Analysis of the Influence of Residential Location on Light Passenger Vehicle Energy Demand

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ABSTRACT

New Zealand's current urban environment assumes a constant availability and affordability of energy (oil) and as such the energy demand of private vehicles is rarely considered during the resource consent process for residential developments. However, due to the uncertainty of future oil supply, it is crucial for the Government to understand the fundamental relationship between transport energy demand and land use.

This research aimed to provide an analysis of energy demand for New Zealand light passenger vehicles relative to residential location through the examination of historic and current data and modelling of future energy demand, including the variation in energy demand between commuting and non-commuting residents located in outlying residential subdivisions and commuter towns. The purpose was to provide local authorities and Government with an improved understanding of the relationship between energy demand and residential location as well as highlight the necessary strategies to reduce this demand.

An application was specifically developed to facilitate the research; Vehicle Energy Demand Analysis Software (VEDAS). The unique functionality of VEDAS was applied to two New Zealand case studies; Greater Christchurch (South Island) and Greater Tauranga (North Island). The most influential factors affecting light passenger vehicle energy demand, including vehicle kilometres travelled (VKT) and vehicle age and engine capacity were examined. In addition, a number of scenarios were modelled to highlight the impact of transport and land-use planning strategies such as transit orientated and location efficient development as well as modelling the effects of a more fuel efficient vehicle fleet.

The results from the case studies and modelling highlighted the significant link between vehicle kilometres travelled (residential location) and energy demand, including the most significant influence on this demand; the distance between residential housing and employment. Indeed, the research revealed a reduction in VKT of 10.5% and a consequent reduction in energy demand of 10.7% over the previous decade for the case studies. Furthermore, residents (in the case studies) who lived and worked locally, regardless of their location used on average 61% less energy (1,202 litres) than commuting residents. Whilst the research found that increasing vehicle fuel efficiency would undoubtedly help to reduce energy demand (9% in the case studies), it proved the importance of residential location over and above that of vehicle efficiency.

The VKT of commuting residents who lived furthest from the city was 28% to 39% over and above that of their commuter based (necessary) annual travel. These residents also had a lower median income. This is of concern as the energy resilience of such residents is already low and leaves little room for adaption in the event of significant fuel price rises. Furthermore, the opportunity to provide an adequate public transport service to these residents would be limited due to the unrealistic financial cost.

A further research finding was that the VKT of non-commuting residents who lived closest to the city was 57% to 127% over and above that of their necessary travel. Thus, there is an opportunity to reduce not only high non-commuter VKT but also commuter related VKT for residents living in commuter towns closest to the city through the development of financially viable transit systems within the existing urban periphery.

Due to numerous factors such as preferred lifestyle, limited public transport and geography, it will always be necessary for New Zealanders to own light passenger vehicles. Thus, it is imperative that not only is the vehicle fleet as fuel efficient as possible but moreover, additional measures are taken to help reduce energy demand. The Government may wish to consider introducing national land-use and transport policy which may help to reduce vehicle kilometres travelled and thus the energy demand of light vehicles and in so doing improve the sustainability and resilience of the New Zealand light passenger vehicle fleet. This would help to lessen the reliance on foreign oil and reduce the impact of episodes of supply uncertainty and price shocks such as witnessed in 2008.

Key words: New Zealand passenger vehicle energy demand, Vehicle kilometres travelled (VKT), Impact of vehicle kilometres travelled on energy demand.

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GLOSSARY

DAA	Data Analysis Application
DPA	Data Processing Application
GIS	Geographical Information Systems
HOV	High Occupancy Vehicle
LED	Location Efficient Development
LINZ	Land Information New Zealand
LPV	Light Passenger Vehicles
MoT	Ministry of Transport
NZTA	New Zealand Transport Authority
SUV	Sports Utility Vehicle
TAD	Transit Adjacent Development
TDM	Transportation Demand Management
TOD	Transit Orientated Development
VA	Vehicle Age
VEC	Vehicle Engine Capacity
VEDAS	Vehicle Energy Demand Analysis Software
VFT	Vehicle Fuel Type
VKT	Vehicle Kilometres Travelled
WoF	Warrant of Fitness

1. INTRODUCTION

1.1. Background

Around 86% of New Zealand's oil consumption (44% of the nation's total energy usage) is used in the transport sector (Energy Efficiency and Conservation Authority, 2012). Furthermore, over the next 25 years the forecast under *business as usual* models is for transport energy demand to increase by approximately 1.4% per annum (Ministry of Transport, 2010). Whilst there has been a great deal of focus on reducing energy demand in areas such as residential and commercial buildings, the issue of reducing energy demand for passenger transport has only recently started to gain attention from the New Zealand Government (Thull, 2012). The energy demand of passenger transport and the potential contribution of urban planning in reducing demand is an area of research which is becoming increasingly important as efforts to reduce demand intensify.

Due to the uncertainty of energy availability, it is crucial for the New Zealand Government to understand the fundamental relationship between land use and transport energy demand, including the difference in energy demand of commuting and non-commuting residents located in outlying residential subdivision and commuter towns. The design and layout of New Zealand cities and towns has traditionally embraced the quarter acre section due to the availability of land and small population, causing residential expansion to occur on the edge of the urban boundary. Such development does not allow for cost effective public transport systems and increases dependence on the private motor vehicle. Despite this, there is a continued drive towards residential development in these areas, increasing commuting distances to access employment and services such as schools and supermarkets. The establishment of new residential areas geographically distant from such destinations will not be viable if transport energy costs increase to levels predicted by industry experts and the academic community.

New Zealand's current urban environment still assumes the constant availability and affordability of energy. However, over the previous decade there has been a steady increase in the oil price, which may be largely attributed to the significant increase in global demand. Indeed, the Executive Director of the International Energy Agency (IEA) recently stated, "The age of cheap energy is over" (International Energy Agency, 2011). The significance of this is it may have serious implications for New Zealand as fuel shocks and long term fuel price increases will have a detrimental effect with regard to accessibility and mobility, such as witnessed in 1979-1980 when the Government introduced carless days (Taylor and Francis , 2007). It will be necessary for New Zealanders to make changes to their use of transport energy as has already been witnessed in Europe. However, due to the design and layout of New Zealand's urban environment, there is a limit as to how far the public can adapt. The issues need to be urgently addressed so as to allow for a period of steady behavioural change which will help reduce demand.

Research has traditionally centred on the use of Geographical Information Systems, social science (both qualitative and quantitative) and mathematical modelling. The data used has been collected via field research or extracted from existing datasets. For practical reasons the sample size of such collected datasets is often limited. Furthermore, data are often used in conjunction with hypothetical datasets and parameters as the type of data collected is not always sufficiently detailed to facilitate the entire analysis. As such, the findings of the analyses are to an extent limited. An example is the New Zealand Household Travel Survey conducted by the Ministry of Transport. Vehicle kilometre travelled data is collected from 4600 households out of a possible 1.6 million. Data is collected over a two day period and as such may not be considered a true representation of driver travel. Furthermore, an average is provided for each major New Zealand city but not for individual suburbs within those cities. In addition, no information is provided for towns and rural areas.

Research has also focussed on climate change as another significant influence regarding the need to reconfigure land use and transport systems as it could be argued that climate change also increases the need to reduce dependence on fossil fuels. However, given the wealth of research in the area of climate change and the specialised focus of this research, climate change is not reviewed in this work.

1.2. Aims

The aim of this research is to analyse the impact of residential location on light passenger vehicle energy demand. The research was inspired by a study undertaken by Thull (2012) which attempted to identify fuel demand for residents in Rangiora, a commuter town north of Christchurch City, through the modelling of a number of scenarios. This research is applicable to all areas in New Zealand but will focus on selected commuter towns within Greater Christchurch (South Island) and Greater Tauranga (North Island) and will include an overview of energy demand in the cities of Christchurch and Tauranga. It aims to highlight the importance of residential location on light passenger vehicle energy demand and provide local authorities and Government with an improved understanding, allowing for the development and implementation of solutions to manage and reduce demand and as a result ensure a sustainable approach with regard to land development. The desired outcome would be for the necessary authorities to address such issues and prepare for future oil price increases.

1.3. Objectives

The impact of residential location on light passenger vehicle energy demand will be identified through the analysis of vehicle kilometres travelled (VKT), vehicle engine capacity (VEC), vehicle age (VA) and energy demand (fuel consumption) data. In addition, a number of scenarios will be modelled to assess the impact of residential location, transportation demand management principles and vehicle efficiency on light passenger energy demand.

The focus of this research will be to:

- Calculate VKT, VEC and VA for light passenger vehicles over the previous decade (2002-2012) for the case studies
- Calculate energy demand for light passenger vehicles over the previous decade (2002-2012) for the case studies using VKT, VEC and VA data
- Model VKT, VEC and VA for two distinct types of resident for the case studies; those who both reside and are employed within the commuter town and those who reside in the commuter town but whose place of employment is in the city (commuting and non-commuting residents)
- Model energy demand for two distinct types of resident for the case studies; those who both reside and are employed within the commuter town and those who reside in the commuter town but whose place of employment is in the city

1.4. Methodology

The research was conducted using the following methods:

- A review of the current international and domestic literature focusing on a series of key topics relevant to this particular research
- Development of eight data processing applications to process the warrant of fitness and electoral residential address datasets provided by the New Zealand Transport Agency and Land Information New Zealand
- Development of Vehicle Energy Demand Analysis Software (VEDAS), a data analysis application to analyse the data from the data processing applications and model a number of different energy demand scenarios
- Create Geographical Information Systems maps to visualise the data produced by VEDAS
- Analyse VEDAS data for two case studies: Greater Christchurch (South Island) and Greater Tauranga (North Island)

1.5. Limitations

Ideally, the research would have provided an analysis for all New Zealand but due to a number of constraints it was only feasible to examine two case studies; Greater Christchurch (South Island) and Greater Tauranga (North Island). Due to the size and number of errors within the warrant of fitness (WoF) dataset provided by the New Zealand Transport Agency (NZTA), it was necessary to develop eight small data processing applications. In addition, a data analysis application (Vehicle Energy Demand Analysis Software) was developed to analyse the corrected WoF dataset and provide unique functionality in order to model a number of different energy demand scenarios. As a result a significant proportion of the research period was spent developing and testing these applications.

1.6. Structure

This thesis is divided into six chapters. After the preceding introductory chapter, Chapter Two presents a literature review of the theoretical concepts underpinning this research through the examination of international and domestic literature. Chapter Three details the method used to perform this research, focusing on the datasets and applications developed specifically for the research. Chapter Four examines background and statistical information for the case studies. Chapter Five presents the findings, including an historical insight into vehicle kilometres travelled (VKT), vehicle engine capacity (VEC), vehicle age (VA) and energy demand for the case studies and presents the numerous energy demand scenario results. The final Chapter presents the conclusion and recommendations.

2. LITERATURE REVIEW

2.1. Introduction

Research in the field of light vehicle energy demand has been in existence for over 25 years in the United Kingdom, United States and the European Union (Hickman & Banister, 2007). The importance of such research continues to grow with the emergence and renewed concern surrounding conservation of finite energy resources and the drive towards sustainable and resilient transportation.

This chapter examines domestic and international literature with regard to energy demand for light passenger vehicles. The first section (2.2) provides an overview of the New Zealand light vehicle fleet and focuses on vehicle efficiency, age and engine capacity and in addition examines the technology which may potentially shape the future fleet. The following section (2.3) examines the energy used to power the light vehicle fleet, focusing on demand and supply, future supply, driver response to energy price increases and energy resilience. Section 2.4 analyses current travel patterns focusing on the role of the urban environment and vehicle efficiency. Following on from this, section 2.5 reviews transportation demand management (TDM) and focuses on a number of significant TDM strategies which have an impact on travel patterns including smart growth, transit orientated and location efficient development. Section 2.6 studies the urban environment, focusing on the effects of urban density and urban layout on energy demand. The final section (2.7) examines the most significant national and regional policy and legislation relating to transportation demand management and the urban environment, including the Resource Management Act, National Policy Statements and Regional Land Transport Strategies.

2.2. Light passenger Vehicle Fleet

2.2.1. Introduction

Ninety percent (2.9 million) of New Zealand's 3.2 million vehicles are classed as light vehicles meaning they have a gross mass less than 3.5 tonnes (Ministry of Transport, 2012). This section provides an overview of the New Zealand light vehicle fleet focusing on vehicle efficiency, age and engine capacity and in addition examines the technology which may potentially shape the future New Zealand light vehicle fleet.

2.2.2. Vehicle Efficiency

The efficiency of light vehicles has a direct impact on the energy demand of passenger transport and as a result many nations have introduced measures to improve the efficiency of their fleets. One of the initiatives used to indirectly increase the efficiency of vehicles fleets in countries such as Japan, Australia, the European Union, United States and United Kingdom is the adoption of emission

standards. Such initiatives have a dual effect. The first and intended effect is the reduction of gases such as CO_2, lessening the environmental effects of vehicles. The second and indirect effect is improved vehicle efficiency. As vehicle manufacturers have striven to meet emissions targets, there has been a reduction in engine capacity. Engine capacity is generally linked with fuel consumption, thus smaller engines generally consume less fuel (Thull, 2012).

New Zealand has the fifth highest CO_2 emissions per capita in the OECD (Statistics New Zealand, 2012). A major contributor to this is the vehicle fleet (New Zealand Transport Agency, 2011).This would indicate the New Zealand fleet is not as efficient as other vehicle fleets in the OECD.

In 2004 the New Zealand Government introduced emissions standards in an effort to reduce harmful emissions from light vehicles (Ministry of Transport, 2011). Whilst the Government did not directly relate the introduction of emissions standards to fuel efficiency, it stated one of the reasons for emission standards was based around the almost complete dependence on imported fuels and the need to reduce fuel consumption (Ministry of Transport, 2011).

Improving the efficiency of the New Zealand light vehicle fleet is of growing significance as there has been a continual increase in the size of the fleet due to an increase in the number of vehicles per capita and population growth. Indeed, between 2000 and 2006 the fleet increased by 22% (Energy Efficiency and Conservation Authority, 2012). As a result the Government recently announced its plan to update the rules on emissions standards for vehicles entering New Zealand. It is proposing changes to the 2007 Vehicle Exhaust Emissions Rule to guarantee New Zealand continues only to import new vehicles which have been built to the highest available exhaust emissions standards (New Zealand Government, 2012). The proposed new standards for new vehicles entering will mirror those which have recently been agreed in Australia known as Euro 5 and 6 which will ensure new vehicles will have a similar efficiency to those of other leading fleets such as in Europe and Japan.

The Government updated the emissions standards for used petrol vehicles in 2012 and used diesel vehicles in 2010. The new standards were a significant improvement on the standards they superseded (Ministry of Transport, 2012). However, the new standards for used vehicles are still behind those of Europe which is considered a leader with regard to emissions and efficiency regulation. Thus, there is room for improvement with regard to the efficiency of used imported vehicles entering New Zealand. The Government is proposing to review these standards in 2014 to assess the need for further improvement (New Zealand Government, 2012).

2.2.3. Vehicle Age

There are various advantages of a younger vehicle fleet including, reduced environmental and health impacts due to emission mitigation technology, enhanced safety systems such as Antilock Braking Systems (ABS), Electronic Stability Control (ESC), multiple passenger airbags and pedestrian protection systems. Whilst these factors are important, it is improved vehicle efficiency which is of most relevance to this research as the age of light vehicles has an impact on vehicle efficiency.

New Zealand has one of the oldest light vehicle fleets in the OECD with an average age of 12.7 years (Ministry of Transport, 2011). In addition, the average age has been increasing steadily since 2005 (Ministry of Transport, 2012). This pattern of an aging fleet is consistent with other countries such as Australia, Europe and the United States, albeit from a higher average age (Ministry of Transport, 2011).

The Ministry of Transport (using the fleet turnover model) predicts the age of the fleet will continue to increase and forecasts that by 2020 the average age of vehicles will increase to a maximum average of 13.1 years. Furthermore, the Ministry also predicts by 2020 more than 15 percent of the light vehicle fleet will be greater than twenty years old (Ministry of Transport, 2011).

It is possible to attribute the continually increasing vehicle age to past purchasing and import patterns. Between 1995-1997 and 2003-2005 (Figure 1) a considerable number of used Japanese imports were registered in New Zealand significantly impacting the average age of the vehicle fleet (Thull, 2012). Indeed, 20% of the vehicles in the current light fleet were manufactured between 1995-1997 (Ministry of Transport, 2009).

(Based on data from the 2011 New Zealand Vehicle Fleet Annual Statistics Spreadsheet - MoT)

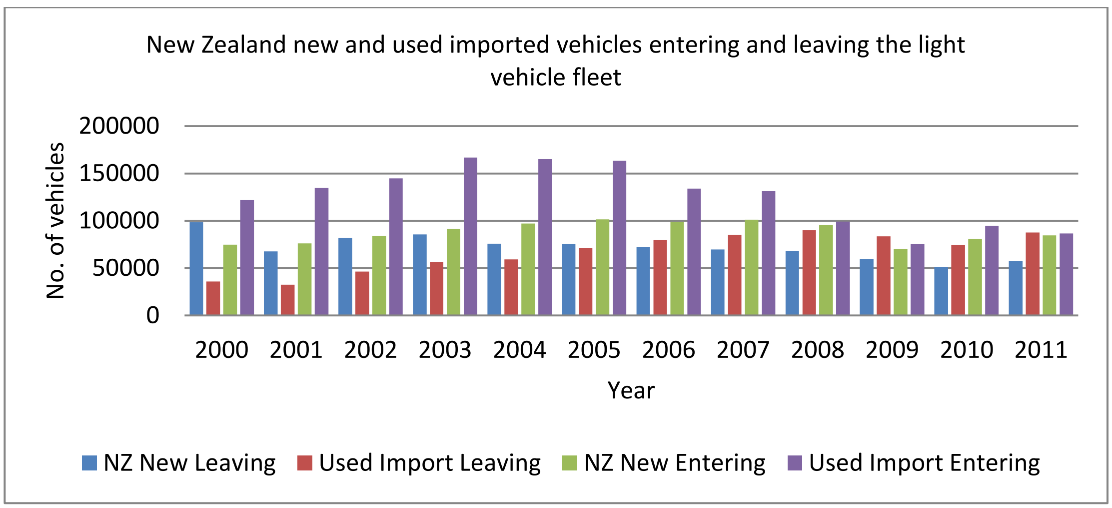


Figure 1: New and used vehicles entering and leaving the light vehicle fleet (2000-2011)

In addition to past purchasing and import patterns the continual increase in average age is due to New Zealanders choosing to keep their vehicles for a longer period. The most likely reason for the retention of older vehicles is the introduction of the emissions standards which reduced the number of cheaper, older and often higher specification vehicles (Thull, 2012). The notion that New Zealanders are keeping their vehicles longer is supported by the fact that for the previous 3 years the ratio of New Zealand new to used imported vehicles was around 1:1 (Figure 2). The continual increase in average age may also be partly due to a preference to buy a used but higher specification vehicle as opposed to a new (often more expensive) vehicle of lower specification.

(Based on data from the 2011 New Zealand Vehicle Fleet Annual Statistics Spreadsheet - MoT)

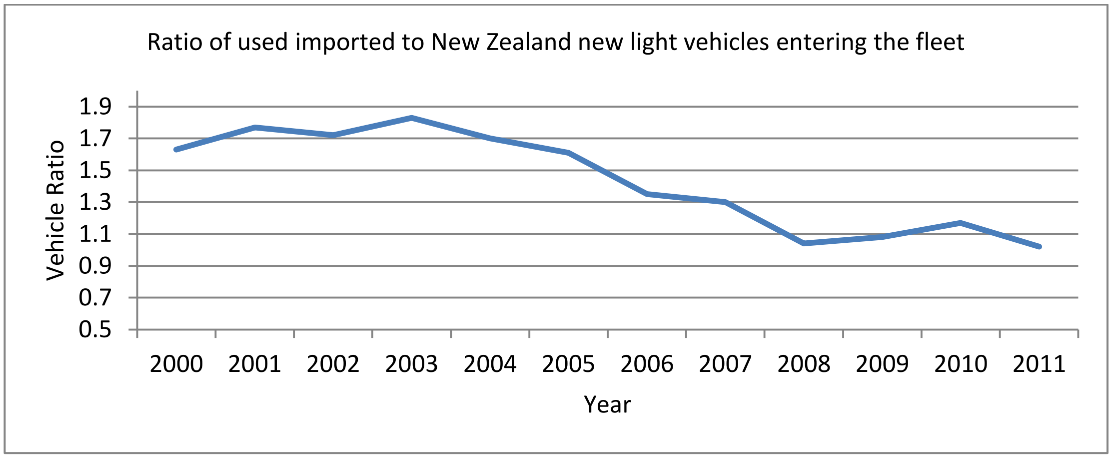


Figure 2: Ratio of used to new light vehicles entering the fleet (2000-2011)

The New Zealand Government has acknowledged the significance of the ageing fleet in the Safer Journeys Strategy, recommending the age of the fleet be reduced to an average of ten years, bringing it in line with Australia (Ministry of Transport, 2011). However, the New Zealand emissions standards appear to have had little effect on the average vehicle age as the age continues to increase (Figure 3).

(Based on data from the 2011 New Zealand Vehicle Fleet Annual Statistics Spreadsheet - MoT)

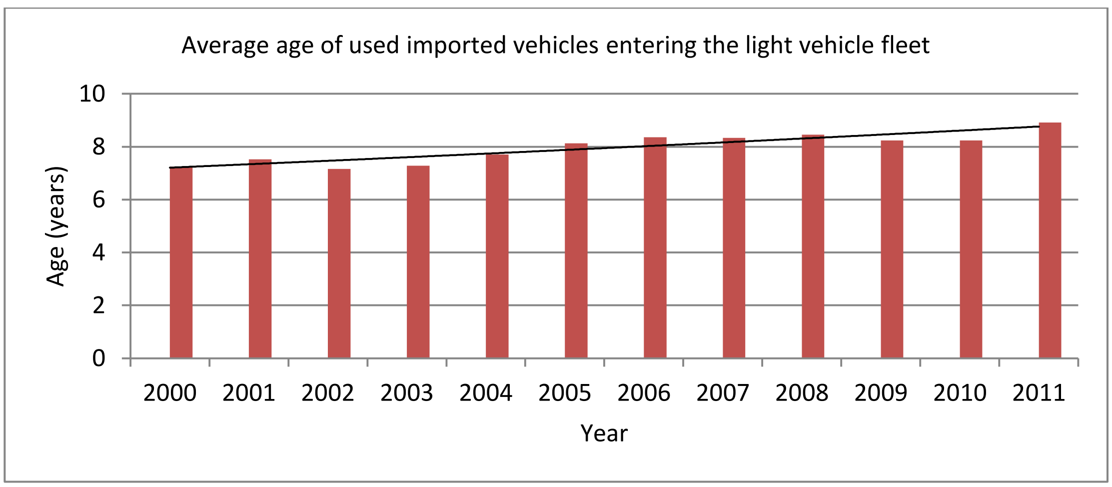


Figure 3: Average age of used imported vehicles entering the light vehicle fleet (2000-2011)

The New Zealand Government predicts within the next decade vehicle age will stabilise and then slowly decrease. However, even if this prediction is correct, New Zealand will face a significant challenge in order to match the comparatively young fleets in other OECD nations (Europe 8.2, United States 10.8, Canada 8.4, Australia 10.2 and the United Kingdom 8.4 years).

2.2.4. Vehicle Engine Capacity

Vehicle engine capacity (VEC) also impacts vehicle efficiency. The average VEC in New Zealand is 2,200cc and matches that of most other OECD nations (Ministry of Transport, 2012). However, the

average VEC in New Zealand is larger than that of the European Union which is considered to be at the forefront of fuel efficient vehicles, the average VEC being approximately 1650cc (European Automobile Manufacturers Association, 2010).

Around 16% of the light fleet in New Zealand are diesel vehicles (US 0.5% and European Union 45.9%). However, the diesel vehicles in New Zealand differ from other OECD countries such as Japan and the European Union as light passenger diesel vehicles in these nations are of a similar VEC to petrol vehicles and are more fuel efficient due to the energy properties of diesel fuel, improvements in fuel saving technology and reduced vehicle weight. In comparison, the VEC of light diesel vehicles in New Zealand is around 2,700cc, indicating a higher fuel consumption.

In addition, diesel vehicles in New Zealand are for the most part, heavier and older than their Japanese and European counterparts. The weight of these vehicles indicates that unlike Europe and Japan, the majority of vehicles are sports utility (SUVs) or 4x4 vehicles. The significance of this lies in the notion that larger, older vehicles will have poorer fuel efficiency compared to a light, modern diesel saloon vehicle. There is no strategy to address the high VEC in New Zealand and the only regulation which currently has the potential to have an impact on VEC are the emission standards.

2.2.5. Vehicle Technology

Vehicle technology plays an important role in the energy demand of a light vehicle fleet. The current New Zealand fleet is not sustainable in the long term due to the trend of increasing fuel prices and will eventually need to be replaced with alternative technologies.

There are currently several available choices of alternative vehicles in New Zealand, including hybrid and electric models. The adoption of this technology has so far been slow with hybrid and electric vehicles accounting for less than 0.0001% of the vehicle fleet (Table 1). Currently, electric vehicles do not have the range of other internal combustion powered vehicles, although they have the ability to travel well in excess of New Zealand’s average 38 kilometre return commute.

Table 1: Light passenger vehicle by fuel type 2012

Fuel Type	Total	Percentage
Petrol	2,513,556	84.10%
Diesel	475,275	15.90%
Electric	46	0.00%
CNG	22	0.00%
LPG	1,245	0.00%
Unknown	105	0.00%
Total	2,990,249	100.00%

(Based on data from the 2011 New Zealand Vehicle Fleet Annual Statistics Spreadsheet - MoT)

Electric vehicle technology has multiple advantages. The primary advantage for New Zealand is that the majority of energy for these vehicles (if charged overnight) would be supplied from renewable sources such as the surplus energy generated from wind. Unfortunately, this technology is currently out of reach of most New Zealanders as the purchase price of such vehicles is over and above what either most can afford or are willing to pay. The purchase price of the Mitsubishi i-MiEV which is the only mass produced electric vehicle available in New Zealand is $59,990 (Mitsubishi Motors New Zealand, 2012). The purchase price of a new hybrid vehicle such as the Toyota Prius is $49,990 (Toyota New Zealand, 2012).

Provided the electricity is from renewable sources, electric vehicles appear to be the most suitable alternative as they will reduce New Zealand's dependence on oil imports and therefore dramatically increase the energy resilience of the light vehicle fleet. However, despite various Government initiatives, policy and legislation, including the ambition for New Zealand to be one of the first countries in the world to widely deploy electric vehicles, the likelihood of realising such goals is low in the current climate.

The literature above describes an *ideal future* in terms of the New Zealand light vehicle fleet, but the current reality is somewhat different. Unless New Zealand adopts policy such as that in the United States and United Kingdom, where the Governments provide significant subsidies to help purchase such vehicles, the adoption of such technologies is likely to take a significant period of time.

One of the more realistic (medium term) initiatives under consideration both globally and in New Zealand which it is thought will provide a solution for reducing fuel consumption in the vehicle fleet is to improve the fuel efficiency of current internal combustion powered vehicles. However, some critics would argue that as vehicle efficiency increases this only allows motorists to travel greater distances for the same dollar outlay (Small & Dender, 2007).

2.3. Energy

2.3.1. Introduction

Passenger transport is one of the largest consumers of energy in New Zealand (Ministry of Economic Development, 2011). This section focuses on energy demand and its effect on fuel price, driver response to fuel price increases, energy resilience and the New Zealand Energy Strategy.

2.3.2. Energy Demand and Fuel Price

The future supply of fossil based energy sources used to power the light vehicle fleet is of major concern due to issues such as peak oil which are gaining ever increasing attention. The Chief Economist of the International Energy Agency (07/11/2011) stated, "The world needs to leave oil before oil leaves us". This comment is in relation to the significant problems these issues will pose if the world's reliance on oil remains unchanged.

With regard to the issue of peak oil there have been numerous debates focused on the timing of onset. However, this section does not attempt to provide an answer to when or if indeed Peak Oil has occurred, but rather the intention is to analyse the consequences of a diminishing supply and increasing demand and the resulting effects on fuel price.

Energy demand (fuel demand) is one of the key drivers in determining the price of oil (Small & Dender, 2007). It is believed within the next five years almost half of global oil demand growth will come from China and other significant demand will increasingly come from countries such as India (International Energy Agency, 2011). This trend is set to continue until 2035 but is in contrast with OECD countries where demand is expected to decline over the next two decades (International Energy Agency, 2011). This will be driven primarily by government policies focusing on fuel efficiency and a levelling of vehicle ownership rates. However, the demand from China and India alone will cause an increase in the overall global demand and in conjunction with reducing supplies will contribute to continuous long-term price increases (International Energy Agency, 2011).

In addition to increased demand, the difficulties of extracting new oil supplies will also play a key role in the increasing global oil price. Oil is designated into one of two categories; conventional and unconventional. Conventional oil includes crude oil and natural gas liquids and condensate liquids, which are extracted from natural gas production. Unconventional oil however, consists of a wider variety of liquid sources including oil sands, extra heavy oil, gas to liquids and other liquids (International Energy Agency, 2011). Conventional oil is more economical to produce than unconventional oil. However, the International Energy Agency (2011) believes these two categories will change over time due to advancements in technology and the constantly evolving economic climate. Despite new oil extraction technologies and a reduction in energy demand in developed nations, demand is set to increase and so too is the cost of fuel (International Energy Agency, 2011).

2.3.3. Driver Response to Fuel Price Increases

The cost of fuel in New Zealand steadily increased from 2000 until 2008 when there was a significant spike in the fuel price (Figure 4).

(Based on data from the 2011 New Zealand Vehicle Fleet Annual Statistics Spreadsheet - MoT)

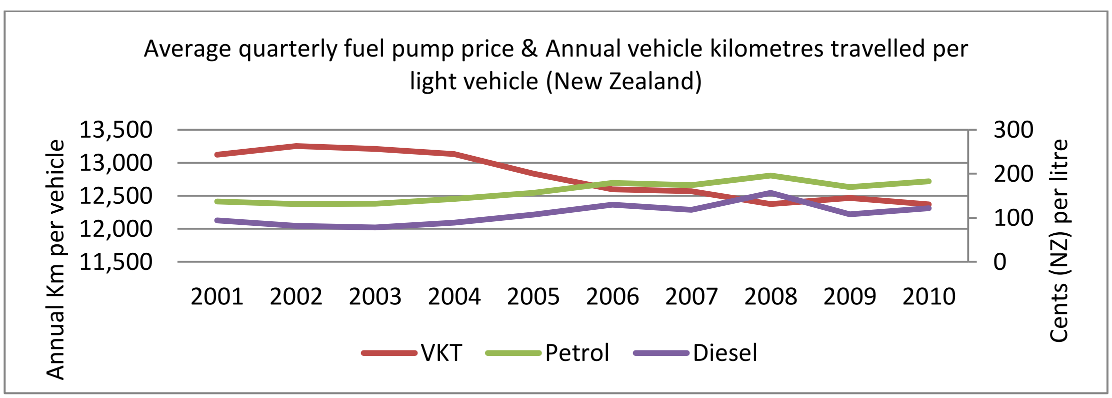


Figure 4: Average quarterly fuel pump price & Annual vehicle kilometres travelled (2001-2010)

Numerous studies have concluded that drivers respond to fuel price increases in several ways. The two main responses are believed to be an increase in the adoption of more efficient vehicles and a reduction in the distances travelled. Small and Dender (2007) found that the primary response to major increases in fuel price in the United States in 2005 was the sales of Sport Utility Vehicles fell dramatically. In return, manufacturers responded by increasing the number of fuel efficient vehicles on offer to the consumer. Furthermore, whilst alternative technology vehicles remain a small percentage of the US Vehicle Fleet, the competition to develop these vehicles (primarily hybrid vehicles) has intensified.

According to Small and Dender (2007) these responses are termed the "fuel efficiency effect". In order to fully understand the effects of substantial fuel increases such as those witnessed in the US in 2005 we need to consider not only responses from consumers and manufacturers but also consider the vehicle kilometres travelled response. It is believed that an increase in fuel price reduces vehicle kilometres travelled. Numerous studies support these findings of Small and Dender including research conducted by Todd, (2010), Joyce, (2004) and Kennedy & Wallis, (2007). This is supported by Figure 4 and Figure 5, where it is possible to attribute the overall reduction in VKT in New Zealand over the previous decade to the fuel price.

(Based on data from the 2011 New Zealand Vehicle Fleet Annual Statistics Spreadsheet - MoT)

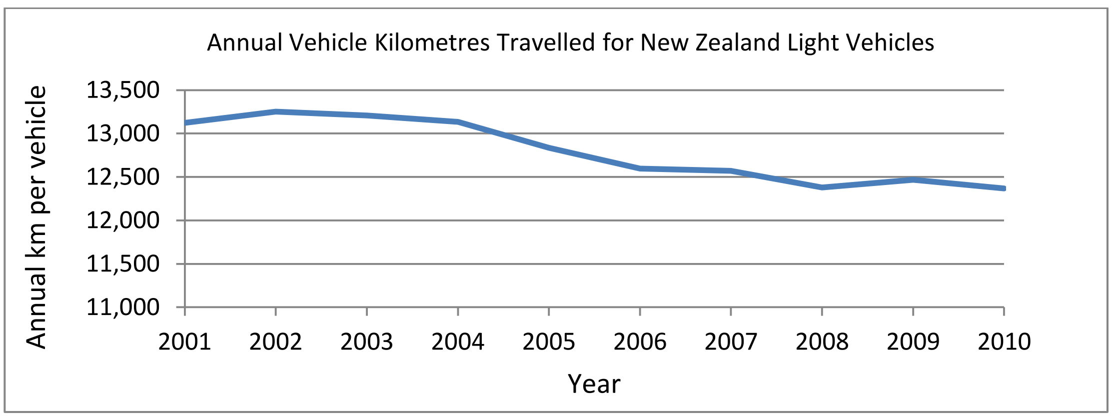


Figure 5: Annual vehicle kilometres travelled for New Zealand light vehicles 2001-2010

2.3.4. Energy Resilience

Resilience is defined as a response to the realisation that we have designed our world to work well, so long as nothing changes very much (Bugler, 2012). Thus resilience is the capacity of any given organisation, system or structure to cope with its designated function under circumstances not considered to be the norm.

Energy resilience is an important issue with regard to the light vehicle fleet as passenger vehicles are a crucial part of the New Zealand transport system and a resilient fleet will enable continued accessibility and mobility as the fuel prices continue to increase. Just how critical the issue of energy

supply is to the New Zealand light vehicle fleet is, to a large extent, determined by the energy resilience of the fleet.

Resilience of the light passenger vehicle fleet is determined by how driving patterns adjust to rapidly increasing fuel prices and peak oil. For instance, residents of a subdivision (located away from the main employment centres) will have several responses to increasing fuels costs. First responses could include purchase of a more efficient vehicle, car sharing and reduced travel through lifestyle changes. However, there is a limit to the effectiveness of such measures, as residents are committed to travel a minimum number of kilometres annually due to employment and other such necessary travel.

Resilience not only anticipates fuel shocks will occur but indeed, they are inevitable as oil is a finite resource. Thus, understanding the resilience of the light vehicle fleet is of major importance because it not only enables us to accept and understand shocks as inevitable, but moreover, resilience enables us to prepare for them.

Achieving energy resilience will require a diverse transport system. For instance, a transport system which relies on one mode will be unable to perform in the case of a severe disruption. However, if the system were to rely on multiple transport modes, disruption will be limited even in the event of a major shock to one particular mode. The resilience of the subdivision example mentioned above would be greatly improved if the concept of transit orientated development had been considered. For instance, if such a development had been located near an existing rail network, then in the case of fuel shocks which were unable to be mitigated by such measures mentioned above, it would be possible for residents to adopt a new primary mode of transport for necessary journeys such as the daily commute.

2.3.5. New Zealand Energy Strategy

The New Zealand Energy Strategy to 2050 (October 2007) acknowledged the issues surrounding passenger transport energy. It outlines a series of key actions, some of which relate to the energy demand and resilience of the New Zealand light vehicle fleet. These include the adoption of sustainable transport and energy efficiency technologies, the in-principle decision to introduce a target to halve domestic transport emissions per capita by 2040, a minimum Bio-fuels sales obligation has been announced to encourage the use of alternative transport fuels over the next five years and energy reduction through the use of travel demand management systems (New Zealand Government, 2007).

In addition to the other strategy measures the government has signalled its commitment to building momentum in the uptake of electric vehicles and has taken an in-principle decision that New Zealand will be one of the first countries in the world to widely deploy such vehicles. This will make New Zealand more resilient to international oil price uncertainty and risks of supply disruptions (New Zealand Government, 2007). However, the updated strategy (2011) whilst striving to achieve the same overall objectives is much less target specific with regard to passenger transport energy.

2.4. Travel Patterns

2.4.1. Introduction

Travel patterns are directly linked to vehicle kilometres travelled, which in turn determines energy demand. This section examines travel patterns and the impact of the urban environment and vehicle efficiency on these patterns.

2.4.2. Travel Patterns

Households in New Zealand have an average of 2.7 residents, with sole occupant households accounting for almost a quarter (Statistics New Zealand, 2010). The most common mode of transport in New Zealand is the light passenger vehicle and the second most common mode is the light company vehicle. The return commute for around 47% of the population is less than 10km and less than 20km for 67% (New Zealand Transport Agency, 2012). Since 1996 there has been an increase in the percentage of people undertaking a longer commute (Ministry of Transport, 2012). This has been influenced by the changing urban environment, including suburban and commuter town expansion.

In the city it is believed the average individual undertakes more than a dozen trips from home each week for employment, shopping, recreational and social activities. A large proportion of these trips are flexible in terms of their timing, mode and destination (Hickman & Banister, 2007). Numerous factors influence travel patterns such as the convenience and safety of particular travel modes for example, street pavements, bike lanes, the quality and cost of public transport and the price of parking. Furthermore, land-use factors such as the location of schools, parks and shops in relation to residential neighbourhoods also have a significant influence on such patterns (Victoria Transport Policy Institute, 2011).

The average New Zealander travels approximately 12,500km annually. The trend over the past decade has been for a steady decrease in vehicle kilometres travelled (VKT) until 2008, when there was a more pronounced reduction. Reduction in VKT was also witnessed in a number of other nations including the United Kingdom, though less significant than in the case of New Zealand (Department for Transport, 2012). The reduction in VKT in the United Kingdom also began in 2008 around the onset of the global financial crisis. Prior to 2008, VKT had been steadily increasing (Department for Transport, 2012). This was also witnessed in the United States where VKT decreased in 2008 due to the oil price spike (Alternative Fuels Data Centre, 2012).

2.4.3. Urban Environment and Travel Patterns

The urban environment has a direct impact on travel patterns, including mode and distance travelled (Victoria Transport Policy Institute, 2010). However, research shows regardless of urban form and residential location, the number of return journeys to necessary destinations such as employment centres, schools and retail facilities remains relatively unchanged (Hickman & Banister, 2007). Travel

patterns (vehicle kilometre travelled) are related to the area in which people choose to reside as well as their chosen modes of transport. The range of suitable options will depend on the urban environment of the area in question.

A case in point is the development of car-centric subdivisions in New Zealand. Currently, the cost of fuel remains affordable to support these developments. However, as New Zealand experiences increasing fuel costs and potential fuel price spikes, these car-centric subdivisions may not be sustainable (Thull, 2012). The residential location of the subdivisions (often many kilometres away from employment) and physical layout do not lend themselves for adaptation to more sustainable transport modes, such as bus rapid transit, cycle lanes and rail links.

2.4.4. Vehicle Efficiency and Travel Patterns

There is a small body of research which supports the notion that increases in vehicle efficiency allow motorists to travel greater distances for the same dollar outlay. This is widely known as the rebound effect (Small & Dender, 2007). Research in support of the rebound effect states the fuel savings are minimal and moreover, exacerbate existing issues such as traffic congestion.

However, a comprehensive study by Small and Dender (2007) from the United States questions the significance of the rebound effect. Indeed, whilst their research recognises the existence of this effect, it was suggested the effect was limited. The research found the current rebound effect was not large and that it decreased over time. Furthermore, it was hypothesized the rebound effect will continue to decrease and thus improvements in fuel efficiency will result in lower fuel consumption (Small & Dender, 2007).

2.5. Transportation Demand Management

2.5.1. Introduction

Transportation Demand Management (TDM) refers to various strategies that change travel behaviour including how, when and where people travel. The purpose of TDM is to increase transport system efficiency and achieve specific planning objectives (Victoria Transport Policy Institute, 2010). This section examines transportation demand management (TDM) and focuses on a number of significant TDM strategies which have an impact on passenger transport energy demand including, smart growth, transit orientated and location efficient development.

2.5.2. Transportation Demand Management Strategies

There are a number of TDM strategies which use various approaches to influence both travel decisions and travel patterns (Table 2). Such strategies include improving the transport options available, providing incentives to change travel mode, time or destination, improving land use

accessibility and involving transport policy reforms and new programmes that provide a foundation for TDM (Victoria Transport Policy Institute, 2010).

Table 2: Transportation demand management strategies

Improved Transport Options	**Incentives**	**Land Use Management**
• Public Transport improvements • Active mode improvements • Car sharing • Working from home	• Toll roads • Commuter financial incentives • Increased parking pricing • Pay-as-you-drive vehicle insurance	• Smart growth • Location efficient development • Transit oriented development • New urbanism • Traffic calming measures • Parking management • Car free planning

(Based on information from the Victoria Transport Policy Institute 2010)

2.5.3. Smart Growth

Smart Growth is a term used for policy which integrates transportation and land use. An example would be encouraging more compact, mixed-use development within existing urban areas and discouraging dispersed, vehicle dependent development at the urban fringe (Victoria Transport Policy Institute, 2012). The purpose is to create more accessible land use patterns and improve transport options, as well as achieve other land use objectives such as limiting urban sprawl (Victoria Transport Policy Institute, 2011).

Critics of Smart Growth policies such as urban growth boundaries argue that such policy can increase development cost and therefore reduce housing affordability (National Center for Public Policy Research, 2002). However, the negative impacts of Smart Growth are often exaggerated as a reduction in the supply of green-field land available for development is another factor affecting housing affordability (Nelson and Nygaard Consulting, 2002). Other factors effecting affordability include land devoted to gardens, building type (single vs. multi-storey), housing size and land devoted to parking and roads (Nelson and Nygaard Consulting, 2002).

2.5.4. Transit Orientated Development

Another TDM strategy and potential solution to transport energy demand is Transit Oriented Development (TOD). TOD refers to residential and commercial centres which are designed to maximize access by public transport and non-motorised transportation and include additional features to encourage public transport ridership (Centre For Transit Orientated Development, 2011).

A typical TOD has a rail or bus station at its centre surrounded by relatively high-density development, with progressively lower-density development spreading outwards between half and

three quarters of a kilometre. The purpose is to use distances which are quickly and easily walked or cycled by pedestrians (Renne, 2009). The aim of TOD is to transport a significant number of people using mass transit as opposed to individual modes such as the passenger vehicle (Thull, 2012). An example of this would be the development of a mass transit corridor utilising the existing rail link between Rangiora Township and Central Christchurch.

TOD using the Main North Line would involve developing stations at Styx Mill and Riccarton with the Styx Mill station also serving the Northwood Shopping Centre. New housing and employment facilities would be developed on land between Styx Mill and Kaiapoi and Kaiapoi and Rangiora. The housing and employment facilities would be developed as close to the rail line as is feasible to ensure access via non-motorised modes. As areas developed along the line, additional stations would be added to ensure each area was as close as possible to the transit corridor (See Appendix 8.13 for map of Greater Christchurch).

There are a number of attributes which help to achieve and also define a transit orientated development (Column 1 - Table 3). However, there are also a number of attributes which help to identify transit adjacent development (Column 2 - Table 3). Transit adjacent development (TAD) is conventional suburbia located near to transit stations. In some instances they are touted as transit orientated developments.

Table 3: Attributes of transit orientated and transit adjacent development

Transit Orientated Development	**Transit Adjacent Development**
• Grid street pattern • Higher densities • Limited surface parking and efficient parking management • Pedestrian and bicycle oriented design • Mixed housing types, including multi-family • Horizontal (side-by-side) and vertical (within the same building) • mixed use office and retail, particularly on main streets	• Suburban street pattern • Lower densities • Limited pedestrian and cycling access • Mainly single-family homes • Segregated land uses • Petrol stations, car dealerships, drive-through stores and other passenger vehicle focused land uses

(Based on information from Renne 2009)

2.5.5. Location Efficient Development

Location Efficient Development (LED) consists of locating residential and commercial centres in areas designed to maximize accessibility and overall affordability (Centre For Transit Orientated Development, 2010). LED requires close proximity to first-rate transit and public services and includes

walking and cycling facilities as well as other features which reduce passenger vehicle dependency (Victoria Transport Policy Institute, 2010).

Location efficient development often involves projects to redevelop inner-city neighbourhoods or converting older industrial buildings to loft apartments commonly referred to as urban infill. In addition, it may also include measures to group activities and services together into commercial centres. Research has shown that residents and employees in LED areas generally drive fewer kilometres and utilise alternative forms of transportation (Victoria Transport Policy Institute, 2012).

In addition, research has shown that household transportation expenditure is likely to be lower for residents in LED areas. This is most evident in cities where a higher level of transit ridership occurs as opposed to residents of more vehicle dependent cities (Litman, 2006). Furthermore, households in more passenger vehicle dependent communities spent on average 20% more of the household budget on transportation than those in communities with more diverse transportation systems (McCann, 2000). This leads to improved residential economic resilience, including the ability to respond to unexpected financial burdens such as fuel price increases (Victoria Transport Policy Institute, 2010).

2.6. Urban Environment

2.6.1. Introduction

This section examines the urban environment, focusing on the effects of urban density and urban layout on energy demand.

2.6.2. Urban Environment

The urban environment provides the framework for the location of housing, employment and other services such as education, health and leisure facilities. Urban environment would appear to be intrinsically linked with energy demand. This is reflected in the growing body of research focused on understanding the relationship between the urban environment and energy demand as efforts to attain sustainable energy demand are increasingly sought, yet prove difficult to achieve.

This topic is of relevance as the percentage of the population residing in urban and suburban areas continues to increase (Hickman & Banister, 2007). This has been witnessed though a dramatic increase in suburban expansion in New Zealand, with 86 percent of the population living in towns and cities; the majority residing in suburban housing (Te Ara - The Encyclopedia of New Zealand, 2011).

2.6.3. Urban Density and Energy Demand

One of the most debated subjects in the field of the urban environment is the relationship between urban density and energy demand. The concept of a high density urban environment is based around

an increased number of households and associated destinations in any given area. Research suggests low density and high density urban environments generate different travel behaviours and as a direct result different energy demands. A large proportion of the research assumes that persons living in low density areas are reliant on passenger transport modes and persons living in high density areas would have access to satisfactory public transport.

There is no overall consensus as to how the urban environment can be structured and whether it is possible or indeed, should be structured to reduce travel demand (Hickman & Banister, 2007). It is impossible to imagine that complete control of the urban environment (centred on the reduction of transportation energy demand) would be possible to implement given any government's unwillingness to adopt extreme and unpopular measures. It is this unwillingness to adopt unpopular measures which has allowed the progression of low density areas, commonly referred to as urban sprawl.

2.6.4. Urban Sprawl and Urban Layout

Urban sprawl is a major issue for sustainable development (European Environment Agency, 2011). It represents a significant contribution to the transport energy demand of an area due to greater spatial separation of activities, resulting in an increase in distances travelled and thus energy demand (Marique & Reiter, 2011).

However, transport energy demand is little considered when assessing the viability of a future residential or commercial development. Suburban residential neighbourhoods, which constitute the majority of urban sprawl, are mainly composed of detached housing often located many kilometres from the main urban centres. As a result, car ownership is often high and public transport is generally less available, favouring and in many cases encouraging the use of passenger vehicles.

Due to the availability of land and a small population, the design and layout of New Zealand cities has traditionally embraced urban sprawl including the quarter acre section (Thull, 2012). This has led to one of the highest vehicle ownership rates per 1000 people in the OECD. Moreover, there is a continued drive towards residential development in areas where no existing facilities exist, such as the fringe of the city and the surrounding countryside, making it economically unfeasible to provide public transport.

2.7. Policy and Legislation

2.7.1. Introduction

This section examines the most significant national, regional and local policy and legislation relating to passenger transport energy demand relative to residential location in New Zealand. This includes, the statutory framework for land-use planning, largely contained within the Resource Management Act (1991) and the Land Transport Management Act (2003) which sets out requirements for the

operation, development and funding of the land transport system. Other legislation such as the Local Government Act (2002) also contains requirements local Government must meet in planning and carrying out its functions (New Zealand Transport Agency, 2011).

2.7.2. National Policy

There are numerous pieces of legislation which guide land transport planning in New Zealand at a national level, the most significant being The Resource Management Act (RMA) 1991 (New Zealand Transport Agency, 2011). The RMA provides for a hierarchy of policy statements and plans. At a national level, national environmental standards and national policy statements can be prepared (Environmental Defence Society, 2012). The purpose of the RMA is to manage the use, development and protection of natural and physical resources in a way, or at a rate, that enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety (New Zealand Government, 2003). The Act sets out the functions, powers and duties of local government and the resource consent and designation process (Ministry of Transport, 2008).

However, the RMA does not include specific land transport and transport energy legislation. An example is the absence of transportation demand management systems such as transit orientated and location efficient development. The only reference in the RMA with regard to energy from a transport or land planning perspective is part 2 - section 7 – Point (ba)

"In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to:

(ba) the efficiency of the end use of energy"

Regulation specific to passenger transport energy and land-use would need to be included in a national policy statement which would in turn be enforced by the Resource Management Act.

National policy statements (NPS) are instruments available under the RMA to help local government decide how competing national benefits and local costs should be balanced (Ministry for the Environment, 2012). An example of an NPS is the New Zealand Coastal Policy Statement (NZCPS). The purpose of the NZCPS is to state policies in order to achieve the purpose of the Act in relation to the coastal environment of New Zealand (Department of Conservation, 2010). The NZCPS contains a number of objectives and policies in order to achieve these objectives. An example is Policy 7 which focuses on strategic planning, including the location of residential subdivisions.

Policy 7- Strategic planning

(1) In preparing regional policy statements, and plans:

(a) Consider where, how and when to provide for future residential, rural residential, settlement, urban development and other activities in the coastal environment at a regional and district level, and:

(b) Identify areas of the coastal environment where particular activities and forms of subdivision, use and development:

(i) Are inappropriate; and

(ii) May be inappropriate without the consideration of effects through a resource consent application, notice of requirement for designation or Schedule 1 of the Act process; and provide protection from inappropriate subdivision, use, and development in these areas through objectives, policies and rules.

(2) Identify in regional policy statements, and plans, coastal processes, resources or values that are under threat or at significant risk from adverse cumulative effects. Include provisions in plans to manage these effects. Where practicable, in plans, set thresholds (including zones, standards or targets), or specify acceptable limits to change, to assist in determining when activities causing adverse cumulative effects are to be avoided.

Addressing the issue of passenger transport energy demand relative to residential location requires specific policy to help mitigate its effects. Whilst it would be possible to develop a new NPS, perhaps the most appropriate method of instigating this particular policy would be via inclusion in the Urban Design National Policy Statement (currently under development). An objective would contain the broad principles for example:

Hypothetical Objective

To ensure that key stakeholders, including planners and decision makers recognise the importance of energy demand in relation to residential location when considering the approval of residential sub-divisions and urban development.

The supporting policy would include:

Hypothetical Policy

(1) In preparing regional policy statements, and plans:

(a) Regional Policy Stakeholders must calculate and include the methods used to calculate passenger transport energy demand relative to residential location for the proposed sub-division or urban development

(b) Where appropriate use Transportation Demand Management Systems, including (but not limited to) Transit Orientated Development and Location Efficient Development.

(c) Where practicable, in plans, set thresholds (including zones, standards or targets), or specify acceptable limits to change and to assist in determining when activities causing adverse cumulative effects with regard to energy demand are to be avoided.

The example hypothetical objective and policy would force the adoption of these measures (through the RMA) in regional and district plans including, regional land transport and urban development strategies ensuring that energy demand relative to residential location is a significant factor in the acceptability of any proposed residential sub-division and urban development.

2.7.3. Regional Policy

At a regional level, the RMA requires compulsory Regional Policy Statements. In the context of transport and land-use planning, the Regional Policy Statements are influenced by the Land Transport Management Act (2003). The Land Transport Management Act (LTMA) requires the development of Regional land transport strategies. Regional Land Transport Strategies (RLTS) set the strategic direction for land transport within a region such as Canterbury or the Bay of Plenty over a 30 year period and are prepared under the requirements of the Land Transport Management Act 2003 (Bay of Plenty Regional Council, 2011). The role of RLTS is to contribute towards the New Zealand Government's overall vision of achieving an integrated, safe, responsive and sustainable land transport system (Environment Canterbury, 2012). The RLTS is designed to identify the region's transport needs and the roles of all land transport modes and how planning, engineering, education, encouragement and enforcement methods are to be utilised to provide for the future land transport system (Bay of Plenty Regional Council, 2011).

Despite strategies such as those for the Canterbury and Bay of Plenty regions acknowledging a number of relevant issues including, oil supply security and volatility of fuel prices, reducing the vehicle kilometres travelled in single occupancy vehicles, reducing the average distance of journeys to employment and increasing residential densities in regional growth areas; both the Canterbury and Bay of Plenty strategies indicate that the majority of funding for land-use and transport will be directed toward the road network.

2.7.4. Local Policy

There are a number of non-statutory documents which exist at local level to guide land-use and transport planning. Examples include the Greater Christchurch Urban Development Strategy (UDS) and the Bay of Plenty Smart Growth Strategy. Such documents represent broad scale, long term land-use strategies prepared under the Local Government Act (2002). Strategies are implemented through Regional Policy Statements and Regional Land Transport Strategies as well as district plans (Ministry for the Environment, 2008). Strategies are traditionally developed for specific areas for instance, a city or a district or a unitary authority. However, to enable better planning and overcome the shortcomings of some individual strategies, for instance those in the Christchurch, Waimakariri and Selwyn districts (North Canterbury), a combined strategy was developed. This was to aid amongst other issues, integrated land-use and transport planning between Christchurch City and the commuter satellite towns located in the Waimakariri and Selwyn districts. Despite the documents being non-statutory, recent work by Wessels (2007) finds that such documents play an important role in creating links between the three urban planning statutes in New Zealand; the RMA, LGA and LTMA.

2.8. Summary

The efficiency of the light vehicle fleet has a direct impact on fuel consumption and thus energy demand. There is undoubtedly room for improvement with regard to the fuel efficiency of the New Zealand light vehicle fleet. A realistic solution to increase vehicle efficiency would be through the introduction of more stringent emissions standards for used imported vehicles. This would not only improve vehicle efficiency through the adoption of smaller engines and new technology, but in addition provide safety and environmental benefits. The Government, upon its next review of emissions standards in 2014, should aim to update the standard to Euro 5 for used imported vehicles. The emissions standards for new vehicles could be matched with that of the European Union. The standards for used vehicles should be continually updated to ensure they are only marginally behind that of the new vehicle emissions standards. This would ensure the age of the New Zealand vehicle fleet remains on par with other OECD nations and there is no opportunity for the fleet to once again amass a large percentage of old and inefficient vehicles.

The replacement of the New Zealand fleet with alternative technology vehicles, for instance hybrid and electric vehicles is currently unrealistic due to the purchase cost. Unless the Government introduces significant subsidies such as those provided in other countries, it is unlikely alternative vehicles will become the mainstay of the New Zealand light vehicle fleet.

It is not only vehicle efficiency which has the potential to influence the energy demand of the light vehicle fleet, but also vehicle kilometres travelled. There are numerous factors which influence vehicle kilometres travelled (VKT), for instance the price of fuel and this is reflected in the decrease in VKT over the previous decade as fuel prices increased. New Zealand cannot influence the price of fuel

and as a result needs to implement solutions to help decrease vehicle kilometres travelled and thus, fuel usage.

The literature finds that VKT may be reduced through improved land-use and urban design, for instance, residential developments being located near to employment and necessary services. A key element would be the adoption of transportation demand management strategies including transit orientated and location efficient development. This is one solution over which the Government can exert control as car-centric land-use is not sustainable in the long term. However, in order to successfully implement such ideas, the Government will need to incorporate such strategies into policy and legislation such as the Resource Management Act.

3. METHODOLOGY

3.1. Introduction

This chapter examines the datasets, data processing applications and data analysis application specifically developed for this research. It provides an overview of the most significant application logic, application testing and Geographical Information Systems mapping used within the research.

3.2. Datasets

3.2.1. Introduction

This section provides an overview of the two key datasets; the warrant of fitness and electoral residential address datasets.

3.2.2. Warrant of Fitness Dataset

The warrant of fitness data were extracted from a dataset provided by The New Zealand Transport Agency. The dataset provided the odometer, vehicle engine capacity and vehicle age data. Although, the dataset contained a vast array of information, a significant proportion was not relevant for the purposes of this research. This included columns such as vehicle colour and wheel size. Unfortunately, columns which may have proved useful, for instance, urban and extra urban fuel consumption were significantly incomplete with less than 5% of the appropriate information recorded.

Table 4: Source for the warrant of fitness (WoF) dataset

Source	Procured from The New Zealand Transport Agency
Updated	11/07/2012

3.2.3. Residential Address Dataset

A significant quantity of the residential address data within the warrant of fitness (WoF) dataset was incomplete and thus unusable in its current form for this research. It required correction, not only for data integrity purposes but also to allow the residential address information to be geo-tagged so the output from the data processing and analysis applications could be displayed using Geographical Information Systems (GIS) mapping. The electoral residential address (ERA) data were extracted from a dataset provided by Land Information New Zealand (LINZ). The dataset is used for electoral purposes by the New Zealand Electoral Commission, thus it is one of the most accurate residential address datasets in New Zealand.

Table 5: Source for the electoral residential address (ERA) dataset

Source	http://data.linz.govt.nz/#/layer/779-nz-street-address-electoral/
Updated	07/07/2012

3.3. Data Processing Applications

3.3.1. Introduction

This section examines the data processing applications specifically developed for this research to process the warrant of fitness data for use by the data analysis application. It provides background information on why the applications were required, including problems encountered and focuses on the functionality of the data processing applications.

3.3.2. Background

Eight data processing applications were developed to process the warrant of fitness and Electoral Residential Address datasets provided by the New Zealand Transport Agency and Land Information New Zealand. The rationale behind the development of the applications was as follows. The Warrant of Fitness dataset comprised over 45 million records with each record containing more than 50 columns of associated information. Due to the required data processing functionality and volume of data under analysis, it was not possible to undertake the required data extraction with *off the shelf* applications such as Microsoft Excel or Microsoft Access.

Each data processing application was designed to perform a simple task efficiently and accurately. Whilst it would have been possible to combine the eight individual applications, the use of multiple applications allowed the logic and code to be separated into smaller sections, decreasing the chance of bugs and errors.

Each application requires an import file/s and produces an output file/s. Data processing application one uses the tab delimited warrant of fitness dataset files. All other data processing applications use files from the preceding data processing application. For example, data processing application six will use the output files from data processing application five. The only exception to this rule is application four which uses the files from application three and also an additional file with residential address information.

The need for several of the data processing applications would be removed had the addresses in the warrant of fitness dataset been correct and geo-tagged. Furthermore, this would have removed the need for the most complex and time consuming data processing applications.

3.3.3. Functionality

Application 1

Application 1 combines all the warrant of fitness tab delimited text files into one tab delimited text file. All text is converted to lower case for data matching purposes by other data processing applications.

Application 2

Application 2 extracts records for passenger (non-commercial) vehicles less than 3500kg. The required vehicles are recorded as *individual* in the Warrant of Fitness dataset. This application removes significant quantities of unwanted information before more complex tasks are performed, allowing the remaining applications to run with greater efficiency.

Application 3

Application 3 extracts records for vehicles where the odometer reading units are in kilometres. If the odometer units are in miles then the reading is converted to kilometres. Records with null or where the unit of distance is unknown are not extracted. The following value is used when converting miles in kilometres: 1 mile = 1.609344 kilometres

Application 4

Application 4 displays the unique cities and towns provided in the warrant of fitness dataset; in many instances incorrect. In addition, it also displays the unique cities and towns in the electoral residential address dataset. The purpose of the application is to allow the user to select all of the incorrect city and town names from the warrant of fitness dataset for instance *Chistchurch* or *ChristchyrchCity* and replace them with the official name from the electoral residential address dataset for example *Christchurch City*.

Application 5

Application 5 matches and corrects the warrant of fitness address information. This is achieved by comparing the addresses from the chosen areas in Application 4 against the official address in the electoral residential address dataset. All matched warrant of fitness addresses are replaced by the official electoral address. In addition, the corrected addresses are geo-tagged, facilitating the creation of geographical information systems mapping using the data from the data analysis application.

Application 6

Application 6 identifies the earliest warrant of fitness odometer reading for each vehicle for each available year. This is necessary as Application 7 requires only one warrant of fitness odometer reading for each vehicle per year. In addition, application 6 removes any miscellaneous characters in the odometer readings for example, spaces and commas.

Application 7

Application 7 calculates the average vehicle kilometres travelled over a 12 month period for each vehicle. This is automatically calculated for all years. One file is created for every year available for each city or town required.

Application 8

Application 8 checks and removes the incorrect vehicle kilometres travelled calculations in all Application 7 files. It removes negative, zero and records with greater than 60,000 kilometres travelled annually. Incorrect values are calculated in Application 7 from data which has been incorrectly entered and not removed by the New Zealand Transport Agency.

3.4. Data Analysis Application

3.4.1. Introduction

This section examines the data analysis application specifically developed for this research and focuses on application functionality, logic and testing.

3.4.2. Background

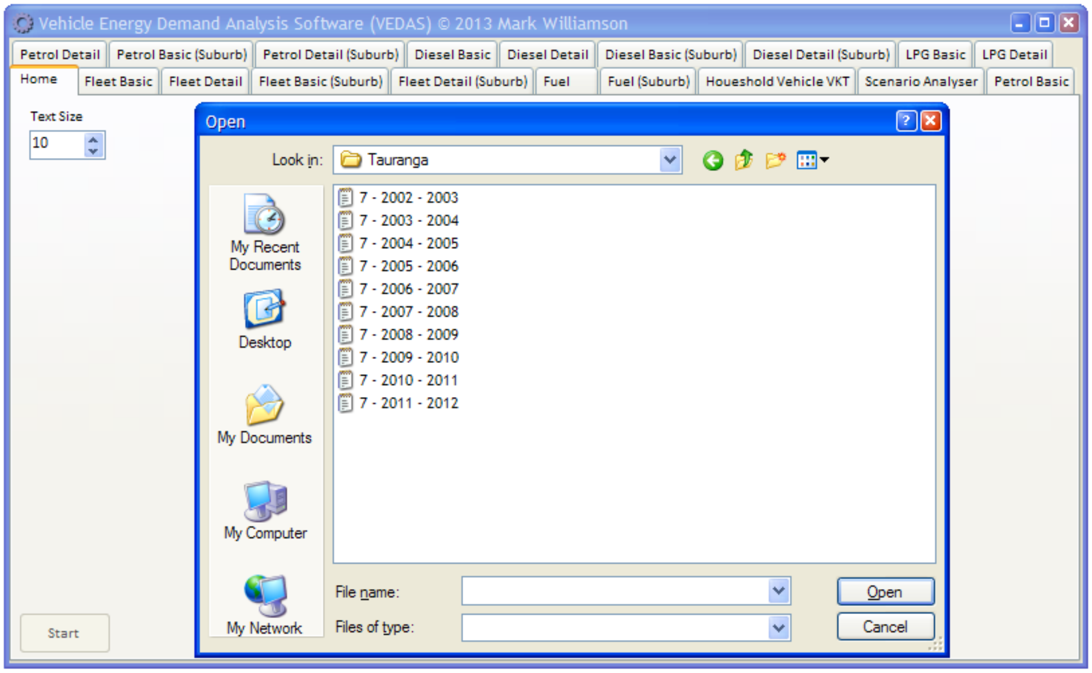
An application was required to analyse the data from the data processing applications. The result was a specifically designed data analysis application; Vehicle Energy Demand Analysis Software (VEDAS).VEDAS uses the files output by data processing application eight and produces a range of data which may be exported and used in tables, graphs and Geographical Information Systems mapping to help visualise the findings presented in the analysis.

3.4.3. Functionality

The functionality of VEDAS is provided through a number of tabs. The tabs are explained in the following pages.

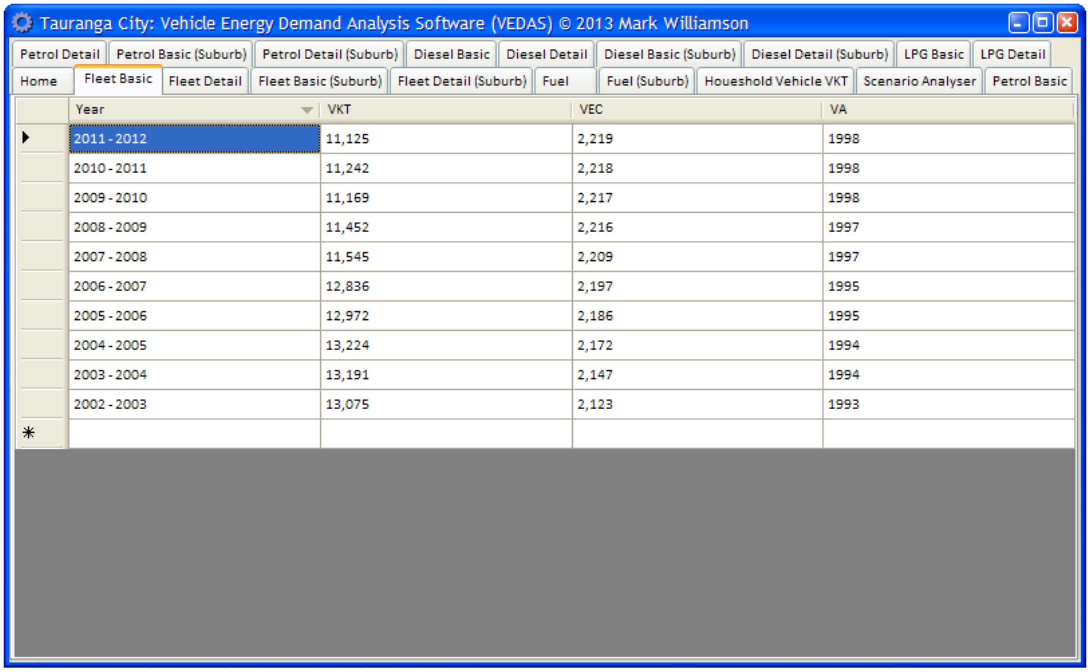
Home

The user loads files from data processing application eight. Each file represents one year for one city or commuter town. The user may alter the application text size to suit their personal preference. In addition, the application may be sized (maximised, minimised or customised), aiding the copying of data from the tables into other software such as Microsoft Word and Microsoft Excel.



Fleet Basic

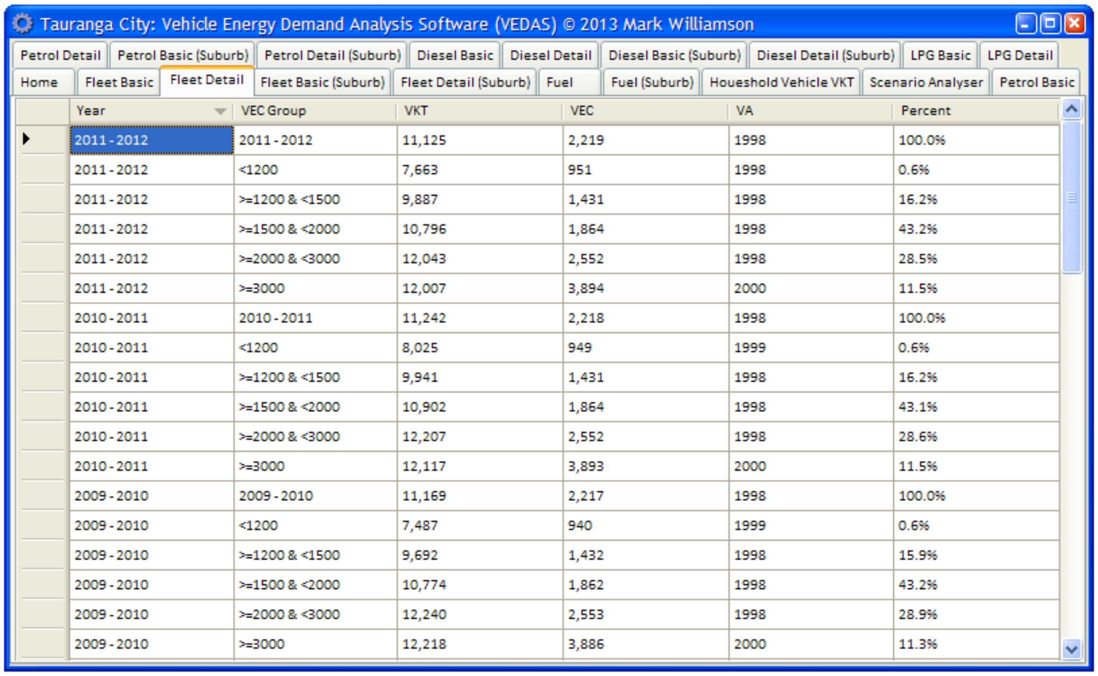
Displays a table containing the average vehicle kilometres travelled, vehicle engine capacity and vehicle age for all years (all files) loaded. The data is automatically sorted in descending order by year. The functionality provided in the Fleet Basic tab is also provided individually for petrol, diesel and LPG vehicles in the Petrol Basic, Diesel Basic and LPG Basic tabs.



Year	VKT	VEC	VA
2011 - 2012	11,125	2,219	1998
2010 - 2011	11,242	2,218	1998
2009 - 2010	11,169	2,217	1998
2008 - 2009	11,452	2,216	1997
2007 - 2008	11,545	2,209	1997
2006 - 2007	12,836	2,197	1995
2005 - 2006	12,972	2,186	1995
2004 - 2005	13,224	2,172	1994
2003 - 2004	13,191	2,147	1994
2002 - 2003	13,075	2,123	1993

Fleet Detail

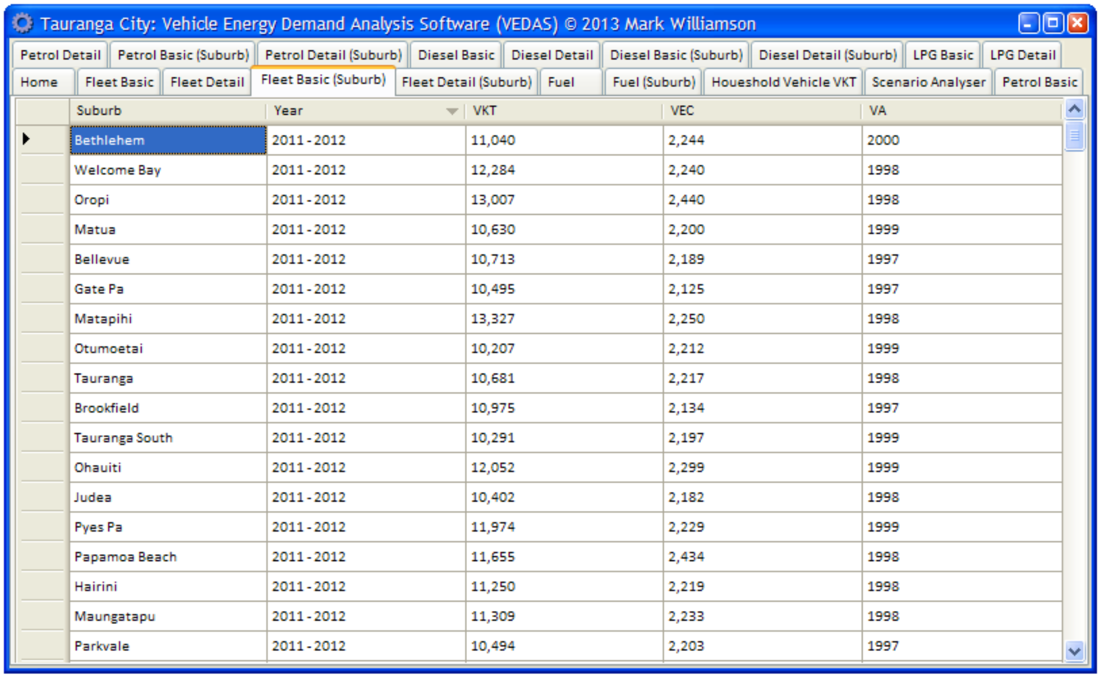
Displays a table containing the average vehicle kilometres travelled, vehicle engine capacity and vehicle age for all years (all files) loaded. The information is categorised by vehicle engine capacity and the percentage of vehicles in each category is displayed accordingly. The data is automatically sorted in descending order by year. The functionality provided in the Fleet Detail tab is also provided individually for petrol, diesel and LPG vehicles in the Petrol Detail, Diesel Detail and LPG Detail tabs.



Year	VEC Group	VKT	VEC	VA	Percent
2011 - 2012	2011 - 2012	11,125	2,219	1998	100.0%
2011 - 2012	<1200	7,663	951	1998	0.6%
2011 - 2012	>=1200 & <1500	9,887	1,431	1998	16.2%
2011 - 2012	>=1500 & <2000	10,796	1,864	1998	43.2%
2011 - 2012	>=2000 & <3000	12,043	2,552	1998	28.5%
2011 - 2012	>=3000	12,007	3,894	2000	11.5%
2010 - 2011	2010 - 2011	11,242	2,218	1998	100.0%
2010 - 2011	<1200	8,025	949	1999	0.6%
2010 - 2011	>=1200 & <1500	9,941	1,431	1998	16.2%
2010 - 2011	>=1500 & <2000	10,902	1,864	1998	43.1%
2010 - 2011	>=2000 & <3000	12,207	2,552	1998	28.6%
2010 - 2011	>=3000	12,117	3,893	2000	11.5%
2009 - 2010	2009 - 2010	11,169	2,217	1998	100.0%
2009 - 2010	<1200	7,487	940	1999	0.6%
2009 - 2010	>=1200 & <1500	9,692	1,432	1998	15.9%
2009 - 2010	>=1500 & <2000	10,774	1,862	1998	43.2%
2009 - 2010	>=2000 & <3000	12,240	2,553	1998	28.9%
2009 - 2010	>=3000	12,218	3,886	2000	11.3%

Fleet Basic (Suburb)

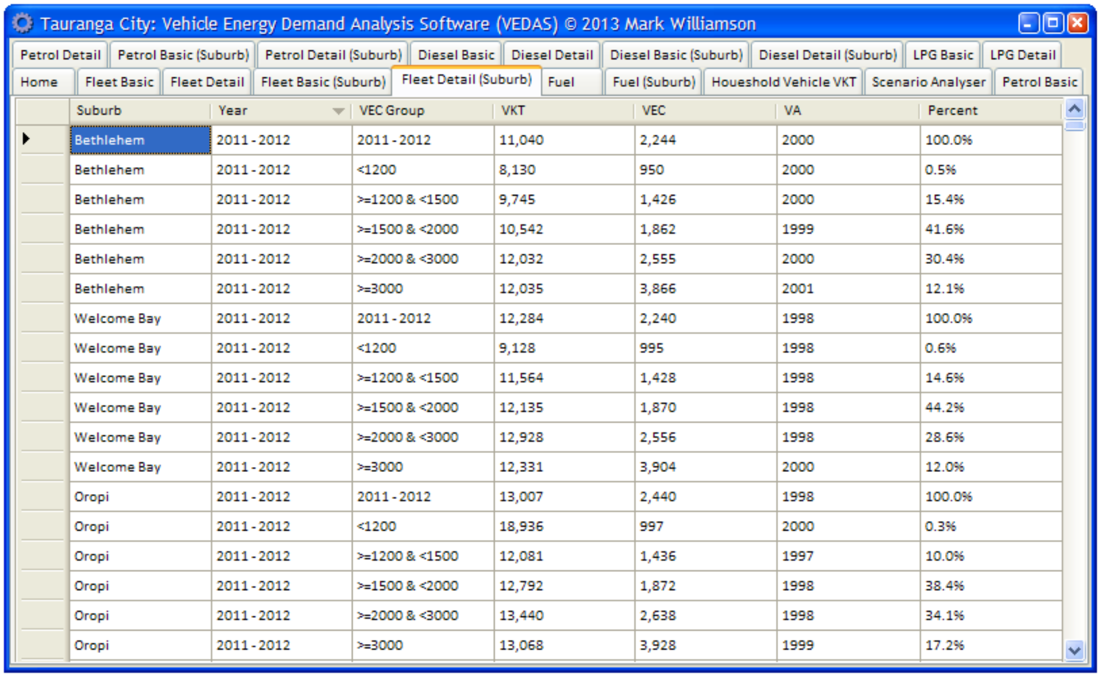
Displays a table containing the average vehicle kilometres travelled, vehicle engine capacity and vehicle age for each suburb and for all years (all files) loaded. Suburb information is only available for cities (not towns). The data is automatically sorted in descending order by year. The functionality provided in the Fleet Basic (Suburb) tab is also provided individually for petrol, diesel and LPG vehicles in the Petrol Basic (Suburb), Diesel Basic (Suburb) and LPG Basic (Suburb) tabs.



Suburb	Year	VKT	VEC	VA
Bethlehem	2011 - 2012	11,040	2,244	2000
Welcome Bay	2011 - 2012	12,284	2,240	1998
Oropi	2011 - 2012	13,007	2,440	1998
Matua	2011 - 2012	10,630	2,200	1999
Bellevue	2011 - 2012	10,713	2,189	1997
Gate Pa	2011 - 2012	10,495	2,125	1997
Matapihi	2011 - 2012	13,327	2,250	1998
Otumoetai	2011 - 2012	10,207	2,212	1999
Tauranga	2011 - 2012	10,681	2,217	1998
Brookfield	2011 - 2012	10,975	2,134	1997
Tauranga South	2011 - 2012	10,291	2,197	1999
Ohauiti	2011 - 2012	12,052	2,299	1999
Judea	2011 - 2012	10,402	2,182	1998
Pyes Pa	2011 - 2012	11,974	2,229	1999
Papamoa Beach	2011 - 2012	11,655	2,434	1998
Hairini	2011 - 2012	11,250	2,219	1998
Maungatapu	2011 - 2012	11,309	2,233	1998
Parkvale	2011 - 2012	10,494	2,203	1997

Fleet Detail (Suburb)

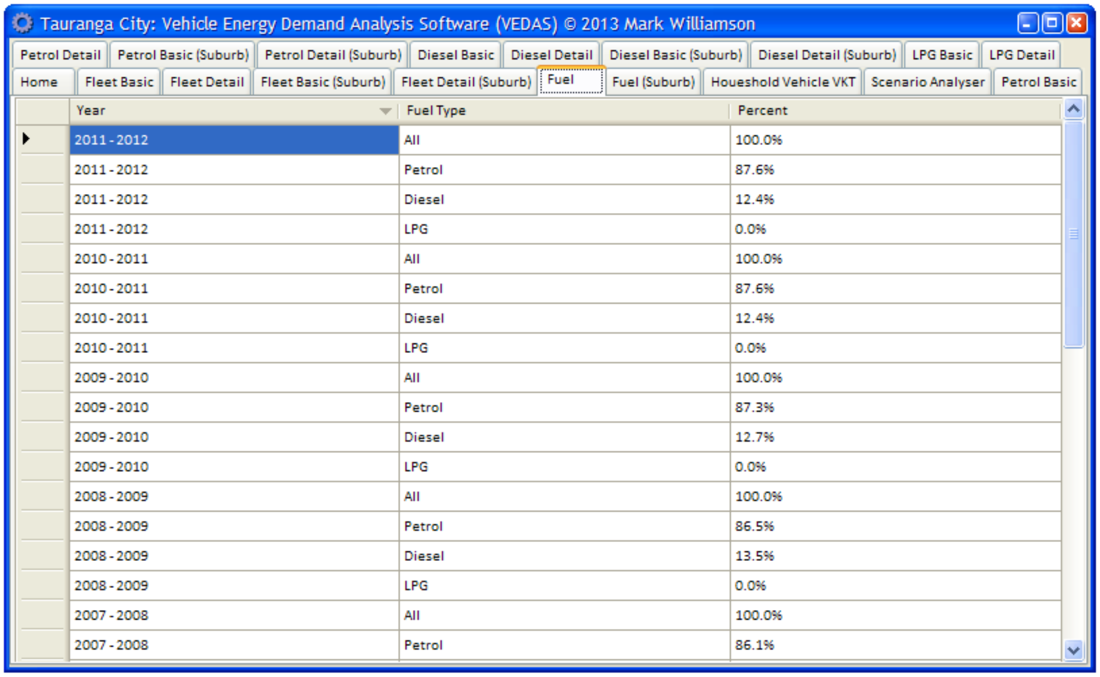
Displays a table containing the average vehicle kilometres travelled, vehicle engine capacity and vehicle age for each suburb and for all years (all files) loaded. The information is categorised by vehicle engine capacity and the percentage of vehicles in each category is displayed accordingly. Suburb information is only available for cities (not towns). The data is automatically sorted in descending order by year. The functionality provided in the Fleet Detail (Suburb) tab is also provided individually for petrol, diesel and LPG vehicles in the Petrol Detail (Suburb), Diesel Detail (Suburb) and LPG Detail (Suburb) tabs.



Suburb	Year	VEC Group	VKT	VEC	VA	Percent
Bethlehem	2011 - 2012	2011 - 2012	11,040	2,244	2000	100.0%
Bethlehem	2011 - 2012	<1200	8,130	950	2000	0.5%
Bethlehem	2011 - 2012	>=1200 & <1500	9,745	1,426	2000	15.4%
Bethlehem	2011 - 2012	>=1500 & <2000	10,542	1,862	1999	41.6%
Bethlehem	2011 - 2012	>=2000 & <3000	12,032	2,555	2000	30.4%
Bethlehem	2011 - 2012	>=3000	12,035	3,866	2001	12.1%
Welcome Bay	2011 - 2012	2011 - 2012	12,284	2,240	1998	100.0%
Welcome Bay	2011 - 2012	<1200	9,128	995	1998	0.6%
Welcome Bay	2011 - 2012	>=1200 & <1500	11,564	1,428	1998	14.6%
Welcome Bay	2011 - 2012	>=1500 & <2000	12,135	1,870	1998	44.2%
Welcome Bay	2011 - 2012	>=2000 & <3000	12,928	2,556	1998	28.6%
Welcome Bay	2011 - 2012	>=3000	12,331	3,904	2000	12.0%
Oropi	2011 - 2012	2011 - 2012	13,007	2,440	1998	100.0%
Oropi	2011 - 2012	<1200	18,936	997	2000	0.3%
Oropi	2011 - 2012	>=1200 & <1500	12,081	1,436	1997	10.0%
Oropi	2011 - 2012	>=1500 & <2000	12,792	1,872	1998	38.4%
Oropi	2011 - 2012	>=2000 & <3000	13,440	2,638	1998	34.1%
Oropi	2011 - 2012	>=3000	13,068	3,928	1999	17.2%

Fuel

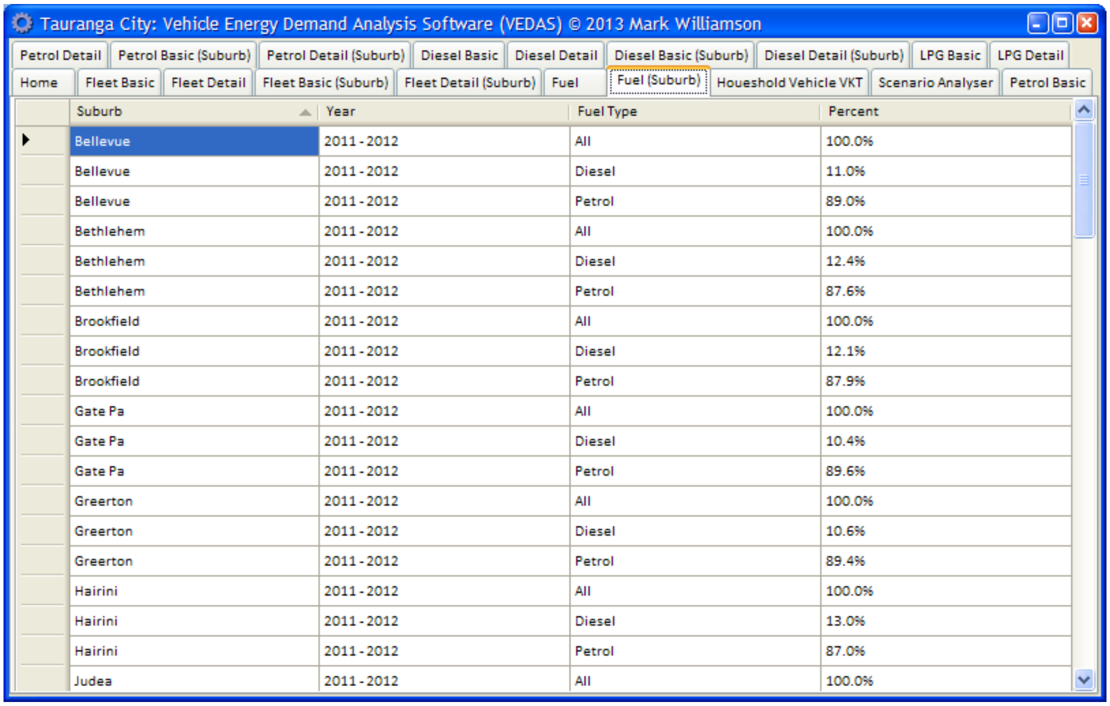
Displays a table containing the vehicle fuel type (Petrol, Diesel and LPG) and the percentage of vehicles for each fuel type. The information is shown for all years (all files) loaded and automatically sorted in descending order by year.



Year	Fuel Type	Percent
2011 - 2012	All	100.0%
2011 - 2012	Petrol	87.6%
2011 - 2012	Diesel	12.4%
2011 - 2012	LPG	0.0%
2010 - 2011	All	100.0%
2010 - 2011	Petrol	87.6%
2010 - 2011	Diesel	12.4%
2010 - 2011	LPG	0.0%
2009 - 2010	All	100.0%
2009 - 2010	Petrol	87.3%
2009 - 2010	Diesel	12.7%
2009 - 2010	LPG	0.0%
2008 - 2009	All	100.0%
2008 - 2009	Petrol	86.5%
2008 - 2009	Diesel	13.5%
2008 - 2009	LPG	0.0%
2007 - 2008	All	100.0%
2007 - 2008	Petrol	86.1%

Fuel (Suburb)

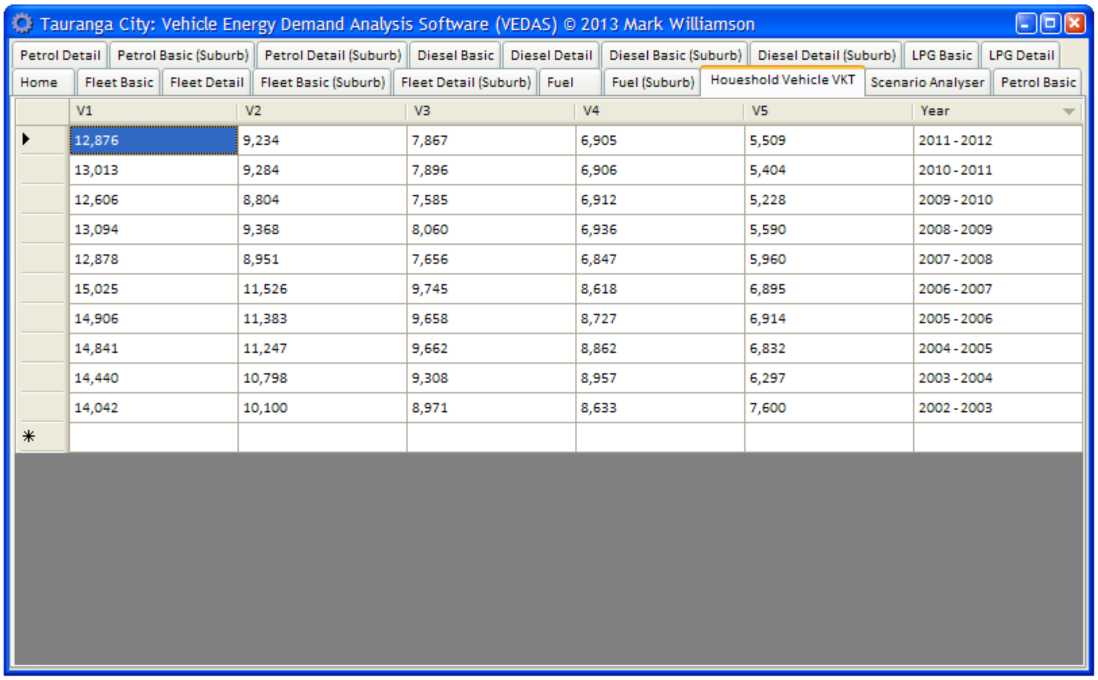
Displays a table containing the vehicle fuel type (Petrol, Diesel and LPG) and the percentage of vehicles for each fuel type. The information is displayed for each suburb and shown for all years (all files) loaded and automatically sorted in descending order by year. Suburb information is only available for cities (not towns).



Suburb	Year	Fuel Type	Percent
Bellevue	2011 - 2012	All	100.0%
Bellevue	2011 - 2012	Diesel	11.0%
Bellevue	2011 - 2012	Petrol	89.0%
Bethlehem	2011 - 2012	All	100.0%
Bethlehem	2011 - 2012	Diesel	12.4%
Bethlehem	2011 - 2012	Petrol	87.6%
Brookfield	2011 - 2012	All	100.0%
Brookfield	2011 - 2012	Diesel	12.1%
Brookfield	2011 - 2012	Petrol	87.9%
Gate Pa	2011 - 2012	All	100.0%
Gate Pa	2011 - 2012	Diesel	10.4%
Gate Pa	2011 - 2012	Petrol	89.6%
Greerton	2011 - 2012	All	100.0%
Greerton	2011 - 2012	Diesel	10.6%
Greerton	2011 - 2012	Petrol	89.4%
Hairini	2011 - 2012	All	100.0%
Hairini	2011 - 2012	Diesel	13.0%
Hairini	2011 - 2012	Petrol	87.0%
Judea	2011 - 2012	All	100.0%

Household Vehicle VKT

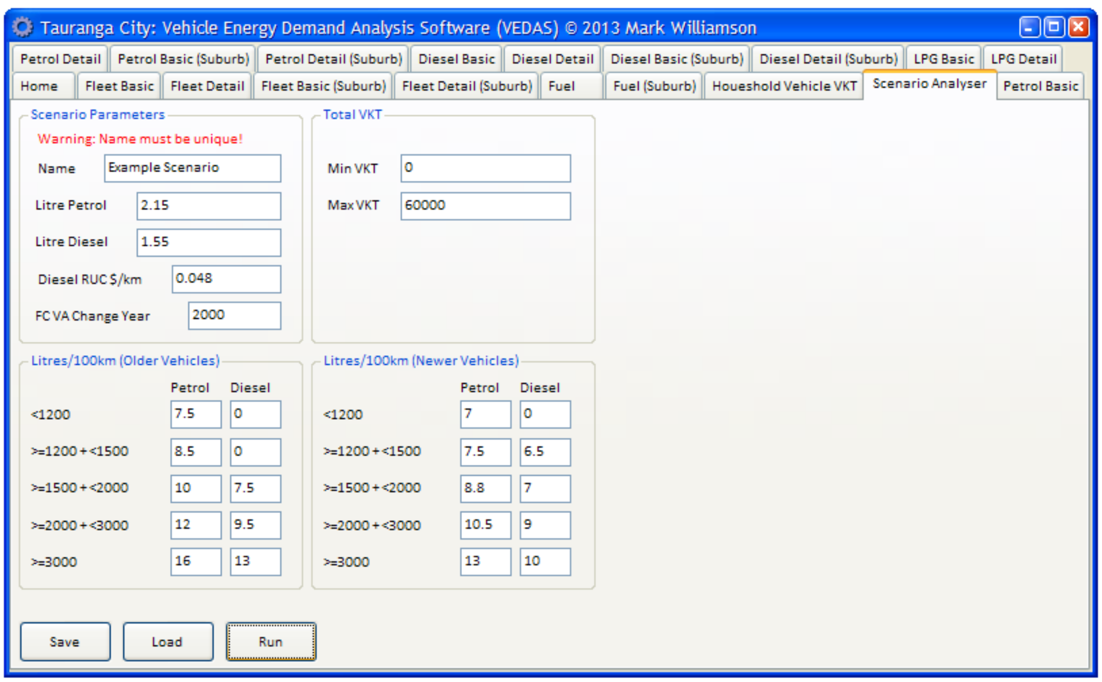
Displays a table containing the average vehicle kilometres travelled for all the vehicles within a household. For example, it provides the average vehicle kilometres travelled for the primary and secondary vehicles and potentially the average vehicle kilometres travelled for up to five vehicles. The information is sorted in descending order from vehicle one (the average vehicle kilometres travelled of the primary household vehicle) up to vehicle five (the average vehicle kilometres travelled of the least used household vehicle).The information is shown for all years (all files) loaded and automatically sorted in descending order by year.



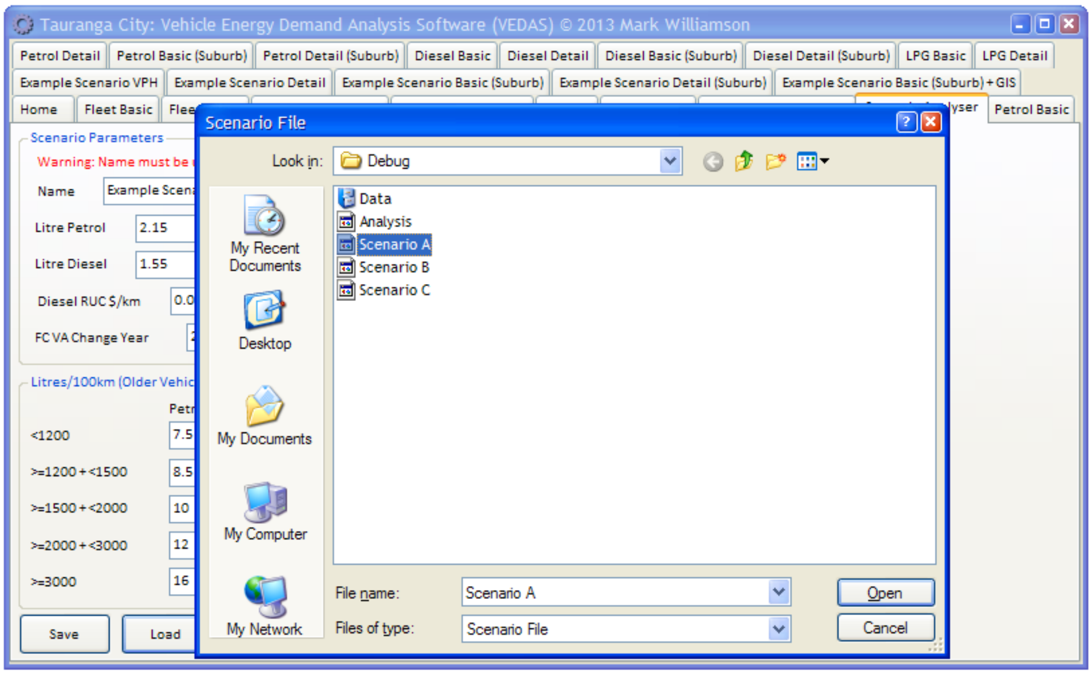
V1	V2	V3	V4	V5	Year
12,876	9,234	7,867	6,905	5,509	2011 - 2012
13,013	9,284	7,896	6,906	5,404	2010 - 2011
12,606	8,804	7,585	6,912	5,228	2009 - 2010
13,094	9,368	8,060	6,936	5,590	2008 - 2009
12,878	8,951	7,656	6,847	5,960	2007 - 2008
15,025	11,526	9,745	8,618	6,895	2006 - 2007
14,906	11,383	9,658	8,727	6,914	2005 - 2006
14,841	11,247	9,662	8,862	6,832	2004 - 2005
14,440	10,798	9,308	8,957	6,297	2003 - 2004
14,042	10,100	8,971	8,633	7,600	2002 - 2003

Scenario Analyser

The Scenario Analyser allows the user to develop a range of transport energy demand scenarios. The user inputs scenario name, petrol and diesel fuel cost, diesel road user charges and fuel consumption change year (determines the year vehicles are assigned different fuel consumption figures). In addition, the user may assign one or two sets of fuel consumption figures for each fuel type and individually for all vehicle engine capacity categories. Moreover, the user may input minimum and maximum vehicle kilometres travelled parameters. This enables the user to develop scenarios for vehicles with particular travel patterns. An example scenario would be for residents who travel a significant number of kilometres annually. This would highlight the residents who are commuting long distances and in conjunction with the Scenario Analyser results tabs make it possible to view a number of statistics for these particular vehicles. These include energy demand (fuel consumed), vehicle kilometres travelled, vehicle engine capacity, vehicle age, fuel cost, household vehicle kilometres travelled and geographical information systems coordinates (See Scenario Analyser results tabs).

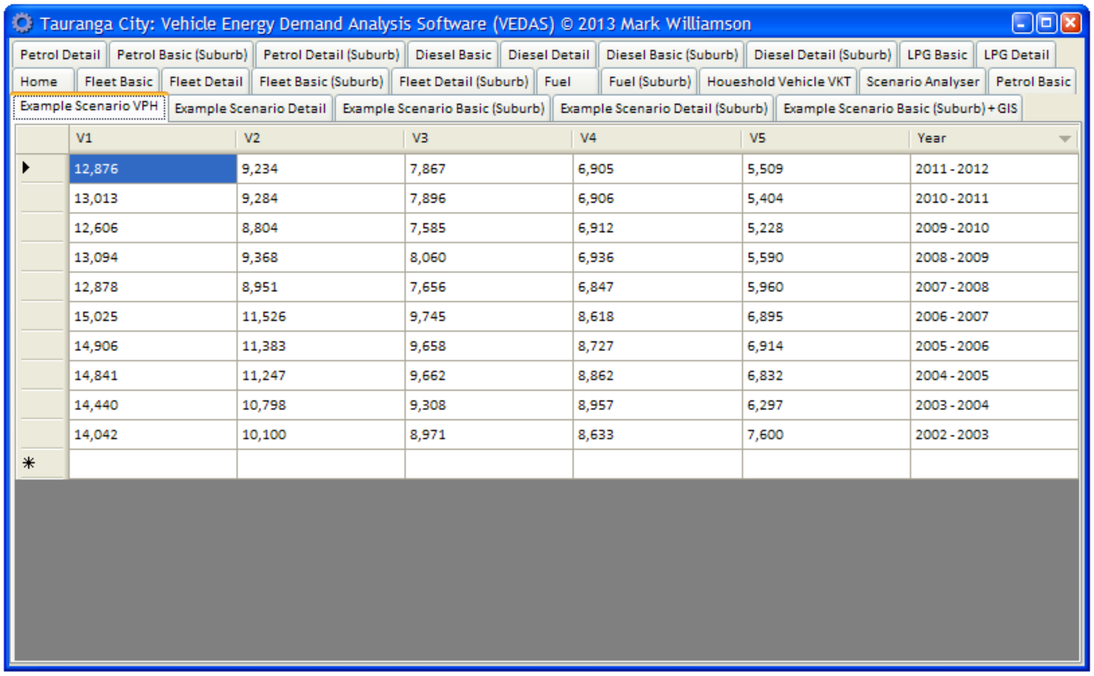


It is possible to load an existing scenario or develop a new scenario and save for future use. The scenarios are saved in a unique file format (scenario analyser file - .saf). The user may run as many scenarios as they require, provided the name of each scenario is unique. This allows the user to compare two or more scenarios for example, model the energy demand of different light vehicle fleets. For explanation purposes, the tabs have been assigned *Scenario Example* and there functional name. However, it should be noted that when the scenario analyser is running, each tab is assigned the name of the scenario and its functional name.



Scenario analyser results tab 1: Example Scenario VPH

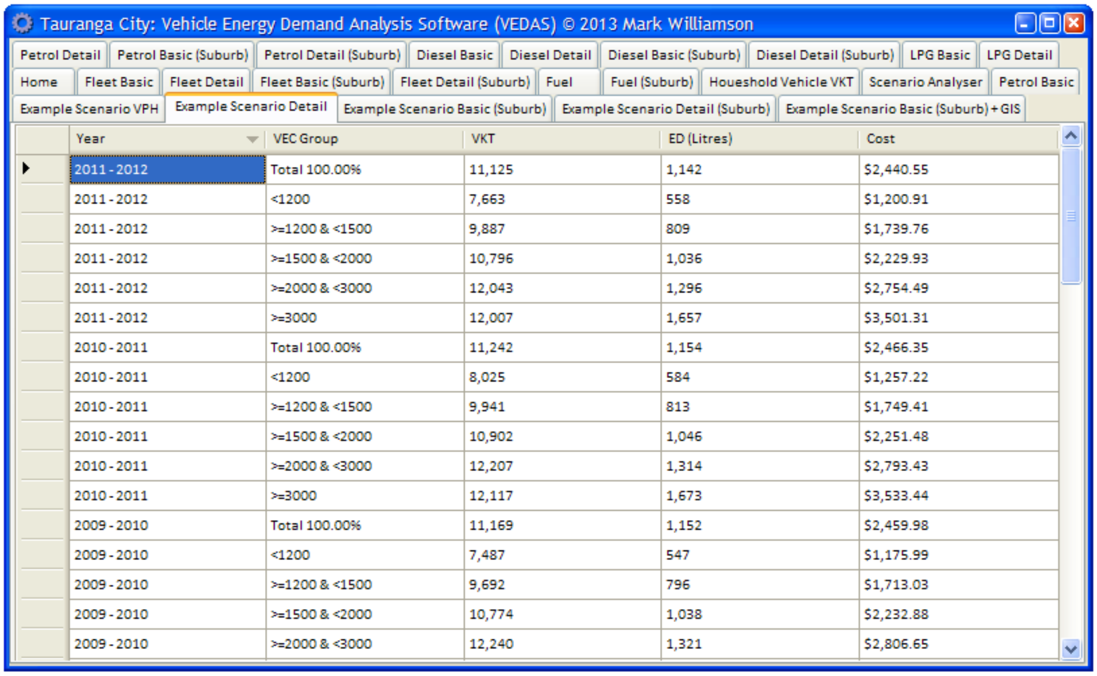
Displays a table containing the average vehicle kilometres travelled for all the vehicles within a household. For example, it provides the average vehicle kilometres travelled for the primary and secondary vehicles and potentially the average vehicle kilometres travelled for up to five vehicles. The information is sorted in descending order from vehicle one (the average vehicle kilometres travelled of the primary household vehicle) up to vehicle five (the average vehicle kilometres travelled of the least used household vehicle). The information is shown for all years (all files) loaded and automatically sorted in descending order by year.



V1	V2	V3	V4	V5	Year
12,876	9,234	7,867	6,905	5,509	2011 - 2012
13,013	9,284	7,896	6,906	5,404	2010 - 2011
12,606	8,804	7,585	6,912	5,228	2009 - 2010
13,094	9,368	8,060	6,936	5,590	2008 - 2009
12,878	8,951	7,656	6,847	5,960	2007 - 2008
15,025	11,526	9,745	8,618	6,895	2006 - 2007
14,906	11,383	9,658	8,727	6,914	2005 - 2006
14,841	11,247	9,662	8,862	6,832	2004 - 2005
14,440	10,798	9,308	8,957	6,297	2003 - 2004
14,042	10,100	8,971	8,633	7,600	2002 - 2003

Scenario analyser results tab 2: Example Scenario Detail

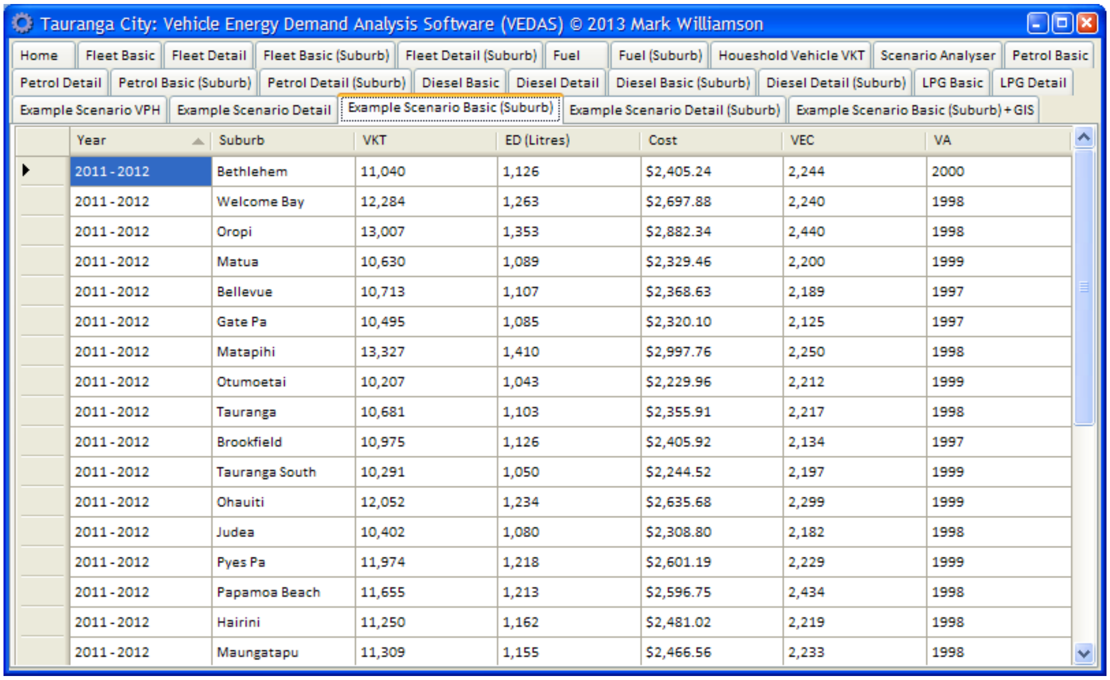
Displays a table containing the average vehicle kilometres travelled, energy demand (litres of fuel consumed) and fuel cost for all years (all files) loaded. The information is categorised by vehicle engine capacity and automatically sorted in descending order by year.



Year	VEC Group	VKT	ED (Litres)	Cost
2011 - 2012	Total 100.00%	11,125	1,142	$2,440.55
2011 - 2012	<1200	7,663	558	$1,200.91
2011 - 2012	>=1200 & <1500	9,887	809	$1,739.76
2011 - 2012	>=1500 & <2000	10,796	1,036	$2,229.93
2011 - 2012	>=2000 & <3000	12,043	1,296	$2,754.49
2011 - 2012	>=3000	12,007	1,657	$3,501.31
2010 - 2011	Total 100.00%	11,242	1,154	$2,466.35
2010 - 2011	<1200	8,025	584	$1,257.22
2010 - 2011	>=1200 & <1500	9,941	813	$1,749.41
2010 - 2011	>=1500 & <2000	10,902	1,046	$2,251.48
2010 - 2011	>=2000 & <3000	12,207	1,314	$2,793.43
2010 - 2011	>=3000	12,117	1,673	$3,533.44
2009 - 2010	Total 100.00%	11,169	1,152	$2,459.98
2009 - 2010	<1200	7,487	547	$1,175.99
2009 - 2010	>=1200 & <1500	9,692	796	$1,713.03
2009 - 2010	>=1500 & <2000	10,774	1,038	$2,232.88
2009 - 2010	>=2000 & <3000	12,240	1,321	$2,806.65

Scenario analyser results tab 3: Example Scenario Basic (Suburb)

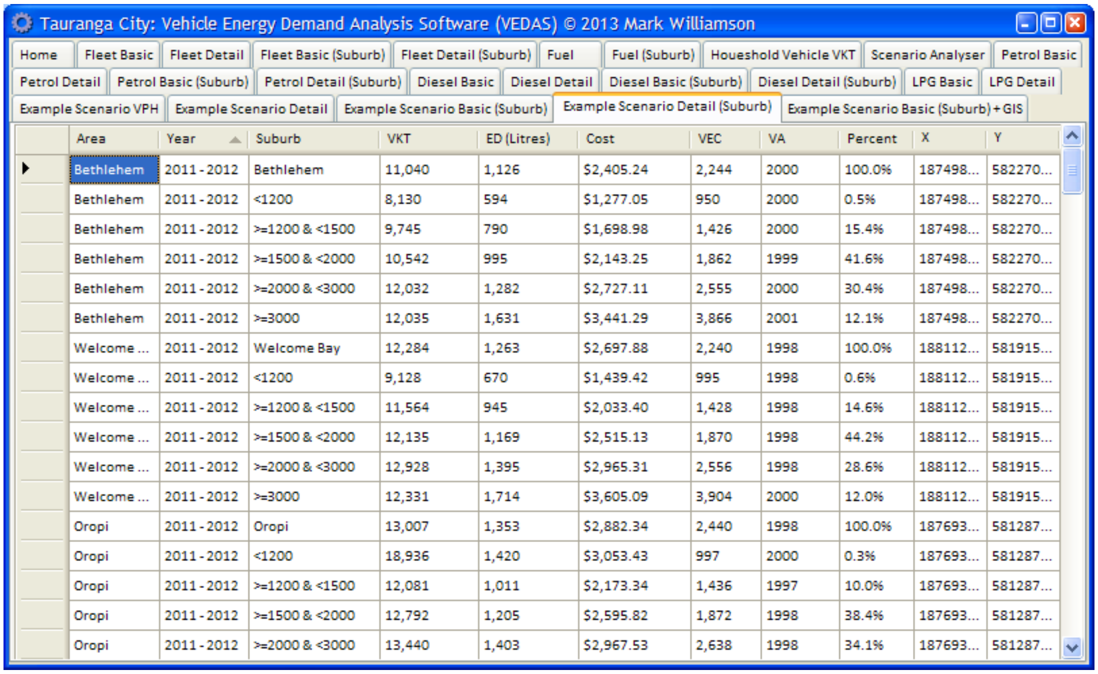
Displays a table containing the average vehicle kilometres travelled, energy demand (litres of fuel consumed), fuel cost, vehicle engine capacity and vehicle age for all years (all files) loaded. The information is displayed for each suburb (only available for cities) and automatically sorted in descending order by year.



Year	Suburb	VKT	ED (Litres)	Cost	VEC	VA
2011 - 2012	Bethlehem	11,040	1,126	$2,405.24	2,244	2000
2011 - 2012	Welcome Bay	12,284	1,263	$2,697.88	2,240	1998
2011 - 2012	Oropi	13,007	1,353	$2,882.34	2,440	1998
2011 - 2012	Matua	10,630	1,089	$2,329.46	2,200	1999
2011 - 2012	Bellevue	10,713	1,107	$2,368.63	2,189	1997
2011 - 2012	Gate Pa	10,495	1,085	$2,320.10	2,125	1997
2011 - 2012	Matapihi	13,327	1,410	$2,997.76	2,250	1998
2011 - 2012	Otumoetai	10,207	1,043	$2,229.96	2,212	1999
2011 - 2012	Tauranga	10,681	1,103	$2,355.91	2,217	1998
2011 - 2012	Brookfield	10,975	1,126	$2,405.92	2,134	1997
2011 - 2012	Tauranga South	10,291	1,050	$2,244.52	2,197	1999
2011 - 2012	Ohauiti	12,052	1,234	$2,635.68	2,299	1999
2011 - 2012	Judea	10,402	1,080	$2,308.80	2,182	1998
2011 - 2012	Pyes Pa	11,974	1,218	$2,601.19	2,229	1999
2011 - 2012	Papamoa Beach	11,655	1,213	$2,596.75	2,434	1998
2011 - 2012	Hairini	11,250	1,162	$2,481.02	2,219	1998
2011 - 2012	Maungatapu	11,309	1,155	$2,466.56	2,233	1998

Scenario analyser results tab 4: Example Scenario Detail (Suburb)

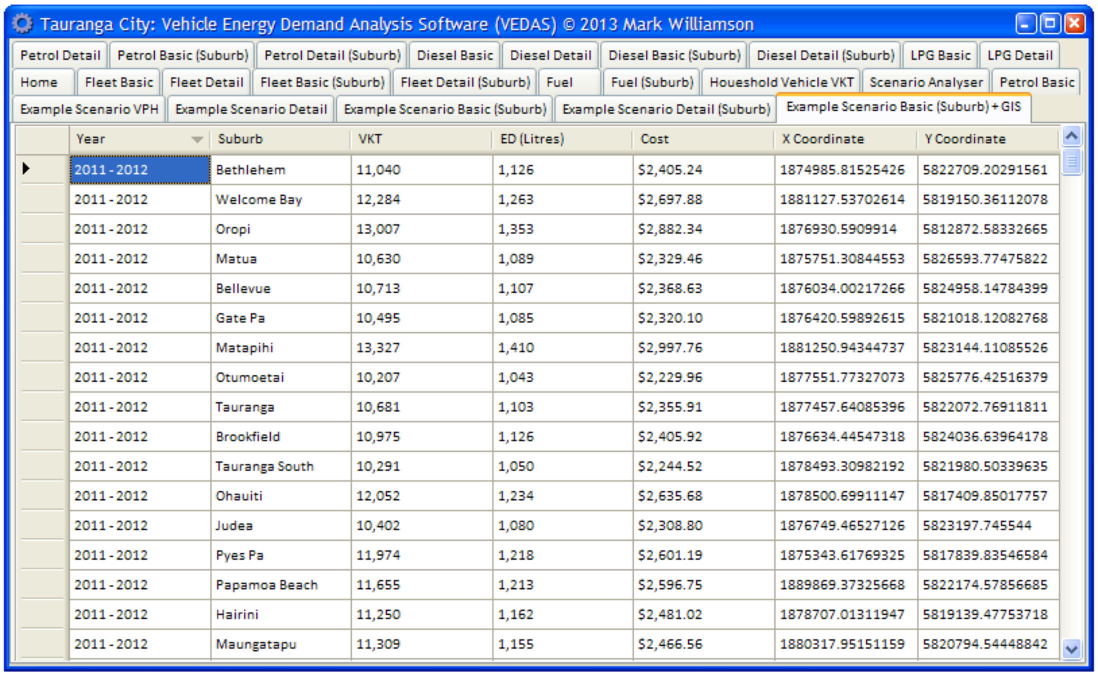
Displays a table containing the average vehicle kilometres travelled, energy demand (litres of fuel consumed) fuel cost, vehicle engine capacity and vehicle age for all years (all files) loaded. The information is displayed for each suburb (only available for cities) and automatically sorted in descending order by year. The information is categorised by vehicle engine capacity and the percentage of vehicles in each category is displayed accordingly. In addition, the information is geo-tagged (contains the coordinates) for use with geographical information systems mapping.



Area	Year	Suburb	VKT	ED (Litres)	Cost	VEC	VA	Percent	X	Y
Bethlehem	2011 - 2012	Bethlehem	11,040	1,126	$2,405.24	2,244	2000	100.0%	187498...	582270...
Bethlehem	2011 - 2012	<1200	8,130	594	$1,277.05	950	2000	0.5%	187498...	582270...
Bethlehem	2011 - 2012	>=1200 & <1500	9,745	790	$1,698.98	1,426	2000	15.4%	187498...	582270...
Bethlehem	2011 - 2012	>=1500 & <2000	10,542	995	$2,143.25	1,862	1999	41.6%	187498...	582270...
Bethlehem	2011 - 2012	>=2000 & <3000	12,032	1,282	$2,727.11	2,555	2000	30.4%	187498...	582270...
Bethlehem	2011 - 2012	>=3000	12,035	1,631	$3,441.29	3,866	2001	12.1%	187498...	582270...
Welcome ...	2011 - 2012	Welcome Bay	12,284	1,263	$2,697.88	2,240	1998	100.0%	188112...	581915...
Welcome ...	2011 - 2012	<1200	9,128	670	$1,439.42	995	1998	0.6%	188112...	581915...
Welcome ...	2011 - 2012	>=1200 & <1500	11,564	945	$2,033.40	1,428	1998	14.6%	188112...	581915...
Welcome ...	2011 - 2012	>=1500 & <2000	12,135	1,169	$2,515.13	1,870	1998	44.2%	188112...	581915...
Welcome ...	2011 - 2012	>=2000 & <3000	12,928	1,395	$2,965.31	2,556	1998	28.6%	188112...	581915...
Welcome ...	2011 - 2012	>=3000	12,331	1,714	$3,605.09	3,904	2000	12.0%	188112...	581915...
Oropi	2011 - 2012	Oropi	13,007	1,353	$2,882.34	2,440	1998	100.0%	187693...	581287...
Oropi	2011 - 2012	<1200	18,936	1,420	$3,053.43	997	2000	0.3%	187693...	581287...
Oropi	2011 - 2012	>=1200 & <1500	12,081	1,011	$2,173.34	1,436	1997	10.0%	187693...	581287...
Oropi	2011 - 2012	>=1500 & <2000	12,792	1,205	$2,595.82	1,872	1998	38.4%	187693...	581287...
Oropi	2011 - 2012	>=2000 & <3000	13,440	1,403	$2,967.53	2,638	1998	34.1%	187693...	581287...

Scenario analyser results tab 5: Example Scenario Basic (Suburb) + GIS

Displays a table containing the average vehicle kilometres travelled, energy demand (litres of fuel consumed) and fuel cost for all years (all files) loaded. The information is displayed for each suburb (only available for cities) and automatically sorted in descending order by year. In addition, the information is geo-tagged (contains the coordinates) for use with geographical information systems mapping.



Year	Suburb	VKT	ED (Litres)	Cost	X Coordinate	Y Coordinate
2011 - 2012	Bethlehem	11,040	1,126	$2,405.24	1874985.81525426	5822709.20291561
2011 - 2012	Welcome Bay	12,284	1,263	$2,697.88	1881127.53702614	5819150.36112078
2011 - 2012	Oropi	13,007	1,353	$2,882.34	1876930.5909914	5812872.58332665
2011 - 2012	Matua	10,630	1,089	$2,329.46	1875751.30844553	5826593.77475822
2011 - 2012	Bellevue	10,713	1,107	$2,368.63	1876034.00217266	5824958.14784399
2011 - 2012	Gate Pa	10,495	1,085	$2,320.10	1876420.59892615	5821018.12082768
2011 - 2012	Matapihi	13,327	1,410	$2,997.76	1881250.94344737	5823144.11085526
2011 - 2012	Otumoetai	10,207	1,043	$2,229.96	1877551.77327073	5825776.42516379
2011 - 2012	Tauranga	10,681	1,103	$2,355.91	1877457.64085396	5822072.76911811
2011 - 2012	Brookfield	10,975	1,126	$2,405.92	1876634.44547318	5824036.63964178
2011 - 2012	Tauranga South	10,291	1,050	$2,244.52	1878493.30982192	5821980.50339635
2011 - 2012	Ohauiti	12,052	1,234	$2,635.68	1878500.69911147	5817409.85017757
2011 - 2012	Judea	10,402	1,080	$2,308.80	1876749.46527126	5823197.745544
2011 - 2012	Pyes Pa	11,974	1,218	$2,601.19	1875343.61769325	5817839.83546584
2011 - 2012	Papamoa Beach	11,655	1,213	$2,596.75	1889869.37325668	5822174.57856685
2011 - 2012	Hairini	11,250	1,162	$2,481.02	1878707.01311947	5819139.47753718
2011 - 2012	Maungatapu	11,309	1,155	$2,466.56	1880317.95151159	5820794.54448842

3.5. Application Logic and Testing

3.5.1. Introduction

It was of the upmost importance to ensure the warrant of fitness and electoral residential address data were processed and analysed correctly. This section examines the logic used in the applications and the testing used to verify the application logic for the data processing applications and data analysis application.

3.5.2. Application Logic

The most significant function performed by the data processing applications and data analysis application is the calculation of vehicle kilometres travelled (VKT). VEDAS is designed to calculate the VKT for each light passenger vehicle under 3500kg over a twelve month period. It is designed to calculate this for all years available. The design of the applications had to consider the time and number of warrants of fitness applicable to each vehicle. A vehicle less than six years old is subject to one WoF per year and a vehicle which is greater is subject to two. Owners can choose when their vehicles are subject to a WoF provided it is within the time period allowed. The method used to calculate the VKT is as follows:

Table 6: Method used to calculate vehicle kilometres travelled

1	The earliest WoF date for each vehicle is identified and established for each available year
2	The number of months between a WoF for two sequential years for instance 2011-2012 is calculated
3	The difference between the two odometer readings for the sequential years is calculated
4	The odometer total is then divided by the number of months to calculate the average VKT per month
5	The VKT per month result is then multiplied by twelve to provide an approximation of the VKT travelled over a twelve month period

During testing it was discovered the period of four months was an insufficient amount of time to produce accurate results thus, vehicles with less than four months odometer information were excluded from the calculations. Furthermore, vehicles which are registered for only three months may be registered for sale purposes, another factor which may potentially distort the VKT results (Thull, 2012).

3.5.3. Application Testing

Due to the significance of the data processing applications and data analysis application, it was extremely important to comprehensively test the logic behind the applications. This was performed using several methods; firstly, all code was thoroughly examined and detailed comments were added to allow for straightforward examination and understanding of the code. This allowed the logic to be checked in a detailed manner at both design and at runtime. Secondly, a series of test datasets were

developed enabling the logic to be checked at runtime. This involved the creation of data, the output of which was manually calculated and could thus be compared with the output from the applications. Thirdly, reduced segments of data extracted from the authentic datasets were used, again with the expected output results pre-calculated to allow for comparison with the output from the applications. Finally, the applications were tested using the full datasets which would be used in the analysis. Random data were selected and the outcomes for those particular data were again manually calculated and checked against that of the applications. Testing was performed for all applications and datasets were developed that would test all logic and functionality.

3.6. Geographical Information Systems Mapping

3.6.1. Introduction

This section provides an overview for the maps created using geographical information systems software, including map design, map data and data categorisation.

3.6.2. Map Design

The maps were designed for A3 paper as it was not possible to display the data and legend on a smaller print area. The maps contain the standard cartography items including, title, legend, north arrow and scale bar. Towns and other areas not in the case studies have been omitted and the only other feature displayed is the coast to aid orientation for those who are not familiar with the case studies. Sixteen maps were created in total (8 for each case study). Four maps (see Appendices 8.13, 8.14, 8.17, 8.18) were created to show the difference in energy demand (fuel consumption) per vehicle for two timeframes (2002-2003 and 2011-2012). Four maps (see Appendices 8.15, 8.16, 8.19, 8.20) were created to show the difference in vehicle kilometres travelled per vehicle for two timeframes (2002-2003 and 2011-2012). The vehicles kilometres travelled maps were created to highlight the relationship between vehicle kilometres travelled and energy demand.

The final eight maps (see Appendices 8.21, 8.22, 8.23, 8.24, 8.25, 8.26, 8.27, and 8.28) were created to highlight the energy demand per vehicle relative to residential location for the period 2011-2012. The first four maps see (Appendices 8.21, 8.22, 8.23, 8.24) show energy demand for commuting and non-commuting residents using Jenks Natural Distribution (see sections 3.6.4) and the remaining four maps (see Appendices 8.25, 8.26, 8.27, 8.28) show energy demand for commuting and non-commuting residents using a manually developed comparable scale for each case study.

3.6.3. Map Data

In order to develop geographical information systems maps, the results from VEDAS were imported into the ESRI Software package ArcGIS. The data used in the maps were extracted from the VEDAS Scenario Analyser tab: Basic (Suburb) + GIS. All data provided in the tab is geo-tagged. The data were

saved in a text (tab delimited) format and imported into ArcGIS. The X and Y coordinates (geo-tagged) were used to display the data as points. The information was combined (joined) with a polygon layer such as a polygon layer of the Greater Christchurch suburbs. The next stage of the processes was to categorise the data in order to display them correctly.

3.6.4. Data Categorisation

The data displayed on the maps are categorised using different methods. The energy demand maps (8.13 & 8.14) and (8.17 & 8.18) and the vehicle kilometres travelled maps (8.15 & 8.16) and (8.19 and 8.20) each have a unique data categorisation. Each set of two maps shares the same unique data categorisation. This allows the reader to directly compare the energy demand or vehicle kilometres travelled for the two timeframes (2002-2003 and 2011-2012). Maps 8.25, 8.26, 8.27 and 8.28 show energy demand for commuting and non-commuting residents using a manually developed comparable scale for each case study.

The maps 8.21, 8.22, 8.23 and 8.24 show energy demand for commuting and non-commuting residents (2011-2012) use Jenks Natural Distribution. Jenks Natural Distribution or Natural Breaks Optimisation is a method of statistical data classification which groups data into classes using the Jenks Optimisation algorithm. It groups data based on the data distribution and is designed to reduce variance within groups and maximise variance between groups (ESRI, 2012).Using Jenks Natural Distribution helps highlight energy demand relative to residential location.

4. CASE STUDIES

4.1. Introduction

This chapter focuses on the two research case studies; Greater Christchurch (South Island) and Greater Tauranga (North Island). It provides background and statistical information and examines the case study data sample size.

4.2. Background Information

4.2.1. Greater Christchurch

The case study of Greater Christchurch includes Christchurch City and selected commuter towns from the Waimakariri District (North of Christchurch City) and the Selwyn District (South of Christchurch City) (See Appendix 8.13 for Greater Christchurch Area).The city of Christchurch is New Zealand's second largest city and is undergoing major redevelopment due to the Darfield and Lyttelton earthquakes. Both Christchurch and the selected commuter towns of Rangiora, Oxford, Kaiapoi, Prebbleton, Rolleston, Lincoln and Pegasus[1] are currently experiencing significant growth and will be joined by other new residential developments within commuting distance to Christchurch. Thus, an analysis of energy demand relative to residential location is highly relevant as it will provide an insight into the current energy demand and the likely demand of these new developments.

4.2.2. Greater Tauranga

The case study of Greater Tauranga analyses Tauranga City and selected commuter towns from the Western Bay of Plenty District (See Appendix 8.17 for Greater Tauranga Area). The city of Tauranga is one of the fastest growing cities in New Zealand and is located within the *Golden Triangle*. The *Golden Triangle* is an economic powerhouse existing between the three cities of Auckland, Hamilton and Tauranga which together produce more than one third of New Zealand's Gross Domestic Product (Kriel, 2011). In addition, the continued expansion and success of the Port of Tauranga has also created jobs and boosted the local economy (Thull, 2012). It is for these reasons that Tauranga and the selected commuter towns of Te Puke, Omokoroa and Katikati have experienced and are expected to experience further significant growth over the coming decades. Thus, as with the Greater Christchurch Study, an analysis of energy demand relative to residential location is highly relevant.

[1] Data for Pegasus were only available for 2011-2012

4.3. Statistical Information

4.3.1. Number of households and residents per household

The information provided in Table 7 and Table 8 was extracted from the 2001 and 2006 census datasets. Unfortunately, more recent data do not exist as the planned 2011 census was cancelled due to the Darfield and Lyttelton earthquakes.

Between 2001 and 2006 there was an increase in the number of households in the cities and commuter towns in both case studies. The number of residents per household in both studies reflects the national average of 2.6 (Ministry for the Environment, 2012). There was little change between 2001 and 2006 with regard to the number of residents per household. Christchurch and Oxford witnessed the only change where the median number of residents per household decreased (Table 7).

Table 7: Number of households and residents per household for case study areas

	Number of Households	**Median Number of Residents Per Household**	**Number of Households**	**Median Number of Residents Per Household**
Greater Christchurch	**2001**	**2001**	**2006**	**2006**
Christchurch	125,031	2	133,743	2
Rangiora	3,336	2	3,597	2
Oxford	585	2	657	2
Kaiapoi	2,541	3	2,847	3
Prebbleton	606	3	996	3
Rolleston	666	3	1,245	3
Lincoln	660	2	855	3
Greater Tauranga	**2001**	**2001**	**2006**	**2006**
Tauranga	34,911	2	39,951	2
Te Puke	2,454	3	2,586	3
Omokoroa	849	2	894	2
Katikati	1,188	2	1,455	2

(Based on 2001 and 2006 New Zealand Census data)

4.3.2. Median income and age per household

The median income of several commuter towns in the Greater Christchurch case study, including Prebbleton, Rolleston and Lincoln is significantly above the 2006 national average of approximately $39,000. With regard to age, Rangiora and Oxford are the only Greater Christchurch commuter towns which are above the 2006 national average age of 36 years (Statistics New Zealand, 2012).

The only variation from the national average with regard to income and age in the Greater Tauranga case study is the higher average ages in Omokoroa and Katikati in 2006 (Table 8). This is most likely caused by the greater number of retired residents and thus is responsible for the lower median

income in these areas. All other areas reflect the national pattern of an ageing population (Statistics New Zealand, 2012).

Table 8: Median Income and median age per household for case study areas

	Median Income	**Median Age**	**Median Income**	**Median Age**
Greater Christchurch	**2001**	**2001**	**2006**	**2006**
Christchurch	$36,500	33	$48,200	35
Rangiora	$32,933	36	$40,633	40
Oxford	$27,500	35	$35,700	38
Kaiapoi	$33,700	34	$43,133	35
Prebbleton	$49,500	31	$77,000	31
Rolleston	$53,200	35	$69,900	36
Lincoln	$41,500	30	$59,600	31
Greater Tauranga	**2001**	**2001**	**2006**	**2006**
Tauranga	$33,300	37	$45,500	38
Te Puke	$30,300	37	$39,450	39
Omokoroa	$28,700	55	$43,000	52
Katikati	$26,400	45	$29,600	48

(Based on 2001 and 2006 New Zealand Census data)

4.3.3. Vehicles per household

It is important to examine the vehicle kilometres travelled for each individual vehicle within a household as each vehicle owner will have different commuting needs. Moreover, unless the kilometres travelled of each individual vehicle are examined, the figures will not provide a true representation of the average vehicle kilometres travelled for each area.

The most significant change in the number of vehicles per household between 2001 and 2006 for the Greater Christchurch case study was the increase in the number of households owning two vehicles (Figure 6 and Figure 7). There was an increase in two vehicle households in all Greater Christchurch areas with the exception of Kaiapoi. However, Kaiapoi witnessed an increase in the number of households owning three or more vehicles.

(Based on data from the 2001 New Zealand Census)

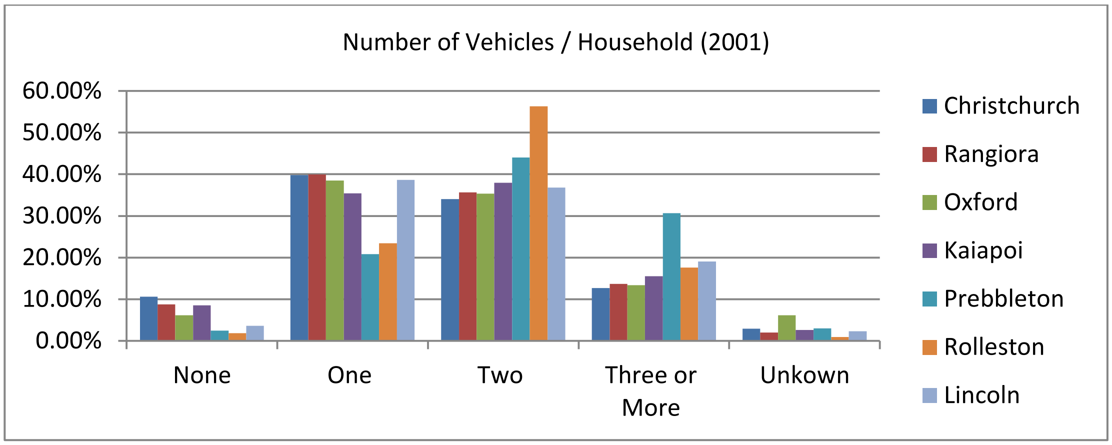


Figure 6: Vehicles per household for Greater Christchurch 2001

(Based on data from the 2006 New Zealand Census)

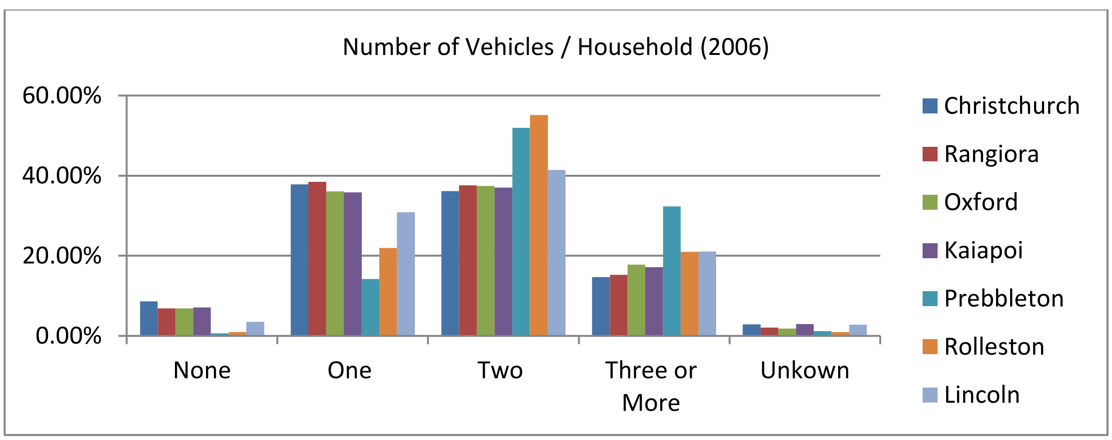


Figure 7: Vehicles per household for Greater Christchurch 2006

The most significant change in the number of vehicles per household between 2001 and 2006 for the Greater Tauranga case study was the reduction in the number of one vehicle households and the increase in the number of households owning two vehicles. In addition, there was an increase in the number of households owning three or more vehicles including a significant increase in Omokoroa and Katikati where the ownership rate increased by over 40%.

(Based on data from the 2001 New Zealand Census)

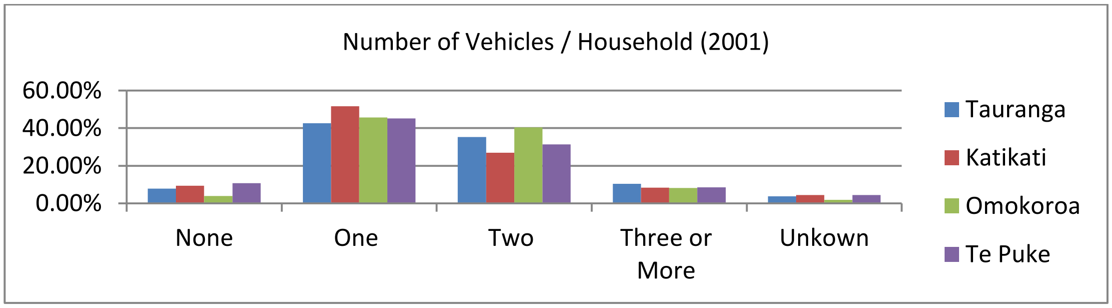


Figure 8: Vehicles per household for Greater Tauranga 2001

(Based on data from the 2006 New Zealand Census)

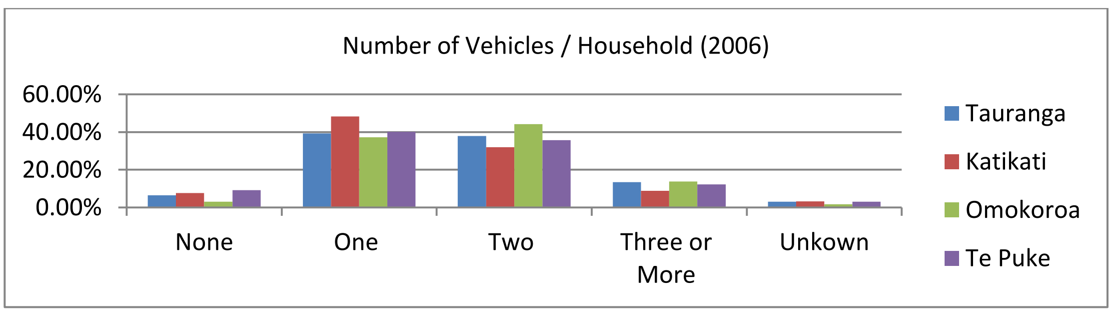


Figure 9: Vehicles per household for Greater Tauranga 2006

Between 2001 and 2006 there was an overall increase in the number of vehicles per household for both case studies. By 2006 85% of households in Greater Christchurch and Greater Tauranga owned one or more vehicles. With regard to Greater Christchurch 90% of commuter town households owned one or more vehicles as opposed to Christchurch City where there was a greater proportion of households without a vehicle. This may be attributed to the superior public transport as well as other factors including a higher proportion of student and elderly residents. The City of Tauranga did not differ from the Greater Tauranga commuter towns. This was most likely caused by the reduced availability of public transport resulting in a higher dependence on light passenger vehicles for mobility.

4.3.4. Data Sample Size

The quantity of data extracted using the data processing applications represents the data sample size used in VEDAS and thus constitutes the data sample size used in the analysis (Table 9). Table 9 compares the number of vehicles recorded in the 2006 census against the number of vehicles matched by the data processing applications for 2005-2006. Using the 2005-2006 data as opposed to the data from 2011-2012, allowed for the closest comparison with the census data.

The light vehicle fleet data from the 2006 census contains both light passenger and light commercial data as opposed to the data from the data processing applications which only contains information for light passenger vehicles. However, despite light commercial vehicles accounting for approximately 12% of all light vehicles in 2006, the match rate for a number of the case study areas was almost 100% (column 4 - Table 9).This can be attributed to the number of unrecorded vehicles in some areas. The light vehicle data from the 2006 census contains a column for the (estimated) number of vehicles not recorded in the census data. The number of unrecorded vehicles is highest for Kaiapoi, Rangiora and Oxford, hence the extremely high match rates for these areas.

Table 9: Data sample size

Area	Census Passenger and Commercial Vehicle Count 2006	VEDAS Passenger Vehicle Count 2006	Match Rate (%)
Greater Christchurch			
Christchurch	205,896	147,849	72%
Rangiora	5,736	5,411	94%
Oxford	1,080	1,034	96%
Kaiapoi	4,599	4,478	97%
Prebbleton	2,136	1,942	91%
Rolleston	2,430	1,891	78%
Lincoln	1,512	1,214	80%
Greater Tauranga			
Tauranga	61,986	45,869	74%
Te Puke	2,019	1,784	88%
Omokoroa	1,494	1,254	84%
Katikati	3,828	3,142	82%

(Based on data from the 2006 New Zealand Census and 2005-2006 VEDAS data)

5. ANALYSIS

5.1. Introduction

This chapter provides an examination of energy demand for light passenger vehicles relative to residential location over the previous decade for two case study areas. The first section (5.2) examines vehicle age (VA), vehicle engine capacity (VEC) and vehicle kilometres travelled (VKT) over the previous decade (2002-2012). The following section (5.3) analyses energy demand for light passenger vehicles over the previous decade, using the parameters analysed in VEDAS in order to calculate demand. Section 5.4 calculates energy demand for a number of light vehicle fleets and observes the parameters used in VEDAS in order to calculate demand. Section 5.5 simulates energy demand for commuting and non-commuting residents and observes the parameters used in VEDAS in order to calculate energy demand. The penultimate section (5.6) calculates energy demand for a new residential development and observes the parameters used in VEDAS in order to calculate energy demand. The final section (5.7) presents a summary of the findings.

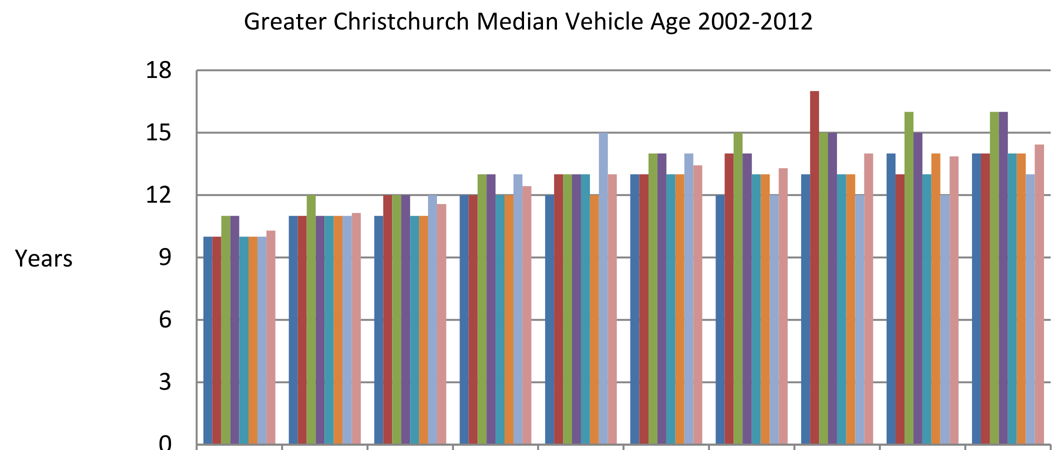
5.2. Vehicle Age, Engine Capacity and Kilometres Travelled

5.2.1. Introduction

This section examines vehicle age (VA), vehicle engine capacity (VEC) and vehicle kilometres travelled (VKT) over the previous decade (2002-2012). The results were produced by VEDAS.

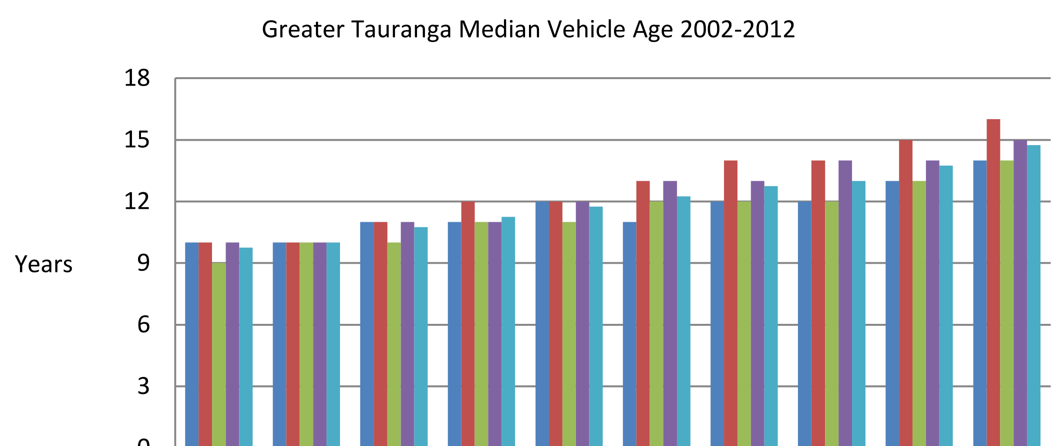
5.2.2. Vehicle Age

The age of light passenger vehicles in Greater Christchurch and Greater Tauranga is slightly greater than the average national light vehicle age of 13 years (Figure 10 and Figure 11). Despite New Zealand having one of the oldest light vehicle fleets in the OECD, the Government predicts that within the next decade vehicle age will stabilise and then slowly decrease (Ministry of Transport, 2011).



	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012
Christchurch	10	11	11	12	12	13	12	13	14	14
Rangiora	10	11	12	12	13	13	14	17	13	14
Oxford	11	12	12	13	13	14	15	15	16	16
Kaiapoi	11	11	12	13	13	14	14	15	15	16
Prebbleton	10	11	11	12	13	13	13	13	13	14
Rolleston	10	11	11	12	12	13	13	13	14	14
Lincoln	10	11	12	13	15	14	12	12	12	13
Average	10	11	12	12	13	13	13	14	14	14

Figure 10: VA for light passenger vehicles in Greater Christchurch 2002-2012



	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012
Tauranga	10	10	11	11	12	11	12	12	13	14
Te Puke	10	10	11	12	12	13	14	14	15	16
Omokoroa	9	10	10	11	11	12	12	12	13	14
Katikati	10	10	11	11	12	13	13	14	14	15
Average	10	10	11	11	12	12	13	13	14	15

Figure 11: VA for light passenger vehicles in Greater Tauranga 2002-2012

It may be argued the continually increasing vehicle age in the case studies is due to import and vehicle life cycle patterns. New Zealanders chose to keep their vehicles for longer periods. Also, there is a preference to buy used higher specification vehicles than a new (often more expensive) vehicle of average specification. This is due to the introduction of the emissions standards which reduced the number of cheaper, older and often higher specification vehicles (Thull, 2012).

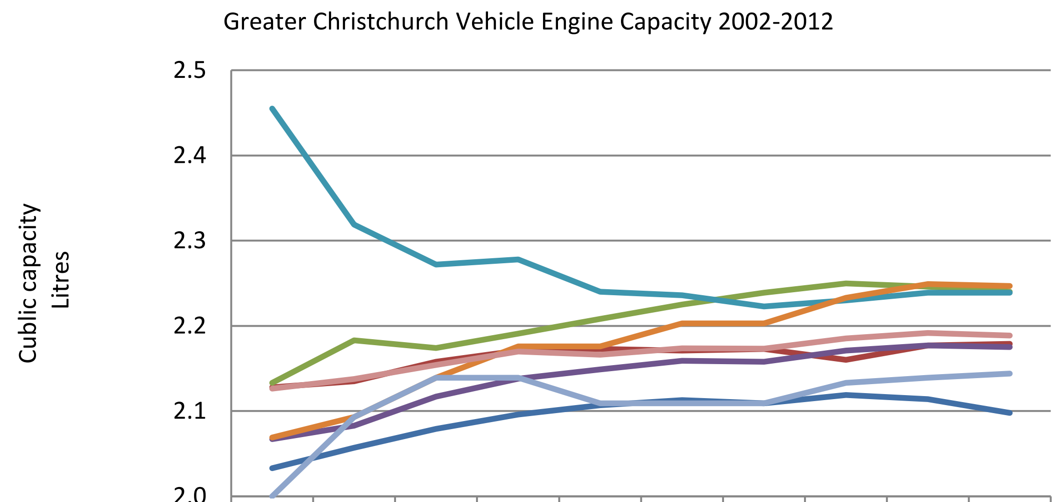
Table 10: VA summary for light passenger vehicles 2002-2012

Area	Vehicle Age Increase 2002-2012 (Years)	Vehicle Age Increase 2002-2012 (%)	Diesel Age > Petrol Age 2002-2012 (Years)
Greater Christchurch			
Christchurch	4	40	2.1
Rangiora	4	40	2.3
Oxford	5	45	1.2
Kaiapoi	5	45	3.0
Prebbleton	4	40	2.4
Rolleston	4	40	2.1
Lincoln	3	30	2.4
Average	4	42	2.2
Greater Tauranga			
Tauranga	4	40	2.7
Te Puke	6	60	1.3
Omokoroa	5	56	3.3
Katikati	5	50	2.1
Average	5	51	2.4

There is a noticeable age difference between diesel and petrol vehicles which indicates diesel vehicle owners are keeping their vehicles on average around 2.2 years longer (Column 4 -Table 10). This is likely due to the longer working life of diesel engines and in addition, the majority of diesel vehicles in New Zealand are large 4x4s (Based on VEDAS weight data) and would be expensive to replace given the current market values which are influenced by emissions standards.

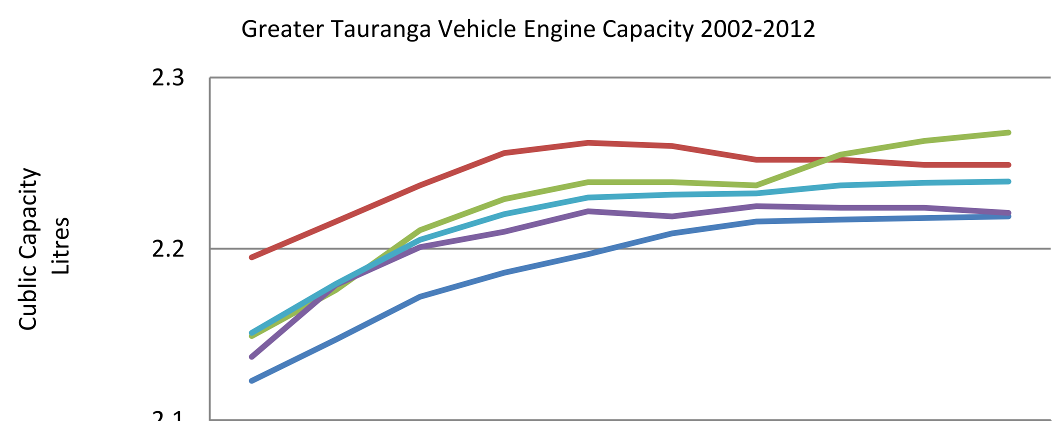
5.2.3. Vehicle Engine Capacity

There is little variation in VEC between the commuter townships (Figure 12 and Figure 13). The reduction in VEC witnessed in Prebbleton was most likely influenced by residential subdivision development (former Christchurch residents bringing smaller VEC vehicles to Prebbleton).



	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012
Christchurch	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Rangiora	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Oxford	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.3	2.2	2.2
Kaiapoi	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2
Prebbleton	2.5	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2
Rolleston	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Lincoln	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Average	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2

Figure 12: VEC for light passenger vehicles in Greater Christchurch 2002-2012



	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012
Tauranga	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Te Puke	2.2	2.2	2.2	2.3	2.3	2.3	2.3	2.3	2.2	2.2
Omokoroa	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.3	2.3	2.3
Katikati	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
average	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2

Figure 13: VEC for light passenger vehicles in Greater Tauranga 2002-2012

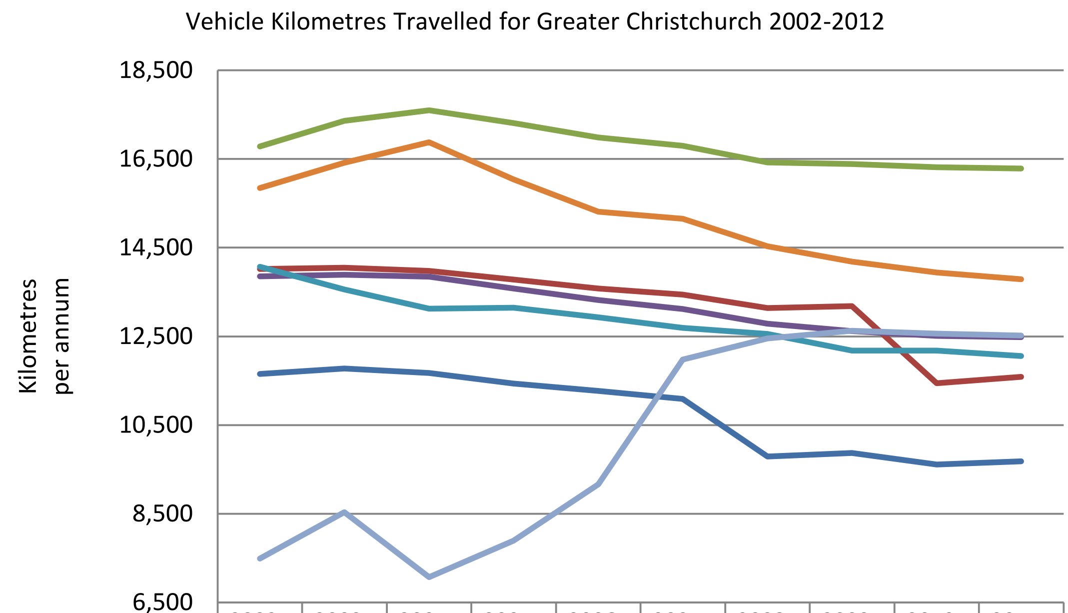
Diesel vehicles have an average engine size around 30% greater than that of petrol vehicles (Column 6 - Table 11). The VEC in Christchurch and Tauranga matches that of most other OECD nations, but is behind that of the European Union (considered to be at the forefront of low VEC / fuel efficient vehicles) where the average VEC is approximately 1650cc (European Automobile Manufacturers Association, 2010).

Table 11: VEC summary for light passenger vehicles 2002-2012

Area	Av. VEC 2002-2012 (Litre)	VEC Increase/Decrease 2002-2012 (%)	Av. Petrol VEC 2002-2012 (Litre)	Av. Diesel VEC 2002-2012 (Litre)	Diesel VEC >Petrol VEC 2002-2012 (%)
Greater Christchurch					
Christchurch	2.1	3	2.0	2.7	36
Rangiora	2.2	2	2.0	2.7	36
Oxford	2.2	5	2.0	2.5	23
Kaiapoi	2.1	5	2.0	2.7	34
Prebbleton	2.3	-8	2.2	2.7	30
Rolleston	2.2	8	2.1	2.7	31
Lincoln	2.1	7	2.0	2.7	32
Average	2.2	3	2.0	2.7	32
Greater Tauranga					
Tauranga	2.2	5	2.1	2.7	29
Te Puke	2.2	2	2.1	2.7	29
Omokoroa	2.2	1	2.1	2.6	24
Katikati	2.2	4	2.1	2.7	29
Average	2.2	3	2.1	2.7	28

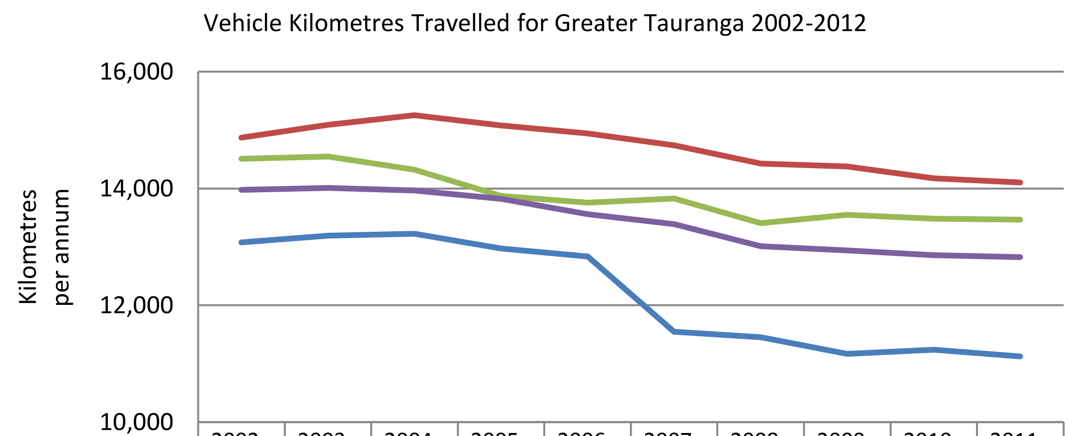
5.2.4. Vehicle Kilometres Travelled

Over the previous decade there has been a continuous reduction in VKT in both Greater Christchurch and Greater Tauranga. The average reduction in VKT for Greater Christchurch and Greater Tauranga is 12% (excluding Lincoln) and 9% respectively (Table 12). In addition, (over the previous decade) residents in the cities of Christchurch and Tauranga have travelled around 2,800 and 1,800 fewer kilometres than their Greater Christchurch and Greater Tauranga counterparts (Figure 14). Christchurch City witnessed the largest reduction in VKT over the same decade (Figure 15 & See Appendices 8.15 and 8.16 for Greater Christchurch and See Appendices 8.19 and 8.20 for Greater Tauranga). This was in contrast to what was witnessed in other nations such as the UK and US as from 2000 until 2008 VKT had either remained steady or even increased. The reduction in VKT witnessed in the UK and US was only evident from 2008 onwards and was attributed to the oil price spike and economic situation. In contrast, the VKT in Greater Christchurch and Tauranga began to stabilise around 2004. This indicates that whilst the continually rising cost of fuel had an impact on VKT in New Zealand, it was difficult for vehicle users to continue to reduce their annual VKT further due to having already economised in travel patterns.



	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012
Christchurch	11,653	11,776	11,671	11,437	11,273	11,090	9,790	9,873	9,611	9,680
Rangiora	14,019	14,048	13,974	13,782	13,580	13,440	13,138	13,184	11,446	11,589
Oxford	16,782	17,362	17,599	17,311	16,985	16,799	16,423	16,385	16,318	16,285
Kaiapoi	13,854	13,890	13,845	13,579	13,321	13,115	12,787	12,617	12,512	12,486
Prebbleton	14,073	13,556	13,122	13,148	12,932	12,689	12,555	12,181	12,176	12,058
Rolleston	15,845	16,418	16,876	16,041	15,315	15,152	14,530	14,188	13,942	13,788
Lincoln	7,488	8,532	7,068	7,896	9,162	11,978	12,456	12,624	12,565	12,522

Figure 14: VKT for light passenger vehicles in Greater Christchurch 2002-2012



	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012
Tauranga	13,075	13,191	13,224	12,972	12,836	11,545	11,452	11,169	11,242	11,125
Te Puke	14,870	15,088	15,253	15,082	14,942	14,740	14,429	14,377	14,175	14,103
Omokoroa	14,508	14,546	14,323	13,874	13,756	13,827	13,407	13,550	13,484	13,469
Katikati	13,977	14,009	13,968	13,826	13,561	13,389	13,012	12,939	12,856	12,827

Figure 15: VKT for light passenger vehicles in Greater Tauranga 2002-2012

The trend in Greater Christchurch and Greater Tauranga is for diesel vehicles to travel further than their petrol equivalents (Column 4 - Table 12). In addition, the results from VEDAS indicate that diesel vehicles are for the most part heavier and older than the leading light passenger vehicle fleets in Europe and Japan as discussed in section 2.3. This would indicate that the New Zealand light passenger vehicle fleet is less fuel efficient than its European and Japanese equivalents.

Table 12: VKT summary for light passenger vehicles 2002-2012

Area	VKT Change 2002-2012 (%)	VKT Change 2002-2012 (km)	Diesel VKT > Petrol VKT 2002-2012 (km)
Greater Christchurch			
Christchurch	-17	-1,973	2,186
Rangiora	-17	-2,430	1,255
Oxford	-3	-497	3,247
Kaiapoi	-10	-1,368	2,250
Prebbleton	-14	-2,015	-1,813
Rolleston	-13	-2,057	1,777
Lincoln	+67	+5,034	1,355
Greater Tauranga			
Tauranga	-15	-1,950	2,186
Te Puke	-5	-767	1,255
Omokoroa	-7	-1,039	2,250
Katikati	-8	-1,150	5,758

The ownership of diesel vehicles (mostly SUV's and 4x4's based on VEDAS weight figures) in the commuter townships is on average 80% greater than in Christchurch and 45% greater than in Tauranga (Table 13). This is particularly evident in the case of Oxford (North Canterbury), a traditional farming community and more recently a popular lifestyle location. Factors influencing this trend are most likely to be agricultural and lifestyle related for instance, 4x4's used in the development and maintenance of rural property (fencing, firewood, fertiliser, stock movement).

Table 13: Percentage of petrol and diesel vehicles for 2012

Area	Petrol Vehicles (%)	Diesel Vehicles (%)
Greater Christchurch		
Christchurch	89.5	10.5
Rangiora	83.4	16.6
Oxford	70.6	29.4
Kaiapoi	82.2	17.8
Prebbleton	82.5	17.5
Rolleston	84.2	15.8
Lincoln	82.2	17.8
Greater Tauranga		
Tauranga	87.5	12.5
Te Puke	80.6	19.4
Omokoroa	82.8	17.2
Katikati	81.8	18.2

5.3. Energy demand for light passenger vehicles

5.3.1. Introduction

This section examines the energy demand results calculated by the Vehicle Energy Demand Analysis Software (VEDAS) and presented as the average litres of fuel consumed over a 12 month period per vehicle for each area. This is achieved by applying a series of parameters to the VKT, VEC and VA figures in VEDAS. Values for petrol and diesel fuel costs and diesel road user charges were derived from the New Zealand Automotive Association and Ministry of Transport websites.

5.3.2. Parameters

The parameters used in VEDAS are shown below in Table 14. The fuel consumption vehicle age change year and fuel consumption parameters were decided upon after an analysis of the New Zealand light passenger vehicle fleet in conjunction with Dr. Thull of Lincoln University. Dr. Thull has substantial empirical experience in the field of motor vehicle fuel efficiency. The minimum VKT parameter was set at 0km and the maximum VKT parameter was set at 60,000km to ensure all vehicles appropriate vehicles were analysed.

Table 14: VEDAS analysis parameters

Parameter Name	Value
Scenario Name	Analysis
Petrol Cost ($/Litre)	2.15
Diesel Cost ($/Litre)	1.55
Diesel Road User Charges (Per Kilometre)	0.048
Fuel consumption VA change Year	2000
Min VKT	0
Max VKT	60,000

(Based on 2012 average fuel price – Automobile Association New Zealand)

The development of fuel consumption figures for light passenger vehicles newer than 12 years old presented a challenge (Table 15). The parameters had to be applicable to a range of vehicles, such as, a newer luxury high performance saloon or 4x4 vehicle; both with a VEC of 3000cc.

Table 15: VEDAS fuel consumption parameters for light passenger vehicles

Vehicle engine capacity (VEC)	Petrol: litres/100km	Diesel: litres/100km
Vehicles older than 12 years		
<1200	7.5	N/A
>=1200 &<1500	8.5	N/A
>=1500 &<2000	10.0	7.5
>=2000 &<3000	12.0	9.5
>=3000	16.0	13.0
Vehicles newer than 12 years		
<1200	7.0	N/A
>=1200 &<1500	7.5	6.5
>=1500 &<2000	8.8	7.0
>=2000 &<3000	10.5	9.0
>=3000	13.0	10.0

5.3.3. Results

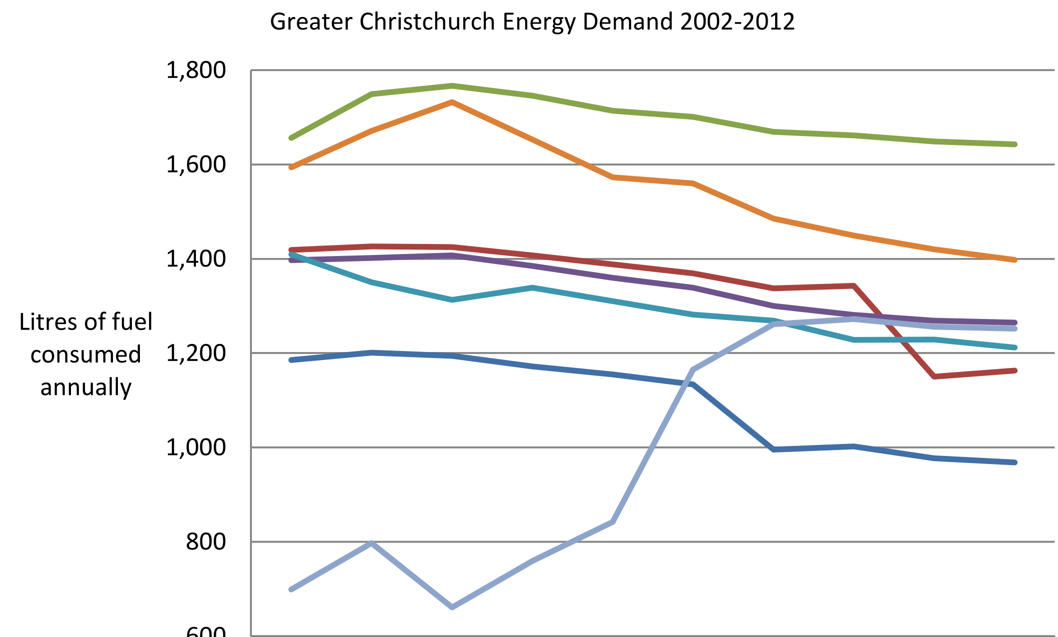
Over the previous decade there has been a reduction in energy demand for Greater Christchurch (14%) and Greater Tauranga (9%) with the exception of Lincoln (Greater Christchurch) where there has been a significant increase in demand (Table 16). The minimal changes in energy demand for Oxford may be attributed to its geographical location (furthest commute of any case study - Table 20). The anomaly with Lincoln is likely due to the significant growth in the town's population from rural village to commuter town. The cities of Christchurch and Tauranga witnessed the greatest reduction in energy demand over the previous decade at 18% and 16% respectively (Table 16).

Table 16: Annual Energy demand summary for light passenger vehicles 2002-2012

Area	Energy Demand Change 2002-2012 (%)	Energy Demand 2002-2003 (Litres)	Energy Demand 2011-2012 (Litres)	Energy Demand Decrease 2002-2012 (Litres)
Greater Christchurch				
Christchurch	-18	1,185	968	217
Rangiora	-18	1,419	1,163	256
Oxford	-1	1,656	1,643	13
Kaiapoi	-9	1,397	1,265	132
Prebbleton	-14	1,409	1,212	197
Rolleston	-12	1,594	1,398	196
Lincoln	+79	699	1,252	+553
Greater Tauranga				
Tauranga	-16	1,353	1,142	211
Te Puke	-6	1,543	1,457	86
Omokoroa	-7	1,479	1,380	99
Katikati	-8	1,422	1,315	107

It is clear from the results that energy demand in Christchurch City over the last decade has been significantly lower than its commuter towns. Indeed, over the previous decade, the energy demand

of Christchurch City has been around 350 litres lower per vehicle than in Greater Christchurch (excluding Lincoln) - (Figure 16 & Appendices 8.13 and 8.14). Energy demand began to stabilise for the Greater Christchurch commuter towns from 2008 onwards. In addition, the reduction in energy demand for Christchurch City was less than in previous years. Christchurch City also experienced a slight increase in energy demand in 2008-2009 but this was most likely caused by the unusually low energy demand in 2010-2011 due the Darfield and Christchurch earthquakes. The commuter towns located the furthest distance from Christchurch City witnessed the smallest reduction in energy demand and the towns closest witnessed the largest reduction in energy demand.

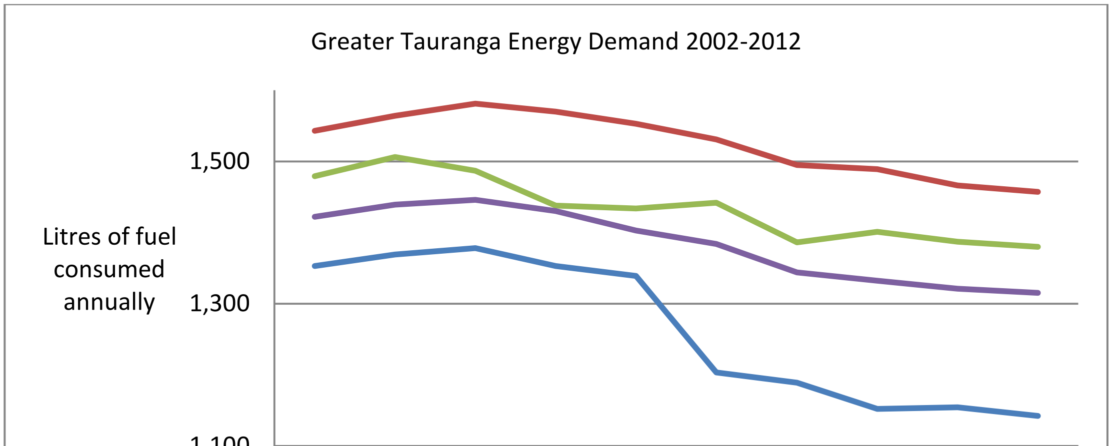


	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012
Christchurch	1,185	1,201	1,194	1,172	1,155	1,134	995	1,002	977	968
Rangiora	1,419	1,426	1,425	1,407	1,388	1,369	1,337	1,343	1,150	1,163
Oxford	1,656	1,749	1,767	1,746	1,714	1,701	1,669	1,662	1,649	1,643
Kaiapoi	1,397	1,402	1,407	1,385	1,360	1,339	1,300	1,281	1,269	1,265
Prebbleton	1,409	1,350	1,313	1,339	1,310	1,282	1,269	1,228	1,229	1,212
Rolleston	1,594	1,671	1,732	1,653	1,573	1,560	1,485	1,449	1,420	1,398
Lincoln	699	797	661	759	842	1,165	1,261	1,272	1,256	1,252

Figure 16: Energy demand for light passenger vehicles in Greater Christchurch 2002-2012

A similar energy demand pattern was also witnessed in Tauranga City, where the energy demand has been around 180 litres lower (Figure 17 & Appendices 8.17 and 8.18). Energy demand began to stabilise for the Greater Tauranga commuter towns from 2008 onwards. In addition, the level of reduction in energy demand for Tauranga City was less significant than in previous years. Similar to the Greater Christchurch findings, the commuter town located the furthest distance from Tauranga

City witnessed the smallest reduction in the energy demand and the town closest to the City witnessed the largest reduction in energy demand.



	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Tauranga	1,353	1,369	1,378	1,353	1,339	1,203	1,189	1,152	1,154	1,142
Te Puke	1,543	1,564	1,581	1,570	1,553	1,531	1,495	1,489	1,466	1,457
Omokora	1,479	1,506	1,487	1,438	1,434	1,442	1,386	1,401	1,387	1,380
Katikati	1,422	1,439	1,446	1,430	1,403	1,384	1,344	1,332	1,321	1,315

Figure 17: Energy demand for light passenger vehicles in Greater Tauranga 2002-2012

The effects of VKT, VEC and VA may be compared against the energy demand results in order to establish the most influential factors with regard to energy demand. In comparison with increasing VEC and VA figures, VKT has witnessed a significant decrease over the previous decade. In addition, section 5.2.4 confirms VKT has historically been lower for the cities as opposed to the commuter towns. This is also mirrored in the energy demand findings, suggesting that VKT plays a significant role in energy demand. Furthermore, sections 5.2.2 and 5.2.3 examine VA and VEC and find that little change has occurred over the previous decade and in some instances the situation is becoming progressively more challenging for older vehicles with larger VECs. This would suggest that whilst VEC and VA undoubtedly have an influence on energy demand, their role is not as significant as that of VKT.

5.4. Modelling energy demand scenarios for light passenger vehicle fleets

5.4.1. Introduction

This section examines the energy demand for three light passenger vehicle fleets using the scenario analyser in VEDAS. The purpose is to determine the reduction in energy demand (fuel consumption) which may be achieved through the adoption of a more fuel efficient fleet. This will allow for direct comparison with the energy saved through a reduction in vehicle kilometres travelled.

5.4.2. Scenarios

Scenario A

Scenario A simulates the fuel efficiency of the current New Zealand light passenger vehicle fleet.

Scenario B

Scenario B simulates a highly fuel efficient light passenger vehicle fleet, similar to fleets in Western Europe and Japan.

Scenario C

Scenario C simulates an ultra-fuel efficient (highly unrealistic) light passenger vehicle fleet. The purpose is to provide an indication of the reduction in energy demand in a *perfect environment* in order to allow for comparison with the relationship between energy demand and vehicle kilometres travelled.

5.4.3. Parameters

A series of fuel consumption parameters designed to represent vehicle efficiency were input into the scenario analyser in VEDAS. The analysis was run using the 2011-2012 VEDAS case study data. In addition, there was no distinction between commuting and non-commuting residents and it was assumed there were no significant changes to travel patterns and vehicle engine capacity distribution.

Table 17: VEDAS Scenario Analyser fuel consumption parameters

Vehicle engine capacity	Petrol: litres/100km	Diesel: litres/100km
Scenario A		
<1200	7.5	N/A
>=1200 &<1500	8.5	N/A
>=1500 &<2000	10.0	7.5
>=2000 &<3000	12.0	9.5
>=3000	16.0	13.0
Scenario B		
<1200	7.0	N/A
>=1200 &<1500	7.5	6.5
>=1500 &<2000	8.8	7.0
>=2000 &<3000	10.5	9.0
>=3000	13.0	10.0
Scenario C		
<1200	6.0	4.5
>=1200 &<1500	6.5	4.5
>=1500 &<2000	7.5	5.0
>=2000 &<3000	9.0	6.5
>=3000	11.0	10.0

5.4.4. Results

The results highlight the potential reduction in energy demand (fuel consumption) which may be achieved through the adoption of a more fuel efficient light vehicle fleet (Table 18).Comparison of Scenarios A and B reveal it would be possible to achieve around a 9% reduction in energy demand assuming there are no significant changes to travel patterns and vehicle engine capacity.

If the Government introduced more stringent policy to encourage the adoption of more fuel efficient vehicles, a transition from a Scenario A to a scenario B light passenger vehicle fleet would be possible although it would take some years.

Comparison of Scenarios of A and C show a more significant reduction in energy demand of around 23%.However, the fuel efficiency and thus potential energy reduction of such a scenario is highly unrealistic. The adoption of such an efficient light vehicle fleet is unlikely to happen in New Zealand before the mass adoption of alternative technology based vehicles such as electric or hydrogen fuel cell vehicles.

Table 18: Energy demand for scenarios A, B and C 2011-2012

Area	**Scenario A Energy Demand (Litres)**	**Scenario B Energy Demand (Litres)**	**Scenario C Energy Demand (Litres)**
Greater Christchurch			
Christchurch	968	886	750
Rangiora	1,163	1,066	897
Oxford	1,643	1,479	1,235
Kaiapoi	1,265	1,138	958
Prebbleton	1,212	1,118	941
Rolleston	1,398	1,276	1,075
Lincoln	1,252	1,155	974
Pegasus	1,654	1,528	1,298
Greater Tauranga			
Tauranga	1,142	1,047	883
Te Puke	1,457	1,312	1,100
Omokoroa	1,380	1,266	1,066
Katikati	1,315	1,194	1,001

5.5. Energy demand for commuting and non-commuting residents

5.5.1. Introduction

This section analyses energy demand for two distinct types of residents. The first resident type consists of those who both reside and are employed within the commuter town (non-commuting residents). The second type is those who reside within the commuter town but are most likely employed in the city or another commuter town (commuting residents). The Scenario and

parameters used in the scenario analyser within VEDAS are discussed and followed by an examination of the findings presented through a series of tables and accompanying text.

5.5.2. Scenarios

Scenario A

Scenario A is designed to represent the energy demand of non-commuting residents.

Scenario B

Scenario B is designed to represent the energy demand of residents who commute for approximately 222 days per year (Table 19).

5.5.3. Parameters

A series of parameters were input into the scenario analyser in VEDAS in conjunction with the data calculated in section 5.2 and used to calculate the energy demand for the scenarios. The parameters included the number of days commuted annually and the minimum and maximum number of vehicle kilometres travelled (depending on the resident type).

Table 19: Approximation of days spent commuting

Reason	No. of Days	Percentage of Year
Public Holiday	11	3%
Annual Leave	28	7%
Weekend	104	28%
Work	222	61%
Total	365	100%

(Based on data provided by the Ministry of Business, Innovation and Employment 2012)

The commuting parameters used in the scenario analyser in VEDAS represent distance travelled between centres such as central Rangiora and central Christchurch (Table 20). The commuting distances are for an estimated 222 employment days annually (Table 19). The data used in the Scenario Analyser are from 2011-2012.

Table 20: Estimated commuting distances

Area	Distance (km)	Return (km)	Commute (km)
Greater Christchurch			
Rangiora	33	66	14,652
Oxford	55	110	24,420
Kaiapoi	20	40	8,880
Rolleston	24	48	10,656
Prebbleton	13	26	5,772
Lincoln	23	46	10,212
Pegasus	29	58	12,876
Greater Tauranga			
Area	**Distance (km)**	**Return (km)**	**Commute (km)**
Te Puke	30	60	13,320
Omokoroa	21	42	9,324
Katikati	36	72	15,984

(Based on data from Google Maps, 2012)

5.5.4. Results

Scenario A

Non-commuting residents in Rangiora, Kaiapoi, Rolleston, Prebbleton, Lincoln and Pegasus have a similar energy demand to residents in the central areas of Christchurch such as Monavale (Table 21 & Appendix 8.2). However, Oxford, the most outlying township, has a higher annual energy demand for non-commuting residents, similar to that of the more outlying areas of Christchurch such as Styx in the North and Ferrymead in the South (Column 4 – Table 21 & See Appendices 8.2, 8.21 & 8.25). This may be attributed to the greater distance from Christchurch City. For instance, if a non-commuting resident from Oxford chooses to visit Christchurch once a week, this will obviously use more fuel than a resident from Kaiapoi making the same trip. The pattern for the Greater Christchurch case studies is similar in Greater Tauranga although non-commuting residents in all Greater Tauranga case study towns have a lower energy demand than residents in the central and lowest energy demand areas of Tauranga such as Tauranga Central and Greerton (Column 4 – Table 21 & See Appendices 8.8, 8.23 & 8.27).

From the results in VEDAS (Table 21) it is possible to calculate and compare the difference between the minimum annual VKT required for commuting residents and the total VKT for non-commuting residents. The total VKT (essential and non-essential) for the non-commuting residents in all case study towns is only 50-60% of the minimum essential (employment) VKT (Table 21 – Columns 2 & 3) which commuters travel. This pattern can be applied to both the Greater Christchurch and Greater Tauranga case study towns.

Table 21: Scenario A energy demand 2011-2012

Area	Commute (km)	Average VKT (km)	Energy Demand (Litres)	Fuel Cost ($)	Percentage of non-commuting vehicles (%)
Greater Christchurch					
Rangiora	14,652	8,062	808	$1,723.75	71
Oxford	24,420	12,671	1,281	$2,719.97	81
Kaiapoi	8,880	5,606	569	$1,213.64	30
Rolleston	10,656	6,842	702	$1,496.79	32
Prebbleton	5,772	3,375	339	$723.16	11
Lincoln	10,212	6,629	650	$1,392.71	38
Pegasus	12,876	8,291	848	$1,822.27	29
Greater Tauranga					
Te Puke	13,320	8,340	856	$1,826.66	51
Omokoroa	9,324	5,800	586	$1,252.82	35
Katikati	15,984	9,048	925	$1,973.97	72

The outlying townships of Rangiora and Oxford have significantly fewer commuters (Column 5 - Table 21). This is most likely driven by the greater number of local employment opportunities. Geographical location may also be a factor for consideration as many residents may consider a daily commute to Christchurch or Tauranga as unacceptable due to the cost of additional fuel and the time lost commuting.

VEDAS shows that non-commuting VKT (per vehicle) steadily decreases as the number of vehicles per household increases. On average (excluding Christchurch & Tauranga), vehicle 2 travels 25% fewer kilometres than vehicle 1, vehicle three travels 36% less than vehicle 1 and vehicle 4 travels 44% less than vehicle 1 (Table 22). Similarly, VKT (per vehicle) in Christchurch City and Tauranga City also steadily decreases in a similar pattern; vehicle 2 travels 30% fewer kilometres than vehicle 1, vehicle three travels 41% less than vehicle 1 and vehicle 4 travels 48% less than vehicle 1 (Table 22).

Table 22: Vehicle kilometre travelled for non-commuting resident vehicles 2011-2012

Area	Vehicle 1 VKT	Vehicle 2 VKT	Vehicle 3 VKT	Vehicle 4 VKT
Greater Christchurch				
Christchurch	10,725	7,430	6,110	5,366
Rangiora	8,828	6,607	5,489	4,862
Oxford	15,792	12,246	10,010	7,931
Kaiapoi	6,285	4,909	3,974	3,170
Rolleston	7,583	5,606	4,552	3,268
Prebbleton	3,671	2,491	1,812	No Data
Lincoln	7,020	5,639	4,998	2,961
Pegasus	8,720	4,434	No Data	No Data
Greater Tauranga				
Tauranga	12,876	9,234	7,867	6,905
Te Puke	9,615	7,905	6,684	5,378
Omokoroa	6,285	4,775	3,683	4,320
Katikati	10,677	8,497	7,161	6,173

Scenario B

Residents who commute to Christchurch for employment purposes have a significantly higher annual energy demand (Table 23). The energy demand for Kaiapoi, Rolleston, Prebbleton and Lincoln exceeds that of outlying suburbs of Christchurch such as Parklands (North) and Sumner (South). However, the significance of the relationship between residential location and energy demand is highlighted in the case of Rangiora, Oxford and Pegasus where the energy demand is greater than any suburb within Christchurch (See Appendices 8.22 & 8.26). Furthermore, there is a direct correlation between the percentage of commuting residents and the distance from Christchurch City; the longer the commute, the lower the percentage of commuters (Table 23). A similar pattern can be seen for residents who are commuting to Tauranga for employment purposes as they also have a higher energy demand than any of the suburbs in Tauranga city (See Appendices 8.24 & 8.28). As the distance between the city and commuter towns increases, the percentage of residents commuting reduces (Column 5 –Table 23). This follows the same pattern for both Greater Christchurch and Greater Tauranga.

Table 23: Scenario B energy demand 2011-2012

Area	Commute (km)	Average VKT (km)	Energy Demand (Litres)	Fuel Cost ($)	Percentage of commuting vehicles
Greater Christchurch					
Rangiora	14,652	20,368	2,046	$4,356.73	29
Oxford	24,420	31,323	3,150	$6,664.17	19
Kaiapoi	8,880	15,401	1,560	$3,321.91	70
Rolleston	10,656	17,048	1,725	$3,678.36	68
Prebbleton	5,772	13,095	1,316	$2,803.79	89
Lincoln	10,212	16,156	1,623	$3,462.19	62
Pegasus	12,876	20,242	1,976	$4,213.99	71
Greater Tauranga					
Te Puke	13,320	20,130	2,086	$4,440.08	49
Omokoroa	9,324	17,518	1,799	$3,829.03	65
Katikati	15,984	22,370	2,299	$4,893.12	28

From the results in VEDAS it is possible to calculate the percentage of non-commuter related VKT over and above that of necessary VKT required for commuting. This calculation assumes commuter related VKT accounts for 100% of a resident's travel and additional VKT is optional. Non commuter VKT includes travel for supermarket trips and leisure purposes. This allows for the comparison of energy demand for commuter towns which are in the main self-sufficient with regard to employment and all other facilities, with commuter towns which are mainly residential, offering few facilities. The calculations are based on data from Table 23.

Whilst Oxford is located further from Christchurch City than any of the case study towns, its commuting residents have the lowest annual non-commuter related VKT (28%). This may be attributed to Oxford commuters regarding further travel to the city over and above that required for employment as not cost effective in terms of time, taking into consideration Oxford has access to supermarket and leisure activities both within Oxford town centre and in the nearby town of Rangiora. Moreover, perhaps residents feel the cost in terms of dollars also cannot be justified; Oxford having the lowest median income of the Greater Christchurch case studies ($35,700 - Table 8).

Similar to Oxford, Rangiora commuting residents also have a relatively low annual non-commuter related VKT (39%). Facilities in Rangiora are well established. For instance, there are a range of schools, supermarkets, hardware stores, food and other retail outlets, restaurants, cafes and bars. However, due to Rangiora's closer proximity to Christchurch, it would appear more commuting residents are willing and able to travel outside of the town for non-employment purposes.

In complete contrast to Oxford and Rangiora, Prebbleton (the closest case study town to Christchurch) has the highest annual non-commuter related VKT for commuting residents (127%). This may be attributed to three factors; close proximity to Christchurch, the lack of facilities in

Prebbleton which necessitates additional travel but moreover, the high median income, the highest of any Greater Christchurch case study town at $77,000 (Table 8).

The commuting residents of the other Greater Christchurch study towns, Rolleston and Lincoln have a similar (relatively high) annual non commuter related VKT (60% & 58% respectively). This may be attributed to the further distance from Christchurch and the higher than average median incomes ($69,900 and $59,600 respectively - Table 8). Annual income for Kaiapoi is lower at $43,133, although closer to Christchurch and this may account for the relatively high annual non-commuter related VKT (73%). Income data for Pegasus wasn't available from the 2006 Census. However, the calculations highlight Pegasus also has a relatively high annual non-commuter related VKT (57%). This could be attributed to the absence of facilities as Pegasus is a new town currently under development.

A similar pattern can be seen in the Greater Tauranga case studies. The two commuter towns located furthest from central Tauranga (Te Puke and Katikati) have a lower annual non-commuter related VKT (51% & 40% respectively) compared to that of the closest town of Omokoroa (88%). This can most likely be attributed to the same reasons as for the Greater Christchurch study towns. Worthy of note is Omokoroa with a high non-commuter related VKT which is almost equal to that of commuter related VKT and has the highest median income of the three towns.

VEDAS shows that commuting VKT (per vehicle) steadily decreases as the number of vehicles per household increases. On average, vehicle 2 travels 15% fewer kilometres than vehicle 1, vehicle three travels 21% less than vehicle 1 and vehicle 4 travels 23% less than vehicle 1 (Table 24). The decrease per vehicle is less significant than that of non-commuter vehicles (Table 22). This highlights the lower energy resilience of commuter households regardless of whether they are single or multi vehicle.

Table 24: Vehicle kilometres travelled for commuting resident vehicles 2011-2012

Area	Vehicle 1 VKT	Vehicle 2 VKT	Vehicle 3 VKT	Vehicle 4 VKT
Greater Christchurch				
Rangiora	20,852	18,432	18,582	19,299
Oxford	32,154	29,575	28,241	29,444
Kaiapoi	17,952	14,711	13,217	12,295
Rolleston	18,933	15,625	14,451	13,824
Prebbleton	15,978	12,036	10,442	9,347
Lincoln	17,347	14,416	14,106	12,505
Pegasus	21,452	17,230	14,430	No Data
Greater Tauranga				
Te Puke	22,402	18,964	17,706	16,637
Omokoroa	19,028	16,191	14,734	12,863
Katikati	23,926	20,724	19,558	18,531

Overall, (based on Tables 21 & 23) residents in the case studies who reside and are employed in one of the commuter townships (non-commuters) use 60% less energy (1,202 litres) than commuting residents (See Appendices 8.25 & 8.26 for Greater Christchurch and 8.27 & 8.28 for Greater

Tauranga). There is no overall difference in energy demand between non-commuting and central city based residents. Indeed, the results show that in some instances it is actually more energy efficient to reside in a commuter town than the city. This is directly linked to a commuter town having not only local employment but also a range of fully established services.

5.6. Energy demand for a new residential development

5.6.1. Introduction

This section examines the potential energy demand for five residential developments of one thousand new homes through a number of scenarios using the Scenario Analyser in VEDAS. Three scenarios were based on development in Rangiora and two on Christchurch. The purpose was to gain an understanding of the differences in energy demand relative to residential location.

5.6.2. Scenarios

Scenario A

Scenario A is based upon the development of 1000 new residential homes on the edge of Rangiora Township (North Canterbury). It simulates the energy demand of these new homes, assuming 100% of the residents are employed locally and travel less than 14,652km annually. The purpose of such a scenario is to highlight energy demand in a *polar case*.

Scenario B

Scenario B is based upon the development of 1000 new residential homes on the edge of Rangiora Township. It simulates the energy demand of these new homes, assuming that 71% of the residents are employed locally and 29% commute more than 14,652km. The non-commuter / commuter split is based on the 2012 Rangiora data from VEDAS. The purpose of this scenario is to represent the current situation.

Scenario C

Scenario C is based upon the development of 1000 new residential homes on the edge of Rangiora Township. It is assumed a bus service between Rangiora and Christchurch is used by commuting residents for 80% of their annual commute (178 days). This would equate to the average commuting Rangiora resident using public transport for almost 50% of their yearly travel needs. The energy demand of the bus service (fuel consumption) is based on 4 return trips per day / per household and 64 litres per 100km fuel consumption (Becken, 2002). It is assumed the bus service is provided every day throughout the year. The non-commuter / commuter split are based on the 2012 Rangiora data from VEDAS. The purpose of such a scenario is to calculate the potential energy saving through the implementation of transportation demand management principles such as transit orientated development.

Scenario D

Scenario D is based upon the development of 1000 new residential homes in the suburb of Monavale in central Christchurch. The purpose of such a scenario is to represent urban environment principles such as the densification of housing in areas where employment, shopping and leisure facilities are already in existence.

Scenario E

Scenario E is based upon the development of 1000 new residential homes in the suburb of Parklands in North-East Christchurch. The purpose of this scenario is to represent housing development on the fringe of the city where there are few established facilities (employment, shopping and schools).

5.6.3. Parameters

A series of parameters were input into the scenario analyser in VEDAS. The number of vehicles per household was based on 2006 Census data. The vehicle fleet data (vehicle engine capacity, age and fuel type) and travel patterns (annual VKT) was extrapolated from the 2011-2012 VEDAS data. In addition, the percentage of commuting and non-commuting residents for selected Rangiora scenarios was also based upon 2011-2012 VEDAS data.

The figures in Table 25 were extracted from the 2006 Census data and show the number of vehicles per household in percentage terms. The figures from Table 26 are calculated using the information from Table 25 and represent the number of vehicles per 1000 houses. The figures in Table 26 (Column 5) represent the sample size (number of records) used in the scenario analyser in VEDAS.

Table 25: Percentage of vehicles per 1000 houses

	Number of vehicles per household					
Area	None	One	Two	Three or More	Unknown	Total
Parklands	5%	36%	41%	16%	2%	100%
Monavale	6%	39%	34%	18%	2%	100%
Rangiora	7%	38%	38%	15%	2%	100%

(Based on 2006 Census data)

Table 26: Number of vehicles per 1000 houses

	Number of vehicles per household			
Area	One	Two	Three or More	Total
Parklands	360	820	480	1660
Monavale	390	680	540	1610
Rangiora	384	752	458	1594

(Calculated using data from Table 25)

5.6.4. Results

The results highlight the impact of residential location on energy demand. As expected Scenario A produced the lowest energy demand (Table 27). However, whilst Scenario A is unrealistic (100% non-commuting residents) it highlights the importance of locating housing near to employment and other facilities such as schools and supermarkets. Furthermore, the importance of locating housing near to employment and in established areas is highlighted through the energy demand of Scenario D, which was only slightly above that Scenario A. Scenario C highlights the importance of transit orientated development and other such transportation demand management systems. Scenarios B and E have the highest energy demand. Both of these scenarios require commuting, one from a commuter town and the other from the edge of Christchurch City. Despite Rangiora being further from Christchurch than Parklands, Rangiora residents also have access to other services such as schools and shopping facilities in the local vicinity.

Table 27: Scenario energy demand (Sorted by energy demand per 1000 homes)

Area	Energy Demand Per 1000 Homes (litres)
Scenario A - Rangiora	1,286,358
Scenario D - Monavale	1,394,260
Scenario C - Rangiora	1,479,761
Scenario B - Rangiora	1,806,002
Scenario E - Parklands	1,806,080

5.7. Summary

The information generated through VEDAS provides an insight into vehicle energy demand for Greater Christchurch and Greater Tauranga. The research finds an overall reduction in VKT of 10.5% and a consequent reduction in energy demand of 10.7% over the previous decade. Furthermore, the results from VEDAS also provide an insight into the influence of vehicle engine capacity (VEC) and vehicle age (VA) on energy demand. Of the three influencing factors responsible for energy demand, the findings suggest VKT is the most influential. This is supported by the notion that despite VEC and VA increasing (worsening) over the previous decade, the majority of areas under analysis witnessed a reduction in demand. In addition, the results highlight the potential impact of improving the fuel efficiency of the New Zealand light passenger vehicle fleet with *realistic* energy savings of up to 9%. Whilst vehicle efficiency does not impact as significantly on energy demand as VKT, it is still an important consideration when striving to reduce the energy demand of the fleet.

The results from the analysis also highlight that energy demand for commuting residents far exceeds that of non-commuting residents. Residents who live and work locally, regardless of their location used on average 61% less energy (1,202 litres) than commuting residents. The energy demand of non-commuting residents in towns with a number of essential and non-essential destinations was

similar to or lower than the energy demand of residents in the lowest energy demand suburbs in the central cities of Christchurch and Tauranga. Thus, the analysis finds it is not only distance to the city which is of importance, but more so distance to employment and other essential destinations.

The research finds there is an opportunity to reduce both non-commuter and commuter related VKT for residents living in commuter towns closest to the city through the development of financially viable transit systems within the existing urban periphery. This is important as commuting residents who live closest to the city travel 57% to 127% over and above that of their commuter based (necessary) travel.

However, the VKT of commuting residents who live furthest from the city is only 28% to 39% over and above that of their commuter based (necessary) annual travel. These residents also have a lower median income. This is of concern as the energy resilience of such residents is already low and leaves little room for adaptation in the event of significant fuel price rises. Furthermore, the opportunity to provide an adequate public transport service to these residents is limited due to the likely high financial cost.

Finally, the analysis highlights the importance of locating housing near to employment and the role of Transportation Demand Management strategies such as Transit Orientated and Location Efficient Development in reducing energy demand. This includes locating housing in established and mixed use areas through increasing housing density, providing as many localised employment opportunities as feasible to increase the number of non-commuting residents and providing energy efficient public transport for commuting residents, in order to maximise the reduction in energy demand.

6. CONCLUSION & RECOMMENDATIONS

The research highlights the considerable impact of residential location on light passenger vehicle energy demand in New Zealand. Moreover, it proves the importance of location over and above that of vehicle fleet efficiency. It demonstrates the strong link between residential location and proximity to employment and other essential services such as schools and supermarkets. As distance increases, so too does vehicle kilometres travelled and thus energy demand. The case study analysis and scenario modelling show the most significant reduction in energy demand was witnessed in areas which provided localised employment and essential services.

Dismissing the impact of residential location on light passenger vehicle fleet energy demand will have significant implications for New Zealand as fuel shocks and long term fuel price increases will reduce accessibility and mobility. As a result, it will be necessary for New Zealanders to make changes to their use of transport energy. However, due to the design and layout of New Zealand's urban and suburban environment, there is a limit to how far the public can effectively adapt. This issue is supported by the research results which show that commuting residents who live further from the city not only have a lower median income but their non-employment related VKT is significantly lower. This is of concern as the energy resilience of such residents is already low and leaves little room for adaptation in the event of significant fuel price rises. In addition, the opportunity to provide an adequate public transport service to these residents is limited due to its financial cost. The issue needs to be urgently addressed so as to allow for a period of steady behavioural change.

Although the Government is unable to control the global oil price, it controls transport and land-use policy. Thus, it needs to introduce policies which will significantly reduce the energy demand of the light vehicle fleet, lessening the reliance on foreign oil and reducing the impact of episodes of supply uncertainty and price shocks such as witnessed in 2008. Traditionally, residential development in New Zealand has been driven by market demand and investors under the Resource Management Act (RMA). The RMA does not currently consider the energy demand of residential developments or incorporate transportation demand management systems. It is particularly important when planning new developments that full consideration is given to the location of the area with respect to distance to employment and other services. Where feasible, mixed land use areas should be established, accommodating residential, commercial and social facilities. Furthermore, transit orientation development and location efficient development principles should be applied to all future developments and where possible retro-fitted in existing areas. This is supported by the finding that non employment related VKT is higher in the commuter towns which are closest to the city. Thus, there is the opportunity not only to reduce non-commuter related VKT but also commuter related VKT which would be financially viable as it is within the urban periphery.

In addition to changes in policy and legislation, the Government should also consider how it can improve the efficiency of the light passenger fleet. The results from the analysis suggest a realistic solution to increase vehicle efficiency would be through the introduction of more stringent emissions

standards. Attempting to replace the fleet with alternative technology vehicles in the medium term is unrealistic. What is realistic is the Government updating emissions standards to Euro 5 for used imported vehicles upon its next review in 2014. In addition, emissions standards for new vehicles should also be upgraded to match those of the European Union.

Due to numerous factors such as preferred lifestyle, limited public transport and geography, it will be necessary for New Zealanders to own light passenger vehicles. Thus, it is imperative that not only is the vehicle fleet as fuel efficient as possible, but moreover, the vehicle kilometres travelled are reduced to a realistic minimum. This can be achieved through the adoption of policy and legislation which will drive the necessary changes in land-use and urban environment.

Tools such as VEDAS will allow the Government and local authorities to gain an insight into current and future energy demand relative to residential location. This has been proven through the results of the two case studies analysed using VEDAS and in addition, the scenarios modelled (also using VEDAS). An extended analysis of all major New Zealand cities and their associated commuter towns would confirm the relationship between residential location and light passenger vehicle energy demand. This would be particularly relevant in cities which are expected to experience significant growth in the foreseeable future.

Moreover, specialised research could be undertaken using the unique functionality of VEDAS. This would be focussed on cities such as Auckland and Wellington due to their established rail and bus transport networks. The energy demand of vehicles located within specified distances to the rail and bus stations (Auckland and Wellington) would be examined and the results compared with areas in these cities where such transport is limited. Such scenarios (Transit orientated and location efficient development) were modelled in this research. However, this would be an opportunity to utilise real New Zealand data.

The research could then be extended to other cities such as Christchurch where there is potential to develop the existing rail link. For instance, if it was proven vehicles in Auckland and Wellington located within 1km of a railway station had a 30% lower annual VKT, hypothetical stations could be modelled for cities such as Christchurch. This would be achieved by assigning a 30% reduction in annual VKT to vehicles located within 1km of hypothetical stations. VEDAS could be used to calculate the potential energy (fuel) reduction which could be achieved. This concept could also be applied to other modes such a cycling, pedestrian and bus rapid transit. This would emphasise the need for New Zealand to adopt smart growth and transportation management strategies such as transit orientated and location efficient development.

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8. APPENDICES

8.1. Christchurch City Results 2002-2003

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Addington	11,976	1,214	2,593.42	1,996	1992	100.0
>=3000	17,287	2,615	5,471.99	3,921	1993	5.3
>=2000 &<3000	13,453	1,445	3,050.46	2,599	1993	18.3
>=1500 &<2000	11,911	1,165	2,506.82	1,852	1992	54.0
>=1200 &<1500	9,541	806	1,734.03	1,427	1992	21.0
<1200	11,394	855	1,837.28	838	1986	1.3
Aidanfield	12,141	1,271	2,708.38	2,184	1994	100.0
>=3000	13,555	1,915	3,966.68	3,828	1997	14.7
>=2000 &<3000	15,059	1,634	3,451.18	2,460	1992	23.5
>=1500 &<2000	12,066	1,163	2,506.12	1,777	1994	44.1
>=1200 &<1500	7,260	522	1,175.04	1,462	1994	17.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Aorangi	11,278	1,132	2,424.16	1,957	1993	100.0
>=3000	11,360	1,701	3,585.16	3,712	1994	3.8
>=2000 &<3000	12,518	1,383	2,934.18	2,539	1993	21.1
>=1500 &<2000	11,439	1,126	2,423.02	1,842	1992	51.8
>=1200 &<1500	10,035	852	1,830.87	1,436	1993	22.0
<1200	5,891	442	949.91	886	1995	1.4
Aranui	12,340	1,232	2,631.89	2,000	1991	100.0
>=3000	12,366	1,827	3,778.02	3,838	1991	4.8
>=2000 &<3000	12,637	1,351	2,845.05	2,531	1990	20.3
>=1500 &<2000	12,574	1,236	2,660.32	1,861	1991	55.1
>=1200 &<1500	11,461	968	2,083.14	1,436	1992	18.4
<1200	10,238	768	1,650.94	817	1995	1.4
Avon Loop	11,166	1,180	2,508.63	2,260	1993	100.0
>=3000	13,449	1,852	3,885.74	4,074	1993	13.1
>=2000 &<3000	13,205	1,424	3,007.63	2,548	1993	28.5
>=1500 &<2000	9,638	947	2,037.47	1,835	1993	41.6
>=1200 &<1500	10,069	852	1,832.08	1,459	1993	15.4
<1200	5,760	432	928.80	917	1994	1.4
Avondale	11,291	1,139	2,429.52	1,998	1993	100.0
>=3000	12,798	1,835	3,778.57	3,799	1994	6.4
>=2000 &<3000	12,433	1,342	2,834.77	2,538	1993	19.3
>=1500 &<2000	11,248	1,108	2,384.53	1,838	1993	51.6
>=1200 &<1500	10,083	851	1,833.15	1,424	1993	21.8
<1200	8,108	605	1,301.08	866	1996	1.0
Avonhead	10,964	1,132	2,419.78	2,045	1994	100.0
>=3000	13,195	1,940	4,058.75	4,023	1995	6.8
>=2000 &<3000	12,445	1,385	2,943.70	2,523	1994	22.4
>=1500 &<2000	10,814	1,063	2,288.16	1,824	1994	51.0
>=1200 &<1500	9,007	760	1,635.46	1,426	1993	18.6
<1200	7,611	553	1,198.79	963	1996	1.2

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Avonhead West	11,966	1,223	2,613.27	2,051	1993	100.0
>=3000	11,972	1,751	3,681.08	3,762	1996	7.6
>=2000 &<3000	13,328	1,456	3,085.40	2,556	1994	22.3
>=1500 &<2000	11,883	1,171	2,519.24	1,828	1993	49.3
>=1200 &<1500	10,687	907	1,949.89	1,434	1993	20.0
<1200	11,117	824	1,772.49	963	1998	0.9
Avonside	11,583	1,145	2,455.40	1,920	1992	100.0
>=3000	12,753	1,912	4,007.51	3,727	1992	4.1
>=2000 &<3000	12,429	1,393	2,964.08	2,534	1993	15.1
>=1500 &<2000	11,707	1,138	2,449.38	1,854	1992	55.5
>=1200 &<1500	10,936	927	1,992.37	1,434	1993	23.5
<1200	6,330	374	868.05	1,020	1989	1.7
Barrington North	11,003	1,089	2,328.06	1,931	1992	100.0
>=3000	11,693	1,687	3,484.83	4,258	1992	3.9
>=2000 &<3000	12,594	1,354	2,857.32	2,535	1992	16.8
>=1500 &<2000	11,236	1,107	2,381.22	1,830	1992	54.1
>=1200 &<1500	9,556	808	1,737.54	1,433	1993	23.0
<1200	6,863	479	1,050.36	838	1994	2.1
Barrington South	11,416	1,127	2,412.72	1,916	1993	100.0
>=3000	11,237	1,640	3,444.03	3,965	1996	3.3
>=2000 &<3000	12,709	1,367	2,884.39	2,535	1993	16.5
>=1500 &<2000	12,262	1,202	2,588.03	1,842	1993	54.9
>=1200 &<1500	8,871	752	1,617.59	1,431	1993	23.9
<1200	6,952	518	1,114.35	912	1995	1.4
Beckenham	11,216	1,128	2,409.80	1,940	1993	100.0
>=3000	14,731	2,206	4,593.15	3,689	1991	4.1
>=2000 &<3000	12,525	1,346	2,839.66	2,488	1993	19.2
>=1500 &<2000	11,603	1,143	2,459.95	1,848	1993	53.3
>=1200 &<1500	8,970	761	1,635.22	1,443	1993	20.5
<1200	6,235	463	995.16	1,022	1998	2.8
Belfast	13,195	1,345	2,861.57	2,069	1992	100.0
>=3000	15,497	2,253	4,650.29	3,835	1992	7.2
>=2000 &<3000	14,036	1,479	3,107.87	2,576	1992	23.0
>=1500 &<2000	13,415	1,321	2,842.78	1,840	1992	50.4
>=1200 &<1500	10,805	916	1,969.65	1,431	1993	18.2
<1200	10,031	752	1,617.45	918	1994	1.2
Belfast South	11,887	1,226	2,628.01	2,054	1994	100.0
>=3000	9,189	1,326	2,750.60	3,974	1994	7.3
>=2000 &<3000	14,381	1,678	3,596.69	2,455	1994	21.3
>=1500 &<2000	12,030	1,175	2,529.03	1,847	1993	52.7
>=1200 &<1500	10,002	845	1,816.42	1,452	1994	17.3
<1200	5,676	426	915.26	1,080	2000	1.3
Bexley	12,636	1,275	2,710.72	1,989	1992	100.0
>=3000	15,038	2,169	4,425.74	3,620	1991	6.7
>=2000 &<3000	14,244	1,484	3,109.97	2,402	1991	19.2
>=1500 &<2000	12,838	1,260	2,711.19	1,855	1992	54.2
>=1200 &<1500	9,608	810	1,740.60	1,422	1993	19.2
<1200	12,960	972	2,089.80	1,171	2000	0.8

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Bishopdale	11,429	1,159	2,476.18	2,003	1993	100.0
>=3000	11,907	1,746	3,604.97	3,909	1993	5.5
>=2000 &<3000	12,270	1,348	2,854.05	2,548	1993	19.7
>=1500 &<2000	11,595	1,151	2,474.81	1,837	1993	53.8
>=1200 &<1500	10,203	864	1,857.83	1,441	1993	19.7
<1200	8,111	605	1,301.12	940	1995	1.2
Bishopdale North	11,606	1,188	2,534.55	2,100	1993	100.0
>=3000	12,376	1,792	3,724.25	3,786	1996	8.5
>=2000 &<3000	11,942	1,293	2,734.70	2,554	1993	24.6
>=1500 &<2000	11,695	1,151	2,477.43	1,859	1993	47.0
>=1200 &<1500	10,937	926	1,990.03	1,425	1993	18.7
<1200	6,139	257	682.27	774	1993	1.2
Bromley	11,862	1,203	2,566.30	2,019	1992	100.0
>=3000	13,463	1,965	4,035.81	3,742	1991	6.2
>=2000 &<3000	12,769	1,388	2,934.81	2,574	1992	19.0
>=1500 &<2000	12,045	1,189	2,557.95	1,864	1991	53.4
>=1200 &<1500	10,122	858	1,844.76	1,449	1992	20.3
<1200	10,411	781	1,678.81	791	1997	1.1
Broomfield	12,270	1,234	2,637.30	1,977	1993	100.0
>=3000	12,154	1,796	3,711.77	4,040	1993	5.5
>=2000 &<3000	14,409	1,582	3,354.10	2,565	1993	16.5
>=1500 &<2000	12,240	1,200	2,581.40	1,816	1993	57.7
>=1200 &<1500	10,850	918	1,974.59	1,439	1993	18.6
<1200	8,431	629	1,353.24	964	1998	1.7
Bryndwr	10,857	1,159	2,464.79	2,224	1994	100.0
>=3000	12,411	1,856	3,884.79	3,955	1995	13.3
>=2000 &<3000	12,200	1,308	2,758.32	2,532	1994	27.1
>=1500 &<2000	10,509	1,033	2,222.61	1,823	1994	42.4
>=1200 &<1500	8,935	744	1,609.10	1,451	1994	15.3
<1200	4,290	318	682.25	911	1998	2.0
Burnside	11,283	1,172	2,505.80	2,048	1994	100.0
>=3000	14,541	2,177	4,594.30	3,995	1995	6.8
>=2000 &<3000	12,355	1,370	2,910.46	2,536	1994	22.2
>=1500 &<2000	11,314	1,116	2,401.52	1,832	1994	51.1
>=1200 &<1500	9,070	767	1,649.31	1,425	1993	18.5
<1200	6,615	494	1,062.02	948	1995	1.4
Burwood	12,095	1,238	2,646.62	1,966	1993	100.0
>=3000	27,012	4,322	9,292.13	3,880	1996	2.2
>=2000 &<3000	13,922	1,495	3,151.71	2,598	1993	23.7
>=1500 &<2000	11,648	1,160	2,494.58	1,825	1993	54.8
>=1200 &<1500	10,184	866	1,861.17	1,453	1994	17.2
<1200	3,756	282	605.66	828	1994	2.2
Camside	13,854	1,397	2,973.56	2,067	1992	100.0
>=3000	14,235	2,066	4,248.05	3,803	1992	7.4
>=2000 &<3000	13,750	1,450	3,047.03	2,543	1992	24.0
>=1500 &<2000	14,505	1,418	3,051.99	1,836	1992	48.8
>=1200 &<1500	12,204	1,035	2,225.84	1,438	1993	18.5
<1200	12,617	944	2,030.56	924	1996	1.2

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Casebrook	11,417	1,129	2,410.66	1,978	1992	100.0
>=3000	9,996	1,389	2,804.30	3,975	1993	5.8
>=2000 &<3000	13,004	1,424	3,013.16	2,570	1992	15.6
>=1500 &<2000	11,699	1,138	2,449.12	1,840	1992	54.9
>=1200 &<1500	10,240	869	1,867.73	1,451	1992	22.3
<1200	7,116	534	1,147.46	884	1997	1.3
Cashmere East	11,075	1,164	2,486.43	2,100	1994	100.0
>=3000	12,573	1,867	3,919.28	3,750	1995	8.9
>=2000 &<3000	13,546	1,510	3,210.05	2,537	1994	24.6
>=1500 &<2000	10,417	1,018	2,191.01	1,830	1994	49.1
>=1200 &<1500	8,812	744	1,599.49	1,428	1994	16.0
<1200	6,953	519	1,115.26	1,018	1996	1.4
Cashmere West	11,211	1,142	2,428.01	1,992	1994	100.0
>=3000	17,328	2,253	4,323.34	3,548	1994	3.2
>=2000 &<3000	13,384	1,484	3,150.10	2,483	1995	28.0
>=1500 &<2000	10,881	1,067	2,295.16	1,843	1994	47.3
>=1200 &<1500	8,193	696	1,497.27	1,448	1993	21.5
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Cathedral Square	13,293	1,462	3,124.43	2,546	1994	100.0
>=3000	9,456	1,513	3,252.86	4,554	1996	14.3
>=2000 &<3000	13,580	1,510	3,202.19	2,731	1993	42.9
>=1500 &<2000	18,300	1,830	3,934.50	1,792	1994	28.6
>=1200 &<1500	6,252	531	1,142.55	1,490	1991	14.3
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Clarkville	14,723	1,412	3,005.01	1,800	1991	100.0
>=3000	26,304	3,420	6,562.85	3,246	1987	2.2
>=2000 &<3000	22,935	2,251	4,660.10	2,448	1989	8.7
>=1500 &<2000	14,694	1,430	3,079.01	1,855	1992	60.9
>=1200 &<1500	11,563	983	2,113.14	1,431	1990	26.1
<1200	9,036	678	1,457.06	659	1992	2.2
Dallington	10,972	1,106	2,363.30	1,990	1992	100.0
>=3000	13,030	1,938	4,035.30	3,702	1992	5.8
>=2000 &<3000	11,571	1,244	2,627.87	2,598	1992	19.3
>=1500 &<2000	11,293	1,110	2,388.42	1,829	1992	51.0
>=1200 &<1500	9,373	795	1,708.25	1,444	1993	22.9
<1200	7,718	579	1,244.59	1,060	1995	1.0
Deans Bush	10,559	1,124	2,400.10	2,133	1995	100.0
>=3000	13,727	2,074	4,375.13	3,888	1997	10.8
>=2000 &<3000	12,666	1,397	2,968.99	2,649	1995	23.7
>=1500 &<2000	9,448	933	2,005.59	1,836	1995	41.7
>=1200 &<1500	8,981	763	1,641.35	1,387	1994	22.3
<1200	8,694	652	1,401.91	657	1998	1.4
Diamond Harbour	20,723	2,022	4,335.06	1,901	1992	100.0
>=3000	No Data	No Data	No Data	No Data	No Data	0.0
>=2000 &<3000	16,744	1,779	3,741.90	2,471	1992	23.1
>=1500 &<2000	22,115	2,138	4,605.58	1,757	1992	69.2
>=1200 &<1500	20,136	1,712	3,679.85	1,493	1992	7.7
<1200	No Data	No Data	No Data	No Data	No Data	0.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Edgeware	10,876	1,071	2,284.03	1,926	1993	100.0
>=3000	12,352	1,851	3,853.70	3,661	1993	2.9
>=2000 &<3000	13,374	1,367	2,853.49	2,606	1992	17.3
>=1500 &<2000	10,605	1,059	2,277.37	1,859	1993	52.9
>=1200 &<1500	9,646	820	1,762.86	1,433	1993	26.9
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Ensors	12,396	1,240	2,651.66	2,038	1992	100.0
>=3000	9,018	1,371	2,875.39	3,980	1994	6.7
>=2000 &<3000	9,615	966	2,008.73	2,606	1992	13.3
>=1500 &<2000	11,998	1,200	2,579.51	1,830	1992	70.0
>=1200 &<1500	21,148	1,798	3,864.80	1,442	1993	10.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Fendalton	10,846	1,132	2,412.77	2,089	1994	100.0
>=3000	12,619	1,810	3,741.13	3,687	1995	9.2
>=2000 &<3000	12,095	1,344	2,857.92	2,511	1995	24.9
>=1500 &<2000	10,416	1,028	2,212.06	1,826	1994	45.9
>=1200 &<1500	9,508	801	1,722.58	1,441	1993	19.7
<1200	7,908	593	1,275.17	1,189	1991	0.4
Ferrymead	9,140	860	1,831.13	1,909	1993	100.0
>=3000	No Data	No Data	No Data	No Data	No Data	0.0
>=2000 &<3000	11,112	1,056	2,169.62	2,660	1995	16.7
>=1500 &<2000	8,536	854	1,835.24	1,994	1993	50.0
>=1200 &<1500	9,060	770	1,655.72	1,406	1994	33.3
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Governors Bay	15,507	1,675	3,527.15	2,446	1995	100.0
>=3000	16,294	2,130	4,191.07	4,435	1994	17.1
>=2000 &<3000	16,747	1,922	4,106.57	2,499	1995	37.1
>=1500 &<2000	16,332	1,559	3,360.55	1,842	1994	25.7
>=1200 &<1500	11,470	975	2,096.19	1,419	1995	20.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Hagley Park	11,958	1,216	2,592.62	2,047	1993	100.0
>=3000	14,172	2,084	4,338.41	3,886	1994	6.5
>=2000 &<3000	12,974	1,391	2,933.69	2,540	1993	22.9
>=1500 &<2000	11,904	1,168	2,512.58	1,846	1992	50.2
>=1200 &<1500	10,318	874	1,878.11	1,437	1993	19.2
<1200	9,292	697	1,498.34	967	1996	1.3
Halswell Domain	12,390	1,254	2,673.35	2,043	1993	100.0
>=3000	13,724	1,991	4,121.91	3,863	1994	6.0
>=2000 &<3000	13,870	1,484	3,127.28	2,576	1993	22.7
>=1500 &<2000	12,177	1,199	2,579.60	1,838	1993	51.4
>=1200 &<1500	10,965	924	1,989.96	1,439	1993	18.8
<1200	8,510	614	1,334.62	930	1996	1.0
Halswell South	13,293	1,322	2,818.71	2,002	1993	100.0
>=3000	15,990	2,558	5,500.56	4,143	1996	3.8
>=2000 &<3000	15,617	1,580	3,295.28	2,611	1993	25.2
>=1500 &<2000	14,003	1,374	2,956.58	1,814	1993	47.2
>=1200 &<1500	9,000	760	1,635.04	1,438	1994	22.0
<1200	9,240	681	1,463.38	882	1997	1.9

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Halswell West	13,293	1,322	2,818.71	2,002	1993	100.0
>=3000	15,990	2,558	5,500.56	4,143	1996	3.8
>=2000 &<3000	15,617	1,580	3,295.28	2,611	1993	25.2
>=1500 &<2000	14,003	1,374	2,956.58	1,814	1993	47.2
>=1200 &<1500	9,000	760	1,635.04	1,438	1994	22.0
<1200	9,240	681	1,463.38	882	1997	1.9
Harewood	11,429	1,159	2,476.18	2,003	1993	100.0
>=3000	11,907	1,746	3,604.97	3,909	1993	5.5
>=2000 &<3000	12,270	1,348	2,854.05	2,548	1993	19.7
>=1500 &<2000	11,595	1,151	2,474.81	1,837	1993	53.8
>=1200 &<1500	10,203	864	1,857.83	1,441	1993	19.7
<1200	8,111	605	1,301.12	940	1995	1.2
Hawthornden	12,686	1,309	2,769.66	2,147	1994	100.0
>=3000	14,922	2,136	4,340.69	3,611	1994	13.6
>=2000 &<3000	12,600	1,318	2,770.77	2,491	1992	20.5
>=1500 &<2000	10,817	1,050	2,260.76	1,842	1994	47.7
>=1200 &<1500	16,011	1,361	2,926.01	1,462	1994	18.2
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Heathcote Valley	13,047	1,284	2,746.52	2,033	1993	100.0
>=3000	11,726	1,784	3,762.08	3,810	1994	5.4
>=2000 &<3000	15,512	1,620	3,399.62	2,600	1993	23.1
>=1500 &<2000	12,640	1,226	2,640.67	1,843	1993	50.6
>=1200 &<1500	11,662	927	2,027.93	1,429	1993	19.6
<1200	11,457	844	1,813.97	1,024	1997	1.3
Hendersons Basin	11,774	1,222	2,578.46	2,074	1993	100.0
>=3000	16,350	2,189	4,277.49	3,669	1993	9.0
>=2000 &<3000	12,453	1,367	2,892.27	2,494	1993	23.6
>=1500 &<2000	11,597	1,150	2,473.09	1,844	1993	47.2
>=1200 &<1500	9,891	837	1,799.87	1,457	1993	19.1
<1200	360	27	58.05	658	1996	1.1
Hillmorton	11,738	1,177	2,509.42	2,027	1992	100.0
>=3000	12,580	1,858	3,850.81	3,943	1994	5.9
>=2000 &<3000	13,668	1,434	3,009.81	2,560	1992	19.7
>=1500 &<2000	11,612	1,135	2,442.56	1,847	1992	53.6
>=1200 &<1500	10,058	855	1,838.05	1,444	1992	20.4
<1200	5,352	401	863.01	999	1991	0.3
Holmwood	10,265	1,103	2,369.22	2,188	1994	100.0
>=3000	9,936	1,550	3,293.70	4,487	1994	8.6
>=2000 &<3000	12,095	1,436	3,083.47	2,537	1996	29.3
>=1500 &<2000	9,819	938	2,022.05	1,783	1993	48.3
>=1200 &<1500	8,147	693	1,488.77	1,427	1993	13.8
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Hoon Hay	11,552	1,158	2,474.72	1,957	1992	100.0
>=3000	12,858	1,896	3,946.67	3,809	1994	5.0
>=2000 &<3000	12,252	1,321	2,787.88	2,527	1992	18.3
>=1500 &<2000	11,993	1,185	2,549.91	1,839	1992	52.5
>=1200 &<1500	9,936	839	1,807.25	1,439	1992	22.7
<1200	7,607	568	1,221.86	858	1996	1.5

Vehicle Engine Capacity by Suburb (CC)	**Average Vehicle Kilometres Travelled (Km)**	**Average Energy Demand (Litres)**	**Average Fuel Cost ($)**	**Average Vehicle Engine Capacity (CC)**	**Average Vehicle Age**	**Vehicle Engine Capacity (%)**
Hoon Hay South	11,429	1,123	2,397.76	1,886	1994	100.0
>=3000	11,248	1,592	3,213.86	3,703	1994	2.9
>=2000 &<3000	13,134	1,413	2,979.87	2,517	1993	20.0
>=1500 &<2000	12,589	1,244	2,675.50	1,861	1994	46.7
>=1200 &<1500	9,353	787	1,691.44	1,447	1994	22.9
<1200	6,149	457	981.53	1,018	1995	7.6
Hornby North	11,625	1,158	2,475.02	1,979	1992	100.0
>=3000	11,695	1,732	3,626.08	3,831	1993	4.6
>=2000 &<3000	11,362	1,216	2,562.48	2,535	1992	21.5
>=1500 &<2000	12,356	1,215	2,615.37	1,833	1992	51.6
>=1200 &<1500	10,486	882	1,897.09	1,442	1993	20.3
<1200	6,790	504	1,083.46	912	1998	1.9
Hornby South	11,552	1,150	2,456.92	1,983	1992	100.0
>=3000	12,090	1,777	3,683.89	4,129	1994	5.1
>=2000 &<3000	12,117	1,286	2,705.85	2,552	1992	18.2
>=1500 &<2000	11,787	1,165	2,505.55	1,838	1992	53.0
>=1200 &<1500	10,677	900	1,937.86	1,433	1992	22.7
<1200	6,181	459	987.43	1,040	1997	1.0
Ilam	10,472	1,080	2,308.70	2,002	1994	100.0
>=3000	12,703	1,854	3,865.64	3,758	1996	6.8
>=2000 &<3000	12,147	1,365	2,904.73	2,520	1995	20.1
>=1500 &<2000	10,314	1,015	2,183.85	1,818	1994	51.8
>=1200 &<1500	8,798	743	1,598.09	1,424	1994	19.9
<1200	4,719	352	757.05	948	1995	1.3
Islington	12,057	1,220	2,597.99	2,049	1991	100.0
>=3000	14,324	2,119	4,384.77	3,932	1991	5.8
>=2000 &<3000	12,695	1,318	2,758.58	2,545	1991	22.6
>=1500 &<2000	12,047	1,192	2,564.52	1,846	1992	53.4
>=1200 &<1500	10,640	904	1,944.50	1,448	1992	17.5
<1200	8,592	645	1,385.46	828	1997	0.7
Jellie Park	11,278	1,132	2,424.16	1,957	1993	100.0
>=3000	11,360	1,701	3,585.16	3,712	1994	3.8
>=2000 &<3000	12,518	1,383	2,934.18	2,539	1993	21.1
>=1500 &<2000	11,439	1,126	2,423.02	1,842	1992	51.8
>=1200 &<1500	10,035	852	1,830.87	1,436	1993	22.0
<1200	5,891	442	949.91	886	1995	1.4
Kennedys Bush	12,893	1,331	2,833.56	2,163	1994	100.0
>=3000	15,130	2,206	4,527.92	4,436	1995	8.3
>=2000 &<3000	14,093	1,550	3,285.72	2,650	1993	24.0
>=1500 &<2000	12,502	1,212	2,608.23	1,823	1994	50.4
>=1200 &<1500	11,394	969	2,082.25	1,434	1994	16.5
<1200	9,600	720	1,548.00	657	1998	0.8
Linwood	9,973	975	2,086.60	1,941	1994	100.0
>=3000	3,492	559	1,201.25	3,984	1996	2.3
>=2000 &<3000	10,442	1,131	2,390.87	2,510	1994	23.3
>=1500 &<2000	9,686	958	2,060.35	1,842	1993	48.8
>=1200 &<1500	11,141	947	2,035.98	1,454	1994	23.3
<1200	6,120	459	986.85	1,171	1999	2.3

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Linwood East	12,923	1,279	2,737.10	1,876	1992	100.0
>=3000	15,628	2,339	4,867.24	3,645	1994	5.2
>=2000 &<3000	20,494	2,274	4,823.35	2,577	1993	10.3
>=1500 &<2000	12,041	1,164	2,507.77	1,847	1991	53.4
>=1200 &<1500	12,038	1,017	2,187.45	1,422	1993	29.3
<1200	1,752	131	282.51	1,000	1982	1.7
Linwood North	10,670	1,070	2,287.49	1,967	1991	100.0
>=3000	11,760	1,745	3,625.87	3,806	1991	5.6
>=2000 &<3000	12,343	1,333	2,812.65	2,512	1991	15.7
>=1500 &<2000	10,730	1,048	2,255.41	1,844	1991	57.2
>=1200 &<1500	9,288	789	1,695.67	1,444	1992	20.3
<1200	4,248	316	679.02	892	1992	1.2
Lyttelton	15,870	1,620	3,447.29	2,034	1993	100.0
>=3000	17,322	2,542	5,236.13	3,456	1988	5.9
>=2000 &<3000	18,467	1,966	4,139.75	2,393	1992	27.9
>=1500 &<2000	15,105	1,488	3,201.92	1,898	1993	48.5
>=1200 &<1500	14,081	1,197	2,573.39	1,398	1993	16.2
<1200	5,616	393	845.21	996	2002	1.5
Mairehau	10,518	1,087	2,324.08	2,057	1992	100.0
>=3000	10,780	1,532	3,207.57	3,961	1993	9.4
>=2000 &<3000	12,287	1,390	2,958.23	2,499	1992	19.8
>=1500 &<2000	10,641	1,044	2,247.77	1,828	1992	49.0
>=1200 &<1500	9,067	766	1,646.60	1,426	1992	19.8
<1200	3,432	257	553.41	657	1997	2.1
Mairehau North	8,997	1,110	2,234.99	2,538	1997	100.0
>=3000	20,244	2,632	5,050.88	3,059	1995	25.0
>=2000 &<3000	5,862	704	1,512.40	2,747	1997	50.0
>=1500 &<2000	4,020	402	864.30	1,598	1998	25.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Marshland	11,960	1,273	2,693.06	2,132	1992	100.0
>=3000	15,391	2,132	4,252.24	3,758	1991	10.5
>=2000 &<3000	12,737	1,430	3,039.59	2,446	1993	29.1
>=1500 &<2000	12,114	1,187	2,555.71	1,813	1993	44.2
>=1200 &<1500	8,175	695	1,493.94	1,425	1993	15.1
<1200	4,992	374	804.96	996	2000	1.2
Mcleans Island	12,764	1,495	3,205.06	2,355	1992	100.0
>=3000	12,416	1,987	4,271.10	3,249	1995	30.0
>=2000 &<3000	10,020	952	1,956.41	2,446	1987	10.0
>=1500 &<2000	13,396	1,340	2,880.14	1,892	1992	60.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Merivale	11,958	1,216	2,592.62	2,047	1993	100.0
>=3000	14,172	2,084	4,338.41	3,886	1994	6.5
>=2000 &<3000	12,974	1,391	2,933.69	2,540	1993	22.9
>=1500 &<2000	11,904	1,168	2,512.58	1,846	1992	50.2
>=1200 &<1500	10,318	874	1,878.11	1,437	1993	19.2
<1200	9,292	697	1,498.34	967	1996	1.3

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Merrin	10,967	1,129	2,416.75	2,057	1993	100.0
>=3000	12,416	1,858	3,908.34	3,902	1995	8.0
>=2000 &<3000	11,557	1,305	2,781.46	2,568	1993	21.3
>=1500 &<2000	11,220	1,088	2,343.42	1,838	1993	49.0
>=1200 &<1500	9,144	776	1,667.59	1,412	1994	19.6
<1200	10,506	788	1,694.09	947	1995	2.1
Middleton	12,381	1,247	2,680.51	1,937	1992	100.0
>=3000	17,283	2,765	5,945.35	3,552	1996	6.0
>=2000 &<3000	11,853	1,316	2,800.35	2,632	1994	11.9
>=1500 &<2000	12,500	1,210	2,605.60	1,879	1992	55.2
>=1200 &<1500	12,374	1,052	2,261.26	1,447	1992	23.9
<1200	2,550	192	411.19	924	1996	3.0
Mona Vale	10,357	1,092	2,315.39	2,110	1993	100.0
>=3000	12,230	1,742	3,528.99	3,518	1994	11.1
>=2000 &<3000	12,853	1,418	3,003.39	2,483	1994	24.1
>=1500 &<2000	10,127	985	2,123.61	1,852	1993	44.4
>=1200 &<1500	6,888	585	1,258.78	1,465	1992	20.4
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Moncks Bay	12,395	1,269	2,703.63	2,089	1994	100.0
>=3000	15,038	2,119	4,385.30	3,990	1997	9.0
>=2000 &<3000	13,377	1,447	3,065.63	2,566	1994	21.5
>=1500 &<2000	11,964	1,169	2,515.20	1,827	1994	49.1
>=1200 &<1500	11,489	973	2,092.60	1,421	1994	18.6
<1200	8,501	638	1,370.71	884	1992	1.8
Mt Pleasant	12,181	1,267	2,701.78	2,129	1994	100.0
>=3000	13,441	1,968	4,092.88	4,142	1994	8.7
>=2000 &<3000	13,351	1,470	3,116.60	2,516	1994	26.3
>=1500 &<2000	11,972	1,178	2,534.88	1,824	1994	46.5
>=1200 &<1500	10,472	882	1,898.00	1,436	1993	17.4
<1200	10,240	765	1,645.77	930	1995	1.2
New Brighton	12,575	1,259	2,687.69	1,992	1992	100.0
>=3000	13,312	1,953	4,044.86	3,835	1992	6.0
>=2000 &<3000	13,994	1,504	3,173.30	2,539	1991	18.9
>=1500 &<2000	12,729	1,241	2,671.51	1,845	1992	52.1
>=1200 &<1500	11,112	944	2,030.13	1,436	1992	21.2
<1200	7,835	580	1,247.49	898	1996	1.7
North Beach	12,449	1,236	2,643.48	2,005	1992	100.0
>=3000	10,981	1,613	3,371.95	3,889	1994	5.4
>=2000 &<3000	13,466	1,432	3,014.96	2,548	1991	20.9
>=1500 &<2000	12,879	1,269	2,731.06	1,863	1992	51.1
>=1200 &<1500	10,815	904	1,952.02	1,433	1993	20.1
<1200	11,451	775	1,716.48	859	1996	2.4
Northcote	12,212	1,234	2,626.58	2,041	1992	100.0
>=3000	14,378	1,923	3,756.60	4,245	1988	5.6
>=2000 &<3000	13,719	1,534	3,256.75	2,564	1992	15.7
>=1500 &<2000	12,081	1,188	2,555.61	1,875	1992	61.8
>=1200 &<1500	10,566	894	1,921.96	1,425	1992	16.9
<1200	No Data	No Data	No Data	No Data	No Data	0.0

Vehicle Engine Capacity by Suburb (CC)	**Average Vehicle Kilometres Travelled (Km)**	**Average Energy Demand (Litres)**	**Average Fuel Cost ($)**	**Average Vehicle Engine Capacity (CC)**	**Average Vehicle Age**	**Vehicle Engine Capacity (%)**
Oaklands East	12,390	1,254	2,673.35	2,043	1993	100.0
>=3000	13,724	1,991	4,121.91	3,863	1994	6.0
>=2000 &<3000	13,870	1,484	3,127.28	2,576	1993	22.7
>=1500 &<2000	12,177	1,199	2,579.60	1,838	1993	51.4
>=1200 &<1500	10,965	924	1,989.96	1,439	1993	18.8
<1200	8,510	614	1,334.62	930	1996	1.0
Oaklands West	12,141	1,271	2,708.38	2,184	1994	100.0
>=3000	13,555	1,915	3,966.68	3,828	1997	14.7
>=2000 &<3000	15,059	1,634	3,451.18	2,460	1992	23.5
>=1500 &<2000	12,066	1,163	2,506.12	1,777	1994	44.1
>=1200 &<1500	7,260	522	1,175.04	1,462	1994	17.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Opawa	11,058	1,120	2,399.41	1,981	1993	100.0
>=3000	15,950	2,523	5,396.31	3,895	1993	3.5
>=2000 &<3000	11,681	1,281	2,713.79	2,629	1993	19.8
>=1500 &<2000	11,112	1,098	2,362.29	1,862	1993	55.4
>=1200 &<1500	10,188	866	1,861.92	1,439	1993	17.8
<1200	6,226	442	964.38	1,048	1993	3.5
Papanui	10,955	1,125	2,400.71	2,027	1993	100.0
>=3000	12,962	1,902	3,959.34	3,804	1994	6.9
>=2000 &<3000	12,435	1,360	2,876.50	2,534	1993	20.7
>=1500 &<2000	10,812	1,067	2,296.59	1,833	1993	52.1
>=1200 &<1500	9,234	782	1,682.06	1,432	1993	19.0
<1200	7,615	571	1,227.98	972	1995	1.3
Paparua	10,803	1,116	2,365.14	2,297	1992	100.0
>=3000	6,520	848	1,687.46	3,572	1996	13.0
>=2000 &<3000	14,106	1,509	3,177.01	2,800	1991	26.1
>=1500 &<2000	11,020	1,102	2,369.38	1,927	1991	47.8
>=1200 &<1500	7,680	653	1,403.52	1,371	1998	13.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Parklands	12,959	1,301	2,777.81	2,019	1992	100.0
>=3000	11,515	1,673	3,462.97	3,798	1993	5.3
>=2000 &<3000	14,152	1,523	3,212.47	2,571	1992	22.0
>=1500 &<2000	13,122	1,296	2,787.41	1,839	1992	53.1
>=1200 &<1500	11,725	989	2,129.50	1,442	1992	18.5
<1200	9,151	589	1,325.28	926	1995	1.2
Phillipstown	11,558	1,155	2,463.31	2,100	1991	100.0
>=3000	10,674	1,588	3,298.21	4,719	1991	7.2
>=2000 &<3000	11,868	1,244	2,614.22	2,617	1991	19.6
>=1500 &<2000	11,806	1,160	2,497.17	1,832	1992	49.8
>=1200 &<1500	10,868	924	1,986.13	1,450	1991	23.0
<1200	19,452	1,459	3,136.64	657	1997	0.5
Rapaki Track	11,314	1,157	2,458.96	2,083	1993	100.0
>=3000	13,805	1,932	3,886.13	3,822	1994	7.3
>=2000 &<3000	12,280	1,328	2,807.05	2,566	1993	24.9
>=1500 &<2000	11,097	1,085	2,336.16	1,831	1992	51.0
>=1200 &<1500	9,829	819	1,766.77	1,419	1994	15.1
<1200	5,597	420	902.54	852	1995	1.6

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Rawhiti	12,575	1,259	2,687.69	1,992	1992	100.0
>=3000	13,312	1,953	4,044.86	3,835	1992	6.0
>=2000 &<3000	13,994	1,504	3,173.30	2,539	1991	18.9
>=1500 &<2000	12,729	1,241	2,671.51	1,845	1992	52.1
>=1200 &<1500	11,112	944	2,030.13	1,436	1992	21.2
<1200	7,835	580	1,247.49	898	1996	1.7
Redwood North	11,710	1,168	2,495.15	1,977	1993	100.0
>=3000	13,956	2,037	4,246.99	3,735	1993	4.7
>=2000 &<3000	12,676	1,348	2,835.75	2,551	1992	21.3
>=1500 &<2000	11,743	1,156	2,488.05	1,841	1993	50.2
>=1200 &<1500	10,553	886	1,910.88	1,432	1993	22.6
<1200	6,481	450	988.65	932	1995	1.3
Redwood South	12,993	1,331	2,819.50	2,196	1993	100.0
>=3000	12,056	1,764	3,626.86	3,778	1993	11.1
>=2000 &<3000	13,238	1,355	2,832.06	2,553	1992	30.8
>=1500 &<2000	13,103	1,299	2,794.14	1,831	1993	41.9
>=1200 &<1500	13,224	1,112	2,390.67	1,425	1993	14.5
<1200	9,996	750	1,611.86	998	1994	1.7
Riccarton	10,865	1,101	2,352.56	2,005	1993	100.0
>=3000	12,888	1,895	3,942.17	3,965	1995	5.2
>=2000 &<3000	12,382	1,357	2,877.98	2,542	1994	20.5
>=1500 &<2000	10,463	1,029	2,214.79	1,845	1993	53.0
>=1200 &<1500	10,092	856	1,841.39	1,435	1993	20.4
<1200	6,042	453	974.27	902	1994	0.9
Riccarton South	11,976	1,214	2,593.42	1,996	1992	100.0
>=3000	17,287	2,615	5,471.99	3,921	1993	5.3
>=2000 &<3000	13,453	1,445	3,050.46	2,599	1993	18.3
>=1500 &<2000	11,911	1,165	2,506.82	1,852	1992	54.0
>=1200 &<1500	9,541	806	1,734.03	1,427	1992	21.0
<1200	11,394	855	1,837.28	838	1986	1.3
Riccarton West	10,357	1,092	2,315.39	2,110	1993	100.0
>=3000	12,230	1,742	3,528.99	3,518	1994	11.1
>=2000 &<3000	12,853	1,418	3,003.39	2,483	1994	24.1
>=1500 &<2000	10,127	985	2,123.61	1,852	1993	44.4
>=1200 &<1500	6,888	585	1,258.78	1,465	1992	20.4
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Richmond North	11,176	1,110	2,372.98	1,959	1992	100.0
>=3000	10,733	1,540	3,134.60	3,809	1992	4.3
>=2000 &<3000	12,717	1,377	2,908.89	2,548	1992	18.3
>=1500 &<2000	11,448	1,129	2,429.03	1,850	1992	54.0
>=1200 &<1500	9,713	808	1,746.45	1,431	1992	22.2
<1200	4,058	208	508.35	910	1993	1.2
Richmond South	9,973	975	2,086.60	1,941	1994	100.0
>=3000	3,492	559	1,201.25	3,984	1996	2.3
>=2000 &<3000	10,442	1,131	2,390.87	2,510	1994	23.3
>=1500 &<2000	9,686	958	2,060.35	1,842	1993	48.8
>=1200 &<1500	11,141	947	2,035.98	1,454	1994	23.3
<1200	6,120	459	986.85	1,171	1999	2.3

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Russley	11,283	1,172	2,505.80	2,048	1994	100.0
>=3000	14,541	2,177	4,594.30	3,995	1995	6.8
>=2000 &<3000	12,355	1,370	2,910.46	2,536	1994	22.2
>=1500 &<2000	11,314	1,116	2,401.52	1,832	1994	51.1
>=1200 &<1500	9,070	767	1,649.31	1,425	1993	18.5
<1200	6,615	494	1,062.02	948	1995	1.4
Rutland	11,215	1,172	2,507.03	2,075	1993	100.0
>=3000	11,280	1,718	3,607.19	3,818	1994	8.8
>=2000 &<3000	12,098	1,372	2,923.39	2,486	1993	23.2
>=1500 &<2000	11,578	1,144	2,461.69	1,863	1994	46.0
>=1200 &<1500	9,688	823	1,770.49	1,421	1993	20.7
<1200	6,882	516	1,109.72	996	1992	1.4
Sawyers Arms	11,542	1,201	2,551.85	2,079	1993	100.0
>=3000	14,319	2,018	4,066.68	3,947	1993	8.1
>=2000 &<3000	11,834	1,328	2,821.72	2,491	1994	25.2
>=1500 &<2000	11,812	1,171	2,517.75	1,833	1992	45.9
>=1200 &<1500	10,034	846	1,818.14	1,444	1992	18.0
<1200	5,952	446	959.76	1,043	1997	2.7
Shirley East	11,184	1,126	2,408.64	1,985	1993	100.0
>=3000	11,251	1,675	3,534.43	3,902	1996	5.9
>=2000 &<3000	13,566	1,461	3,082.35	2,491	1992	18.9
>=1500 &<2000	11,307	1,108	2,384.92	1,841	1992	52.7
>=1200 &<1500	8,977	761	1,636.90	1,437	1993	20.9
<1200	7,693	546	1,190.59	876	1995	1.6
Shirley West	11,082	1,107	2,370.58	1,959	1992	100.0
>=3000	11,072	1,667	3,490.54	3,844	1993	3.8
>=2000 &<3000	12,804	1,405	2,975.40	2,531	1992	19.3
>=1500 &<2000	11,148	1,092	2,349.46	1,844	1992	56.1
>=1200 &<1500	9,442	793	1,710.37	1,445	1993	19.0
<1200	7,993	551	1,215.28	961	1994	1.9
Sockburn	11,114	1,111	2,369.66	1,949	1993	100.0
>=3000	12,984	1,835	3,752.62	3,824	1994	4.5
>=2000 &<3000	12,439	1,348	2,851.94	2,486	1993	21.4
>=1500 &<2000	11,121	1,094	2,354.66	1,824	1993	48.3
>=1200 &<1500	9,827	834	1,793.81	1,439	1993	24.0
<1200	7,569	568	1,220.47	1,030	1996	1.7
Somerfield	11,501	1,139	2,439.89	2,039	1992	100.0
>=3000	13,527	1,848	3,834.24	4,170	1993	8.1
>=2000 &<3000	12,765	1,359	2,864.64	2,688	1992	14.1
>=1500 &<2000	11,045	1,087	2,339.30	1,813	1992	55.6
>=1200 &<1500	11,645	918	2,014.36	1,461	1992	20.2
<1200	5,646	423	910.42	999	1989	2.0
South Brighton	13,238	1,327	2,819.92	2,049	1992	100.0
>=3000	15,455	2,222	4,527.14	3,906	1993	5.8
>=2000 &<3000	14,210	1,467	3,069.90	2,548	1993	24.0
>=1500 &<2000	13,666	1,337	2,877.23	1,855	1991	50.6
>=1200 &<1500	10,372	875	1,882.26	1,420	1992	18.2
<1200	8,712	654	1,404.81	823	1998	1.3

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Spreydon	10,578	1,058	2,262.51	1,943	1992	100.0
>=3000	10,953	1,493	2,951.64	3,390	1988	3.0
>=2000 &<3000	12,082	1,364	2,908.08	2,671	1992	20.1
>=1500 &<2000	10,501	1,041	2,238.51	1,861	1992	50.7
>=1200 &<1500	10,330	878	1,887.75	1,456	1992	23.1
<1200	3,276	246	528.26	766	1996	3.0
St Albans East	10,676	1,103	2,355.90	2,046	1993	100.0
>=3000	12,802	1,913	4,033.50	3,874	1995	7.2
>=2000 &<3000	12,690	1,383	2,925.38	2,533	1994	22.5
>=1500 &<2000	10,361	1,022	2,199.30	1,840	1993	49.2
>=1200 &<1500	8,748	742	1,595.15	1,428	1993	19.4
<1200	6,287	470	1,010.03	953	1996	1.7
St Albans West	10,676	1,103	2,355.90	2,046	1993	100.0
>=3000	12,802	1,913	4,033.50	3,874	1995	7.2
>=2000 &<3000	12,690	1,383	2,925.38	2,533	1994	22.5
>=1500 &<2000	10,361	1,022	2,199.30	1,840	1993	49.2
>=1200 &<1500	8,748	742	1,595.15	1,428	1993	19.4
<1200	6,287	470	1,010.03	953	1996	1.7
St Martins	10,355	1,036	2,211.35	1,957	1993	100.0
>=3000	14,200	2,087	4,354.92	3,759	1995	4.5
>=2000 &<3000	13,192	1,416	2,987.29	2,579	1993	20.7
>=1500 &<2000	9,967	961	2,069.55	1,838	1992	50.8
>=1200 &<1500	8,779	745	1,602.13	1,430	1992	19.5
<1200	4,671	348	747.45	923	1996	4.5
Strowan	11,233	1,193	2,544.57	2,122	1994	100.0
>=3000	14,300	2,089	4,381.13	3,733	1995	10.5
>=2000 &<3000	13,681	1,518	3,225.26	2,548	1994	23.6
>=1500 &<2000	10,302	1,007	2,167.76	1,827	1994	48.6
>=1200 &<1500	9,044	763	1,640.64	1,432	1993	16.1
<1200	3,977	271	600.35	893	1996	1.3
Styx	15,985	1,631	3,442.30	2,219	1991	100.0
>=3000	17,026	2,400	4,835.70	3,859	1991	11.6
>=2000 &<3000	15,686	1,589	3,314.06	2,532	1991	28.9
>=1500 &<2000	16,246	1,581	3,404.88	1,861	1992	45.7
>=1200 &<1500	15,157	1,275	2,740.05	1,450	1992	12.7
<1200	11,886	891	1,916.62	657	1996	1.2
Styx Mill	12,212	1,234	2,626.58	2,041	1992	100.0
>=3000	14,378	1,923	3,756.60	4,245	1988	5.6
>=2000 &<3000	13,719	1,534	3,256.75	2,564	1992	15.7
>=1500 &<2000	12,081	1,188	2,555.61	1,875	1992	61.8
>=1200 &<1500	10,566	894	1,921.96	1,425	1992	16.9
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Sumner	13,876	1,430	3,046.14	2,113	1994	100.0
>=3000	16,714	2,394	4,994.18	4,155	1996	8.5
>=2000 &<3000	16,356	1,767	3,736.16	2,530	1994	25.0
>=1500 &<2000	13,404	1,303	2,804.25	1,842	1993	46.0
>=1200 &<1500	11,007	934	2,008.42	1,418	1993	18.4
<1200	8,256	610	1,312.22	882	1996	2.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Sydenham	11,438	1,145	2,446.46	2,016	1992	100.0
>=3000	12,112	1,729	3,582.83	3,864	1993	4.8
>=2000 &<3000	11,962	1,288	2,717.22	2,553	1992	21.0
>=1500 &<2000	11,941	1,161	2,500.48	1,850	1992	56.8
>=1200 &<1500	9,189	780	1,677.12	1,432	1992	16.1
<1200	6,225	467	1,003.78	982	1992	1.2
Templeton	13,602	1,364	2,900.76	2,024	1993	100.0
>=3000	14,720	2,141	4,403.16	3,861	1994	6.6
>=2000 &<3000	14,544	1,516	3,177.20	2,528	1992	23.1
>=1500 &<2000	13,609	1,336	2,875.80	1,828	1993	47.5
>=1200 &<1500	12,669	1,075	2,311.25	1,419	1993	21.6
<1200	5,734	430	924.54	886	1992	1.2
Travis	11,791	1,198	2,557.17	2,017	1993	100.0
>=3000	13,090	1,936	4,030.24	3,782	1994	6.3
>=2000 &<3000	13,200	1,438	3,040.65	2,566	1993	20.5
>=1500 &<2000	11,583	1,143	2,458.14	1,840	1993	50.8
>=1200 &<1500	10,682	905	1,946.37	1,439	1993	21.1
<1200	9,202	682	1,465.41	950	1996	1.3
Travis Wetland	13,566	1,353	2,891.77	2,036	1992	100.0
>=3000	12,222	1,939	4,152.02	3,844	1995	4.5
>=2000 &<3000	14,400	1,512	3,173.22	2,627	1991	22.7
>=1500 &<2000	13,461	1,322	2,844.09	1,855	1992	53.8
>=1200 &<1500	13,178	1,120	2,408.20	1,451	1993	17.4
<1200	13,290	997	2,143.01	924	1992	1.5
Trents-Ladbrooks	12,414	1,276	2,697.90	2,162	1993	100.0
>=3000	17,070	2,485	5,097.27	3,704	1993	11.8
>=2000 &<3000	12,815	1,269	2,651.15	2,691	1995	23.5
>=1500 &<2000	11,102	1,086	2,338.16	1,839	1992	44.1
>=1200 &<1500	11,646	981	2,109.73	1,431	1992	17.6
<1200	14,880	1,116	2,399.40	996	2000	2.9
Upper Riccarton	10,508	1,051	2,250.71	1,931	1993	100.0
>=3000	13,198	1,917	3,991.32	3,962	1994	3.8
>=2000 &<3000	11,684	1,294	2,749.19	2,505	1993	18.4
>=1500 &<2000	10,573	1,037	2,231.09	1,831	1993	54.2
>=1200 &<1500	9,081	770	1,656.55	1,422	1993	21.7
<1200	8,134	571	1,249.22	910	1996	1.8
Waimairi Beach	13,706	1,394	2,979.17	2,039	1993	100.0
>=3000	12,764	1,921	4,047.23	3,766	1992	7.3
>=2000 &<3000	15,661	1,721	3,642.44	2,488	1992	23.2
>=1500 &<2000	13,584	1,331	2,865.19	1,878	1993	45.5
>=1200 &<1500	12,465	1,058	2,273.76	1,423	1993	22.3
<1200	10,797	810	1,741.02	944	1992	1.8
Wainoni	11,731	1,179	2,512.54	2,008	1992	100.0
>=3000	13,436	1,921	3,902.47	3,948	1991	6.1
>=2000 &<3000	14,308	1,521	3,199.71	2,587	1991	17.6
>=1500 &<2000	11,465	1,130	2,432.08	1,839	1992	55.0
>=1200 &<1500	9,920	825	1,783.41	1,435	1992	20.8
<1200	6,372	478	1,027.49	826	1999	0.6

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Wairarapa	10,705	1,112	2,371.33	2,062	1995	100.0
>=3000	14,172	2,059	4,217.21	3,798	1994	8.0
>=2000 &<3000	11,823	1,351	2,887.93	2,608	1995	21.7
>=1500 &<2000	10,694	1,035	2,229.42	1,839	1994	48.6
>=1200 &<1500	8,780	736	1,581.81	1,415	1995	19.4
<1200	4,524	339	729.50	1,027	1996	2.3
Waltham	13,243	1,294	2,781.24	1,855	1992	100.0
>=3000	No Data	No Data	No Data	No Data	No Data	0.0
>=2000 &<3000	9,672	1,161	2,495.38	2,960	1993	14.3
>=1500 &<2000	13,953	1,395	2,999.90	1,810	1991	57.1
>=1200 &<1500	13,608	1,157	2,486.86	1,393	1994	28.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Westburn	11,078	1,164	2,489.42	2,063	1994	100.0
>=3000	11,680	1,731	3,631.64	3,642	1995	8.7
>=2000 &<3000	13,526	1,544	3,293.41	2,584	1995	22.6
>=1500 &<2000	10,996	1,089	2,342.70	1,830	1994	45.2
>=1200 &<1500	8,992	764	1,643.35	1,452	1993	21.7
<1200	4,446	334	716.92	1,086	1994	1.7
Westhaven	12,095	1,238	2,646.62	1,966	1993	100.0
>=3000	27,012	4,322	9,292.13	3,880	1996	2.2
>=2000 &<3000	13,922	1,495	3,151.71	2,598	1993	23.7
>=1500 &<2000	11,648	1,160	2,494.58	1,825	1993	54.8
>=1200 &<1500	10,184	866	1,861.17	1,453	1994	17.2
<1200	3,756	282	605.66	828	1994	2.2
Westmorland	11,849	1,273	2,718.20	2,207	1994	100.0
>=3000	13,455	2,017	4,252.20	3,808	1996	12.7
>=2000 &<3000	13,237	1,475	3,136.48	2,543	1995	27.9
>=1500 &<2000	11,238	1,095	2,355.71	1,829	1994	41.7
>=1200 &<1500	10,075	853	1,833.58	1,421	1994	17.2
<1200	4,140	311	667.58	1,080	1999	0.4
Wharenui	10,508	1,051	2,250.71	1,931	1993	100.0
>=3000	13,198	1,917	3,991.32	3,962	1994	3.8
>=2000 &<3000	11,684	1,294	2,749.19	2,505	1993	18.4
>=1500 &<2000	10,573	1,037	2,231.09	1,831	1993	54.2
>=1200 &<1500	9,081	770	1,656.55	1,422	1993	21.7
<1200	8,134	571	1,249.22	910	1996	1.8
Wigram	12,141	1,271	2,708.38	2,184	1994	100.0
>=3000	13,555	1,915	3,966.68	3,828	1997	14.7
>=2000 &<3000	15,059	1,634	3,451.18	2,460	1992	23.5
>=1500 &<2000	12,066	1,163	2,506.12	1,777	1994	44.1
>=1200 &<1500	7,260	522	1,175.04	1,462	1994	17.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Woolston South	11,346	1,129	2,408.61	2,039	1992	100.0
>=3000	11,610	1,686	3,463.12	4,512	1992	5.8
>=2000 &<3000	12,333	1,313	2,764.75	2,538	1991	19.6
>=1500 &<2000	11,549	1,121	2,414.91	1,844	1992	53.1
>=1200 &<1500	10,010	849	1,824.40	1,441	1993	19.4
<1200	8,507	635	1,365.99	919	1996	2.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Woolston West	11,406	1,116	2,383.72	1,967	1992	100.0
>=3000	7,444	1,088	2,234.90	3,890	1991	3.9
>=2000 &<3000	13,038	1,344	2,820.91	2,533	1991	19.7
>=1500 &<2000	11,912	1,177	2,533.03	1,887	1992	51.3
>=1200 &<1500	10,093	858	1,844.57	1,420	1992	22.4
<1200	6,408	465	998.98	1,052	1998	2.6
Yaldhurst	12,124	1,242	2,654.01	2,046	1992	100.0
>=3000	17,040	2,600	5,531.00	3,790	1994	8.3
>=2000 &<3000	10,427	1,083	2,266.77	2,551	1989	19.3
>=1500 &<2000	11,832	1,162	2,499.71	1,837	1992	50.5
>=1200 &<1500	12,722	1,081	2,324.87	1,447	1992	21.1
<1200	5,892	442	950.09	993	1997	0.9

8.2. Christchurch City Results 2011-2012

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Addington	9,282	934	2,001.14	2,041	1997	100.0
>=3000	8,602	1,207	2,553.93	3,866	1998	7.2
>=2000 &<3000	10,814	1,198	2,551.68	2,490	1997	22.0
>=1500 &<2000	9,117	889	1,910.90	1,856	1997	49.9
>=1200 &<1500	8,564	700	1,504.69	1,429	1997	19.1
<1200	5,518	398	856.53	926	2001	1.8
Aidanfield	9,047	995	2,133.19	2,320	1999	100.0
>=3000	12,330	1,712	3,680.56	3,718	2002	18.2
>=2000 &<3000	10,856	1,215	2,587.81	2,577	1998	27.3
>=1500 &<2000	7,103	687	1,476.85	1,870	1998	40.9
>=1200 &<1500	5,292	411	883.01	1,439	2000	9.1
<1200	10,068	755	1,623.47	990	1997	4.5
Aorangi	9,074	906	1,938.19	2,062	1998	100.0
>=3000	10,803	1,463	3,066.19	3,972	1999	6.9
>=2000 &<3000	10,046	1,091	2,321.88	2,557	1998	24.4
>=1500 &<2000	8,978	867	1,864.48	1,860	1997	44.9
>=1200 &<1500	7,901	647	1,391.09	1,421	1998	22.4
<1200	5,703	422	907.68	915	1998	1.5
Aranui	10,418	1,068	2,282.08	2,150	1996	100.0
>=3000	10,016	1,448	3,056.93	3,921	1997	10.2
>=2000 &<3000	11,160	1,224	2,599.84	2,553	1996	25.0
>=1500 &<2000	10,121	993	2,134.19	1,862	1996	43.7
>=1200 &<1500	10,392	861	1,850.86	1,426	1997	20.0
<1200	9,550	696	1,496.50	1,033	2000	1.1

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Avon Loop	9,636	965	2,063.87	2,091	1999	100.0
>=3000	10,409	1,457	3,073.15	3,817	1999	10.9
>=2000 &<3000	10,901	1,196	2,545.84	2,567	1998	21.1
>=1500 &<2000	8,863	844	1,817.77	1,842	1998	43.6
>=1200 &<1500	9,483	764	1,643.23	1,415	1999	21.8
<1200	10,356	733	1,575.64	859	2005	2.6
Avondale	10,048	997	2,129.59	2,040	1998	100.0
>=3000	10,515	1,457	3,040.80	3,859	1998	7.0
>=2000 &<3000	11,509	1,239	2,628.61	2,564	1998	22.9
>=1500 &<2000	9,969	964	2,072.97	1,851	1997	44.8
>=1200 &<1500	8,861	722	1,551.53	1,421	1998	24.0
<1200	6,354	472	1,015.04	926	1998	1.3
Avonhead	8,738	869	1,858.60	2,050	1999	100.0
>=3000	9,732	1,359	2,863.94	3,971	2000	7.6
>=2000 &<3000	9,717	1,054	2,243.50	2,529	1999	23.8
>=1500 &<2000	8,543	820	1,763.28	1,839	1998	42.8
>=1200 &<1500	7,918	641	1,377.99	1,409	1999	24.6
<1200	6,572	483	1,037.49	960	2000	1.1
Avonhead West	8,926	880	1,879.68	2,037	1998	100.0
>=3000	8,198	1,144	2,386.25	3,788	1999	7.7
>=2000 &<3000	10,048	1,078	2,290.35	2,538	1998	23.5
>=1500 &<2000	9,018	866	1,861.88	1,843	1998	42.1
>=1200 &<1500	8,092	660	1,418.45	1,409	1999	25.4
<1200	6,099	449	964.77	1,016	1999	1.2
Avonside	10,010	1,001	2,137.52	2,053	1997	100.0
>=3000	9,396	1,272	2,639.78	4,036	2000	6.3
>=2000 &<3000	12,462	1,339	2,844.60	2,535	1997	24.8
>=1500 &<2000	9,589	937	2,014.39	1,861	1996	45.5
>=1200 &<1500	8,628	717	1,541.66	1,419	1997	21.9
<1200	5,249	394	846.42	916	1992	1.6
Barrington North	8,890	879	1,877.83	2,021	1997	100.0
>=3000	8,789	1,218	2,536.60	3,882	1998	6.7
>=2000 &<3000	9,743	1,055	2,241.70	2,549	1997	21.9
>=1500 &<2000	8,974	870	1,871.70	1,848	1997	45.6
>=1200 &<1500	8,088	664	1,426.74	1,434	1998	23.7
<1200	7,507	556	1,195.13	958	1999	2.1
Barrington South	9,077	898	1,921.64	2,007	1998	100.0
>=3000	9,125	1,290	2,724.02	3,750	2000	7.1
>=2000 &<3000	10,559	1,146	2,437.76	2,551	1998	22.3
>=1500 &<2000	8,826	854	1,836.32	1,842	1998	42.2
>=1200 &<1500	8,390	685	1,473.31	1,433	1998	26.1
<1200	6,948	514	1,105.19	922	1999	2.3
Beckenham	9,154	907	1,938.14	2,011	1998	100.0
>=3000	11,658	1,557	3,212.60	3,673	2000	5.2
>=2000 &<3000	10,342	1,112	2,366.64	2,526	1998	25.4
>=1500 &<2000	9,121	874	1,879.83	1,855	1998	46.5
>=1200 &<1500	7,517	618	1,329.28	1,404	1998	21.7
<1200	4,256	319	685.48	996	1998	1.2

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Belfast	10,797	1,084	2,313.07	2,151	1998	100.0
>=3000	11,614	1,613	3,399.57	3,904	1999	11.2
>=2000 &<3000	11,929	1,261	2,669.87	2,577	1997	24.7
>=1500 &<2000	10,374	999	2,149.47	1,861	1998	39.1
>=1200 &<1500	10,172	825	1,775.08	1,430	1998	23.4
<1200	7,299	537	1,154.75	1,035	1999	1.7
Belfast South	10,060	1,000	2,139.33	2,097	2000	100.0
>=3000	11,956	1,620	3,419.77	3,816	2001	8.5
>=2000 &<3000	11,200	1,204	2,567.17	2,560	2000	25.5
>=1500 &<2000	9,826	927	1,993.39	1,863	1999	43.0
>=1200 &<1500	8,582	687	1,478.10	1,405	2000	22.0
<1200	7,573	564	1,213.43	1,003	1999	1.1
Bexley	9,973	1,020	2,176.27	2,147	1997	100.0
>=3000	10,418	1,527	3,207.91	3,786	1997	11.4
>=2000 &<3000	9,969	1,074	2,276.12	2,577	1996	23.4
>=1500 &<2000	9,934	977	2,100.12	1,874	1996	42.5
>=1200 &<1500	9,707	791	1,701.57	1,451	1998	19.8
<1200	10,622	787	1,691.63	1,028	1999	3.0
Bishopdale	8,996	903	1,932.79	2,071	1998	100.0
>=3000	10,160	1,405	2,953.33	3,976	1998	8.1
>=2000 &<3000	9,960	1,090	2,324.34	2,572	1998	21.1
>=1500 &<2000	8,986	870	1,871.06	1,859	1997	46.7
>=1200 &<1500	7,885	646	1,388.23	1,420	1998	22.8
<1200	5,657	412	886.24	936	2001	1.2
Bishopdale North	9,352	936	1,997.38	2,186	1999	100.0
>=3000	9,906	1,343	2,821.75	3,760	2000	11.2
>=2000 &<3000	10,026	1,054	2,241.11	2,555	2000	29.9
>=1500 &<2000	9,133	861	1,852.61	1,851	1999	39.2
>=1200 &<1500	8,385	670	1,440.70	1,412	2000	19.1
<1200	10,725	788	1,693.45	911	1998	0.5
Bromley	9,655	978	2,094.17	2,168	1997	100.0
>=3000	9,776	1,426	3,044.57	4,987	1999	8.0
>=2000 &<3000	10,433	1,140	2,420.64	2,574	1996	24.0
>=1500 &<2000	9,915	972	2,089.67	1,858	1996	42.9
>=1200 &<1500	8,526	703	1,511.48	1,435	1998	23.7
<1200	6,928	512	1,100.24	960	2000	1.5
Broomfield	9,074	903	1,934.17	2,050	1998	100.0
>=3000	9,566	1,334	2,811.21	3,913	1999	7.1
>=2000 &<3000	9,601	1,057	2,250.76	2,579	1997	20.2
>=1500 &<2000	9,203	895	1,925.30	1,871	1998	49.0
>=1200 &<1500	8,299	668	1,436.08	1,415	1999	22.9
<1200	5,420	387	832.18	1,044	1995	0.7
Bryndwr	9,028	918	1,960.61	2,239	2000	100.0
>=3000	10,751	1,471	3,107.28	3,935	2000	13.8
>=2000 &<3000	9,317	972	2,064.58	2,547	2000	27.3
>=1500 &<2000	8,843	832	1,789.88	1,836	2000	40.1
>=1200 &<1500	7,977	640	1,375.72	1,427	2000	17.7
<1200	3,676	263	564.81	989	2000	1.1

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Burnside	9,107	918	1,961.72	2,116	1998	100.0
>=3000	10,021	1,388	2,930.53	3,864	2000	9.2
>=2000 &<3000	10,129	1,092	2,321.79	2,554	1998	26.2
>=1500 &<2000	8,846	851	1,830.21	1,847	1998	42.1
>=1200 &<1500	8,171	662	1,423.61	1,425	1998	21.3
<1200	5,641	413	888.06	959	1998	1.2
Burwood	9,870	1,017	2,165.51	2,227	1997	100.0
>=3000	11,699	1,596	3,342.05	3,809	2000	13.2
>=2000 &<3000	9,441	988	2,081.47	2,621	1997	24.8
>=1500 &<2000	9,719	951	2,045.36	1,831	1997	47.1
>=1200 &<1500	9,441	763	1,640.26	1,414	1998	14.9
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Camside	12,486	1,265	2,694.31	2,175	1996	100.0
>=3000	12,058	1,696	3,532.91	3,905	1997	11.0
>=2000 &<3000	12,929	1,368	2,886.49	2,585	1995	25.5
>=1500 &<2000	12,642	1,232	2,650.13	1,856	1995	43.2
>=1200 &<1500	11,900	983	2,114.58	1,426	1996	19.0
<1200	10,691	785	1,690.60	951	1998	1.3
Casebrook	8,947	905	1,937.01	2,027	1997	100.0
>=3000	10,161	1,478	3,150.47	3,695	1999	7.5
>=2000 &<3000	9,998	1,077	2,282.87	2,525	1996	21.4
>=1500 &<2000	9,163	898	1,930.82	1,870	1996	46.0
>=1200 &<1500	7,498	621	1,335.84	1,431	1997	23.1
<1200	4,985	365	784.91	945	1998	2.0
Cashmere East	9,647	972	2,077.15	2,173	1999	100.0
>=3000	10,054	1,375	2,898.33	3,871	2000	10.2
>=2000 &<3000	11,052	1,177	2,504.19	2,579	1999	28.5
>=1500 &<2000	9,184	873	1,878.44	1,850	1999	42.1
>=1200 &<1500	8,471	684	1,470.96	1,413	1999	18.0
<1200	6,859	498	1,069.77	926	1999	1.3
Cashmere West	9,320	908	1,945.91	2,081	1999	100.0
>=3000	10,753	1,405	2,976.37	3,984	2001	6.5
>=2000 &<3000	9,176	988	2,107.03	2,552	1999	26.8
>=1500 &<2000	9,665	904	1,945.21	1,852	1998	46.4
>=1200 &<1500	8,167	654	1,405.76	1,413	1999	18.1
<1200	9,044	643	1,383.31	1,017	2004	2.2
Cathedral Square	9,913	1,038	2,153.61	2,575	1999	100.0
>=3000	9,099	1,230	2,419.32	3,994	1996	23.5
>=2000 &<3000	13,112	1,323	2,773.95	2,604	1999	35.3
>=1500 &<2000	6,725	620	1,333.51	1,873	2002	29.4
>=1200 &<1500	9,912	843	1,811.42	1,405	1998	11.8
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Clarkville	11,542	1,147	2,447.58	2,086	1996	100.0
>=3000	11,500	1,614	3,358.58	4,119	1996	10.1
>=2000 &<3000	12,838	1,371	2,901.86	2,541	1996	20.2
>=1500 &<2000	11,415	1,104	2,376.57	1,855	1996	44.4
>=1200 &<1500	11,692	939	2,018.45	1,399	1998	21.2
<1200	5,784	434	932.67	872	1999	4.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Dallington	10,064	996	2,129.15	2,010	1997	100.0
>=3000	10,547	1,506	3,178.68	3,762	1998	6.7
>=2000 &<3000	10,757	1,147	2,425.07	2,583	1997	21.6
>=1500 &<2000	10,412	1,012	2,175.95	1,838	1997	45.4
>=1200 &<1500	8,806	723	1,554.67	1,427	1998	24.5
<1200	8,345	616	1,324.75	888	1997	1.8
Deans Bush	8,176	834	1,787.62	2,223	1999	100.0
>=3000	9,448	1,272	2,723.77	3,869	2003	11.6
>=2000 &<3000	9,791	1,041	2,214.98	2,633	2000	27.4
>=1500 &<2000	7,788	734	1,581.48	1,868	1999	42.7
>=1200 &<1500	6,012	495	1,063.17	1,409	1998	17.7
<1200	1,296	97	208.98	996	2000	0.6
Diamond Harbour	15,006	1,461	3,117.44	2,007	1998	100.0
>=3000	10,344	1,655	3,558.34	4,398	1997	6.3
>=2000 &<3000	20,304	1,992	4,157.73	2,447	1996	18.8
>=1500 &<2000	14,693	1,446	3,109.20	1,912	1999	50.0
>=1200 &<1500	15,220	1,260	2,708.36	1,363	1996	18.8
<1200	5,640	395	848.82	996	2004	6.3
Edgeware	9,547	935	2,002.01	2,032	1998	100.0
>=3000	10,515	1,367	2,916.76	4,336	2002	4.9
>=2000 &<3000	10,920	1,158	2,460.51	2,587	1999	25.8
>=1500 &<2000	9,280	896	1,927.75	1,835	1997	44.5
>=1200 &<1500	8,567	705	1,515.56	1,391	1999	22.0
<1200	7,070	530	1,140.10	996	1999	2.7
Ensors	8,325	827	1,763.07	2,308	1997	100.0
>=3000	2,646	385	799.92	4,034	1997	15.4
>=2000 &<3000	10,839	1,097	2,299.77	2,676	1997	17.9
>=1500 &<2000	9,272	904	1,942.97	1,874	1997	56.4
>=1200 &<1500	7,233	595	1,279.13	1,456	1998	10.3
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Fendalton	8,179	813	1,745.08	2,067	1999	100.0
>=3000	11,151	1,527	3,282.68	3,851	2002	6.2
>=2000 &<3000	8,527	927	1,978.27	2,575	1999	27.1
>=1500 &<2000	7,983	755	1,624.58	1,863	1999	43.4
>=1200 &<1500	7,454	610	1,311.49	1,412	1999	22.1
<1200	5,268	391	840.44	779	1997	1.2
Ferrymead	12,347	1,225	2,598.88	1,867	1996	100.0
>=3000	9,276	1,206	2,314.36	3,050	1996	12.5
>=2000 &<3000	14,844	1,559	3,351.03	2,770	2002	12.5
>=1500 &<2000	15,328	1,533	3,295.52	1,651	1999	37.5
>=1200 &<1500	9,556	812	1,746.36	1,386	1992	37.5
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Governors Bay	11,902	1,210	2,595.98	2,142	2000	100.0
>=3000	14,439	2,028	4,338.58	3,572	2000	11.8
>=2000 &<3000	13,581	1,442	3,083.91	2,577	2000	23.5
>=1500 &<2000	11,674	1,083	2,330.35	1,829	2000	47.1
>=1200 &<1500	8,578	694	1,492.04	1,445	2000	17.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Hagley Park	9,652	962	2,055.34	2,076	1998	100.0
>=3000	10,334	1,422	2,993.95	3,856	1999	8.7
>=2000 &<3000	10,610	1,135	2,405.96	2,560	1997	23.7
>=1500 &<2000	9,584	927	1,994.56	1,857	1997	42.5
>=1200 &<1500	8,757	715	1,536.71	1,414	1998	23.0
<1200	7,159	524	1,127.57	962	2000	2.1
Halswell Domain	9,989	991	2,119.28	2,108	1999	100.0
>=3000	10,310	1,408	2,964.59	3,901	2000	9.0
>=2000 &<3000	10,763	1,148	2,439.30	2,550	1999	24.8
>=1500 &<2000	9,979	953	2,050.78	1,852	1998	43.8
>=1200 &<1500	9,100	735	1,580.54	1,425	1999	21.4
<1200	7,585	561	1,206.36	973	1999	1.1
Halswell South	10,126	1,020	2,179.80	2,146	1998	100.0
>=3000	11,041	1,546	3,268.23	4,163	1999	8.0
>=2000 &<3000	11,165	1,194	2,529.43	2,596	1996	25.5
>=1500 &<2000	10,461	1,000	2,152.04	1,864	1999	47.0
>=1200 &<1500	7,603	632	1,357.74	1,443	1997	18.0
<1200	7,364	542	1,165.99	992	2000	1.5
Halswell West	10,126	1,020	2,179.80	2,146	1998	100.0
>=3000	11,041	1,546	3,268.23	4,163	1999	8.0
>=2000 &<3000	11,165	1,194	2,529.43	2,596	1996	25.5
>=1500 &<2000	10,461	1,000	2,152.04	1,864	1999	47.0
>=1200 &<1500	7,603	632	1,357.74	1,443	1997	18.0
<1200	7,364	542	1,165.99	992	2000	1.5
Harewood	8,996	903	1,932.79	2,071	1998	100.0
>=3000	10,160	1,405	2,953.33	3,976	1998	8.1
>=2000 &<3000	9,960	1,090	2,324.34	2,572	1998	21.1
>=1500 &<2000	8,986	870	1,871.06	1,859	1997	46.7
>=1200 &<1500	7,885	646	1,388.23	1,420	1998	22.8
<1200	5,657	412	886.24	936	2001	1.2
Hawthornden	9,782	993	2,118.95	2,288	1998	100.0
>=3000	8,615	1,236	2,630.31	3,863	1999	14.0
>=2000 &<3000	10,772	1,149	2,429.19	2,562	1997	33.3
>=1500 &<2000	8,237	797	1,712.97	1,893	1997	28.1
>=1200 &<1500	10,873	866	1,869.69	1,470	1999	24.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Heathcote Valley	11,002	1,099	2,341.27	2,105	1998	100.0
>=3000	11,504	1,607	3,331.77	3,814	1998	9.8
>=2000 &<3000	12,334	1,304	2,761.86	2,582	1998	24.4
>=1500 &<2000	11,159	1,073	2,309.14	1,848	1997	41.0
>=1200 &<1500	9,225	744	1,599.89	1,422	1999	23.3
<1200	9,491	692	1,488.72	906	1998	1.5
Hendersons Basin	9,425	930	1,986.63	2,115	1998	100.0
>=3000	8,028	1,081	2,255.60	3,716	1997	9.2
>=2000 &<3000	9,983	1,098	2,334.31	2,679	1997	25.2
>=1500 &<2000	9,280	890	1,913.80	1,882	1998	39.7
>=1200 &<1500	9,554	778	1,673.24	1,427	1998	23.7
<1200	10,084	738	1,587.17	660	2001	2.3

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Hillmorton	9,206	930	1,986.19	2,147	1997	100.0
>=3000	8,947	1,236	2,598.75	3,823	1999	10.3
>=2000 &<3000	9,952	1,077	2,284.18	2,566	1997	24.0
>=1500 &<2000	9,326	903	1,941.58	1,882	1997	44.6
>=1200 &<1500	8,291	678	1,458.72	1,430	1998	20.2
<1200	6,864	495	1,063.83	996	2001	0.9
Holmwood	7,947	837	1,785.30	2,283	1999	100.0
>=3000	10,443	1,422	3,015.66	3,778	2002	12.1
>=2000 &<3000	8,948	951	2,015.78	2,594	1998	37.9
>=1500 &<2000	7,177	676	1,458.19	1,763	1999	39.4
>=1200 &<1500	4,373	358	771.07	1,394	1999	10.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Hoon Hay	9,316	929	1,983.67	2,055	1997	100.0
>=3000	9,515	1,330	2,775.25	3,876	1998	7.6
>=2000 &<3000	10,492	1,130	2,395.50	2,544	1997	23.2
>=1500 &<2000	9,155	889	1,912.69	1,853	1997	44.3
>=1200 &<1500	8,479	697	1,499.25	1,428	1998	23.4
<1200	7,960	589	1,267.53	966	1999	1.5
Hoon Hay South	10,283	1,021	2,171.02	2,123	1999	100.0
>=3000	11,040	1,508	3,100.66	3,872	1998	9.5
>=2000 &<3000	11,438	1,188	2,514.62	2,629	1999	25.0
>=1500 &<2000	10,393	1,002	2,154.87	1,844	1998	43.2
>=1200 &<1500	9,304	734	1,577.62	1,420	2000	18.9
<1200	3,689	258	555.16	995	2002	3.4
Hornby North	9,600	956	2,043.63	2,068	1997	100.0
>=3000	9,818	1,383	2,916.12	3,870	1999	8.6
>=2000 &<3000	10,027	1,073	2,277.99	2,568	1997	22.5
>=1500 &<2000	9,727	951	2,044.91	1,856	1997	42.3
>=1200 &<1500	9,001	732	1,573.69	1,423	1998	25.4
<1200	8,355	620	1,333.60	963	1999	1.3
Hornby South	9,141	918	1,962.49	2,071	1998	100.0
>=3000	9,747	1,376	2,896.32	3,853	1999	8.8
>=2000 &<3000	9,798	1,062	2,256.48	2,565	1997	20.9
>=1500 &<2000	9,273	901	1,936.69	1,856	1997	46.6
>=1200 &<1500	8,162	666	1,431.04	1,428	1998	22.3
<1200	6,788	497	1,067.89	974	1999	1.4
Ilam	8,332	824	1,762.05	2,021	1999	100.0
>=3000	9,793	1,346	2,830.27	3,782	2000	7.0
>=2000 &<3000	9,514	1,018	2,165.75	2,537	1999	23.8
>=1500 &<2000	8,093	776	1,669.41	1,826	1998	43.9
>=1200 &<1500	7,235	584	1,254.66	1,408	1999	23.9
<1200	7,123	526	1,130.32	1,022	1998	1.5
Islington	9,430	967	2,061.24	2,171	1997	100.0
>=3000	10,743	1,530	3,206.69	3,858	1997	10.3
>=2000 &<3000	9,652	1,036	2,196.81	2,614	1997	27.7
>=1500 &<2000	9,186	899	1,933.59	1,866	1996	39.7
>=1200 &<1500	8,992	750	1,611.41	1,428	1997	20.5
<1200	8,899	647	1,391.56	943	1999	1.8

Vehicle Engine Capacity by Suburb (CC)	**Average Vehicle Kilometres Travelled (Km)**	**Average Energy Demand (Litres)**	**Average Fuel Cost ($)**	**Average Vehicle Engine Capacity (CC)**	**Average Vehicle Age**	**Vehicle Engine Capacity (%)**
Jellie Park	9,074	906	1,938.19	2,062	1998	100.0
>=3000	10,803	1,463	3,066.19	3,972	1999	6.9
>=2000 &<3000	10,046	1,091	2,321.88	2,557	1998	24.4
>=1500 &<2000	8,978	867	1,864.48	1,860	1997	44.9
>=1200 &<1500	7,901	647	1,391.09	1,421	1998	22.4
<1200	5,703	422	907.68	915	1998	1.5
Kennedys Bush	11,342	1,099	2,342.17	2,185	1999	100.0
>=3000	9,272	1,222	2,562.27	3,757	2000	9.1
>=2000 &<3000	12,948	1,314	2,771.58	2,677	1999	31.0
>=1500 &<2000	10,870	1,035	2,228.37	1,885	1999	37.4
>=1200 &<1500	10,846	876	1,882.80	1,411	2000	20.3
<1200	9,822	714	1,535.62	960	2004	2.1
Linwood	9,240	916	1,954.75	1,982	1997	100.0
>=3000	12,096	1,673	3,495.30	3,677	2000	5.6
>=2000 &<3000	10,722	1,122	2,362.67	2,557	1998	16.9
>=1500 &<2000	8,673	845	1,817.25	1,869	1997	57.7
>=1200 &<1500	8,833	742	1,595.25	1,420	1995	16.9
<1200	8,694	652	1,401.91	827	1998	2.8
Linwood East	9,919	967	2,076.08	2,009	1997	100.0
>=3000	9,284	1,335	2,869.39	4,219	2000	6.5
>=2000 &<3000	9,995	1,114	2,382.02	2,607	1997	19.4
>=1500 &<2000	9,022	888	1,909.80	1,831	1996	43.0
>=1200 &<1500	10,554	861	1,850.79	1,451	1998	29.0
<1200	20,526	1,540	3,309.82	1,090	1979	2.2
Linwood North	9,501	962	2,058.73	2,059	1997	100.0
>=3000	9,880	1,432	3,022.74	3,983	1998	8.3
>=2000 &<3000	9,820	1,087	2,317.10	2,515	1997	21.1
>=1500 &<2000	9,618	944	2,029.11	1,861	1996	45.7
>=1200 &<1500	8,920	739	1,588.37	1,427	1997	23.1
<1200	8,510	628	1,350.26	908	1998	1.8
Lyttelton	12,334	1,248	2,645.09	2,187	1998	100.0
>=3000	10,326	1,452	3,010.96	3,282	1994	18.2
>=2000 &<3000	13,850	1,438	3,027.18	2,484	1996	27.3
>=1500 &<2000	10,944	1,056	2,270.61	1,850	2000	31.8
>=1200 &<1500	14,069	1,125	2,418.18	1,429	1999	22.7
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Mairehau	9,161	940	2,007.39	2,337	1998	100.0
>=3000	9,523	1,305	2,734.76	5,241	1998	10.8
>=2000 &<3000	10,483	1,134	2,416.28	2,528	1998	29.7
>=1500 &<2000	8,642	834	1,793.85	1,852	1997	42.3
>=1200 &<1500	7,725	626	1,345.23	1,428	1999	15.3
<1200	9,570	718	1,543.16	916	1996	1.8
Mairehau North	10,169	1,033	2,165.95	3,011	2000	100.0
>=3000	10,848	1,187	2,453.18	3,830	2003	45.5
>=2000 &<3000	7,772	798	1,679.38	2,830	1999	27.3
>=1500 &<2000	10,914	987	2,120.35	1,994	1998	18.2
>=1200 &<1500	12,480	1,061	2,280.72	1,498	1991	9.1
<1200	No Data	No Data	No Data	No Data	No Data	0.0

Vehicle Engine Capacity by Suburb (CC)	**Average Vehicle Kilometres Travelled (Km)**	**Average Energy Demand (Litres)**	**Average Fuel Cost ($)**	**Average Vehicle Engine Capacity (CC)**	**Average Vehicle Age**	**Vehicle Engine Capacity (%)**
Marshland	10,196	1,077	2,274.33	2,333	1997	100.0
>=3000	11,349	1,576	3,238.15	3,931	1999	18.6
>=2000 &<3000	12,044	1,256	2,645.52	2,582	1998	25.1
>=1500 &<2000	9,809	959	2,062.46	1,859	1996	35.1
>=1200 &<1500	7,556	619	1,331.16	1,438	1997	20.3
<1200	9,504	713	1,532.52	990	1999	0.9
Mcleans Island	9,268	923	1,961.68	1,964	1997	100.0
>=3000	9,792	1,273	2,443.10	3,059	1995	7.7
>=2000 &<3000	5,412	650	1,396.30	2,344	1994	15.4
>=1500 &<2000	11,541	1,121	2,411.30	1,925	1996	53.8
>=1200 &<1500	6,360	525	1,129.01	1,439	2000	23.1
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Merivale	9,652	962	2,055.34	2,076	1998	100.0
>=3000	10,334	1,422	2,993.95	3,856	1999	8.7
>=2000 &<3000	10,610	1,135	2,405.96	2,560	1997	23.7
>=1500 &<2000	9,584	927	1,994.56	1,857	1997	42.5
>=1200 &<1500	8,757	715	1,536.71	1,414	1998	23.0
<1200	7,159	524	1,127.57	962	2000	2.1
Merrin	9,359	919	1,970.34	1,982	1998	100.0
>=3000	10,687	1,587	3,362.66	3,606	1998	6.0
>=2000 &<3000	10,151	1,096	2,333.12	2,602	1998	19.3
>=1500 &<2000	9,471	900	1,935.83	1,865	1998	47.7
>=1200 &<1500	8,348	687	1,477.38	1,403	1998	25.4
<1200	7,320	525	1,129.58	994	2000	1.5
Middleton	7,778	788	1,677.85	2,085	1997	100.0
>=3000	9,256	1,321	2,719.71	4,009	1998	12.6
>=2000 &<3000	7,784	845	1,801.95	2,490	1998	17.5
>=1500 &<2000	7,555	736	1,582.41	1,857	1996	37.9
>=1200 &<1500	7,530	621	1,335.47	1,415	1996	29.1
<1200	6,716	504	1,082.96	995	1997	2.9
Mona Vale	7,884	794	1,707.04	2,308	1998	100.0
>=3000	5,277	742	1,596.36	4,071	1999	18.6
>=2000 &<3000	8,435	949	2,031.94	2,542	1998	23.7
>=1500 &<2000	8,143	759	1,633.71	1,843	1998	30.5
>=1200 &<1500	8,903	736	1,581.34	1,412	1997	27.1
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Moncks Bay	11,158	1,136	2,423.40	2,268	2000	100.0
>=3000	12,664	1,731	3,653.60	4,047	2002	12.1
>=2000 &<3000	12,758	1,345	2,855.37	2,615	2000	30.2
>=1500 &<2000	10,253	968	2,082.92	1,864	1999	40.0
>=1200 &<1500	9,581	765	1,645.50	1,408	2000	16.3
<1200	7,742	550	1,183.46	898	2002	1.3
Mt Pleasant	10,704	1,074	2,294.81	2,168	1999	100.0
>=3000	10,319	1,420	3,007.00	3,773	2000	10.9
>=2000 &<3000	12,401	1,314	2,791.55	2,571	1999	27.7
>=1500 &<2000	10,283	973	2,093.31	1,847	1999	42.6
>=1200 &<1500	9,563	767	1,650.14	1,410	1999	17.3
<1200	7,321	523	1,123.54	973	2001	1.5

Vehicle Engine Capacity by Suburb (CC)	**Average Vehicle Kilometres Travelled (Km)**	**Average Energy Demand (Litres)**	**Average Fuel Cost ($)**	**Average Vehicle Engine Capacity (CC)**	**Average Vehicle Age**	**Vehicle Engine Capacity (%)**
New Brighton	10,741	1,079	2,301.02	2,090	1997	100.0
>=3000	11,252	1,580	3,272.62	3,778	1997	9.1
>=2000 &<3000	11,610	1,250	2,650.36	2,565	1997	23.7
>=1500 &<2000	10,747	1,039	2,235.49	1,858	1997	43.5
>=1200 &<1500	9,863	811	1,744.28	1,423	1997	22.2
<1200	6,940	510	1,096.10	996	1999	1.6
North Beach	10,902	1,080	2,307.08	2,032	1997	100.0
>=3000	9,425	1,322	2,757.65	3,816	1998	6.5
>=2000 &<3000	12,475	1,338	2,832.65	2,574	1997	22.9
>=1500 &<2000	11,026	1,079	2,320.29	1,871	1996	44.7
>=1200 &<1500	9,833	812	1,746.19	1,413	1997	24.4
<1200	7,078	514	1,103.83	989	1999	1.5
Northcote	8,285	834	1,789.45	2,093	1996	100.0
>=3000	7,659	1,185	2,540.57	3,956	1995	8.2
>=2000 &<3000	8,285	913	1,943.89	2,508	1996	23.5
>=1500 &<2000	8,621	823	1,770.43	1,865	1996	48.2
>=1200 &<1500	7,961	646	1,387.70	1,430	1997	18.8
<1200	4,032	302	650.16	657	1998	1.2
Oaklands East	9,989	991	2,119.28	2,108	1999	100.0
>=3000	10,310	1,408	2,964.59	3,901	2000	9.0
>=2000 &<3000	10,763	1,148	2,439.30	2,550	1999	24.8
>=1500 &<2000	9,979	953	2,050.78	1,852	1998	43.8
>=1200 &<1500	9,100	735	1,580.54	1,425	1999	21.4
<1200	7,585	561	1,206.36	973	1999	1.1
Oaklands West	9,047	995	2,133.19	2,320	1999	100.0
>=3000	12,330	1,712	3,680.56	3,718	2002	18.2
>=2000 &<3000	10,856	1,215	2,587.81	2,577	1998	27.3
>=1500 &<2000	7,103	687	1,476.85	1,870	1998	40.9
>=1200 &<1500	5,292	411	883.01	1,439	2000	9.1
<1200	10,068	755	1,623.47	990	1997	4.5
Opawa	9,085	896	1,912.79	2,003	1998	100.0
>=3000	12,331	1,587	3,272.61	3,742	1999	6.4
>=2000 &<3000	10,411	1,137	2,421.22	2,586	1998	19.2
>=1500 &<2000	8,530	823	1,769.86	1,870	1998	49.6
>=1200 &<1500	8,525	699	1,502.60	1,411	1998	22.4
<1200	6,510	466	1,001.34	984	2002	2.4
Papanui	8,838	882	1,885.14	2,076	1998	100.0
>=3000	9,502	1,311	2,774.16	3,856	2000	8.6
>=2000 &<3000	10,165	1,082	2,297.20	2,556	1998	24.0
>=1500 &<2000	8,670	834	1,793.64	1,847	1998	42.8
>=1200 &<1500	7,599	623	1,340.08	1,414	1998	22.9
<1200	7,715	571	1,228.55	960	1999	1.7
Paparua	11,231	1,157	2,466.26	2,235	1998	100.0
>=3000	6,884	895	1,870.44	3,673	2001	12.5
>=2000 &<3000	14,168	1,567	3,333.80	2,464	1997	37.5
>=1500 &<2000	10,161	967	2,078.19	1,831	1999	33.3
>=1200 &<1500	10,020	808	1,737.31	1,452	1999	16.7
<1200	No Data	No Data	No Data	No Data	No Data	0.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Parklands	10,838	1,088	2,324.49	2,139	1998	100.0
>=3000	10,791	1,517	3,191.98	3,882	1999	10.0
>=2000 &<3000	11,916	1,279	2,718.01	2,570	1998	25.4
>=1500 &<2000	10,490	1,007	2,165.92	1,858	1998	42.2
>=1200 &<1500	10,333	839	1,803.38	1,424	1998	21.3
<1200	9,521	702	1,510.27	938	1999	1.1
Phillipstown	9,087	903	1,932.66	2,081	1996	100.0
>=3000	7,998	1,146	2,441.77	4,165	1996	5.4
>=2000 &<3000	8,988	983	2,084.65	2,536	1996	29.4
>=1500 &<2000	9,388	907	1,951.19	1,867	1997	42.1
>=1200 &<1500	9,069	752	1,616.39	1,420	1997	22.4
<1200	3,780	279	599.85	998	1991	0.7
Rapaki Track	9,953	992	2,111.97	2,128	1998	100.0
>=3000	11,326	1,555	3,214.49	3,937	1998	9.1
>=2000 &<3000	11,004	1,166	2,471.13	2,618	1998	26.0
>=1500 &<2000	9,225	883	1,900.00	1,840	1998	41.3
>=1200 &<1500	9,663	786	1,689.27	1,417	1998	22.0
<1200	7,763	580	1,247.65	1,048	1996	1.6
Rawhiti	10,741	1,079	2,301.02	2,090	1997	100.0
>=3000	11,252	1,580	3,272.62	3,778	1997	9.1
>=2000 &<3000	11,610	1,250	2,650.36	2,565	1997	23.7
>=1500 &<2000	10,747	1,039	2,235.49	1,858	1997	43.5
>=1200 &<1500	9,863	811	1,744.28	1,423	1997	22.2
<1200	6,940	510	1,096.10	996	1999	1.6
Redwood North	9,470	950	2,031.91	2,101	1998	100.0
>=3000	9,957	1,394	2,938.26	4,000	1999	8.9
>=2000 &<3000	10,342	1,112	2,362.80	2,543	1998	23.9
>=1500 &<2000	9,442	913	1,963.81	1,856	1997	43.8
>=1200 &<1500	8,517	697	1,498.70	1,420	1998	21.9
<1200	7,455	551	1,184.92	956	1999	1.5
Redwood South	10,701	1,100	2,346.89	2,212	1998	100.0
>=3000	12,258	1,634	3,376.37	4,096	1999	10.0
>=2000 &<3000	10,717	1,180	2,519.85	2,475	1998	31.4
>=1500 &<2000	10,065	981	2,109.60	1,864	1997	42.9
>=1200 &<1500	11,416	927	1,993.01	1,434	1998	15.7
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Riccarton	8,647	852	1,826.23	2,024	1998	100.0
>=3000	7,438	1,008	2,120.33	3,910	1999	6.9
>=2000 &<3000	9,862	1,084	2,313.30	2,544	1998	20.6
>=1500 &<2000	8,754	844	1,816.06	1,854	1997	47.6
>=1200 &<1500	7,841	640	1,375.84	1,413	1999	24.1
<1200	5,547	408	876.97	911	1997	0.8
Riccarton South	9,282	934	2,001.14	2,041	1997	100.0
>=3000	8,602	1,207	2,553.93	3,866	1998	7.2
>=2000 &<3000	10,814	1,198	2,551.68	2,490	1997	22.0
>=1500 &<2000	9,117	889	1,910.90	1,856	1997	49.9
>=1200 &<1500	8,564	700	1,504.69	1,429	1997	19.1
<1200	5,518	398	856.53	926	2001	1.8

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Riccarton West	7,884	794	1,707.04	2,308	1998	100.0
>=3000	5,277	742	1,596.36	4,071	1999	18.6
>=2000 &<3000	8,435	949	2,031.94	2,542	1998	23.7
>=1500 &<2000	8,143	759	1,633.71	1,843	1998	30.5
>=1200 &<1500	8,903	736	1,581.34	1,412	1997	27.1
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Richmond North	9,421	941	2,009.51	2,030	1997	100.0
>=3000	9,726	1,345	2,789.41	3,657	1997	6.2
>=2000 &<3000	10,130	1,096	2,325.21	2,586	1997	22.5
>=1500 &<2000	9,690	946	2,035.14	1,866	1997	48.7
>=1200 &<1500	8,337	689	1,481.92	1,418	1997	20.8
<1200	4,623	339	729.37	951	1998	1.8
Richmond South	9,240	916	1,954.75	1,982	1997	100.0
>=3000	12,096	1,673	3,495.30	3,677	2000	5.6
>=2000 &<3000	10,722	1,122	2,362.67	2,557	1998	16.9
>=1500 &<2000	8,673	845	1,817.25	1,869	1997	57.7
>=1200 &<1500	8,833	742	1,595.25	1,420	1995	16.9
<1200	8,694	652	1,401.91	827	1998	2.8
Russley	9,107	918	1,961.72	2,116	1998	100.0
>=3000	10,021	1,388	2,930.53	3,864	2000	9.2
>=2000 &<3000	10,129	1,092	2,321.79	2,554	1998	26.2
>=1500 &<2000	8,846	851	1,830.21	1,847	1998	42.1
>=1200 &<1500	8,171	662	1,423.61	1,425	1998	21.3
<1200	5,641	413	888.06	959	1998	1.2
Rutland	9,235	941	2,013.71	2,154	1998	100.0
>=3000	9,485	1,322	2,807.78	3,827	1999	9.5
>=2000 &<3000	10,999	1,191	2,540.27	2,574	1998	28.0
>=1500 &<2000	8,846	850	1,828.92	1,865	1998	41.9
>=1200 &<1500	7,426	606	1,302.36	1,424	1998	19.1
<1200	8,513	608	1,306.51	990	2000	1.4
Sawyers Arms	8,905	874	1,867.31	2,056	1998	100.0
>=3000	8,692	1,145	2,401.53	3,695	2000	7.3
>=2000 &<3000	9,176	984	2,088.36	2,541	1998	30.1
>=1500 &<2000	8,793	860	1,849.31	1,852	1997	34.0
>=1200 &<1500	8,181	666	1,432.39	1,421	1999	25.7
<1200	14,326	1,070	2,299.55	938	1998	2.9
Shirley East	9,482	952	2,034.83	2,089	1998	100.0
>=3000	10,333	1,443	3,039.42	3,925	2000	8.7
>=2000 &<3000	10,648	1,153	2,453.38	2,564	1998	24.0
>=1500 &<2000	9,468	911	1,960.21	1,860	1997	42.2
>=1200 &<1500	8,164	667	1,433.17	1,417	1998	23.3
<1200	7,206	528	1,134.15	955	1999	1.8
Shirley West	9,333	924	1,975.54	2,025	1997	100.0
>=3000	10,227	1,435	3,003.37	3,758	1999	6.9
>=2000 &<3000	10,086	1,086	2,303.55	2,564	1997	21.3
>=1500 &<2000	9,233	894	1,922.90	1,860	1997	46.7
>=1200 &<1500	8,674	710	1,526.89	1,426	1998	23.4
<1200	8,057	594	1,276.86	973	1998	1.7

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Sockburn	8,673	849	1,816.81	1,985	1998	100.0
>=3000	8,495	1,181	2,467.41	3,798	1999	7.0
>=2000 &<3000	8,701	951	2,024.74	2,505	1998	20.9
>=1500 &<2000	9,112	882	1,896.43	1,846	1997	43.2
>=1200 &<1500	8,022	650	1,397.53	1,412	1999	26.9
<1200	8,261	611	1,312.54	978	1999	2.0
Somerfield	8,856	899	1,925.17	2,106	1998	100.0
>=3000	8,670	1,267	2,706.73	3,867	1999	10.6
>=2000 &<3000	10,419	1,113	2,369.00	2,578	1998	22.0
>=1500 &<2000	8,804	858	1,844.50	1,836	1997	41.1
>=1200 &<1500	7,966	658	1,413.71	1,438	1997	24.8
<1200	3,108	221	474.40	1,084	2001	1.4
South Brighton	10,380	1,049	2,239.12	2,094	1997	100.0
>=3000	11,240	1,669	3,513.29	3,720	1997	8.9
>=2000 &<3000	10,503	1,125	2,378.01	2,597	1996	25.1
>=1500 &<2000	10,569	1,017	2,185.96	1,847	1998	40.8
>=1200 &<1500	9,810	821	1,766.08	1,433	1997	24.6
<1200	1,800	135	290.25	650	1995	0.5
Spreydon	9,104	908	1,944.44	2,040	1998	100.0
>=3000	10,894	1,600	3,439.81	3,865	2000	7.7
>=2000 &<3000	10,283	1,096	2,316.06	2,540	1997	20.1
>=1500 &<2000	9,242	885	1,902.08	1,865	1998	45.9
>=1200 &<1500	7,436	602	1,294.36	1,427	1999	26.3
<1200	No Data	No Data	No Data	No Data	No Data	0.0
St Albans East	9,228	924	1,975.71	2,107	1999	100.0
>=3000	9,790	1,345	2,822.05	3,872	2000	9.3
>=2000 &<3000	10,692	1,144	2,434.39	2,559	1999	23.9
>=1500 &<2000	8,977	859	1,847.37	1,850	1998	45.2
>=1200 &<1500	7,976	648	1,393.93	1,414	1998	20.2
<1200	6,588	481	1,033.56	937	1998	1.4
St Albans West	9,228	924	1,975.71	2,107	1999	100.0
>=3000	9,790	1,345	2,822.05	3,872	2000	9.3
>=2000 &<3000	10,692	1,144	2,434.39	2,559	1999	23.9
>=1500 &<2000	8,977	859	1,847.37	1,850	1998	45.2
>=1200 &<1500	7,976	648	1,393.93	1,414	1998	20.2
<1200	6,588	481	1,033.56	937	1998	1.4
St Martins	9,277	922	1,974.24	1,956	1998	100.0
>=3000	12,128	1,741	3,687.08	3,745	1999	5.5
>=2000 &<3000	10,567	1,152	2,451.17	2,529	1998	20.4
>=1500 &<2000	9,185	892	1,917.74	1,843	1997	46.9
>=1200 &<1500	8,015	654	1,405.23	1,421	1998	23.8
<1200	7,039	520	1,119.06	932	1998	3.4
Strowan	9,013	911	1,948.30	2,190	2000	100.0
>=3000	10,362	1,406	2,988.14	3,839	2001	12.1
>=2000 &<3000	10,248	1,081	2,301.36	2,571	2000	27.4
>=1500 &<2000	8,535	805	1,733.30	1,850	1999	39.0
>=1200 &<1500	7,555	609	1,310.15	1,415	1999	20.3
<1200	7,344	541	1,163.98	1,029	1998	1.1

Vehicle Engine Capacity by Suburb (CC)	**Average Vehicle Kilometres Travelled (Km)**	**Average Energy Demand (Litres)**	**Average Fuel Cost ($)**	**Average Vehicle Engine Capacity (CC)**	**Average Vehicle Age**	**Vehicle Engine Capacity (%)**
Styx	12,550	1,267	2,690.13	2,224	1997	100.0
>=3000	13,814	1,860	3,837.74	3,747	1998	12.1
>=2000 &<3000	12,684	1,303	2,743.36	2,650	1996	27.9
>=1500 &<2000	12,293	1,180	2,539.81	1,846	1997	42.9
>=1200 &<1500	12,271	1,032	2,219.57	1,436	1997	15.8
<1200	9,676	711	1,529.30	884	1999	1.3
Styx Mill	8,285	834	1,789.45	2,093	1996	100.0
>=3000	7,659	1,185	2,540.57	3,956	1995	8.2
>=2000 &<3000	8,285	913	1,943.89	2,508	1996	23.5
>=1500 &<2000	8,621	823	1,770.43	1,865	1996	48.2
>=1200 &<1500	7,961	646	1,387.70	1,430	1997	18.8
<1200	4,032	302	650.16	657	1998	1.2
Sumner	12,035	1,191	2,541.37	2,152	1999	100.0
>=3000	11,521	1,551	3,242.59	3,860	2000	9.0
>=2000 &<3000	13,416	1,410	2,986.84	2,595	1999	29.3
>=1500 &<2000	11,813	1,118	2,407.60	1,842	1999	41.8
>=1200 &<1500	10,625	863	1,854.94	1,411	1998	18.1
<1200	11,447	824	1,771.56	999	2002	1.8
Sydenham	9,447	937	2,003.28	2,036	1997	100.0
>=3000	9,487	1,306	2,725.58	3,859	1999	6.0
>=2000 &<3000	10,860	1,169	2,480.52	2,554	1997	23.3
>=1500 &<2000	9,362	909	1,954.28	1,860	1997	47.7
>=1200 &<1500	8,242	676	1,453.67	1,430	1997	21.3
<1200	7,415	540	1,161.31	993	2000	1.7
Templeton	11,756	1,157	2,462.89	2,163	1998	100.0
>=3000	10,236	1,421	2,973.79	3,941	2000	10.0
>=2000 &<3000	12,582	1,292	2,717.96	2,593	1997	27.7
>=1500 &<2000	11,855	1,138	2,446.18	1,851	1998	39.4
>=1200 &<1500	11,220	911	1,960.39	1,422	1998	22.2
<1200	12,240	918	1,973.70	861	1998	0.8
Travis	10,196	1,016	2,170.08	2,078	1998	100.0
>=3000	10,838	1,511	3,161.89	3,801	1999	9.1
>=2000 &<3000	10,991	1,180	2,506.75	2,579	1998	22.7
>=1500 &<2000	10,248	989	2,126.79	1,853	1998	42.1
>=1200 &<1500	9,193	747	1,606.61	1,424	1998	24.8
<1200	9,190	676	1,452.41	922	1999	1.3
Travis Wetland	10,717	1,066	2,279.17	2,099	1997	100.0
>=3000	10,268	1,439	3,059.84	4,290	1997	6.2
>=2000 &<3000	11,568	1,247	2,639.39	2,552	1997	26.7
>=1500 &<2000	10,794	1,041	2,239.15	1,871	1997	45.3
>=1200 &<1500	9,587	793	1,704.13	1,416	1998	20.5
<1200	10,500	735	1,580.25	993	2002	1.2
Trents-Ladbrooks	11,576	1,189	2,525.25	2,382	1998	100.0
>=3000	13,223	1,779	3,745.61	3,878	2000	16.5
>=2000 &<3000	11,976	1,186	2,492.12	2,692	1999	32.2
>=1500 &<2000	11,209	1,097	2,359.13	1,868	1998	34.7
>=1200 &<1500	10,495	848	1,824.07	1,412	1998	14.9
<1200	4,758	357	767.23	921	1997	1.7

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Upper Riccarton	8,087	797	1,707.25	1,958	1998	100.0
>=3000	8,551	1,197	2,542.85	3,819	2000	6.0
>=2000 &<3000	9,286	1,010	2,148.13	2,495	1998	20.7
>=1500 &<2000	8,145	790	1,698.84	1,833	1997	44.6
>=1200 &<1500	7,072	579	1,245.21	1,419	1998	26.2
<1200	6,676	491	1,055.20	960	2000	2.6
Waimairi Beach	11,249	1,123	2,398.17	2,134	1999	100.0
>=3000	12,190	1,652	3,467.41	3,749	2001	10.9
>=2000 &<3000	12,421	1,328	2,818.32	2,568	1998	22.2
>=1500 &<2000	11,088	1,047	2,253.61	1,870	1999	46.5
>=1200 &<1500	9,842	793	1,705.22	1,412	1999	20.2
<1200	9,852	690	1,482.73	989	2006	0.3
Wainoni	10,281	1,039	2,216.66	2,064	1997	100.0
>=3000	10,619	1,460	3,013.32	3,780	1998	9.3
>=2000 &<3000	11,668	1,273	2,704.80	2,518	1996	18.9
>=1500 &<2000	10,216	998	2,146.54	1,862	1997	49.4
>=1200 &<1500	9,275	772	1,660.57	1,428	1997	21.4
<1200	5,549	416	894.74	963	1999	1.0
Wairarapa	9,167	925	1,973.48	2,069	1998	100.0
>=3000	11,387	1,508	3,161.42	3,851	2000	9.9
>=2000 &<3000	11,223	1,214	2,578.80	2,573	1998	20.5
>=1500 &<2000	8,848	852	1,832.85	1,823	1998	45.3
>=1200 &<1500	7,208	586	1,260.57	1,406	1999	22.4
<1200	5,994	445	956.28	964	2001	1.9
Waltham	9,652	974	2,087.34	2,030	1997	100.0
>=3000	9,108	1,457	3,133.15	3,800	1998	5.6
>=2000 &<3000	8,508	924	1,951.85	2,420	1997	22.2
>=1500 &<2000	10,538	1,028	2,213.50	1,876	1996	55.6
>=1200 &<1500	8,404	697	1,498.85	1,432	1999	16.7
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Westburn	8,751	851	1,818.33	2,009	1998	100.0
>=3000	9,804	1,275	2,661.31	3,785	2000	5.2
>=2000 &<3000	8,756	922	1,952.57	2,564	1999	23.2
>=1500 &<2000	9,294	895	1,925.48	1,869	1998	46.4
>=1200 &<1500	7,915	651	1,399.32	1,439	1998	23.2
<1200	3,243	234	503.58	874	2003	2.1
Westhaven	9,870	1,017	2,165.51	2,227	1997	100.0
>=3000	11,699	1,596	3,342.05	3,809	2000	13.2
>=2000 &<3000	9,441	988	2,081.47	2,621	1997	24.8
>=1500 &<2000	9,719	951	2,045.36	1,831	1997	47.1
>=1200 &<1500	9,441	763	1,640.26	1,414	1998	14.9
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Westmorland	9,913	985	2,104.68	2,186	2000	100.0
>=3000	9,877	1,312	2,757.62	3,874	2001	10.6
>=2000 &<3000	10,823	1,145	2,435.19	2,559	2000	30.2
>=1500 &<2000	9,415	892	1,918.63	1,849	1999	38.8
>=1200 &<1500	9,477	758	1,628.69	1,418	2000	19.6
<1200	10,954	777	1,671.94	925	2000	0.8

Vehicle Engine Capacity by Suburb (CC)	**Average Vehicle Kilometres Travelled (Km)**	**Average Energy Demand (Litres)**	**Average Fuel Cost ($)**	**Average Vehicle Engine Capacity (CC)**	**Average Vehicle Age**	**Vehicle Engine Capacity (%)**
Wharenui	8,087	797	1,707.25	1,958	1998	100.0
>=3000	8,551	1,197	2,542.85	3,819	2000	6.0
>=2000 &<3000	9,286	1,010	2,148.13	2,495	1998	20.7
>=1500 &<2000	8,145	790	1,698.84	1,833	1997	44.6
>=1200 &<1500	7,072	579	1,245.21	1,419	1998	26.2
<1200	6,676	491	1,055.20	960	2000	2.6
Wigram	9,047	995	2,133.19	2,320	1999	100.0
>=3000	12,330	1,712	3,680.56	3,718	2002	18.2
>=2000 &<3000	10,856	1,215	2,587.81	2,577	1998	27.3
>=1500 &<2000	7,103	687	1,476.85	1,870	1998	40.9
>=1200 &<1500	5,292	411	883.01	1,439	2000	9.1
<1200	10,068	755	1,623.47	990	1997	4.5
Woolston South	9,466	952	2,033.39	2,061	1997	100.0
>=3000	10,091	1,433	3,009.77	3,956	1998	8.0
>=2000 &<3000	10,343	1,118	2,371.68	2,534	1997	23.0
>=1500 &<2000	9,585	935	2,010.15	1,850	1996	44.6
>=1200 &<1500	8,412	690	1,484.10	1,423	1998	22.6
<1200	5,968	435	935.54	912	2000	1.9
Woolston West	8,943	881	1,876.15	2,090	1997	100.0
>=3000	8,069	1,123	2,300.98	3,816	1997	8.7
>=2000 &<3000	9,878	1,065	2,252.64	2,541	1996	24.3
>=1500 &<2000	8,498	810	1,744.12	1,872	1997	43.5
>=1200 &<1500	9,330	754	1,620.10	1,419	1997	21.7
<1200	6,528	457	982.46	992	2002	1.7
Yaldhurst	10,767	1,084	2,301.92	2,160	1997	100.0
>=3000	14,817	1,935	3,955.93	4,049	1998	9.6
>=2000 &<3000	11,397	1,199	2,538.25	2,564	1997	24.7
>=1500 &<2000	10,526	1,018	2,190.46	1,897	1998	42.8
>=1200 &<1500	9,201	757	1,627.09	1,442	1997	21.7
<1200	2,184	153	328.69	993	2002	1.2

8.3. Greater Christchurch Commuter Town Results 2002-2003

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Rangiora	14,019	1,419	3,014.46	2,128	1993	100.0
<1200	8,956	628	1,373.00	923	1994	0.9
>=1200 &<1500	12,401	1,049	2,255.42	1,438	1993	17.7
>=1500 &<2000	14,136	1,379	2,968.27	1,851	1993	46.5
>=2000 &<3000	14,709	1,530	3,207.70	2,570	1992	26.8
>=3000	15,176	2,187	4,487.42	3,899	1993	8.1
Oxford	16,782	1,656	3,510.38	2,133	1992	100.0
<1200	12,307	903	1,941.98	947	1998	2.0
>=1200 &<1500	15,375	1,296	2,786.58	1,429	1994	12.2
>=1500 &<2000	18,081	1,693	3,652.47	1,844	1992	49.6
>=2000 &<3000	14,782	1,484	3,085.31	2,549	1990	27.0
>=3000	18,480	2,594	5,279.53	3,654	1992	9.3
Kaiapoi	13,854	1,397	2,973.56	2,067	1992	100.0
<1200	12,617	944	2,030.56	924	1996	1.2
>=1200 &<1500	12,204	1,035	2,225.84	1,438	1993	18.5
>=1500 &<2000	14,505	1,418	3,051.99	1,836	1992	48.8
>=2000 &<3000	13,750	1,450	3,047.03	2,543	1992	24.0
>=3000	14,235	2,066	4,248.05	3,803	1992	7.4
Rolleston	15,845	1,594	3,416.03	2,069	1993	100.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	13,682	1,154	2,480.98	1,459	1993	20.5
>=1500 &<2000	17,237	1,644	3,543.83	1,848	1993	47.4
>=2000 &<3000	16,359	1,846	3,926.99	2,506	1993	25.6
>=3000	10,404	1,613	3,418.63	3,912	1990	6.4
Prebbleton	14,073	1,409	3,003.38	2,455	1993	100.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	10,745	847	1,857.76	1,418	1992	17.1
>=1500 &<2000	15,206	1,501	3,229.50	1,866	1992	52.4
>=2000 &<3000	15,149	1,541	3,218.24	2,603	1993	22.0
>=3000	11,004	1,623	3,353.16	7,772	1994	8.5
Lincoln	7,488	699	1,503.30	1,534	1993	100.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	6,612	562	1,208.34	1,480	1995	50.0
>=1500 &<2000	8,364	836	1,798.26	1,587	1991	50.0
>=2000 &<3000	No Data	No Data	No Data	No Data	No Data	0.0
>=3000	No Data	No Data	No Data	No Data	No Data	0.0

8.4. Greater Christchurch Commuter Town Results 2011-2012

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Rangiora	11,589	1,163	2,478.15	2,179	1998	100.0
<1200	8,465	627	1,347.89	930	1999	1.1
>=1200 &<1500	10,838	883	1,898.19	1,422	1999	20.6
>=1500 &<2000	11,355	1,088	2,341.19	1,861	1998	39.6
>=2000 &<3000	12,693	1,338	2,832.09	2,583	1998	27.5
>=3000	11,385	1,561	3,264.21	3,812	1999	11.3
Oxford	16,285	1,643	3,484.05	2,240	1996	100.0
<1200	14,905	1,049	2,294.53	964	1997	1.0
>=1200 &<1500	16,841	1,373	2,959.13	1,426	1997	16.3
>=1500 &<2000	16,136	1,550	3,337.91	1,856	1995	39.5
>=2000 &<3000	16,196	1,665	3,493.38	2,620	1995	30.9
>=3000	16,356	2,291	4,713.51	3,691	1996	12.4
Kaiapoi	12,486	1,265	2,694.31	2,175	1996	100.0
<1200	10,691	785	1,690.60	951	1998	1.3
>=1200 &<1500	11,900	983	2,114.58	1,426	1996	19.0
>=1500 &<2000	12,642	1,232	2,650.13	1,856	1995	43.2
>=2000 &<3000	12,929	1,368	2,886.49	2,585	1995	25.5
>=3000	12,058	1,696	3,532.91	3,905	1997	11.0
Rolleston	13,788	1,398	2,981.01	2,247	1998	100.0
<1200	13,707	1,020	2,193.02	978	1998	0.9
>=1200 &<1500	13,450	1,094	2,353.39	1,426	1998	18.7
>=1500 &<2000	13,955	1,348	2,900.64	1,861	1997	39.9
>=2000 &<3000	14,232	1,504	3,181.31	2,583	1997	27.4
>=3000	12,842	1,784	3,749.07	3,958	1999	13.2
Prebbleton	12,058	1,212	2,581.83	2,239	1998	100.0
<1200	6,716	496	1,067.39	997	2000	0.3
>=1200 &<1500	10,724	874	1,880.72	1,417	1998	18.9
>=1500 &<2000	12,063	1,154	2,484.03	1,864	1998	40.2
>=2000 &<3000	12,547	1,307	2,765.56	2,597	1998	29.0
>=3000	13,122	1,742	3,641.14	4,010	2000	11.6
Lincoln	12,522	1,252	2,672.58	2,144	1999	100.0
<1200	9,725	714	1,535.45	946	1998	1.2
>=1200 &<1500	11,425	931	2,001.94	1,429	1999	18.3
>=1500 &<2000	12,198	1,163	2,503.72	1,859	1998	44.9
>=2000 &<3000	13,549	1,434	3,041.30	2,588	1999	25.8
>=3000	13,716	1,850	3,883.61	3,780	2000	9.7
Pegasus	16,828	1,654	3,530.64	2,113	1999	100.0
<1200	14,664	1,100	2,364.57	997	1999	1.4
>=1200 &<1500	14,944	1,198	2,575.33	1,416	1999	22.9
>=1500 &<2000	16,742	1,598	3,435.07	1,861	1999	42.9
>=2000 &<3000	20,060	2,142	4,546.53	2,555	1999	22.9
>=3000	14,424	1,900	3,968.35	3,939	1997	10.0

8.5. Greater Christchurch Commuter Town Results – Commuting Residents 2011-2012

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Rangiora	20,368	2,046	4,356.73	2,217	1999	100.0
<1200	23,512	1,763	3,791.31	959	1999	0.5
>=1200 &<1500	19,840	1,619	3,481.81	1,430	1999	18.4
>=1500 &<2000	19,610	1,873	4,030.91	1,870	1998	38.0
>=2000 &<3000	21,200	2,220	4,695.90	2,597	1999	32.5
>=3000	21,307	2,889	6,029.31	3,724	2000	10.6
Oxford	31,323	3,150	6,664.17	2,240	1996	100.0
<1200	29,160	2,151	4,623.84	933	1998	1.0
>=1200 &<1500	30,818	2,500	5,394.41	1,426	1997	18.0
>=1500 &<2000	31,574	3,030	6,522.76	1,862	1996	37.0
>=2000 &<3000	31,520	3,211	6,736.98	2,646	1996	30.6
>=3000	31,020	4,286	8,742.46	3,543	1996	13.4
Kaiapoi	15,401	1,560	3,321.91	2,153	1996	100.0
<1200	14,684	1,083	2,328.68	956	1998	1.0
>=1200 &<1500	14,612	1,208	2,598.22	1,432	1996	18.7
>=1500 &<2000	15,228	1,485	3,194.29	1,861	1995	44.5
>=2000 &<3000	16,093	1,702	3,591.53	2,582	1996	25.7
>=3000	15,940	2,234	4,645.72	3,809	1998	10.1
Rolleston	17,048	1,725	3,678.36	2,216	1998	100.0
<1200	18,484	1,375	2,956.63	979	1997	0.8
>=1200 &<1500	16,419	1,335	2,870.64	1,429	1998	18.6
>=1500 &<2000	16,771	1,620	3,485.38	1,863	1997	41.6
>=2000 &<3000	18,000	1,900	4,019.48	2,580	1998	27.0
>=3000	16,749	2,319	4,871.29	3,912	2000	12.1
Prebbleton	13,095	1,316	2,803.79	2,232	1998	100.0
<1200	10,932	820	1,762.79	997	1999	0.1
>=1200 &<1500	11,791	960	2,066.07	1,415	1998	18.3
>=1500 &<2000	12,892	1,234	2,654.46	1,865	1998	41.0
>=2000 &<3000	13,567	1,412	2,987.45	2,590	1999	29.4
>=3000	14,745	1,952	4,080.56	3,983	2001	11.2
Lincoln	16,156	1,623	3,462.19	2,198	1999	100.0
<1200	14,136	1,039	2,232.30	958	2000	0.9
>=1200 &<1500	15,493	1,263	2,716.15	1,440	1999	16.6
>=1500 &<2000	15,829	1,510	3,248.51	1,871	1999	43.5
>=2000 &<3000	16,731	1,769	3,750.69	2,582	1999	28.2
>=3000	17,155	2,294	4,810.64	3,768	2001	10.8
Pegasus	20,242	1,976	4,213.99	2,105	1999	100.0
<1200	14,664	1,100	2,364.57	997	1999	2.0
>=1200 &<1500	18,099	1,449	3,115.27	1,428	1999	22.0
>=1500 &<2000	21,519	2,041	4,388.62	1,887	2000	38.0
>=2000 &<3000	20,060	2,142	4,546.53	2,555	1999	32.0
>=3000	22,844	2,908	5,979.54	3,939	1998	6.0

8.6. Greater Christchurch Commuter Town Results – Non Commuting Residents 2011-2012

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Rangiora	8,062	808	1,723.75	2,163	1998	100.0
<1200	6,089	447	962.08	925	1999	1.3
>=1200 &<1500	7,747	630	1,354.44	1,419	1999	21.5
>=1500 &<2000	8,221	790	1,699.46	1,858	1997	40.2
>=2000 &<3000	8,328	886	1,875.65	2,576	1997	25.4
>=3000	7,726	1,072	2,246.11	3,844	1998	11.5
Oxford	12,671	1,281	2,719.97	2,240	1995	100.0
<1200	11,342	773	1,712.20	972	1996	1.0
>=1200 &<1500	13,039	1,066	2,296.66	1,426	1997	15.9
>=1500 &<2000	12,716	1,222	2,632.31	1,855	1995	40.1
>=2000 &<3000	12,553	1,297	2,722.31	2,613	1995	31.0
>=3000	12,451	1,760	3,640.47	3,731	1996	12.1
Kaiapoi	5,606	569	1,213.64	2,229	1995	100.0
<1200	5,367	388	839.84	944	1997	1.8
>=1200 &<1500	5,785	476	1,024.10	1,412	1997	19.6
>=1500 &<2000	5,871	569	1,225.25	1,842	1995	40.1
>=2000 &<3000	5,287	561	1,183.85	2,590	1994	25.1
>=3000	5,182	745	1,562.29	4,077	1996	13.4
Rolleston	6,842	702	1,496.79	2,312	1997	100.0
<1200	7,258	541	1,162.15	976	1998	1.2
>=1200 &<1500	7,148	584	1,255.49	1,420	1997	18.7
>=1500 &<2000	7,073	684	1,472.10	1,856	1997	36.3
>=2000 &<3000	6,566	699	1,477.24	2,590	1996	28.2
>=3000	6,409	904	1,902.77	4,033	1998	15.6
Prebbleton	3,375	339	723.16	2,293	1996	100.0
<1200	4,608	335	719.69	996	2000	1.7
>=1200 &<1500	4,019	333	715.62	1,430	1997	24.3
>=1500 &<2000	3,438	331	712.44	1,861	1997	33.0
>=2000 &<3000	2,930	317	672.40	2,666	1994	26.1
>=3000	2,810	406	849.53	4,176	1994	14.8
Lincoln	6,629	650	1,392.71	2,057	1998	100.0
<1200	6,197	455	977.97	937	1996	1.8
>=1200 &<1500	6,253	508	1,094.05	1,414	1998	21.1
>=1500 &<2000	6,772	646	1,390.79	1,841	1998	47.1
>=2000 &<3000	6,926	736	1,564.63	2,600	1999	22.0
>=3000	6,056	860	1,818.87	3,807	2000	7.9
Pegasus	8,291	848	1,822.27	2,134	1998	100.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	8,002	645	1,387.47	1,389	1999	25.0
>=1500 &<2000	8,489	832	1,788.02	1,816	1997	55.0
>=2000 &<3000	No Data	No Data	No Data	No Data	No Data	0.0
>=3000	8,109	1,144	2,459.97	3,939	1997	20.0

8.7. Tauranga City Results 2002-2003

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Arataki	14,301	1,482	3,143.21	2,253	1994	100.0
>=3000	18,684	2,523	5,199.17	4,008	1996	11.3
>=2000 &<3000	15,486	1,612	3,388.49	2,480	1995	33.9
>=1500 &<2000	13,680	1,338	2,878.87	1,839	1994	41.9
>=1200 &<1500	9,372	700	1,559.52	1,467	1994	12.9
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Bellevue	12,714	1,298	2,779.82	2,050	1993	100.0
>=3000	13,908	2,102	4,427.13	3,976	1995	4.9
>=2000 &<3000	13,718	1,526	3,239.92	2,518	1993	22.9
>=1500 &<2000	12,359	1,218	2,621.27	1,862	1992	56.1
>=1200 &<1500	11,952	1,015	2,182.66	1,462	1992	16.0
<1200	34,188	0	1,641.02	1,000	1985	0.2
Bethlehem	13,337	1,396	2,978.91	2,183	1994	100.0
>=3000	14,929	2,206	4,650.66	3,978	1996	8.6
>=2000 &<3000	15,009	1,642	3,477.24	2,552	1994	30.0
>=1500 &<2000	12,710	1,236	2,661.61	1,853	1994	46.9
>=1200 &<1500	11,055	934	2,008.19	1,450	1993	14.0
<1200	8,416	631	1,357.08	849	1997	0.5
Bethlehem East	13,337	1,396	2,978.91	2,183	1994	100.0
>=3000	14,929	2,206	4,650.66	3,978	1996	8.6
>=2000 &<3000	15,009	1,642	3,477.24	2,552	1994	30.0
>=1500 &<2000	12,710	1,236	2,661.61	1,853	1994	46.9
>=1200 &<1500	11,055	934	2,008.19	1,450	1993	14.0
<1200	8,416	631	1,357.08	849	1997	0.5
Brookfield	12,586	1,289	2,751.97	2,060	1993	100.0
>=3000	14,176	2,107	4,417.60	3,899	1995	4.9
>=2000 &<3000	14,199	1,541	3,255.34	2,535	1993	25.6
>=1500 &<2000	12,203	1,203	2,588.40	1,841	1993	54.2
>=1200 &<1500	10,827	919	1,976.13	1,460	1993	15.2
<1200	3,012	226	485.69	996	2000	0.2
Doncaster	5,796	580	1,246.14	1,997	1990	100.0
>=3000	No Data	No Data	No Data	No Data	No Data	0.0
>=2000 &<3000	No Data	No Data	No Data	No Data	No Data	0.0
>=1500 &<2000	5,796	580	1,246.14	1,997	1990	100.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Gate Pa	12,623	1,258	2,686.58	1,984	1992	100.0
>=3000	16,205	2,438	5,087.98	3,874	1993	3.5
>=2000 &<3000	13,469	1,422	2,987.31	2,523	1992	20.7
>=1500 &<2000	12,737	1,246	2,681.86	1,864	1992	56.7
>=1200 &<1500	10,728	908	1,954.03	1,444	1992	18.2
<1200	10,696	798	1,715.83	912	1996	1.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Gravatt	5,796	580	1,246.14	1,997	1990	100.0
>=3000	No Data	No Data	No Data	No Data	No Data	0.0
>=2000 &<3000	No Data	No Data	No Data	No Data	No Data	0.0
>=1500 &<2000	5,796	580	1,246.14	1,997	1990	100.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Greerton	12,212	1,243	2,655.62	2,051	1993	100.0
>=3000	14,591	2,201	4,656.80	4,408	1993	4.0
>=2000 &<3000	14,677	1,592	3,367.86	2,536	1993	25.9
>=1500 &<2000	11,544	1,138	2,448.90	1,861	1992	49.6
>=1200 &<1500	10,354	879	1,889.40	1,450	1993	20.0
<1200	6,582	494	1,061.35	1,010	1998	0.5
Hairini	14,801	1,546	3,292.40	2,226	1994	100.0
>=3000	15,106	2,176	4,536.59	3,973	1996	11.2
>=2000 &<3000	16,449	1,760	3,712.53	2,543	1994	25.4
>=1500 &<2000	14,980	1,463	3,147.91	1,877	1993	51.1
>=1200 &<1500	10,579	899	1,933.34	1,461	1993	11.9
<1200	4,236	318	683.06	657	1995	0.4
Judea	12,592	1,272	2,703.66	2,098	1992	100.0
>=3000	14,602	2,029	4,098.43	3,795	1994	6.9
>=2000 &<3000	13,517	1,423	2,992.11	2,596	1992	23.4
>=1500 &<2000	12,485	1,218	2,622.67	1,873	1992	54.1
>=1200 &<1500	10,785	917	1,970.91	1,438	1992	14.3
<1200	9,572	701	1,507.37	729	1992	1.3
Kairua	16,181	1,553	3,309.53	1,984	1993	100.0
>=3000	No Data	No Data	No Data	No Data	No Data	0.0
>=2000 &<3000	17,788	1,851	3,877.47	2,637	1993	33.3
>=1500 &<2000	16,422	1,541	3,323.97	1,748	1993	44.4
>=1200 &<1500	13,290	1,130	2,428.75	1,475	1993	22.2
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Kaitemako	13,359	1,358	2,890.46	2,073	1993	100.0
>=3000	16,315	2,328	4,838.25	3,788	1995	6.4
>=2000 &<3000	15,450	1,622	3,406.19	2,539	1992	25.1
>=1500 &<2000	12,741	1,256	2,701.69	1,860	1993	50.1
>=1200 &<1500	11,512	977	2,100.77	1,448	1993	17.3
<1200	5,172	279	669.55	944	1987	1.0
Matapihi	15,954	1,634	3,487.40	2,149	1992	100.0
>=3000	17,592	2,543	5,196.61	3,980	1991	10.0
>=2000 &<3000	5,736	654	1,393.67	2,728	1996	10.0
>=1500 &<2000	17,601	1,719	3,701.09	1,909	1992	70.0
>=1200 &<1500	13,002	1,105	2,376.12	1,418	1994	10.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Matua	12,099	1,281	2,739.63	2,137	1994	100.0
>=3000	14,578	2,225	4,720.48	3,843	1996	8.6
>=2000 &<3000	13,730	1,530	3,254.03	2,549	1995	26.2
>=1500 &<2000	11,603	1,132	2,437.50	1,846	1994	49.9
>=1200 &<1500	9,499	807	1,734.63	1,444	1994	14.8
<1200	10,648	794	1,707.14	936	1997	0.5

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Maungatapu	13,202	1,375	2,931.65	2,143	1993	100.0
>=3000	14,670	2,208	4,616.52	3,841	1994	9.5
>=2000 &<3000	14,022	1,505	3,173.61	2,567	1993	23.7
>=1500 &<2000	13,301	1,306	2,810.67	1,851	1993	50.3
>=1200 &<1500	10,913	927	1,992.20	1,452	1993	16.3
<1200	7,764	582	1,251.95	847	1997	0.2
Mt Maunganui North	14,301	1,482	3,143.21	2,253	1994	100.0
>=3000	18,684	2,523	5,199.17	4,008	1996	11.3
>=2000 &<3000	15,486	1,612	3,388.49	2,480	1995	33.9
>=1500 &<2000	13,680	1,338	2,878.87	1,839	1994	41.9
>=1200 &<1500	9,372	700	1,559.52	1,467	1994	12.9
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Ohauiti-Ngapeke	14,801	1,546	3,292.40	2,226	1994	100.0
>=3000	15,106	2,176	4,536.59	3,973	1996	11.2
>=2000 &<3000	16,449	1,760	3,712.53	2,543	1994	25.4
>=1500 &<2000	14,980	1,463	3,147.91	1,877	1993	51.1
>=1200 &<1500	10,579	899	1,933.34	1,461	1993	11.9
<1200	4,236	318	683.06	657	1995	0.4
Omanu	14,301	1,482	3,143.21	2,253	1994	100.0
>=3000	18,684	2,523	5,199.17	4,008	1996	11.3
>=2000 &<3000	15,486	1,612	3,388.49	2,480	1995	33.9
>=1500 &<2000	13,680	1,338	2,878.87	1,839	1994	41.9
>=1200 &<1500	9,372	700	1,559.52	1,467	1994	12.9
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Otumoetai North	11,598	1,212	2,589.28	2,100	1994	100.0
>=3000	13,311	1,984	4,172.66	3,858	1996	7.2
>=2000 &<3000	13,232	1,459	3,092.82	2,541	1994	25.3
>=1500 &<2000	11,512	1,131	2,434.70	1,838	1994	53.0
>=1200 &<1500	8,316	702	1,512.19	1,444	1993	14.0
<1200	5,834	438	940.69	733	1997	0.6
Otumoetai South	11,598	1,212	2,589.28	2,100	1994	100.0
>=3000	13,311	1,984	4,172.66	3,858	1996	7.2
>=2000 &<3000	13,232	1,459	3,092.82	2,541	1994	25.3
>=1500 &<2000	11,512	1,131	2,434.70	1,838	1994	53.0
>=1200 &<1500	8,316	702	1,512.19	1,444	1993	14.0
<1200	5,834	438	940.69	733	1997	0.6
Pacific View	23,178	2,641	5,530.46	3,332	1994	100.0
>=3000	13,512	2,162	4,648.13	4,000	1993	50.0
>=2000 &<3000	32,844	3,120	6,412.79	2,663	1995	50.0
>=1500 &<2000	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Palm Beach	16,363	1,690	3,600.25	2,077	1993	100.0
>=3000	19,178	2,796	5,744.08	3,858	1994	8.2
>=2000 &<3000	18,524	2,022	4,281.18	2,559	1994	19.7
>=1500 &<2000	15,514	1,532	3,295.33	1,833	1993	54.4
>=1200 &<1500	15,264	1,297	2,789.50	1,468	1993	17.7
<1200	No Data	No Data	No Data	No Data	No Data	0.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Palm Springs	5,796	580	1,246.14	1,997	1990	100.0
>=3000	No Data	No Data	No Data	No Data	No Data	0.0
>=2000 &<3000	No Data	No Data	No Data	No Data	No Data	0.0
>=1500 &<2000	5,796	580	1,246.14	1,997	1990	100.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Papamoa Beach East	16,363	1,690	3,600.25	2,077	1993	100.0
>=3000	19,178	2,796	5,744.08	3,858	1994	8.2
>=2000 &<3000	18,524	2,022	4,281.18	2,559	1994	19.7
>=1500 &<2000	15,514	1,532	3,295.33	1,833	1993	54.4
>=1200 &<1500	15,264	1,297	2,789.50	1,468	1993	17.7
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Poike	12,739	1,296	2,765.98	2,095	1992	100.0
>=3000	23,184	3,397	7,135.68	3,884	1998	3.4
>=2000 &<3000	11,569	1,240	2,613.84	2,526	1991	30.2
>=1500 &<2000	12,153	1,189	2,560.23	1,873	1992	55.2
>=1200 &<1500	15,562	1,323	2,843.98	1,479	1993	11.2
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Pyes Pa	15,089	1,585	3,373.26	2,201	1994	100.0
>=3000	18,294	2,687	5,628.82	3,937	1996	9.8
>=2000 &<3000	17,049	1,807	3,804.16	2,551	1994	27.3
>=1500 &<2000	14,114	1,389	2,987.76	1,867	1993	50.1
>=1200 &<1500	12,313	1,047	2,250.27	1,448	1992	12.4
<1200	11,226	842	1,810.19	996	1998	0.4
Sulphur Point	11,598	1,212	2,589.28	2,100	1994	100.0
>=3000	13,311	1,984	4,172.66	3,858	1996	7.2
>=2000 &<3000	13,232	1,459	3,092.82	2,541	1994	25.3
>=1500 &<2000	11,512	1,131	2,434.70	1,838	1994	53.0
>=1200 &<1500	8,316	702	1,512.19	1,444	1993	14.0
<1200	5,834	438	940.69	733	1997	0.6
Tauranga Central	12,782	1,352	2,886.06	2,200	1994	100.0
>=3000	17,171	2,582	5,477.92	4,764	1996	9.3
>=2000 &<3000	15,907	1,722	3,639.77	2,539	1994	22.5
>=1500 &<2000	11,495	1,130	2,431.63	1,836	1993	51.7
>=1200 &<1500	10,009	844	1,814.18	1,441	1993	16.3
<1200	15,000	1,125	2,418.75	1,130	1987	0.3
Tauranga Hospital	12,621	1,309	2,788.74	2,142	1993	100.0
>=3000	15,155	2,238	4,656.93	3,916	1995	7.6
>=2000 &<3000	14,417	1,546	3,261.43	2,551	1993	26.3
>=1500 &<2000	12,022	1,178	2,535.05	1,867	1993	51.8
>=1200 &<1500	10,175	858	1,847.68	1,448	1993	13.9
<1200	7,896	586	1,258.55	736	1994	0.3
Tauranga South	12,782	1,352	2,886.06	2,200	1994	100.0
>=3000	17,171	2,582	5,477.92	4,764	1996	9.3
>=2000 &<3000	15,907	1,722	3,639.77	2,539	1994	22.5
>=1500 &<2000	11,495	1,130	2,431.63	1,836	1993	51.7
>=1200 &<1500	10,009	844	1,814.18	1,441	1993	16.3
<1200	15,000	1,125	2,418.75	1,130	1987	0.3

Vehicle Engine Capacity by Suburb (CC)	**Average Vehicle Kilometres Travelled (Km)**	**Average Energy Demand (Litres)**	**Average Fuel Cost ($)**	**Average Vehicle Engine Capacity (CC)**	**Average Vehicle Age**	**Vehicle Engine Capacity (%)**
Tauriko	16,054	1,677	3,539.94	2,407	1996	100.0
>=3000	17,194	2,350	4,942.38	3,720	1997	17.6
>=2000 &<3000	18,978	1,898	3,956.85	2,562	1996	38.2
>=1500 &<2000	13,714	1,324	2,851.74	1,867	1995	30.9
>=1200 &<1500	11,548	963	2,071.44	1,467	1994	13.2
<1200	No Data	No Data	No Data	No Data	No Data	0.0
TeMaunga	23,178	2,641	5,530.46	3,332	1994	100.0
>=3000	13,512	2,162	4,648.13	4,000	1993	50.0
>=2000 &<3000	32,844	3,120	6,412.79	2,663	1995	50.0
>=1500 &<2000	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
TeReti	13,871	1,425	3,024.79	2,194	1992	100.0
>=3000	12,996	1,949	4,059.36	3,820	1993	10.1
>=2000 &<3000	16,009	1,611	3,358.53	2,582	1991	25.8
>=1500 &<2000	13,935	1,375	2,957.27	1,867	1992	50.6
>=1200 &<1500	10,191	866	1,862.41	1,460	1993	13.5
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Welcome Bay East	15,316	1,577	3,347.91	2,157	1993	100.0
>=3000	20,359	2,800	5,562.93	3,724	1991	6.7
>=2000 &<3000	11,871	1,275	2,694.13	2,633	1994	28.0
>=1500 &<2000	17,630	1,741	3,745.23	1,869	1993	53.3
>=1200 &<1500	10,271	873	1,876.96	1,450	1992	12.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Welcome Bay West	14,290	1,471	3,137.76	2,110	1993	100.0
>=3000	15,809	2,276	4,728.97	3,861	1994	7.0
>=2000 &<3000	15,467	1,683	3,556.98	2,505	1993	26.4
>=1500 &<2000	14,126	1,383	2,976.44	1,858	1993	51.9
>=1200 &<1500	12,072	1,025	2,203.02	1,459	1993	14.6
<1200	5,448	409	878.49	1,166	1976	0.1
Yatton Park	13,100	1,301	2,772.90	2,017	1992	100.0
>=3000	15,133	2,172	4,419.75	3,529	1992	3.9
>=2000 &<3000	14,689	1,530	3,212.28	2,547	1993	21.3
>=1500 &<2000	12,687	1,240	2,669.88	1,886	1992	57.4
>=1200 &<1500	12,061	1,025	2,204.07	1,460	1992	17.4
<1200	No Data	No Data	No Data	No Data	No Data	0.0

8.8. Tauranga City Results 2011-2012

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Arataki	11,714	1,212	2,590.54	2,222	1998	100.0
>=3000	12,371	1,758	3,761.93	3,807	2001	14.7
>=2000 &<3000	12,538	1,276	2,676.85	2,592	1998	18.9
>=1500 &<2000	11,687	1,137	2,445.07	1,851	1997	53.8
>=1200 &<1500	10,353	846	1,818.71	1,451	1998	11.2
<1200	5,586	419	900.74	994	1994	1.4
Bellevue	10,713	1,107	2,368.63	2,189	1997	100.0
>=3000	11,037	1,582	3,347.89	3,922	1998	10.1
>=2000 &<3000	11,642	1,280	2,725.87	2,547	1997	28.1
>=1500 &<2000	10,391	1,004	2,159.39	1,866	1997	44.3
>=1200 &<1500	9,976	829	1,781.40	1,443	1997	16.9
<1200	5,532	411	882.83	827	2000	0.5
Bethlehem	11,040	1,126	2,405.24	2,244	2000	100.0
>=3000	12,035	1,631	3,441.29	3,866	2001	12.1
>=2000 &<3000	12,032	1,282	2,727.11	2,555	2000	30.4
>=1500 &<2000	10,542	995	2,143.25	1,862	1999	41.6
>=1200 &<1500	9,745	790	1,698.98	1,426	2000	15.4
<1200	8,130	594	1,277.05	950	2000	0.5
Bethlehem East	11,040	1,126	2,405.24	2,244	2000	100.0
>=3000	12,035	1,631	3,441.29	3,866	2001	12.1
>=2000 &<3000	12,032	1,282	2,727.11	2,555	2000	30.4
>=1500 &<2000	10,542	995	2,143.25	1,862	1999	41.6
>=1200 &<1500	9,745	790	1,698.98	1,426	2000	15.4
<1200	8,130	594	1,277.05	950	2000	0.5
Brookfield	10,975	1,126	2,405.92	2,134	1997	100.0
>=3000	11,425	1,621	3,404.14	3,804	1998	8.6
>=2000 &<3000	11,925	1,304	2,772.31	2,507	1997	28.3
>=1500 &<2000	10,865	1,056	2,271.75	1,868	1997	45.1
>=1200 &<1500	9,609	794	1,709.98	1,439	1997	17.5
<1200	7,756	568	1,221.97	1,006	2000	0.6
Doncaster	13,248	1,722	3,702.82	3,984	2006	100.0
>=3000	13,248	1,722	3,702.82	3,984	2006	100.0
>=2000 &<3000	No Data	No Data	No Data	No Data	No Data	0.0
>=1500 &<2000	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Gate Pa	10,495	1,085	2,320.10	2,125	1997	100.0
>=3000	11,682	1,690	3,573.12	3,855	1998	9.6
>=2000 &<3000	11,303	1,244	2,645.82	2,525	1996	23.9
>=1500 &<2000	10,448	1,022	2,198.42	1,864	1996	46.9
>=1200 &<1500	9,154	754	1,623.32	1,432	1997	18.7
<1200	6,468	469	1,008.67	897	2000	0.9

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Gravatt	13,248	1,722	3,702.82	3,984	2006	100.0
>=3000	13,248	1,722	3,702.82	3,984	2006	100.0
>=2000 &<3000	No Data	No Data	No Data	No Data	No Data	0.0
>=1500 &<2000	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Greerton	10,137	1,037	2,218.83	2,125	1997	100.0
>=3000	10,837	1,567	3,323.48	3,845	1999	9.2
>=2000 &<3000	10,791	1,177	2,502.51	2,558	1997	25.4
>=1500 &<2000	10,254	998	2,146.24	1,856	1997	44.5
>=1200 &<1500	8,796	723	1,556.92	1,443	1997	19.6
<1200	8,581	615	1,322.99	978	2000	1.3
Hairini	12,052	1,234	2,635.68	2,299	1999	100.0
>=3000	11,995	1,630	3,451.68	4,026	2001	13.9
>=2000 &<3000	12,756	1,358	2,885.40	2,574	1999	29.2
>=1500 &<2000	11,834	1,130	2,430.53	1,858	1999	40.8
>=1200 &<1500	11,451	937	2,014.92	1,434	1998	15.5
<1200	9,327	675	1,451.64	960	1997	0.6
Judea	10,402	1,080	2,308.80	2,182	1998	100.0
>=3000	11,709	1,663	3,528.31	3,912	1999	9.2
>=2000 &<3000	11,897	1,298	2,761.23	2,583	1998	28.6
>=1500 &<2000	10,107	987	2,123.51	1,881	1997	43.5
>=1200 &<1500	8,245	681	1,463.41	1,424	1997	18.0
<1200	5,139	372	798.61	989	1998	0.6
Kairua	11,739	1,175	2,531.92	2,324	2000	100.0
>=3000	15,942	2,308	4,961.60	3,967	2000	16.7
>=2000 &<3000	9,664	954	2,004.89	2,520	1998	25.0
>=1500 &<2000	13,810	1,158	2,528.44	1,961	2001	41.7
>=1200 &<1500	5,472	420	901.45	1,297	2000	16.7
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Kaitemako	11,250	1,162	2,481.02	2,219	1998	100.0
>=3000	11,889	1,657	3,492.32	3,959	1999	11.2
>=2000 &<3000	12,081	1,307	2,775.64	2,564	1998	27.4
>=1500 &<2000	11,166	1,083	2,329.11	1,865	1997	45.8
>=1200 &<1500	9,728	799	1,717.40	1,432	1999	15.1
<1200	5,504	407	875.46	855	1991	0.5
Matapihi	13,327	1,410	2,997.76	2,250	1998	100.0
>=3000	14,162	1,933	4,014.73	3,644	1999	14.5
>=2000 &<3000	14,128	1,547	3,288.20	2,442	1998	35.5
>=1500 &<2000	11,960	1,180	2,536.43	1,848	1996	34.2
>=1200 &<1500	13,754	1,133	2,435.43	1,448	1998	14.5
<1200	13,332	1,000	2,149.79	990	1999	1.3
Matua	10,630	1,089	2,329.46	2,200	1999	100.0
>=3000	12,704	1,730	3,670.46	3,819	2001	11.6
>=2000 &<3000	11,200	1,207	2,569.73	2,550	1999	28.4
>=1500 &<2000	10,300	980	2,108.45	1,851	1999	42.6
>=1200 &<1500	9,139	742	1,595.06	1,424	1999	16.9
<1200	8,910	653	1,403.65	911	1999	0.6

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Maungatapu	11,309	1,155	2,466.56	2,233	1998	100.0
>=3000	11,407	1,569	3,308.01	3,883	2000	12.3
>=2000 &<3000	12,176	1,308	2,781.13	2,558	1998	28.6
>=1500 &<2000	10,929	1,045	2,248.48	1,862	1998	41.9
>=1200 &<1500	10,614	865	1,862.39	1,430	1998	16.5
<1200	13,407	974	2,092.92	1,021	2001	0.7
Mt Maunganui North	11,714	1,212	2,590.54	2,222	1998	100.0
>=3000	12,371	1,758	3,761.93	3,807	2001	14.7
>=2000 &<3000	12,538	1,276	2,676.85	2,592	1998	18.9
>=1500 &<2000	11,687	1,137	2,445.07	1,851	1997	53.8
>=1200 &<1500	10,353	846	1,818.71	1,451	1998	11.2
<1200	5,586	419	900.74	994	1994	1.4
Ohauiti-Ngapeke	12,052	1,234	2,635.68	2,299	1999	100.0
>=3000	11,995	1,630	3,451.68	4,026	2001	13.9
>=2000 &<3000	12,756	1,358	2,885.40	2,574	1999	29.2
>=1500 &<2000	11,834	1,130	2,430.53	1,858	1999	40.8
>=1200 &<1500	11,451	937	2,014.92	1,434	1998	15.5
<1200	9,327	675	1,451.64	960	1997	0.6
Omanu	11,714	1,212	2,590.54	2,222	1998	100.0
>=3000	12,371	1,758	3,761.93	3,807	2001	14.7
>=2000 &<3000	12,538	1,276	2,676.85	2,592	1998	18.9
>=1500 &<2000	11,687	1,137	2,445.07	1,851	1997	53.8
>=1200 &<1500	10,353	846	1,818.71	1,451	1998	11.2
<1200	5,586	419	900.74	994	1994	1.4
Otumoetai North	10,207	1,043	2,229.96	2,212	1999	100.0
>=3000	11,277	1,521	3,226.24	3,914	2001	11.4
>=2000 &<3000	11,476	1,230	2,617.86	2,542	1999	28.6
>=1500 &<2000	9,708	926	1,992.70	1,857	1999	42.7
>=1200 &<1500	8,789	718	1,543.61	1,430	1999	16.8
<1200	2,808	207	444.54	981	1999	0.5
Otumoetai South	10,207	1,043	2,229.96	2,212	1999	100.0
>=3000	11,277	1,521	3,226.24	3,914	2001	11.4
>=2000 &<3000	11,476	1,230	2,617.86	2,542	1999	28.6
>=1500 &<2000	9,708	926	1,992.70	1,857	1999	42.7
>=1200 &<1500	8,789	718	1,543.61	1,430	1999	16.8
<1200	2,808	207	444.54	981	1999	0.5
Pacific View	13,644	1,756	3,775.06	3,141	1996	100.0
>=3000	11,412	1,826	3,925.73	3,984	1998	50.0
>=2000 &<3000	9,816	1,178	2,532.53	2,600	1996	25.0
>=1500 &<2000	21,936	2,194	4,716.24	1,994	1991	25.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Palm Beach	11,655	1,213	2,596.75	2,434	1998	100.0
>=3000	8,287	1,138	2,433.59	4,341	2000	16.0
>=2000 &<3000	12,613	1,366	2,907.76	2,508	1998	32.1
>=1500 &<2000	11,899	1,158	2,491.28	1,884	1998	42.2
>=1200 &<1500	13,001	1,068	2,294.94	1,420	1999	9.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Palm Springs	13,248	1,722	3,702.82	3,984	2006	100.0
>=3000	13,248	1,722	3,702.82	3,984	2006	100.0
>=2000 &<3000	No Data	No Data	No Data	No Data	No Data	0.0
>=1500 &<2000	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Papamoa Beach East	11,655	1,213	2,596.75	2,434	1998	100.0
>=3000	8,287	1,138	2,433.59	4,341	2000	16.0
>=2000 &<3000	12,613	1,366	2,907.76	2,508	1998	32.1
>=1500 &<2000	11,899	1,158	2,491.28	1,884	1998	42.2
>=1200 &<1500	13,001	1,068	2,294.94	1,420	1999	9.6
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Poike	12,475	1,279	2,727.59	2,186	1997	100.0
>=3000	14,702	2,032	4,259.86	3,713	2000	9.8
>=2000 &<3000	12,767	1,376	2,916.79	2,580	1996	28.6
>=1500 &<2000	11,916	1,159	2,493.33	1,890	1997	43.7
>=1200 &<1500	12,342	1,020	2,195.35	1,457	1997	17.6
<1200	4,104	308	661.77	997	1996	0.4
Pyes Pa	11,974	1,218	2,601.19	2,229	1999	100.0
>=3000	13,153	1,768	3,727.16	3,883	2001	12.4
>=2000 &<3000	12,962	1,379	2,931.73	2,534	1999	28.1
>=1500 &<2000	11,483	1,092	2,349.47	1,871	1999	42.4
>=1200 &<1500	10,852	880	1,894.88	1,436	1999	16.4
<1200	7,358	532	1,146.05	970	1998	0.7
Sulphur Point	10,207	1,043	2,229.96	2,212	1999	100.0
>=3000	11,277	1,521	3,226.24	3,914	2001	11.4
>=2000 &<3000	11,476	1,230	2,617.86	2,542	1999	28.6
>=1500 &<2000	9,708	926	1,992.70	1,857	1999	42.7
>=1200 &<1500	8,789	718	1,543.61	1,430	1999	16.8
<1200	2,808	207	444.54	981	1999	0.5
Tauranga Central	10,291	1,050	2,244.52	2,197	1999	100.0
>=3000	11,842	1,610	3,408.45	3,980	2001	11.8
>=2000 &<3000	11,797	1,253	2,664.22	2,554	1999	24.7
>=1500 &<2000	9,775	935	2,011.34	1,846	1998	46.3
>=1200 &<1500	8,635	701	1,508.47	1,428	1999	16.5
<1200	4,661	345	741.62	956	1999	0.7
Tauranga Hospital	10,681	1,103	2,355.91	2,217	1998	100.0
>=3000	11,641	1,626	3,439.75	3,874	1999	11.3
>=2000 &<3000	11,705	1,261	2,679.20	2,559	1998	28.9
>=1500 &<2000	10,373	1,001	2,152.78	1,867	1998	42.8
>=1200 &<1500	9,183	753	1,620.12	1,431	1998	16.3
<1200	6,722	476	1,037.34	942	1997	0.7
Tauranga South	10,291	1,050	2,244.52	2,197	1999	100.0
>=3000	11,842	1,610	3,408.45	3,980	2001	11.8
>=2000 &<3000	11,797	1,253	2,664.22	2,554	1999	24.7
>=1500 &<2000	9,775	935	2,011.34	1,846	1998	46.3
>=1200 &<1500	8,635	701	1,508.47	1,428	1999	16.5
<1200	4,661	345	741.62	956	1999	0.7

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Tauriko	13,416	1,360	2,894.10	2,371	2000	100.0
>=3000	15,532	1,977	4,153.56	3,841	2003	14.5
>=2000 &<3000	14,493	1,489	3,147.14	2,572	2000	37.6
>=1500 &<2000	11,790	1,089	2,350.15	1,857	1999	38.7
>=1200 &<1500	12,078	983	2,112.71	1,442	1998	8.7
<1200	19,380	1,454	3,125.03	990	1999	0.6
TeMaunga	13,644	1,756	3,775.06	3,141	1996	100.0
>=3000	11,412	1,826	3,925.73	3,984	1998	50.0
>=2000 &<3000	9,816	1,178	2,532.53	2,600	1996	25.0
>=1500 &<2000	21,936	2,194	4,716.24	1,994	1991	25.0
>=1200 &<1500	No Data	No Data	No Data	No Data	No Data	0.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
TeReti	12,074	1,253	2,665.55	2,272	1997	100.0
>=3000	12,437	1,792	3,744.01	3,798	1997	14.0
>=2000 &<3000	11,805	1,264	2,675.72	2,590	1997	30.8
>=1500 &<2000	11,676	1,136	2,442.89	1,859	1998	36.0
>=1200 &<1500	12,991	1,062	2,283.23	1,430	1999	19.2
<1200	No Data	No Data	No Data	No Data	No Data	0.0
Welcome Bay East	12,681	1,301	2,780.81	2,332	1998	100.0
>=3000	12,946	1,760	3,740.03	3,932	2000	12.7
>=2000 &<3000	12,451	1,339	2,841.07	2,590	1998	35.7
>=1500 &<2000	12,935	1,224	2,635.07	1,901	1997	36.9
>=1200 &<1500	12,801	1,044	2,245.49	1,426	1998	14.0
<1200	3,000	210	451.50	796	2004	0.6
Welcome Bay West	12,284	1,263	2,697.88	2,240	1998	100.0
>=3000	12,331	1,714	3,605.09	3,904	2000	12.0
>=2000 &<3000	12,928	1,395	2,965.31	2,556	1998	28.6
>=1500 &<2000	12,135	1,169	2,515.13	1,870	1998	44.2
>=1200 &<1500	11,564	945	2,033.40	1,428	1998	14.6
<1200	9,128	670	1,439.42	995	1998	0.6
Yatton Park	10,494	1,100	2,354.30	2,203	1997	100.0
>=3000	12,798	1,875	3,993.82	3,942	1998	10.4
>=2000 &<3000	10,743	1,183	2,514.82	2,559	1996	28.1
>=1500 &<2000	10,023	975	2,097.72	1,872	1997	45.5
>=1200 &<1500	9,781	806	1,731.86	1,430	1997	15.1
<1200	11,794	865	1,859.15	890	1998	1.0

8.9. Greater Tauranga Commuter Town Results 2002-2003

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Te Puke	14,870	1,543	3,276.90	2,195	1993	100.0
<1200	5,262	395	848.50	828	1995	0.3
>=1200 &<1500	12,932	1,095	2,355.06	1,438	1993	12.6
>=1500 &<2000	14,479	1,420	3,056.97	1,862	1993	47.2
>=2000 &<3000	15,668	1,653	3,477.09	2,557	1993	31.0
>=3000	17,210	2,479	5,119.12	3,807	1995	9.0
Omokoroa	14,508	1,479	3,142.16	2,149	1994	100.0
<1200	No Data	No Data	No Data	No Data	No Data	0.0
>=1200 &<1500	11,751	999	2,147.50	1,421	1994	14.3
>=1500 &<2000	13,956	1,311	2,827.62	1,849	1994	49.3
>=2000 &<3000	16,654	1,810	3,826.49	2,592	1994	27.9
>=3000	15,307	2,169	4,384.40	3,647	1995	8.6
Katikati	13,977	1,422	3,033.44	2,137	1993	100.0
<1200	6,914	518	1,114.88	773	1989	0.8
>=1200 &<1500	11,909	999	2,153.99	1,447	1993	14.6
>=1500 &<2000	14,061	1,358	2,926.18	1,855	1993	49.2
>=2000 &<3000	14,427	1,517	3,187.45	2,583	1993	27.8
>=3000	16,553	2,417	5,087.36	3,825	1996	7.5

8.10. Greater Tauranga Commuter Town Results 2011-2012

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Te Puke	14,103	1,457	3,104.15	2,249	1996	100.0
<1200	11,763	867	1,864.96	955	1998	0.5
>=1200 &<1500	13,144	1,096	2,357.65	1,433	1996	13.5
>=1500 &<2000	14,040	1,369	2,945.09	1,868	1995	43.9
>=2000 &<3000	14,455	1,533	3,240.28	2,564	1996	30.9
>=3000	14,627	2,052	4,301.23	3,911	1999	11.2
Omokoroa	13,469	1,380	2,939.20	2,268	1998	100.0
<1200	5,791	415	891.83	854	2000	0.4
>=1200 &<1500	12,336	1,012	2,174.79	1,431	1998	13.1
>=1500 &<2000	12,650	1,203	2,589.14	1,870	1998	42.9
>=2000 &<3000	15,068	1,599	3,391.52	2,568	1998	31.0
>=3000	13,785	1,867	3,889.74	3,808	2000	12.6
Katikati	12,827	1,315	2,802.32	2,221	1997	100.0
<1200	10,087	737	1,583.28	901	1997	0.7
>=1200 &<1500	11,380	938	2,019.16	1,444	1997	14.6
>=1500 &<2000	12,544	1,202	2,587.36	1,856	1996	42.8
>=2000 &<3000	13,772	1,464	3,100.10	2,571	1997	31.0
>=3000	13,353	1,872	3,917.89	3,774	1998	10.9

8.11. Greater Tauranga Commuter Town Results – Commuting Residents 2011-2012

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Te Puke	20,130	2,086	4,440.08	2,292	1996	100.0
<1200	18,948	1,395	2,999.30	978	1997	0.4
>=1200 &<1500	20,072	1,681	3,613.93	1,442	1996	11.6
>=1500 &<2000	19,961	1,948	4,191.98	1,878	1995	43.3
>=2000 &<3000	20,321	2,150	4,542.87	2,579	1997	32.7
>=3000	20,315	2,831	5,920.32	3,891	1999	11.9
Omokoroa	17,518	1,799	3,829.03	2,296	1999	100.0
<1200	9,420	659	1,417.71	659	2007	0.1
>=1200 &<1500	16,595	1,364	2,931.97	1,435	1999	12.0
>=1500 &<2000	16,654	1,581	3,405.06	1,873	1998	41.3
>=2000 &<3000	18,956	2,006	4,255.34	2,555	1999	33.4
>=3000	17,503	2,363	4,915.30	3,764	2000	13.2
Katikati	22,370	2,299	4,893.12	2,287	1997	100.0
<1200	30,960	2,256	4,849.45	923	2000	0.2
>=1200 &<1500	21,226	1,764	3,792.69	1,457	1997	12.8
>=1500 &<2000	22,174	2,124	4,572.52	1,876	1996	39.6
>=2000 &<3000	22,975	2,432	5,147.25	2,559	1998	35.8
>=3000	22,242	3,075	6,411.86	3,788	1999	11.6

8.12. Greater Tauranga Commuter Town Results – Non Commuting Residents 2011-2012

Vehicle Engine Capacity by Suburb (CC)	Average Vehicle Kilometres Travelled (Km)	Average Energy Demand (Litres)	Average Fuel Cost ($)	Average Vehicle Engine Capacity (CC)	Average Vehicle Age	Vehicle Engine Capacity (%)
Te Puke	8,340	856	1,826.66	2,208	1996	100.0
<1200	5,376	398	856.67	934	1998	0.5
>=1200 &<1500	8,081	669	1,439.17	1,427	1997	15.2
>=1500 &<2000	8,532	830	1,785.25	1,858	1996	44.5
>=2000 &<3000	8,187	874	1,848.21	2,548	1996	29.3
>=3000	8,458	1,208	2,546.90	3,932	1998	10.5
Omokoroa	5,800	586	1,252.82	2,214	1998	100.0
<1200	4,884	354	760.36	902	1999	1.0
>=1200 &<1500	5,984	486	1,045.44	1,427	1998	15.2
>=1500 &<2000	5,854	559	1,203.38	1,866	1998	46.1
>=2000 &<3000	5,728	620	1,316.67	2,601	1997	26.3
>=3000	5,588	773	1,628.82	3,905	1999	11.3
Katikati	9,048	925	1,973.97	2,195	1997	100.0
<1200	7,768	568	1,220.37	899	1997	0.9
>=1200 &<1500	8,136	666	1,434.91	1,440	1997	15.3
>=1500 &<2000	9,117	874	1,880.99	1,850	1996	44.0
>=2000 &<3000	9,288	993	2,102.71	2,577	1996	29.1
>=3000	9,516	1,353	2,841.47	3,767	1998	10.7

The following appendices are printed on A3 paper and attached separately:

8.13. Energy Demand for Greater Christchurch 2002-2003

8.14. Energy Demand for Greater Christchurch 2011-2012

8.15. Vehicle Kilometres Travelled for Greater Christchurch 2002-2003

8.16. Vehicle Kilometres Travelled for Greater Christchurch 2011-2012

8.17. Energy Demand for Greater Tauranga 2002-2003

8.18. Energy Demand for Greater Tauranga 2011-2012

8.19. Vehicle Kilometres Travelled for Greater Tauranga 2002-2003

8.20. Vehicle Kilometres Travelled for Greater Tauranga 2011-2012

8.21. Energy Demand for Non-Commuting Residents in Greater Christchurch 2011-2012

8.22. Energy Demand for Commuting Residents in Greater Christchurch 2011-2012

8.23. Energy Demand for Non-Commuting Residents in Greater Tauranga 2011-2012

8.24. Energy Demand for Commuting Residents in Greater Tauranga 2011-2012

8.25. Energy Demand for Non-Commuting Residents in Greater Christchurch 2011-2012

8.26. Energy Demand for Commuting Residents in Greater Christchurch 2011-2012

8.27. Energy Demand for Non-Commuting Residents in Greater Tauranga 2011-2012

8.28. Energy Demand for Commuting Residents in Greater Tauranga 2011-2012

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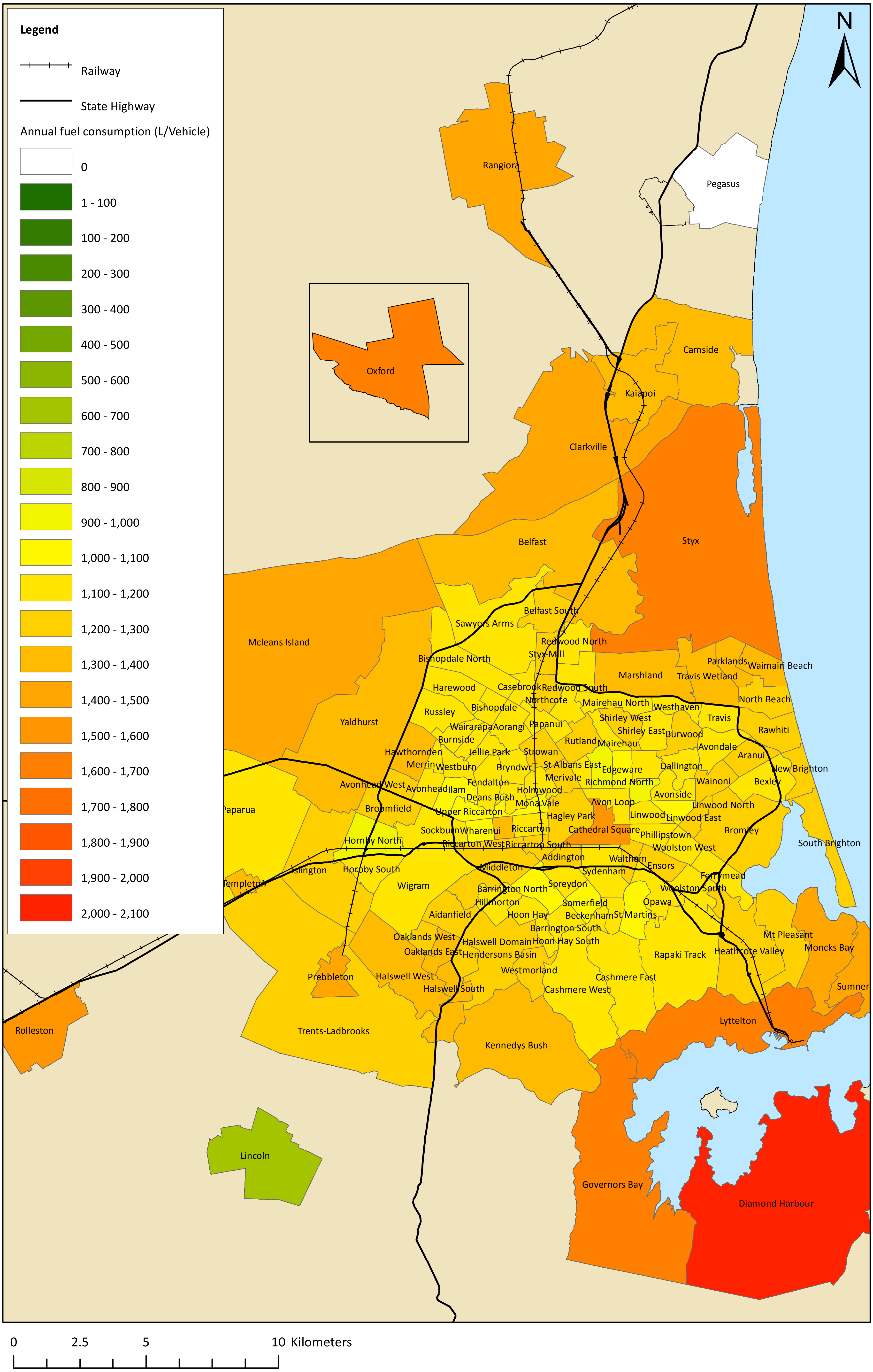
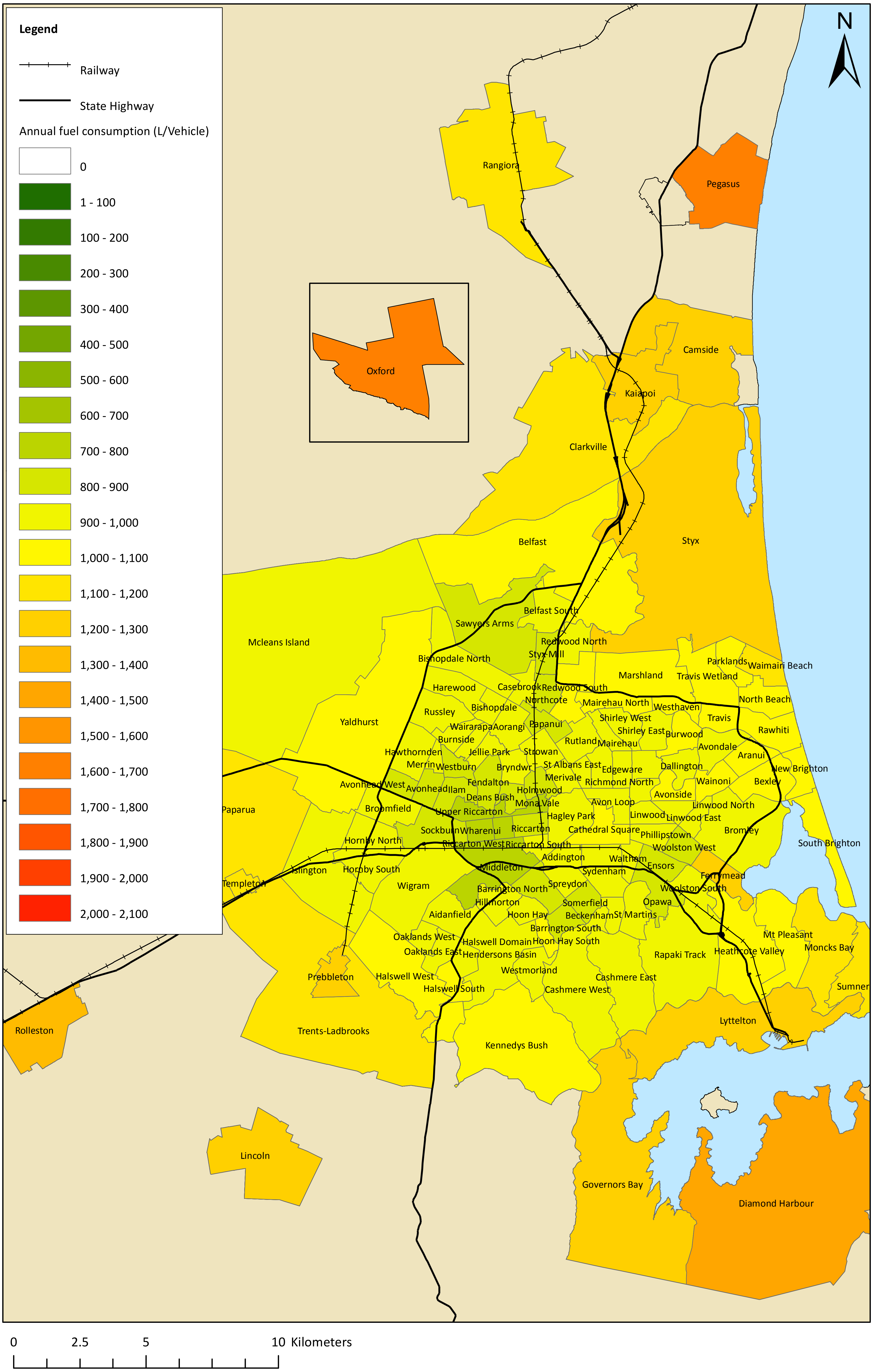
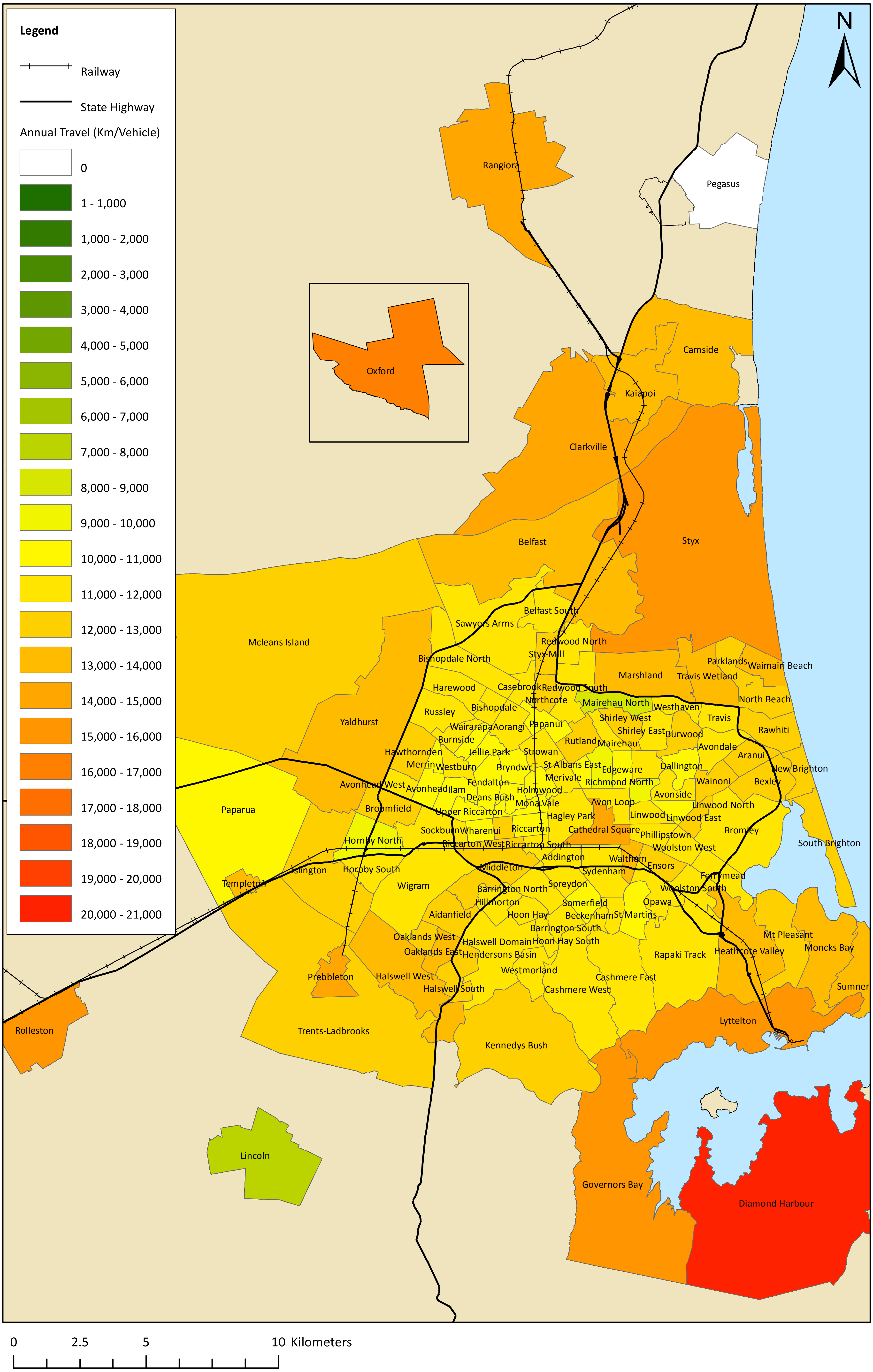
Appendix 8.13: Energy Demand for Greater Christchurch 2002-2003 (For comparison with Appendix 8.14)



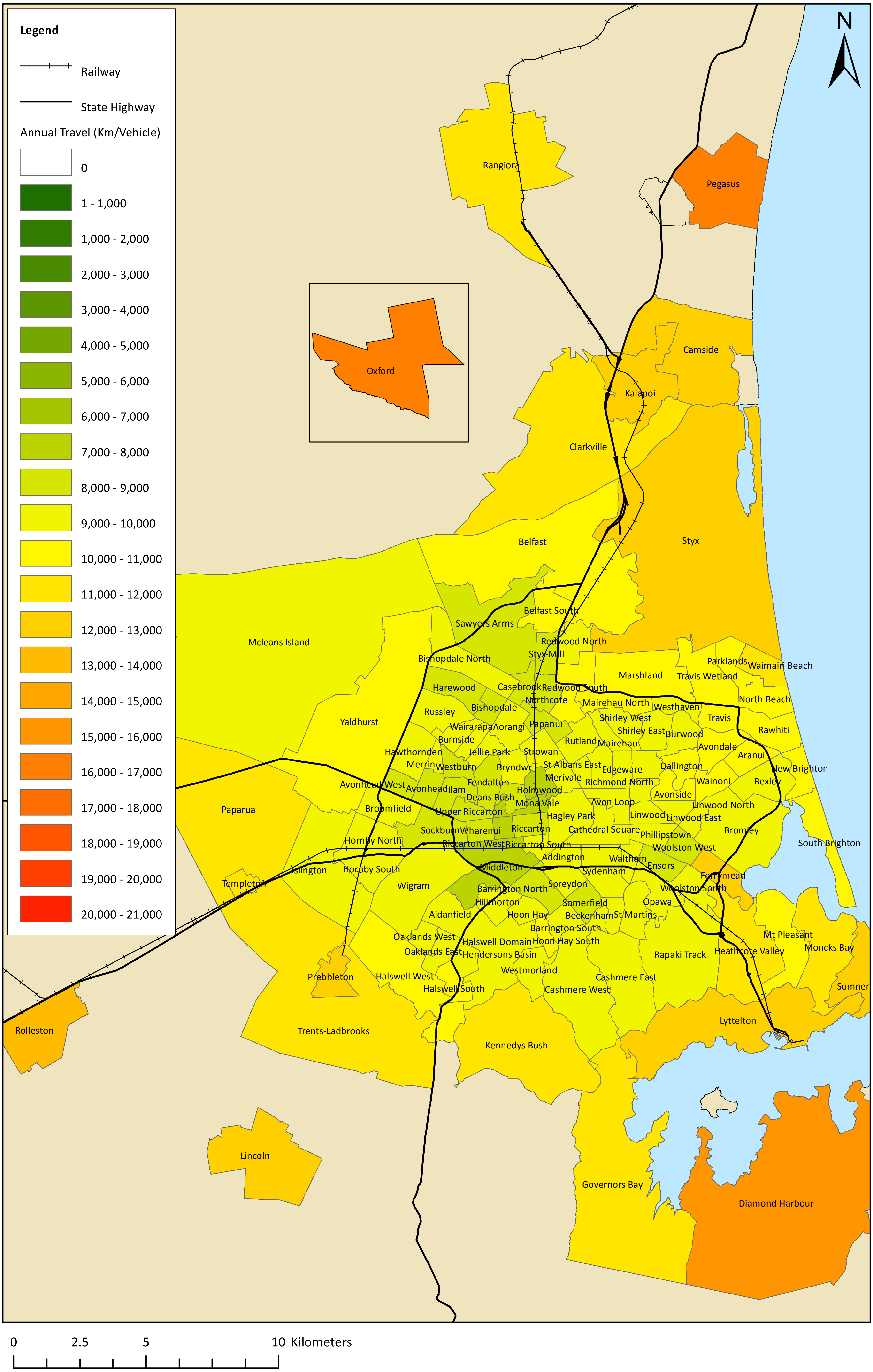
Appendix 8.14: Energy Demand for Greater Christchurch 2011-2012 (For comparison with Appendix 8.13)



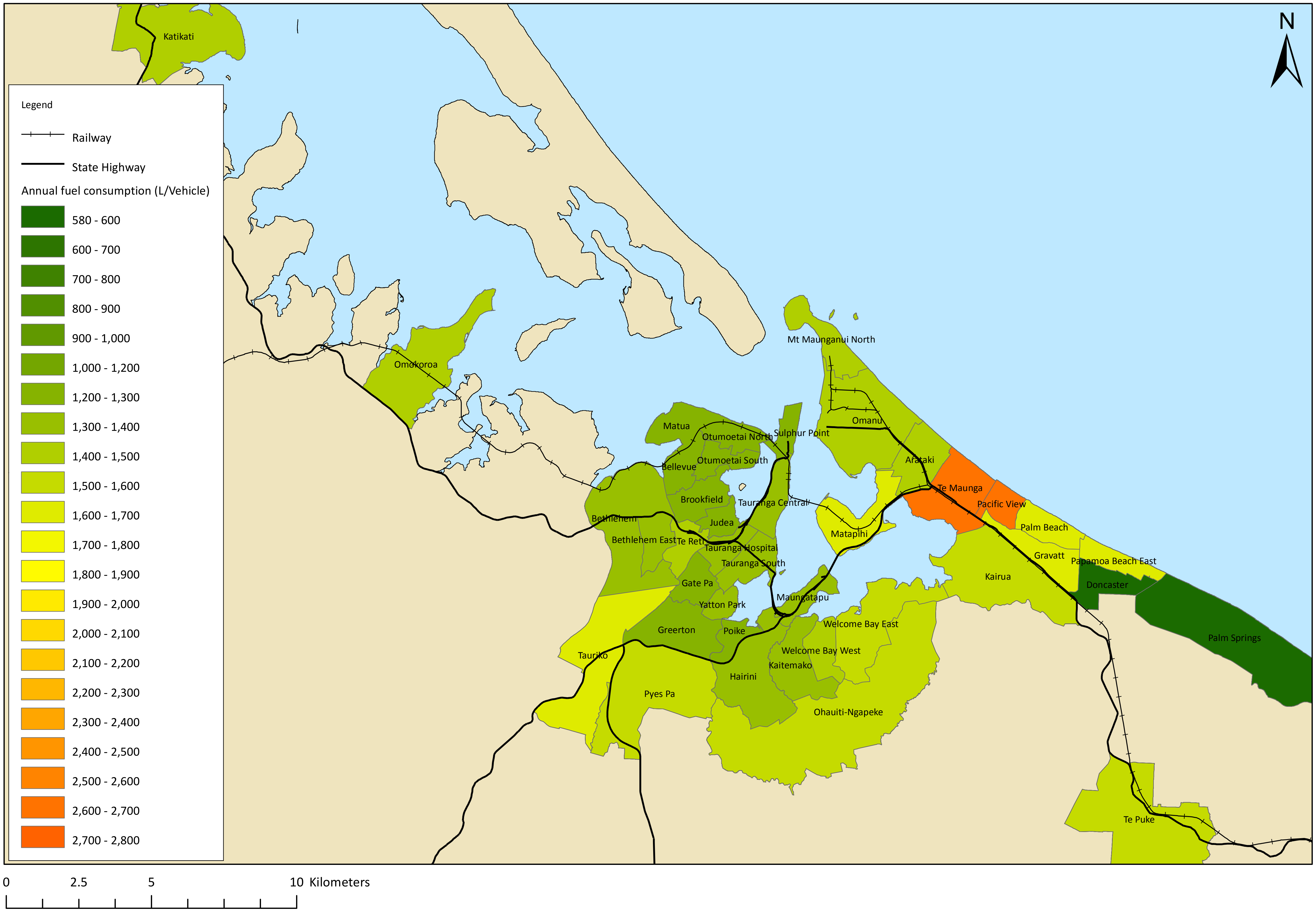
Appendix 8.15: Vehicle Kilometres Travelled for Greater Christchurch 2002-2003 (For comparison with Appendix 8.16)



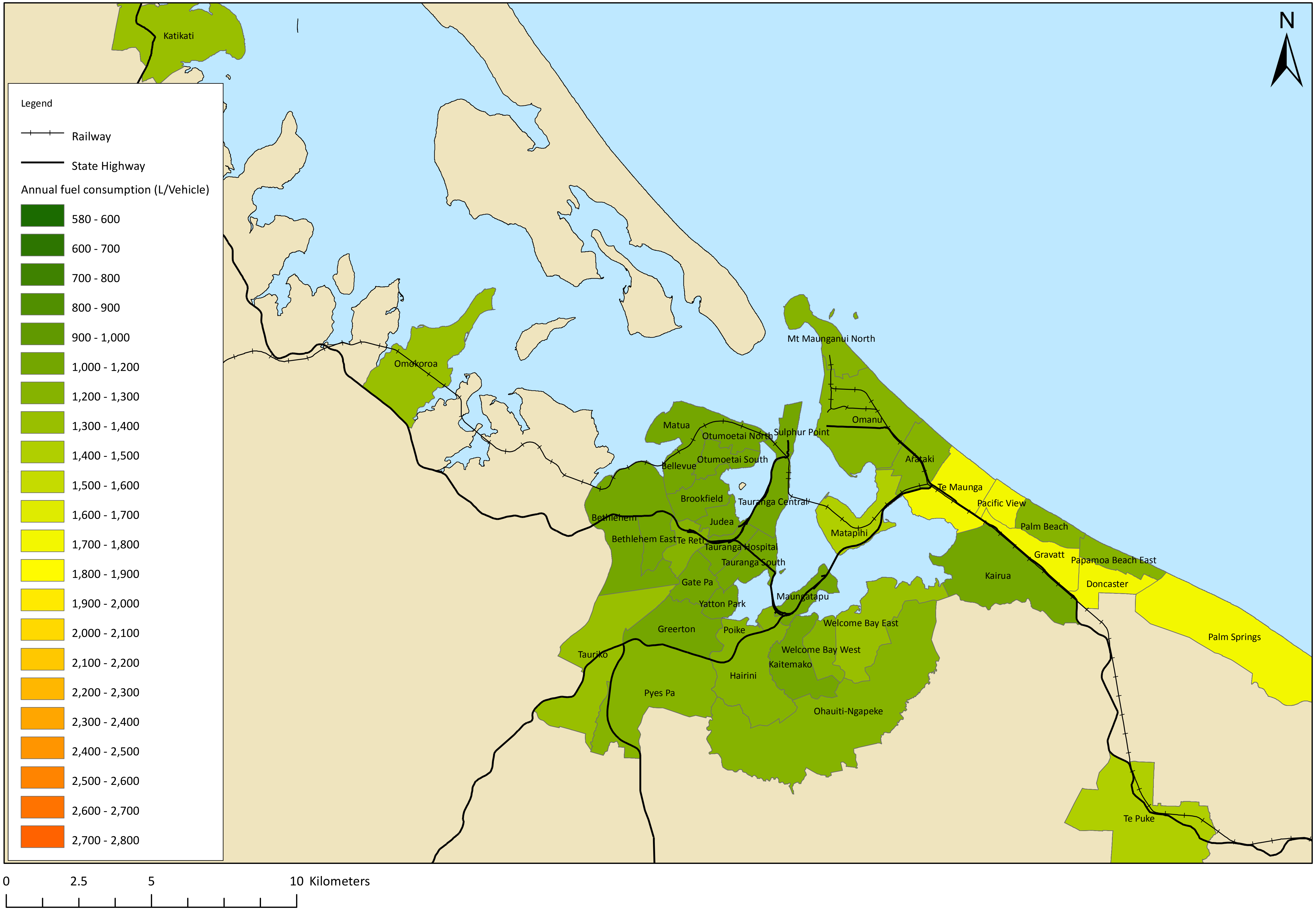
Appendix 8.16: Vehicle Kilometres Travelled for Greater Christchurch 2011-2012 (For comparison with Appendix 8.15)



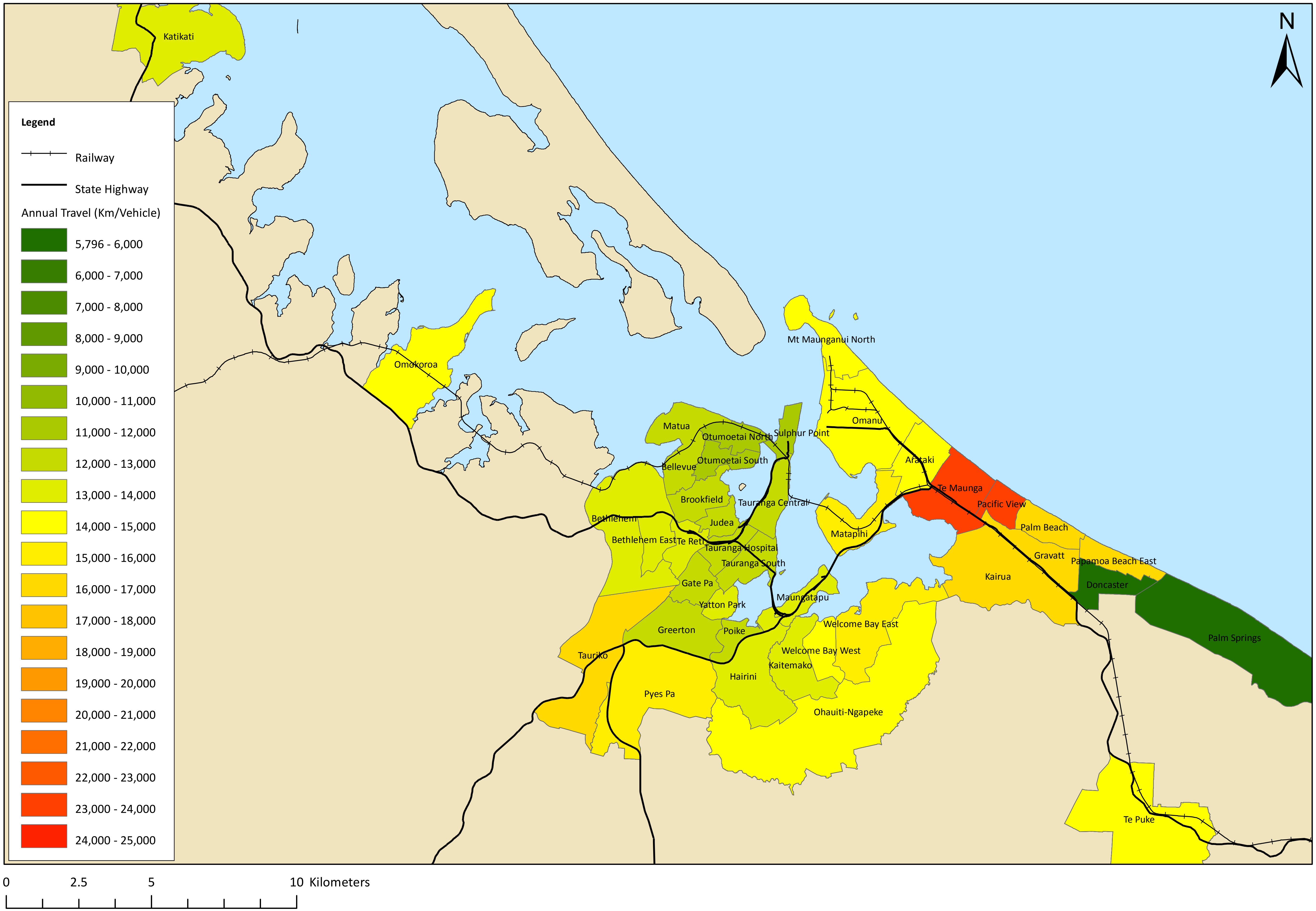
Appendix 8.17: Energy Demand for Greater Tauranga 2002-2003 (For comparison with Appendix 8.18)



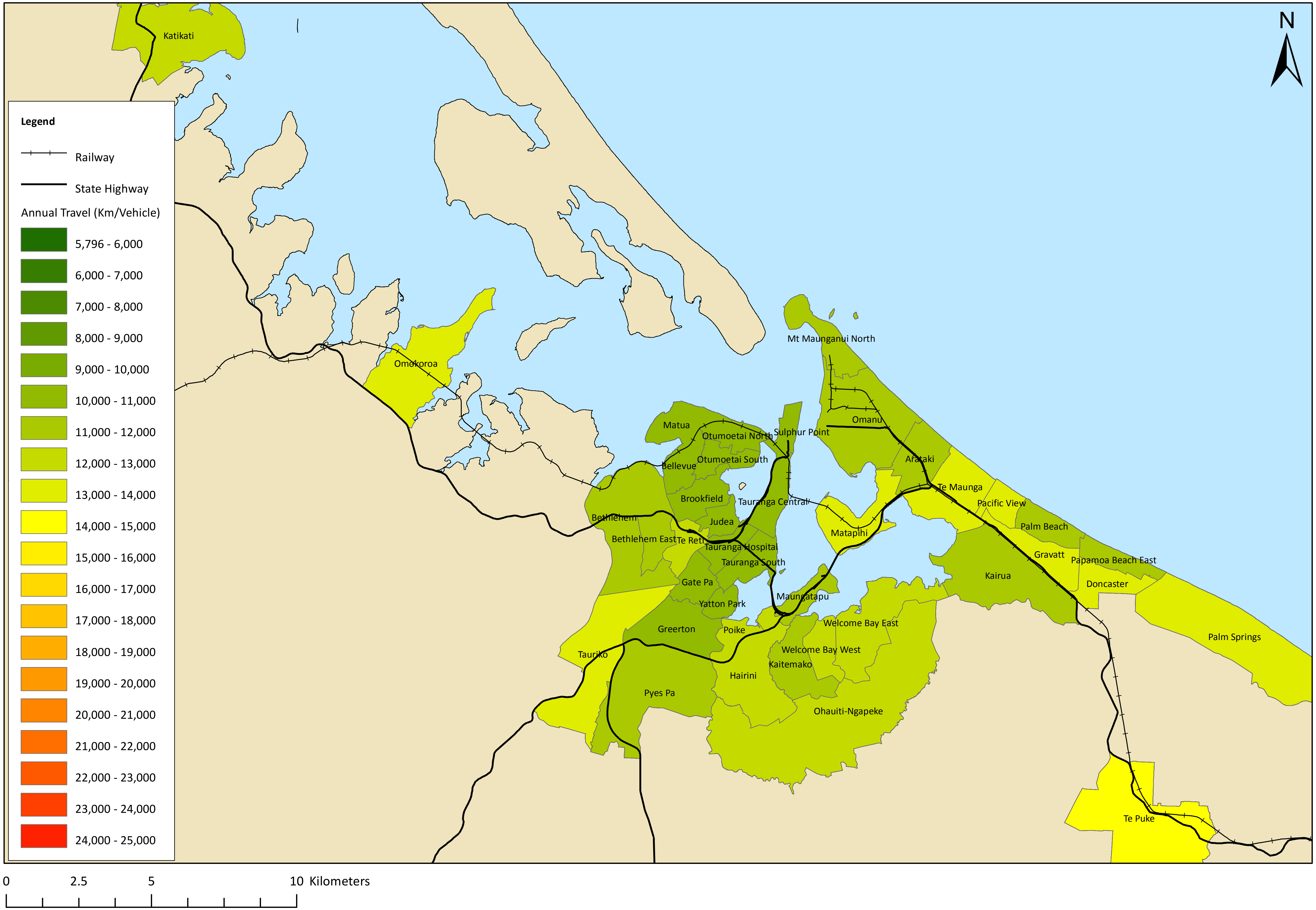
Appendix 8.18: Energy Demand for Greater Tauranga 2011-2012 (For comparison with Appendix 8.17)



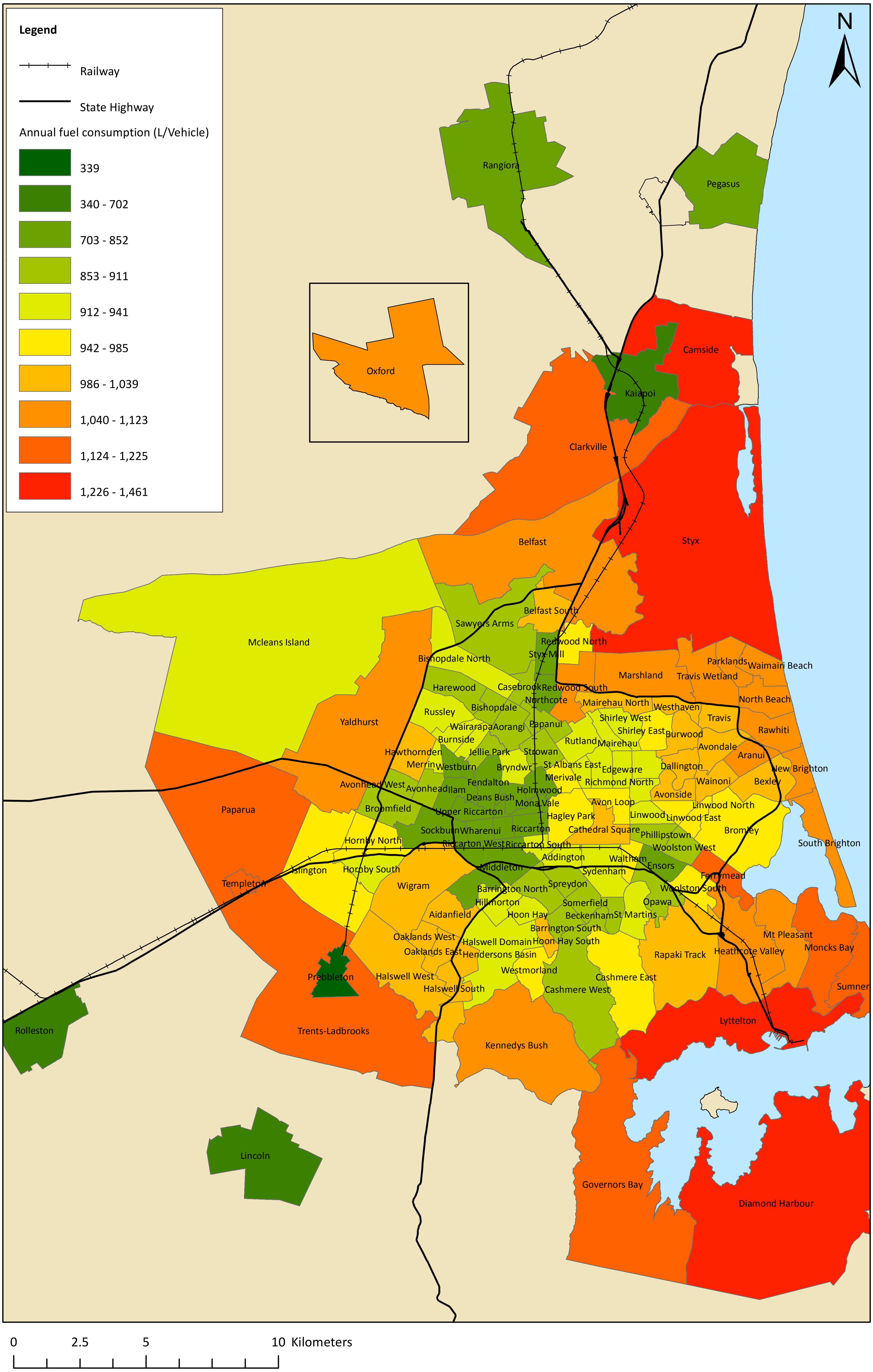
Appendix 8.19: Vehicle Kilometres Travelled for Greater Tauranga 2002-2003 (For comparison with Appendix 8.20)



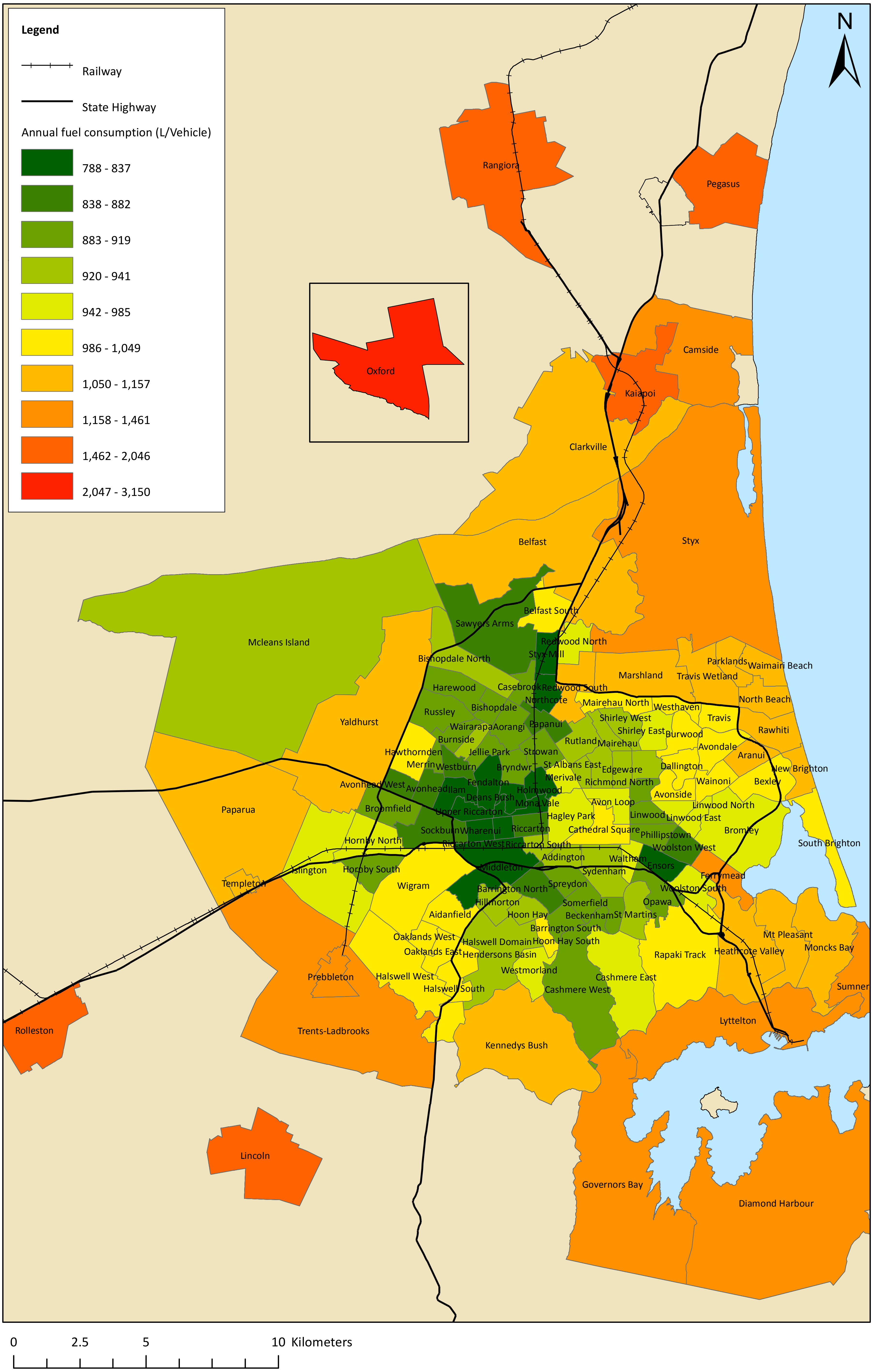
Appendix 8.20: Vehicle Kilometres Travelled for Greater Tauranga 2011-2012 (For comparison with Appendix 8.19)



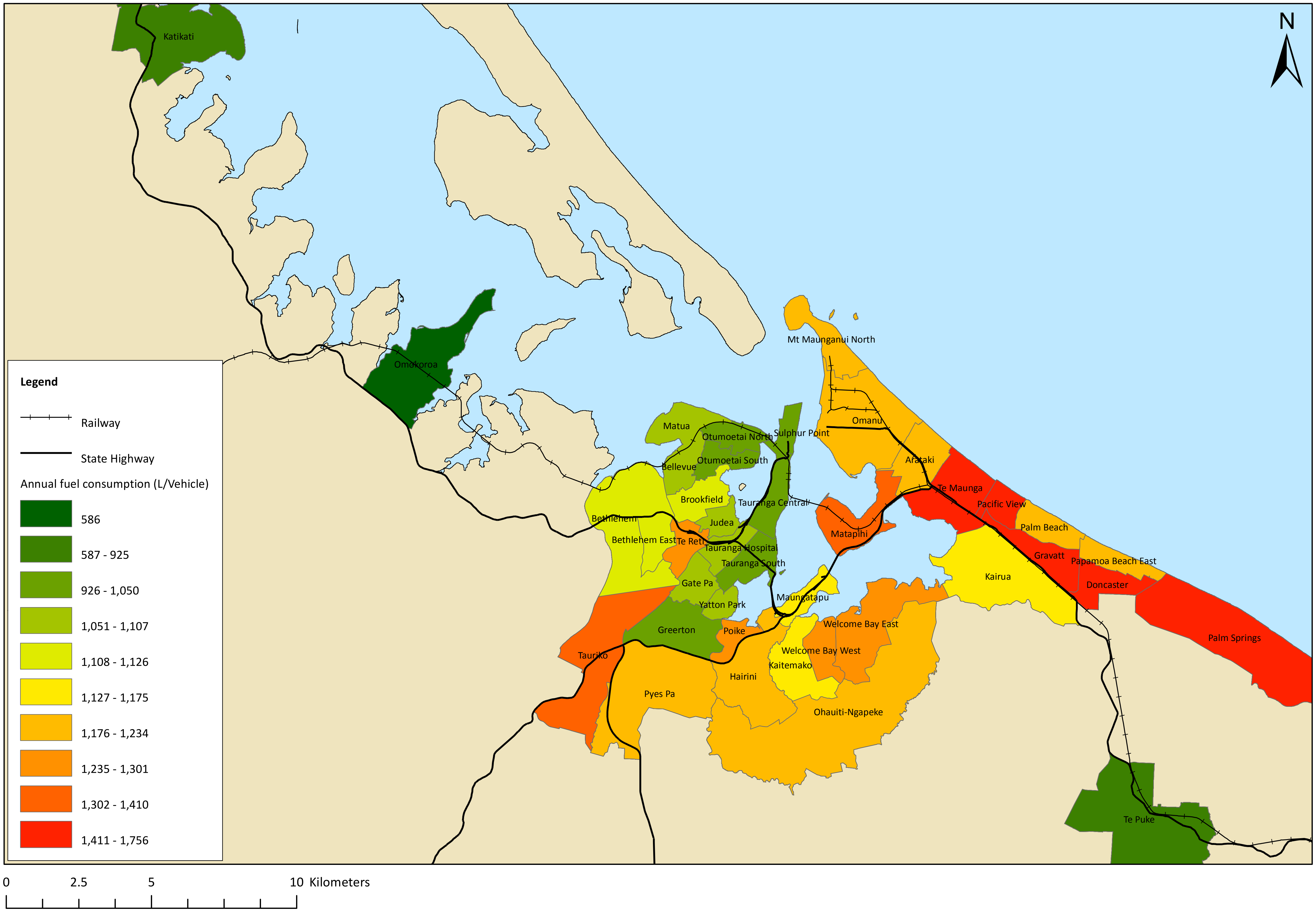
Appendix 8.21: Energy Demand for Non-Commuting Residents in Greater Christchurch 2011-2012



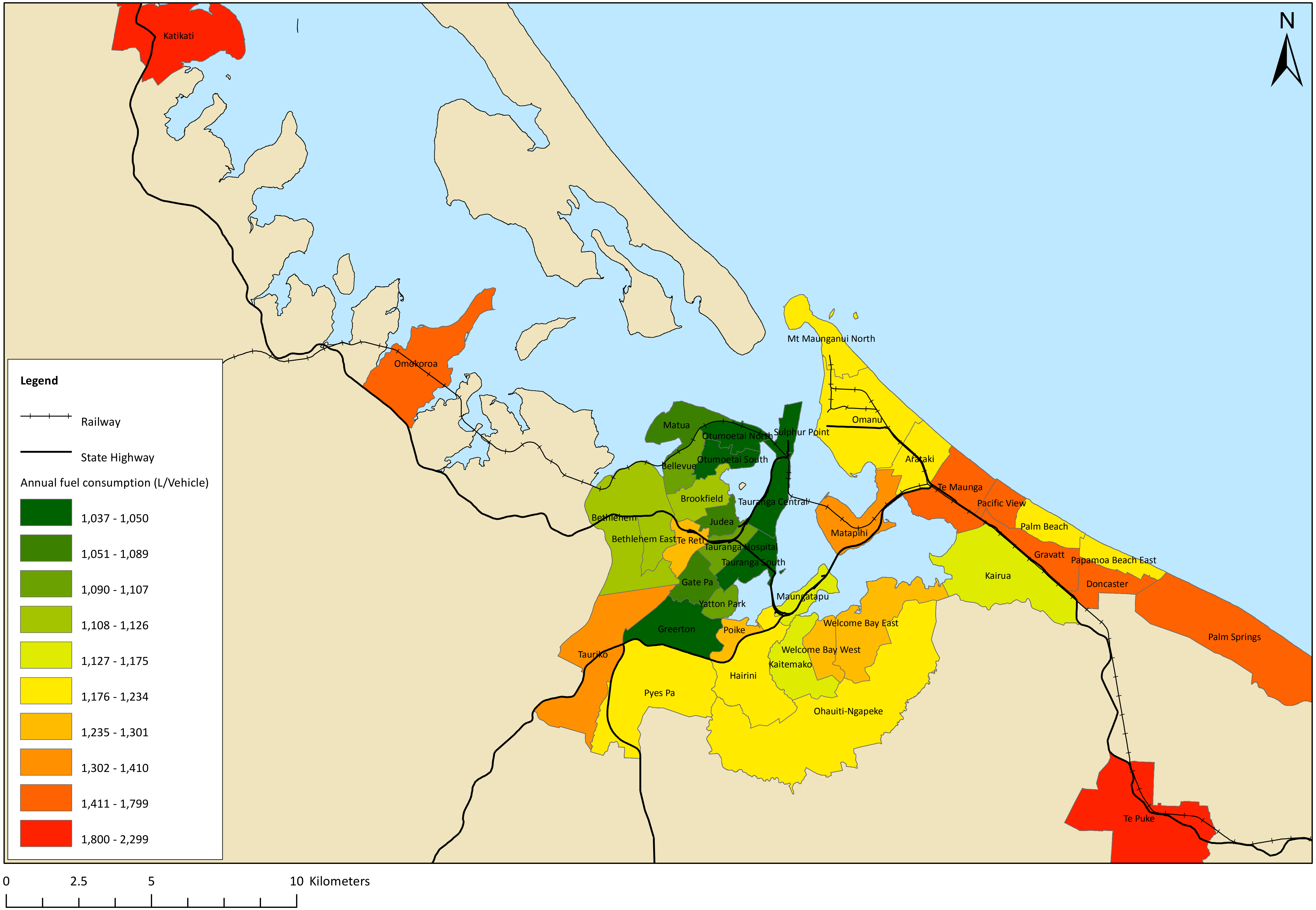
Appendix 8.22: Energy Demand for Commuting Residents in Greater Christchurch 2011-2012



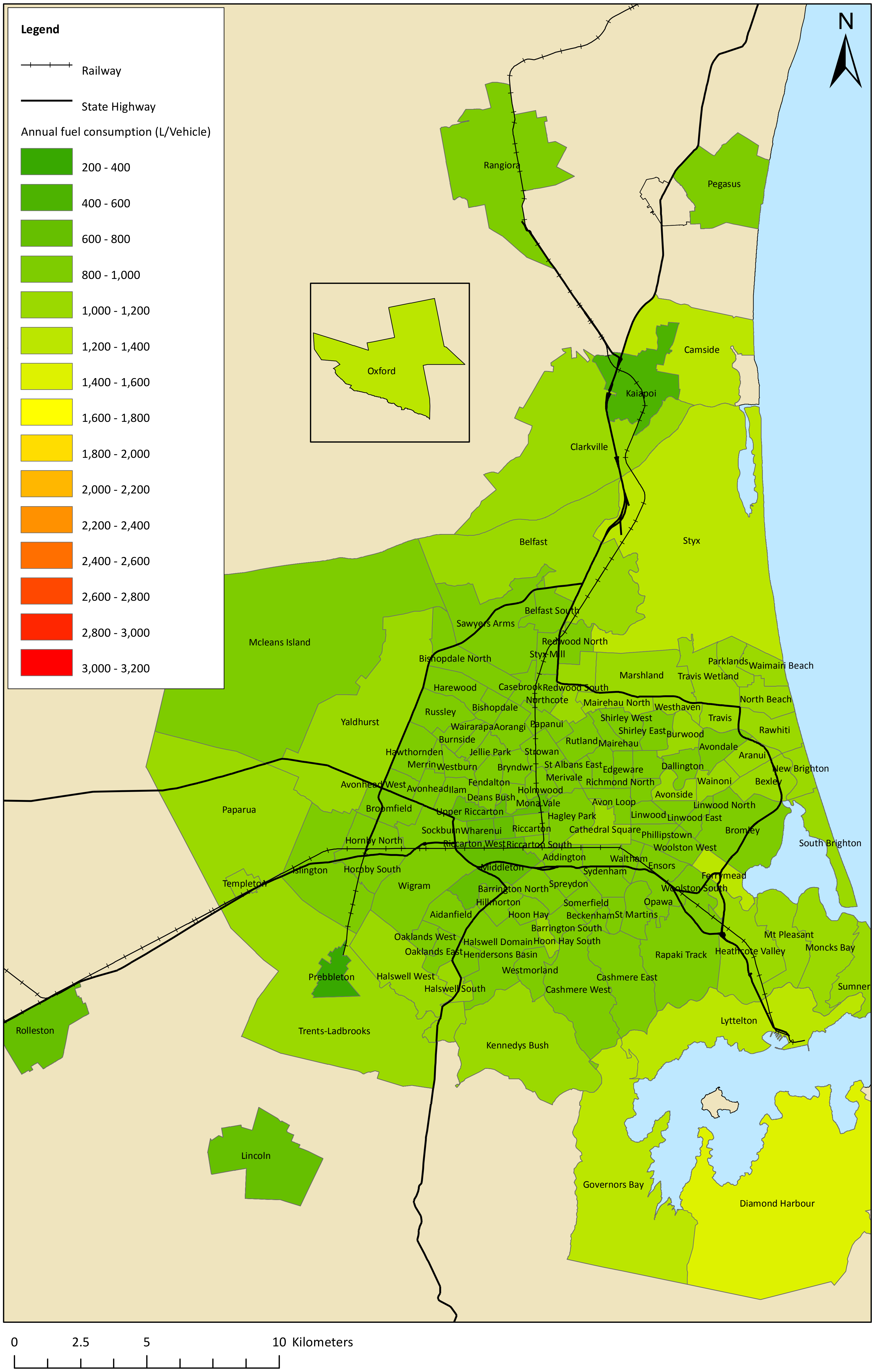
Appendix 8.23: Energy Demand for Non-Commuting Residents in Greater Tauranga 2011-2012



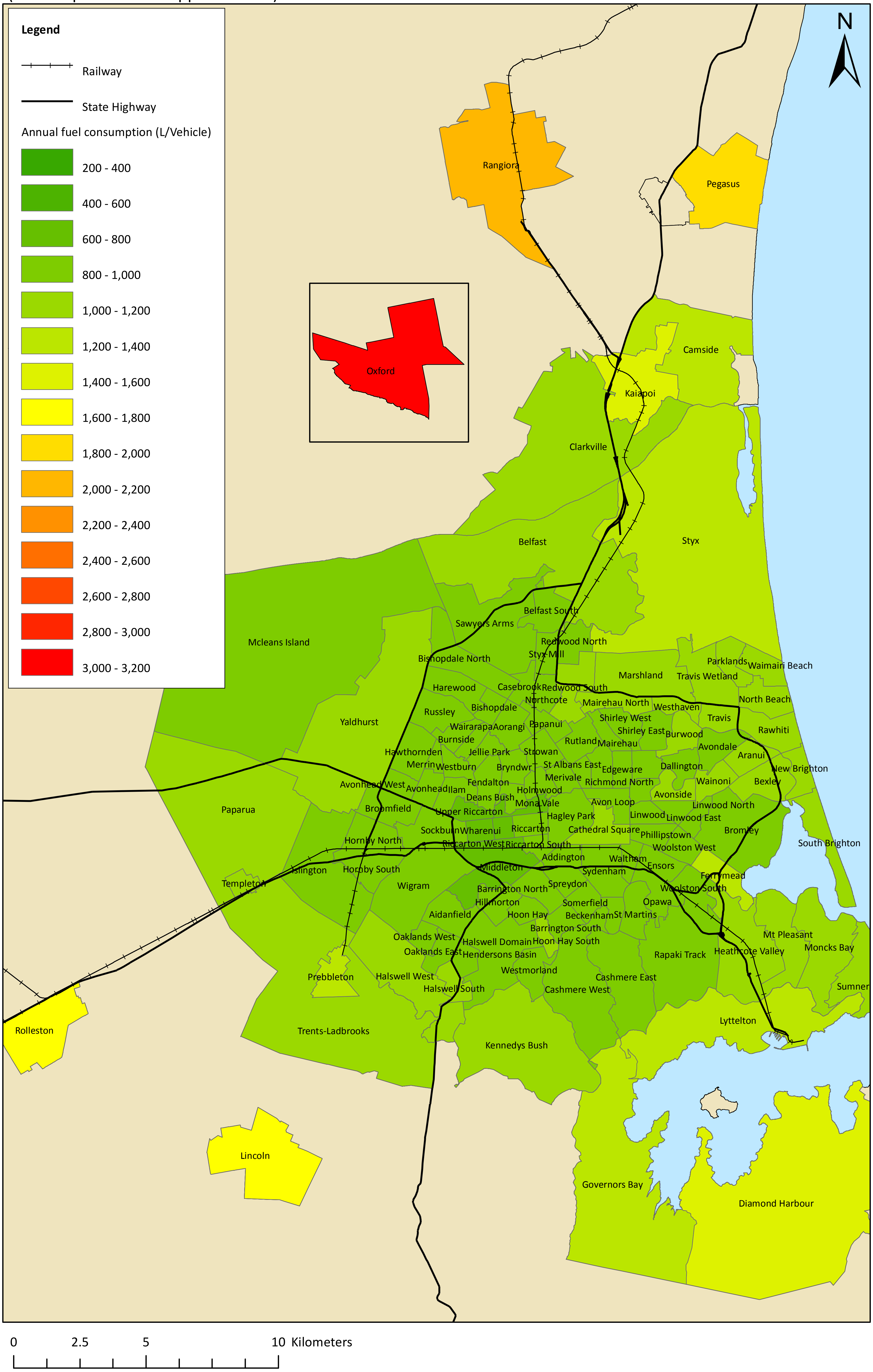
Appendix 8.24: Energy Demand for Commuting Residents in Greater Tauranga 2011-2012



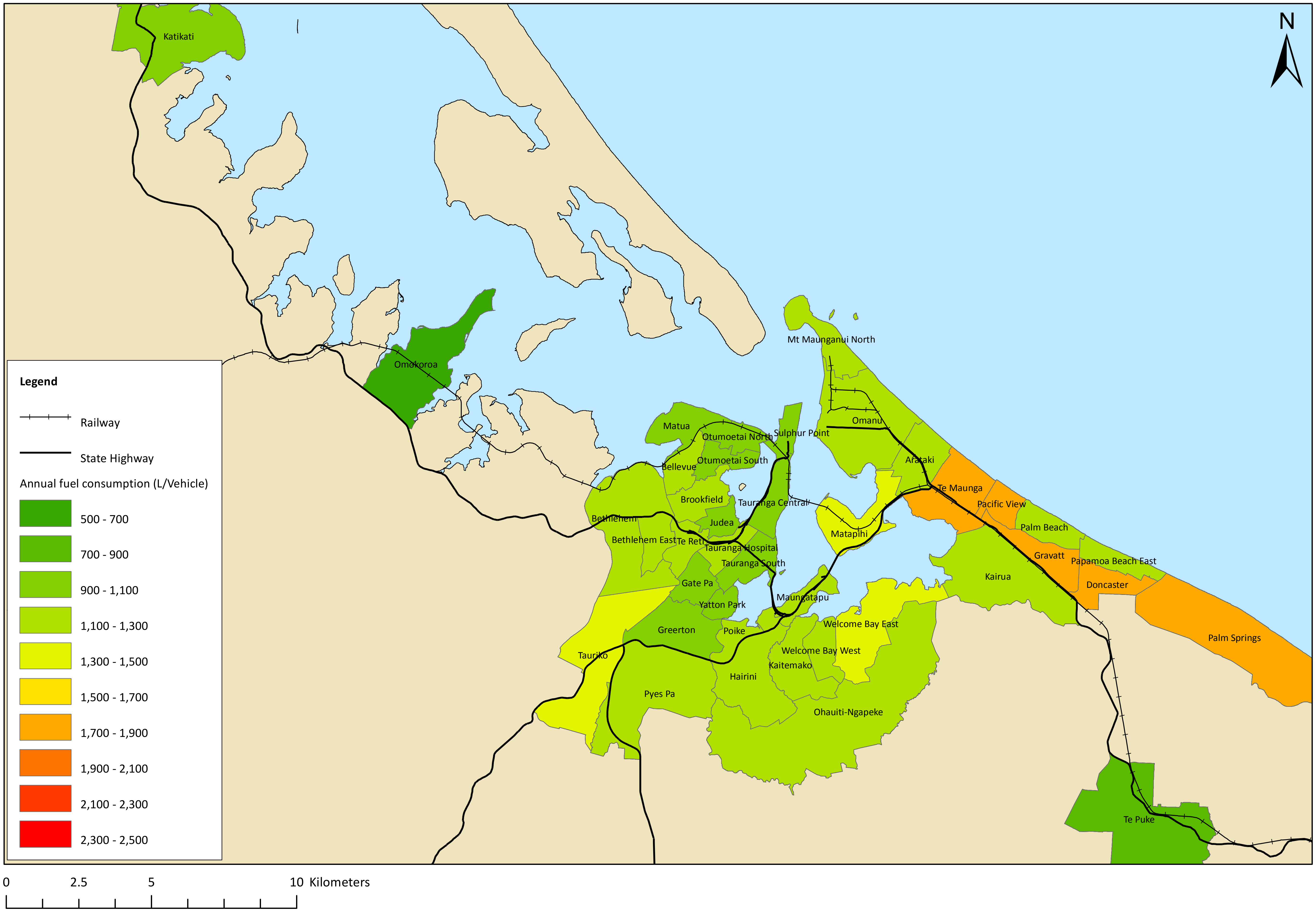
Appendix 8.25: Energy Demand for Non-Commuting Residents in Greater Christchurch 2011-2012
(For comparison with Appendix 8.26)



Appendix 8.26: Energy Demand for Commuting Residents in Greater Christchurch 2011-2012
(For comparison with Appendix 8.25)



Appendix 8.27: Energy Demand for Non-Commuting Residents in Greater Tauranga 2011-2012 (For comparison with appendix 8.28)



Appendix 8.28: Energy Demand for Commuting Residents in Greater Tauranga 2011-2012 (For comparison with appendix 8.27)