

Improving freight efficiency within the ‘last mile’

A Case study of Wellington’s Central
Business District

Brigitte Jessica Allen

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Abstract

Freight movement within the Central Business District has generally been overlooked in both academic planning literature and urban plans. There is little understanding of the nature of urban freight activity despite the significant impacts it can have on the natural, social and economic environment. This is an increasing concern because the frequency and volume of freight needed within the Central Business District is growing. In addition to this, increasing urbanisation and traffic volumes are predicted to intensify problems that are already occurring.

The aim of this study is to investigate how urban freight activity within Central Business Districts in major urban centres can be made more efficient and reliable. Urban freight efficiency is complex; it is affected by a wide range of actors and activities. Because little is known about the last mile this study looks to explore freight from the perspectives of the key actors involved. Semi-structured interviews have been conducted with professionals from local planning organisations and freight and retail businesses. A literature review and field observation have also been used to investigate the main drivers of urban freight activity, the constraints and barriers to efficiency and potential solutions to the problem. This research used the Wellington CBD as a case study.

Overall this study found that planning for efficient freight movement requires a combination of solutions which incorporate a supply chain perspective. The key findings show that consumer demand was the main driver of urban freight activity. Therefore there is a need to incorporate representatives from local businesses and freight companies, who are providing services to meet this demand into the planning process. Currently there is little co-operation between the freight, retail and planning sectors, this needs to be improved in order to achieve efficiency.

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1 Introduction

Freight movement within the Central Business District has generally been a low priority in international and national local planning and research. There is little understanding of the nature of urban freight activity, despite the significant impacts it can have on aspects such as human health, traffic flow, air quality and the economy. When freight within the Central Business District is inefficient, delivery vehicles spend more time in the Central Business District which can result in increased costs to the freight industry and subsequently an increased cost in commodities, as well as intensification of negative problems associated with freight. Factors such as increasing urbanisation, traffic volumes and the demand for more frequent freight services are predicted to intensify problems that are already occurring (OECD, 2003). Therefore, the aim of this study is to investigate how urban freight movement can become more sustainable, so benefits can be increased and inconveniences reduced.

1.1 The Last Mile

It is important to recognise that the movement of goods within a metropolitan area is just one aspect of a complex transportation system. This study will focus primarily on the 'last mile' of freight movement; this is defined as being the pickup and drop-off point to the end customer. For the purposes of this research the end customer will be businesses within the Central Business District. The 'last mile' within the Central Business District is characterised by final products being delivered in low volumes and at high frequencies, therefore, it generally has the greatest number of trip ends (Anderson *et al.*, 1996). On time delivery to the Central Business District is essential for economic reasons and will often take priority over achieving the lowest possible delivery cost (Rodrigue *et al.*, 2009). The 'last mile' of freight movement is always undertaken by road because the final customer is unable to be reached by alternative modes of transport.

1.2 Importance of Urban Freight

The delivery and pick up of goods within the Central Business District has a vital role in supporting retail centres, which are major generators of wealth for the area. Freight services need to be efficient in order for industries to develop a competitive edge, and the costs of commodities to be reduced (Anderson *et al.*, 2005). Freight transport services also have a direct impact on the level of access people have to goods and services (Hanson, 2004). Therefore, it affects health and wellbeing. People need to be able to access goods and services necessary to carry out their day-to-day lives.

Despite the benefits that freight may bring, inadequate facilities for loading and unloading freight within the central city contribute to negative effects such as increased congestion, risk of accidents, and reduced mobility (Kawamura and Rashidi, 2010; Scott, 2009). Negative impacts such as congestion have flow on effects to the environment due to the associated effects of increased fuel consumption and air pollution. Congestion also has a negative impact on the economy because it increases the costs of delivering goods. It may also exacerbate the negative effects freight vehicles have on social sustainability, such as increased noise, pollutants, accidents, and a negative effect on amenity and liveability.

1.3 Links between Planning and Urban Freight

Traditionally, freight activity has been predominantly developed and managed by the private sector (OECD, 2003; Rodrigue *et al.*, 2009). As a result, public planning for freight is still relatively new. The public generally perceives freight in a negative light, and in planning policy there tends to be a more dominant focus on the problems associated with urban goods movement, rather than on the benefits (OECD, 2003). For example, planners and politicians will generally pay more attention to urban freight when issues relating directly to the safety of pedestrians and other motorists are involved. This shows that there may be a lack of awareness for the benefits urban freight movement can have on its communities.

Planning and urban freight activities are interconnected because the urban form has a large influence on the flows of traffic within the city (Anderson *et al.*, 1996). Due to limited urban space in the Central Business District there is a constant competition for space between commercial vehicles for places to park, motorists for access to road infrastructure, pedestrians for safe places to walk or cross the street, and cyclists needing safe places to ride (OECD, 2003; Scott, 2009). The main goal for planners is to balance the various needs of stakeholders using this space. Supporting urban freight activities to be more efficient will have a wide range of positive effects on other modes of transport within the Central Business District and on people socialising, residing and working within the area. It is important that planning for urban freight is integrated into land use and transportation planning because urban freight movement is affected by the surrounding built environment and existing infrastructure, both of which are unable to be easily changed to accommodate the growing needs of urban freight movement.

1.4 Justification for Research

The nature of freight activity to and from the pick-up and drop-off points in commercial buildings has generally been overlooked by those involved in local and national planning policy. There is a general consensus among experts in the transportation field that there has been a severe shortage of literature exploring the movement of urban goods (Allen and Browne, 2008; Anderson *et al.*, 1996; Anderson *et al.*, 2005; OECD, 2003; Rodrigue *et al.*, 2009; Scott, 2009; Woudsma, 2001). This becomes especially evident when comparing it to research done on passenger movement. Although there have been many studies that address the links that planning, policy and land use have on the movement of people within the urban environment, there has been very little done to address the links with the movement of goods (OECD, 2003; Woudsma, 2001).

Studies and research into urban freight movement only began 50 years ago and are limited in numbers (Allen and Browne, 2008). The few studies that have been conducted are generally a result of research needed to address the planning needs of particular urban areas, they have not been carried out regularly, and there is

little correlation between other studies (Woudsma, 2001). The studies that do focus on traffic movement in the central city fail to recognise the impact that the pick-up and delivery of goods have on congestion. Studies conducted in this area have shown that insufficient enforcement, curb space and excessive grid lock all contribute negatively to central city dwell times (Morris, 2009; Morris *et al.* 1998). Studies from New York show that deliveries to commercial properties have steadily increased, however, the number of bays required for loading and off-loading goods has not changed (Morris, 2009).

1.5 Research Design

The overall approach to this study is based on developing a greater understanding of urban freight activity. It has been established that this is an area that has been under-researched and therefore, little is known about it. Urban freight activity is also complex and requires a methodology that can acknowledge the integrated nature of human activities. Therefore, in order to deal with the nature of this topic an exploratory research approach has been taken. This study is grounded by a constructivist view, involving a holistic, qualitative and case study approach.

This research will be carried out in the Wellington Central Business District. This area has been selected as the case study because it is a large city that will generate high levels of freight activity. It is also very compact which means the effects of urban freight activity will be more concentrated and easier to observe. It is also a city facing increasing freight volumes (GWRC, 2010), therefore research into improving freight efficiency will be useful.

A qualitative research methodology will be used in order to gain a more in depth understanding of the research area. This will be achieved through a series of semi structured interviews with a range of stakeholders, including representatives from the freight industry, retail sector and local planning authorities. Other research techniques such as a field observation and literature review will also be utilised to further understand urban freight activity.

1.6 Aim and Objectives

The aim of this thesis is to investigate how urban freight activity can be made more efficient and sustainable in the Wellington Central Business District. This research will seek to gain a better understanding of how the movement of urban goods can become more reliable and efficient in order to reduce the negative impacts freight activity has on the social, economic and environmental wellbeing of the community. In order to achieve this, the following objectives have been developed:

Objective One: *To develop an understanding of the factors influencing current urban freight transport services within Wellington's Central Business District.* In order to achieve sustainable urban freight movement it is important to know what drives urban freight activity.

Objective Two: *To identify the key constraints to efficient freight activity within the Central Business District.* There is currently very little known about urban freight movement in the Central Business District. This objective seeks to explore barriers to the efficient movement of goods, and whether the barriers identified in Wellington are similar to those that are occurring overseas.

Objective Three: *To investigate how cities can improve the efficiency and reliability of urban freight within the Central Business District.* This requires taking into account findings from the first two objectives to explore the connections between the movement of urban goods and key actors within the city. This objective will provide possible ways forward for improving planning for urban freight activity in the future.

1.7 Thesis Structure

The following chapter will set the wider context for this research by highlighting key findings and arguments from international and national literature surrounding urban freight activity. The literature review will begin by establishing the importance of urban freight and developing reasoning for why it warrants

attention. This chapter then explores trends in demand and distribution occurring internationally, and compares this to what is currently occurring in New Zealand. It also looks into the concept of sustainability and efficiency, and the relationship between planning and urban freight.

The process used to gather and analyse the information for this research will be discussed in Chapter Three. This chapter elaborates on the constructivist research approach underpinning the decisions and actions taken throughout this study. It will provide justification for the qualitative methods, and research techniques used to obtain and process perceptions and information about urban freight data.

Chapter Four will introduce the setting in which this research has been conducted: the Wellington Central Business District. This chapter will illustrate how urban freight activity has been incorporated into Wellington (and subsequently New Zealand) planning policy and practice. It will also highlight the key planning actors which impact freight activity at the national, regional and local level.

Chapter Five will discuss the results that have emerged from the research process. This chapter illustrates the key findings from semi-structured interviews conducted with a range of participants', covering the freight, retail and planning sectors.

Chapter Six will discuss the key findings within a similar structure to the objectives set out above. This Discussion Chapter is set out in three sub-sections; the drivers of urban freight activity, key constraints to efficient freight vehicle movement, and solutions for improving urban freight activity in the future. This chapter will weave together findings from the results, literature review and context chapter to investigate how urban freight activity can be made more efficient and sustainable in the Wellington Central Business District.

Finally, this thesis will conclude by summarising the key findings, what have been learnt from the research process, and recommendations that can be taken from the study.

2 Literature Review

This thesis aims to explore how freight movement within the central business district can be made more efficient in order to improve sustainability. The review of literature begins by illustrating the importance of freight and exploring the important role it plays in society, both overseas and within New Zealand. It explains why freight movement within the Central Business District warrants attention due to the negative impacts it can have on the natural, economic and social environment. The concept of sustainability, different measures for sustainability, and the barriers to efficient freight movement within a compact urban setting are briefly discussed. This is followed by a review of current international trends in freight transportation, the factors that are driving these trends, and how these will impact on freight activity in the future. Freight management and the ways in which planning can contribute to more efficient freight movement within the urban environment will also be discussed. The Chapter concludes by addressing the research questions.

2.1 The Importance of Freight

Freight transportation operates on a variety of scales and is a vital component to a wide range of social and economic activities. It also allows people to “access resources and products that would otherwise be unavailable locally” (New Zealand Productivity Commission, 2011:4). Freight transportation is a critical component to all sectors of the economy. Commerce is dependent on the freight industry for the pick-up and delivery of goods at every step of the supply chain seen below in Figure 2.1. Freight transportation is needed to move raw materials between suppliers and manufacturers, transport semi-finished goods within the manufacturing sector, distribute the final product to distribution centres which then distribute goods to retail outlets (the customer), and to deliver goods to consumers at their individual homes (Ministry of Transport *et al.*, 2008).

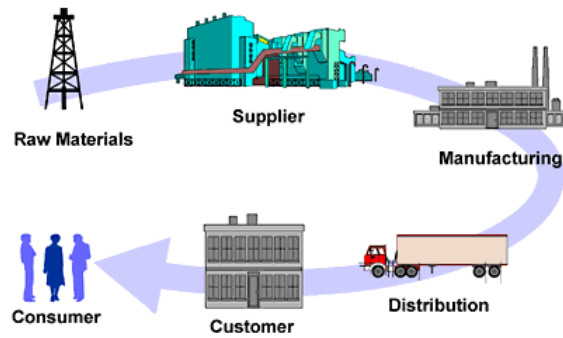


Figure 2.1: Supply Chain (source: The Progress Group , 2011)

Developing more efficient freight systems is important because it allows industries to become more competitive and the cost of commodities to be reduced (Anderson *et al.*, 2005). This generates wealth because it increases economic productivity and encourages trade (Anderson *et al.*, 2005; New Zealand Productivity Commission, 2011:4). Therefore improvement to freight efficiency within the central business district will make it more appealing for businesses to locate there (GWRC, 2010:7)

Going beyond economics, freight is a key component to everyday life and without it communities would not be able to function (Department for Transport (UK), 2010). For example, the freight sector is responsible for essential domestic services such as waste removal, snow removal and the transportation of water for fire fighting (Ministry of Transport *et al.*, 2008).

2.2 Sustainability

Freight transportation warrants attention not only for the vital role it plays in supporting the economy, but also because of the negative impacts it can have on the natural, economic and social environment (Table 2.1: Issues in Sustainable Transportation (Litman and Burwell, 2006:335). The movement of goods within the urban environment poses significant challenges to the concept of sustainable cities. Although there is no commonly agreed upon definition of sustainable transport, most authors support the view that the principles of sustainable transport should be based on achieving social equity, economic growth and

environmental protection (Behrends *et al.*, 2008; Goldman and Gorham, 2006). These three principles are commonly referred to as the triple bottom line. It is also generally agreed that the sustainability goals should be achieved while finding a balance between the current and future needs of the community (Goldman and Gorham, 2006).

Table 2.1: Issues in Sustainable Transportation (Litman and Burwell, 2006:335)

<i>Economic</i>	<i>Social</i>	<i>Environmental</i>
Traffic congestion	Inequity of impacts	Air and water pollution
Mobility barriers	Mobility disadvantaged	Habitat loss
Accident damages	Human health impacts	Hydrologic impacts
Facility costs	Community interaction	DNRR
Consumer costs	Community liveability	
DNRR	Aesthetics	

DNRR: Depletion of non-renewable resources.

2.2.1 Impacts of Freight

The movement of urban freight can have widespread impacts on this triple bottom line. Freight transport can have detrimental effects on the natural environment, such as increasing air pollution and the depletion of natural resources (Behrends *et al.*, 2008; GWRC, 2010; Kuse *et al.*, 2010). For example, goods vehicle movement makes up between 20% and 30% of vehicle kilometres in a city, and can contribute to between 16% and 50% of air pollution from transportation within a city (LET-Aria Technologies, 2006, cited in Dablan, 2007).

Freight transport is also highly fuel intensive (New Zealand Productivity Commission, 2011). Its reliance on fossil fuel is contributing to the depletion of a limited and non-renewable resources (GWRC, 2010). This is having both an economic and environmental impact. Due to this scarcity and society's reliance on fossil fuel for mobility, it is predicted that by 2030 the demand for oil will have grown by 41% (Ministry of Transport, 2008). This increase in demand, accompanied by reductions in supply, will lead to a rise in oil prices (Ministry of Transport, 2008). Purchasing fuel is "a significant component of the cost" for freight transportation, therefore improving the efficiency of freight will help to

reduce the impact of rising fuel prices on industry (New Zealand Productivity Commission, 2011:2), and of consumption of a non-renewable resource on the natural environment.

Another issue highlighted in Table 2.1 are the social impacts urban freight transport can have on surrounding communities. Litman and Burwell (2006) state that the road network is a major component to the quality of a public space. Lindholm (2010) agreed that the movement of goods can affect the liveability of a space. Social problems associated with urban freight include high levels of noise, congestion, emissions, reduced pedestrian and motorist safety, and a decline in the “total urban experience” (Lindholm, 2010:6206).

These problems can exhibit in a number of ways. For example, freight vehicles are generally big and noisy and therefore tend to have a negative impact on the acoustic and visual environment (GWRC, 2010; Lindholm, 2010). The noise generated by freight vehicles can become an even bigger concern when freight activity occurs outside of day time hours (Department for Transport (UK), 2008). Because the population of people residing within the Central Business District is increasing, freight deliveries that originally occurred during the night are being challenged due to the impact the noise has on the residential amenity. Looking for ways to improve the efficiency of freight is important because it could help reduce the amount of time that vehicles are present in the public realm, therefore improving community liveability.

Freight vehicles can be detrimental to the safety and accessibility of pedestrians and motorists. If the provision of loading zones or off-street parking is not sufficient freight vehicles have to park illegally to make their delivery or pick up of goods. This may involve freight vehicles parking on footpaths, in bus stops and double parking in part of a traffic lane if they are unable to find a suitable park. Lack of provision for freight transport parking can therefore lead to increased risk of harm to pedestrians and other vehicles, and can impede pedestrian and motorists’ accessibility.

The movement of goods also contributes to congestion which has a negative effect on all three principles of sustainability (Behrends *et al.*, 2008; Morris *et al.*, 1999).

Although delivery trucks only account for a small percentage of total kilometres travelled in urban areas, they are accountable for almost 30% of congestion (Lomax *et al.*, 2010; Morris, 2009). This is due to freight vehicles restricting traffic flow through actions such as double parking, undertaking U-turns, and their contribution to traffic volumes when circling around the Central Business District. Congestion has negative economic effects due to the increase in travel time and associated fuel consumption (GWRC, 2010; Transportation Research Board, 2009). It also has negative impacts on the environment and people's wellbeing due to increased air pollution and a reduction in mobility (GWRC, 2010). Congestion intensifies other negative impacts already associated with freight movement.

2.2.2 Managing Impacts

It has previously been established that inefficient freight transport contributes to problems such as congestion, environmental pollution and resource depletion, and impacts on social health and safety (Litman and Burwell, 2006). It is important that the movement of urban goods is made more sustainable in order to minimise these negative effects. Behrends *et al.* (2008) identify four key objectives to achieving a sustainable urban freight system:

1. To ensure that the transport system is accessible to all categories of freight transport;
2. To reduce air pollution, emissions, waste and noise so that there are no negative effects to people's health and the environment;
3. To improve resource, energy and cost efficiency of freight;
4. To enhance the liveability of the urban environment by enhancing the attractiveness of public space, improving safety, minimising land use and maintaining a high level of mobility.

Achieving these sustainability objectives will ensure that the negative impacts freight transport has on the social, natural and economic environment are reduced. This is supported by the Wellington City Council (2009b:1/2) who state that "non-renewable resources need to be used efficiently to avoid, remedy or mitigate the effects caused by their use". Therefore minimising unnecessary use of

resources (such as fuel) will reduce waste, pollution and environmental degradation (WCC, 2009b). Anderson *et al.* (1996) state that one form of resource conservation can be accomplished by reducing driving. Making freight movements more efficient would help to achieve the sustainability goals outlined by Behrends *et al.* (2008).

Anderson *et al.* (2005) have found that one of the key barriers to successfully implementing a sustainable strategy is determining how sustainability will be measured. The way sustainability is defined will depend on which group is defining it. May *et al.* (2001, cited in Behrends *et al.*, 2008) state six objectives for sustainable transport, based on the three sustainability principles:

- Economic efficiency;
- Liveable streets and neighbourhoods;
- Protection of the environment;
- Equity and social inclusion;
- Safety; and
- Contribution to economic growth.

2.3 Freight in New Zealand

This section will illustrate the role that freight plays in New Zealand. It generally focuses on freight movement at the national level. Freight trends that are relevant to the study area will be discussed in the context chapter.

Most of the freight trends occurring within New Zealand are consistent with those that are taking place internationally. Within New Zealand the freight sector plays an important economic role, contributing approximately 4.7% to the country's total economy (NZBCSD, 2011). In 2007 the freight transport, postal and warehousing sector made 18.5 million dollars in revenue (NZBCSD, 2011). The New Zealand Business Council for Sustainable Development expects freight movement within New Zealand to grow between 70 and 75% between 2006/07 and 2031 (NZBCSD, 2011). The freight sector in New Zealand is responsible for approximately 43% of the total energy consumed by the transportation sector

(Ministry of Transport *et al.*, 2008). Clearly there is an increasing need for sustainable freight transport solutions to be explored.

Similarly to international trends, road transportation is the dominant mode of freight transport within New Zealand, with the occasional exception of rail and coastal shipping being used for large consignments between distribution centres (Ministry of Transport, 2008; Ministry of Transport *et al.*, 2008; NZBCSD, 2011). Figure 2.2 illustrates New Zealand's freight transportation by mode. The graph on the left shows that 92% of total freight volume is moved by road. Although the proportion of goods shifted by road decreases when freight movement is measured in tonnes per km, it is still the dominant mode of transportation (see right hand graph in Figure 2.2).

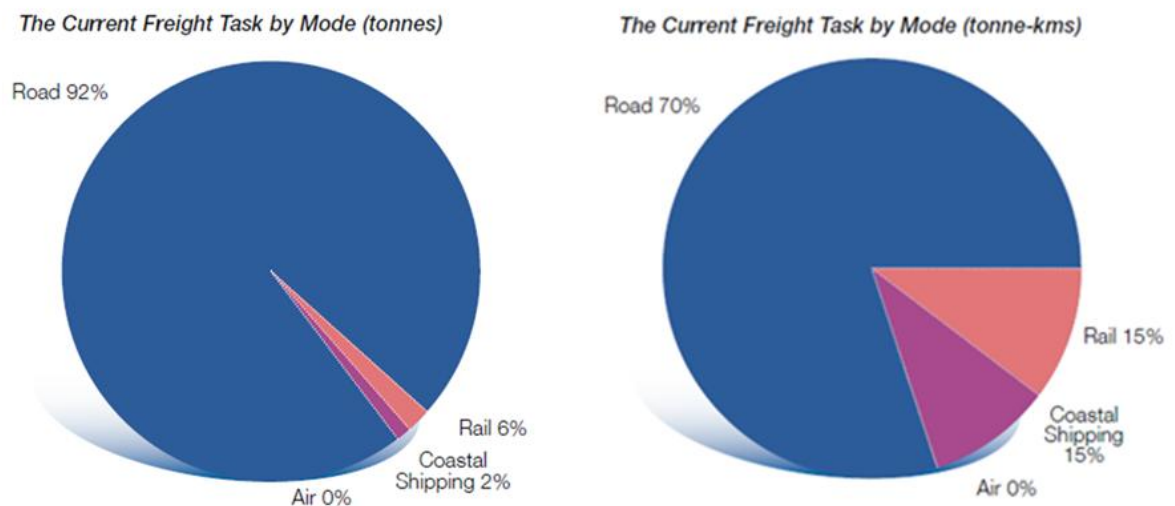


Figure 2.2: New Zealand's Current Freight Task by Mode (Source: Ministry of Transport *et al.*, 2008)

In response to growing freight volumes, road transportation has steadily increased over time (this can be seen in Figure 2.3). Between 2000 and 2008 the amount of freight tonne-kilometres in road freight transportation has increased by 34% (Ministry of Transport, 2008). In addition to the growing dominance of road based freight transportation, New Zealand's roads are expected to see a 40% increase in vehicle usage by 2040 (Ministry of Transport, 2008). This will pose major threats to vehicle mobility.

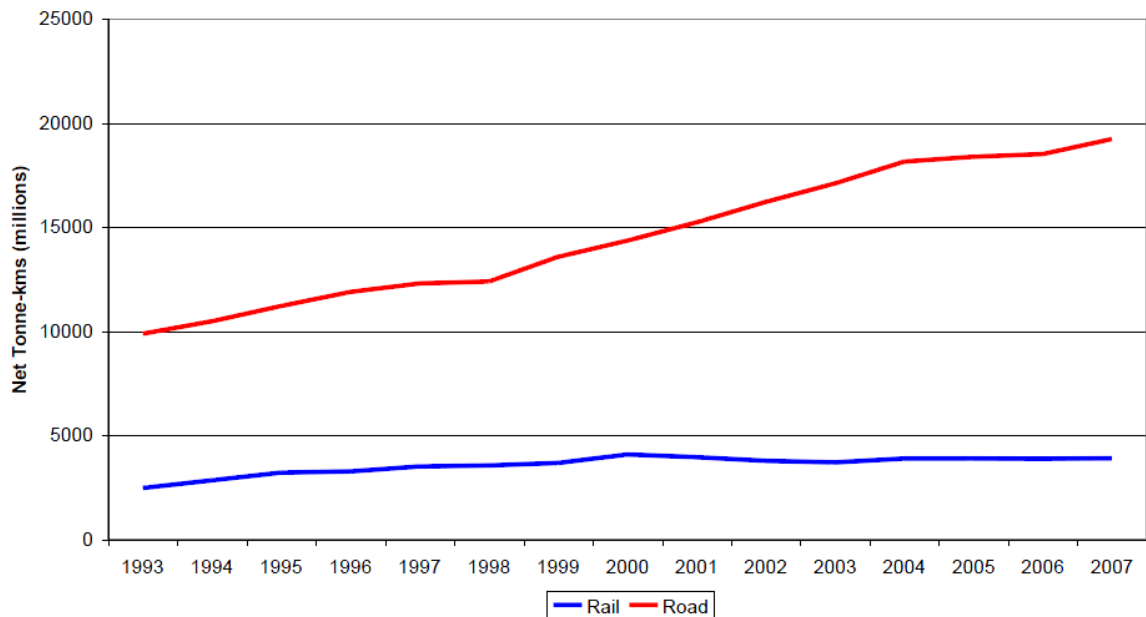


Figure 2.3: Growth in Road and Rail Freight in New Zealand 1993-2007 (Source: Ministry of Transport *et al.*, 2008).

The amount of freight arriving in New Zealand is predicted to increase significantly by 2040. Trends in the volume of freight arriving in New Zealand have shown growth from approximately 2.2 to 4.2 million tonnes between 2002 and 2007 (Ministry of Transport, 2008). Between 2008 and 2040 the amount of freight needing to be transported in New Zealand is expected to double (Ministry of Transport, 2008).

2.4 The Last Mile

The purpose of freight transportation is to move goods from one location to another. This usually involves transferring goods from places where they are abundant to places where they are scarce (Department for Transport (UK), 2010; Rodrigue *et al.*, 2009). There are a variety of ways goods can be transported, and “each mode tends to specialise in moving goods that suit that particular sort of transport” (Department for Transport (UK), 2008:22). The mode of transportation will vary depending on the nature and volume of the good and the distance it will be travelling. For example, goods that are in liquid form such as oil or water will, where possible, be transported using pipelines. Larger volumes of goods traveling

between countries will generally be transported by air, sea or rail whilst goods that are in smaller loads and travelling shorter distances (such as those traveling regionally or locally) tend to travel by road (Department for Transport (UK), 2008).

The last leg of the supply chain is very important and is commonly referred to as the 'last mile'. Morris (2009:2) defines it as "the pick-up /drop-off point to the end customer in commercial buildings". The last mile can involve any size delivery vehicle, carrying any type of good, as long as delivery to the final destination is carried out by professionals to a customer, or commercial outlet. Although the last mile appears to play a minor role in the supply chain, the Council of Supply Chain Management Professionals stated that they expect that "as much as 28% of all transportation costs occur in the last mile" (Scott, 2009:3).

This area has been chosen as the focus of this thesis because over the past 20 years literature on the movement of goods has been scarce among urban studies research (Woudsma, 2001). For example, Woudsma (2001) found that only 3% of 1000 articles in the 1999 Transport Research Board Proceedings address freight transport. There are several authors who agree that research into urban freight has been neglected (Anderson *et al.*, 1996; Lindholm, 2010; Woudsma, 2001). Woudsma (2001) states that the key reasons urban freight has been neglected is because of the small percentage of traffic volume that freight contributes too, the complexity of the topic, and the absence of reliable urban freight data. Research conducted on the 'Last Mile' has been a response to the need for improved planning in specific urban areas (Woudsma, 2001). However, Woudsma (2001) found that there is no consistency in approach or the definitions used in this research.

The last mile always operates within the urban environment and is concentrated around the central business district where commercial buildings are at their highest concentration (Scott, 2009). The central business district will often be a location with the highest number of trip ends, residents and densest employment (Anderson *et al.*, 1996). Within urban areas freight movement can contribute to between 20 and 30% of total vehicle kilometres (Dablanc, 2007). Therefore in

order to achieve sustainability it is essential that more attention be paid to the movement of goods within the urban environment.

Although freight can be transported by a variety of modes, the 'last mile' requires a high degree of flexibility which can only be provided by road transportation (Department for Transport (UK), 2008). The Department for Transport (UK) (2008:23) noted that although many freight journeys utilise modes such as "rail, water or even pipeline, the final leg to the end customer is often conducted by road." This is due to its relationship with the retail sector, which requires goods to be delivered in low volumes and at high frequencies on a day to day basis (Rodrigue *et al.*, 2009).

Freight vehicles transporting goods within the 'last mile' can vary in size depending on the requirements of the goods being transported (Morris *et al.* 1999). Factors such as the size, volume and urgency of the freight being delivered will affect what size vehicles the freight is moved in. For example, packages that need to be delivered promptly will generally be delivered by small courier vans because they are more manoeuvrable than larger trucks.

A large majority of freight involved in the 'last mile' can be categorised as retail and courier commodities. The retail sector within New Zealand is "estimated to generate over 10 million tonnes of freight traffic into stores and between the main companies' own distribution centres" (Ministry of Transport *et al.*, 2008:100). The left hand graph in Figure 2.4.**Error! Reference source not found.** shows that within New Zealand 14.5 million tonnes of freight are categorised as retail and courier commodities. This proportion increases when the freight volume is measured in tonnes per km rather than tonnes lifted (see right hand graph in Figure 2.4). This illustrates that retail and courier packages travel further than other commodities such as aggregates or milk and dairy products.

In terms of the last mile, there is currently no accessible information of freight task associated with retailing in New Zealand (Ministry of Transport *et al.*, 2008). For example, there is no publically available data on the scale of freight activity carried out by courier companies (Ministry of Transport *et al.*, 2008). This is because freight patterns supporting the retail sector are complex and in many different

forms. Freight can come directly from suppliers or importers, a retail outlet's personal distribution centre, or through third party distribution centres (Ministry of Transport *et al.*, 2008). However, what is known about demand for retail transport is that the total demand of retail products is expected to increase at the same speed as GDP (roughly 2% per year). Changes to distribution patterns will result in the tonnes per km growing more slowly (Ministry of Transport *et al.*, 2008). The only exception to this will be that of courier movements which are increasing at a faster rate than GDP.

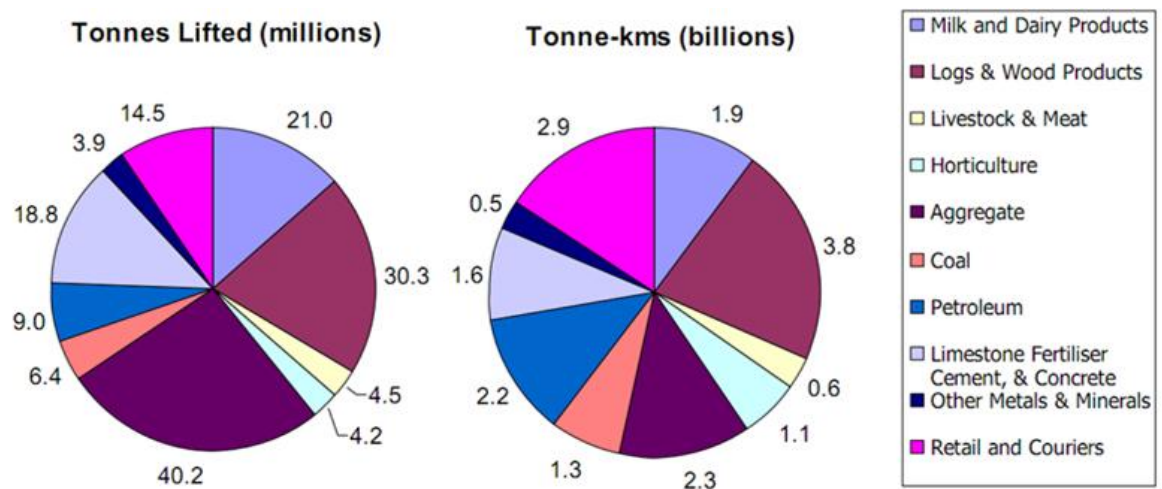


Figure 2.4: Movement of Key Commodities 2006/07 (Source: Ministry of Transport *et al.*, 2008)

Several changes are expected to occur in food distribution patterns throughout New Zealand in the future. The change that will impact on freight moving in the last mile is a growing volume of freight moving through centralised distribution centres (Ministry of Transport *et al.*, 2008). It is expected that this volume will increase by 15% between 2011 and 2016, which will result in fuller truck loads between the suppliers and retail store (Ministry of Transport *et al.*, 2008).

2.4.1 Barriers to Urban Freight

There are many factors that impact on how efficient the last mile will be within the urban environment. Morris *et al.* (1998) found that delivery vehicles face many challenges when dropping off and picking up freight within the central city. Key issues identified as major barriers to urban goods movement are congestion,

inadequate provision of loading and unloading facilities, lack of strict enforcement, security, and inadequate infrastructure (Morris *et al.*, 1998).

Although freight vehicles are a cause of congestion, they are also subject to it. Congestion is largely due to increasing urbanisation and traffic volumes and has negative impacts on freight vehicle mobility (de Magalhães, 2010). Congestion is often unavoidable for freight deliveries within the city centre due to limited route options, timing and legislation (OECD, 2003). Other factors such as competition for space, changing traffic conditions and unpredictable pedestrian and bicyclist behaviours can also negatively impact on delivery times within the urban environment (Thomas *et al.*, 2007). It is important that these issues are addressed because they can have detrimental effects on freight transporters and the economic health of the Central Business District (Walter, 2001).

2.5 Demand for Freight in Urban Areas

Urban freight transportation is facing substantial growth (Goldman and Gorham, 2006). There is an increasing demand for goods to be shifted in smaller volumes, at higher frequencies, across greater distances in less time and at lower prices (de Magalhães, 2010; Goldman and Gorham, 2006; Leinbach, 2004; Morris *et al.*, 1998). As a result, an increased level of freight mobility has become essential in order for freight transportation companies to remain competitive (Lehtonen, 2008). These changes in demand are due to improvements in technology, changing planning regulations and supply chain pressures.

E-commerce and Globalisation

Advancements in technology such as e-commerce have fundamentally changed how goods are traded. E-commerce is defined as the use of electronic communications and computer technology to support and conduct business (OECD, 2001). Since its development, e-commerce has enabled actors within the supply chain (such as manufacturers, suppliers, transporters, warehouses, retailers and customers) to become more integrated (OECD, 2003; Rodrigue *et al.*,

2009). This has had a direct impact on freight demand and distribution and led to the rapid increase of small package deliveries (de Magalhães, 2010; Goldman and Gorham, 2006). Improved cohesion between the various actors within the supply chain has also contributed to an increasing customer focus, just in time distribution, online shopping, outsourcing of transportation services, and globalisation, all of which affect the demand and distribution of freight (OECD, 2003).

E-commerce and globalisation have allowed more businesses to operate on a global scale (de Magalhães, 2010). This has led to manufacture specialisation and a larger market base, which requires goods to travel further distances to reach their manufacturers and customers. For example, manufacture specialisation has resulted in fewer production centres, therefore raw materials and products need to be sourced from locations that are further away and the finished product needs to be distributed over greater distances.

Just In Time Distribution

Just in Time distribution (JIT) is a business strategy occurring at all levels of the supply chain that is having significant effects on the demand for freight transportation. Just in time distribution involves raw materials and finished goods being delivered on a need to order basis. This distribution strategy allows the retail sector to maximise on profits by converting storage space to service and manufacturing space (de Magalhães, 2010). To compensate for the reduction of inventories, retail stores require goods to be delivered faster (OECD, 2003), more frequently and in lower volumes (de Magalhães, 2010; Morris *et al.*, 1998). Just in Time distribution is therefore one of the drivers behind the increasing number of freight vehicles travelling with volumes below capacity (de Magalhães, 2010; Goldman and Gorham, 2006).

Customer Focus

An increasing focus on providing high quality customer service has had a direct impact on the transportation industry. Due to an increasingly competitive

environment freight companies are committed to delivering goods to the customer on time, even if that means doing so at a higher cost (Morris *et al.*, 1998). de Magalhães (2010) states that this increased pressure to narrow the time delivery window has caused an increase in individualised deliveries to businesses. Customers are having increasing input into the supply chain and are now able to track where their good is in the transportation system. There is growing customer expectation for goods to be delivered promptly to their homes or businesses (OECD, 2003). This puts extreme pressure on the transportation sector because it may require that vehicles run their routes at half capacity, which is much less efficient than bulk deliveries.

Urbanisation

Urbanisation has had an impact on freight demand within the 'last mile'. The level of freight activity is determined by the needs of people and industry, therefore, freight movement will generally be greater in areas where "industries are based, where goods are sourced and where people live" (Department for Transport (UK), 2008:29). With more and more people moving into cities, the demand and nature of goods that need moving into the urban environment are changing (de Magalhães, 2010). For example, an increased concentration of residential dwelling will result in more waste which needs to be transported out of the city, and an increase in goods such as furniture and appliances to be delivered into the city.

2.6 Freight Distribution

Changes in the demand for freight have a direct impact on how freight is distributed. The way in which goods are transported has had to adapt in order to accommodate the changing nature of freight deliveries. Browne *et al.* (2010a) identify that changes in distribution include:

- Increased use of third party logistics operators;
- Reduction in the number of locations where goods are dispatched from;
- Increased distance between suppliers and other establishments;

- Spreading of deliveries over more days of the week;
- Increasing use of light goods vehicles;
- Greater seasonal peaks in delivery traffic;
- Increased vehicle average dwell times (probably linked to larger delivery quantities); and
- Increase in service trips to establishments.

One of the most significant changes in distribution patterns has been an aggregation of long distance trips and de-aggregation of local level deliveries (New Zealand Productivity Commission, 2011). This has been a response to an increasing demand for smaller, more frequent goods deliveries. Freight travelling at the local level is harder to collectively transport because there are a large number of small packages that need to be delivered to different locations on a day to day basis. With larger volumes traveling greater distances (such as products moving from the manufacturer to distribution centres) there are a greater number of options for how it is moved. It is also much more cost effective to move goods traveling long distances at full capacity.

When dealing with small volumes of freight, some distribution strategies are more cost effective than others. One option is to not make any changes to the way freight is transported. This is expensive because it can result in deliveries being made with less than full vehicle loads. Other distribution strategies that have begun to emerge involve transportation companies outsourcing in order to deal with smaller volumes of freight, making it more cost efficient (Browne *et al.*, 2010a). It can sometimes be more expensive for two firms to transport two products separately than it is for one transport company to transport the two products together, because the costs are shared between a greater number of products (New Zealand Productivity Commission, 2011). This outsourcing of transportation services has consequently led to a decrease in warehousing.

Another distribution trend that has evolved is the use of small delivery vehicles which are rapidly replacing heavy goods vehicles (Browne *et al.*, 2010b; Department for Transport (UK), 2008). It is now more common for goods moving into the city centre to be delivered by small vehicles (Browne *et al.*, 2010a; OECD,

2003). Light goods vehicles are less efficient than larger freight vehicles. This is due to the economy of scale; the unit cost will fall as the volume transported increases (New Zealand Productivity Commission, 2011). Therefore a larger vehicle will “use less fuel per tonne of freight transported” than a smaller vehicle (New Zealand Productivity Commission, 2011:17).

Changes in distribution include more transportation being undertaken by road because it is the most flexible mode to deal with the increasing mobility required for goods movement. Road transportation is the most common form of freight movement in the United Kingdom (Department for Transport (UK), 2008). This form of freight transportation is growing due to demands for reduced transportation costs, as it is much more cost effective and flexible to cope with high frequency and low volume deliveries. In comparison transportation modes such as rail and inland water are likely to be less flexible because there is only one route they are able to take (OECD, 2001). The Department for Transport (UK) (2008) states that one reason for this road based dominance is the relationship between the origin and destination of goods. Approximately 70% of freight transported remains in the same region of the United Kingdom (Department for Transport (UK), 2008).

A study conducted by Browne *et al.* (2010a) found that most freight deliveries are made on weekdays, with the peak delivery time in the mornings between 6am and 12pm. There are very few deliveries and collections (5%) conducted at night. Browne *et al.* (2010a) also found that the average dwell time of a parked freight vehicle ranged from 7-34 minutes. This is dependent on a variety of factors such as the distance from the parked vehicle to the establishment where goods need to be delivered or collected, the number of people doing the delivery or collection, the volumes of the delivery, the type of park (i.e. off-street or on-street), the way the goods are transported from vehicle to the premises, how much help is provided by establishment staff, and the paperwork required for the delivery (Allen *et al.*, 2000, cited in Browne *et al.*, 2010a).

2.7 Urban Freight Management – the Key Actors

This section will discuss how freight has been managed in the past, how it is currently being managed, and how it should be managed in the future. Freight has traditionally been primarily managed by the private sector; however, the public sector is starting to have a greater input. This is due to a growing awareness of increasing freight activity and its associated problems.

2.7.1 Private Sector

Freight movement has been, and still is, managed predominantly by the private sector (Behrends *et al.*, 2008). Governments have little control over how and when freight transport is undertaken because a majority of the transportation inventory and facilities are privately owned. This is the case in New Zealand where freight transport services are owned and operated by the private sector (Ministry of Transport, 2005). The private sector possesses the vehicles, vessels, and aircrafts that freight is transported in, as well as “distribution centres and most ports through which freight flows” (Department for Transport (UK), 2008). One of the government’s roles is to be responsible for maintaining transport infrastructure and regulations and policy that support the private business sector as well as the local community and natural environment (Kuse *et al.*, 2010).

The management of freight activity within the private sector is commonly referred to as logistics. The Council of Supply Chain Management Professionals (2009, cited in Kuse *et al.*, 2010:6255) defines logistics as;

the part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements.

The role that logistics plays in the supply chain can be seen in Figure 2.5 below.

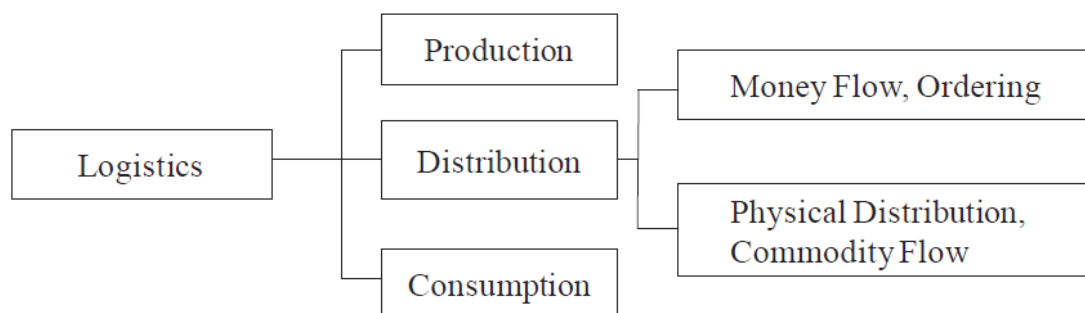


Figure 2.5: Logistics Definition (Source: Kuse et al., 2010)

The private sector has been responsible for many of the developments that have led to improvements in time, cost and environmental efficiency (OECD, 2003). The competitive drive of business encourages the freight industry to develop more efficient logistics systems (Morris *et al*, 1998; New Zealand Productivity Commission, 2011:5). Morris *et al*. (1998) agree that businesses are constantly looking for new ways to improve the cost effectiveness of their transportation networks. There are strong incentives to minimise costs and the delivery time window to customers. It is also becoming increasingly common for logistics to minimise the impacts that these flow of goods have on the environment (Kuse *et al*, 2010). It is important to note that the level of costs does not define economic efficiency alone. Increasing the cost of a transportation service is justified if the customer places a higher value on the service provided (New Zealand Productivity Commission, 2011:5)

The goal of servicing customers at the minimum cost is achieved through a “tightly integrated and constantly reactive ‘supply chain’” (Morris *et al*, 1998:27). Although this research focuses solely on one component of the supply chain (the last mile) it is important to appreciate that efficiency of the whole system is most effective (New Zealand Productivity Commission, 2011:8). The New Zealand Productivity Commission (2011:8) found that “users are affected by the price and performance of the system as a whole rather than its components”. Although the private sector incorporate the whole supply chain, planning measures surrounding urban freight movement do not take the supply chain as a whole into account (OECD, 2003).

2.7.2 Public Sector

There is general consensus among authors that freight activity within planning has been neglected (Browne *et al.*, 2007; Lindholm, 2010; Woudsma, 2001). This is supported by Morris *et al.* (1998) who describe urban freight within the planning process as an 'afterthought', and the OECD (2003) who note that planning agencies have played a limited role in facilitating urban freight vehicle movement and its impacts on local communities. However, Browne *et al.* (2007) also acknowledge that urban freight is beginning to become a higher priority in planning. In the last 5 years cities such as London and Paris have begun giving urban freight serious consideration (Browne *et al.*, 2007).

This planning neglect is partly due to freight transport being perceived in a negative light by the general public. Commuters perceive freight vehicles as an annoyance, and urban residents opt for freight vehicles to be kept at a distance from where they reside due to the noise they generate (de Magalhães, 2010). Although trucks are only accountable for a small proportion of traffic on the road their "large size, poor manoeuvrability, noisiness and high pollution makes their presence objectionable" (Rodrigue *et al.*, 2009:303). In addition, large trucks are perceived to pose a higher risk of injury because of their large mass and higher risk of severe injury when involved in accidents, compared to cars (Department for Transport (UK), 2010).

The planning that does occur in relation to freight transportation is generally "limited to urban and traffic planning" (Behrends *et al.*, 2008:694). There also appears to be a greater focus on the problems associated with urban freight movement, rather than the benefits (Dablanc, 2007; OECD, 2003). Dablanc (2007:282) found that most cities perceived larger delivery vehicles as something they should restrict, rather than as "a service they should help organize" to improve efficiency. Morris (2009) found that most planning focused on urban traffic management does not consider the negative impact that delivery vehicles may have on traffic flows. Planning associated with freight activity has also predominantly focused on larger, inter-regional movements rather than urban

areas. Policy regulating freight movement and its impacts is primarily targeted at freight moving at the macro rather than micro level (Behrends *et al.*, 2008; Scott, 2009).

There is consensus among the freight literature that one of the most serious obstacles facing urban freight activity is a general lack of knowledge held by governments, planners and the general public (Morris *et al.*, 1999; OECD, 2003, 2010; Rodrigue *et al.*, 2009). In order to effectively plan for freight it is essential that the government has a sound understanding of the changing needs of the transportation industry (Morris *et al.*, 1998). This is also important for determining how sustainable the changes are, and the best possible solutions for improving this (Browne *et al.*, 2010a; Morris *et al.*, 1998).

The availability of freight data is generally poor among municipalities (Huschebeck, 2001). For example, in the BESTUFS study on European cities it was found that less than 50% of the cities undertook freight transport monitoring, and the majority did not specify any efforts had been carried out (Huschebeck, 2001). This supports Lomax *et al.*'s (2010) findings that planning agencies are not undertaking systematic or consistent data collection of local urban freight vehicle movements. Browne *et al.* (2010a) found in the few studies that have been conducted that the data collected is not comparable. They state that more work needs to be invested in improving consistency in collection of urban freight data. This would allow smaller studies to be combined and build on the body of knowledge.

The few studies that have been conducted around freight movement have focused on the mode (number of HGV or trains) rather than what freight is being shifted, and to what location. The Department for Transport (UK) (2008) and Anderson *et al.* (1996) argue that more studies need to be carried out on the logistical side to investigate the type of freight being moved, the route it takes, and the factors that generate demand for freight movement, to provide better planning. This general lack of awareness has resulted in transport-related policies and facilities being designed and planned from a passenger transport perspective, neglecting the specialised needs of freight transport (Behrends *et al.*, 2008; OECD, 2003).

In order to ensure that freight is prioritised in the planning process there needs to be better data collection to demonstrate just how important it is. This is supported by the Department for Transport (UK) (2010:13) who state that “developing a thorough understanding of the nature of freight should help to justify the relative importance of freight within other policy priorities.” However it should be taken into consideration that collecting data around urban freight can be difficult due to the variety of stakeholders involved. The limited information available on urban freight activity is held by different actors within both the private and public sectors and there is no collaboration to remedy this (Ministry of Transport *et al.*, 2008).

Another barrier to urban freight activity is inconsistencies among different organisations. Organisations and municipalities at different levels will often act independently of one another when implementing changes that impact on urban freight transport (Transportation Research Board, 2009). Litman and Burwell (2006) found that traditional planning has adopted a reductionist decision making approach, in that problems are given to organisations with a specialised focus. For example, one group of people will be asked to reduce traffic congestion, while another group will be asked to improve pedestrian safety. This segmented perspective of a system which is linked can lead to solutions for one problem worsening another (Litman and Burwell, 2006).

Traditionally engineers have played a dominant role in managing transportation networks. However, there is growing recognition that a broader multidisciplinary approach is required to manage increasing transportation demand (Rodrigue *et al.*, 2009).

2.7.3 Planning Tools

There are many tools that planners can utilise to manage the impacts of freight vehicle movements within dense urban areas. These tools vary from planning policy, to pricing and enforcement. Some of these tools have been designed specifically to manage urban freight while others have been designed for different purposes but have an impact on freight. The following section explores planning

tools which have been implemented to manage urban freight movements overseas.

The urban transport system is significantly influenced by the urban form and spatial land use patterns (Litman and Burwell, 2006; Rodrigue *et al.*, 2009). Therefore policies that facilitate for improved urban freight activity are highly beneficial. The ideal solution to adequately address the issue of insufficient loading and pick-up zones is to ensure that service areas specifically designed for deliveries are incorporated into new establishments during the design phase (Department for Transport (UK), 2010). For example, in Paris “all commercial and industrial buildings larger than 250 square meters have to provide an off-street unloading area” (Huschebeck, 2001:12). In Barcelona urban form policy was used to ensure that new bars and restaurants have adequate storage space (minimum 5m²) to reduce the frequency of deliveries (Dablanc, 2007).

In some places access restrictions have been used to control the size and time of day that delivery vehicles can enter a particular urban zone. These regulations have been employed to minimise the impact of urban freight vehicles on local traffic volumes and urban amenity. There are many different types of access restrictions; several cities have sought to limit what hours of the day trucks are able to make pick-ups and deliveries in dense urban areas, whilst some have placed restrictions on size to prevent heavy vehicles from entering specific urban areas (Rodrigue *et al.*, 2009). Other types of access regulation that have been widely used relate to preferred truck routes, loading and unloading zones, regulation licences and the type of vehicle being used in terms of emission outputs (Huschebeck, 2001; Rodrigue *et al.*, 2009).

City access regulations, although made with good intentions, can have negative impacts on traffic flow and cost (Huschebeck, 2001). For example, one approach has been to restrict urban deliveries to hours during the day instead of the night, as this reduces the negative impact of noise on local residents trying to sleep. However, this increases the number of freight vehicles circulating the city during the busy hours of the day and adds to congestion and the risk to pedestrian safety. Therefore, it is important that a balance is found between; “allowing freight access

to commercial centres whilst ensuring a safe and pleasant environment for local residents” (Department for Transport (UK), 2010:38).

Enforcement is a tool that can be used to strengthen other planning tools put in place to improve freight efficiency. One of the most common problems that prevent deliveries and collections from having access to the premises is illegal parking (Department for Transport (UK), 2010). Because there is such high competition for kerbside space within the Central Business District, cars or commercial vehicles will frequently stay beyond the allocated time required for them to conduct a delivery. It is therefore important that local authorities enforce parking restrictions. de Magalhães (2010) and Huschebeck (2001) note that without this enforcement regulations will become weaker and eventually ineffective. However Morris *et al.* (1998) argue that targeting high-profile freight transporters with parking infringements increases the cost of doing business in the Central Business District and encourages a hostile relationship between the freight industry and the city.

Bus lanes are a common technique used to enhance the efficiency of public transport. ‘No car’ lanes are less common, but work on the same principle as the bus lane by giving priority to the movement of goods as well as people traveling on public transport (Department for Transport (UK), 2010). This technique provides benefits such as freeing up road capacity, and enhancing safety of drivers by separating the larger vehicles from the smaller ones (Department for Transport (UK), 2010). ‘No car’ lanes also act to encourage larger vehicles to travel down an allocated route, reducing the negative impacts they may have on other roads. Some of the negative aspects associated with this initiative are that it may reduce the efficiency of buses and it is difficult to enforce (Department for Transport (UK), 2010).

In addition to planning tools there are many ways to improve freight vehicle mobility within the central business district. Transportation efficiency can be improved through technological advancements, supply chain management and market forces. Developments in technology can allow vehicles to become more fuel efficient, which will make them more cost effective and minimise the impact

they may have on the natural environment. Advancements in supply chain management can allow for outsourcing of freight deliveries to occur in order to reduce the number of less than full vehicles making deliveries.

Although technology has contributed to the increased pressure to deliver goods quickly and in smaller volumes, it has also contributed to solutions which allow freight companies to be more efficient. Improvements in logistic information systems allow goods to be traced throughout their journey in the supply chain (New Zealand Productivity Commission, 2011). This allows supply for transport to be more closely aligned with demand (New Zealand Productivity Commission, 2011). It also enables better use to be made of spare space within the vehicles because it has become easy to communicate when there is spare capacity or goods in need of being quickly transferred. Websites such as 'www.findatruckload.co.nz' and 'www.backload4u.co.nz' have been developed to help drivers fill up empty trucks on their return journeys (New Zealand Productivity Commission, 2011). However, sharing commercial data between freight transporters can create the potential of misuse for competitive advantages (New Zealand Productivity Commission, 2011).

2.7.4 Public, Private Collaboration

The literature shows there is growing awareness of the need to use a more integrated approach to manage transportation issues (Morris *et al.*, 1998). It has been established that planning policy often lacks a supply chain perspective (OECD, 2003). Lomax *et al.* (2010) and Kuse *et al.* (2010) agree that in order to combat congestion, governmental actions need to be accompanied by the "efforts of businesses, manufacturers, commuters and travelers" (Lomax, *et al.*, 2011). Morris *et al.* (1998:32) state; "the improvement or elimination of even a single transportation barrier... will require an integrated, flexible approach by representatives from a mix of agencies, along with appropriate private-sector representatives". This is applicable for improving freight vehicle mobility. The New Zealand Business Council of Sustainable Development also supports the view that in order to deal with increasing freight movement a broader perspective

needs to be adopted when focusing on freight issues. A supply chain perspective should be implemented rather than looking at each mode independently from one another (NZBCSD, 2011).

The municipal planners stated in the BESTUFS research that a co-operative approach with the transport industry, regular data collection and improved co-ordination of infrastructure planning and economic planning across a larger geographical area are some of the most effective ways to solve problems regarding urban freight (Huschebeck, 2001). Another solution suggested by municipal planners is to provide information to the freight industry on relevant rules, regulations and delivery and pick up locations within the urban environment (Huschebeck, 2001).

The diagram below illustrates beneficial areas for the public and private sector to collaborate. Figure 2.6 shows that the private sector is responsible for providing transportation services and in most cases the unloading and loading facilities at inner city destinations. It also shows that the public sector is responsible for land use, architecture, traffic and road planning. It would be advantageous for private-public collaboration to occur in transport and loading/unloading facility planning (Kuse *et al.*, 2010:6258).

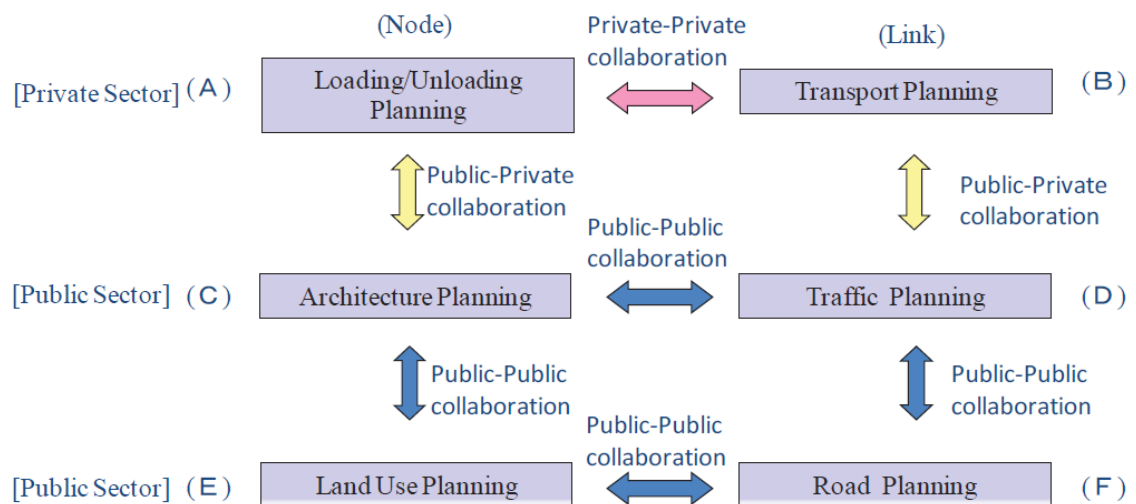


Figure 2.6: Relationship Between Public and Private Sectors (Source: Kuse and Iwao, 2007, cited in Kuse *et al.*, 2010)

Public Private collaboration is a key aspect to improving freight efficiency. Browne *et al.* (2010a) state that although the geography of urban areas does influence the

pattern of urban freight activity, factors such as the type of establishment where goods are delivered or collected, the scale of the site, organisation of their supply chain, and the range of products being delivered will be most influential.

2.8 Literature Summary

One of the tough questions planners face is; how do you minimise the impacts of freight vehicle movement while not impairing the economy? (Rodrigue *et al.*, 2009). This literature review has established that in order to effectively plan for freight, more data needs to be collected and an integrated approach between the private and the public sector is required.

“Sustainable planning reflects the realisation that impacts and objectives often interact, so solutions must reflect integrated analysis” (Litman and Burwell, 2006:334). The freight transportation industry is much more complex than it used to be and requires an awareness of issues such as environmental protection, safety, aesthetics, working conditions, equity, inadequate funding and governance (Transportation Research Board, 2009). Providing solutions requires a broader set of skills as the issues associated with transportation and urban freight movement cannot be addressed separately (Transportation Research Board, 2009).

The following chapters will seek to answer the following research questions; 1) What factors influence current freight transport behaviours in Wellington’s Central Business District? 2) What are the key constraints to efficient freight movement within Wellington City? And 3) How can cities use urban planning to improve the efficiency, and therefore sustainability, of freight vehicle movement?

3 Methodology

3.1 Introduction

The purpose of this chapter is to outline the nature of methodological decisions made during this research and justify how these decisions can be viewed as 'reasonable' (Denscombe, 1998). It is important to be aware of the differing views that researchers have and how these views affect the ways knowledge is gathered (Grix, 2002). This chapter will describe the approach and rationale used to guide the research. It will then illustrate how data was collected and analysed, and the limitations that were encountered during the research. Providing an accurate account of the methods and thought process behind decisions that have been made will help the reader to determine how reliable this research is.

3.2 Research Approach

The research approach refers to the nature of knowledge and justification surrounding how we know what we know (Baillie, 2003; Dunne *et al.*, 2005). The research approach is important because it shapes the questions that we ask and how we set about answering them (Grix, 2002). It provides the justification and logic behind the methods and methodological approaches that have been chosen (Grix, 2002; Neuman, 2000). The research approach also underpins how researchers interpret data, therefore a "researcher's ontological and epistemological positions can lead to different views of the same social phenomenon" (Grix, 2002:178).

This research uses a constructivist approach to describe and understand urban freight activity within the last mile. A constructivist approach fits well with this research topic because achieving sustainable transport (and consequently urban freight activity) is a complex problem, in which efficiency is reliant on many feedback loops. Litman and Burwell (2006:332) state that sustainable transport

requires a comprehensive approach which recognises the “integrated nature of human activities” and therefore the need for integrated solutions. A constructivist approach is consistent with this thinking. It encompasses a holistic outlook which acknowledges that there are multiple factors (and groups of people) which are interacting and shaping reality.

In this study it was important to gain perspectives from a range of stakeholders. This is particularly important when looking at a complex topic such as the freight industry which involves a number of different groups, each with their own particular sets of goals, and views on the world. Neuman (2000) acknowledges that there are many “different ways to look at the world – ways to observe, measure and understand social reality”. A constructivist approach is therefore useful because it explicitly sets out to take account of multiple views, “multiple knowledges” and interpretations (Guba and Lincoln, 1994:113).

Three key attributes of constructivist inquiry are that it is undertaken in natural settings, uses a case study approach, and tends to use qualitative methods (Guba and Lincoln, 1982; Guba and Lincoln 1994). Understanding this research approach will help to illustrate the relationships between abstract issues in theory and solid research techniques, as well as guiding ethical behaviour (Grix, 2002; Neuman, 2000). The remaining sections will look more closely at these areas.

3.2.1 Methodological Approach

The methodology is the manner in which the researcher seeks information, and is underpinned by the assumptions associated with the chosen research approach. Within the social sciences there are two main methodological approaches; quantitative and qualitative. Although these two orientations differ significantly they share common ground in that all researchers will collect and analyse data in order to discover patterns which will explain social life (Neuman, 2000). The main difference between the two methods is that qualitative methods gather data from sources in the form of words and images rather than numbers (Denscombe, 1998; Neuman, 2000).

It is important to be aware that different methodologies are appropriate for different situations. A qualitative approach has been chosen for this research because it “generally exhibits a preference for seeing things ‘in context’ and for stressing how things are related and interdependent” (Denscombe, 1998:176; Patton, 1990). This holistic and context specific approach to research is consistent with a constructivist view. Clifton and Handy (2001:3) support the use of qualitative research for this very reason stating “Qualitative research is vital to understanding the complexity of transportation behaviour”. Qualitative methods are also good for studying systems in detail such as sustainable urban freight, because they generate ‘thick descriptions’ which provide for information rich data (Denscombe, 1998:220). In qualitative research the data is analysed by extracting themes and generalisations in order to create a coherent picture (theme analysis is discussed in further detail later in this chapter) (Neuman, 2000).

A qualitative research approach is suitable for an emergent research design. Emergent research design is where the researcher only begins to discover the meaning once becoming involved in analysing the data, unlike research using quantitative data where the researcher will begin with a hypothesis (Neuman, 2000). This is particularly beneficial for this research topic because (as illustrated in Chapter 2) very little is known about the realities of freight operations in the ‘last mile’. Qualitative research is an ‘umbrella term’ that covers a variety of research methods (Denscombe, 1998:207). These will be discussed in the following section.

3.3 Methods of Data Collection

The subsequent paragraphs describe the methods that have been utilised during the research process to collect and analyse data (Grix, 2002). The research methods have been chosen based on the aim of this research and available sources of data. A number of independent research methods have been used to answer the research objectives, including; secondary data collection techniques such as policy and document analysis, and primary data collection techniques such as

exploratory interviews, semi-structured interviews, snowball sampling and field observation.

Neuman (2000:124) states that “it is better to look at something from several different angles rather than to look at it in only one way”. This thought underpins the method of triangulation and consequently the way in which this research has been conducted. Triangulation employs a range of independent approaches to strengthen the research process. The use of multiple approaches allows the strengths of one method to offset the weakness of another (Singleton Jr and Straits, 2010). This research employs triangulation in two ways: it investigates the research objectives from the perspective of three different groups (local authorities, retailers and freight transporters), and it uses a combination of methods – a literature review, semi-structured interviews and field observations.

3.3.1 Single Case Study Approach

A single case study approach was used for this research. This was an appropriate way to address the research objectives because it allows more focus to be placed on understanding a specific context, rather than comparing different examples (Bryman, 2004). A case study approach allowed me to concentrate my resources within one area in order to develop a more in-depth understanding of how freight activity within the Central Business District can be improved. The single case study approach enabled me to explore the research question and the ‘last mile’ from a range of perspectives.

Wellington was chosen as the case study location because it has a compact Central Business District (Appendix 1) and is a city large enough to generate high volumes of urban freight. Wellington is also facing pressures from a transport network that is at near capacity, this pressure is predicted to increase due to increasing volumes of road freight in the region (GWRC, 2010). Therefore there is a potential need to improve freight vehicle efficiency in Wellington. It should be noted that, although, the case study was carried out in Wellington, a pilot interview was conducted in Queenstown. Quotes from this pilot interview have been included in the results for

topics which are not case sensitive, such as defining freight efficiency and reducing freight transportation costs.

3.3.2 Literature Review

The aim of the literature review is to build an understanding of the topic and key issues within it. Chapter 2 presents a detailed literature review discussing international and national trends, and theories and debates encompassing urban freight planning and business practices. The purpose of the literature review is to show the reader which “theories and principles have been influential in shaping” the research approach (Denscombe, 1998:158). A literature review is a cost-effective method of obtaining data because there is a large amount of information held in literature which is easily accessible (Denscombe, 1998).

Information obtained in the literature review is a form of secondary data collection because the literature being analysed has not been produced specifically in line with the objectives and aims of this research (Denscombe, 1998). Analysing the documents requires relying on the interpretations of the researchers that produced them, who may have a biased view (Denscombe, 1998). Therefore, the credibility of the source being used in the literature review has to be taken into account. The credibility can be established by examining; who wrote the document and for what purpose, who funded it, if it is reported from first-hand experience, and the social context of the document when it was produced (Denscombe, 1998).

In this study the literature review provided the basis for helping refine the research questions, and for setting the initial interview agenda.

3.3.3 Key Informant Interviews

Having discussions with people is a good way to develop an in-depth understanding of the issues and perspectives surrounding a particular research topic (Bradshaw and Stratford, 2000). This is important in looking at freight because as we have seen there are many different actors, all with their own

perspectives of the problem. Developing these discussions requires finding ways to manage the conversation, identifying who to talk to and other technical issues which are expanded on below.

Semi Structured Interviews

A semi structured interview is defined as a discussion with a pre-set agenda which guides the flow of conversation (Yates, 2004). Semi structured interviews allow the potential meanings of questions and answers to be explored and negotiated in more detail to ensure that an accurate understanding of the participant's perception is obtained (Yates, 2004). The pre-set agenda allows semi-structured interviews to be flexible by allowing the researcher to probe further into areas of interest as they arise (Yates, 2004). The respondent is also less constrained in their replies because, unlike structured interviews, there are no limits on what can be talked about (Yates, 2004).

Bryman (2004) and Yates (2004) explain that the flexibility associated with semi-structured interviews allows the researcher to clear up inconsistencies and ongoing concerns as they develop, vary the order of questions, and follow up on leads during the conversation. Semi-structured interviews also encourage more of an interviewee perspective because it allows the participant to talk about what they believe to be relevant and important rather than just what the researcher would like to hear (Bryman, 2004). This can lead to the participant providing ideas that the researcher may not have considered themselves (Yates, 2004). This is particularly important for a research topic such as this one where not much is known about the topic, as evidenced in the previous chapter.

For this research there were three pre-set interview agendas. Each has been tailored towards the specific knowledge held by various participants who were interviewed; there is an interview agenda for local planning authorities (Appendix 2), freight transporters (Appendix 3) and retailers (Appendix 5). The pre-set questions have been developed based on design and practice recommendations provided by Yates (2004).

Yates (2004) states that questions should be neutral and open ended, a 'funnelling' technique should be used where the interview begins with broad questions about the topic and then narrows down to specific follow up questions, and the researcher should be confident that the participant understands the concepts and definitions being used throughout the interview. Following this guide, each agenda has two phases: the first explores what the participant knows about urban freight activity, their role in relation to it, what they perceive to be the problems associated with urban freight, and how these problems are shown or measured. The second phase investigates what factors help to provide an efficient situation and how efficiency could be improved.

Key Informants

Participants in the research were found through a combination of two methods. Web based research was used to identify a starting set of interviewees, and these were expanded through snowball sampling. Snowball sampling is based primarily on referrals from one participant to other potential participants. It is founded on the assumption that people included in the target population have links with others who are in a similar population or industry (Singleton Jr. and Straits, 2010). Therefore, it is a useful strategy for identifying additional people who have relevant knowledge to contribute to the study.

Miller and Brewer (2003) consider snowball sampling an informal technique to reach the targeted population. It is predominantly used for locating participants who are difficult to find or in a minority population (Miller and Brewer, 2003). However, snowball sampling has been useful for this research because it has proved an efficient way to target others in fields that are relevant to this study. During the interview process some of my key informants recommended that I also meet with retailer outlets within the Central Business District. This was a group of people who, originally, I had not considered to be of relevance to this study. However, after including this group into the research process I have discovered that retailers are one of the most influential actors in determining how efficient urban freight activity will be.

Miller and Brewer (2003) also state that snowball sampling can be used to establish greater trust when first initiating contact with participants because the researcher appears to be a part of the group rather than an outsider. I found this to be true; during my field observation the participant I was with introduced me to some of the retailers he made frequent deliveries to. This made it very easy to come back and ask for their participation in the study.

Although the snowball sampling technique has many benefits, it is important to be aware of the limitations associated with it. Using a snowball sampling technique increases the risk of ending up with a homogenous sample due to the reliance on participants' social networks (Miller and Brewer, 2003). Participants are not randomly drawn therefore they are at risk of becoming biased. Another limitation is that referrals that are obtained by participants are dependent on the "subjective perceptions of initial respondents of the involvement of others in the same activity" (Miller and Brewer, 2003). This may result in individuals that are most popular or have wider social networks being identified more than others (Miller and Brewer, 2003). This risk was minimised by using web based research to identify other potential participants in addition to the snowball sampling technique. This ensured that the research was not reliant on one group of people (Miller and Brewer, 2003). Using multiple research participants provided a complex understanding of the issue and allowed me as a researcher to move beyond a single point of view.

Sample Size

Although there are no rules regarding sample sizes in qualitative enquiry, the sampling strategy must suit the purpose of study, research questions and resources available (Patton, 1990). The research objectives require a purposeful sampling method which analyses the meanings of a specific context rather than representative probability sampling. A lot of samples are needed in order for the results to be representative however these random probability samples are unable to achieve what in-depth purposeful samples can accomplish (Bradshaw and Stratford, 2000; Patton, 1990). Bradshaw and Stratford (2000:43) state that, "it is perfectly feasible that conducting in-depth interviews with a small number of

the 'right' people will provide significant insights into a research issue". Therefore "in-depth information from a small number of people can be very valuable" (Patton, 1990:184). Limitations such as time and money will also impact how research methods are carried out. The resources that are available may limit the decision of who to include and exclude from the study (Bradshaw and Stratford, 2000).

Because qualitative research tends to be more focused than quantitative research it relies on smaller samples for research (Denscombe, 1998). This may lead to data being less representative however, this is not a concern here because this research is a first exploratory research phase which seeks to gain a broad understanding of the main issues. The research objectives set out to explore the topic rather than provide a set of sound theories that can be applied to other contexts.

Research Participants

In total, 13 semi-structured interviews were conducted with 15 participants and one field observation study was undertaken to provide a more direct view of the freight industry from a first-hand perspective. The participants can be divided into three groups; local authorities, freight transporters and retailers. Each key informant and their associated occupation can be seen in Table 2. In order to gain a better understanding of each group, I sought a variety of different sized retail outlets and freight transporters. I also conducted interviews with local authorities in different governmental organisations, this group will be discussed in detail in the following Context Chapter (4).

The retail stores that participated in this research were either situated along, or just off Lambton Quay. Each store within this group were categorised as small, medium or large. The category of the store was determined by the number of staff working on the floor rather than the store size. A small store was considered to have between 1-3 staff working on any given day, a medium store has between 3 and 8 and a large store has 9 or more.

Table 2: Key Informant Reference Guide

Local Authorities	
New Zealand Transport Agency	Key Informant 9
Greater Wellington Regional Council	Key Informant 2 and 3
Wellington City Council	Key Informant 10 and 11
Freight Industry	
Courier Company	Key Informant 7
Bulk Freight	Key Informant 1, 4 and 6
Fragile Goods	Key Informant 5
Retailers	
Small (1-3 staff)	Key Informant 15
Medium (3-8 staff)	Key Informant 12, 13 and 14
Large (9 or more)	Key Informant 8 and 16

The participants in the 'Freight Industry' group were categorised into sub-groups based on the service their companies offered. Each type of company has very different needs due to time frame, vehicle size and the goods that are being delivered. Courier companies specialise in same day delivery services, therefore they predominantly deal with smaller, more frequent deliveries, and operate from vans. Bulk freight companies generally transport larger goods in higher volumes, and are predominantly associated with larger delivery vehicles, such as trucks. Companies that deal with fragile goods specialise in providing a high quality delivery and pick up service, this type of company generally does the least amount of deliveries per day however, each delivery will take a greater amount of time.

The pilot interview conducted in Queenstown has also been included in Table 2, this was with Key informant 1. This interview was undertaken as a pilot study. It enabled me to test both my interview schedule and my interview technique before conducting interviews in Wellington. It was helpful doing this in a different area than the case study, because this meant I could then go to the case study with more confidence. The field observation was carried out with Key Informant 4. This participant has been included in the Key Informant Reference Guide because the field observation involved an adapted semi-structured interview technique.

Ethics

Dowling (2000:28) states that “we must constantly consider the ethical implications of our activities”. Opportunities for unethical research are a risk in all studies, research is consistently evolving and presenting new challenges, therefore ethical issues require constant attention. Being aware of potential ethical concerns will ensure that participants feel comfortable and that they can speak truthfully and honestly (Yates, 2004). What you write has the power to change how people think about a particular area (Dowling, 2000), therefore it is important that the conclusions drawn have been based on ethical methods. In order to ensure truthful and honest research ethical approval for this research was granted from the University of Otago Ethics Committee prior to conducting interviews with the participants.

In order to be consistent with ethical procedures, permission was sought from each participant before being involved in the research process. Dowling (2000) and Yates (2004) agree that in order to obtain permission, participants must be aware of what they are consenting too. Accordingly, at the beginning of each interview participants were provided with an information sheet and consent form (Appendix 5 and 6) detailing the purpose of the research and their rights as the participant. This included, what was required of the participant if they chose to participate, and what they could expect from the interviewer. It also outlined that a participant was able to decline or cease the interview at any stage without any consequence to them. It provided the participant with an opportunity to choose whether their interview was recorded using a dictaphone and if they would like their identity to remain confidential.

In practice, each person who was approached for an interview agreed to participate in the research before being shown the information and permission sheet (Appendix 5 and 6). Providing the participant with the information sheet, explaining what it entailed and asking the participant to sign the permission form often felt uncomfortable because it formalised the interview process. However this ethical procedure proved to be invaluable to the research because it enabled the participants to feel at ease when asked questions that required them to divulge information that may have been commercially sensitive, or negative towards a

particular group. When questions arose that participants seemed hesitant about I was able to refer back to the information sheet to reinforce that their comments would be kept anonymous and if they felt uncomfortable they did not need to answer. This allowed key informants to speak truthfully without having to worry about the implications of what they said. This was particularly useful when speaking to key informants from the freight and retail industry because it allowed them to share information such as the number of deliveries they do, how many vehicles they own, and how they develop more efficient freight systems.

3.3.4 Field Observation

Field observation was another research technique employed. Unlike semi-structured interviews and the literature review, the field observation allowed me to gain a first-hand perspective of freight activity within Wellington Central Business District. Sarantakos (2005) states that obtaining first-hand information is a strength associated with observation because the researcher does not have to rely on what others say.

The field observation consisted of me participating in one delivery cycle with Key Informant 4. The observation was approximately three hours long. This was a valuable experience because it enabled me to see, first-hand, the constraints such as limited building and parking access, and the impacts the delivery vehicle had on other modes of transport within the Central Business District. Key Informant 4 pointed out relevant issues as we drove, this was the most beneficial form of research as I saw the impact constraints and inefficient transport has on the whole system. Many of these things may have been forgotten if the interview had been conducted in an office, without being in the actual context of the delivery area.

The limitations of field observation methods are that it is time consuming, unable to provide information on future events, and does not provide an opportunity to study opinions and attitudes (Sarantakos, 2005). Although this technique took the longest, it was the most beneficial. The field observation was complimented by an adaption of a semi-structured interview with Key Informant 4. This allowed me to probe for opinions and attitudes associated to the context we were in.

3.4 Methods of Data Analysis

Dunne *et al.* (2005:78) state, the interpretation of data “is the attempt to create order and meaning out of the research experience”. The following section will explain the techniques employed to analyse the information collected from the research methods.

3.4.1 Transcription and Theme Analysis

Theme analysis is a method that can be used with different theoretical frameworks. The aim of theme analysis is to identify patterns, connections and differences among different data sets (Miles and Huberman, 1994). Themes may be identified using existing theories or personal hunches to identify key themes within the data (Denscombe, 1998). It is a process that should be repeated over and over again to refine the themes emerging (Denscombe, 1998).

It is important to be aware that during theme analysis the message participants are trying to get across may be misconstrued if sections of text are taken out of context (Bryman, 2004; Denscombe, 1998). Context refers to either the words that surround the extracted piece in a transcription or the events that surrounded how that data was constructed (Denscombe, 1998). The meaning of data can also be changed by oversimplifying the explanation (Denscombe, 1998). Therefore, as recommended by Denscombe (1998) and Yates (2004), all the data that was recorded was transcribed and depicted as carefully and as accurately as possible.

Transcribing and theme analysis of data was carried out in an on-going process. It was done as soon as possible after the interviews to ensure that I was able to reflect back on the subtle non-language cues from participants surrounding context and gestures. Bryman (2004) found that analysing data in this way allows the researcher to become more aware of emerging themes that can be explored in subsequent interviews. I found this useful to ensure rigour. Themes that emerged through analysis were effectively checked back with subsequent participants as

prompt questions which ensured a check on their validity, and helped me gather more data about important themes. I did all the transcribing myself which helped me to immerse myself in the data. I then developed mind maps to set out the themes and see how different topics fitted together.

3.5 Thinking about Limitations and Rigour

One of the limitations of qualitative methods is that the results are dependent on interpretations made by the researcher. Because interpretation is reliant on the 'self' of the researcher, the researchers own beliefs and background play a role in the data that is collected and how it is analysed (Denscombe, 1998). Therefore different researchers might reach different conclusions given the same raw data (Denscombe, 1998). Care was taken to minimise this by use of triangulation. This was done by using three techniques to collect data – these were semi-structured interviews, field observations and a literature review.

There were also practical difficulties that occurred during the research process. For example, I lost two interview recordings. This illustrated the risk of relying on mechanical devices to obtain data. This also highlighted the importance of having enough participants to cater for the potential loss of information.

With more time I would have liked to do another cycle of interviews, which could look more closely at the final themes that emerged. This cycle could also look at quantifying some of the findings, which would lead to better support for subsequent discussions and studies. I consider a cycle to be the first set of literature analysis, interviews and theme analysis carried out so far in the study. The second cycle would allow me to check what I have found so far and expand on particular themes which have emerged. Such a study would provide a good follow-up to this research.

3.6 Methodology Summary

This chapter has illustrated the framework to address the aim of this research: to improve urban freight efficiency and therefore, sustainability within the Central Business District. A constructivist perspective has been an appropriate research design for this study because it has promoted a holistic view of the research problem and is an approach that is flexible to manage perspectives from a range of actors. Research on literature surrounding the topic (see Chapter 2) illustrated that urban freight is an activity that is under-researched. This study has adopted methods that are able to cope with the exploratory tactic needed to approach a topic in which little is known. Triangulation has been used to ensure rigour throughout the research process. The techniques that have been used to collect perceptions and information surrounding urban freight are: semi-structured interviews, a field observation and a literature review. On-going theme analysis has also been used to ensure rigour by validating themes in subsequent interviews. The following chapter will define the case study context and set the back drop for planning's role in urban freight activity.

4 Context

4.1 Introduction

This Chapter will discuss the research case study and the national, regional and local planning frameworks that influence urban freight in New Zealand. This chapter begins by introducing the current freight picture in Wellington's Central Business District. It then identifies the key institutional actors from a range of governmental levels that influence freight transportation. Finally it looks at the planning frameworks that impact urban freight movement both directly and indirectly.

4.2 Wellington Central Business District

There are several different ways to define Wellington's Central Business District. For the purpose of this study it is defined as the area that can be seen in Appendix 1. The boundaries that define the CBD make a rough 'L' shape; they are Jervois Quay and Wakefield Street (roughly east), Whitmore Street at the northern end, The Terrace to the west and Ghuznee and Tennyson Street to the south-west.

Within the Central Business District there are two distinct areas. One is a concentration of high rise buildings centred on Lambton Quay and Willis Street. The other is a surrounding area of low rise buildings (WCC, 2009b). There is also the 'Golden Mile', the main retail strip, which generally spans from the northern end of Lambton Quay to the eastern end of Courtenay Place (see Appendix 7) (WCC, 2009b).

The key defining feature of Wellington's Central Business District is its compactness. The central area has developed this way due to major physical constraints such as the motorway to the West, Harbour to the East and railway lines and industrial area to the north (WCC, 2009b). There is high competition for

space within the Central Business District due to this dense development and the large numbers of people working, living and undertaking recreational activities within the area.

The CBD has a high employment density; approximately one third of jobs within the Wellington region are located within the Wellington City CBD (GWRC, 2010). It also has a high proportion of people residing in the area. It was estimated that in 2010 there was a population of 5490 residing in the Lambton area unit, and 5,890 residing in the Willis Street Cambridge Terrace area (Statistics New Zealand, 2006). These area units are located within the boundary of the Central Business District in Appendix 1. These populations are expected to increase by between 150% and 160% by 2031 (Statistics New Zealand, 2006).

As a result of this high competition for space there is a proportionately high demand for parking within the City centre and the city's transport network is under strain, reaching near capacity at peak travel periods (WCC, 2011; GWRC, 2010). These issues are expected to grow due to the expected increase in freight and people moving into the CBD. Because there is no area for the Central Business District to expand, these issues need to be addressed with alternative solutions (WCC, 2011).

4.3 Wellington Region

There is little accessible information on freight movements within Wellington's Central Business District, however there have been trends published on freight movement within the wider region. Freight trends identified within the Wellington region are very similar to that highlighted across the broader country, and in fact internationally – as illustrated in the literature review. Regional trends such as increasing population and economic growth are expected to contribute to the doubling of the region's freight by 2031 (GWRC, 2011a).

The Wellington region is a net importer of goods, receiving more freight from outside the region than that which is produced internally. Based on 2006 and 2007 figures the Wellington region imports approximately 2.5 million tonnes

more than it generates (GWRC, 2011a). Freight movement within the Wellington region is characterised by fairly short road journeys (less than 20 km) (Hyder, 2009 cited in GWRC, 2010). In 2010 70% of freight transported into, out of and within the Wellington region was conducted by road (GWRC, 2010:12). The key road freight destinations within the region are Seaview/Gracefield, Petone, Porirua/Tawa and Centre Port (GWRC, 2010). A large proportion of freight will stop here before getting transported to the central city.

4.4 Key Actors

There are four key government actors who impact on freight movement at the local level. These actors operate at a range of scales and include the New Zealand Transport Agency (Section 4.3.1), Greater Wellington Regional Council (Section 4.3.2), Wellington City Council (Section 4.3.2) and the Regional Transport Committee (an amalgamation of representatives from each of the previous groups)(Section 4.3.3). The following section will provide a background of their roles, responsibilities and connections with other agencies and organisations in relation to planning for freight within the central business district.

4.4.1 New Zealand Transport Agency

The New Zealand Transport Agency (NZTA) is a crown entity established in response to Section 68(1) of the Land Transport Management Act (LTMA) 2003. Its purpose is to promote “an affordable, integrated, safe, responsive and sustainable land transport system” (LTMA, 2003, s94). One of the New Zealand Transport Agency’s five key priorities is to improve the efficiency of freight movement (NZTA, 2009b). Therefore the New Zealand Transport Agency has a significant impact on planning surrounding freight.

The New Zealand Transport Agency has an impact on urban freight planning at various governmental levels. At the regional and national level it is responsible for distributing funds from the National Land Transport Fund to land transport

activities such as freight management. The allocation of funds must go towards activities that are consistent with the Government Policy Statement on land transport funding (NZTA, 2009b). New Zealand Transport Agency is also able to influence urban freight planning through its participation in the development of key planning documents which guide decisions at the district and city council level. This involves input into regional land transport programmes, land transport strategies, long-term council community plans and district plans (NZTA, 2009d).

4.4.2 Local Government

Local governments within New Zealand are responsible for making decisions concerning public infrastructure and services. Section 10(a) of the Local Government Act (2002) sets out the purpose of local government:

- a) to enable democratic local decision-making and action by, and on behalf of, communities; and
- b) to promote the social, economic, environmental, and cultural well-being of communities, in the present and for the future.

Local government is defined by its locality, and includes both Regional Councils and their corresponding Territorial Authorities. Actors within local government play a key role in urban freight management because they “own, maintain and develop” the local road networks in New Zealand as well as propose and implement transport regulations (NZTA, 2009a). The regional and local authorities are also able to make some funding decisions on their transport facilities, however most of the prioritisation of funding comes from New Zealand Transport Agency and the Ministry of Transport.

Regional Council

The Greater Wellington Regional Council is required to provide local territorial authorities with guidance on transport decision making and funding (with the assistance of NZTA) for public transport and mobility programmes (NZTA, 2009a). This allows them to have a direct influence on initiatives influencing urban freight movement. The Greater Wellington Regional Council provides guidance through

the development of a Regional Land Transport Strategy (RLTS), which outlines transport outcomes the region should strive to achieve. The Land Transport Management Act (2003) also requires that the Regional Council approve the regional land transport programmes which identify what activities will take priority within the region (NZTA, 2009c).

City Council

The Wellington City Council is a lower tier of local government. It is charged with the responsibility of maintaining and managing the local road network and parking for future generations. The City Council will often collaborate with the Regional Council and the New Zealand Transport Agency on transportation activities.

4.4.3 Regional Transport Committee

The Regional Transport Committee is a group made up of representatives from New Zealand Transport Agency, the Regional Council, and territorial authorities within the region. The Regional Transport Committee is responsible for developing regional land transport programmes and regional land transport strategies. The Regional Transport Committee acts as a means for the Greater Wellington Regional Council to direct development at the local level.

4.5 Planning Frameworks

There are many planning frameworks operating at the national, regional and local level that influence the decisions made by the key institutional actors mentioned above. This section will provide a brief overview of the law, policies, plans and strategies that influence freight within the Central Business District. Some of these have a more direct impact on freight than others. It should be noted that these do not operate in isolation from one another.

4.5.1 National Level

There are several pieces of legislation that provide guidance for land transport planning in New Zealand. These include the Resource Management Act (RMA) 1991, Land Transport Management Act 2003, and the Local Government Act 2002.

Resource Management Act

The Resource Management Act is the main piece of environmental legislation in New Zealand. One of the roles of the Resource Management Act (1991) is to provide the framework for local and regional authorities to manage the impacts transport activities have on the environment (WCC, 2003). It requires that national, regional and local authorities develop a set of planning documents to guide transport planning. These include documents such as Regional Policy Statements (RPS) and District Plans. As of yet there has been no National Policy Statement issued for transport.

Land Transport Management Act

The Land Transport Management Act (2003) gives effect to the New Zealand Transport Strategy (NZTS). One of the ways this is achieved is by requiring the Regional Land Transport Strategy to be consistent with the New Zealand Transport Strategy (S175(4)). The Land Transport Management Act (2003) impacts planning around freight movement in different ways. For example the Land Transport Amendment Bill (2007) has a provision for regional councils to levy fuel taxes. However it should be noted that there is no mention of congestion charging (Hon. A. King, 2007, cited in Farrell, 2008).

New Zealand Transport Strategy 2008

The purpose of the New Zealand Transport Strategy is to promote sustainable transport. The strategy has five transport objectives which are supported by the Land Transport Management Act (2007). The five transport objectives are to: assist economic development, assist safety and personal security, improve access and mobility, protect and promote public health, and ensure environmental

sustainability (Ministry for Transport, 2008). The New Zealand Transport Strategy provides an outline of actions that have been taken to achieve these objectives, and future initiatives that would be appropriate (Quality Planning, 2007). These objectives are then translated into Regional Land Transport Strategy.

4.5.2 Regional Level

Wellington Regional Land Transport Strategy 2010-2040

The Regional Land Transport Strategy (RLTS) plays a critical role in establishing a link between transport activities at the national and local level (NZTA, 2009d). It is a statutory document which enables Regional Councils (through participation in Regional Transport Committees) to direct development within the region's transport system. The RLTS achieves its purpose by guiding investment and acting as a platform to identify and prioritise transport projects and activities within the region (GWRC, 2010; GWRC, 2011c)

The vision for the Wellington Regional Land Transport Strategy 2010/40 is:

To deliver an integrated land transport network that supports the region's people and prosperity in a way that is economically, environmentally and socially sustainable (GWRC, 2010).

In order to accomplish this vision, the RLTS has developed objectives, outcomes, strategies and targets. There are seven key outcomes that the RLTS seeks to achieve over the next 30 years. The key outcomes (and their associated objectives) that directly or indirectly relate to this study can be seen in Table 3 below.

The Regional Land Transport Strategy has also defined the role it expects freight transport to play within the region. It has an emphasis on safety and efficiency; "the appropriate role for land transport freight traffic is the safe and efficient movement of goods within, to, from and through the region" (GWRC, 2010:50).

The Wellington Regional Land Transport Strategy (2010-40) states that one of the key ways to reduce the impact of heavy commercial vehicles is to make improvements to "their size, average load, switching away from a just in time

delivery culture, driver training and more efficient vehicle technology” (GWRC, 2010:15).

Table 3: Relevant Freight Outcomes, Targets and Measures from the Wellington RLTS (GWRC, 2010).

Land Transport Outcomes (Key outcomes in bold)	Strategic Targets	Target/Measure
3.1 Reduced greenhouse gas emissions 3.3 Reduced fuel consumption	Hold the line despite population and economic growth	<ul style="list-style-type: none"> • Advocate for improved fuel efficiency and for alternative fuels. • Promote efficient land use integrated with transport. • Advocate for road pricing.
4.1 Reduced severe road congestion 4.3 Improved reliability of the strategic roading network	Hold the line despite population and economic growth	<ul style="list-style-type: none"> • Advocate for infrastructure improvements consistent with the Regional Land Transport Programme. • Advocate road pricing.
7.1 Improved regional freight efficiency 7.2 Improved inter-regional freight efficiency	Encourage and facilitate economic growth	<ul style="list-style-type: none"> • Advocate for infrastructure improvements along regionally significant priorities. • Implementation of the Wellington Road of National Significance.

Transport Corridor and Implementation Plans

The purpose of the Transport Corridor and Implementation Plans is to provide action programmes that will achieve the vision, outcomes and targets that are set out in the Greater Wellington Regional Transport Strategy (discussed in the previous subsection) (GWRC, 2010; GWRC, 2011c). Although the Corridor Plans share a similar goal to this thesis (to improve freight transport efficiency) they are aimed at improving this on key traffic routes between residential and business areas. Therefore the Transport Corridor plans do not directly impact freight movement in the Central Business District.

Greater Wellington Regional Freight Plan 2011

The Greater Wellington Regional Council has recently developed a Regional Freight Plan to improve the movement of goods into, out of and within the region. This is an implementation plan that aims to help the Regional Land Transport Strategy to achieve its objectives by providing in-depth and up-to-date information that is specific to freight movements within the region (GWRC,

2011a). It also aims to help the Regional Transport Committee prioritise actions which will influence freight transport (GWRC, 2011c).

The vision for the Greater Wellington Regional Freight Plan is to:

identify issues and opportunities for freight movement in, out and through the Wellington region as well as prioritise a series of projects and activities for inclusion in future Regional Land Transport Programmes (GWRC, 2011b).

The Regional Freight Plan identifies the role of freight, how it moves within the region, and the key trends, issues and opportunities for the freight sector. It also identifies freight projects which are directly related to one or more of the four corridor plans and a number of new initiatives which fall outside those existing plans. Table 4 below highlights the actions within the Regional Freight Plan which are of relevance to this study. All the listed actions are aimed to be completed by 2015.

Table 4: Action Programme adapted from the Wellington Regional Freight Plan (GRWC, 2011b)

Actions	Responsibility	Target/Measure
Improve knowledge of freight supply chains and requirements Investigate local road usage by Heavy Commercial Vehicles and Light Commercial Vehicles to improve knowledge of freight supply chains and requirements including: <ul style="list-style-type: none"> • Origins and destinations • Timing of deliveries • Improvements necessary to local roads • Regulations on loading zones. 	GWRC	Report Published
Improve freight transport modelling Conduct a survey and update the LCV and HCV freight matrix of the Wellington Strategic Model.	GWRC	Updated freight matrix included in WTSM
Facilitate Information Sharing Advocate for the 'Freight Information Gathering System' to include data on the tonnage, commodities, and modes share of freight travelling through the Wellington region.	GWRC TAs	Investigation report published

The Regional Freight Plan outlines that some of the most pressing freight issues and opportunities within the region are freight growth, freight efficiency, empty running and the capacity of key transport nodes, such as the ferry, port and airport.

Regional Policy Statement

Section 59 of the Resource Management Act (1991) requires that each regional council produce a Regional Policy Statement that promotes the sustainable use of the regions resources. The Regional Policy Statement is therefore a statutory document, that together with the Wellington Regional Strategy (WRS) guides what economic and land use development will occur within the region (GWRC, 2010). The economic and land use considerations of relevance to this study include improved access to the Wellington City CBD, well designed and compact urban form, “the need to encourage higher density housing and mixed use development close to centres”, and “the need to encourage local employment opportunities and manage travel demand” (GWRC, 2010:57).

4.5.3 Local Level

Long Term Council Community Plan

The Local Government Act requires that a Long Term Council Community Plan (LTCCP) be produced every three years to outline the council’s intentions for the next ten years (NZTA, 2009d; WCC, 2011a). The LTCCP is based on community feedback and sets out the challenges, goals and priorities for the city.

The 2009/19 LTCCP is divided into seven strategic areas. These are governance, environment, economic development, cultural well-being, social and recreation, urban development and transport. The Plan outlines the outcomes and activities that the council wishes to achieve within each of these strategic areas, how the council proposes to fund these, and when they will be implemented (NZTA, 2009d). The priorities within the transport section of the Long Term Council Community Plan (2009/19) are centred on improving public transport, walking and cycling throughout the city. Moving goods into and out of the central city is noted as a challenge facing the city. However there is little mention of freight

movement within the key outcomes and monitoring does not incorporate an opportunity to get feedback from the freight industry.

Wellington City Council 2011/12 Annual Plan

Each year the City Council publishes an annual plan that addresses the work programme and any changes that are needed in the Long Term Council Community Plan (WCC, 2011). The Annual Plan is set out in a similar structure to the LTCCP, addressing the same seven strategic areas. The Annual Plan sets out what work is being done in this area, why, what the goals are, how much these will cost and how they can be measured.

The Annual Plan acknowledges that the transport network is at full capacity and there is not much room for expansion on the narrow, hilly streets of Wellington. Therefore the main transport goal is to free up road capacity by reducing travel demand. The Annual Plan also acknowledges the high competition for parking within the CBD. In order to address this, it was proposed in the draft annual plan that parking prices within the CBD be increased. However this was amended and did not appear in the annual plan, due to opposition highlighted during the consultation process. Instead the Annual Plan states that they will look for ways to address the continual demand for parking by carrying out an “on-going programme to identify areas of off street or roadside parking that can be improved” (WCC, 2011:97).

Wellington City District Plan

The Resource Management Act (1991) requires that the Wellington City Council prepares a District Plan to effectively manage land use and development within Wellington city. This District Plan provides “a practical set of guides and controls” which ensure that the principles set out in the Resource Management Act (1991) are achieved (WCC, 2003). The District Plan is relevant to this thesis topic because it provides guidance on transportation decisions, and it has a specific set of rules for the central city area which includes the defined study area. Appendix 9 shows the relevant objectives, policies and methods that relate to freight movement within Wellington’s Central Business District.

The objectives that are relevant to freight also apply to the movement of people. Freight is never dealt with in isolation from other modes of transportation. The District Plan states that one of its objectives is to improve accessibility for goods and people. This will be achieved through policies that promote the provision of off-street servicing, and appropriate land use. The District Plan also establishes that public transport, cycling, pedestrianisation and people with mobility restrictions will be given higher priority than freight and private vehicles.

The District Plan sets out rules specific to the central area. The rules that apply to freight movement within the Central Business District can be seen in Table 5. The requirements for on-site loading and site access have been developed to reduce congestion and improve safety for drivers and pedestrians (WCC, 2009b). The District Plan states that allowing freight vehicles to load and unload in off street areas and ensuring that vehicles are able to access all sites easily, will both contribute to improved traffic flow and pedestrian movement.

Table 5: Wellington Central Area Rules of Relevance to Urban Freight Movement within the Central Business District (Source: WCC, 2009b)

<p>Servicing</p> <p>13.1.1.7.6</p> <p>On each site in the Central Area at least one loading area must be provided as follows:</p> <ul style="list-style-type: none"> • all loading areas must be provided and maintained in accordance with the standards set out in Appendix [8]; • where loading areas are located within a building, a minimum height clearance of 4.25 metres is required, • for buildings serviced by lifts, all levels shall have access to a loading area by way of a lift; • the loading area shall be located no further than 15 metres from a lift and there shall be level access between them.
<p>13.1.1.7.13 All access to sites must be designed to permit a free flow of traffic, so that vehicles do not queue on the street.</p>

4.6 Context Summary

This chapter has looked at the case study context. It shows the compact nature of the CBD, and highlights the general trends expected for freight. Broadly these are expected to increase in the foreseeable future due to increasing competition for space within the Central Business District, and increasing volumes of freight moving throughout the region. The chapter then looked at the range of institutional actors that influence freight – the New Zealand Transport Agency, Greater Wellington Regional Council, Wellington City Council and the Regional Transport Committee. Finally this chapter illustrated the broad framework of legislative and policy influences on freight. In general these are strong at the regional level and weak at a more local, city level.

5 Results

5.1 Introduction

This chapter illustrates the key themes and accompanying information that emerged from the key informant interviews and observation process. Semi-structured interviews were undertaken with 15 research participants. These participants were identified using web based research and a snowball sampling social science technique, as discussed in detail in the Methodology Chapter. In order to ensure that this work explored a range of different perspectives around freight in the “last mile”, care was taken to speak with people from different stakeholder groups. To gain a broad understanding of how the freight sector operates and is managed, research participants were chosen from the freight industry, its customers and the transport policy sector. Information about research participants involved in this study is provided in full in the Methodology Chapter.

When approached, all potential research participants agreed to be involved, and in all interviews discussion flowed freely. Many participants expressed their appreciation for being included in the process, and demonstrated interest in, and enthusiasm for the project. The exploratory, semi-structured interviews focussed on what the participants know about urban freight, their role in relation to it, what they perceive to be the problems associated with urban freight, and how these problems are shown or measured. The second phase investigates what factors help to provide an efficient situation and how efficiency could be improved. A full version of the interview schedules used to guide discussion is included in Appendix 2, 3 and 4.

These interviews resulted in a rich data set, which was sorted through thematic analysis (explained in more detail in Chapter 3). The following sections detail the information in these themes, using quotes from the research participants to

illustrate the topics being highlighted. Codes have been used to identify research participants to ensure that their anonymity is maintained.

The first section of this chapter investigates factors that drive urban freight vehicle behaviour, these are largely economic and have mainly been identified by the retail and freight industry participants. The second section addresses key constraints to efficient freight delivery within the Central Business District. And the third section explores the relationship between urban freight activity and the planning framework. It examines the consultation process between the two groups and how planning authorities are able to influence freight vehicle movement.

5.2 Market Efficiencies

One of the objectives of this research was to investigate what factors drive freight vehicle activity within the Central Business District. This section will explore this objective by looking at how each freight company defines efficiency and the priority they place on fulfilling customer demands.

5.2.1 Defining Urban Freight Efficiency

Interviews with key informants from the freight industry illustrated that freight transportation within the Central Business District is not as efficient or sustainable as it could be. Key Informant 4 stated; “I will go around three or four times just waiting for loading zones to open up. And believe it or not there are three loading zones I can use within 20 metres of one another but I still have to go round and round”. This is supported by Key Informant 5 who stated that “you can easily spend 20 minutes waiting for something”.

[Not being able to find an available park] could easily add 10-15% [of time onto a trip] very easily. Especially if you are doubling back and you decide nah that’s not going to work I am going to come back later... a big part of an inefficient run is the doubling back (Key Informant 5).

All the key informants from the freight industry stated that cost and profits are one of the most important measures of efficiency. Other factors mentioned as important indicators were the time taken to move goods, the volume moved, and the ability to provide the service that has been guaranteed to the customer. This can be seen in the comments below;

It is a combo of both [time and cost], it can't be one or the other... It's a combo of volume and time which gives you the cost. And then if the volume drops down then one of those two things have to go up you have to pick up more revenue somehow (Key Informant 1).

How do we tell if a run is efficient or deficient? Well it is all by money... That is a viable run because you [the driver] are providing a service for the company and you are making money (Key Informant 7).

Key Informant 4 explained that when measuring efficiency it cannot be based on one run; it must be measured in context of the whole supply chain: "You can't look at it in isolation, just one run. You have to look at the whole delivery programme as a concept". This illustrates how integrated the supply chain is.

5.2.2 Retailer Demand

It was established from interviews with the freight and retail sector that the main factor influencing freight vehicle behaviour in the Central Business District is demand for transportation services. Key Informant 7 illustrates this: "The customer, really at the end of the day is driving what the standard is. So depending on how much you like that particular standard is where you are going to fit in the mix".

The demands that retailers place on the freight industry determine what volume of goods need to be shifted, where they need to be shifted to, and what time windows they need to be moved in. Key Informant 7 gave an example of how customer requests can significantly impact on the time it takes to do deliveries:

You get some customers, who will say; “Alright when you come down in the morning just leave everything down here for the building and we will get the mail guy to do it. So they are the cool ones because you just want to get the freight to the customer, what they do with it after that, then that is their problem. But you will have other customers that say they want each level within the building to be serviced... “If there is 3 boxes for this level and four for the next level, those have to go onto each individual level and they have to go into the photo copier room.”

Three of the retail shops that were interviewed require freight deliveries to be made between 7:30am and 8:30am to prevent deliveries coinciding with when customers are in the store (Key Informants 12, 13 and 14). Although each store receives one delivery per day, each delivery can range in size from 5 to 50 boxes (Key Informant 12, 13 and 14). As these are only able to be delivered through the front entrance that customers use, it is important for the retail store that deliveries are completed before customers arrive (Key Informants 12, 13 and 14).

The other retail outlets do not specify a delivery time because they either have an off-street servicing area where goods can be unloaded, or they do not receive goods regularly enough for it to be a problem (Key Informants 8, 15 and 16). Key Informant 15, an employee at a small retail business on Lambton Quay, stated that his store only receives deliveries three or four times a week and the volumes are small, therefore deliveries do not interfere with customer service. Key Informants 8 and 16 are employees at two large department stores which receive between 8-12 different deliveries per day, and therefore have a specific area set aside for unloading and loading goods.

5.2.3 Improving Efficiency

Key Informant two explains that the freight sector has a large influence on how efficient urban freight activity will be:

If you are looking at market efficiencies, it is really the businesses that participate in the market that are in the best place to be the most efficient with their own businesses (Key Informant 2).

This was confirmed by participants from the freight industry who identified a few strategies that make delivering goods in the urban environment more efficient.

If there are special requests placed on how the goods are transported the companies are able to build this into their pricing (Key Informant 1, 4, 5 and 7). For example, if customers require that something is urgently delivered the price for the service increases. Key Informant 4 explained, "Some of the deliveries can be time specific which again impacts on the cost, they pay for that". Key Informant 7 agrees,

[Delivering before 9am] is a service that they sell to the customers. We guarantee that your items will be there before nine. And so that gives them the right to do things like price increases to the customer (Key Informant 7).

Freight company incentives can make delivering at particular times more profitable for drivers than it would be otherwise. Key Informant 7 stated, "They offer [incentives] to the contractors because obviously for them to be able to go and sell [specific time guarantees] they need the contractors to make it happen". Key Informant 5 also adjusts his prices for specialised customer requests.

Predominantly we deal in fragile goods or valuable goods and so the distance that they travel and how they are moved around inside the buildings are actually quite important... Our times are not important; our service is more about the fragility and the extra care and attention that go into it... As opposed to one of these couriers that is only making a dollar fifty per parcel so he has to deliver 300 parcels a day to make a living. We are happy just to do five (Key Informant 5).

Freight Monitoring

Monitoring is another method that the freight industry use to improve freight efficiency within the Central Business District. Data collected from freight industries appears to be much more accurate than that collated by the Council. The following quotes illustrate how freight vehicle movement is monitored, and what type of data is collected by the freight industry:

All of this is just a tracking device on all of our trucks. This is a breakdown of roughly everywhere he has gone to within the CBD and how long he has been there. He was there about 9:02 and it took him 15-20 minutes to do it and then he has moved onto his next one... it is a great tool to use (Key Informant 6).

We have GPS function on our scanners I don't have one here unfortunately... so basically on the scanner we know exactly where the driver is. This is what pays the driver so every time they scan something it automatically generates a payment (Key Informant 7).

5.2.4 Local Knowledge

Having local knowledge of the area was an unexpected theme that was highlighted by both the City Council and freight industry. Representatives from both groups stated that being familiar with the area and being able to find the delivery or pick up address has a direct impact on how efficiently freight can be moved around the Central Business District.

Key Informants 10 and 11 from the Wellington City Council recognised that it is hard for freight vehicle drivers to find some off-street parking locations. This finding was supported by Key Informant 6. He explained that developing an understanding of the best places to park is dependent on experience and local knowledge; "It is just experience". When it does get difficult for drivers to find their way around the Central Business District they rely on advice from the truck driver that has been around the longest:

If there is a place you need to know about in the CBD Sam [not his real name] is your driver. You ask and he will tell you exactly where to go and how to get in... We also use Google maps, that helps you out but only to a certain point because the pictures are old (Key Informant 6).

Key Informant 10 from the Wellington City Council suggested creating a resource that listed available off-street parking within the area. When the idea was suggested to the key participants from the freight industry most agreed that this would be worthwhile. Key Informant 5 said “It would be of use. It is certainly something that we check when we are costing a job”.

Having local knowledge of the area was less important for Key Informant 6 because his company carries out site visits before delivering the goods. Costing a job allows the driver to pre plan where they are going to park which improves the efficiency of their trip. Looking for potential parking places “is certainly something that we check when we are costing a job... We find out where the access is and how we go about doing that” (Key Informant 5).

5.2.5 Summary

Overall, the findings show that customer demand is the key driver of urban freight activity within the Central Business District. Businesses place demands on freight transporters, who then try to achieve these in the most economically efficient way possible. The freight industry has utilised techniques and strategies such as freight monitoring, increased pricing and relying on local experience to improve economic efficiency where possible.

5.3 Physical Constraints

Many of the key informants from the freight industry identified several physical and regulatory constraints which negatively impact freight vehicle efficiency. The majority of the constraints are a result of how the built urban environment is constructed. These physical constraints can be divided into three sub-themes;

constraints encountered while the delivery vehicle is on-route to its destination, the accessibility and provision of loading zones and off-street servicing areas, and, shifting goods between the freight vehicle and the building goods are delivered too.

5.3.1 Constraints Faced While On-route to a Destination

Key informant interviews highlighted that the built environment significantly impacts how long it takes to deliver or pick-up goods within the Central Business District. Factors such as the width of the street, one way systems and the curvature of the road were identified as some of the key factors and constraints to efficient deliveries. For example, two of the key informants from the freight industry noted that Wellington's narrow streets are not conducive to consistent traffic flow (Key Informant 4 and 5). Key Informant 4 explained that the narrow streets can prevent delivery trucks from moving past vehicles in adjacent lanes. He stated, "The streets are getting narrower... [in some places along Lambton Quay] you can't get a bus and a truck through - if there is a bus [stopped at the bus stop] you have to wait for all the people to get on to move".

Another physical constraint identified by key informants from the freight industry is the limited number of places in the Central Business District that drivers are able to turn around. This is an issue that drivers believe is specific to the Wellington context because of the compactness of the city, and how the one way streets are set out. Key Informant 4 and 7 supported this, stating:

In Lambton Quay, you can either go north or south, and when you are on either that is the direction you will go. It is just the landscape of it and you can't change that... In Auckland that is different, you can go north or south but there are a lot of places where you can turn around and reverse your trip if you need to. But in Lambton because it is so confined, sorry you are locked in (Key Informant 7).

Some of those one way streets will kill you. If you don't know your way around and you miss the exit you want it's not just like turn around the

next block and come back, that could be all the way down to the other end of town and then turn around and come all the way back (Key Informant 4).

Super-elevation has been identified as a constraint to efficient deliveries. Super elevation, also known as a curvature in the road seal, can cause trucks to tilt over which prevents them from parking close to the curb or entering off-street loading areas. This was identified by Key Informant 4 and witnessed during the field observation. Key Informant 4 explained that, “When they tar seal [the road] they do the middle of the road but not to the footpath. So you can pull up alongside the footpath and your truck is actually like that [gestures that the truck is on an angle]”.

When the delivery vehicle is not level, access into off-street servicing areas can become difficult. Key Informant 4 stated that when there is super-elevation, “the truck leans over but the building is straight, the next thing is the door is no longer wide enough because of the angle you’re on”. Figure 5.1 illustrates this phenomenon. The diagram on the left shows that when the road is level with the entrance way the truck is able to easily fit through the entrance space. However, when the angle of the road is increased the truck tilts over and is no longer able to fit through. This can render existing off-street areas inaccessible to larger delivery vehicles.

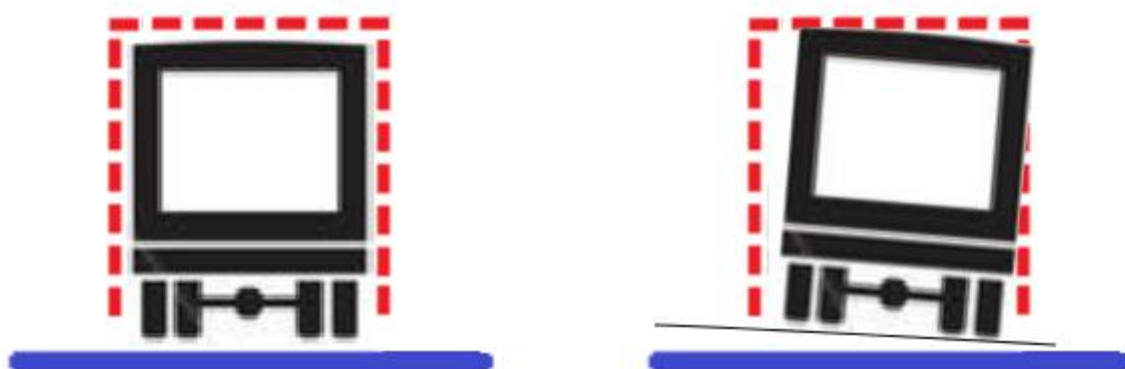


Figure 5.1: The effect of super-elevation at the entrance to an off-street servicing area

Super-elevation can also have a negative impact on traffic flow within the Central Business District. For example, when super-elevation is paired with verandas that

hang out to the edge of the footpath some trucks are unable to park close to the kerbside.

They build their awnings right out to the side of the street to protect the pedestrians but they have heaps of knocks on them from when higher vehicles come along and lean over onto the footpath...look at how many dents and bangs and knocks are in that [points to awning], that is all from the trucks leaning over (Key Informant 4).

An example of these 'knocks' can be seen in the photographs in Figure 1.4 and 1.5. These photographs were taken in front of the loading zone outside the Witchery store on Featherston Street. During the field observation it was witnessed that the delivery vehicle had to park further away from the curb to make allowance for the delivery vehicle leaning over into the veranda. This resulted in the vehicle sitting outside the loading zone boundary and partially blocking one lane of traffic. Figure 5.2 shows that when the ground is level vehicles are able to park close to the kerbside (left), however if there is super-elevation the vehicle leans into the veranda (right).



Figure 5.2: Super-elevation causes the vehicle to lean over the kerbside where it collides with the veranda

Super-elevation also impacts how close delivery vehicles are able to park to the kerbside when using a tail lift. The tail lift is a device attached to the rear of the truck that is used to lower heavy goods to the ground. Key Informant 4 stated, "If the truck reverses all the way into the gutter the tail lift can't be used. Instead if I want to fold the tail lift out I have to go back a wee bit so it doesn't go into [the

kerbside]”. Therefore the vehicle must sit further out onto the road, which can interfere with the traffic flow.



Figure 5.3: Photo of a damaged awning above a loading zone (Photo: Brigitte Allen)



Figure 5.4: Close up photo of a damaged awning caused by delivery vehicles (Photo: Brigitte Allen)

Key Informant 4 also noted unclear addresses as another constraint to efficient deliveries. He stated that making sure building numbers are clear and visible is a simple way to speed up the deliveries. He went on to explain that the absence of street numbers can result in having to back track and do U-turns, which has the potential to hold up traffic. Also, when a business changes the name of their company but remains in the same location it can add unnecessary time onto a pick up or delivery (Key Informant 4).

5.3.1 Parking

Findings from the results show that access to parking facilities within the Central Business District is another key theme. Having access to adequate parking facilities was a major physical constraint identified by most of the key informants involved in the freight industry (Key Informant 4, 5, 6). The key informants identified a variety of factors that affect the accessibility of parking spaces. These include; access to off-street parking (both the ability for vehicles to fit and servicing space being used for alternative purposes), and loading zone position, size, and availability.

Off-street Parking

One of the biggest issues with off-street loading areas is that they are not always used as the council intends them to be. This has been established as an issue by key informants from the freight industry and local government. Observations during field research and statements from retail informants support these findings.

The inappropriate use of off-street servicing areas is an issue recognised by both the Wellington City and Regional Council. The City Council has a policy that requires all new buildings to provide space for off-street parking. However Key Informants 3, 10 and 11, all mentioned that maintaining that space for loading and

unloading activities is very difficult to enforce once the building has been established.

What tends to happen is that [off-street servicing areas] get filled up with rubbish or materials so the trucks are still on the street... what the building is designed for is not how it is used and so that is always an issue (Key Informant 3).

Key Informants 10 and 11 from the Wellington City Council recognised that although off-street parking is technically available, it may not necessarily be used for this purpose. Off-street servicing areas may be locked, or entrances that require entry access from staff may be unmanned, preventing vehicles from being able to enter (Key Informant 10 and 11).

Key Informants 5 and 7 from the freight industry supported the view that off-street servicing areas are often not able to be accessed. Key Informant 5 stated, "Just because they exist doesn't necessarily mean that they are accessible". Key Informant 7 did not believe that new buildings were required to have built in service areas because couriers are still having to park out on the street; "If that was what they said it is you wouldn't have the constant run-in that courier drivers in general have with their parking wardens".

During the field research, service areas being used for alternative purposes were observed in a number of places. One example sighted was in a major retail store which had installed shelving down one side of their store room. This prevents trucks from turning around inside the store room, or driving through from the entrance at the end of one street to the exit at the beginning of another street. This has resulted in trucks having to reverse out onto a busy street which Key Informant 4 noted as being "quite dangerous".

These opinions and observations are supported by Key Informant 8 and 16 from the retail sector. Key Informant 8 stated that the dock way on the other side of the store building is not used for loading and unloading freight:.

It is not used as a delivery dock way it is used as a, um, they use it for storing rubbish. It holds rubbish bins for all of the businesses in the building, all of the rubbish is held and collected from there. It used to be used for deliveries in the past (Key Informant 8).

Key Informant 16 stated that his store also uses their off-street servicing area to store rubbish that needs to be taken out.

Another factor that affects the accessibility of off-street servicing areas is the size of the service space entrance way (Key Informant 4, 5, 6 and 16). This was raised as a key issue by Key Informant 5 who has an “oversized van”, “The big thing I think is the buildings, it is the biggest problem we have... getting the vehicles that won’t fit into the basement”. Key Informant 6 supported this, “We do a lot of deliveries into the BNZ centre and we have got a little dock way down there that you drive under but our trucks are too big... In the past our trucks have hit it when they have gone down there”. Key Informant 16, who works in the retail sector, stated that there are a few trucks that do not fit into his off-street servicing area because of the height limitation. On more than one occasion, this informant has seen a delivery vehicle take out the roof of the entrance way.

On-street Loading Zones

Delivery vehicles are also able to park in on-street loading zones. However, a majority of the freight industry participants (Key Informants 4, 5 and 7) noted that the position of loading zones was not always adequate. For example, Key Informant 4 stated, “[the City Council] don’t really think about where you are going to do deliveries to buildings, they don’t sort of worry about that”. The key informants identified several factors that determine how effective loading zone positions are, these include; the location of the loading zone in relation to businesses, other loading zones and one way street systems.

Key Informant 7 thought that there needed to be less loading zones around Courtenay Place and more along Lambton Quay, due to the higher concentration of businesses that need servicing in that area.

Now when you start heading down to Courtenay Place, there are businesses down there but it is definitely not as busy as Lambton Quay... in Courtenay place there is more [loading zones] per businesses... they have the mix wrong... They could just be a bit smarter, the council, about where they put things in relation to where the main action happens. I.e. where all the businesses are - they are going to want stuff picked up and delivered, let's facilitate it rather than have a whole heap down here [at Courtenay Place] (Key Informant 7).

Although Key Informant 5 agreed that the placement of loading zones was not adequate he disagreed with Key Informant 7 about which ones were more accessible. Key Informant 5 stated that, "Courtenay place is difficult" and "Lambton Quay area is usually quite good because there are zones everywhere".

Key Informants 4 and 5 also noted that the availability (and therefore accessibility) of loading zones was also dependant on the loading zone position in relation to other loading zones. For example, Key Informant 5 stated that, "Some of them are more available than others and I think that it is really more about how many other zones are around it". Key Informant 4 expanded on this, "There are six loading zones around [where Willis Street, Custom House Quay and Lambton Quay merge]. Have you ever tried to get onto one of them? It is not practical because it is just everything congested into one point".

5.3.2 Building Accessibility

Access provisions inside buildings were another key theme identified in the interviews. Once the vehicle is parked the driver must transfer goods from the vehicle to the final destination within the building. "The big thing is the buildings, it is the biggest problem we have, especially with all these apartments – is the getting items in and out of the apartments" (Key Informant 5).

Limited lift access was one factor identified as an issue that negatively impacts delivery efficiency. Key Informant 6 and 7 explained that the level of accessibility will vary between buildings in the city centre. When asked if the access to buildings within the Central Business District was considered good, Key Informant

6 answered, “Some are, some aren’t and that is just the nature of the game”. Key Informant 7 explained that some buildings have lift access, others have older lifts - “where you have to double close the door... they take up most of your time once you load in” and then there are ones with no lift access at all. Key Informant 7 went on to state that no lift access adds a considerable amount of time onto the freight delivery.

Some of those places still don’t have lift access. So if you’ve got to carry up 10 boxes, and you can only manage two (I don’t know if you have seen those boxes of paper), so that is 5 trips. You would spend fifteen minutes doing that let alone the ten minutes you need to be back in your van (Key Informant 7).

When access between the off-street servicing area and building are inadequate, goods must be delivered through the front door. For example Key Informant 5 stated, “Very few of them [off-street servicing areas] even have lifts going to them. So really the only choice is to park out of the front of the building and walk it in through the lobby to the lift and then you get a parking ticket for it”.

5.4 Non-physical Constraints

5.4.1 Competition for Space

A further factor identified as a key constraint to freight vehicle efficiency is competition for loading zone space between businesses such as taxis, other business operators, and private vehicles.

Taxis have been identified as a nuisance by key informants from the freight sector, and the Regional and City planning authorities (Key Informants 4, 5, 7, 10 and 11). Taxis create issues for delivery vehicles because they sometimes take up valuable loading zone space, and make it difficult for larger delivery vehicles to move past them when they are not parked correctly. Statements relating to Taxis can be seen in Table 6 below.

Table 6: Key Informant Statements Relating to Taxis in Wellington Central Business District

"They [Taxis] leave their rear end out and you can't get past them" (Key Informant 4).
"The Terrace is difficult and that is mainly around taxis, taxis take a lot of space... their taxi ramps aren't holding they are overflowing" (Key Informant 5).
"The problem they also have is that they allow things like taxis to be parking there" (Key Informant 7).
Key Informants 10 and 11 explained that taxis are a big problem in the Central Business District, they have grown exponentially and the City Council is looking for new ways to restrict and enforce where they are allowed to go.

Other modes that compete with freight vehicles for loading zone space are private vehicles owned by business operators. Key Informant 4 pointed out that vehicles used for business are able to park in loading zones even if they are a similar size to a car.

"The worst thing the Council did - to use those loading zones you have to have goods vehicle or a goods licence, the council wanted to make money so they went and sold stickers that you put on your car that allows you to use loading zones. You give them to a lot of sales reps, and the sales reps put their stickers on their car because it's a business car, go into town, park in a loading zone to go and have their meeting for half an hour or an hour and then the loading zone is busy. The warden will come along and see the sticker on it and just walk off. You want to do a delivery but you can't get onto the loading zone. The council doesn't care because they are getting money for it (Key Informant 4).

Freight vehicles must also share the loading zone with general traffic at times. Key Informant 4 stated, "They make loading zones a shared zone for a couple of hours".

5.4.2 Enforcement

Enforcement was identified as a key constraint by all freight industry participants. The findings show that participants operating in the Wellington Central Business District perceived parking enforcement to be too strict. For example, Key Informant 6 mentioned that parking enforcement was a "major issue" in the

Central Business District. Key Informant 4 stated, “The biggest nuisance is the parking wardens... If you are double parking you get a ticket straight away”. And Key Informant 8 said, “I know [parking wardens] have a job to do but I think they unfairly target couriers and the carrier service”.

Key Informant 1 operates his business in the South Island and noted the opposite - that enforcement was lacking. He identified a lack of enforcement as an issue because he believes one of the biggest constraints to efficient deliveries is other competitors staying in the loading zones for extended periods of time. This informant said that stricter enforcement is needed to make other freight transporters more efficient so loading zones can be made more available.

[Loading zones] are not policed, so they can stay there for an hour and it doesn't matter how efficient any one particular freight company can be in their day to day operations, because their day to day operations can be grossly affected by other companies' inefficiencies and the local authority's inability to police (Key Informant 1).

However, interviews with the Key Informants from Wellington have illustrated that increasing enforcement does not necessarily deter delivery vehicles from parking illegally in loading zones. There is general consensus among all participants interviewed in Wellington that parking enforcement is too vigilant within the Central Business District and therefore difficult to abide by. Key Informant 5 has a stack of parking infringements in his office and stated, “It still has to be done and it doesn't stop you, it is more a matter of if you get caught”. Key Informant 5 went on to explain, “There is no problem to have \$200 dollars worth of tickets in a month. And we only have one vehicle, some of those big guys must have more than that”.

If everybody wants to be in the one part of the city at the one time... people have to miss out and then you get into the whole double parking and... disabled parking and infringe that way just to try and get a park... No one wants to get a fine, but if you are running a business (Key Informant 7).

Key Informants 10 and 11 from the Wellington City Council were aware that freight companies are having issues with parking enforcement. However, they agreed that there is so much competition for space within the Central Business District that it is important to maintain the regulations that are in place.

This strict parking enforcement has been raised as a growing concern by Key Informant 8 from the retail sector. “Traffic flow is only ever going to increase and the availability of parks, as well as loading zones, for the freight vehicles is going to decrease. It is going to be put under more pressure”.

5.4.3 Summary

It has been established that there are many constraints preventing freight deliveries from being as efficient as they could be within the Central Business District. Key constraints identified are physical constraints, other modes of transport competing for space, and parking regulations. Each constraint increases the cost of freight transportation services within the Central Business District. Constraints associated with urban form and competition for parking space has a direct impact on time, which increases the cost of transporting goods. Enforcement of parking regulations does not necessarily affect time but infringements increase the cost of working in the Central Business District.

5.5 Urban Freight and Local Planning Authorities

A key aspect of this research was to investigate what impact planning authorities have on the sustainability of freight within the Central Business District. This section will explore how planning authorities balance the needs of the various modes using the Central Business District. It will also investigate the relationship between the freight industries and planning authorities, how freight is monitored, and potential solutions to improve freight efficiency.

5.5.1 Planning Framework

It was made clear by all Governmental participants (Key Informants 2, 3, 9, 10 and 11) that they must take into account wider considerations than the needs of freight vehicles. There is high competition for space within the Central Business District and local planning authorities must balance their priorities among modes such as walking, cycling, public transport, private vehicles, and freight vehicles (Key Informant 2, 10 and 11). Key Informant 3 noted that the amenity needs of people residing within the Central Business District must also be taken account of.

Key Informant 2 and 3 from the Greater Wellington Regional Council illustrated the difficulties when catering for the variety of modes present in the Central Business District;

[Loading zones] are always a quandary, because it is that competing use of loading zones, versus parking versus pavements and pedestrians, and taxis are the other thing. It is always competing for space (Key Informant 3).

We also have to take a wider set of concerns... we don't have a road network just for freight vehicles. That is not the only purpose of having roads and rail tracks. So it is definitely a balancing act that the public sector is responsible for and the private sector has to use (Key Informant 2).

So it's not just about freight; it's about passengers, pedestrians, it's about amenities. So we have a wider set of concerns that we have to balance in providing infrastructure. So sometimes it can feel a bit of a lolly scramble (Key Informant 2).

The decisions that government take in relation to freight are determined by planning frameworks at the national, regional and local level (Key Informant 2). Key Informant 2 from the Regional Council explained that determining what priority different modes of transport will receive within the region is largely a "political question". Commuter vehicles make up a larger proportion of traffic volume but freight vehicle trips are considered to be of higher value. "The value of

a freight trip is a lot higher than the value of a passenger trip – depending on what’s in it” (Key Informant 2).

This informant stated that although priorities are outlined in planning frameworks, funding also influences the decisions that are made. Funding has a large influence over which planning projects are carried out. “There are parallel processes for funding as well. Regional Councils and the territorial authorities have their 10 year long term plans and, their annual budgets... so there is that parallel thing in local governments” (Key Informant 2).

5.5.2 Planning and Complexity

Key Informant 9 from the New Zealand Transport Agency acknowledged the complexity of planning for transport: “Transport is a complex problem and you need to look at the big picture”. Key Informant 2 from the Regional Council agreed that planning for transport is complex and requires a broad range of solutions:

How do you plan for reality? The ultimate outcome is a combination of different solutions... In planning you must match the rules and incentives to people’s behaviour. However you also must incentivise behaviour (Key Informant 2).

Findings from the results show that urban freight activity requires coordination between planning at different scales. Key Informant 9 explained that planning for freight is linked at all levels: “Land Transport New Zealand could design an efficient system but if there is congestion on local roads this will eventually create a backload on our efficient system”.

You can go from very sort of in the sky outcomes... to more practical, more - what is actually going to happen now. And planning around, okay - this project has been identified in other higher level documents what is it actually going to look like? What is it going to do?... So planning runs the gamut; from very general outcomes - we want to improve road safety, to, we are going to put a median barrier in here and it is going to be hard or it’s going to be soft (Key Informant 2).

5.5.3 Urban Freight Monitoring

Key Informant 2 stated that modelling is the way the Regional Council can be most effective. “Our responsibility in the freight area is largely around modelling, that is where we can have the biggest impact”. Key Informant 2 and 9 explained that monitoring is carried out at all levels of government such as the New Zealand Transport Agency, the Regional Council and territorial authorities.

Developing consistent freight monitoring within the Wellington region is a primary focus for the Regional Council. When developing the Regional Freight Background Report, Key Informant 2 found that although there is a significant amount of data collected on freight movement within the region, the data sets are fragmented and inconsistent. “There is a lot of data out there but it is not directly comparable so we don’t have a good picture about how freight works sort of bleed into the city” (Key Informant 2).

The primary purpose of [freight modelling] will be to try and integrate the different TA’s freight monitoring so that they are all comparable so that we can have an idea of what is actually going on... it’s mostly about getting more reliable, more robust, more up to date data so that we can provide modelling (Key Informant 2).

The Regional Council is reliant on various sources of knowledge for information on freight. One source is the institutional knowledge held by people working for governmental organisations. Key Informant 2 found that people working within the territorial authorities generally have good local knowledge of transport systems within their area. He stated, “[freight monitoring] is primarily based on institutional knowledge, people that have been there for a while”.

The Regional Council also relies on lobby groups at trade industry level to obtain information on freight movement, issues and concerns within the region. Key Informant 2 from the Regional Council explained those higher level representatives are sought instead of specific freight companies to avoid favouritism, providing competitive advantages, and complaints.

In developing the freight plan I sort of tried to keep it more at the trade industry levels; Heavy Haulage Association, Road Transport Forum, Automobile Association. At that level so we are not talking to one company and not the other (Key Informant 2).

5.5.4 Public/Private Cooperation

There was consensus among key informants from the freight industry that there was very little communication between the local planning authorities and themselves. The majority of freight industry participants did not perceive consultation with planning authorities to be beneficial and it was not identified as something they would be interested in in the future. For example, Key Informant 7 stated, "As an industry I don't think that [consultation with planning authorities] is a major practice... In regards to planning of what goes on, and what our needs are - no, it is not really a big thing to be fair". Key Informant 5 stated, "I wouldn't really have thought that [consultation with the City Council] would be a productive use of time". "We don't really have much say over what happens in [the Central Business District] we just go with the flow" (Key Informant 6).

Consultation between the two groups is more common surrounding conflicts between enforcement officers and freight vehicle drivers. For example, when Key Informant 6 was asked whether his company undergoes consultation with the City Council, he answered, "No, not unless we have complaints about parking". Key Informant 7 said, "We have had the dude that looks after all the parking wardens but that is nothing to do with planning, that is just so that the couriers can have a whinge about how many tickets they are getting".

Key Informant 1 and 4 disagreed with the majority of freight key informants and indicated that they would prefer the Council to collaborate with the freight industry more. Key Informant 1 stated, "In all district plans there are specific things set aside for loading zones but the consultation isn't there". Key Informant 4 stated consultation would be most beneficial when new buildings are being developed. For example, "When they build big brand new buildings with 20 stories, that are going to have 30 or 40 different companies in them... they are

going to have to be serviced with deliveries“. Key Informant 4 stated he would like to be consulted on the following topics: “Is there an ideal place where we can put a loading zone for it? Or, how is the access going to be done for the delivery? Or, whether there is going to be loading zone inside that you can go into?”

Key Informant 2 from the Regional Council was the only planning informant that freight consultation was discussed with. This informant explained that the Regional Council cooperates with representatives in the freight industry when establishing things such as the Wellington Regional Freight Plan (2011).

We at the Regional Council here do have a pretty good working relationship with everyone so we tend to work very cooperatively with industry players as well as other government agencies (Key Informant 2).

We made a very conscious decision to keep it at the industry representative levels because we thought we would get their point of view and it wouldn't artificially favour one company over the other or one sector over the other (Key Informant 2).

5.5.5 Sharing Freight Industry Information

When key informants from the freight industry were asked if they would be comfortable sharing their freight vehicle data, all agreed that this could be a possibility. As a subsequent interview probe, I then suggested that freight vehicle data could include information such as the number of freight vehicles servicing the Central Business District at one time, the number of shops that are serviced, the volume of goods carried, and the route the vehicle has taken. All agreed that sharing information with the council could be a possible solution if they were to benefit from it. “Yeah if it benefits [our company] for sure... I can't really see it being a big problem” (Key Informant 6). “I wouldn't have thought [that information] was such a big secret” (Key Informant 5).

Key Informant 7 originally did not think that sharing that information would be worthwhile;

I don't know whether we would share that with council because I don't think that's primarily what our talks would be with the council. It would be about the relationship of having couriers in the Business District at any point, at any given time and then having the access to be able to park so that they can quickly get in and get out (Key Informant 7).

However after discussing the potential benefits of sharing that sort of information with me as the interviewer, Key Informant 7 stated:

Maybe it could be a relationship between the various companies and the council to be able to share what sort of volumes is moving. So that we aren't as demanding as our customers but it gives us a real good basis to sit down and go well, collectively we have given you the data and information which states that over the last year we have moved this amount into and out of the city...We could save them money (Key Informant 7)

5.5.6 Summary

This section has explored the roles that the planning authorities have in relation to urban freight vehicle activity. It has been established that balancing needs of the various users operating within the Central Business District is determined through planning policy frameworks and funding from national government. It was recognised that monitoring is one of the key tools that enables local government to influence urban freight activity and that this is an area that needs improvement. A potential solution to improve data collection could be for local government to cooperate with the freight industry to share information.

5.6 Results Summary

A large proportion of this chapter has focused on the factors affecting efficient freight vehicle movement from a freight industry perspective. Some of these factors have been identified in a negative light and therefore are seen as constraints to efficiency, while others have been perceived as advantageous to

achieving efficiency. This chapter has also established that most freight companies define efficiency in economic terms and are bound to provide a transportation service that meets customer demand in order to make a profit. Therefore, customer needs have the greatest influence over freight vehicle activity. Another theme that has emerged from the research is the role that planners have in relation to urban freight movement. This chapter explored the weighting urban freight activity has in planning and the current means of addressing issues. Future solutions that have been identified by participants include better public/private collaboration and information sharing. Overall this chapter has established that planning around freight is complex.

6 Discussion

6.1 Introduction

Freight transportation, described simply, is about getting goods from one place to another and therefore is a crucial element in economic trade. However, the findings from the results in the previous chapter show that urban freight is far more complex than this description portrays. It involves a wide range of stakeholders who have different responsibilities, goals and objectives. The literature review illustrated that urban freight activity should be perceived as a means to meet larger sustainability goals. The discussion will bring together the perspectives of key informants from local planning authorities and the freight and retail industry, using the aim and objectives of this study as a framework. The first two objectives are discussed primarily from a freight industry perspective. The key drivers of freight activity within the urban environment, the constraints facing efficient urban freight movement, and the relationship between planning and freight will be explored. This chapter will conclude with a discussion of the concept of sustainability and outline ways that planning can encourage more efficient and reliable urban freight activity.

6.2 Objective One: What factors influence current freight transport behaviours?

In order to improve the sustainability of freight movement within the Central Business District it is necessary to understand what drives urban freight activity. It can be concluded from both the literature in Chapter 2 and the results in Chapter 5 that the movement of goods within the last mile is primarily influenced by the needs and demands of the customer. In order to increase economic growth the freight industry must look for ways to improve the service offered to the customer, while minimising costs. Morris *et al.* (1998) state that these

improvements in economic efficiency are sought internally, from within the supply chain.

Findings from the interviews show that the overall objective for freight transportation companies is to improve economic efficiency while still delivering on what has been guaranteed to the customer. There is general consensus among the freight industry participants that the two main indicators of an efficient transport service are the total cost and the ability to complete the transportation service to an adequate standard. The following quote from Key Informant 7 illustrates this, “How do we tell if a run is efficient or deficient? Well it is all by money... That is a viable run because you [as the driver] are providing a service for the company and you are making money”. This finding is supported by Morris *et al.* (1998), who state that the primary strategic goal of freight transportation is to reduce cost and improve customer service.

Therefore it can be concluded from the research that freight vehicle behaviour is primarily driven by the needs of customers in order to achieve economic growth. The following quote from Key Informant 7 illustrates that the needs of the customer take priority in the freight industry, “The customer, really at the end of the day is driving what the standard is. So depending on how much you like that particular standard is where you are going to fit in the mix”. Browne *et al.* (2010a) support that customer requests will be more influential in determining urban freight activity than the built form will be.

Morris *et al.* (1998) note that in order for freight transporters to be competitive they must respond to increasing pressures from customers to provide greater levels of service at lower prices. The findings from the results are consistent with this and show that customers increasingly require more from freight transporters. This is illustrated in a quote from Key Informant 7, “Now the customer is much more flexible in saying what other options can you give me apart from the normal pick-up and delivery? How else can you look after me as a customer?” Changes in customer requests have seen freight transporters looking for ways to shift smaller volumes of goods, at higher frequencies, for a competitive price (de Magalhães, 2010; Goldman and Gorham, 2006; Leinbach, 2004; Morris *et al.*, 1998)

The results show that customers have a large influence over current freight transportation activity in the Central Business District. It was established from the interviews that customers are able to dictate (to a certain extent) what time deliveries occur, the volume of goods delivered, and where it will be delivered to. For example, the majority of retailers that were interviewed require freight transporters to deliver their stock at least once daily, before 9am.

This increasing pressure for faster, more frequent and smaller deliveries from customers is ultimately driven by consumers. Retail businesses require goods to be delivered before 9am so that the delivery of goods does not interfere with the consumer when they are shopping. In addition to this it is common for retail outlets to order one item from another store for the consumer. This contributes to the need for small package deliveries.

6.2.1 Supply Chain Focus

In order to achieve the primary goal of economic growth, the freight industry is consistently looking for ways to improve freight efficiency within the supply chain. This goal of servicing customers at the minimum cost is achieved through a “tightly integrated and constantly reactive supply chain” (Morris *et al.*, 1998:27). The freight sector goes to great lengths to achieve this by focusing on the supply chain as a whole. This involves collaborating with other competitors to ensure that goods are delivered to the final customer at the lowest cost possible.

Because urban freight activity is managed predominantly by the private sector (Behrends *et al.*, 2008; Ministry of Transport, 2005), actors within the freight industry are able to have a large impact on the efficiency of urban freight. Key Informant 2 supports this, “If you are looking at market efficiencies, it is really the businesses that participate in the market that are in the best place to be the most efficient with their own business”. Morris *et al.* (1998) state that the freight industry invests time and money to achieve economic efficiency and is constantly looking for new ways to improve the cost effectiveness of the transportation networks. OECD (2003) found that the private sector has been responsible for

many of the developments that have led to improvements in time, cost and environmental efficiency.

6.2.2 Summary

It has been established that the demands of the customer have a large impact on freight distribution behaviour. OECD (2003) found that current planning methods surrounding urban freight movement do not take the supply chain as a whole into account. Therefore, solutions for improving urban freight sustainability need to incorporate a whole supply chain perspective, in order to integrate the needs and requirements of customers which drive urban freight activity, into the planning process.

6.3 Objective Two: What are the key constraints to efficient freight vehicle movement within the Central Business District?

Although the needs of the customer are the primary driver influencing freight vehicle activity, factors such as the built form and regulations also have an impact on how freight operates within the Central Business District. This section will highlight the factors that hinder urban freight from operating efficiently, and how the freight industry works around these constraints in the most economically efficient way. It has been concluded, from both the literature review (Chapter 2) and results (Chapter 5), that the freight industry generally perceives these constraints to be outside their control.

6.3.1 Physical Constraints

A key theme that arose throughout the interview process was the impact the built urban form has on freight vehicle movement and delivery times. It was established

from the interviews that physical factors such as the layout of the street, entrance ways to off-street parking areas, and accessibility within buildings can affect how much time delivery vehicles spend in the Central Business District. Anderson *et al.* (1996), Litman and Burwell (2006), Morris *et al.* (2000) and Rodrigue *et al.* (2009) agree that the built environment can have a major impact on the urban transport system.

The key physical constraint identified by participants from the freight, planning and retail sectors is the inaccessibility and inadequacy of off-street servicing areas. This was a major constraint identified by Morris *et al.* (1999 and 2000) in a similar studies. Browne *et al.* (2010a:5961) support this finding, explaining that although, off-street servicing areas may exist, “this does not necessarily mean that they are always used”. Factors that prevent off-street servicing areas from being used for unloading and loading goods were identified in the results, these include; the inability of vehicles to enter off-street areas due to super-elevation, the size of the entrance way in relation to the delivery vehicle, the conversion of space for purposes other than loading and unloading goods, entrance points being locked, and inadequate access between the servicing area and the establishment where goods need to be delivered to or picked up from.

One of the consequences of inadequate and inaccessible off-street servicing areas is that delivery vehicles must park on the street and enter through the front door of business and retail premises. This increases the impact of freight vehicles on the surrounding environment. For example, Browne *et al.* (2010) state that on-street loading zones have the potential to cause more traffic delays, compared with off-street servicing areas.

Minimising the physical constraints impacting on freight efficiency will have positive flow on effects for the city. However it is very difficult to change the built form once it has been established. Some physical aspects will be more difficult to change than others. Those that are entrenched in the physical form such as one way streets would need monumental effort to adjust. This illustrates the importance of adequately catering for freight in the planning process because once the built form is established it is not easy to alter.

6.3.2 Regulatory Constraints

Parking enforcement has been identified as a major issue by all the key informants from the Wellington freight industry. Although Huschebeck (2001) and de Magalhães (2010) agree that enforcement is an important tool for upholding regulations, findings from the results show that while enforcement increases cost, it does not necessarily change the behaviour of businesses operating in the Central Business District. Interviews with the key informants established that freight transporters are often unable to avoid parking infringements because abiding by parking regulations would prevent them from completing the service guaranteed to their customers. This is illustrated by Key Informant 5's comment, "It still has to be done and [a parking ticket] doesn't stop you". Key Informant 7 stated that the reduction in loading zones and increased enforcement "is costing us as a business because we aren't able to do our service as we promised".

Factors which make it difficult for freight transporters to operate within the set parking regulations are an inadequate provision of loading zones and short time limits. Key informants established that variables such as the volume of goods, distance between the loading zone and delivery destination, and the number of trips needed to deliver the goods all impact on how much time a delivery vehicle will spend in a loading zone.

So you are finding now guys are parking a kilometre away from where the delivery point is. That causes delays both in the item getting to the customer on time, and it causes frustration because it is only a 5-10 minute window that they have. And yet by the time they have walked down there that is the 5 minutes gone, and then they have a ticket because they have been there too long (Key Informant 7).

One of the participants suggested that a potential solution to this problem could be to increase the designated time limit of loading zones. This would compensate for the reduction in loading zones, which require freight vehicles to park further away from the delivery or pick up destination.

Unreasonable parking regulations may lead to infringements being built into pricing. Freight transporters are able to build other costs, such as congestion, into their pricing over time. This is occurring overseas and was identified in the interviews. For example, Key Informant 1 explained that the cost of delivering goods in a particular time frame is built into freight pricing, “There are so many freight companies out there doing similar things and just through economies of scale they can’t be any more efficient than anyone else”.

Similarly to congestion, unavoidable fines from parking infringements may be built into delivery pricing. Most key informants from the freight industry raised parking enforcement as an issue, however they still parked illegally. This would imply that enforcement is a deterrent but not a fixed preventative. If the cost of parking infringement becomes internalised in freight pricing this may lead to parking enforcement becoming ineffective. Therefore it is important that local authorities work with the freight industry to come up with solutions that suit both parties.

Morris *et al.* (1999) support the finding that enforcement increases the cost of doing business in the Central Business District. They also found that targeting freight delivery vehicles for infringements increases animosity between the freight industry and local planning authorities. Although none of the key informants from the freight industry demonstrated any hostility towards the Wellington City Council, it is notable that their only form of communication with the City Council was over parking infringements. For example, Key Informant 6 states, “Not unless we have complaints about parking”. Key Informant 7 said, “We have had the dude that looks after all the parking wardens but that is nothing to do with planning, that is just so that the couriers can have a whinge about how many tickets they are getting”.

It is interesting to note that although the freight industry invests a large amount of resources into improving freight efficiency within the supply chain, efforts to improve economic efficiency do not extend to improving the physical and planning constraints identified in the results chapter (Morris *et al.* 2000). The freight industry participants identified many constraints that prevent deliveries within

the urban environment from being efficient, such as inadequate provision for loading and unloading goods, strict parking enforcement, and competition for loading zone space with other users. Despite identifying these, no effort has been made by the key informants from the freight industry to improve the physical and legal constraints within the Central Business District. Interviewees from the freight sector view these regulatory and physical constraints as aspects that are external to their control. This is illustrated by Key Informant 6, “We don’t really have much say over what happens in [the Central Business District] we just go with the flow”. However, as the next section illustrates there would be a number of advantages if the freight industry could be linked more closely with urban planning cycles.

It should be noted that this study only focused on the impact enforcement is having from a freight industry perspective. Enforcement may have positive effects on freight efficiency that have not been recognised by the freight industry participants. For example, enforcement could be preventing private vehicles from parking in loading zones which increases the availability for delivery vehicles.

6.3.3 Summary

The findings show that the built and regulatory environment can negatively impact the efficiency of freight within the Central Business District. These constraints affect freight efficiency in different ways; the built constraints have an impact on the time it takes for freight to do deliveries, whereas regulatory constraints such as enforcement affect the cost of deliveries. Overall the key informants from the freight industry have illustrated that in order to achieve their primary goal to service the customer they must adapt to the legal and physical environments they operate within. Freight companies will do what they can to optimise efficiency around given legal and physical constraints; however they generally perceive these to be outside their control.

6.4 Objective Three: How can cities improve the efficiency and reliability of freight?

The previous two sections have explored the key drivers and constraints for freight operators on the ground. These corresponded to the first two objectives of this study. This section aims to address the third objective and look at how cities can improve the efficiency and reliability of freight. This section takes a broader view of freight transport outcomes than economic efficiency, and looks at efficiency as part of sustainability. It weaves together the key findings from the literature, interviews and field observations to show how urban freight activity is linked with city planning. It will first explore the connections between the movement of urban goods and the concept of sustainability. This will be followed by discussion on the ways planning authorities in Wellington cater for the movement of goods within the broad city setting, and will conclude by providing possible ways forward to improving planning for urban freight activity in the future.

The findings from the literature and results show that improving freight efficiency within the Central Business District is an area that lacks attention from both the local authorities and freight industry. For these key actors the efficiency of urban freight activity is a shared challenge. The freight industry needs to improve efficiency in order to increase economic growth, and planning authorities need to improve efficiency to minimise the impacts of freight vehicles on the surrounding community and the wider environment. There are no simple answers as improving freight transportation is a complex problem which requires a variety of solutions and cooperation from various stakeholders.

A major part of this complexity stems from the fact that decisions and actions made by urban freight transporters, retailers and local planning authorities have a direct impact on one another. Planning decisions that shape the built form, policy regulations and transportation networks influence freight's primary goal of

economic growth. Likewise, the negative impacts associated with urban freight activity have a direct impact on local authorities' efforts to achieve sustainability.

6.4.1 Linking Planning and Urban Freight

Planning for urban freight activity is important due to the negative effects freight vehicles can have on the wider economic, social and environmental sustainability objectives. It has been established in the literature review that issues associated with freight include; congestion, air pollution, the consumption of non-renewable resources and impacts on human health, safety, and liveability (Litman and Burwell, 2006). These negative impacts have a detrimental effect on the sustainability objectives that local planning authorities are trying to achieve. When urban freight activity operates inefficiently the problems associated with freight become intensified. Therefore, the efficiency of urban freight vehicle movement has a direct impact on the level of sustainability that is achieved.

The primary aim of planning authorities is to achieve economic, social and environmental sustainability for their city. The Wellington City Council has developed 13 outcomes (displayed in Table 7) for the city that it aspires to achieve over the next 10 years (LTCCP, 2009). These outcomes are consistent with the three principles of sustainability. An essential requirement for achieving these outcomes is a sustainable transport network; in their Annual Plan (2011/12) the Wellington City Council identified transportation as one of the seven strategic areas of focus.

Although it may not be immediately obvious, the decisions that local planning authorities make have a significant impact on freight. As the previous chapter highlighted, the built environment and planning regulations impact the efficiency of freight activity. Physical factors such as narrow roads and inaccessible off-street servicing areas can result in freight vehicles spending a longer period of time within the Central Business District. This increases the cost of urban freight activity but also intensifies the negative impacts freight vehicles have on the surrounding environment. For example, when off-street servicing areas are

inaccessible, delivery vehicles are forced to park on the street which has the potential to cause more traffic delays to other road users (Browne *et al.*, 2010b).

Table 7: Adapted from Wellington City Council Outcomes (Source: LTCCP, 2009:30)

Wellington City Council Outcomes		
Economic	Environmental	Social
More Prosperous	More compact	More liveable
More competitive	More sustainable	Stronger sense of place
Better connected	Better connected	Safer
More entrepreneurial and innovative		Healthier
		More eventful
		More inclusive
		More actively engaged

Urgency for Action

It was identified in planning policy and by the key informants that there is high competition for road and kerbside space within Wellington's Central Business District. The Wellington Regional Land Transport Strategy and the Wellington City Council 2011/12 Annual Plan state that Wellington's transport network is at near capacity. Key informants from the Council and freight industry support this observation. The results show that freight participants are having difficulty finding available places to park, resulting in vehicles circling the block three or four times or parking illegally.

In addition, the negative impact of freight on the central city is likely to grow due to the predicted increase in congestion (LTCCP, 2009). Key Informant 7 indicates that his business will strive to expand, even if the city cannot adequately cater for more vehicles. The mounting pressure for loading zone and servicing space within Wellington's Central Business District is not a deterrent to freight transporters. Key Informant 7 explains that the primary aim of the company is to expand the business to increase the profit return. "It is not like you are decreasing your size of your fleet to try and accommodate, because you are trying to grow a business but there is only a limited amount of parks" (Key Informant 7). A compounding factor

is that there is no room to expand the roading network due to the physical constraints of the Wellington area (WCC, 2009).

Overall this highlights the need for urban freight activity to be improved. It is important that freight is catered for in order to achieve sustainability objectives such as more liveable streets, economic efficiency, and human safety. Inefficiencies in traffic flow and built environment directly impact the efficiency of a freight vehicle run. It is clear that urban freight activity is a shared problem. Improving the efficiency of freight within the Central Business District will lead to improvements in sustainability and economic efficiency which will be beneficial for the freight industry, retailers and local planning authorities.

6.4.2 Current Planning for Freight

In order to improve freight transport sustainability within Wellington, it is necessary to determine how urban freight movement is catered for through the planning process. Findings from the literature and results show that urban freight activity in the Central Business District has received limited attention in planning (Browne *et al.*, 2007; Lindholm, 2010; Morris *et al.*, 2009; OECD, 2003; Woudsma, 2001). Dablanc's (2007:282) research on European cities found that very few municipalities view "freight activities as a service they should help organize" to become more efficient. And Woudsma (2001:2440) stated that "issues related to urban freight movement do not carry much weight, unless safety is an issue".

The context chapter established that urban freight is generally neglected within planning at the city level. Local plans such as the Wellington Annual Plan (2011/12) and the Long Term Council Community Plan acknowledge that urban freight movement is a crucial function needed to service the city. However there are no policies that specifically target freight efficiency within the Central Business District. Plans and policies that incorporate urban freight either target freight moving at a regional level or only mention freight briefly in conjunction with other modes of transport.

The movement of goods holds high priority at the national and regional level. A large degree of attention has been placed on improving freight efficiency along roads of national significance. This has been due to commands from higher level governmental documents, such as the Government Policy Statement, that direct investment into this area. Objective 7.1 of the Wellington Regional Land Transport Strategy (2010) is to improve regional freight efficiency. This goal is not applicable at the city level because the targets and measures only apply to roads of national or regional significance.

Similarly, planning that targets the Central Business District and focuses on transportation is primarily based on improving walking, cycling and public transport. The Long Term Council Community Plan provides a good example. This plan is centred on improving public transport, walking and cycling throughout the city. Moving goods into and out of the central city is noted as a challenge facing the city, however there is little mention of freight movement within the key outcomes, and monitoring does not incorporate an opportunity to get feedback from the freight industry (LTCCP, 2009). Another example of this can be seen in the Wellington District Plan. Objective 12.2.8 (Appendix 9) sets out to improve efficiency for both people and goods within the central area. However, the policies and explanations associated with this objective do not elaborate on how freight can be improved; the detailed descriptions focus only on the movement of people.

The limited attention being placed on urban freight activity can, in part, be blamed on the extensive responsibility councils have. Local authorities are responsible for managing a broad range of social, economic and environmental needs. The movement of goods within the Central Business District is just one component of this picture. It was illustrated in the results that the role of local planning authorities requires that the needs of all stakeholders using the Central Business District are given consideration. This involves catering for modes such as walking, cycling, public transport, private vehicles and the movement of urban goods. It also involves minimising the effects that transport has on people residing, socialising and working in the area. Therefore urban freight activity must compete with other transportation modes and strategic activities for investment and further development.

The level of attention given to each mode of transportation or strategic activity within the city tends to be dictated by available funding and higher level planning frameworks. Although urban freight is largely neglected in planning, the strong focus on reducing congestion through sustainable modes such as walking, cycling and public transport will have positive impacts on urban freight movement.

Literature shows there is a growing recognition overseas of the importance of planning for freight. It would appear that a similar trend is occurring in New Zealand at a regional scale because, until recently there has not been a specific regional freight plan for Wellington. However, the importance of planning for urban freight has not yet been recognised at a local level where, some would argue, it is needed the most.

6.4.3 Where To From Here?

The way that transport operators choose to conduct their business has a direct impact on the achievability of the city's sustainability goals and visions. In order to minimise the impact freight vehicles have on the social and natural environment, efforts need to be made to make them as efficient as possible. Likewise, decisions made by government can dramatically affect how transport conducts business, therefore it would be beneficial for both parties to work alongside one another.

It was established in the results that there is limited consultation between local freight transporters and planning authorities. Although a lack of communication between the two groups was not recognised as a constraint to efficient freight vehicle movement, authors such as Huschebeck (2001), Lomax *et al.* (2011), Kuse (2010) and Morris *et al.* (2000) agree that governmental actions are most effective when accompanied by those of businesses. Therefore improved cooperation between the freight industry, retail sector and local planning authorities is one method that cities can utilise to improve the efficiency and sustainability of urban freight movement.

Huschebeck (2001) found that one of the benefits of a co-operative approach between planning authorities and the transport industry is the ability for more

regular data collection and improved infrastructure planning. This will be particularly important for Wellington because a lack of comparable freight data was identified as a major constraint by the planning participants. Findings from this research have illustrated that local government have a limited understanding of freight vehicle movement patterns and behaviours within the Wellington Central Business District. This was established in both key informant interviews and the Wellington Regional Freight Background Report (2011b).

There is consensus among the literature that a lack of understanding and knowledge held by governments is a major issue facing sustainable urban goods movement (Anderson *et al.*, 1996; Browne *et al.*, 2010a; Lomax, 2011; Morris *et al.*, 2009; OECD, 2003; Rodrigue *et al.*, 2009). Morris *et al.* (2009) and Browne *et al.* (2010a) agree that it is important to have an understanding of freight vehicle behaviour in order to determine how sustainable urban freight is, and potential solutions that could improve it. A lack of understanding and awareness is a serious obstacle to effective planning for freight because it means that specific needs of freight activities will not be catered for in transport-related policies and facilities (Browne *et al.*, 2010a). Anderson *et al.* (1996) and the United Kingdom's Department for Transport (2008) agree that effective policy cannot be implemented without a better understanding of freight.

Clearly there is a need for the freight industry and planning authorities to collaborate to improve freight efficiency. In order to develop a co-operative approach there needs to be better communication between local freight companies and planning authorities. As this study has highlighted, neither party communicates with the other except when parking infringements are being disputed.

Improved communication may lead to better sharing of data between policy makers and the freight industry. Freight transporters closely monitor the route delivery vehicles take, the volume of goods carried, and the establishments that deliveries are being made to. This information is recorded using GPS devices attached to the freight vehicle or scanners that freight drivers use when picking up or delivering the good to the customer. Morris *et al.* (2000) also found that

transportation businesses in the United States closely monitor and record the cost and time data in order to improve freight vehicle efficiency.

A potential solution for improving freight monitoring undertaken by planners could be to form a relationship that enables commercial information collected by the freight industry to be shared with local authorities. During the interviews all the key informants from the freight sector agreed this could be possible if there was some benefit to the freight industry. The Ministry of Transport *et al.* (2008b) state that the limited information available on urban freight activity is held by different actors within the private and public sectors. Cooperation between the freight and planning sectors will help to remedy this. It will also help to address the issue of incomparable data sets, identified by the Greater Wellington Regional Council. When analysing the results of United Kingdom urban freight studies, Browne (2010a) also found incomparable data sets. Improving freight monitoring is a key measure municipalities can undertake to improve efficiency, and therefore improve the sustainability of urban freight movements.

6.5 Discussion Summary

In conclusion, improving urban freight activity is a complex problem. The movement of urban goods is affected by a wide range of actors, including planners and policy makers who have input into regulations and the built urban form, the freight industry who provide a transportation service, and the customers who dictate what goods will be shifted, where they will be shifted to, and what time frame they will be shifted within. Therefore planning for efficient freight movement requires a combination of solutions that involve a supply chain perspective.

The findings show that despite the impacts of inefficient freight on both the urban environment and the profitability of the transportation service, it remains an area that has received very little attention from local authorities and key players within the freight sector. This is because the freight industry focuses on improving efficiency within the internal supply chain, and perceives the physical and legal

constraints identified to be outside of their control. Likewise, local authorities do not have the resources to focus solely on urban freight because they are responsible for managing and improving a broad range of activities over the entire city.

It is concluded that a co-operative approach is needed to improve the movement of goods within the Central Business District. Collaboration between the Council, local freight transporters and the retail sector can lead to benefits for all parties involved. Potential partnerships could lead to the sharing of freight data, improved accessibility to off-street parking, and planning policies that specifically cater for urban freight.

7 Conclusion

7.1 The Importance of Urban Freight

7.1.1 Growth

It has been established that freight is a crucial element to society. Without it people would be unable to trade or have access to goods or services that are not available locally. The volumes and frequency of goods being moved within the urban environment are increasing (Goldman and Gorham, 2006). The literature review (Chapter 2) shows that businesses are becoming increasingly reliant on the freight industry to deliver goods in small volumes and at high frequencies. This is due to a combination of factors such as advancements in e-commerce, just in time distribution, and increasing customer expectations. This observation is consistent with findings in Wellington that show the region is witnessing increasing freight volumes. The growing demand for freight transportation is the reason this research topic has been pursued.

7.1.2 Implications

Urban freight within the Central Business District warrants attention for the negative impacts it can have on sustainability. Freight vehicles can cause air pollution, human health impacts, noise, negative effects on liveability, and congestion. Overseas the negative impacts of freight are becoming more apparent in urban areas and are predicted to worsen. Freight is forecasted to increase, as is urban density. Together these factors are expected to lead to more congestion and greater environmental inefficiencies. Improving the efficiency of freight within the Central Business District will be beneficial for all actors involved because it will contribute to sustainability and economic efficiency. This highlights the need to improve freight efficiency within the urban environment.

In Wellington the need for improved freight efficiency is growing. There is currently high competition for road and kerbside space and the transport network is at near capacity. This has been identified in the city's Annual Plan (WCC, 2011) and from key informant interviews. In addition to this there is a predicted increase in congestion (LTCCP, 2009). Wellington is unable to expand its road network to cater for this increased pressure due to the physical and built constraints, therefore, there is an increasing need to find alternative solutions to alleviate inefficient freight movement.

7.1.3 Rationale

Despite the impact of freight on economic, environmental and social sustainability, very little is known about it. Findings from the literature and results show that urban freight has received little attention in academic research, and planning regulations do not support greater organisation of freight activity. This has been observed in Wellington and recognised in international examples within the literature review (Chapter 2). In addition, there is a knowledge gap in academic research surrounding urban freight activity. This knowledge gap, both in practice and theory, indicates the need for more research into urban freight efficiency within the last mile.

7.2 Research Process

7.2.1 Aims and Objectives

The aim of this study was to explore how urban freight activity within the Central Business District can be made more sustainable by improving efficiency. It was established in Chapter 2 that little is known about urban freight operating within the Central Business District. Therefore the objectives for this research were relatively broad. The first two objectives investigated the drivers and constraints facing urban freight activity on the ground. The third objective took a broader approach to investigate how the efficiency and reliability of freight can be

improved. This was achieved by exploring the relationship and connections between urban freight, planning, and the concept of sustainability.

7.2.2 Methods

The limited understanding of freight within the Central Business District has led to an exploratory research approach being adopted. As Chapter 3 explains constructivism has provided a base from which the study has been conducted. This was an appropriate research approach because it encompasses a holistic view that appreciates the interconnected nature of urban freight activities within the surrounding environment. Three key attributes of constructivist inquiry are that it is undertaken in natural settings, uses a case study approach, and tends to use qualitative methods (Guba and Lincoln, 1982; Guba and Lincoln 1994). These attributes were adopted for this study in conjunction with methods such as a pilot interview, semi-structured interviews, and field observation.

7.2.3 Lessons Learnt

The combination of research techniques used during this study worked well together. The case study approach was good because it grounded the semi-structured interviews. Participants were able to talk about a specific place rather than urban freight in a general context. The field observation enabled me to develop an in-depth understanding of the issues raised during the semi-structured interviews. And the pilot interview proved highly beneficial because it allowed me to test my interview technique. It also provided a base platform of what to expect during following interviews. I was able to identify some initial key themes to look out for when talking to other participants and an understanding of common terms used within the freight industry. Overall, this led to a good response with all the participants.

This research approach can be considered as one cycle of data collection which included a series of semi-structured interviews with a range of parties, field observation and a literature review. This was beneficial and worked well for

uncovering urban freight as evidenced in this thesis. However I believe another cycle could add another layer. A further cycle of data collection would allow key themes to be explored in more depth. This cycle would enable the next researcher to use this study in the same way I used the pilot interview.

This cycle could also seek to quantify some of the key findings. At the onset of this research I sought to collect both quantitative and qualitative data. However, gathering quantitative data would require more time than a master's study would permit. Collecting quantitative data would have required first establishing trust and rapport with freight transportation companies, and working through processes to ensure that information being processed would not be commercially sensitive. Because this study was based primarily on qualitative methods, interpretations of data are reliant on the perception of the researcher. In order to minimise bias and ensure rigour, triangulation was used. Key themes that arose during interviews were checked in subsequent interviews, looked for in the field observation, and compared against international literature to see if the finding could be supported.

7.2.4 Key Findings

It can be concluded that improving urban freight is a complex problem, in which the decisions and actions made by freight transporters, retail businesses and local planning authorities are interlinked. The demands from retail businesses are the primary driver of urban freight activity. Likewise, planning decisions that shape the built form, policy regulations, and transportation networks have an impact on how freight vehicles operate while servicing the retail sector. The performance of freight vehicles within the Central Business District have a direct impact on the cost for retailers who require the service, but the negative impacts associated with freight also have a direct impact on the sustainability objectives local authorities are trying to achieve. This indicates the importance of developing solutions that are integrative and incorporate a wide range of actors.

Improving freight efficiency within the Central Business District is an area that has generally been neglected by both the local authorities and freight industry. This

needs to change. Overall success requires that there is on-going communication and cooperation between the planning authorities, freight sector and retail industry. Currently there is little communication between the three groups. Literature supports that current planning does not incorporate a supply chain perspective. In order to achieve the desired goals, there needs to be an integrated approach to planning for freight. Having good channels of communication may result in some of the physical and regulatory constraints being modified to improve freight efficiency.

7.3 Recommendations

7.3.1 General Recommendations

Although this research was conducted in Wellington, the general problems encountered and recommendations provided are applicable to other locations. It is supported in the literature review that key constraints identified in Wellington are being experienced in other cities; therefore the lessons learnt from this research may be transferable to other contexts. This research has found that urban freight activity in the Central Business District can be improved in a number of ways. The following section will provide both general recommendations and practical recommendations that are more case specific.

- 1. Planning needs to support the improvement of urban freight activity within the Central Business District.*

Improving urban freight activity within the Central Business District has not been recognised as a priority in local planning and is largely perceived by local authorities as the responsibility of the private sector. Improving urban freight activity is important because it will have positive flow on effects to other sustainability objectives.

- 2. Planning for urban freight activity should incorporate a supply chain perspective.*

It has been established that urban freight activity is driven by the demands and expectations of customers and subsequently the final consumer. The primary goal

of freight transporters is make the maximum profit; this is achieved by fulfilling the requests of its customers. Therefore, the retailer and commercial businesses that freight transporters deliver to are very influential in the pattern of freight activity that occurs within the Central Business District. It is important that these actors are included in the planning process.

3. Develop a co-operative relationship between local authorities, freight transporters and the retail sector to improve freight efficiency.

This recommendation follows on from Recommendation 2. The results show that there is very little communication between local authorities, freight transporters and the retail sector in regards to planning for urban freight. Literature suggests that forming partnerships with businesses is the most effective way to improve freight efficiency and reliability.

4. Regulations and incentives put in place to improve urban freight activity need to be realistic and achievable.

In order to complete the service guaranteed to its customers, freight transporters are sometimes unable to avoid parking illegally due to inadequate provision of alternative parking. Regulations may be rendered useless if freight transporters build these into their costs. Regulations that are unavoidable increase costs for businesses operating in the Central Business District, which are then passed onto the customer.

5. Improve monitoring of urban freight activity within the Central Business District.

Monitoring has been identified by the local authorities in Wellington, and in literature from overseas, as an area that needs improvement. It is important for local planning authorities to have an understanding of urban freight vehicle movement so they are able to develop plans, policies and regulations that are effective at improving freight efficiency. Investigations into freight data sharing with the private sector could be explored as a potential solution for improving freight monitoring.

7.3.2 Practical Recommendations

The following recommendations have been specifically designed to address the constraints raised in the Results and Discussion chapters (5 and 6).

6. *Improve freight vehicle accessibility to off-street servicing areas:*
 - a. *Enforcement is needed to ensure that off-street servicing areas are able to be used for loading and unloading of goods.*

Off-street servicing areas being utilised for purposes alternative to the loading and unloading of goods was identified as a major constraint in the results (Chapter 5). Although off-street servicing areas exist, they are often inaccessible because the space has been converted for storage. This can prevent vehicles from entering the off-street servicing area and can also prevent them from turning around within the area. This leads to vehicles reversing out onto busy streets, in spaces that are not designed for them, which is unsafe.

- b. *Ensure that entrance ways to off-street areas are large enough for a range of freight vehicles to fit through.*

Large vehicles are unable to fit in some off-street servicing areas due to the size of the entrance way or super-elevation. It is important that these larger vehicles are able to access off-street servicing areas because these vehicles have the greatest impact on the urban environment.

7. *Develop a parking data base which allows freight transporters to view up-to-date information on available off-street servicing areas, their location, and the street they can be accessed from.*

Creating a resource that formalises local knowledge will help to ensure that available off-street servicing areas are used. The results established that having experience and knowledge of parking areas improved urban freight efficiency. This may also lead to identifying and improving servicing areas that should be accessible but are currently locked or used for other purposes.

7.4 Future Challenges

This thesis has highlighted the importance of freight in urban areas. By concentrating on the last mile it has made the importance of this sector more visible. All predictions are that this importance will grow in line with increasing congestion and urbanisation. It is hoped that more research is put into improving freight efficiency. As shown in this thesis, good information management and the development of more collaborative problem solving will be key to supporting good inner-city freight management. If these changes are to be achieved, individuals and key stakeholder sectors must be supportive and directly involved in research and decision making. In these cases urban and freight researchers can play a major role in providing the tools and approaches to ensure that policy initiatives and freight management work together to find sustainable and efficient solutions.

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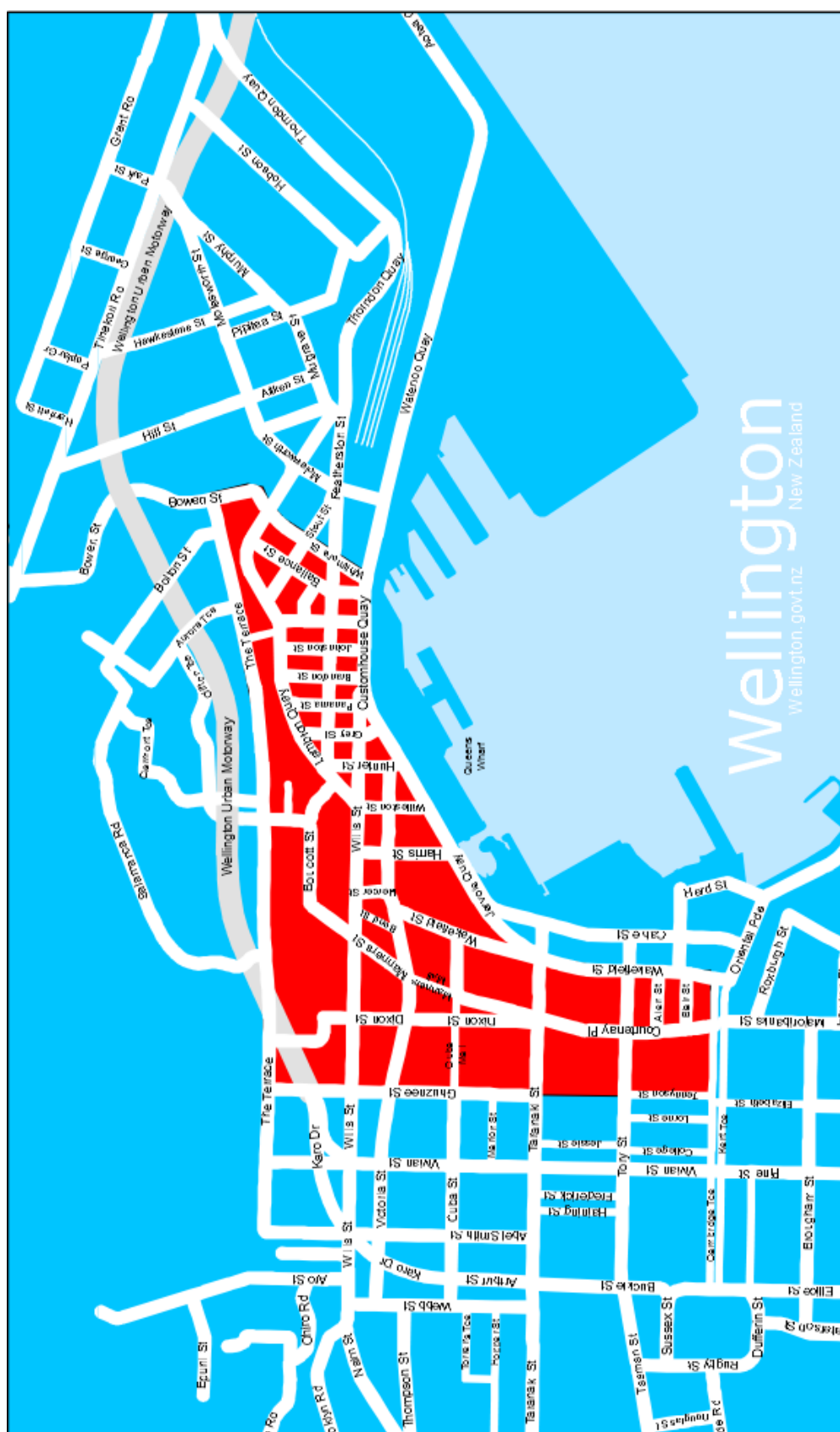
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9 Appendix

Appendix 9: Map of Wellington Central Business District (Adapted from WCC, 2009)



Appendix 2: Local Authority Interview Agenda

Phase One: What do you know about the 'last mile' in Wellington?

1. Could you please state your name and your involvement in planning?
2. Compared to other transport areas you work on, how important is planning for freight within Wellington's Central Business District?
3. What impact or effects do you think freight movement is having on Wellington? And would you consider these effects to be significant problem?
4. From your perspective; how efficient is urban freight activity within the Central Business District? What factors cause this?
5. How do you define urban freight efficiency?
6. What do you know about urban freight? For example, do you know how many freight vehicles enter the Central Business District? How long do they stay there for? Do you think that there is an adequate provision of facilities for freight within the Central Business District?
7. What trends or changes are occurring in freight vehicle movement within the Central Business District?

Phase Two: Planning in Relation to Freight

8. What planning approaches are you using to manage the movement of freight vehicles within the Central Business District?
9. What planning tools have the greatest impact on freight movement?
10. What processes do you use when developing and implementing planning tools that impact on freight? For example, how do you determine what size loading zones are and where they are placed?
11. What interactions do you have with other stakeholders? Is there effective co-operation between the local council, freight industry and community?

12. What do you consider to be some of the key constraints affecting the movement of goods within the CBD?
13. How do you prioritise and balance the needs for efficient business, social wellbeing and the natural environment?
14. What do you think about current planning legislation for urban freight? For example is it sufficient?

Phase Three: Future Directions

15. How is your organisation planning for increasing freight activity in the future?
AND does this link with existing policy goals?
16. Do you have any suggestions on how current policy/practice can be improved? OR
What do you think are some solutions to the problems you identified?
17. Do you have any final thoughts or views on this topic that you would like to share?
18. Do you know of anyone that would be interested in this topic that I would be able to talk to?

Appendix 3: Freight Industry Interview Agenda

Phase One: What do you know about the 'last mile' in Wellington?

1. Could you please state your name and your involvement in the movement of urban goods?
2. How important is improving freight efficiency within the Central Business District to you? I would like to know why it is important from your perspective, how it impacts on your company and what the consequences of inefficient freight movement are to you or your company.
3. Do you think that the delivery and pick up of goods within the CBD is efficient as it could be? Are there different trends with the different sized vehicles that you use?
4. What do you consider to be some of the key constraints affecting the movement of goods within the CBD?
5. How do you differentiate between an efficient run and an inefficient run? Can you quantify this? What factors do you think cause this inconsistency or inefficiency?
6. Do you think that others in the freight industry would share this same perspective? Or does it differ depending on the company?
7. What is your opinion regarding the effectiveness of:
 - a. Infrastructure
 - b. Provision of loading and unloading facilities
8. Is the current planning legislation and protocol for urban freight sufficient/effective enough?
9. Is there adequate enforcement of laws and rules?

Phase Two: Causes and future changes

10. Is there anything that has been particularly successful in regard to the movement of goods within the central business district?

11. Do you believe that these ideas can be applied to other areas within New Zealand?
12. Are there any particular changes that you can think of that would have a negative impact on urban freight? i.e That would contribute to a less efficient transport system?
13. How is your organisation planning for increasing freight activity in the future?
AND does this link with existing policy goals?
14. What do you think are some solutions to the problems you identified?

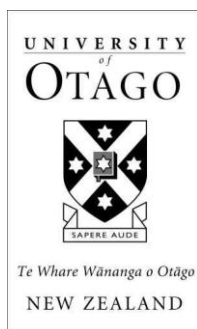
Consultation/co-operation

15. What interactions do you have with other stakeholders?
16. Is there effective co-operation between the local council, freight industry and community?
17. Do you have any final thoughts or views on this topic that you would like to share?

Appendix 4: Retailers Interview Agenda Business Survey

1. How many deliveries do you receive in a week?
2. How many different companies make deliveries or pick up goods at your store?
3. Between what hours of the day do you receive most of your deliveries?
4. Do you think that there is adequate facilities for the delivery and pick up of goods?
5. Who do you receive deliveries from
 - i. Couriers
 - ii. Distributors
 - iii. Direct suppliers
 - iv. Company vehicles
6. What size packages do you generally receive?
7. Are you satisfied with the level of service provided by freight deliveries?
8. Is there off-street parking or a back entranceway for this store? Does it get used? If not, why?

Appendix 5: Information Sheet for Participants



Improving the integration of urban freight activity in transportation and land use planning **INFORMATION SHEET FOR** **[PARTICIPANTS or PARENTS / GUARDIANS ETC.]**

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

What is the Aim of the Project?

This project is being undertaken as part of the requirements for a Master of Planning degree from Otago University. The aim of this research is to gain a better understanding of how planning policy and initiatives impact on freight activity within the central business district in order to help local authorities make more informed decisions for future urban planning. It is hoped that the research gathered in this thesis will promote greater integration of urban goods movement into land-use and transportation planning policy and legislation in New Zealand.

What Type of Participants are being sought?

The research seeks to gather the perspectives of around 10-12 people within the planning and urban freight industry at each of the three case study locations. The names of participants contacted will be obtained based on their job position or through referral from other participants. Once completed the research will be available to participants on request.

What will Participants be Asked to Do?

Should you agree to take part in this project, you will be asked to consent to a semi-structured interview. During the course of the interview, questions relating to the topic of the research will be asked. Interviews will be around 30-45 minutes long and will be arranged to be at a time that is convenient to you. If at any stage you feel uncomfortable you may refuse to answer the question(s) or request that the interview be terminated. Please be aware that you may decide not to take part in the project without any disadvantage to yourself of any kind.

What Data or Information will be Collected and What Use will be Made of it?

The data that will be collected is expected to be from a combination of semi-structured interviews and site analysis. The semi-structured interviews will make use of any knowledge and opinions that you may have on planning and urban freight movement within the central business district. No commercially or politically sensitive information is required for the purposes of this study. Your responses to questions will be recorded using audio tapes and then transcribed at a later date.

The data collected will be used to complete my thesis in order to fulfil the requirements of the University of Otago Master of Planning Programme. Information collected from the semi-structured interviews will be used to identify key themes within the research which will contribute to the completion of the final document.

The data collected will be securely stored in such a way that only those directly involved in the undertaking or supervision of the research will be able to gain access to it. This will be myself (Brigitte Allen) and Wayne Stephenson. At the end of the project any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in secure storage for five years, after which it will be destroyed.

The research is not externally funded and so it is not expected that there will be any commercial use of the data. However in the event of a request for commercial use, this will only be granted subsequent to further consent being obtained by yourself and the other participants.

On the Consent Form you will be given options regarding your anonymity. Please be aware that should you wish we will make every attempt to preserve your anonymity. However, with your consent, there are some cases where it would be preferable to attribute contributions made to individual participants. It is absolutely up to you which of these options you prefer.

This project involves an open-questioning technique where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops. In the event that the line of questioning does develop in such a way that you feel hesitant or uncomfortable you are reminded of your right to decline to answer any particular question(s) and also that you may withdraw from the project at any stage without any disadvantage to yourself of any kind. Participants may also withdraw information and data they have supplied if they would prefer it not be included as part of the research.

The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand). You will be able to request a copy of the research once it has been completed.

This proposal has been reviewed and approved by the Department of Geography, University of Otago.

Can Participants Change their Mind and Withdraw from the Project?

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

What if Participants have any Questions?

If you have any questions about our project, either now or in the future, please feel free to contact either:-

Brigitte Allen
Masters of Planning Student
Telephone: (03) 479 4216
allbr512@student.otago.ac.nz

and/or

Wayne Stephenson
Department of Geography
Telephone: (03) 479 8776
wjs@geography.otago.ac.nz

This study has been approved by the Department stated above. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Appendix 6: Consent Form for Participants

CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:

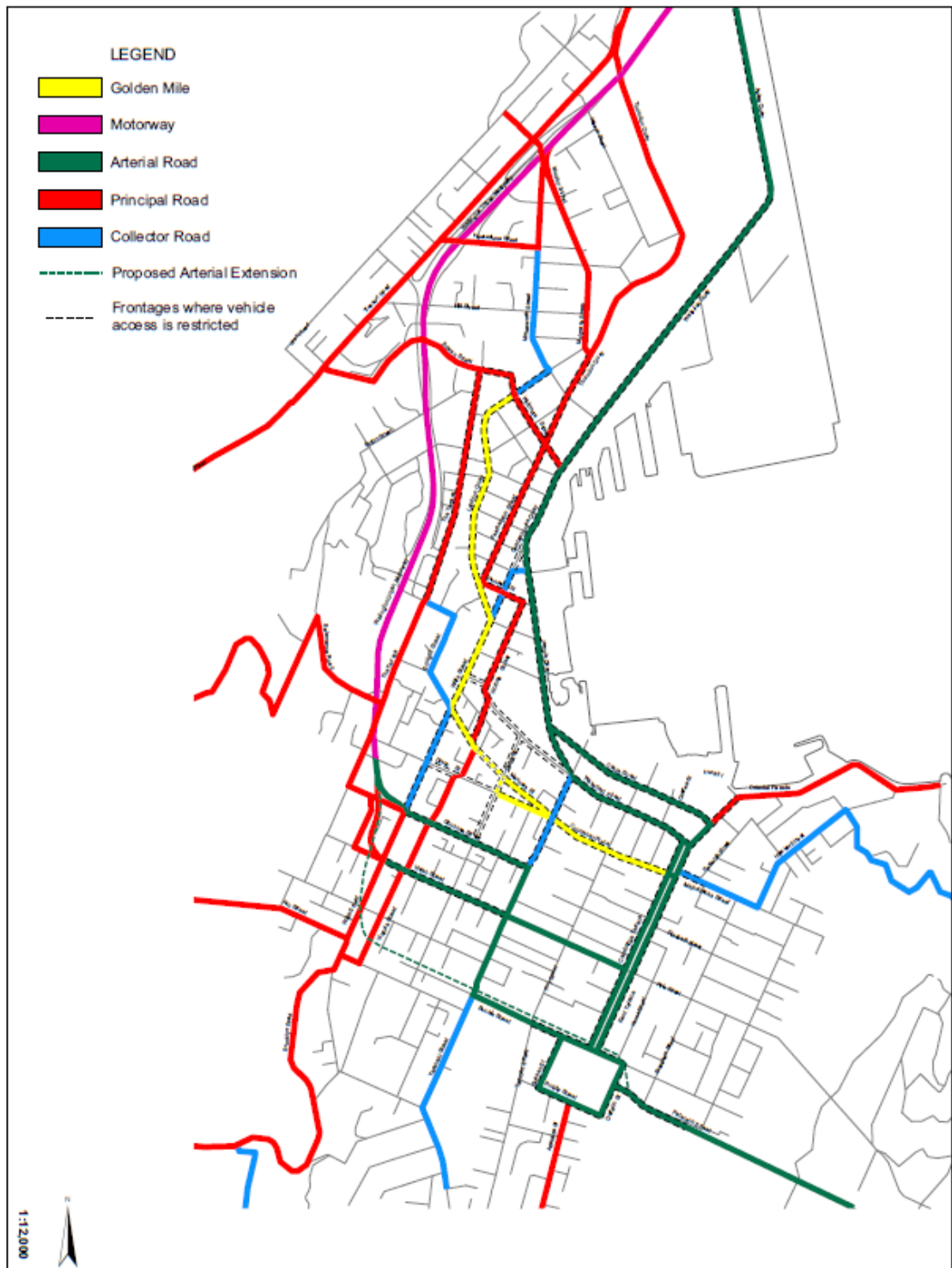
1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage
3. I am aware of the nature and extent of my involvement in this research project and that the interview process will take approximately 30-45 minutes of my time;
4. Personal identifying information will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for at least five years after which it will be destroyed.
5. This project involves a semi-structured questioning technique, where although the questions have been arranged in advance, the interview will develop in an open-ended fashion based on the responses you give. In the event that the line of questioning develops in such a way that I feel hesitant or uncomfortable I may decline to answer any particular question(s) and/or may withdraw from the project without any disadvantage of any kind.
6. There are no known or anticipated risks to participating in this study;
7. There is no remuneration for participating in this study;
8. The results of the project may be published, and will be made available in the University of Otago Library (Dunedin, New Zealand). Every attempt will be made to preserve my anonymity if I choose to remain anonymous.
9. I grant/ do not grant * permission to allow the research audio record my interview
10. I grant/ do not grant * permission to allow the research to use my identity

*Please indicate by circling

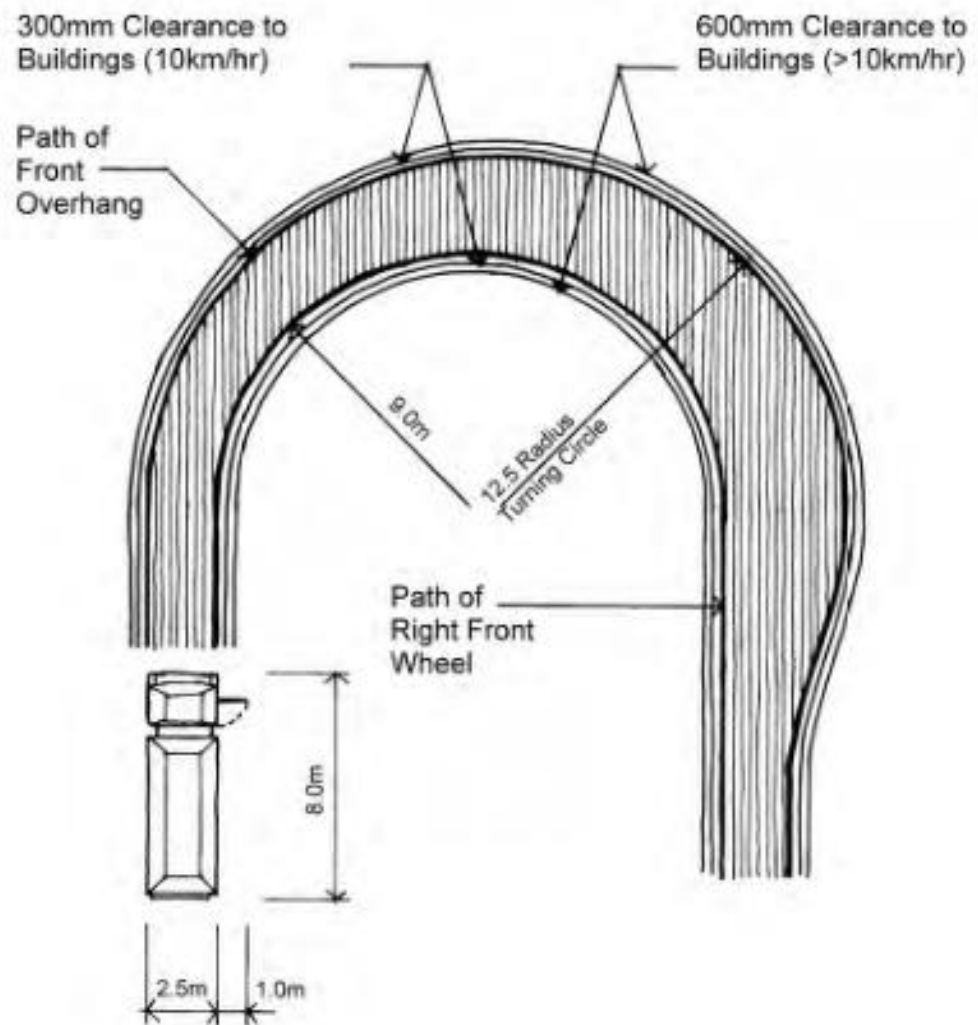
I agree to take part in this project

_____	_____	_____
(Signature of participant)	Participant's name	Date
_____	_____	_____
(Signature of researcher, acknowledging receipt)		Date

Appendix 7: Central Area Hierarchy of Roads (WCC, 2009b)



Appendix 8: Central Area Loading Standards (WCC, 2009)



Note: All on-site servicing assumes the use of a medium rigid truck. Compliance will be assessed using this standard of vehicle.

LOADING AREA DIMENSIONS

For loading areas located outdoors, the minimum width shall be 3 metres and the minimum length 9 metres.

For loading areas located within a building, the minimum width shall be 4 metres and the minimum length 9 metres.

Appendix 9: Wellington District Plan, Central Area Objectives, Policies, Methods and Explanations relating to Freight Movement

Objective	Policies	Methods	Explanation
12.2.2 To maintain and enhance the amenity values of the Central Area and any nearby Residential Areas.	12.2.2.11 - Manage the road network to avoid, remedy or mitigate the adverse effects of road traffic on the amenity of the Central Area and the surrounding Residential Areas.	<ul style="list-style-type: none"> • Rules • Operational activities (traffic Management) • Other mechanisms (WCC bylaws) 	Traffic on roads, whether active or stationary, can have major impacts on the amenities of the Central Area and surrounding Residential Areas. Council will continue to use traffic management techniques to control congestion and parking. Council is also aware of the impact that heavy trucks and similar vehicles can have on the Central Area and residential neighbourhoods in terms of noise and general disturbances and will seek to minimise through-traffic, particularly at night. Bylaws may be used to exclude heavy trucks on certain streets.
12.2.8 To enable efficient, convenient and safe access for people and goods within the Central Area.	12.2.8.1 - Seek to improve access for all people, particularly people travelling by public transport, cycle or foot, and for people with mobility	<ul style="list-style-type: none"> • Rules • National standard access design criteria • Other mechanisms (Regional Land Transport Strategy) • Operational activities 	Good access for all modes of movement is an important element of a sustainable city. Council will use a variety of methods to improve accessibility. Its Transport Strategy includes a broad range of both short and longer-term initiatives to improve access to the Central Area. Programmes and plans under this Strategy are implemented primarily through the Annual Plan process.

	restrictions.	(WCC Transport Strategy) • Advocacy (Council Social Policy)	
	12.2.8.3 - Limit the supply of commuter carparking and require appropriate loading and site access for activities in the Central Area.	• Rules	Premises must be able to be serviced safely and efficiently, so that streets are not blocked and people and cars can move freely. New access ways will not be permitted onto roads where access is prohibited (as identified on the Planning Maps). Well-designed and safe access to sites is needed to help prevent traffic congestion or conflict between street users. Where significant disruption would occur because of the nature of the traffic or pedestrian environment, access may be limited.
	12.2.8.4 - Manage the road system in accordance with a defined road hierarchy.	• Rules	A road hierarchy classifies roads according to their function. A road hierarchy is used in the administration of the Plan to ensure that land uses or activities are appropriately related to the network. The environmental result will be the development of land uses or activities in the Central Area which have better access because they are better related to the function of the roads on which they are sited.