristics include transport infrastructure, connectivity/accessibility, funding, urban design, and land use mix. Strategies and methods used to achieve these characteristics include education and promotion, consultation and collaboration, monitoring, evidence-based planning, and integration; which have identified ways for other local authorities to achieve successful active living outcomes. The current state of active living in Dunedin will be assessed using an analysis of planning documents coupled with Key Informant interviews. These methods will determine the current state of built environment characteristics in Dunedin, and what methods are used locally, and to establish these characteristics in comparison with international best practice. The identified characteristics and methods used by successful international cities will highlight areas where measures can improve active living provisions in local planning documents in Dunedin.

Dunedin has been purposefully selected as the site for data collection as little is known of active living efforts in the city. A document analysis and Key Informant interviews formed the basis of the data collection methods to provide insight as to how active living is currently provided for in the Dunedin context. While the research did not attempt to assess the level of success of the implementation of plans, policies or strategies or attempt to evaluate their outcomes or outputs, the Key Informant interviews did indicate some level of implementation. The following sub-sections will provide details on the methodology used to answer the research question: how can examples of best practice in active living planning inform the Dunedin planning framework to meet any deficiencies in active living planning in Dunedin?

4.2 Characteristics of Active Living Planning

From the literature review characteristics of active living environments were identified that were common across many international best practice cities (refer Table 3). At the same time

the methods used by the best practice cities in order to implement or achieve the characteristics were also identified (refer Table 3). This has established a set of criteria against which to assess Dunedin's current active living environment. Using the characteristics and methods, the areas where Dunedin can improve opportunities for active living can be identified in light of the most appropriate methods to implement them. The most appropriate documents to provide for the opportunities for active living can also be identified such as the District or Long Term Plans.

Table 3: *Best Practice Built Environment Characteristics and Methods as Identified in the Literature Review.*

Best practice characteristics	Best practice methods
Transport Infrastructure	Education and promotion
Connectivity/Accessibility	Consultation and collaboration with public and private sectors
Funding	Monitoring
Urban design	Evidence-based planning
Land use mix	Integration with plans and organisations

4.3 Research Design and Methods

Dunedin city was used as a case study for this research. A qualitative research design presented the most effective design in order to answer the research question as it utilises the researcher as the primary data collector and can use multiple sources of data through inductive analysis. The ability to answer the research question was also well suited to a case study analysis as highlighted by Tharenou, Donohue and Cooper (2007) who describe a case study as an in-depth, empirical investigation of a single instance or setting to explain the processes of a phenomenon in context. Dunedin was therefore used as the setting in which to explore active living planning through provisions in documents and responses from Key Informants. It is also common in case study research to use exemplar sites to provide the best example of a phenomenon (best practice) as claimed by Tharenou et al. (2007). The literature review acted as a source of best practice examples against which to compare to Dunedin. It also acted as a theoretical base for the research methods, as case studies benefit from the prior development of theoretical propositions to guide data collection and analysis (Yin, 1994, p.13).

Tharenou et al. (2007) suggest case studies may use a combination of methods because the phenomena studied are complex and multiple methods allow triangulation. To address the complexity of active living planning, as evident through the multiple characteristics and methods used to promote active living, two methods were adopted for the purposes of this research: document analysis and Key Informant interviews. McCutcheon and Meredith (1993) have suggested that case study research should involve data from primary sources such as direct observations or interviews with people involved, and secondary sources such as documents or records. The use of a document analysis and Key Informant interviews therefore allow the researcher to draw upon multiple sources of evidence to seek convergence and corroboration through different data sources and methods (Bowen, 2009). Using a second data collection method allows triangulation of evidence that breeds credibility and reduces the impact of potential biases that can exist in a single study (Bowen, 2009, p.28).

4.3.1 Document Analysis

A document analysis was carried out on DCC planning documents (refer Table 4). Documents were selected based on their potential to influence the built environment and/or activity patterns through their provisions. As such, regional level documents were not included within the document analysis as these focussed on active travel whereas this research examines active living in relation to the built environment. Regional level documents such as the Otago Regional Land Transport Strategy and Otago Regional Land Transport Programme have limited influence on built environment characteristics such as land-use and urban design and therefore were precluded from this research. Territorial authorities have statutory and non-statutory influence on the built environment and should also have regard to regional level documents; hence the document analysis focussed solely on DCC plans and strategies.

A document analysis was chosen as a research method because of its ability to allow data to be examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge (Corbin & Strauss, 2008). Documents also contain text and images that have been recorded without a researcher's intervention (Bowen, 2009, p.27); therefore the researcher is not able to impart influence on the document. The document analysis also combines elements of content analysis and thematic analysis. Thematic analysis is a form of pattern recognition within the data, with emerging themes becoming the categories for analysis (Fereday & Muir-Cochrane, 2006). Content analysis is the process of organising information into categories related to the questions of the research (Bowen, 2009, p.32).

The document analysis, incorporating elements of thematic and content analysis, involved a search for provisions or keywords that indicate whether a characteristic or method is provided for in the plans and/or strategies. Provisions that did not relate to active living were discounted and ignored. However where a characteristic or method was mentioned without a specific reference to active living, that provision was considered on its ability to enhance active living and the built environment. If it was decided that the implementation of this provision will improve active living in Dunedin, then it was included within the study. This decision was made by the researcher based on the description of characteristics and methods within the literature review. This was to ensure all characteristics and methods were accounted for in relation to active living, despite not containing specific reference to active living. A brief overview of the purpose and function of the documents analysed is provided below.

Table 4: *Dunedin Planning Framework Documents Used for the Document Analysis and Key Informant Interviews.*

Document Name	Operative Date
District Plan (DP)	2006
Long Term Plan - Incorporating the Annual Plan 2012/13 (LTP)	2012/13 – 2021/22
Dunedin Cycling Strategy (DCS)	2004
Transportation Strategy (TS)	2006
Physical Activity Strategy (PAS)	2007
Tertiary Precinct Development Plan (TPDP)	2008

4.3.1.1 District Plan

The District Plan (DP) (DCC, 2006a) is a statutory document prepared by the DCC under the Resource Management Act (RMA, 1991). In accordance with section 75 of the RMA (1991) it identifies issues and develops objectives, policies and methods to manage the effects of land use activities on the environment (DCC, 2006a, p.1:1). All users of land and water surfaces must abide by DP provisions which control the development and subdivision of land in accordance with section 31 of the RMA (1991). The DP therefore determines the development and use of the built environment which will affect opportunities for active living. This research looks primarily at how the built environment can influence the uptake of active living, and the DP is the primary means as to how the DCC can influence urban form. The analysis of this document is therefore essential to answering the research question.

4.3.1.2 Long Term Plan

The Long Term Plan (LTP) (DCC, 2012) sets out the council's financial strategy, activities of the local authority, community outcomes, and provides information on council projects over the next ten years along with other purposes in accordance with the Local Government Act (2002) section 93(6). The LTP is a statutory document required under the Local Government Act (2002) and is driven by the DCC. This document is important to analyse as it outlines the key priorities for the local authority over the next ten years which may include provision for active living or built environment changes. Given this research looks at the built environment influence on active living, priorities of the local authority which may or may not include active living and the built environment should therefore be analysed.

4.3.1.3 Dunedin Cycling Strategy

The Dunedin Cycling Strategy (DCS) (DCC, 2004) is a non-statutory document prepared by the DCC for the purpose of addressing the needs of cyclists in Dunedin. The purpose of the strategy is to encourage participation in cycling and address cycling safety (DCC, 2004, p.2). The strategy sees cycling as essential for promoting an integrated transport system and its provisions therefore provide the impetus for cyclists to be catered for in the transportation network. This research looks primarily at the built environment and the means by which the DCC has to influence it, and increase active living opportunities. The DCS is an essential document to analyse for the purpose of this research because cycling is a mode to achieve active living. The provisions of the strategy therefore directly influence the ability of the community to engage in active living within Dunedin.

4.3.1.4 Transportation Strategy

The Transportation Strategy (TS) (DCC, 2006b) is a non-statutory document prepared by the DCC under the guidance of the New Zealand Transport Strategy (2002) and its legislation, the Land Transport Management Act (2003). The TS is designed to meet the requirements of transport in Dunedin and to ensure vitality and vibrancy of commercial areas is maintained through future growth (DCC, 2006b, p.3). Given active living is defined by active transport modes; the TS will directly impact opportunities for active living within Dunedin. This document is important to analyse because active transportation, and therefore active living, is reliant on infrastructure within the built environment which is provided for within the TS.

4.3.1.5 Physical Activity Strategy

The Physical Activity Strategy (PAS) (DCC, 2007) outlines targets and interventions to get Dunedin city residents physically active. The strategy is driven by the DCC in conjunction with local organisations and is a non-statutory document. The PAS addresses the distribution and availability of resources for organisations to encourage physical activity and also provides for methods to promote and educate the community on opportunities for physical activity which will directly improve active living within the city. The PAS is important to analyse because this research argues that without an appropriate built environment, and subsequent measures for encouraging active living, increasing residents physical activity is likely to be harder to achieve.

4.3.1.6 Tertiary Precinct Development Plan

The Tertiary Precinct Development Plan (TPDP) (DCC, 2008) is a non-statutory document designed to address issues specific to the University of Otago and Otago Polytechnic campus areas. The plan also provides for the large student population in general. It is driven by the DCC who forms part of the Tertiary Sector Steering Group (TSSG) along with the two tertiary institutions and the Otago Regional Council. The TPDP provides for improved opportunity for active living among the student population and indirectly improves active living for other Dunedin residents. This document is important to analyse because the student population makes up a large percentage of the total Dunedin population. Provision for built environment changes to assist active living dedicated to the student population will ensure a large percentage of the Dunedin population use active means of travel.

4.3.2 Key Informant Interviews

The second data collection method involved semi-structured interviews with Key Informants in Dunedin. Informants were identified based on their involvement in providing for active living or their ability to have input on the plan or strategy development process (refer Table 5). A small list of questions was pre-assigned for the interview focusing around the degree to which characteristics and methods were provided for in Dunedin. The Key Informant interviews were therefore carried out following the document analysis. Flexibility in the interview questions was also crucial to reduce researcher bias on responses. The aim of the interview process was to establish whether efforts were being made to improve active living in Dunedin, such as new directions for active living projects or to gain responses to the provisions (or lack of) active living characteristics and methods within the Dunedin planning framework. Interviews were recorded using a dictaphone to capture all verbal information thus allowing the researcher to listen without having to scribe simultaneously.

Table 5: *List of Key Informants.*

Key Informant (KI) Number	Representative of
KI 1	DCC Cycling/Walking
KI 2	DCC Planning
KI 3	DCC Transport
KI 4	Sporting Organisation
KI 5	Physical Activity Advocacy
KI 6	Cycling Advocacy

4.3.3 Data Analysis Procedures

The document analysis produced a wealth of information that needed to be organised and reduced into key themes as determined by the criteria identified in the literature review. Data reduction procedures were used by compiling summaries of words or provisions that pertain to the research criteria, with each individual plan or strategy having their own summary. Data reduction was also applied throughout the interview process with transcription of audio tapes following each interview to enable data to be organised into relevant themes and summaries of key points to be made. This also had the added benefit of directing future interviews away from irrelevant themes or topics.

Data is presented in Chapter Four in two different sections based on the characteristics of best practice active living and the methods used to achieve them. The results are presented as descriptive quotes and document provisions under each section through the use of sub-headings relating to the characteristics and methods. Tables are also used for the document analysis which acted as a summary of plan provisions, and also for Key Informant interviews to identify common themes. To interpret the state of active living as portrayed by the document analysis and Key Informants, conclusions were drawn from the key themes and criteria found, and recommendations supported by content and interview quotes were constructed. Supported by further academic literature, these were used to provide recommendations to the Dunedin planning framework for improving active living and are presented in a visual representation (refer Chapter Five section 5.5 recommendations).

4.4 Ethics

A Low-Risk Notification (LRN) was submitted to the Massey University Ethics Committee and subsequently registered prior to the commencement of fieldwork (refer Appendix One). Ethical considerations were discussed including the potential for a conflict of interest. The researcher is an employee of the organisation where some interview participants were sourced from. However given the organisation has no vested interest in the research, all sources of information were in the public domain, the organisation did not request this research nor does the student work in a related department, it was agreed that no conflict of interest existed. The researcher upheld the obligation to collect and present data verbatim and not attempt to leave out information that may threaten the research. The researcher upheld the obligation to respect the rights, needs, values and desires of the Key Informants.

Details of the research were explained to all participants during the recruitment process including the objectives of the research, how the information would be obtained, what information the interview process aimed to elicit, a description of how the data would be used, and the assurance of anonymity of the participants (refer Appendix One). Details were also provided in terms of the devices and methods of data collection including the use of a dictaphone to record the interview for transcription at a later date. Voluntary participation in the data collection process was explicitly outlined with provisions detailing the participant's right to refrain from answering any question if they were uncomfortable with it, their right to end the interview at any time, and the requirement for written consent of each participant prior to the commencement of the interview (or verbal consent for phone interviews). The participant was also explained their right to have the results presented in a way they are comfortable with and for the researcher to provide a copy of the results or the completed research document at their request.

4.5 Validity and Limitations

Validity refers to an evidence-based claim about the trustworthiness of decisions made from data (Andreatta, Marzano & Curran, 2011). Tharenou et al. (2007) identified a threat to the trustworthiness of data can come from the researchers interpretation of data which can be influenced by their own biases and assumptions, known as a threat to internal validity. The researcher is a Dunedin local and has a physical education academic background therefore may impart biases on the data collected. The researcher took steps through the research

methods to reduce this effect. Data triangulation, through the use of multiple methods, assists researchers in establishing defensible relationships (Tharenou et al., 2007). Through the use of a combined document analysis and Key Informant interview methodology, researcher bias was reduced thus improving internal validity.

A limitation of the case study research design comes through the issue of external validity and generalisability. Sommer and Sommer (1991) suggested one way for researchers to increase generalisability is to undertake multiple case studies of the phenomena of interest. This was essentially carried out through the literature review. The literature review only presented single case studies for each characteristic however the preceding explanation of the characteristic was drawn from multiple case study examples. Despite this, the findings of the literature review may not be generalisable to the Dunedin context, especially given the best practice case studies were all drawn from international examples.

4.6 Conclusion to Methodology

The above methods and procedures represent the approach taken for the purposes of this research. The case study research design along with data collection and analysis procedures enable the research question to be addressed by providing two sets of comparable data (international best practice and Dunedin's context) as a basis to answering the research question. The following chapter presents the results obtained through the use of the above methodology and a discussion on the results compared with international best practice. Recommendations to the Dunedin planning framework to improve active living within the city are then provided.

Chapter Five: Results and Discussion

5.1 Introduction

This chapter presents the findings of the document analysis and Key Informant interviews, both of which help to answer the research question: how can examples of best practice in active living planning inform the Dunedin planning framework to meet any deficiencies in active living planning in Dunedin? The chapter is organised into two sections. The first section presents the results of the document analysis and Key Informant interviews as they relate to best practice built environment characteristics. As identified in the literature review, these characteristics include transport infrastructure, connectivity/accessibility, funding, urban design and land use mix. The second section presents the results of the document analysis and Key Informant interviews as they relate to methods used to implement the characteristics. These methods were identified as education and promotion, consultation and collaboration, monitoring, evidence-based planning, and integration. Findings from the document analysis and Key Informant interviews are stated and discussed in light of the research question and inferences are drawn from this discussion and compared to international best practice. This comparison allows the development of a visual representation containing recommendations to inform the Dunedin planning framework to meet the deficiencies in Dunedin's active living planning. The visual representation will be presented following the results and discussion of the characteristics and methods in order to answer the research question.

5.2 Characteristics

As noted, this section contains the results of the document analysis and Key Informant interviews relating to the five best practice built environment characteristics of active living. Drawn from the literature review, these are transport infrastructure, connectivity/accessibility, funding, urban design and land use mix, and each of these is further discussed with regard to the Dunedin context.

5.2.1 Transport Infrastructure

The literature review identified transport infrastructure as being an essential characteristic of successful active living because it increases the opportunities for pedestrians and cyclists (Hess

et al., 1999). Provisions for infrastructure, and recognition of its importance in improving active living, were prevalent across all documents analysed.

The TS identified multiple infrastructural additions to the built environment to improve active mode shares. One of the aims of the strategy was to provide more options for travelling residents and pinpoints infrastructure as being important to active living and that *“accelerated completion of pedestrian, cycling and mobility works, integrated with enhancements to the passenger transport network”* is required in order to provide realistic alternatives to the private car (DCC, 2006b, p.6). This is further backed up by the statement that *“the efficient use of Dunedin’s infrastructure encourages physical activity”* (DCC, 2006b, p.19).

The acknowledgment that *“walking and cycling enhancements increase walking and cycling participation levels”* (DCC, 2006b, p.19) indicates some role for infrastructure as ‘enhancements’. Although Key Informants did not divulge specific infrastructure targets, the views on transport infrastructure in general were unanimous with many agreeing on the essential role it plays in promoting and encouraging active travel. Key Informant One identifies infrastructure as *“a key starting point when considering how we get more people cycling and walking”* (KI 1, 2012). The identification of infrastructure as an essential component of active living is therefore comparable to best practice.

In relation to the types of infrastructure referred to in Dunedin planning documents, a majority of provisions reflect best practice as discussed in the literature review. Safe and secure bike parking facilities, pedestrian crossings and intersections which prioritise pedestrians, end-point facilities, and most importantly tracks and routes allowing the ease of movement for pedestrians and cyclists have been shown to promote walking and cycling in successful active living cities (Litman, 2003; Pucher & Buehler, 2007; Banister, 2005). The document analysis revealed that Dunedin is well placed to be a successful active living city as similar best practice infrastructure has been provided for across multiple documents (refer Table 6).

Specific infrastructure targets were also provided in some documents, for example the DCS includes the following targets: *“to increase the length of on-street cycle lanes, off-street cycle paths or wide road shoulders with cycle route markings by 5km per year”*; *“to install on-street cycle lanes on State Highway One between the Gardens and Oval by the end of 2007”* and; *“to increase the number of public bicycle parking spaces by 20 spaces per year”* (DCC, 2004, p.21). Best practice cities contained arguably more ambitious targets for lengths of cycle-ways and bike parking facilities (for example 70 kilometres of new cycle lanes in Copenhagen by 2025),

but the targets set in the DCS are more appropriate for Dunedin, and are comparable to Copenhagen on a per head of population level. On the basis of the document analysis, the incorporation of bike parking facilities, multiple tracks and pathways, traffic and intersection modifications and specific targets for improvements represents a positive outlook for active living infrastructure in Dunedin.

Table 6: *Infrastructure Provisions from Plans and Strategies.*

Plan/Strategy	Provisions
Dunedin Cycling Strategy	Smooth surfaces Intersection facilities Bike parking facilities Buses with bicycle carrying facilities End point facilities
District Plan	Cycle parking Cycle lanes Off-street cycle paths Wide road shoulders Cycle route markings On-street cycle lanes
Long Term Plan	37 cycle sub-routes Safety improvements Separated cycle lanes Shared pathways Cycle parking
Transportation Strategy	Pedestrian, cycling and mobility works Walking and cycle enhancements Traffic lights to improve pedestrian safety Pedestrian and cycle tracks next to railway Upgrading pedestrian crossings
Tertiary Precinct Development Plan	Cycleway alongside the Leith River Sheltered bicycle stands

Note. From DCC (2004; 2006a; 2006b; 2008; 2012).

In contrast, the Key Informant's view on Dunedin's current and planned infrastructure, and its potential to contribute to a successful active living city, introduces an element of doubt as their opinions varied.

Whereas Key Informant One states *"Dunedin is showing promising signs of improvements in infrastructure as there has been a noticeable increase in inner city bike parking facilities"* (KI 1, 2012), another Informant stated that *"the city has taken a long time to realise people need the physical infrastructure like tracks or even on-road cycle lanes to accommodate those wishing to walk or cycle to work"* (KI 4, 2012). Other Informants showed dissatisfaction regarding the

amount of infrastructure supplied for active travellers in the city. Key Informant Three stated *“there is a distinct lack of cycle storage or parking facilities in the city and you quite often see bicycles chained to lampposts and signs because people have nowhere to safely store their bicycle while in town”* (KI 3, 2012). Key Informant Two suggests the bike parking facilities in Amsterdam, similar to those in Copenhagen as identified in the literature review, *“should be something Dunedin should consider as an alternative to car parking”* (KI 2, 2012). The data from the Key Informant interviews therefore suggest that while the planning documents contain adequate infrastructure provisions for Dunedin to become a successful active living city, these provisions are not yet being realised.

As noted in the literature review, the Provincial Health Services Authority in Canada (2007) identified the initial problem for many local authorities is a lack of facilities and infrastructure supporting walking and cycling, leading to little motivation to initiate or improve infrastructure for active travellers. It would be interesting to have looked at historical documents to determine whether walking and cycling infrastructure was supported in previous decades, or whether the current emphasis on walking and cycling provisions in the documents analysed is a new approach. Key Informant Two supports the latter by stating *“the current efforts by the council and community to improve cycle and walking facilities such as the Port to City and City to Mosgiel walking/cycling tracks show a proactive and promising direction for getting residents active”* (KI 2, 2012).

Dunedin’s current plans (the subject of the document analysis) reflect the importance of infrastructure as highlighted in the literature review and contain provisions to increase and improve transport infrastructure. Yet based on the Key Informant responses, it appears that progress on pedestrian and cycling infrastructure is slow.

An area of improvement for active living infrastructure in Dunedin could come from requirements for new developments. Dunedin shows little evidence of requiring walking and cycling infrastructure with new development as there was little mention in the documents of active living infrastructure considerations when new developments are proposed. The District Plan refers to the Code of Subdivision and Development which requires links to be provided for pedestrians and cyclists for new developments however there is little detail provided on what infrastructure is required to meet the needs of active travellers.

As shown in the literature review, Dill (2009) carried out a review of bicycle infrastructure and found that Oregon State law requires both bicycle and pedestrian infrastructure be built whenever roads are built or rebuilt (with few exceptions). The Oregon State law refers to specific types of infrastructure including footpaths and trails, curb cuts and ramps, and signs and signals (Dill, 2009). Although this was a law change at a state-national level, this concept could be adopted by the DCC which could make walking and cycling more attractive and more prominent. Going further, the Oregon law only requires active living infrastructure for highway, road, or street construction or reconstruction. Adopting similar requirements for road *and* building construction or redevelopment in Dunedin will further allow greater infrastructure provision for pedestrians and cyclists. Such examples include mandatory bicycle parking or access ways between buildings to make block lengths shorter for pedestrians and cyclists. Incorporating this concept into the TS with reference to the DP represents the most appropriate planning documents for these changes to be applied, given that the DP controls land use and development while provision in the TS will make the concept an important transport issue for Dunedin to address.

5.2.2 Connectivity/Accessibility

Better connectivity within cities leads to more walking and biking, fewer vehicle miles travelled, higher air quality, and greater sense of community among residents (Benfield et al., 1999). It is therefore encouraging that the issue of connectivity is a major characteristic addressed through multiple documents in Dunedin (refer to Table 7).

The DCS states that providing a linked cycle network is a key method to achieve the objectives of the strategy through *“improved cycle-friendliness of identified cycle routes”* and by providing *“connectivity between origins and desired destinations”* (DCC, 2004, p.16). The LTP states one of Dunedin’s community outcomes is a connected city or a connected community whereby the vision is that *“Dunedin’s communities are connected by safe, effective transportation”* (DCC, 2012, p.68). A priority to achieve this vision is that *“Dunedin is safe and easy to get around for cyclists and pedestrians”* (DCC, 2012, p.26).

The connected community outcomes were also reflected through the Key Informants who unanimously agreed on the importance of connectivity in Dunedin. Key Informant One stated that *“having a network with multiple paths and tracks is all well and good but if these are not connected together then you create barriers and reduced fluidity for walking or cycling journeys”* (KI 1, 2012). Key Informant Three stated that *“allowing free-flowing access for residents to reach Central or Local Activity Zones on foot or by cycle is an important part of*

encouraging community interaction and to generate greater use of sustainable transport” (KI 3, 2012). This links back to the social benefits of active living as detailed in the literature review, identifying the link between connectivity and social interaction. The identification of the importance of connectivity is therefore acknowledged through Dunedin’s planning documents and Key Informants.

Table 7: *Connectivity/Accessibility Provisions from Plans and Strategies in Dunedin.*

Plan/Strategy	Provision
The Dunedin Cycle Strategy	Connectivity between origins and destinations
Tertiary Precinct Development Plan	Roads create barriers to movement Direct cycle routes Campus through routes Pedestrian priority at traffic lights Lanes for pedestrian shortcuts Street closures Extensive pedestrian network Link the two tertiary institutions
Transportation Strategy	Ensure viable choices for commuters Rail crossing access to the city
Long Term Plan	A connected city A connected community Dunedin communities are connected by safe transport
District Plan	Restrictive nature of roads

Note. From DCC (2004, 2006a, 2006b, 2008).

Safe and convenient connectivity and accessibility in Dunedin is also comparable to international best practice. The transportation section of the DP identifies the restrictive nature of roads and their ability to prevent movement of pedestrians from one area to another and the potential conflict arising from multiple users of the transportation network. It also identifies how vehicles can prevent safe access around town for pedestrians and cyclists:

The loading and unloading of goods can use areas of the road or footpath which can impede pedestrian flows and compromise safety, heavy vehicles can damage roads thereby affecting the safety and comfort of cyclists, and

vehicles can impede safe and efficient movement of pedestrian traffic (DCC, 2006a, p.20:3).

Providing safe and efficient access for pedestrians around the city is therefore acknowledged in the DP.

The issue of connectivity is further addressed in the transportation section of the TPDP where it is identified that there is a *“lack of continuous cycling routes through the campus”* and that *“one-way major roads in the area create barriers to pedestrian movement and constrain vitality”* (DCC, 2008, p.20). To address these issues the plan proposes creating a pedestrian and cycle oriented tertiary precinct with good links to the campus area and the city. This includes *“direct cycle routes between the campus, central city and key residential areas”* (DCC, 2008, p.22). Having an extensive pedestrian network will make it easier to travel by foot due to the shorter block distances and variety of available routes, giving choice to the traveller (Frank & Engelke, 2000).

The literature review identified street layout as being a major influencing factor on how people choose to travel. A grid-like street layout is hypothesized to make travel between two points - ‘as the crow flies’ - shorter and more direct than a cul-de-sac type layout (Ryks, 2008). Key Informant One believes *“the majority of Dunedin streets are conducive to active living and certainly have the potential to be used as such, with little modification”* (KI 1, 2012), suggesting Dunedin may already have a grid street layout.

However newer subdivision developments are sometimes based around cul-de-sac designs and therefore restrict connectivity and accessibility. To address this issue, provision for pedestrian and cyclist access and links in subdivisions is provided for in the DP. The plan refers to relevant sections of the Dunedin Code of Subdivision and Development through which the application of these provisions will ensure *“provision is made for cyclists and pedestrian links”* (DCC, 2010, p.20:10). Specific sections of the Dunedin Code of Subdivision and Development referred to in the DP state that the street and road networks shall provide a high level of internal accessibility and external connectivity for all modes of transport including pedestrians and cyclists. This shows that accessibility and connectivity within developments and subdivisions are attempting to be addressed to ensure adequate links are provided for.

Randall and Baetz (2001) found that retro-fitting existing streets with added sidewalks and pathways that bypass road networks create shorter and safer routes to destinations and are

more likely to encourage people to walk or cycle to desired destinations. Retro-fitting existing streets with pedestrian and cycling tracks was evident in Dunedin through provisions for adding shared pathways to road and rail networks to connect the harbour communities (Port Chalmers and Portobello) to the Central Activity Zone. However the importance of eliminating missing links in pedestrian and cycle networks was identified by The City of Copenhagen (2011), as they create unnecessary stops, reduce flow, and increase travel times for active travellers. Key Informant Six believes that many of the tracks and paths being added to the existing cycling network in Dunedin remain incomplete and *“although progress is being made to complete an extensive cycle network, it will be years before Dunedin has an efficient cycle network to feed residential communities”* (KI 6, 2012). Key Informant Five also states that *“Dunedin has the potential to provide an extensive and complete cycle network feeding many of the cities suburbs however missing sections of existing paths and safety issues of travelling through these missing sections reduce the number of people wishing to cycle or walk to work”* (KI 5, 2012). This statement highlights the importance of filling in missing links in the cycle or pedestrian network.

A possible area of improvement for Dunedin therefore lies in completing routes or identifying routes and paths that contain missing links. Provision for completing new cycle tracks are provided for in the TS (refer to pages 12-18) and DCS (refer to pages 21-22) however there is no mention of identifying and improving missing links in *existing* cycle tracks or pedestrian routes. Increasing the length of existing routes is provided for in the DCS (refer page 10) but identifying routes with reduced fluidity is not mentioned. Aligning improvements to existing tracks and routes with the provisions for new connections already provided for in the TS will see Dunedin reduce missing links in its network and therefore improve connectivity and accessibility for active travellers. Making this a key target in the DCS would also add emphasis on creating a complete cycle network.

5.2.3 Funding

The literature review identified funding as being the underlying characteristic for active living planning. Banister (2005) recognised government assistance as being the primary funding source for a majority of active living projects. This was certainly shown in Dunedin planning documents with a majority of funding coming directly from central government. The LTP identifies \$1.5 million of funding towards active living projects annually for the next three years will be provided by the local government (i.e. DCC) however \$3 million of that amount (two-thirds) will come from the NZTA. The DCS further elaborates on where this funding will go

including “\$100,000 per annum for the cycling infrastructure programme” (DCC, 2004, p.24). Further detail on how transport funding is distributed between different modes is not provided.

Key Informants identified cycling and walking projects still receive little funding compared to roading and public transport. Key Informant Five stated that “*public transport and active travel mode share rates are similar across New Zealand and Dunedin yet public transport receives a far greater proportion of funding*” (KI 5, 2012). Key Informant Six shares similar sentiments by claiming that “*funding for vehicle and bus transport far exceed the money going into cycling or walking within the city, despite the relative affordability of cycling infrastructure and the associated benefits to the resident population*” (KI 6, 2012). It is assumed that these Key Informants have knowledge of the distribution of transport funding therefore it can be inferred active living receives little funding in Dunedin.

There is however some indication of a redirection in the focus of road funding. The DCS states that conventional road funding sources can be used for improvements to network surfaces which have multiple benefits to vehicles and cyclists. It uses the example of road shoulder widening which not only protects the road surface from edge damage from heavy commercial vehicles but will also improve safety and convenience for cyclists (DCC, 2004, p.31). Therefore recognition of the shared benefits from investment in roading infrastructure is evident, despite little provision for active living-specific funding in Dunedin.

Finding alternative forms of funding was also identified as an important part of active living in best practice cities (for example London’s Congestion Charge). The DCS aligns with this best practice as it identifies a need to find alternative forms of funding for cycle projects:

DCC should explore all avenues of fund-raising for supporting the cycling programme including partnerships with other interested parties (both public and private) such as tourism and health, the involvement of the community through charitable trusts, and support ‘in kind’ the production of promotional and publicity material (DCC, 2004, p.32).

The TS also indicates that the council has thought about alternative forms of funding for improvements to transport networks such as increasing parking charges within the Central City

Commuter Charging Boundary. The funds from this were identified as being able to help fund other projects and also provide an encouragement for alternative forms of transport. Importantly, this document notes the increase in parking charges would only occur *“following the introduction of enhancements to passenger transport, pedestrian and cycling networks”* (DCC, 2006b, p.19), highlighting the interdependence of all built environment characteristics.

Key Informant views on alternative funding were mixed. Key Informant Two stated that *“finding different ways to fund active projects is quite important especially given central government’s current focus on roading and little emphasis on walking or cycling”* (KI 2, 2012). In contrast, Key Informant Five believes *“it’s not a matter of finding additional funding for these initiatives, a greater proportion of existing funding allocated to road development and maintenance should be re-directed towards improving opportunities for sustainable transport”* (KI 5, 2012). Although little detail is provided from the document analysis on the amount of funding going into walking and cycling projects in the city, the Key Informants have indicated these modes receive little allocated funding.

In the meantime leveraging off small successes in active living projects, a concept identified in the literature review, will provide incentive for greater percentages of transport funds to be directed to active living projects. Such an example in Dunedin could be monitoring the Port to City pedestrian and cycle track which would demonstrate the successes of investment in active living projects.

Drawing on best practice as highlighted in the literature review, Dunedin could also consider establishing an organisation comprising public, private and voluntary members that support funding for active living initiatives. In America, funding for walking and cycling infrastructure has come from the ALbD group, an organisation that works with local and national partners to generate support for active living initiatives. The literature review identified where local or national governments do not support active living funding, the existence of such organisations as ALbD is crucial to the process of encouraging active living funding. The formation of a similar group could be provided for in the Dunedin planning framework through specific provisions for a commitment to establish and foster the development of an inter-sectoral group, dedicated to securing funding for active living projects. Such a group would provide an adequate solution to the varying opinions on where active living funding should come from as shown in Table 8. The DP, LTP and TPDP could provide for the formation of an active living group.

Table 8: Key Informant Responses to Question on Funding.

Key Informant	Question: In your opinion, where should funding for active living in Dunedin be sourced from?
One	<i>"It needs to be a combination of government supplied funding and community driven initiatives".</i>
Two	<i>"The responsibility lies with central government, if they want a greater proportion of people to bike or cycle to work they would make it a priority, unfortunately this is not the focus of this government".</i>
Three	<i>"Using our available funds we can direct them towards projects that benefit all road users including cyclists and pedestrians".</i>
Four	<i>"There are obvious benefits for companies who operate in a city that is active so I think the business community of Dunedin needs to get involved".</i>
Five	<i>"I think it comes down to interest, a lot of money can be saved by volunteers getting involved, as we are seeing for the Caversham Tunnel Cycleway".</i>
Six	<i>"For there to be big active travel projects, like a complete cycle network connecting all Dunedin's suburbs, there needs to be big funds, it's as simple as that".</i>

5.2.4 Urban Design

Making the built environment aesthetically appealing and safe for active travellers was identified in the literature review as being critical to encouraging active living. This is because people are more likely to use active travel where routes to desired destinations are visually attractive, free of crime, are well maintained, and contain illuminated pathways (Larco et al., 2012). Although few documents in Dunedin made reference to urban design associated with active living, many documents provided for urban design in a non-active living role. The effect of urban design changes in these different roles improves the aesthetic built environment which may encourage active living as a result. For example the DP makes specific references to the historical character of Dunedin in Issue 13.1.4 and 13.1.5 (DCC, 2006a, p.13:4), whereby building and street design should match the historic character of the city and maintain the cities identity. Although there is no reference to active living in these issues, through the implementation of this provision urban environments will become more vibrant and provide a pleasant surrounding with a unique identity, which may encourage pedestrians and cyclists to travel through these environments. Tied to this provision is a policy to provide an environment suitable for pedestrians such as requiring verandas on buildings, excluding vehicle crossing places, and through designs of buildings, their edges and margins (DCC, 2006a, p.13:12). Although active living is not mentioned explicitly, this policy combines multiple features of urban design to create a pedestrian friendly environment.

The TPDP also contains provisions for urban design; however they are more directed at improving the pedestrian environment to cater for the primary method of transport for students. The plan makes specific provision for improving urban design features for establishing *“green routes of high amenity value”* (DCC, 2008, p.21). This has been specifically provided for to improve the pedestrian experience and encourage walking. The plan refers to urban design characteristics such as *“improving signage and way finding; improving quality of street furniture; well lit and sheltered connections; and increased tree planting”* (DCC, 2008, p.21, 22). There is also provision for developing ‘themed walks’ such as the current sculpture walk, to add increased vitality and interest to the pedestrian environment.

Further provisions for urban design features are provided for in the Works Programme section of the DP to achieve townscape outcomes. The mention of phrases such as *“street improvement and landscaping”, “public open spaces”, “a range of street furniture items”, “street tree planting, replanting and maintenance”, “appropriate street lighting for pedestrians”,* and *“widening of footpaths to encourage a safer and more pleasant pedestrian environment”* (DCC, 2006a, p.13:16) provide evidence of extensive urban design features which would encourage active living. The combination of similar urban design provisions in the TPDP ensures both the student population and general Dunedin residents are provided for. The document analysis has shown Dunedin is utilising urban design to make the pedestrian environment more appealing, and this would potentially have a positive effect on active living.

The TS provides similar urban design provisions but tie this specifically to active living. Urban design is considered by the DCC as a potential area to make a more pleasant environment for pedestrians and cyclists (DCC, 2006b, p.24). Traffic turning movement bans are seen by the DCC as a good way of increasing pedestrian safety and improve pedestrian amenity and flow during peak times (DCC, 2006b, p.25). This *“recognises pedestrians as priority users”* (DCC, 2006b, p.24) of the transport system. Social wellbeing which has an effect on improving active friendly transport modes is given recognition through improved street lighting and improvements to roads and footpaths (DCC, 2006b). Similar improvements have been shown to improve safety and reduce fear of crime, leading to better social cohesion and community interaction (Jacobs, 1961; Appleyard, 1981). However there is no further mention of any effort to improve streetscape design or beautification of cycle or pedestrian routes; there are merely measures to redirect or control traffic movement to improve safety but with little provision for improving the visual or aesthetic design of the streets.

Key Informant views on urban design in Dunedin suggested more could be done to make the city visually attractive for pedestrians and cyclists. Key Informant One stated that the new Port to City cycle track provided naturally aesthetic attributes however safety issues needed to be addressed when the track enters the CBD. Key Informants Four and Six highlighted the potential for more greenery around the city's main roads and identified several locations where pedestrian and cyclist safety issues needed to be addressed including the Anzac Ave/Cumberland St intersection and several railway crossing points.

Dunedin could therefore benefit from improvements in the aesthetic quality and safety of active transport routes. These improvements would encourage more residents to walk or cycle into the city in order to achieve best practice with regard to this characteristic. Retro-fitting existing paths and routes into the city with urban design features identified in international best practice could significantly improve active mode share rates in Dunedin. This may include but is not limited to street art work, garden beds on extended footpaths, increased tree planting, footpath renewal to reflect the heritage of areas, traffic calming measures or street closures and barriers separating automobile traffic from pedestrians and cyclists, as shown by Chippendale, Sydney (refer NSWG, 2011). The DCS represents the best document to contain such provisions as it should be incorporated as a specific outcome with its own targets and monitoring methods. The DP and LTP may also provide an appropriate avenue, tied to current urban design provisions regarding townscape and heritage.

5.2.5 Land Use Mix

A mix of land uses was identified as being typical of successful active living cities due to reduced distances between origins and destinations (Frank & Engelke, 2000). Mixed land use and its effect on active living had very limited provision in Dunedin planning documents. The DP was the only document to identify the importance of mixed land use in creating people friendly environments, albeit without mention of active living. Land use is identified in the DP as having the potential to adversely affect pedestrian movement and the amenity of an area. A DP objective provides for *“business, recreational, social, cultural, religious and commercial activities in the Central Active Zone (CAZ) and Local Activity Zones (LAZ) and enhance the amenity there to make them pleasant for people”* (DCC, 2006a, p.9:2). There is an emphasis on developing ‘people places’ in both the CAZ and LAZ as *“people bring vitality and vibrancy to activity areas and it is important to enhance and sustain a people-friendly environment”* (DCC, 2006a, p.9:7). The DP also shows the importance of a mix of activities within these zones as they provide for the social, economic and cultural wellbeing of the community (DCC, 2006a,

p.9:8). There is specific mention of the location of service stations; that they generate high levels of traffic and therefore should be restricted to the periphery of Local and Central Activity Zones to ensure safe pedestrian movement (DCC, 2006a, p.9:10). Although active living is not given a specific mention in these DP provisions, the clustering of activities within the CAZ and/or LAZ will have the effect of providing mixed use destinations in a pedestrian friendly environment.

The Key Informants were in agreement on the current state of mixed land use in Dunedin. Key Informant Two noted *“major local activity areas in the city by-in-large contain multiple destination points in terms of chemists, supermarkets, schools and cafes and are easily reachable for walkers and cyclists”* (KI 2, 2012). However as Key Informant One highlighted: *“contemporary mixed use areas contain both retail hubs and workplaces but given Dunedin’s relatively small size and population, it is relatively simple to travel into the CBD for both retail and work purposes”* (KI 1, 2012). Key Informant Six highlighted the issue of topography in Dunedin by stating that *“many residents don’t realise how close they are to a corner dairy, a supermarket, or a hairdresser because they perceive the hills as requiring large amounts of effort therefore have a tendency to take the car, even though the distance may be minimal”* (KI 6, 2012).

Dunedin may therefore require little in the way of physical changes to the built environment in terms of mixed land use but rather may require information on the opportunities for active living within their communities. The DP could therefore be altered with the addition of education and promotion methods to accompany the more regulatory mixed use development provisions throughout the document. The TS and PAS could also contain education and promotion provisions regarding the opportunity for active living in LAZ’s. Sandnes in Norway discovered promotion, education and cooperation were three key methods used to achieve greater active mode shares after significant changes in mixing land use were applied (Barton et al., 2003). Given Dunedin has been identified as already containing good land use mix, the application of these methods may provide further impetus for more residents to travel by foot or cycle.

5.3 Methods

This section contains the results of the document analysis and Key Informant interviews relating to best practice methods used to accompany the built environment characteristics. Drawn from the literature review, these are education and promotion, consultation and

collaboration, monitoring, evidence-based planning and integration. Each of these is further discussed with regard to the Dunedin context.

5.3.1 Education and Promotion

The results from the literature review indicate that education and promotion are important methods to achieve changes in active living characteristics. The document analysis and Key Informant interviews revealed education and promotion are two methods commonly used in the planning framework for Dunedin. The DCS in particular details several provisions for developing education and promotion projects including:

Develop appropriate promotion programmes to encourage cycling, improve the image of cycling and cyclists; develop education and information programmes advising cyclists where cycle facilities are, and how to use them appropriately; facilitate promotion efforts for cycling through relevant local and regional strategies and plans; and operate and support enforcement and education programmes to improve the behaviour of cyclists and motorists that affect cycling safety and convenience (DCC, 2004, p.22, 23).

The DP also includes information, education and public awareness as methods to achieve townscape changes through urban design. Examples include providing publicity and information which promotes the retention of buildings and provides information and education on the feasibility of re-using and modifying existing buildings. Preparing information and guidelines on compliance and to promote the awareness of safety and amenity expectations in LAZ's and CAZ's is also mentioned. Encouraging and promoting the use of cycling and walking is further mentioned in relation to the transportation network (DCC, 2006a).

Key Informants agreed on the importance of educating the public both in terms of keeping them updated on projects to improve active living and to inform them on the benefits of taking active transport to work (refer Table 9). However, many of the Key Informants also agreed on the difficulty of the education process. Key Informant One for example stated that *"finding the most effective way of informing the public is somewhat difficult as not everyone responds to the same type of media"* (KI 1, 2012). Key Informant Three stated that *"only those that are interested in pursuing cycling and walking will be receptive to education campaigns on such topics"* (KI 3, 2012). Nevertheless education and promotion were shown to be key methods in

achieving modal shift to walking or cycling in best practice active living cities (refer The City of Copenhagen, 2011; Adler et al., 2008; TenBrink et al., 2009, & Barton et al., 2003). Through the incorporation of these methods, Dunedin's planning framework has shown evidence that the city is adopting best practice methods to implement plan provisions relating to active living. The proposed characteristic changes to the planning framework to achieve best practice characteristics of successful active living cities suggested from the results of this research should therefore use education and promotion and ensure that multiple media sources are used to reach a majority of Dunedin residents.

Table 9: *Key Informant Viewpoints on the Importance of Consultation and Collaboration for Active Living Planning.*

Key Informant	The importance of education and promotion for achieving a greater mode share of active travellers
One	<i>"We do our best to promote what our city has to offer in terms of physical activity and this is important for those who may not realise the potential to get active"</i>
Two	<i>"Some people need to know what's happening in their city while others want to know or even both, so education and promotion is very important"</i>
Three	<i>"Education is essential for ensuring safety for pedestrians and cyclists in a vehicle dominated environment, understanding the needs of other forms of travel helps everyone become more tolerant and weary of each other which is very important"</i>
Four	<i>"Promoting active travel is one of the best things we can do to get people out of their cars and living a healthier lifestyle"</i>
Five	<i>"People may take the same routes to work, walk the same footpaths and venture little outside their own house without knowing the opportunities for getting active in every aspect of their lives, so education and promotion is vital"</i>
Six	<i>"Part of our goal is to get members out into the rural and urban areas and experience the opportunities for cycling, I guess that is one of our forms of education"</i>

5.3.2 Consultation and Collaboration

The case study of Jackson, Michigan saw the concept of consultation and collaboration being the cornerstone to receiving support and funding for local active living projects. Collaboration between schools, businesses, healthcare professionals and government offices lead to an integrated approach to direct the population of Jackson towards active living. Encouragingly, consultation and collaboration with various public and private groups was the most prevalent method used to achieve built environment characteristics in the Dunedin planning framework.

The DCS presents a large focus on consultation to achieve the specified provisions including to *“undertake community consultation as a part of any cycling infrastructure improvements”* (DCC, 2004, p.22). Consultation is further expressed as a means of gathering data to establish current cycle trends within the city:

Conduct market research and consultation to find out base data on cycling in Dunedin including the number of cycles and cyclists, the amount of cycling, and the views of cyclists, residents and motorists with respect to cycling (DCC, 2004, p.23).

Cooperation between planning agencies is also evident with the council acknowledging that *“DCC, with support from the ORC [Otago Regional Council], should encourage people to consider alternative modes of travel for their daily trips”* (DCC, 2004, p.29). Although little information is provided with regards to how it will occur, the strategy highlights the importance of coordination between *“relevant agencies”* (p.30) in safety, education and enforcement matters (DCC, 2004). Maintaining links with members of the cycling interest group is also provided for in relation to periodic reviews of the strategy and to help coordinate activities to promote cycling (DCC, 2004, p.24).

The PAS shows evidence of good collaboration with multiple organisations as mentioned in the executive summary (DCC, 2007, p.2). A list of 11 organisations is provided who collaborated on the development of the strategy. Collaboration is further emphasised in Goal Three which aims to *“ensure efficient collaboration between the organisations involved in promoting, delivering and researching physical activity”* (DCC, 2007, p.20). There is also evidence of a continued commitment to undertake collaboration in the PAS: *“establish an inter-sectoral working group to review existing collaborative approaches and effective practice”* (DCC, 2007, p.19). The strategy even combines the commitment to collaboration with evidence-based research in the explanatory text of Goal Three: *“both domestic and international effective practice identifies the importance of inter-sectoral collaboration to achieve higher physical activity rates”* (DCC, 2007, p.19).

Given the DCC has a statutory requirement to consult; it is unsurprising that consultation appears throughout the DP. For example in reference to townscape changes and methods of implementation: *“the council will endeavour to consult with developers at the earliest stages in order to facilitate a mix of uses and highlight opportunities”* (DCC, 2006a, p.13:16). Incorporating consultation into new developments presents a positive direction for the council. Cooperation with the private sector and other agencies through liaison is another key

method used in the DP. Firstly, the plan makes specific mention of supporting the work undertaken by the ORC and Otago Fish and Game in relation to improving the urban environment. Liaison with the Campus Constituent Institutions and Healthcare Otago in regards to the preparation of environmental accords and protocols is also mentioned. A broader provision for liaison is provided with respect to the council's efforts to liaise with *"road user groups, public transport operators, the Otago Regional Council Land Transport Strategy and Road Controlling Operators"* (DCC, 2006a, p.20:10).

Similar cooperation is evident in the TPDP whereby to create a car free environment or pedestrian priority zone the plan aims to facilitate partnerships with the private sector to develop alternative solutions to the current car-dominance on and around the campus. Although the plan does not outline specific solutions to the current issue, as this would depend on the results of consultation, the strategy of public and private cooperation represents a promising method for creating a more active friendly environment in Dunedin.

The views on consultation and collaboration in the drafting of plan provisions were positive according to Key Informants. Many informants believed in the criticality of consulting with the private and public sectors in order to develop effective solutions and outcomes. Key Informant Three states *"collaborating with public and private organisations brings different needs and perspectives to situations and is therefore essential for creating meaningful and positive solutions"* (KI 3, 2012). Key Informant Six meanwhile emphasised the desire for consultation before any changes to the way Dunedin looks or operates because *"it's about giving people a say in the way their city is run as they are the ones who have to live with potential changes and their consequences"* (KI 6, 2012).

Multiple case studies within the literature review identified the array of people and organisations that should be consulted with to achieve successful active living outcomes. Such examples include community consultation on the benefits of active living in Damascus, Portland, as well as collaboration between local private organisations to secure funding for active living projects and programs in Jackson, Michigan. Any changes to the built environment in Dunedin should therefore involve consultation and collaboration with both private organisations and the community to develop solutions that suit the needs and wants of the residents of Dunedin.

5.3.3 Monitoring

One of the key methods identified as being crucial to Copenhagen's success as a cycle city was the monitoring of all cycle tracks and infrastructure, and the number of people who use them. This allowed for the identification of areas or facilities that were lacking in infrastructure or areas where more could be done to improve user rates (The City of Copenhagen, 2011). Monitoring is therefore an essential method for successful active living cities.

The TS in Dunedin shows extensive evidence of monitoring to make the strategy effective and to enable its outcomes to be measured. The strategy states it will use multiple data sets to monitor the progress of the strategy including Census Journey to Work surveys, collision statistics, traffic modelling, traffic counts, Household Travel surveys, pedestrian crossing surveys, manual pedestrian and cycling counts, and opinion surveys (DCC, 2006b, p.58-59). Monitoring is also a key component of the PAS. The strategy uses multiple monitoring levels to measure the outcomes of the strategy. These range from high levels of national and regional surveys such as the Quality of Life Survey and Sport and Physical Activity Survey, to lower levels of key performance indicators within the strategies implementation plan (DCC, 2007, p.10). Each goal within the strategy contains its own set of monitoring measures showing extremely efficient use of monitoring.

The DCS represents the only infrastructure specific monitoring measures through Action 1.11; to gauge the quality and quantity of cycle facilities while identifying the need for improvements (DCC, 2004, p.22). The strategy also contains provisions for monitoring cycling promotion programmes through a review of responses to, and impact of, such programmes (DCC, 2004, p.23).

Key Informants believe monitoring is the cornerstone to achieving the desired outcomes of plans and strategies. Key Informant Six stated that *"monitoring plays a key role in determining the progress towards achieving a goal and is therefore crucial to any changes or proposed changes"* (KI 6, 2012). Key Informant Two also pointed out that *"feeding the results of monitoring processes back into the system is often a process neglected"* (KI 2, 2012), highlighting the need for feedback into plan methods and actions.

Changes to the built environment characteristics portrayed through Dunedin's planning framework must therefore contain adequate monitoring provisions. Monitoring has the purpose of measuring the progress of the provisions in plans while allowing room to feed monitoring results back into the change process to achieve successful active living is essential. The success of Copenhagen as a model cycle city included monitoring provisions in its cycle

strategy to identify strengths and weaknesses in the bicycle network. Dunedin shows positive efforts to address similar monitoring provisions to Copenhagen, particularly in the DCS. Ensuring regular and meaningful monitoring is provided for all active living modes would be a priority for the Dunedin planning framework.

5.3.4 Evidence-based Planning

Successful active living cities drew upon evidence-based characteristics to assist active living planning. Sandnes for example is a city which is involved with developing evidence-based practices and guidelines to share with other European countries (Barton et al., 2003). Chippendale also applied proven (evidence-based) techniques to develop an active friendly environment. It is therefore encouraging to find evidence-based planning apparent in the DCS and PAS in Dunedin. The DCS used evidence-based planning to identify five main requirements for cycling infrastructure, which were based on European research (DCC, 2004, p.27). These included coherence, directness, attractiveness, safety and comfort. There is also reference to other local government research into reasons why people don't cycle, and the strategy uses this as a basis for focusing promotion and education campaigns (DCC, 2004, p.29). The strategy uses evidence-based research for both infrastructure characteristics and methods in which to achieve effective change in transport choice.

The PAS also draws upon international research when developing four key principles of the strategy, one of which happens to be evidence-based planning (DCC, 2007, p.2). This is used later in the strategy where specific reference is made to researching best practice data on appropriate interventions for improving physical activity in the urban environment. The strategy mentions that *"internationally, nationally, and locally, considerable effort has gone into researching both the obstacles preventing physical activity participation and the interventions that are most likely to overcome them"* (DCC, 2007, p.7). This best practice evidence for interventions is further emphasised in the actions for Goal One where further research is advised on how environments can be optimised to encourage physical activity. This shows the Dunedin planning framework acknowledges the importance of best practice or what the PAS term 'effective practice'.

Key Informants One, Two and Three all said evidence-based planning underlies most planning within Dunedin. They stated that extensive research is done when drafting plans for the city as to what has proven to work for whatever outcome or effect is desired. However as Key Informant Three pointed out *"just because an idea has worked in another city does not mean it will have the same effects here; Dunedin presents its own unique culture, identity, topography*

and vision therefore any planned idea for the city has to be judged on whether it is suitable to our cities environment” (KI 3, 2012).

International best practice active living cities applied evidence-based approaches to achieving successful active living outcomes, such as proven design techniques in Chippendale and evidence-based interventions for design in Portland. The Dunedin planning framework provides similar evidence-based approaches through the DCS and PAS, comparable to best practice. Yet Key Informants highlighted the issue of generalisability and whether evidence-based approaches are suitable to the Dunedin environment. When incorporating changes to the built environment characteristics contained within Dunedin’s planning framework, evidence-based research assessed against Dunedin’s identity, culture, topography and vision should therefore be carried out.

5.3.5 Integration

Provision for integration with other plans, strategies, organisations and authorities was highlighted as being important for active living success. An integrated approach to active transportation was adopted in Jackson, including inter-organisational coordination to develop integrated policies and physical projects for active living (TenBrink et al., 2009). A document analysis in Dunedin revealed integration between the DCS and the Annual Plan and Long Term Financial Strategy is provided for to ensure adequate funding to support cycling is available. Integration is also evident at a national level with a policy/legislative framework provided, detailing the key documents underpinning the DCS at a national and regional level. These include the New Zealand Transport Strategy (2002) and the Otago Regional Land Transport Strategy (2005).

On the other hand the PAS contains no reference to the provisions of other strategies or plans which indicates poor integration. The PAS presents an appropriate document to incorporate aspects of the DCS in order to get Dunedin residents more physically active. For example to achieve Goal One: to *“create urban and rural environments that foster more active lifestyles for all Dunedin residents”* (DCC, 2007, p.14), reference to accelerated completion of the capital projects from the DCS presents one possible objective or action that could have been used to achieve the goal. This would also have the combined effect of providing an incentive to implement the actions as the result would benefit two strategies within the planning framework.

Three Key Informants agreed on the ability of good integration to achieve combined or similar outcomes across multiple strategies. Key Informant Two stated:

The fact is the issues that these individual plans and strategies address do not exist singularly, they all combine to make-up the functioning of a whole city, meaning a change in one plan will more than likely affect another so integrating plan provisions ensures other plans are not adversely affected or on the other hand that plan outcomes can be more achievable (KI 2, 2012).

Key Informant Five also emphasised the cross-strategy effect of similar provisions claiming *“goals in the cycle strategy such as adding on-road cycle lanes may conflict with provisions in the District Plan that provide for efficient vehicle transportation through the main arterials in Dunedin, therefore checks must be made to ensure conflicts like this do not occur”* (KI 5, 2012).

Allowing good integration between multiple plans in the Dunedin planning framework will ensure changes to the provisions in plans and strategies does not conflict with other documents while provisions can be tailored to aid the achievement of similar goals across different strategies and plans. Sandnes provides a model example of document integration with the Municipal Comprehensive Plan containing the same key principles, objectives and strategies as the City Health Development Plan, thus providing more institutional weight (Barton et al., 2003). More plan provisions consistent across multiple planning documents in Dunedin will ensure active living priorities are given greater weight and will see the city provide a model active living environment.

5.4 Recommendations

The results of the document analysis and Key Informant interviews have been combined to provide recommendations to the Dunedin planning framework as shown in Table 10. Applying these changes through specific documents that can be used to achieve success in active living are represented in Figure 7. These recommendations are designed to address areas in Dunedin’s planning framework where improvements can be made to ensure the city is directed towards achieving greater numbers of residents walking and cycling.

Table 10: *Recommendations Drawn from Results and Discussion of the Built Environment Characteristics in Dunedin.*

Findings and recommendations			
Characteristics	Method: Document Analysis	Method: Key Informants	Recommended changes to planning framework
Transport Infrastructure	Dunedin is improving with specific targets for cycling and walking infrastructure	Infrastructure in Dunedin is varied but showing promising signs for future	Introduce requirements active living infrastructure with new street and building developments
Connectivity / accessibility	A priority area addressed throughout documents	Need to complete connections and remove existing missing links	Eliminate missing links in new and existing cycle and pedestrian networks
Funding	Central government driven with efforts to find alternative forms of funding	Little funding for active living, greater proportion of transportation funding should go into active living projects	Developing an active living organisation
Urban design	Little active living related but provisions to improve aesthetic quality of built environment	Currently room for improvement in Dunedin to improve aesthetic environment and safe access	Retrofitting existing pedestrian and cyclist routes in the city with best practice urban design and safety features
Land use mix	Encouraging mixing of uses in people friendly environments	Mixed land use already evident, people lack the education or information on opportunities	Improve education and promotion of active living opportunities in Local Activity Areas

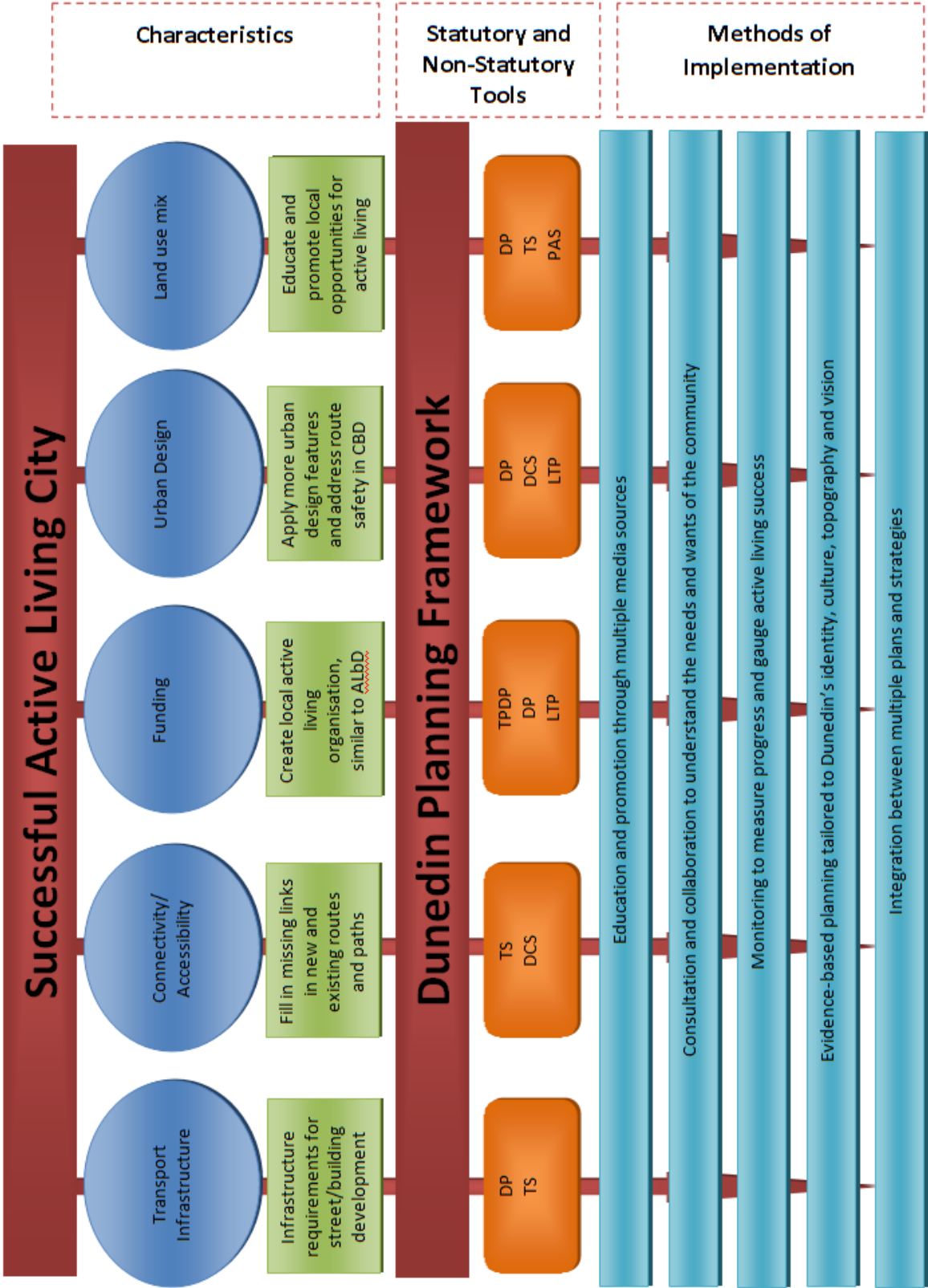


Figure 7: Visual representation of recommended changes in built environment characteristics for the Dunedin Planning Framework.

5.5 Conclusions of Results and Discussion

International best practice has provided Dunedin with multiple built environment characteristics and methods for improvement in active living planning. A document analysis and Key Informant interviews have revealed Dunedin compares very well to international best practice on active living. Concurrently, deficiencies in the Dunedin planning framework have also been identified and best practice has been used to remedy these deficiencies and develop changes to the planning framework. Applying these changes through the recommendations provided will assist Dunedin in becoming a successful active living city.

Chapter Six: Conclusions

The purpose of this research was to explore the application of best practice active living to Dunedin's planning framework. Little was known of the Dunedin planning frameworks provision for improving active living through built environment changes. Recent declining active travel statistics also needed to be addressed for the city to reach levels of active mode shares experienced in international best practice cities. Built environment best practice characteristics for active living were reviewed and applied to a document analysis and Key Informant interviews in Dunedin. These methods served the purpose of comparing the current state of active living in Dunedin with best practice. International examples of best practice active living planning have provided Dunedin sufficient criteria against which to assess the city's current and future direction towards becoming a successful active living city. Dunedin compares very well to international examples of best practice active living on the grounds that it has many of the characteristics and methods of successful active living cities. However as highlighted through specific comparisons of built environment characteristics and associated methods, more can be done to help the city be on par or even exceed the active transport mode share rates experienced in other cities worldwide.

The deficiencies in the Dunedin planning framework compared to international best practice were identified and recommendations were provided to remedy them. These recommendations included active living infrastructure requirements for street and building development, filling in missing links in new and existing pedestrian and cycle paths, creating a local active living organisation to assist with funding, applying greater urban design features and addressing aesthetics and route safety into the CBD, and to educate and promote opportunities for active living in existing mixed use Dunedin neighbourhoods. Underlying the implementation of these changes to the Dunedin planning framework were several methods. These included education and promotion through multiple media sources, consultation and collaboration to understand the needs and wants of the community, monitoring to measure progress and gauge active living success, evidence-based planning tailored to Dunedin's identity, culture, topography and vision, and integration between multiple plans and strategies.

International best practice has provided multiple recommendations to meet the deficiencies of the Dunedin planning framework and through the application of these recommendations, Dunedin will become a successful active living city.

Opportunities for future research exist through the application of a similar methodology to other towns or cities within New Zealand or worldwide. Using the local planning framework to assess best practice against will allow the identification of potential areas for improvement in active living planning. Future research using this methodology should however address several limitations found throughout the research process. Primarily the issue of plan effectiveness needs to be addressed to gain an accurate analysis of the success of past and present plan provisions. Key Informants provided some detail on the success of plan provisions however they were not in a position to accurately assess whether these provisions had been realised, they merely provided subjective opinions. Obtaining objective data on the success of plan provisions through the results of monitoring provisions used to determine their effectiveness may assist in accurately identifying the current state of active living planning.

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Appendix One

Low Risk Notification Registration


MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

9 August 2012

Cody Davidson
1 Heriot Row
Dunedin Central
DUNEDIN 9016

Dear Cody

Re: Active Living in Dunedin, New Zealand

Thank you for your Low Risk Notification which was received on 24 July 2012.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely



John G O'Neill (Professor)
Chair, Human Ethics Chairs' Committee and
Director (Research Ethics)

cc Ms Jo Ross
School of People, Environment and Planning
PN331

Mrs Mary Roberts, HoS Secretary
School of People, Environment and Planning
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Appendix Two

Key Informant Information Sheet and Consent Form

Active Living in Dunedin

Interview Information Sheet

Purpose of the research: To understand the current state of physical activity through transport (active living) in the city of Dunedin and what can be done to improve active living through urban planning in Dunedin.

Your role in this research: If you decide to volunteer, you will be asked to participate in a one-off interview. The interview will be semi-structured with questions relating to your impressions of active living in Dunedin, and what has been done or can be done to improve active living in Dunedin. With your permission, the interview will be tape recorded for transcription at a later date.

Time commitment: The interview is expected to take no longer than 20 minutes.

Risks: No risks are anticipated to you or your organisation, all questions are designed not to cause discomfort or harm and the interview can cease at any moment upon request.

Confidentiality: Your responses to interview questions will be completely confidential. Your name and associated organisation will be kept anonymous and assigned a random numbered code for use in the study. The recorded interview will be transcribed only by the researcher and erased as soon as this process has concluded. The transcript, identifiable by a numerical code, will be kept until the research is complete, and destroyed thereafter. The data you provide will be used to summarise the current state of active living in Dunedin and provide an evidence base for comparison against international best practice characteristics of active living.

Participation and withdrawal: Your participation is completely voluntary and you may withdraw from the study at any time without penalty. You may withdraw by contacting the researcher or their supervisor stating your desire to no longer being a part of the study; no questions asked. You may refrain from answering any question, and skip to the next question, or cease the interview at any point.

To contact the researcher: If you have any questions or concerns about this research, please contact the researcher via any of the following methods: **Cody Davidson – Phone:** 0274760094; **Address:** 1 Heriot Row, Dunedin Central, Dunedin, 9016; **Email:** cdavidsonemail@gmail.com. You may also contact the Massey University research supervisor **Joanna Ross – Phone:** (06) 356 9099 extn. 7241; **Address:** Social Sciences Tower, Room 5.16, Massey University, Private Bag 11 222, Palmerston North, 4442; **Email:** J.M.Ross@massey.ac.nz.

Active Living in Dunedin

PARTICIPANT CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the interview being sound recorded

I wish/do not wish to have my recordings returned to me

I agree to participate in this study under the conditions set out in the Information Sheet.

Signature:

Date:

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Full Name - printed

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