

University of Southern Queensland
Faculty of Health, Engineering and Sciences

Review of Shared Zones as a Solution to Grade and Space Restrictive Residential Streets

A dissertation submitted by
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Abstract

Nelson City Council (NCC) has difficulty in some of the older areas of town in implementing standard compliant roading asset renewals due to the restrictive nature of grade and road reserve width. As a response to these issues, NCC has implemented three shared zone projects where the road upgrade reduces the requirements set out in the design manuals and provides a space in which vehicles, cyclists and pedestrians all share the same road space. Rather than providing footpaths and full parking width, the road is constructed in a way that formalises the existing narrow nature.

This dissertation intends to provide a means by which to assess existing zones based on how well they meet the objectives they set out to achieve, and provide the ability for NCC to assess the suitability for future upgrades.

A literature review was undertaken based on global and local best practice in this space. It was found that whilst the zones are meeting the basic requirements of shared space, there is significant room for improvement.

A set of performance objectives, and criteria by which to assess them, were developed based on the literature. It was intended that the objectives provide a qualitative and quantitative means by which to assess the shared zones.

A comparative assessment has been undertaken between a shared zone design treatment and a standard compliant treatment based on the selected candidate site of Airlie Street, Glenduan. It was found that the shared zone treatment has a positive benefit over existing maintenance regime. Quantifying the cost effect that benefits provided have on the net present value was not undertaken however it is hypothesised due to the low volume nature of the roads, these effects will be minimal in relation to the capital outlay of the projects.

Finally a guidance document was produced based on this work. This is presented in draft form with the intention of obtaining Council approval for its use. Further analysis of some of the existing shared zones is yet to be undertaken. This was deemed beyond the scope of this project.

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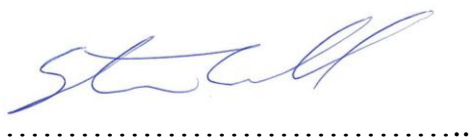
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I further certify that the work is original and has not been previously submitted for assessment in any other course or institution, except where specifically stated.

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.....
Signed

13 October 2016

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Glossary of Terms

NZTA	New Zealand Transport Agency
LATM	Local Area Traffic Management
NCC	Nelson City Council
LDM	Land Development Manual
NRMP	Nelson Resource Management Plan
CBD	Central Business District
AADT	Annual Average Daily Traffic
MoTSaM	Manual of Traffic Signs and Markings
MPa	Megapascal
LiDAR	Light Detection and Ranging
NPV	Net Present Value
IPENZ	Institute of Professional Engineers New Zealand

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1. Introduction

Nelson City Council is facing difficulties in funding infrastructure renewal in some of the oldest areas in the city. The steep terrain and narrow road reserves make reconstruction of the roads cost prohibitive through both the need to retain large sections of steep cut and fill areas and the need to purchase adjacent land to widen the road reserve to meet requirements set out in its own development standards.

In response to these challenges the Council has implemented shared zones in residential areas in an effort to reduce costs of construction whilst improving the safety and amenity of the streets.

The decisions made to implement these treatments were primarily cost driven. Although efforts were made to ensure that the new treatments were in line with industry best practice, it was difficult to ensure that the right design choices were made for the area in which the upgrades occurred.

The lack of research in New Zealand literature relating to shared space within a residential environment is the key driver for this dissertation. It is intended that answers be sought to the following as part of this research:

- How can a residential street be identified as a suitable space for shared zone treatment?
- How can a shared zone be assessed on whether it is achieving the objectives it sets out to achieve?
- What are the key features that make up a successful shared zone treatment in the New Zealand context?

This section of the research intends to provide background to the problem, outline the aims and objectives of the research, set out the intended methodology of determining these outcomes and provide a level of insight into foreseen limitations.

1.1 Background

In 2009 Nelson City Council undertook to develop a renewal project on Locking Street in the suburb of Nelson South. Soon after project initiation it became clear that a standard treatment on the road was going to be prohibitively costly to implement under the funding limitations provided for the project. Rather than requesting increased budget through extra borrowings, a shared zone was suggested as a solution.

Research into the current best practice at the time led project staff to discover that there had been few upgrades of the scale and type intended for Locking Street. Whilst traffic calming upgrades had been regularly undertaken throughout the country, shared space projects road were found to be scarce. For this reason extensive public consultation was entered into along with ensuring that the upgrade met the requirements of the Land Transport Rule for setting of speed limits. It was also undertaken to ensure the authority to amend the speed environment and implement the treatment type fell into the delegated power of a Regional Road Authority under the Local Government Act 2009.

After consulting the available literature and undertaking public consultation it was determined that the shared zone treatment would be undertaken on Locking Street. This upgrade was to serve as a trial of the concept and subsequently similar treatments have been implemented on Queens Road in Britannia Heights and Iwa Road in The Wood. There have also been minor improvement works on other roads that follow similar principles however these fall into the category of local area traffic management rather than shared zones.

The key feature that is missing from this process is an objective assessment on how well the shared residential zones function and a reflection on whether they meet the intentions that were set at the conception of the projects.

1.2 Project Aims

The project aims to provide an objective assessment of the current residential shared zones of Locking Street and Iwa Road by developing a set of objectives to assess them by. This assessment is intended to identify what is working well in the spaces and what improvements could be made to improve their functionality.

It is also intended to provide a comparative assessment of the cost benefit of utilising this type of upgrade in opposition to a conventional, development standard compliant, upgrade.

The ultimate aim of the project is to develop a guidance document on the implementation and evaluation of residential shared zones which directs the user in how to assess the suitability of the treatment for a site and how best to achieve the desired outcomes. It is intended that this document be presented to Council for discussion and adoption as a tool to assist in developing business cases for future capital projects.

1.3 Methodology

The methodology used to achieve the project aims was split into five key areas as follow.

- Literature review in both a domestic and international context;
- Development of a set of objectives for shared zones and performance indicators used to determine how well the existing zones meet these objectives;
- Two designs undertaken on a selected candidate site meeting the objectives of a conventional and shared zone upgrade respectively;
- Cost benefit analysis of the treatment types using estimates based on the two designs;
- Development of a guidance document for use in considering future residential shared zones and implementing design features within the zones.

The literature review has been undertaken to cover both the domestic and international context of the associated topic matter. It was identified early in the project that there are significant differences in the way the road environment is perceived in New Zealand compared to some of the European areas where these zones are prevalent. For this reason the original approach has been modified slightly to provide comment on how mind sets vary within the different settings.

The objectives used to assess the shared zones were developed from a set of objectives identified by Reid, Kocak and Hunt in their report to the United Kingdom Department for Transport in 2009. (Reid S, Kocak N & Hunt L, 2009). These

objectives aptly summarise the objectives of shared space in a central business district (CBD) context but lack in ability to be used for residential shared space where the nature of use is considerably different. From these objectives a revised set was developed specific to a residential street environment. Furthermore a set of key performance indicators were identified to assist in determining whether a zone is meeting the objectives it sets out to achieve.

In developing the performance objectives for the zones it became apparent that user perception of the spaces was of particular importance in assessing how well the objectives are met. This led to the development of two surveys to obtain qualitative information from residents of the streets and expert Council officers who had either involvement with the upgrades or extensive experience in decision making in regards to Nelson road infrastructure.

The conventional upgrade design was undertaken in accordance with the Land Development Manual 2010 (Nelson City Council, 2010). This document prescribes the minimum standards to which design needs to adhere in relation to the requirements of the Nelson Resource Management Plan (Nelson City Council, 2012). The alternate design was developed using design parameters deemed suitable for the site chosen for the study. Estimates have been produced in accordance with Nelson City Council procurement procedures and using a database of prices that is kept current as of the last 5 median tendered prices for a standard item. Where an item was specialised in nature or data was minimal, a first principles estimate approach was undertaken based on known day hire rates from recent projects, and material prices from local suppliers.

The designs have been produced to a preliminary design standard. Based on the Nelson City Council's Capital Project Quality Assurance processes, a preliminary design should be produced to an accuracy of +/- 20% of the final cost. It would be expected that this would be achieved if the project were to proceed to detailed design and procurement.

A simple analysis of the benefits associated with each upgrade type in relation to the cost of implementation and ongoing maintenance was performed. The fact that the design data is at a high level means that the cost benefit analysis was kept to a similar preliminary level. Further analysis could have been undertaken but it was

deemed that little value would be added to the research for the effort that would be required. This means that social factors and benefits have not been costed into the overall analysis and a simple net present value (NPV) comparison was undertaken.

The guidance document has been developed to a draft level ready for peer review. This is the final extent to which this document will be developed as part of this research due to deadlines required of the research project, and local body elections negating the ability for the document to be presented to Council until early in 2017. The intention is to hold a workshop with the Senior Leadership Team of Nelson City Council and then present the document to the Works and Infrastructure Committee at a later date.

1.4 Project Justification

A gap in knowledge exists in assessing the success or otherwise of shared spaces in residential areas in New Zealand. The project aims and methodology outlined seek to inform this gap by providing a locally relevant way in which to make decisions on the suitability of a shared zone treatment in residential areas.

Key to providing this information is the development of the performance indicators allowing direct assessment of the objectives to be made. It is intended that the guidance document developed becomes a benchmark against industry best practice in relation to residential shared zones.

2. Literature Review

The purpose of the literature review is to determine best practice in relation to the implementation of shared space in residential areas and to understand how some of the features of this space contribute to a safe and functional road environment. It is intended to focus on the following areas:

- Background to the shared zones in Nelson City Council Area
- Road speed environment and safety considerations
- Methods for achieving target design speed
- Shared space functionality
- Shared zone use and assessment
- Shared Space within New Zealand
- New Zealand local authority position on shared space

2.1 Justification for the use of shared space

The road environments in which the proposed zones are to be used incorporate the majority of the following features:

- Steep terrain
- Narrow road reserve or usable space within the reserve
- Residential use as their primary function
- Vehicle counts less than 100 vehicles per hour (1000 vpd)
- Significant barriers to widening (cut, fill, retaining)
- Existing naturally low prevailing speeds
- High demand for on-street vehicle parking
- Moderate to high proportion of pedestrian relative to vehicle movements
- Aging road and stormwater drainage infrastructure

The areas pose significant challenges to the local authority to provide safe and functional upgrades to meet the requirements of the Nelson City Council Land Development Manual 2010 (LDM) (Nelson City Council, 2010)

The LDM outlines the target requirements for a local road as defined in table 2.1:

Road Hierarchy	Zoning	Traffic Lanes	Cycle Lanes	Parking	Berm	Foot paths	Service Strips
Local Roads	Residential	1x5.2m	-	1x2m	2x1.5m	2x1.5m	2x1.6m
	Residential <25 dwellings	1x3.5m	-	1x2m	2x1.5m	1x1.5m	2x1.6m

Table 2.1 – Expected minimum parameters for Local Road hierarchy level (Nelson City Council, 2010)

The overall minimum width required by the LDM is 16.4m for a standard residential local road and 13.2m for a residential local road with less than 25 dwellings. These prescribed widths are difficult and costly to achieve in implementing a roading upgrade on many Nelson City Council streets due to the nature of the road environment.

The Locking Street project was the first to use a shared zone. This was chosen for the site based on the steep grades (12-15%) and the narrow available workable roadway width. (Nelson City Council, 2010). Figure 2.1 shows the street before upgrade was constructed and Figure 2.2 shows the resulting road environment.



Figure 2.1 – Locking Street prior to road upgrade (Google Street View, 2016)



Figure 2.2 – Locking Street Post Upgrade

The ultimate aims of the project included:

- Improving functionality of the road
- Minimising cut and fill requirements
- Providing a reliable stormwater system capable of catering for Q₁₅ flows and secondary flow capacity within the road reserve for Q₅₀ flows.
- Catering for on street parking as well as the needs for pedestrians within the constrained road width.

This was achieved through implementing the shared zone approach and thus reducing the outcomes required of the LDM. The need for dual carriage width was removed by reducing the speed environment and designing the road in a fashion that allowed parking whilst maintaining a single traffic lane past parked cars. This in itself provides a level of calming to the road environment as parked cars effectively create a priority give way point which encourages inter driver communication to safely navigate the area.

In the report to Council seeking approval to proceed with the upgrade of Locking Street (Nelson City Council, 8 April 2010) a brief outline of what constitutes a shared zone was identified. Advantages of the shared zones were identified as:

- Improvement to street character and amenity;
- Safety;
- Reduced risk of speeding vehicles;
- Community Cohesion;
- Reduced cost of upgrade.

In contrast to these benefits, disadvantages were identified as:

- No separate footpath for pedestrians;
- Slower vehicle speeds being seen as a negative by some;
- Concerns relating to vulnerable and visually impaired road users.

The features identified in this report go only as far as to identify the potential that they exist. No specific consideration was given specifically to how these benefits were to be achieved and how the disadvantages were to be mitigated. From the report and recommendation it is suspected that the key driver for implementation of the Locking Street upgrade treatment was cost reduction.

The reduction of speed in the shared zone is undertaken in accordance with the Land Transport Rule Setting of Speed Limits – 2003 in particular Clause 3.2(6) which specifies that for a speed limit less than 50kmh to be implemented the following must be met:

- The calculated speed limit for the relevant road is 50kmh;
- The proposed speed limit would be likely to increase the safety of pedestrians, cyclists or other road users; and
- Safe and appropriate traffic engineering methods are installed so that the measured mean operating speed is within 5kmh of the proposed speed limit.

The current shared zones in Nelson City Council provide a speed limit of 30kmh. This speed has been determined through the literature to be the most commonly used speed where pedestrians, cyclists and vehicles need to use the same space.

2.2 Road speed environment and safety

There has been a significant volume of research undertaken on road speed environment and the effect this has on safety. The Transport Research Laboratory undertook a study into the stopping distance required at varying speeds in both wet and dry conditions. This comparison is graphically represented in Figure 2.2.

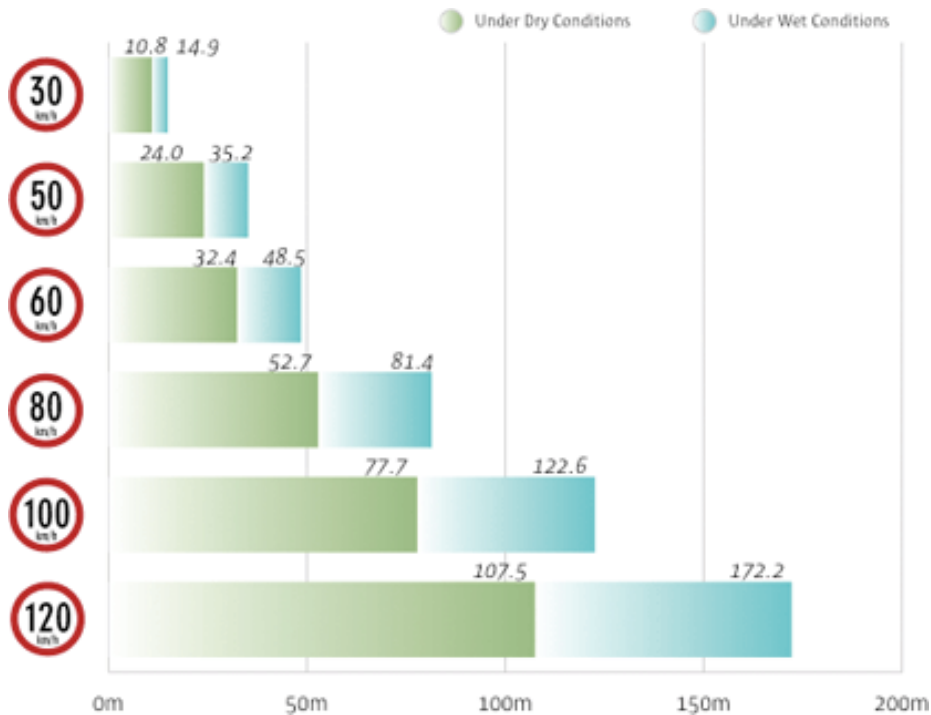


Figure 2.3 – Graphical representation of change in stopping distance required at varying speeds (Transport Research Laboratory, UK, 2007)

The Nelson City Council shared zones utilise a 30km/h design speed. This leads to a reduction in required stopping distance of between 13.2m and 20.3m depending on the road conditions.

The National Highway Traffic Safety Administration (U.S. Department of Transportation, 1999) analysed pedestrian fatality and injury data over a vast range of accidents and related the consequence of the accidents to speed. Table 2.2 outlines the relationship between injury severity and speed. This table has been modified to indicate the location of the 30kmh and 50kmh speed limits as the original data is presented in mph.

Injury Severity	Travel Speed (Officer Estimate)						Total
	1-20 mph	21-25 mph	26-30 mph	31-35 mph	36-45 mph	46+ mph	
Fatal (K) injury	1.1%	3.7%	6.1%	12.5%	22.4%	36.1%	6.5%
Incapacitating (A) Non	19.4%	32.0%	35.9%	39.3%	40.2%	33.7%	27.0%
incapacitating (B) Possible Inj. (C) or none	43.8%	41.2%	36.8%	31.6%	24.7%	20.5%	38.8%
Total Frequency	13.368	1.925	2.873	2.188	2.493	0.906	23.753
	30km/h		50km/h				

Table 2.2 – Vehicle travel speed and pedestrian injury severity modified to indicate kilometres per hour (Table 2, U.S. Department of Transportation, 1999)

The data indicates a dramatic increase (1.1% - 6.1%) in the percentage of fatal accidents with an increase of 10mph (16kmh).

The Royal Society for the prevention of Accidents (RoSPA, UK, 2007) states that at an impact speed of 30kmh a pedestrian has a 10% chance of being killed. At 50kmh the likelihood of fatality jumps to 50%.

A study undertaken in Sweden (Rosen & Sander, 2009) determined the risk factor of fatality as shown in Figure 3.2. This study indicates a likelihood of fatality at 30kmh of 1.5% (0.7%-3% confidence range at 95%) and 8.1% (5.5%-17% confidence range at 95%).

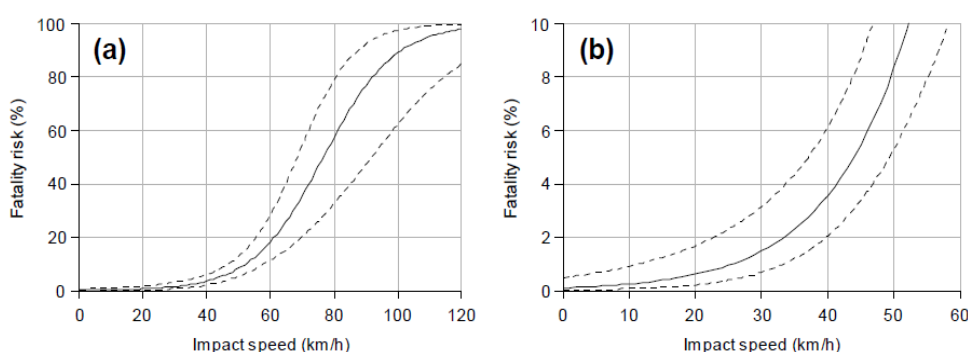


Figure 2.4 – Likelihood of fatality in relation to impact speed of a pedestrian crash

Grundy Et Al. found in their study on the effect of 20mph traffic speed zones in London from 1986 – 2006 (Grundy Et Al, 2009) that there was a 41.9% reduction in road casualties associated with a reduction in speed limits to 20mph (32kph) (Adjusted for time and with a 95% confidence interval 36% to 47.8%)

From the available literature two factors are clear:

1. There is significant variation in the determined likelihood of fatality across research in the field. This indicates that there are a number of factors that influence the likelihood calculations outside direct correlation with speed.
2. In all cases there is a significant jump in the likelihood of fatality between 30kmh and 50kmh. This suggests that a reduction in speed zone of 20kmh is likely to have a tangible positive effect on the survivability of pedestrian crashes.

2.3 Methods for achieving target design speed

Achieving the target speed of 30kmh for the shared zones is critical to the success of the shared zone concept. The UK Department for Transport's Manual for Streets (Department for Transport, UK, 2007) outlines the methods for passively enforcing speed zones in residential streets. This can consist of a combination or individual components of the following:

1. Physical features such as horizontal or vertical deflection (Least preferred method)
2. Changes in priority at junctions and pedestrian crossings
3. Narrowing of street dimensions
4. Reducing forward visibility
5. Psychology and perception including visually narrowing the roadway with line marking, carriageway obstructions, pedestrian refuges and on-street parking.

Physical features such as speed bumps, chicane arrangements and threshold treatments are the least preferred method for controlling speed but are an integral part of the implementation of shared zones. They create a visible change in road environment and alert the driver to the required interaction with pedestrians and cyclists. The Austroads Guide to Traffic Management Part 8 (Austroads, 2012) outlines the specific factors to consider in implementing local traffic areas. The concepts developed in this guide are expanded on in the UK Manual for Streets which specifically outlines how a home zone should look and function.

Martens, Comte and Kaptein found in 1997 that the most effective methods of speed reduction are those that force the driver to reduce speed. The paper discusses that this is not necessarily the best outcome and that the options that provide a voluntary reduction are the most effective through passive enforcement and self-explaining roads.

Charlton Et Al. take the self-explaining concept further by finding that self-explaining roads can be designed to maximise visual differences between road categories. The paper demonstrates through the use of increased landscaping, forward visibility limitations and removal of road markings a distinct local road environment can be created (Charlton Et Al. 2007, Waikato, New Zealand). The results of these treatments led to a reduction in the prevailing speed of the roads in which the endemic road features were employed but also a homogenisation of speed variation.

2.4 Shared Space functionality

For shared space to function effectively there needs to be alternative routes through or around the space to effectively maintain the low traffic movement areas within the zone. A reduction in through traffic within these spaces reduces demand placed on the streets by traffic seeking a route from one place to another.

Shared zones should aim to provide sojourn areas where they provide an environment in which people can move freely and where they have the option to get to know the area. They should not be designed as a traffic space but rather a space for living and experiencing the area. (Methorst et al. 2007)

2.4.1 Features of ‘true’ shared space

There is an argument to be made that there are very few places in New Zealand where the treatments implemented hold true to the fundamental outcomes a shared space is designed to achieve. There is a drive in the public sector space to provide prescriptive detailed methods of implementing engineering parameters and this is directly opposite to what the provision of shared space intends.

The shared space concept originated with Dutch traffic engineer Hans Monderman in The Netherlands in the 1970s as a response to post-war auto centric street

designs. (Collarte, N 2012, Cambridge, USA). Within these areas there is a complete removal of the features that have come to be recognised within a road environment. Typical speeds within the zones vary depending upon the actual needs of the place rather than a prescribed target that is commonly the aim of modern traffic engineering.

These spaces aim to engender a level of doubt and confusion within the road user, short of leading to discomfort, which encourages communication. The Dutch zones tend to incorporate a level of awareness of human behaviour and psychology that is sometimes missing from attempts at employing similar zones in other locations. Flow Transportation Specialists in their Shared Space in Urban Environments – Guidance Note, produced on behalf of the Institute of Professional Engineers New Zealand (Joyce, 2012), state that drivers are only willing to accept a certain level of task complexity. By reducing the complexity of the driving task (Through standardising the road environment and separating pedestrians and vehicles) the result is an increase in vehicle speed.

2.4.2 Difficulties in implementation

The difficulties in creating true shared space in New Zealand is the push towards standardisation that exists in other areas of traffic and transport engineering. By their nature, shared spaces should be designed in direct compliment to the environment in which they are being implemented. Caution should be taken when stipulating standard features such as traffic calming and threshold treatments. (Flow Transportation Specialists, 2012).

2.5 Shared zone use and assessment

The use of shared space across the globe has been approached in a number of different ways. Typically within a domestic context they have been viewed as a novelty treatment approach more so than a viable solution to some transport issues within road networks. The following section touches on a number of approaches worldwide and domestically in the effort to understand best practice.

2.5.1 UK Home Zones

One of the most widely employed systems of shared spaces are implemented as part of the UK “Home Zone” scheme. These schemes were introduced to deal with local road areas where space was at a premium due to historical buildings and narrow streets. The benefits that have stemmed from these zones are stated by UK Ministry for Transport as:

1. Creating a high-quality street environment
2. Striking balance between the needs of the local community and drivers
3. Encourage low vehicle speeds
4. Create an environment where pedestrians can walk, or stop and chat, without feeling intimidated by motor traffic
5. Make it easier for people to move around in their local area
6. Promote social interaction

The implementation of shared surface zones can lead to some problems (Ministry of Transport, UK 2007):

1. Poor parking behaviours through unclear area designation
2. Vulnerable road users feel threatened by having no separation from vehicular traffic
3. Visual clutter created through the implementation of traffic calming devices
4. Unclear path of travel for the visually impaired.

Reid, Kocak & Hunt in their report to the UK Transport Department (Reid, Kocak & Hunt, 2009) conclude that the design and implementation of shared zones is inevitably a compromise between the needs of a range of road users which seeks to accommodate rather than exclude particular uses. They go further to state that well designed zones in the UK have brought benefits in terms of visual amenity, economic performance and perceptions of personal safety.

The appraisal of shared space is neutral on the actual safety benefits presented by the zones but alludes to some trends of slight increase in casualties in some areas and some decrease in others.

The final conclusion is presented that shared spaces should be approached utilising a “Design Approach” rather than attempting to employ a “Design Type” utilising a

set of standard features. The general consensus is that the zones should be developed on a case by case basis and the mixture of treatment types and functions should be representative of the particular environment in which the zones are being employed.

2.5.2 Dutch Woonerven

Most of the world's shared spaces are modelled in principle on the concept developed in the late sixties in The Netherlands known as Woonerven (Living Streets). The development of these spaces was in opposition to the auto-centric views in transport engineering at the time and was a new direction for urban planning and development. (Collarte, 2012).

Typically the Dutch zones tend to be much more vigorous in their deployment of the features that make up shared spaces. In 1976 the first regulations in relation to the Woonerf's were developed by the Dutch government and the two defining regulations are (Eran, BJ 1995):

- Article 88a RVV: Pedestrians may use the full width of the highway within an area defined as a 'Woonerf', playing on the road is also permitted;
- Article 88b RVV: Drivers within a 'Woonerf' may not drive faster than at walking pace. They must make allowance for the possible presence of pedestrians, including children at play, unmarked objects and irregularities in the road surface, and the alignment of the roadway.

2.5.3 Local Area Traffic Management (LATM)

It can be argued that the outcomes desired of the shared zones in Nelson derive from the stated aims of Local Area Traffic Management as prescribed in Austroads Guide to Traffic Management Part 8 – Local Area Traffic Management (Austroads, 2016). This guide specifies an LATM as a treatment to an area of the road network, between arterial roads and collector roads, with the intended aim of improving functionality, reducing speed and removing unnecessary trips within the area. The main difference between the Nelson zones and LATM approach is the isolated nature of the shared zones. Whereas LATM intends to approach the area as a whole, a shared zone is specific to the road environment in which it is employed.

The Austroads guide references a study undertaken by Brindle and Morrissey (1998) as justification for this approach. Their review of LATM practices in Australia concludes that:

- LATM generally results in a reduction in crashes within the space – Typically by up to 50%;
- Speeds within LATM were generally reduced substantially with numbers of vehicles exceeding 60km/h greatly reduced;
- Community perception of effectiveness of LATM in reducing speed varied significantly across the literature with approximately 60% believing they were effective in this manner;
- LATM is compatible with bicycle use if properly designed;
- Vertical calming devices were more effective than horizontal devices in reducing speed and were generally more accepted by the public than previously thought.

Austroads produced a further technical report analysing the effect of LATM approaches on speed and safety. Within this report the various treatment types are analysed in relation to a reduction in 85th percentile speed at the treatment location and as part of the wider area. Table 2.3 presents the results found relating to these various treatment types.

Treatment Type	Change in 85 th percentile speed		Crash Reduction Factor
	At treatment	Scheme Wide	
Raised Tables	-24%	-	71% ³
Road Humps	-45%	-21%	71% ³
Road Cushions	-27%	-	60% ⁴
Kerb Extensions	-7%	-	-
Slow Points – two lane	-27%	-	51%
Slow points – one lane	-34%	-32% ¹	61%
Centre Blisters	-24%	-	-
Midblock median treatments	-	-	15-20% painted 45% constructed
Modified T intersections	-	-	-
Tactile surface treatments	-2.5% ²	-	60% ²

1. Speeds were measured between treatments

2. There was a low confidence in the figure due to the reported study limitations.

3. This UK-based figure referred to all crashes and was not adjusted for regression to the mean.
4. Estimated from speed reduction and other relevant studies rather than crash data.

Table 2.3 – Summary of literature review results relating to change in speed and crash reduction factor (Austroads 2009)

2.5.4 European Shared Space Research Project

Between 2004 and 2008 seven project partners from five different countries in northern Europe collaborated with the aim of applying shared space principles to a variety of contexts within the road environment and assessing their effectiveness and benefits. (Shared Space, Fryslân Province, 2008)

Key projects incorporated as part of this scheme include:

- Stroobossertrekvaart, Province of Fryslân, The Netherlands
- Bremer Straße, Municipality of Bohmte, Germany
- Ejby, Municipality of Middelfart, Denmark
- Hesselterbrink, Municipality of Emmen, The Netherlands
- Konterdam Neighbourhood, City of Oostende, Belgium
- Ipswich, Suffolk County Council, United Kingdom
- Noordlaren and Onnen, Municipality of Haren, The Netherlands



Figure 2.5 – Ejby shared zone project as part of the shared space research project. (Project for Public Spaces, 2016)

A number of parameters were identified as being common aims for these projects being:

- Road Safety – High value placed on reducing the number of deaths and injuries and removing perceptions of danger that act as a barrier to walking or cycling
- Community Safety – Shared interest in reduction of crime and increase in perception of security within the projects
- Public Engagement – Wider participation in the analysis, design and management of streets and public places
- Liveability – Shared interest in promoting the attractiveness and sustainability of a space within the community.

2.5.5 Guidance on Shared Space in New Zealand

Until recently the concept of shared space in New Zealand has been limited to central business districts and street scaping projects and has not focussed on the real benefits that the concept can bring to the road environment. The prescriptive nature of New Zealand transport engineering has slowed the development and creativity that can be employed to improve the street environment as a whole. Karndacharuk et al argue that there are certain design elements that need to be incorporated to make a space truly shared space. (Karndacharuk A, Wilson DJ & Dunn R, 2014).

Auckland City has developed a number of shared spaces based on the principles outlined earlier. In 2012 a guidance note on shared space was developed by Flow transportation specialists for the Institute of Professional Engineers New Zealand (IPENZ) This guide outlines the general approach to employ shared space however it is centralised on CBD and street scaping areas more so than residential streets. Outside private property in residential developments there are very few real examples of shared spaces in a residential setting in similar vein to the “Home Zones” and “Woonerven” in Europe.

There has been little assessment of the effectiveness of shared residential space within a New Zealand context and this poses a gap in the literature. The difficulty lies in the subjectiveness of assessing how effective the zones are in achieving the five objectives and performance indicators as developed by Reid Et al in their report for the UK Department for Transport (Reid S, Kocak N & Hunt L, 2009):

1. *Placemaking* – The street should provide better use of public space via a lively quality of the environment that attracts users to spend time within the space. It is also reflected in a wider range of street activities. The performance indicators include time spent in the area or user dwell time (which is a possible measure to indicate that the zone is an origin/destination rather than a through route), use of facilities provided, type of activity occurring (e.g. eating, chatting etc.) and user perceptions.
2. *Pedestrian Focus* – This objective involves an environment with improving pedestrian priority and the ability to walk along and across as well as freely roam the street. The performance indicators include pedestrian flows, number and density of pedestrians, safety and user perceptions.
3. *Economic Impetus* – A road space that complements the operation and prosperity of the surrounding businesses. The performance indicators include property and leasing values, retail occupancy rates and user perceptions.
4. *Vehicle Behaviour Change* – A goal is to reduce the current dominance of the motor vehicle and the driver in the environment. This change of priority should enable the measurement of the vehicle driver feeling more like a guest within the environment. The performance indicators include traffic volume and speed reductions, travel time increase through the zone and observed sharing behaviour. The traffic data on the surrounding road network will also be measured to determine the impact of a shared space on the surrounding environment as it cannot be taken in isolation.
5. *Safety For All Users* – Shared spaces are to provide a safer environment for all users, including cyclists, the elderly and children. The performance indicators include crash history, injury severity and costs, user demography and perceptions.

These objectives and performance indicators are an adequate assessment of the goals and objectives of areas with high road user volumes however the intended study areas in residential streets have a different set of drivers to determine what a successful implementation of shared space constitutes.

2.6 Road Authority position on Shared Space in New Zealand

There are still very few shared space upgrades in a residential context evident within New Zealand. Where the features of shared space are applied they still tend to be limited to very low volume and private residential areas or central business district destination areas.



Figure 2.6 – Excerpt from Nelson City Council information page regarding residential shared zones

Nelson City Council is the only local authority in New Zealand to actively define a shared zone as part of its standard approach to hierarchy. Whilst the prescribed features of the roads still fall short of those from foreign zones, it is actively encouraged in guidance that the zones attempt to achieve some of the same level outcomes. Particular similarity to UK home zones is drawn in the prescribed approach to Nelson City Council zones (Shearer, 2011). Further reference is made to the specifics of these zones at the start of this literature review.

2.6.1 Auckland City Council

Auckland City Council have undertaken a number of shared space upgrades within their CBD spaces based on their city centre masterplan developed in 2011.



Figure 2.5 – O’Connell Street shared zone upgrade before and after (Auckland City Council, 2016)

The Auckland Transport Code of Practice Chapter 5 – Special Routes and Road Elements (Auckland City Council, 2013) provides a measure of guidance to the provision of these spaces. There is significant guidance for urban orientated spaces within the document but limited approach to the provision of shared space in residential areas.

The document refers to “Home Zones” as section 5.5.6 (pp. 77) with a coverall statement advising that for residential shared spaces the aforementioned urban zone design principles are generally applicable with the following further considerations:

- Rather than relying on active frontage for user interactions in the case of non-residential shared spaces in activity centres, a home zone implementation looks to the residents and local communities for the sense of ownership in utilising and maintaining the public (road) space.
- The motor vehicle movements should be strictly restrained. A residential shared zone should only cater for vehicle traffic generated specifically for the immediate local community it is designed for.
- The design and location of on-street parking spaces within a home zone should be restricted in number and time only to cater for the local residents.
- Community focal points and facilities are to be provided to reinforce the community ownership aspects.

The provision and clarity of requirements for residential shared space in the Auckland Transport Code of Practice is deemed to be of low level with the primary focus in this space being central activity areas.

2.6.2 Wellington City Council

The Wellington City Council code of Practice for Development: Part C – Road Design and Construction (Wellington City Council, 2012) tends along the route of the Austroads LATM outlined earlier in the literature review. Section C.1.9 – Traffic Calming Measures for Residential Areas typically summarise their response to local traffic areas in two points:

- Carriageway and alignment of traffic calming measures shall discourage motorists from travelling above the intended speed;
- Local roads shall not provide routes which are more convenient for through traffic than roads higher in the network category.

Some of the principles and objectives of shared space are provided for in the Urban Development Design Objectives (Wellington City Council, 2016) including reference to Walkability, sense of identity and place, connectivity and Accessibility. These tend to be more overarching design principles with a general view rather than specific detailed approaches.

Details of Wellington’s approach to shared space are difficult to find and what is available tends to be underdeveloped in providing a sense of direction or guidance.

2.6.3 Christchurch City Council

Christchurch City Council, as with other major cities, prescribe the requirements of LATM outlined earlier. The Christchurch City Council Infrastructure Design Standard (Christchurch City Council, 2015) presents the requirements for traffic management, calming device use and references the Austroads Guide for LATM for further information.

Christchurch City Council’s level of guidance appears to be highly prescriptive in nature rather than site specific. In terms of maturity of approach to shared space the Council is underdeveloped.

2.6.4 Other New Zealand Local Authorities

In general New Zealand Councils across the board have relatively low flexibility in terms of providing for shared space in a residential context. Whilst they tend to be open to main street developments and town square type treatments, the

guidance documents for transport infrastructure tend towards specifying the New Zealand Standard, NZS4404:2010 Land Development and Subdivision Infrastructure or the various Austroads Guides as their basis.

Typically a specific approach to shared space is not presented. Rather if these types of spaces are to be approved by the local authority, then they need to be on an individual basis and subject to significant level of bureaucracy to achieve the desired outcomes. For this reason it is argued that the lack of guidance from local authorities in the area of shared space is a roadblock to developing better functioning zones within residential spaces.

2.6.5 New Zealand Transport Agency

The NZTA provides some literature regarding the use of shared space for the road network. The guidance provided relies heavily on the guidance note produced by IPENZ (Joyce 2012) and the Land Transport (Road User) Rule 2004 specifically stating that:

- A driver of a vehicle entering or proceeding along or through a shared zone must give way to a pedestrian who is in the shared zone
- A pedestrian in a shared zone must not unduly impede the passage of any vehicle in the shared zone.

Whilst providing a number of definitions regarding what might constitute a shared zone, such as an off street carpark with no designated footpaths, the guidance stops short of providing any details regarding the use of the zones.

Furthermore they make mention of the ‘trafficable zone’ within the space rather than identifying the use of the entire space by all road users.

The NZTA tends to remove responsibility from itself in the implementation of shared space by stating that a local authority can produce by-law declaring an area as a shared zone. This is reasonable as the state controlled network would have very few areas in which this type of approach is suitable.

Overall the NZTA has a position whereby they could advance and improve the use of these zones, but tend to shy away from imparting their will on what is deemed a local road authority domain.

3. Objectives and Performance Indicators

Objectives and performance indicators for a shared residential space have been developed to assess the success and functionality of existing zones as well as giving guidance for future upgrades. The key areas to be assessed have been simplified and adapted to the residential environment from those proposed by Reid et al.:

- Placemaking
- Catering for a range of road users
- Economic Impetus
- Road user behaviour change

In this assessment it is intended that the focus on pedestrian dominance in these zones be modified to allow an equal share of dominance between all road users. The development of uncertainty in pedestrian, cyclist and vehicle movements is more likely to create the safety and functionality outcomes desired in the zones.

It should be noted that the performance indicators within residential shared zone are more qualitative in nature than those for high traffic destination zones in central areas. The guidance on residential shared zones limits their implementation to areas of a maximum of 100 vehicle movements per hour. Crash data, if it exists, is likely to be minimal and statistically insignificant. Due to tight road reserves and steep grades, it is likely that prevailing vehicle speeds are already low. For these reasons perception and judgement are likely to be the major drivers in assessing performance and success of the zones.

3.1 Placemaking

The drive to create a destination in residential zones is not as prevalent as in shared spaces in CBD environs. The residential nature of the areas already denotes the space as a destination space. For this reason the critical indicators for placemaking are more focussed towards enhancing liveability of the street. Factors to be incorporated include an enhancement in perceived safety from crime, Table 3.1 outlines the proposed objective statement and performance indicator for the concept of placemaking.

Objective Statement	Performance Indicators
Creates a street environment that encourages interaction between residents and relegates vehicular operation to a secondary function	<ul style="list-style-type: none"> - Resident interaction increases - Reduction in vehicle movements within the space
Improves liveability of the street as a result of encouraging active modes of transport and providing social safety aspects.	<ul style="list-style-type: none"> - Increase of cycling and walking journeys to and from the street - Enhancement in perception of safety from crime and anti-social behaviour

Table 3.1 – Objective statements and performance indicators for placemaking

3.2 Catering for a range of road users

Shared space in a residential area has a slightly lower level of focus on pedestrian dominance however the aim should still be providing a safe and easy access for pedestrians as an equal user of the space. The distinct feature of a lack of footpaths in the space requires that thought be given specifically to the desired route of pedestrians. Whilst the space overall should be designed to enable free access to all users, a specific route for pedestrians should be considered. This should include designated bypass routes through pinch points in the space.

Cyclists should also be considered in the design through ensuring rough surfaces are avoided. They should be encouraged to utilise the main flow through the space with vehicles rather than feeling the need to secede to them. It is critical that the design speed be such that maximum vehicle speeds match reasonably close to those achievable by cyclists. Even though the zones are speed restricted to 30km/h, the aim should be to provide a road environment that passively enforces this limit.

Vehicular traffic in the space still needs to be considered as a major function although the focus should be to actively encourage residents to use alternative modes of transport for journeys within the immediate area. The aim is to encourage trips to local amenities, such as a convenience store or park, to be undertaken via active transport modes rather than driving.

The indicators and objectives for catering for a range of road users are aligned to vehicle speeds and level and manner of use through the zone and are the best quantitative measure of the success of the space. Table 3.2 shows the proposed objectives and indicators.

Objective Statement	Performance Indicators
Provides a sense of safety in route for vulnerable pedestrians whilst encouraging use of the entire road space.	<ul style="list-style-type: none"> - Pedestrian perception of safety increases - Pedestrian use increases
Caters for cyclists using the space as part of the traffic flow.	<ul style="list-style-type: none"> - Cyclist perception of safety increases - Cyclist use increases
Design to passively enforce design speed of 30km/h or lower.	<ul style="list-style-type: none"> - 85th percentile speed of traffic through space within 5km/h of design speed

Table 3.2 – Objective statements and performance indicators for catering for a range of road users

3.3 Economic Impetus

Economic impetus of residential shared space is of lower importance than that for high traffic, destination spaces. However it is still important to consider the economic impact that a potential upgrade could have.

For residential streets the indicator should be more focussed towards demographic of adjacent occupiers rather than occupancy rates in themselves. A successful zone is likely to see a shift towards a higher density of owner occupiers than renters. This indicator is the most subjective of the proposed performance measures and is the most difficult to quantify. However enhancement of property value should remain as an aim in any potential upgrades to a shared residential zone. Proposed objectives and indicators for economic impetus are outlined in table 3.3.

Objective Statement	Performance Indicators
Provides an increase to the perceived and actual value of adjacent properties through street appeal.	<ul style="list-style-type: none"> - Increase in perception of street appeal - Increase in number of owner occupiers in adjacent residences.

Table 3.3 – Objective statements and performance indicators for economic impetus

3.4 Road user behaviour change

Behaviour change in road users aligns closely with the objectives associated with catering for a range of road users with the key difference being a stated aim of changing the road user’s perception of appropriate behaviour within the zone. Providing a measure of this indicator is difficult and for the most part relies on subjective opinion of the road user. However it is an important aim to achieve a road environment that actively encourages users to align their behaviour with the intended outcomes of a residential shared zone upgrade.

A key measure of the success for this objective is the level of interaction between road users. Engagement of road users with each other within the zone are key to measuring this performance

Objective Statement	Performance Indicators
Road users possess an understanding of the expected behaviour within the zone.	<ul style="list-style-type: none"> - Increase in perception of expected behaviour - Increase in the level of communication between road users

Table 3.4 – Objective statements and performance indicators for economic impetus

4. Shared Zone Objective Assessment

It was intended to develop a model for assessing the objectives for residential shared zones using a combination of methods to make judgement on the success in each of the performance indicators. Three key areas make up this assessment:

- Gathering of data prior to and post shared zone implementation;
- Development and carrying out a resident survey to assess the qualitative indicators;
- Survey of key persons in roading asset management and maintenance areas with Nelson City Council.

4.1 Resident survey

The resident survey has been designed to take into account the views of the residents in the area. Whilst there is a risk of bias dependent upon the views of particular residents in relation to how their street should function the information should give a good picture of how the residents perceive the residential area in which they live and possible improvements to the zones could be sourced.

4.1.1 Survey Development

In developing the resident survey it is important to distinguish between long term and short term residents of the streets in question. Those who lived in the street prior to the shared zone implementation will be able to give comparative assessments on indicators whereas those who have moved to the street since the upgrade will be able to assess how the street environment contributed to their selection of property.

The survey has been designed with 6 questions stemming from the initial parameter of whether they lived in the street prior to the upgrade. Table 4.1 shows the question flow chart:

Did you live in the street prior to the upgrade?	
YES	NO
Do you feel there has been an increase in safety through implementing the street upgrade?	Did the street environment provide extra appeal to your purchase of the property?
Do you think the upgrade has improved how well you interact with your neighbours?	Do you think the street environment contributes to getting to know your neighbours?
Do you think the upgrade has contributed to an increase in value of your property?	Do you feel safe from crime and antisocial behaviour in the street?
Do you think the upgrade has contributed to a decline in crime and antisocial behaviour in the street?	
BOTH	
Do you regularly walk or cycle for short trips?	
Are you comfortable with the speed and behaviour of other drivers in the street?	

Table 4.1 – Resident survey question chart

Residents in Locking Street and Iwa Road were selected to participate in the survey. Whilst there is a third residential shared zone on Queens Road, this zone is not considered as part of this research as it was retrofitted after the fact rather than consisting of a full road upgrade.

Owner occupiers of properties were selected as targets for the survey based on their investment in the street environment and the direct effect that it plays on the way in which they live and perceive the zones. It was decided not to target renters as there are a large variety of reasons outside physical desire to live in the area that could have implication on why they are renting the property. They also do not have any real economic drivers beyond price to select a property in these streets.

4.1.2 Methodology

Residents who are owner-occupiers were targeted with the survey to gain an insight into what they value about their home environment and factors residents believe could be improved within the shared spaces.

The survey was delivered as a paper copy with the two options provided for those that lived in the street prior to the upgrade and those that have moved there since. The survey was also offered online via the “survey monkey” platform. It was deemed important that a paper based version of the survey be offered to ensure the views of those who are not technically adept with internet were still encouraged to respond.

Surveys were issued 13th of August with no timeframe identified for completion. A follow up letter drop to the residents targeted was completed on 5th of September advising that the survey would close on the 9th of September.

4.1.3 Summary of Responses

By the survey close there had been three responses online from residents who lived in the streets prior to the upgrade and two who had moved to the streets since the upgrades. In addition to this a further 3 paper based responses were returned from residents who lived on the streets prior to the upgrades. Survey responses are summarised in table 4.2.

Number of respondents who lived in the streets prior to upgrade	6
Number of respondents who moved to the streets since the upgrades	2
Number of respondents who view the zones as a positive treatment	3
Number of residents who were somewhat satisfied with the treatments but suggested improvements	4
Number of respondents entirely unsatisfied with the treatment type	1

Table 4.2 – Summary of survey responses

4.1.4 Analysis

The small sample group made it difficult to obtain statistically relevant data which was anticipated by the open question style. The value of this survey lies in the

suggestions and responses to questions based on the individual views of residents. Throughout the surveys a number of common suggestions became apparent. These are presented in table 4.3.

Car parking space	A number of respondents suggested that the most irritating feature of the shared zones is the way in which residents park. The narrow nature of the road space means that parking is restricted in a number of areas. Of particular concern was how well emergency vehicles are able to transit the street. 3 respondents declared concerns that a fire truck would not be able to move freely through the street at all times due to vehicles parking opposite each other creating pinch points.
Desire for one-way operation	2 respondents suggested they would prefer if the street operated in a one-way fashion. This was driven by concerns in regards to the narrow nature of the street and increased parking demand due to development of land below the street.
Crime and anti-social behaviour	Crime and anti-social behaviour was a critical point in a number of the surveys. Whilst one respondent believed the street environment contributed to a reduction in poor behaviour a number advised that it had no impact. It is likely that the respondent who suggested it created a reduction was from the Iwa Road zone whereas the other respondents were from Locking Street. It is also likely that a recent spate of vandalism in the area at large contributed to poor responses to this question.
Active modes of transport	Whilst there were two negative comments in relation to feeling safe within the road environment, all 8 of the respondents advised that they regularly walk or cycle for short trips. Whilst it is difficult to draw conclusions regarding the contribution shared space makes to encouraging active modes of transport, it is clear that those in the areas are utilising these transport modes.
Speed and safety factors	A number of respondents declared concerns in relation to the speed and behaviour of road users in the shared space. Whilst

	generally respondents were content with the speed in the zones the general concern stemmed from the occasional driver travelling too fast. There was also comment made in regards to cyclists on the uphill sections of the street frustrating impatient motorists due to slow speeds and lack of space to pass. Anecdotally there are instances where cyclists have been required to veer to the side of the road to allow vehicles pass.
Economic Impetus and place making	Respondents were generally neutral on how they feel the street contributes to an increase in property price and whether the upgrade creates a desirable place to live. Comment was made in relation to landscaping and how it was implemented and maintained. Two respondents suggested that there should have been more landscaping included and maintenance should be of a higher standard. There was also suggestion that the nature of the streets tend to oppose the concept of placemaking. Most dwellings are set back and are significantly higher or lower in elevation than road level. This leads to individual properties being disconnected from the street space.
Traffic calming devices	Most of the responses received were positive in relation to speed control devices. In particular there were two responses that suggested that the narrow control points spaced every 80m in Locking Street were not enough alone. The respondents were of the opinion that these devices should have all been combined with speed tables to reduce travel speed further.

Table 4.3 – Summary of survey respondent themes

4.2 Council Expert survey

A second set of questions has been developed to assess success of the zones by experts currently working with Nelson City Council. Five officers have been selected based on either their involvement with the original projects or their ongoing maintenance involvement with the streets:

4.2.1 Survey Development

Team Leader Roding Operations – Supervises the roading maintenance of Council’s operations and champions road safety initiatives.

Capital Projects Engineer – Project managed the Locking Street upgrade project.

Capital Projects Senior Engineering Officer – Project managed the Iwa Road upgrade and has extensive experience with roading safety upgrades.

Group Manager Infrastructure – Manages the functions of the infrastructure group within Council and is the Senior Leadership Team member for the group. Also provides a link between the elected officials and staff within the group.

Senior Asset Advisor – Asset manager for roading and was involved with all of the shared space initiatives.

The proposed questions are outlined in Table 4.4:

Do you think the design of the streets in question contribute positively or negatively to road safety?
Do the upgrades contribute to a better functioning street in relation to all road users?
Do you feel the street environment contributes to active modes of transport?
Do you feel the street environments meet the objectives of: <ul style="list-style-type: none">- Placemaking- Catering for a range of road users- Economic Impetus- Road user behaviour
Are there any improvements you feel would contribute to meeting these objectives?

Table 4.4 – Council expert question chart

4.2.2 Methodology

The council expert survey was developed to obtain expert information from officers within Council who have either extensive experience in the field of road safety, or were directly involved with the upgrades.

The choice of questions focussed on the previously developed objectives for the shared zones and the performance indicators associated with each.

Officers were interviewed individually with discussion free to cover topics prompted by the questions in the survey. The officers were then requested to complete the survey afterwards to obtain direct answers to the questions incorporated. In this way it was possible to determine opinions on the subject that may have been outside the range of discussion in the interviews.

4.2.3 Analysis

Generally responses to the questions asked were positive, however there were a number of improvements that could have been made. Table 4.5 provides a summary of the areas covered:

Economic Drivers	The main theme that came through from a number for the respondents was the fact that the main drivers for the shared zones tended to be for cost reduction rather than suitability for the treatment type. Whilst costly, full upgrade treatment was an option in the reconstruction of Locking Street. Further to this some of the design features important to this treatment type were deemed to be of lower importance which may have led to the zone not functioning as well as it could.
Public Engagement	Engaging with the public and seeking feedback was identified as the most difficult stage of the upgrades. Some of the concepts involved in the development of shared zones seem counter intuitive to those lacking experience in the transport field. An example of this was given in trying to explain how lack of forward visibility contributes to lower speeds and safer road environment. Generally the opinions related to this feature were negative and were difficult to convince members of the public who attended information sessions.
Continuing the status quo	The road environments in which the shared zone upgrades have taken place are effectively formalising what has already been occurring within the street. The roads prior to upgrade were already very narrow and steep and the upgrades, particularly

	<p>Locking Street, have accentuated this rather than attempting to change the dynamic in which they function. All officers surveyed agreed that this has led to easier acceptance of the shared zone concept as it is seen as an improvement rather than a reduction in level of service.</p>
Cyclist Speed	<p>There were issues raised in relation to the Locking Street upgrade in relation to cyclist speed on the downhill sections. Potential to consider designing in a way that reduces cyclist speed at critical points.</p>
Parking Behaviour	<p>Parking was identified as an issue within the zones with difficulty in ensuring residents park in appropriate areas and don't reduce the overall capacity of the road to carry the traffic required.</p>
Cost as main driver for upgrade	<p>All officers interviewed suggested that the main driver for these upgrades has been cost. Whilst all agreed that other benefits had been achieved through the upgrades, there was a general agreement that these benefits are difficult to quantify in a meaningful way to present to decision makers. The asset managers in particular were interested in methods to quantify these benefits in a manner useful to the business case approach that Council takes to capital project upgrades.</p>
Ongoing education and promotion of shared zone behaviours	<p>Ongoing education of residents in both in the shared zones and in surrounding areas was identified as a potential area for improvement. As time passes and new residents move to these areas, the original message relating to how the zones should function tends to get lost. Regular updates and flyers to these spaces could potentially negate this issue.</p>
Targeting shared zones to their audience	<p>It was identified by one of the officers interviewed that the existing zones tended to be too generic in their approach. A site specific approach to the zones is needed to ensure that the shared zones are achieving the benefits required.</p>

Cul-de-sac approach to through roads	Serious consideration should be given to blocking through access on linked roads in the areas in which the treatment type is being considered. Vehicles are far more likely to travel at the design speed if it serves no benefit to them to travel quicker as they are already close to their destination. This will also provide potential reduction in traffic volumes on the roads although may negatively impact surrounding streets if not thoroughly considered.
Vulnerable pedestrians	The issue of vulnerable pedestrians including children, the elderly and vision impaired were considered by a number of the respondents. Although the consensus was that council should be catering for these users where possible, there was also a general acceptance of a reduction in level of service based on the accessibility of the road prior to the upgrade.

Table 4.5 – Summary of council expert survey responses

5. Comparative Assessment Shared Zone Approach

The second section of the project incorporates development of a preliminary design matching the current requirements of Council's Land Development Manual and comparatively assessing it against a preliminary design attempting to achieve the objectives developed for residential shared zone assessment. The designs have been compared by estimating the construction costs using median tendered rates from the past three years of Nelson City Council capital projects. Where rates from particular items are unavailable, an estimate from first principles was developed.

5.1 Selection of study site

Council asset managers have previously identified a number of sites that could be considered for the shared zone approach. After analysing these potential sites, Airlie Street in the village of Glenduan was chosen to undertake the comparative designs upon. This decision was made based on the following:

- Availability of site information. As a detailed design had been undertaken on the location by a consultant in 2013, survey information and knowledge of service locations was readily accessible;
- Nature of the site – The difficult grades and proximity of the road to property boundaries meant the location would clearly highlight any issues with the upgrade designs;
- The small nature of the village and the fact that the road is already a dead end meant that the impact on surrounding areas of the shared zone approach was deemed minimal.
- The traffic and speed parameters fit the previously identified guidance on shared zones. (Less than 100 vehicles per hour and local road hierarchy).

5.2 Detailed Site Analysis

Glenduan is situated approximately 15km north east of the Nelson City CBD. Located off State Highway 6 the small population is made up of primarily lifestyle blocks with slightly larger section size than would typically be found on a potential

shared residential zone site. A typical steep grade and narrow road reserve are present and the road is well overdue for upgrade or reconstruction.

The street rises from approximately 30m above sea level to 65m above sea level over 315m length. This gives an approximate average grade of 11%. The average width of road reserve is 15m, however steep cross grades prevent the full width being deemed usable space.

A major consideration of any potential upgrade will be capturing stormwater within the road space. Historical floods have inundated a number of properties along this stretch of road so it will be critical that the upgrade design caters for carrying significant stormwater flows. It was decided that an assumed stormwater design would be undertaken and estimated using sizing from similar projects.

There was also a current shortage of on road parking space so any upgrade proposed would need to at least provide for the number of spaces currently available to the area. Property accesses were be of significance in design and on street parking was able to be used to provide slow points on the road to allow passive enforcement of target speeds through side friction effects.

The average daily traffic on the road is around 140 vehicles per day and the primary purpose of the road is a residential local road. The main local trip generators for the area are a local park and beach. Outside of these destinations, all trips are likely to be undertaken in a vehicle based on the distance from amenities including shops, workplaces, schools and sporting facilities. This poses the problem that there will be more vehicular movements than might normally be the case in a residential shared space but should provide a good baseline in demonstrating the effectiveness of catering for all road users.

The residence types bordering the street tend towards larger properties matching the lifestyle blocks they are located on. The general demographic is appealing towards retirees who prefer to be away from the central areas of the city. For this reason it was assumed that an ageing demographic is required to be catered for. On this basis it was deemed likely that considerations for vulnerable pedestrians would be significant in the designs.

Figure 5.1 shows the location of the site in relation to Nelson City and Figure 5.2 provides a topographic representation of the subject site.

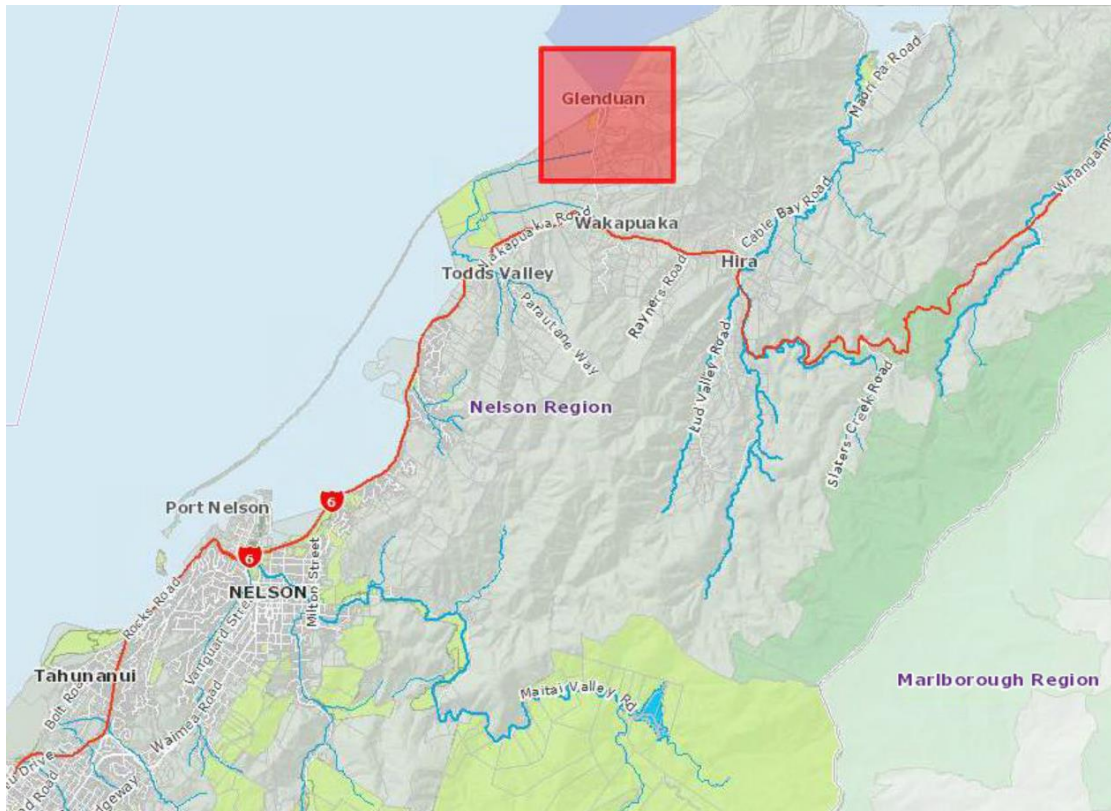


Figure 5.1 – Locality plan of Glenduan in relation to Nelson City

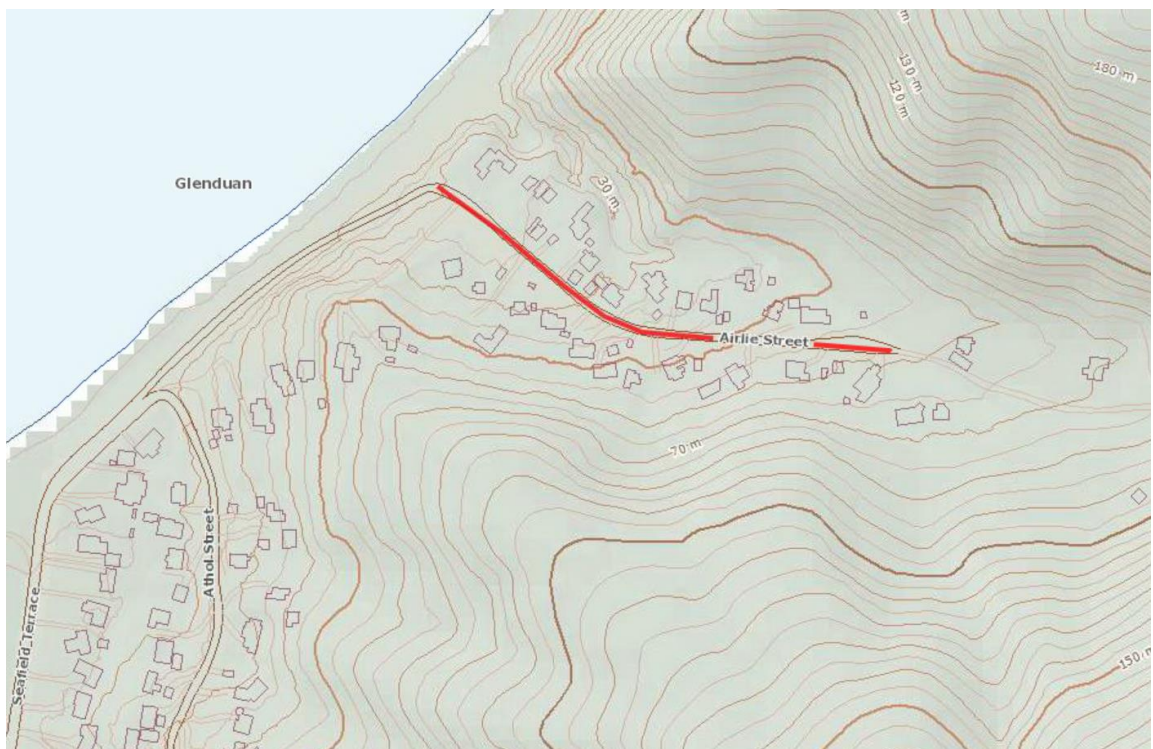


Figure 5.2 – Topographic representation of Airlie Street, Glenduan

5.3 Design

Two designs have been developed as part of the project with the intention of providing quantities for comparative estimates. These designs were undertaken in accordance with Nelson City Council design standards to a preliminary design level.

5.3.1 Design brief

The intention was to develop two designs to a preliminary design standard suitable for taking quantities. The first design was to outline a standard upgrade on a residential street with greater than 20 dwellings. The design parameters for this are outlined in Table 9.1 based on the requirements of the Nelson City Council Land Development Manual 2010:

Parameter	Value	Comment
Lane Width	1 x 5.5m traffic lane	This lane is to cater for traffic in both directions.
Parking width	1 x 2.0m parking lane	2m may be on either side of the road and contributes to the overall road width rather than a specific parking bay.
Footpaths	2 x 1.5m wide footpaths	May be reduced to one side if space is prohibitive. At least one continuous footpath should be provided for the length of the upgrade with road crossing points at strategic points to ensure this connectivity is maintained.
Berm / Service alignment	2 X 1.5m wide berm / service corridor	Provided to allow for future telecommunication, power or council services as required. Usually requires separate berms and service corridors but it is common practice to combine

		these two features if necessary due to space restriction.
Kerb and channel type	Mountable as per Council's standard drawing number SD407	Provided to allow transition to driveways with footpath immediately adjacent to kerb.
Driveway Reinstatement	Reinstate to extent of disturbed area for road cut or fill providing a suitable property access in accordance with Council's standard drawing numbers SD409 and SD410 and Section 4.3.15.2 of LDM2010.	Provided to allow for maximum driveway grades and change in vertical alignment over the length of the driveway.
Service Reinstatement	Reinstate water, sewer and stormwater lateral connections and meters in accordance with LDM2010.	Those areas where service lateral connections are crossing through cut areas will need to be reinstated to suit the new road edge profile. This includes all fittings, meters and manholes as required.
Retaining walls	Construct timber retaining walls in accordance with section 4.4.13 of LDM2010 where cut slopes mean batters are unachievable within the road reserve. Walls over 1.5m require building consent approval.	Provided to allow return to existing ground level where the width of road profile is such that the maximum batter slopes would intrude upon the property boundary adjacent.

Table 5.1 – Design parameters for Land Development Manual 2010 compliant upgrade

The design for shared zone compliant upgrade incorporates the majority of features above with exceptions to design standard shown in table 5.2:

Lane Width	1 x 5.5m lane	Lane caters for traffic in both directions
Parking Width	No specific parking lane provided	Parking provision relies on staggered parking within the 5.5m lane width.
Footpaths	None provided	Pedestrians use road width
Buildout width	3.5m road width	Incorporated to provide speed reduction by reducing forward visibility and deviation from set alignment of traffic
Speed Tables	15% ramp grade cobble dressed with exposed aggregate top.	Traffic calming.

Table 5.2 – Design parameters for Land Development Manual 2010 compliant upgrade

Figure 5.3 shows a typical cross section approach to the LDM compliant requirements. Of particular note within this arrangement is the fact that two-way operation is maintained regardless of whether a vehicle is parked in the location.

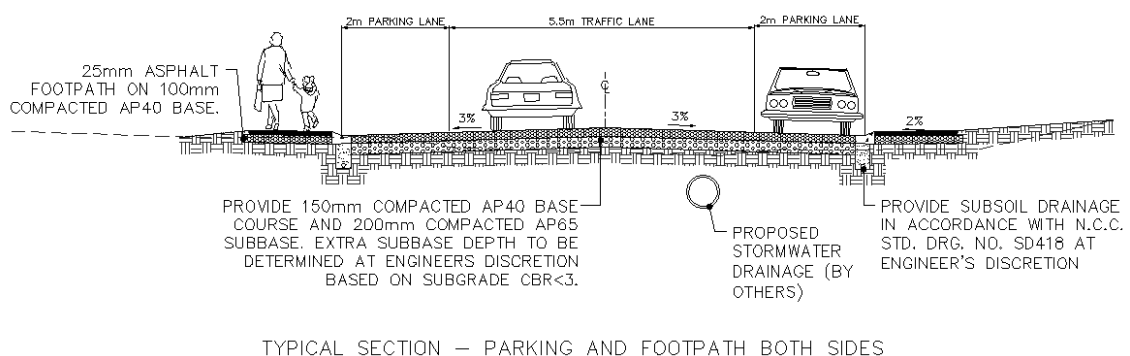


Figure 5.3 – Typical cross section of treatment compliant with requirements of LDM 2010.

Figure 5.4 shows a typical section in accordance with outlined requirements of shared residential zones. The key feature to note is the lack of parking provision

meaning that any parked vehicle within the space contributes to achieving the design speed of the zone.

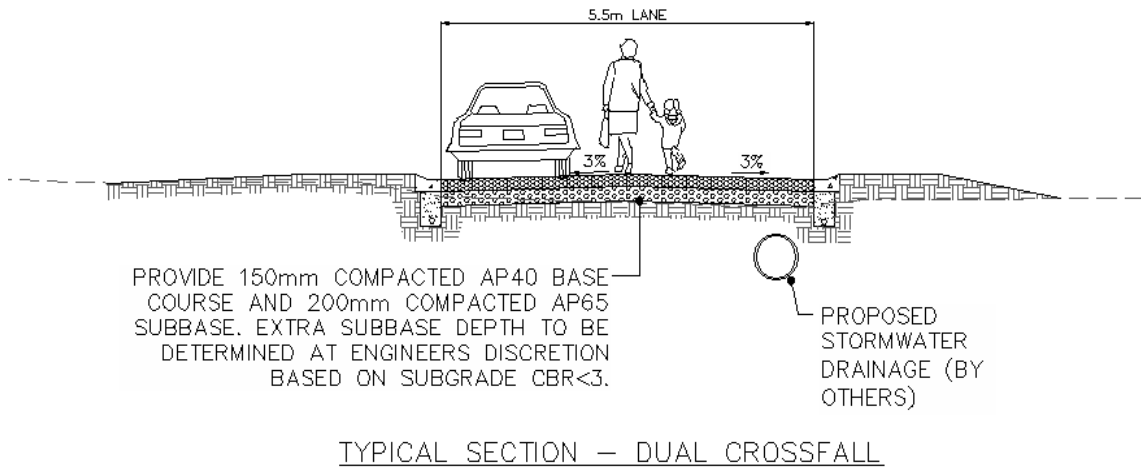


Figure 5.4 – Typical cross section of treatment to LDM 2010 standard

The threshold treatment for the shared zone treatment is particularly important in identifying the area as a change from the normal road environment. It needs to actively encourage a reduction in vehicle speed as well as visually signalling drivers of the potential for interactivity with other road users. Figure 5.5 shows the layout for the threshold treatment and Figure 5.6 demonstrates a typical section through the speed table.

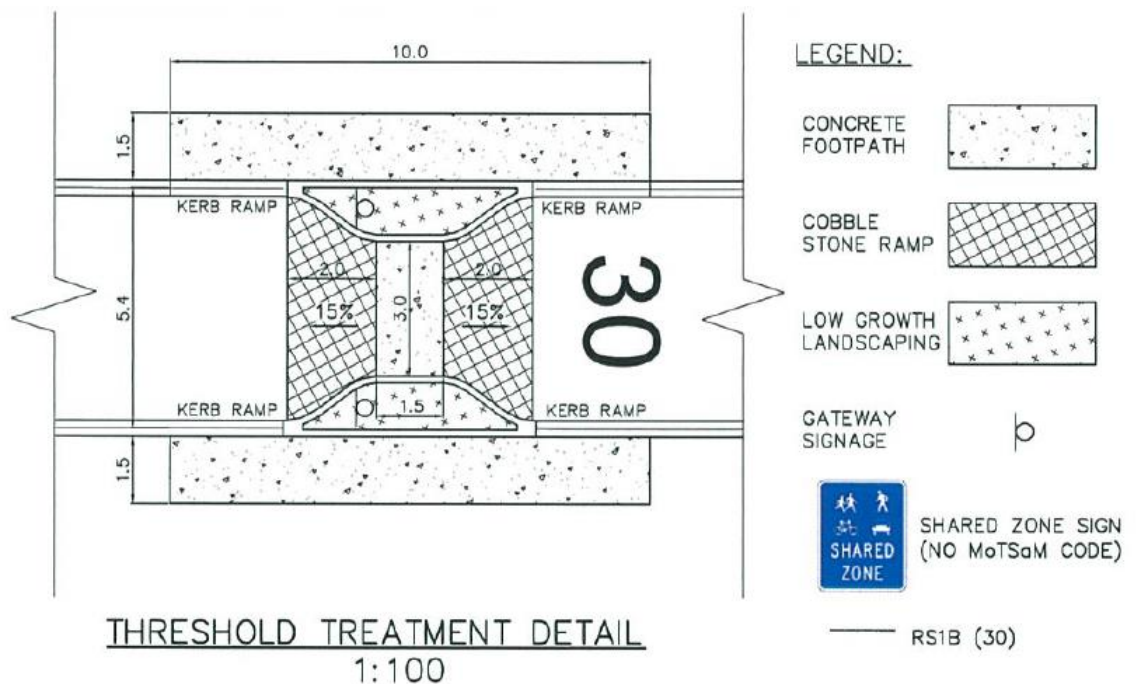
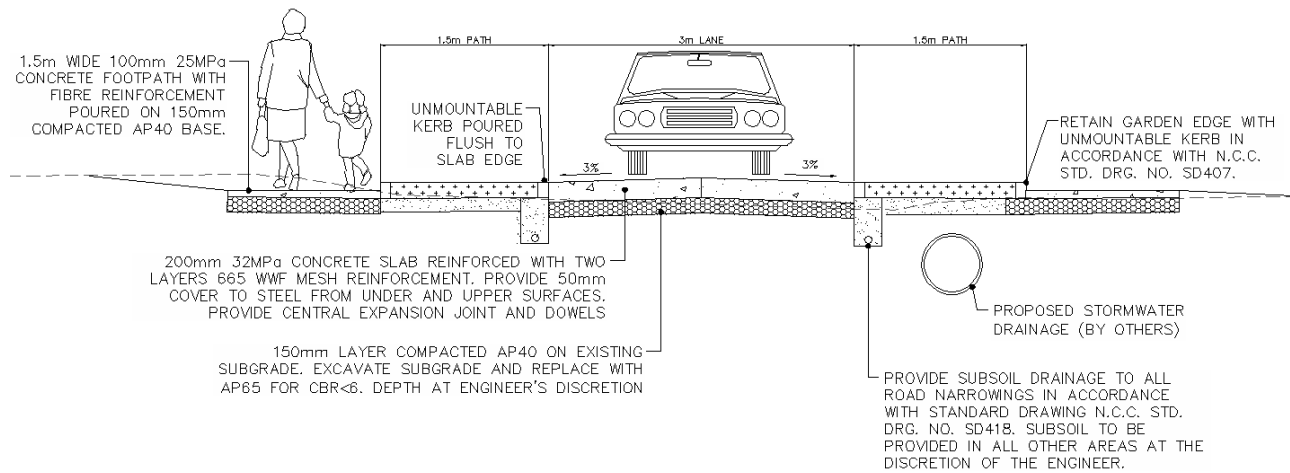


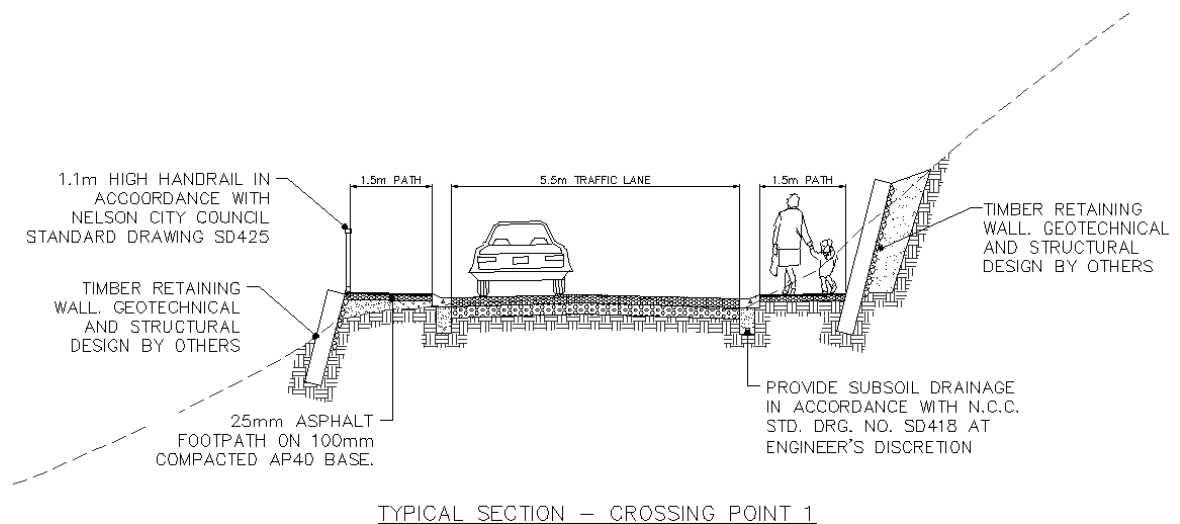
Figure 5.5 – Typical layout of threshold treatment



TYPICAL SECTION THROUGH SPEED TABLE

Figure 5.6 – Typical section through threshold treatment

Retaining structures are required to be used wherever cut and fill requirements require vertical changes in elevation. These walls have been designed to an indicative level only with no consideration made to geotechnical conditions of the site. The walls are assumed to be constructed of 250mm treated timber piles with half 100mm diameter bollards used to clad the wall. These features are assumed based on the retaining structures implemented in the Locking Street Upgrade. Figure 5.7 shows a typical cross section through these proposed retaining walls.



TYPICAL SECTION – CROSSING POINT 1

Figure 5.7 – Typical section at crossing point requiring retaining walls

5.3.2 Parameters and Methodology

The steep cross grade of the road means that tie in to driveways will be difficult in areas of cut. For this reason the decision has been made to maintain the vertical geometry as near to existing as possible. Whilst this will minimise cut areas on the upslope side of the road, there will still be areas that need to have specific design of property accesses considered. This has been incorporated by modelling problem driveways in civil 3d and ensuring that the levels tie in with the proposed roading upgrade. Quantities of the driveway reconstruction have been included.

Stormwater would be a normal consideration of an upgrade of this magnitude. Outside of potential extra sump requirements in the shared zone upgrade, there is no real variation in the size and installation requirements between the two design options. This leads to the inclusion of stormwater as an indicative size in the estimates and an indicative alignment only. No consideration of stormwater design is made beyond an indicative alignment and sump placements along with an assumption of diameter based on similar designs in other locations.

Service alignments have been shown indicatively on plans and the alignment of road upgrade adjusted to suit as required. It is assumed that all service crossings are at depth sufficient for the required upgrade. Where the roading alignment impinges on the alignment of services likely requiring relocation, this has been considered in the estimate. Of particular note is the alignment of 100mm water main on the upslope side of the upgrade. It is likely that any significant cut in this area will require relocation of the water main. Depth of this service is assumed to be at minimum 700mm shown indicatively on cross sections.

The alignment of the road centreline has been designed to match with the existing road. There may be instances that require superelevation generation or radius adjustment on curves but this has been deemed beyond the scope of preliminary design. The design for the shared zone upgrade is presented as Appendix A and the LDM compliant design as Appendix B to this report.

5.3.3 Expected Outcomes

The upgrade in compliance with the LDM 2010 requires a significantly greater amount of cut and fill than that of the shared type treatment. Further to this there is a need to construct extra pavement area and footpaths.

The extra cut and fill and wider profile of the LDM compliant treatment is expected to require extensive retaining of adjacent slopes to allow the space to cater for it. This will increase the overall cost through the retaining structures directly as well as extra earthworks associated with them.

The LDM compliant design also has difficulty in obtaining suitable linkage with existing property accesses. This is likely to increase the area and subsequent cost of reinstating property accesses after construction.

Extra cut and fill also leads to the need to relocate service laterals in the road as well as potential to require full service relocation depending on depth again increasing costs.

It is expected that the shared zone treatment will result in a significantly lower construction estimate than the LDM compliant treatment. In addition it is likely that ongoing maintenance costs of the shared zone treatment will be lower.

5.3.4 Quantities

Quantities for the designed upgrades have been extracted based on length and area for most items shown in the schedule. Whilst draft cross sections were produced to extract cut and fill volumes outside of the road profile, these sections have not been included in the preliminary design which is standard practice at a preliminary design stage. The fact that the design is based on LiDAR data with +/- 50mm accuracy supports this decision.

The full schedule of quantities for each option form part of the estimate documents and are included as Appendices C and D to this report.

5.3.5 Estimates

The estimates for each option have been produced using rates from NCCs database of median tendered prices from the last three years with engineering judgement made on the suitability of rates. Judgement on the most suitable rate for specific

quantities depended on other projects with similar amounts and the age of the prices included. Projects with an age outside three years old have been excluded from use in averages.

The shared zone upgrade was estimated at \$774,866.40 including a 15% contingency amount and excluding GST. Table 5.3 provides a summary of the estimate excluding the contingency amount. The full estimate is available as Appendix C to this report.

ITEM	DESCRIPTION	Amount
A	PRELIMINARY AND GENERAL	\$ 91,000.00
B	WATERWORKS	\$ 18,825.00
C	DRAINAGE WORKS (STORMWATER)	\$ 228,000.00
D	SEWERAGE	\$ 11,200.00
E	EARTHWORKS	\$ 68,270.00
F	ROADWORKS / CYCLEWAY CONSTRUCTION	\$ 240,750.00
G	ROADMARKING AND SIGNS	\$ 5,500.00
H	MISCELLANEOUS	\$ 7,335.00
J	UNSCHEDULED WORKS	\$ -
	TOTAL THIS TENDER (carried to Form of Tender – Excl. GST)	\$ 670,880.00

Table 5.3 – Estimate summary for shared zone upgrade

The standard compliant upgrade has been estimated as \$1,062,099.75 including 15% contingency amount and excluding GST.

Table 5.4 provides a summary of the estimate excluding the contingency amount. The full estimate is located in Appendix D to this report.

ITEM	DESCRIPTION	Amount
A	PRELIMINARY AND GENERAL	\$ 110,000.00
B	WATERWORKS	\$ 45,675.00
C	DRAINAGE WORKS (STORMWATER)	\$ 228,000.00
D	SEWERAGE	\$ 11,200.00
E	EARTHWORKS	\$ 95,120.00
F	ROADWORKS / CYCLEWAY CONSTRUCTION	\$ 358,000.00
G	ROADMARKING AND SIGNS	\$ 7,000.00
H	MISCELLANEOUS	\$ 68,570.00
J	UNSCHEDULED WORKS	\$ -
	TOTAL THIS TENDER (carried to Form of Tender – Excl. GST)	\$ 923,565.00

Table 5.4 – Estimate summary for standard compliant upgrade

5.3.6 Ongoing Maintenance Costs

A net present value analysis was undertaken on the designs to determine the cost benefit they deliver. The baseline of this assessment has been based on a “do nothing” approach where ongoing maintenance costs of the road are assumed without capital renewal intervention.

Ongoing maintenance costs of both the existing “Do nothing” option as well as those for the proposed upgrade types have been estimated using base rates as follow in Table 5.5. Rates are present value with 2016/17 financial year as zero year.

Asset Renewal Requirement	Unit	Rate
Reseal	m ²	\$13.45
Moderate Pavement Repair (Assume 10% repair area)	m ²	\$134.41
Major Pavement Repair (Assume 25% Repair area)	m ²	\$134.41
Slope Stability Maintenance	Lump Sum	\$100,000
Major Pavement Rehabilitation (Stabilisation)	Lump Sum	\$250,000

Table 5.5 Asset maintenance unit rates

A value for slope stability maintenance has been assumed based on historical slips previously during sever weather events. The arbitrary figure of \$100,000.00 has

been taken to represent an estimate of varying annual costs over a 15 year period during the life of the asset.

Reseals have been assumed to be required every 12 years in all cases which aligns with current NCC practice.

The pavement along the length of Airlie Street is of low structural integrity and as such is prone to high levels of failure. A major pavement stabilisation is assumed to be required as part of ongoing maintenance. It is also assumed that after this major pavement stabilisation, significant reduction in ongoing pavement repair costs will eventuate.

A capital outlay of \$375,000 has been assumed for stabilisation based on an approximate cost of \$100,000 per kilometre including resurfacing. The suitability of this stabilisation based on material present has not been considered as the alternative would require a full reconstruction of the pavement leading to one of the capital upgrades being considered as alternatives.

5.3.7 Net Present Value Assessment of Options

A net present value (NPV) analysis was performed based on capital expenditure of the two upgrade options as well as ongoing maintenance requirements of the existing road. NZTA assessment tools have been used in determining these values. The tools are used by Council when providing cost benefit analysis for NZTA subsidised capital projects. The tool provides a 40 year project life with ongoing maintenance of the capital upgrade options included in the consideration.

Table 5.6 provides the comparison of NPV determined by this analysis. A full summary of the analysis is available in Appendix E to this report.

Option	Net Present Value
Do nothing approach – Continue with existing maintenance regime with stabilisation in year	\$954,357.00
Standard Compliant Upgrade – Provision of a full LDM compliant upgrade as based on preliminary design estimate	\$1,176,214.00
Shared Zone Upgrade – Provision of a shared zone upgrade based on preliminary design estimate	\$806,218.00

Table 5.6 – Net Present Value comparison

Based on the determined NPV for the three alternatives it was found that the shared zone upgrade option has a NPV benefit factor of 1.2. The NPV benefit factor for the LDM compliant upgrade is determined as less than one at 0.81.

It is noted that the NPV analysis does not take benefit costs into account on each of the options. Factors such as improved physical amenity and increase to road safety are difficult to quantify in the case of a road with the low volume that Airlie Street has. One of the major difficulties in determining the value that the upgrades add in this regard is the lack of significant data,

Further analysis could be undertaken in the following areas to enhance the cost benefit ratio of the potential upgrades however this was deemed beyond the scope of the project:

- Reduction in crash rates
- Improvement to physical amenity of road environment
- Increase in the use of active modes of transport contributing to resident wellbeing
- Provision of resilience to disaster and climate change through upgrade of stormwater system to appropriate levels
- Reduction to ground stability risk based on retaining structures
- Improvement to accessibility in the street
- Overall increase to adjacent property values

6. Guidance Document

The ultimate aim of the guidance document is to provide a manual for use by Nelson City Council when developing and implementing future shared zone treatments. It is intended that this document be presented to Council and approved for reference in the Land Development Manual upon its review in 2017. The document expands on the current 2 page guidelines produced in conjunction with the original Locking Street Upgrade.

6.1 Legislative Considerations

In implementing a shared zone the lower speed limit of 30km/h presents a legislative challenge. Whilst the local authority has the power to implement speed zones appropriate to the road environment, 30km/h is significantly lower than the standard 50km/h limit. Each individual 30km/h zone is required to seek approval for the lower speed from New Zealand Transport Agency.

6.2 Local Government Approval

The document will be required to seek Council approval to be implemented for use on future capital projects. The process involves presenting a report to the Senior Leadership Team (SLT) and subsequently presenting the report to the Works and Infrastructure committee of council. Upon their approval it might be necessary to present to the full Council depending on the resolution made by the Works and Infrastructure committee.

6.3 Guidance on Use and Expectations

The document is expected to be used as a guide only. The nature of the shared zone is such that each individual upgrade should be designed specifically to the merits and constraints of each site. For this reason the term 'should' is used more frequently than 'shall'. The document presents details of how the zones should function rather than prescriptively stating detailed design standards.

6.4 Catering for lower mobility and disability

It is of particular importance that road users with lower mobility or physical impairment are taken into account in implementing shared zones. Of particular concern are vision impaired users who through removal of designated footpaths lose their cues to move freely within the space. For this reason one of the defining decision points in choosing whether to implement a shared zone should be whether the upgrade will make navigability more difficult for those with visual impairment.

The majority of the road environments where this could be considered as a treatment have limited to no footpath facilities in their current form. Furthermore the road terrain is such that navigability by users with reduced mobility is likely to be minimal anyway. However when designing the road these users should still be catered for. Tactile paths for the visually impaired and providing footpaths through narrow points should be considered. It is also reasonable to expect that parking should be provided for on one side of the road only to allow a consistent path of travel through the shared zone by those lacking in mobility or vision.

6.5 Document Specifics

The guidance document provides direction in the key areas that relate to achieving the objectives of shared residential space as developed previously.

It is intended that the guidance document provides direction to the user rather than instructing them directly in what should and shouldn't perform part of their project. Each potential site for a shared zone treatment will vary in the way in which it performs and should be assessed using the parameters within the document and engineering judgement made as to the suitability of the project.

A checklist is provided at the end of the document. This checklist runs the user through the particular requirements of a shared zone approach such as traffic volumes and prevailing speed. It then runs the user through a series of yes or no questions relating directly to the performance indicators developed as part of this dissertation. The full document is included as Appendix F to this report.

7. Limitations and Further Work

This dissertation set out with one of the aims to provide a level of qualitative measure on the performance of the shared zones. Due to the low volumes of traffic and significant gaps in available data for the roads it was deemed inappropriate to continue with the proposed comparison between crash rates and speed parameters for the areas. This provides the potential for a major point of research that could be undertaken upon the next implementation of a shared zone treatment in the Nelson City Council area. It is intended that measures be put in place now to understand the dynamics of traffic within the zones prior to a potential upgrade. The author is currently seeking approval to obtain this data through a range of counts on the roads that have been identified as potential future shared zone candidates.

Further work is to be undertaken on the guidance document developed as part of this dissertation. Potential improvements include:

- Providing further detail into the performance objectives identified as part of this dissertation.
- Incorporate an overview of the literature into the document as guidance for to the user on the benefits that may be encountered and what can go wrong if the design does not meet the needs of the environment into which it is being placed.

It is also intended that the shared zone approach be formalised into the road hierarchy in transport planning policy of Nelson City Council. This could be difficult as there is a current push to a standardised approach to road network hierarchy across New Zealand and where shared zones fall within this framework is yet to be determined.

There is also potential to further the study in a number of areas including:

- Comparatively assessing the differences between residential and CBD zones and their drivers;
- Study into the effect of the shared zones on surrounding streets as a whole;

- Effect of engaging a Local Area Traffic Management approach to some of the streets in question and assessing how well they function compared to the shared zones;

8. Conclusions

The use of shared zones in the Nelson City Council area for a solution to grade and space restrictive residential streets is proposed as a suitable option.

The benefits found in the literature review provide justification for their use however there are a number of areas in which the current zones are failing. Options to remedy these issues in line with the performance objectives presented in Chapter 3 should be considered. Of particular concern is the way in which vulnerable pedestrians are catered for within the zones.

Generally the target speeds within the zones are being achieved however there remains a level of concern regarding the expected behaviour of drivers in the road space. More thought needs to be given to ensuring that the public understand how the zones are supposed function and educating drivers to be more accommodating to pedestrians within the spaces.

Placemaking amenity within the existing zones is adequate although improvements to the way they look and feel could enhance this objective further.

A comparison was made between a design undertaken in accordance with the Nelson City Council design standards and one developed based on the shared zone principles. The net present value analysis based on estimates for the shared zone was found to have a benefit factor greater than 1 for the shared zone and less than 1 for the LDM compliant upgrade in comparison with an estimate of routine maintenance over a 40 year life span. This demonstrates that the potential cost benefits along with the unvalued social benefits that the approach can provide are likely to outweigh those achieved through a full LDM compliant upgrade.

A guidance document has been developed to assist Nelson City Council in implementing future zones. This has been based on the best practice determined from the literature review with the central focus based on the performance objectives previously identified. The document requires significant further refining and is presented in draft format for this project.

The dissertation intended to answer the questions posed as problem statements in the introduction. Through the development of the dissertation it became clear that there were a number of further areas of study that should be undertaken to complement the findings of this research.

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Appendix A – Shared Zone Upgrade Preliminary Design

AIRLIE STREET ROADING UPGRADE SHARED ZONE TREATMENT




LOCALITY PLAN NOT TO SCALE

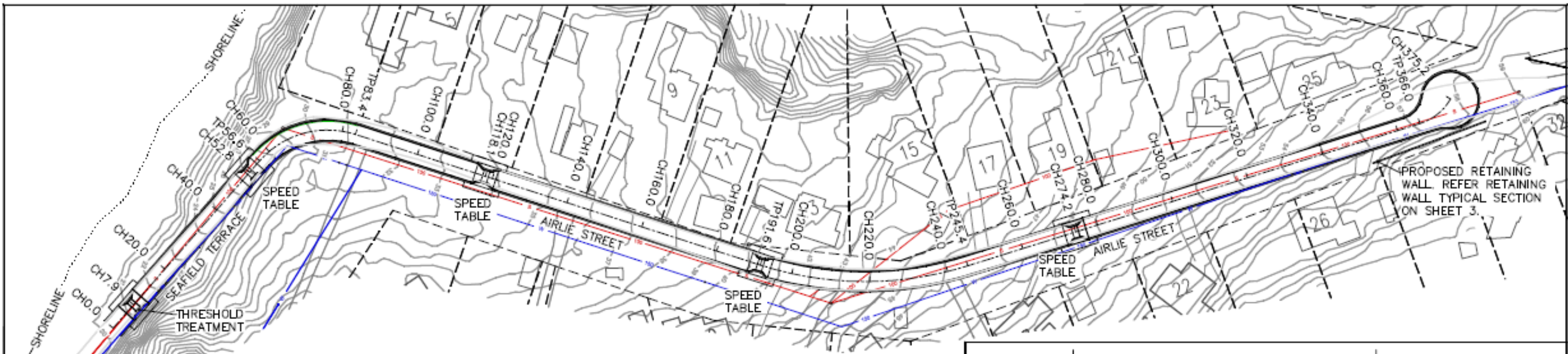


SITE PLAN SCALE 1:1,500

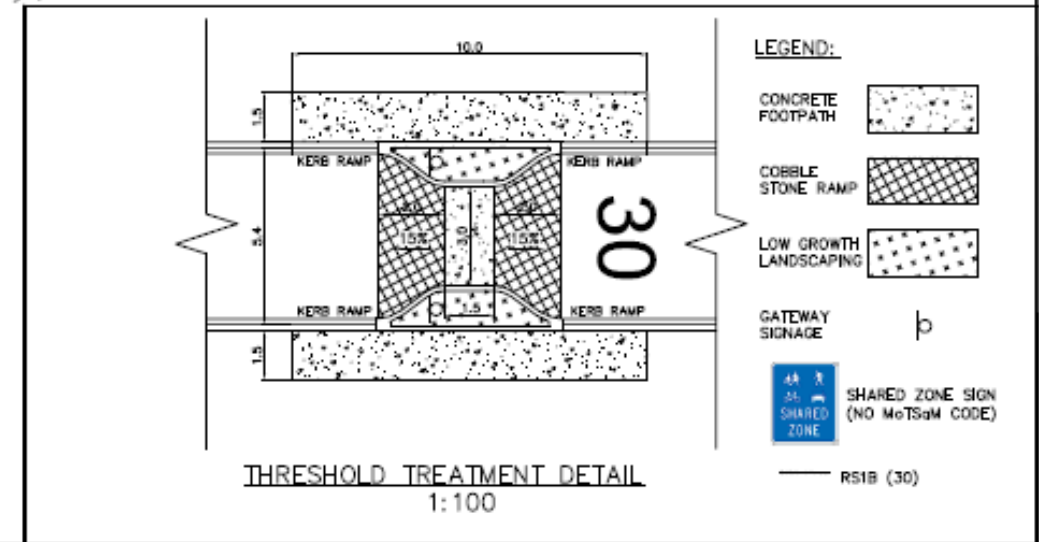
PLANS :

- 01 TITLE SHEET
- 02 LAYOUT PLAN AND LONG SECTION
- 03 TYPICAL CROSS SECTIONS

 Nelson City Council Infrastructure	JOB TITLE AIRLIE STREET SHARED ZONE UPGRADE	 NORTH	SURVEYED: DESIGNED: SWR DRAWN: SWR DATE: 01/06/2016	CHECKED: RECOMMENDED: PRINTED ON: Not Set JOB No:	SCALE SHOWN: FOR: LIT: CONTRACT No:	No. DATE AMENDMENTS 	Dn Ch'd Ap'd 	DIMENSIONS SHALL NOT BE SCALED FROM THIS DRAWING SHEET 1 OF 3 SHEETS PLAN No: NCC-SR-001
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LAYOUT PLAN
1:500



THRESHOLD TREATMENT DETAIL
1:100

Datum: 15mAHd

EXISTING GROUND LEVEL (AHD)	51.28	53.26	54.97	56.69	57.11	57.90
PROPOSED CL LEVEL (AHD)	51.03	52.95	54.68	56.22	56.61	57.35
CUT / FILL	-0.25	-0.31	-0.29	-0.57	-0.50	-0.54
CHAINAGE	300.0	320.0	340.0	360.0	366.0	375.2

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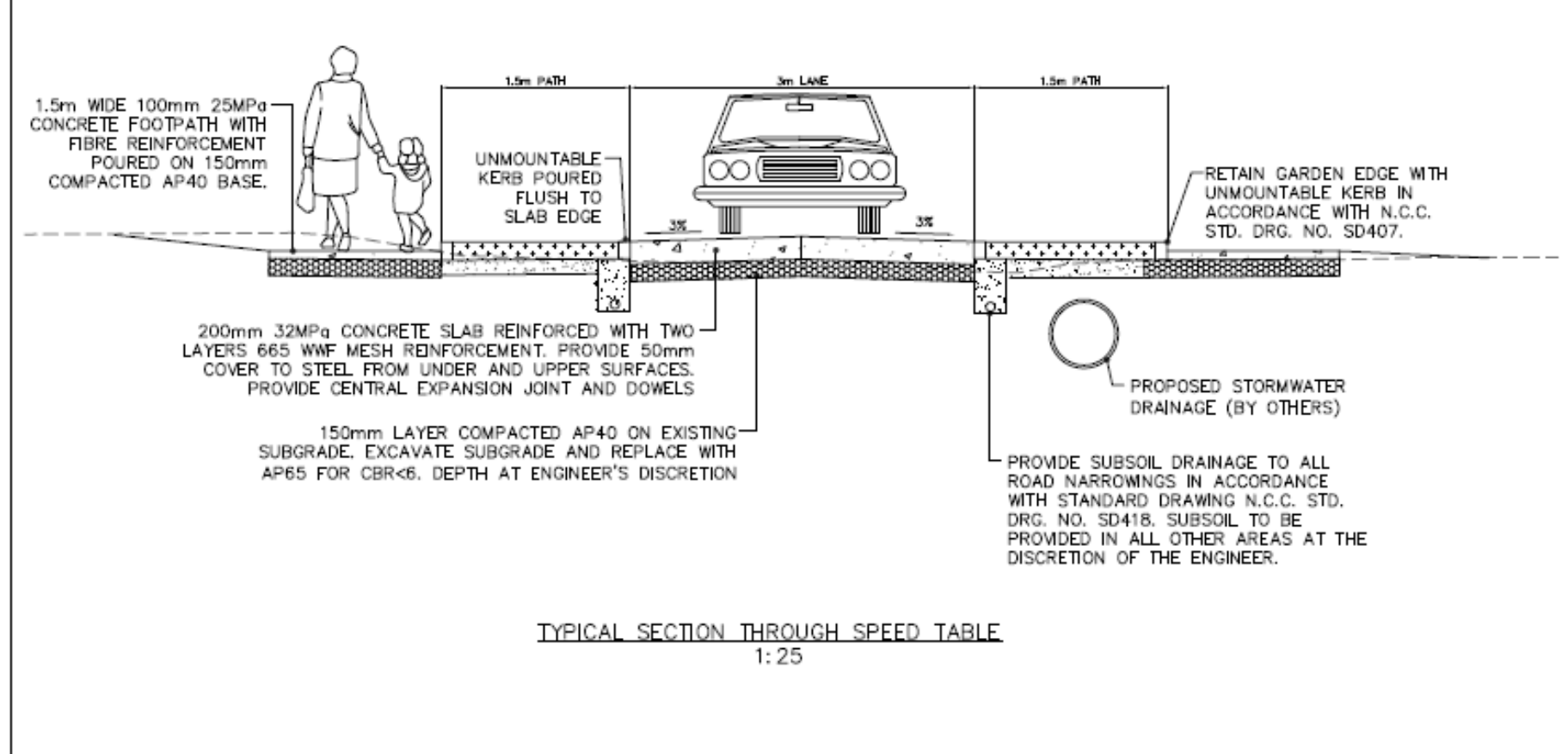
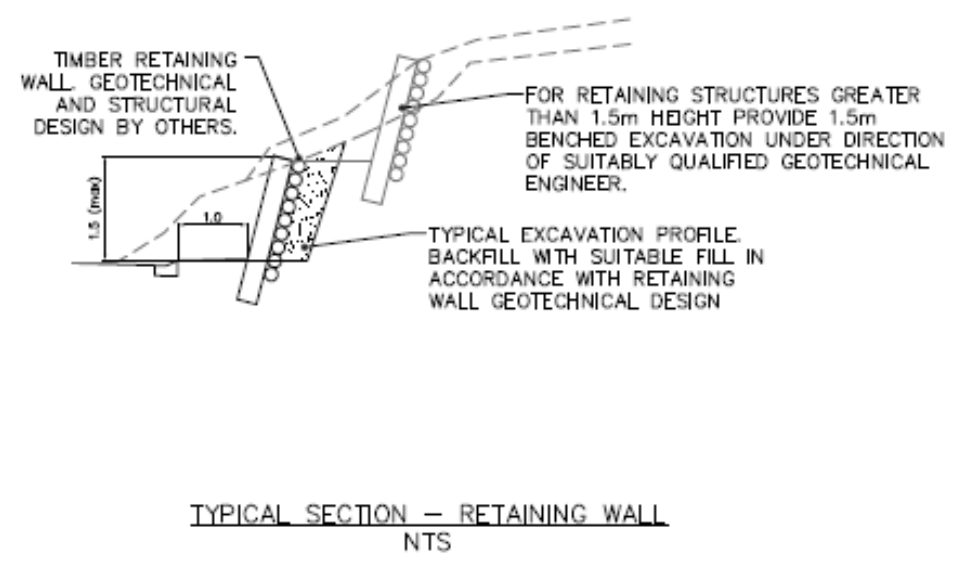
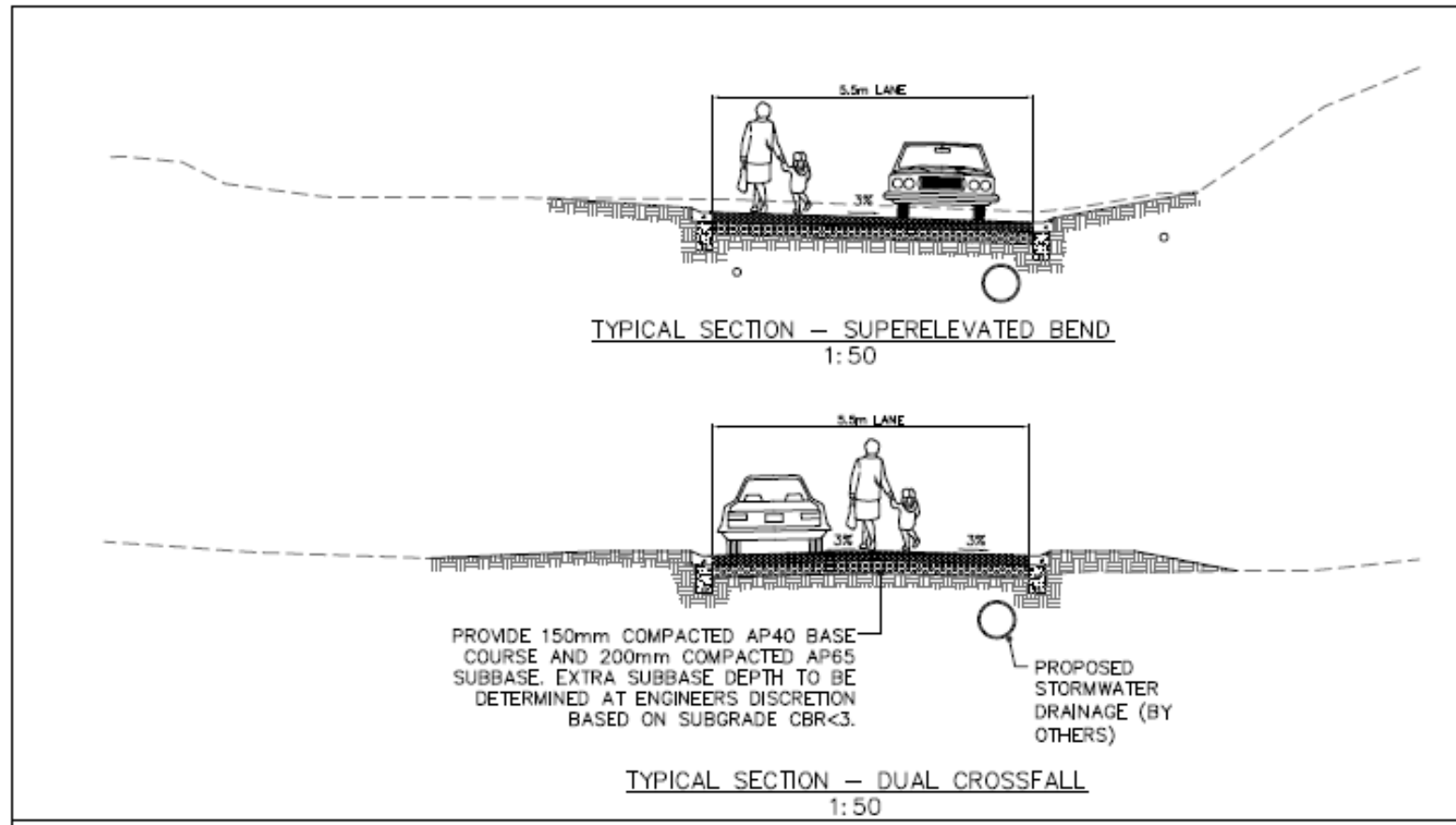
Datum: 15mAHd

EXISTING GROUND LEVEL (AHD)	20.36	22.14	27.11	27.62	27.11	27.62	30.88	31.17	32.57	33.76	33.89	35.42	37.24	39.04	40.41	41.40	44.05	46.07	46.42	47.37	48.54	49.02	51.28
PROPOSED CL LEVEL (AHD)	20.36	22.20	22.67	25.28	27.31	27.62	30.70	30.99	32.46	33.93	34.03	35.74	37.59	39.57	40.82	41.66	44.00	45.90	46.33	47.51	48.75	49.16	51.03
CUT / FILL	0.0	+0.06	+0.04	+0.30	+0.20	+0.08	-0.19	-0.18	-0.11	+0.17	+0.14	+0.32	+0.35	+0.53	+0.41	+0.25	-0.05	-0.17	-0.09	+0.14	+0.21	+0.15	-0.25
CHAINAGE	0.0	7.9	20.0	40.0	52.8	56.6	80.0	83.4	100.0	118.1	120.0	140.0	160.0	180.0	191.6	200.0	220.0	240.0	245.4	260.0	274.2	280.0	300.0

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LONGITUDINAL SECTION
1:500 VERT.
1:500 HORIZ.

<p>INFRASTRUCTURE</p>	<p>JOB TITLE</p> <p>AIRLIE STREET SHARED ZONE UPGRADE</p>	<p>APPROVED</p> <p>GROUP MANAGER INFRASTRUCTURE</p> <p>DATE</p>	<p>SURVEYED</p> <p>DESIGNED: SWR</p> <p>DRAWN: SWR</p> <p>DATE</p>	<p>CHECKED</p> <p>RECOMMENDED:</p> <p>PRINTED ON: Not Set</p> <p>JOB No:</p>	<p>SCALE: As Shown</p> <p>FILE:</p> <p>LINK:</p> <p>CONTRACT No:</p>	<p>No.</p> <p>DATE</p> <p>AMENDMENTS</p> <p>DR</p> <p>CR/D</p> <p>AP/D</p>	<p>MEASUREMENTS SHALL NOT BE SCALED FROM THIS DRAWING</p> <p>SHT 2 OF 3 SHTS</p> <p>PLAN No:</p> <p>NCC-SR-002</p>
	<p>SHEET TITLE</p> <p>LAYOUT PLAN LONGITUDINAL SECTION AND DETAIL PLAN</p>		<p>NORTH</p>	<p>DATE</p>	<p>DATE</p>	<p>DATE</p>	<p>DATE</p>



- NOTES:**
1. ALL SERVICE LIDS AND COVERS TO BE RAISED OR LOWERED TO SUIT NEW ROAD LEVEL.
 2. WHERE SITE CONSTRAINTS REQUIRE THE BERM SPACE REQUIRED IN DESIGN BRIEF MAY BE OMITTED.
 3. ALL DRIVEWAYS ARE TO BE REINSTATED 1m BEYOND DISTURBED SECTION. MATERIAL IS TO MATCH EXISTING DRIVEWAY AS REQUIRED.
 4. ALL SERVICE LATERAL CONNECTIONS ARE DEEMED TO BE AT REASONABLE DEPTH ADJACENT TO ROAD FORMATION BUT SUSCEPTIBLE TO EXTENSIVE CUT INTO BANK. WHERE CUT EXTENDS BEYOND THREE METRES OUTSIDE THE ROAD FORMATION REPLACEMENT LATERALS ARE ASSUMED TO BE NECESSARY.
 5. RETAINING WALLS HAVE BEEN DESIGNED FOR ALIGNMENT ONLY. ASSUMED NECESSARY WHERE CUT OR BATTER SLOPE REQUIRED EXCEEDS 1 IN 2 OR CUT WOULD REQUIRE UNDERCUTTING SLOPE ABOVE TO ACHIEVE THIS GRADE.
 6. STORMWATER UPGRADE IS INCLUDED IN ESTIMATE BUT NOT SHOWN ON DESIGN FOR SIMPLICITY. CATCHMENTS, GRADES AND PIPE SIZING HAVE NOT BEEN DESIGNED.

<p>Nelson City Council Infrastructure</p>	<p>JOB TITLE</p> <p>AIRLIE STREET SHARED ZONE UPGRADE</p>	<p>NORTH</p>	<p>APPROVED</p> <p>GREY WAREHISE INFRASTRUCTURE</p> <p>DATE</p>	<p>SUBMITTED</p> <p>DESIGNED: SWR</p> <p>DRAWN: SWR</p> <p>DATE</p>	<p>CHECKED</p> <p>RECOMMENDED:</p> <p>PRINTED on: Not Set</p> <p>JOB No:</p>	<p>SCALE As Shown</p> <p>FR:</p> <p>LIK:</p> <p>CONTRACT No:</p>	<p>No.</p> <p>DATE</p> <p>AMENDMENTS</p>	<p>DR</p> <p>CR/1</p> <p>AP/1</p>	<p>INDICATED SHALL NOT BE SOLID FROM THIS DRAWING</p> <p>SHT 3 OF 3 SHTS</p> <p>PLAN No:</p> <p>NCC-SR-003</p>
	<p>SHEET TITLE</p> <p>TYPICAL SECTIONS AND CONSTRUCTION NOTES</p>								

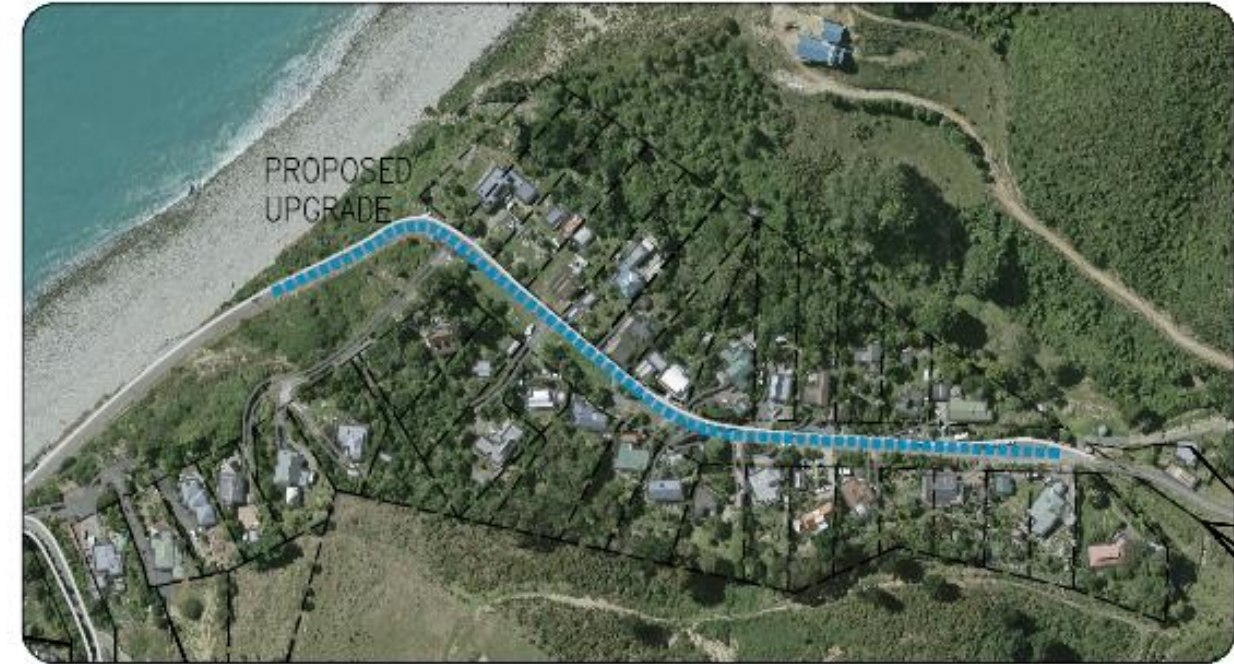
Appendix B – LDM 2010 Upgrade Preliminary Design

AIRLIE STREET ROADING UPGRADE

STANDARD LDM TREATMENT



LOCALITY PLAN NOT TO SCALE

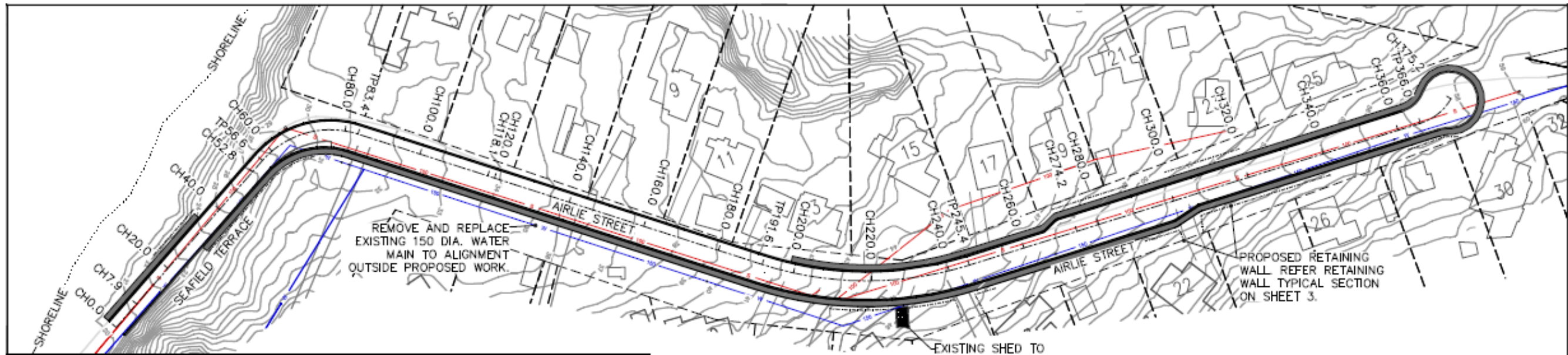


SITE PLAN SCALE 1:1,500

PLANS :

- 01 TITLE SHEET
- 02 LAYOUT PLAN AND LONG SECTION
- 03 TYPICAL CROSS SECTIONS

 Nelson City Council Infrastructure	JOB TITLE	AIRLIE STREET STANDARD COMPLIANT UPGRADE	 NORTH	SURVEYED:	DESIGNED:	SCALE SHOWN:	No.	DATE:	AMENDMENTS	Drn	Ch'd	Ap'd	MEASUREMENTS SHALL NOT BE SCALED FROM THE DRAWING
	SHEET TITLE	COVER PAGE		DESIGNED: SWR	RECOMMENDED:	FR:							
				DRAWN: SWR	PRINTED ON: Not Set	LR:							PLAN No: NCC-SR-001
				DATE: 01/09/2016	JOB No:	CONTRACT No:							



LAYOUT PLAN
1:500

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Datum: 15m AHD

EXISTING GROUND LEVEL (AHD)	300.0	320.0	340.0	360.0	366.0	375.2
PROPOSED CL LEVEL (AHD)	51.03	51.03	52.95	54.68	56.61	57.35
CUT / FILL	-0.25	-0.31	-0.29	-0.57	-0.50	-0.54
CHAINAGE	300.0	320.0	340.0	360.0	366.0	375.2

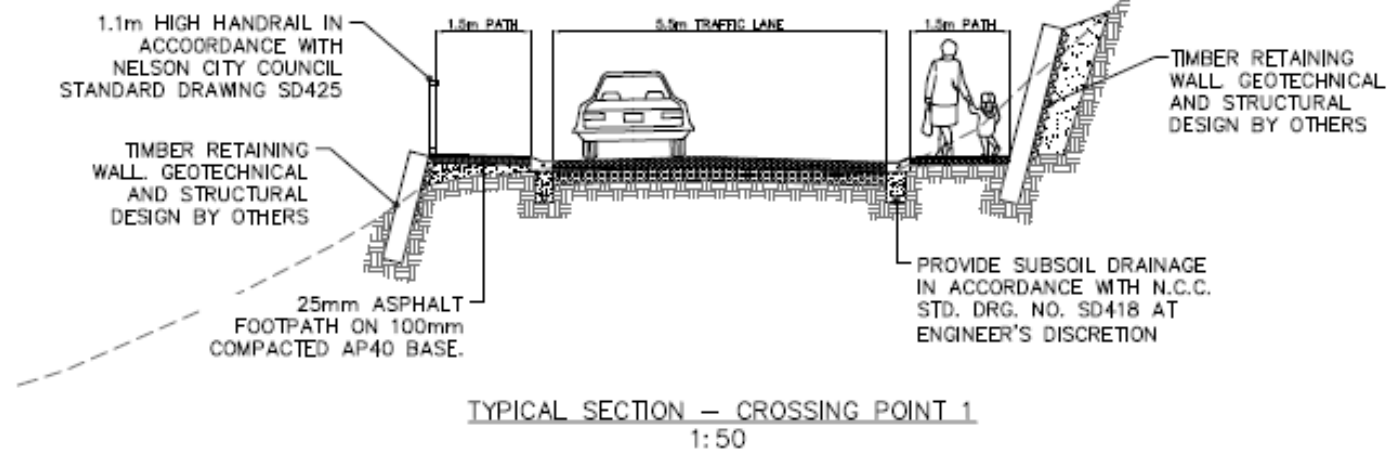
Datum: 15m AHD

EXISTING GROUND LEVEL (AHD)	0.0	7.9	20.0	40.0	52.8	56.6	60.0	80.0	83.4	100.0	118.1	120.0	140.0	160.0	180.0	191.6	200.0	220.0	240.0	245.4	260.0	274.2	280.0	300.0
PROPOSED CL LEVEL (AHD)	20.36	22.20	22.67	25.28	27.31	27.70	28.16	30.70	30.99	32.46	33.93	34.03	35.74	37.59	39.57	40.82	41.66	44.00	45.90	46.33	47.51	48.75	49.16	51.03
CUT / FILL	0.0	+0.06	+0.04	+0.30	+0.20	+0.08	+0.03	-0.19	-0.18	-0.11	+0.17	+0.14	+0.32	+0.35	+0.53	+0.41	+0.25	-0.05	-0.17	-0.09	+0.14	+0.21	+0.15	-0.25
CHAINAGE	0.0	7.9	20.0	40.0	52.8	56.6	60.0	80.0	83.4	100.0	118.1	120.0	140.0	160.0	180.0	191.6	200.0	220.0	240.0	245.4	260.0	274.2	280.0	300.0

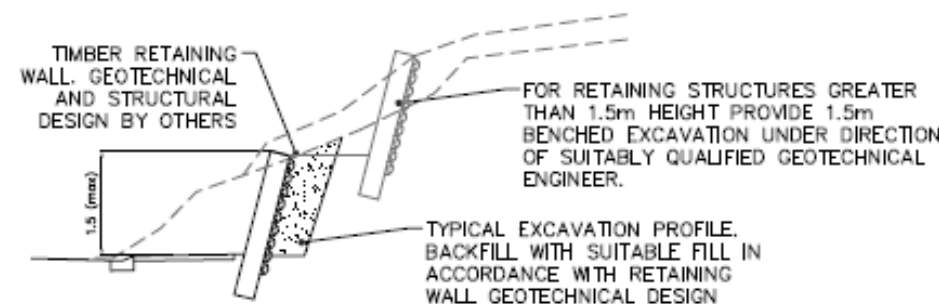
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LONGITUDINAL SECTION
1:500 VERT.
1:500 HORIZ.

<p>Hobson City Council Infrastructure</p>	<p>JOB TITLE AIRLIE STREET STANDARD COMPLIANT UPGRADE</p>	<p>NORTH</p>	<p>APPROVED GROUP MANAGER INFRASTRUCTURE DATE:</p>	<p>SURVEYED: DESIGNED: SWR DRAWN: SWR DATE:</p>	<p>CHECKER: RECOMMENDED: PRINTED ON: Not Set JOB No:</p>	<p>SCALE As Shown FBI: LIC: CONTRACT No:</p>	<p>No. DATE AMENDMENTS</p>	<p>Div. Cr's Ap'd</p>	<p>MEASUREMENTS SHALL NOT BE SCALED FROM THIS DRAWING SHT 2 OF 3 SHTS PLAN No: NCC-SR-002</p>
	<p>SHEET TITLE LAYOUT PLAN AND LONGITUDINAL SECTION</p>								

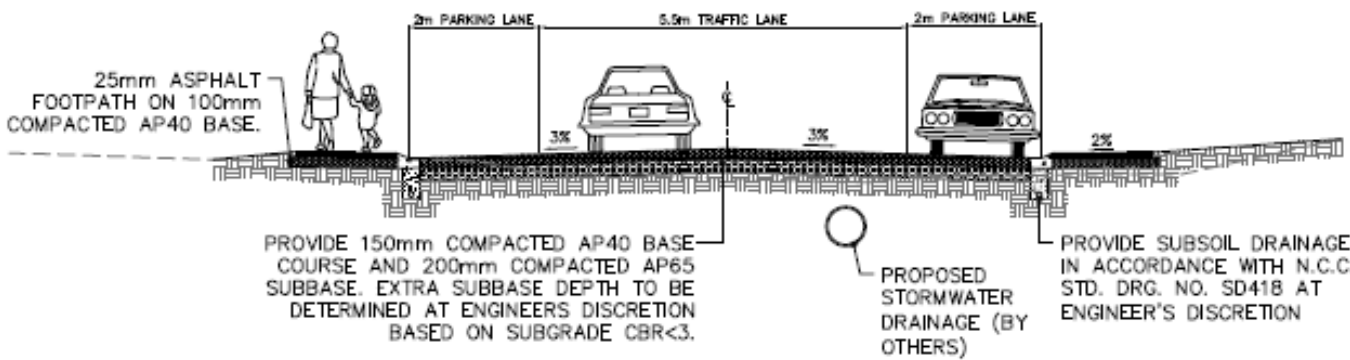


TYPICAL SECTION - CROSSING POINT 1
1:50



TYPICAL SECTION - RETAINING WALL
NTS

- NOTES:**
1. ALL SERVICE LIDS AND COVERS TO BE RAISED OR LOWERED TO SUIT NEW ROAD LEVEL.
 2. WHERE SITE CONSTRAINTS REQUIRE THE BERM SPACE REQUIRED IN DESIGN BRIEF MAY BE OMITTED.
 3. ALL DRIVEWAYS ARE TO BE REINSTATED 1m BEYOND DISTURBED SECTION. MATERIAL IS TO MATCH EXISTING DRIVEWAY AS REQUIRED.
 4. ALL SERVICE LATERAL CONNECTIONS ARE DEEMED TO BE AT REASONABLE DEPTH ADJACENT TO ROAD FORMATION BUT SUSCEPTIBLE TO EXTENSIVE CUT INTO BANK. WHERE CUT EXTENDS BEYOND THREE METRES OUTSIDE THE ROAD FORMATION REPLACEMENT LATERALS ARE ASSUMED TO BE NECESSARY.
 5. RETAINING WALLS HAVE BEEN DESIGNED FOR ALIGNMENT ONLY. ASSUMED NECESSARY WHERE CUT OR BATTER SLOPE REQUIRED EXCEEDS 1 IN 2 OR CUT WOULD REQUIRE UNDERCUTTING SLOPE ABOVE TO ACHIEVE THIS GRADE.
 6. STORMWATER UPGRADE IS INCLUDED IN ESTIMATE BUT NOT SHOWN ON DESIGN FOR SIMPLICITY. CATCHMENTS, GRADES AND PIPE SIZING BY OTHERS.



TYPICAL SECTION - PARKING AND FOOTPATH BOTH SIDES
1:50

 Nelson City Council Infrastructure	JOB TITLE AIRLIE STREET STANDARD COMPLIANT UPGRADE	 NORTH	APPROVED GROUP MANAGER INFRASTRUCTURE DATE:	SURVEYED: DESIGNED: SWR DRAWN: SWR DATE:	CHECKED: RECOMMENDED: PRINTED ON: Not Set JOB No:	SCALE As Shown FILE: LINC: CONTRACT No:	No. DATE AMENDMENTS 	Drawn By: Checked By: Date:	MEMORANDUM SHALL NOT BE SOLD FROM THE DRAWING SHEET 3 OF 3 SHEETS PLAN No: NCC-SR-003
	SHEET TITLE TYPICAL SECTIONS								

Appendix C – Shared Zone Estimate

**SECTION E : SPECIFICATION
SUB SECTION FOUR : SCHEDULES**

Airlie Street Shared Path Upgrade Estimate

PART 1 : SCHEDULE SUMMARY

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

ITEM	DESCRIPTION	Amount
A	PRELIMINARY AND GENERAL	\$ 110,000.00
B	WATERWORKS	\$ 45,675.00
C	DRAINAGE WORKS (STORMWATER)	\$ 228,000.00
D	SEWERAGE	\$ 11,200.00
E	EARTHWORKS	\$ 95,120.00
F	ROADWORKS / CYCLEWAY CONSTRUCTION	\$ 358,000.00
G	ROADMARKING AND SIGNS	\$ 7,000.00
H	MISCELLANEOUS	\$ 68,570.00
J	UNSCHEDULED WORKS	\$ -
	TOTAL THIS TENDER (carried to Form of Tender – Excl. GST)	\$ 923,565.00
	DAY WORKS TOTAL	\$ -
	TOTAL FOR TENDER COMPARISON	\$ 923,565.00

CONTRACTOR: _____

ADDRESS: _____

NAME: _____

SIGNED: _____

The schedule is to be read in accordance with the drawings. All work is to be done in accordance with Nelson City Council standards and/or manufacturers specifications irrespective of whether this is referred to in the schedule or not. Should the contractor be unsure of any item they must contact the Engineer for clarification prior to submission.

The basis of payment reference is to clauses detailed in Section E : "Specification" Sub Section Three "Basis of Measurement and Payment".



PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
A		PRELIMINARY & GENERAL				
1	A1 / A2	TIME RELATED COSTS Allow for all time related costs including operation and maintenance of all facilities on site, supervision, company and head office overhead costs, insurances and all other time related obligations	30	Weeks	1500	45000
2	A1 / A2	FIXED COSTS Allow for all fixed costs including site establishment and disestablishment, moving on to site and removing from site all plant and equipment, construction set out, contractual requirements, accommodation of traffic permits, tidy up site on completion and all other fixed costs	100%	LS	-	65000
		SUB TOTAL CARRIED TO SUMMARY				\$ 110,000.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
B		WATERWORKS				
1	B1	<p>PIPE LAYING</p> <p>Excavate and dispose of excess material, supply, deliver, lay, anchor, bed, test, disinfect, connect and backfill pipeline, fixtures and fittings with imported/approved materials and any inspection potholing required. Rate to include all reinstatement up to finished level as per NCC Standard Drawings SD801, SD802 and SD803, as well as all PMB Bandaging.</p> <p>a) DN150 PN12 PVC pipe</p> <p>i) Exceeding 0m up to 1.5m</p> <p>ii) Exceeding 1.5m up to 2.0m</p> <p>b) DN100 PN12 PVC pipe</p> <p>i) Exceeding 0m up to 1.5m</p> <p>ii) Exceeding 1.5m up to 2.0m</p> <p>c) DN50 PN12.5 PE80 type B pipe</p> <p>i) Exceeding 0m up to 1.5m</p> <p>ii) Exceeding 1.5m up to 2.0m</p> <p>d) DN50 PN15 PVC pipe</p> <p>i) Exceeding 0m up to 1.5m</p> <p>ii) Exceeding 1.5m up to 2.0m</p> <p>e) saw cutting and PMB bandaging</p>	150	m	230	34500
2	B1	<p>SERVICE CONNECTIONS</p> <p>Excavate and dispose of excess material, supply, deliver, lay, bed, test, disinfect, connect and backfill service connections, fixtures and fittings with imported/approved materials. Rate to include all reinstatements up to finished level as per NCC Standard Drawings SD801, SD802 and SD803, as well as PMB Bandaging.</p> <p>a) DN25 PN125 type B pipe as extension of existing water service lateral to new water main or ridermain.</p> <p>i) Exceeding 0m up to 1.5</p> <p>ii) Exceeding 1.5m up to 2.0m</p> <p>b) DN25 PN12.5 PE80 type B pipe to replace existing service connection pipe</p> <p>i) Exceeding 0m up to 1.5m</p> <p>ii) Exceeding 1.5m up to 2.0m</p>	25	m	165	4125

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
3	B2	HYDRANT Supply and construct hydrant in accordance with NCC Standard Detail No SD706. a) 150mm dia b) 100mm dia	2 1	Each Each	1600	1600
12	B1	TEMPORARY WATER MAIN Excavate and dispose of excess material, supply, deliver, lay, anchor, bed, test, disinfect, connect and backfill pipeline, fixtures and fittings with imported/approved material. Rate to include all reinstatement (temporary or otherwise including protection at vehicle crossing points).	150	m	30	4500
13	B3	EXCAVATE UNSUITABLE MATERIAL Excavate below trench subgrade where directed by the Engineer and dispose of unsuitable material.	50.00	m ³	19	950
		SUB TOTAL CARRIED TO SUMMARY				\$ 45,675.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
C		DRAINAGE WORKS (STORMWATER)				
1	C1	<p>PIPE LAYING</p> <p>Excavate trench, and dispose of excavated material, supply, deliver, lay, bed, connect (including all bends junctions, fittings etc) and backfill with imported hardfill material to underside of basecourse. The pipe laying rates are to include the provision of shoring to protect and support existing services when excavating within 2.0m of services. Locate existing services on SW pipe runs confirm invert levels and grades prior to construction. Connections for pipes into other pipes, manholes, sumps or other structures, new or existing, to be allowed for in rate.</p> <p>a) 300 dia RCRRJ Class 2 pipe</p> <p>b) 375 dia RCRRJ Class 2 pipe</p> <p>c) 450 dia RCRRJ Class 2 pipe</p> <p>d) 600 dia RCRRJ Class 2 pipe</p> <p>e) 750 dia RCRRJ Class 2 pipe</p> <p>f) 100 dia lateral extensions (Provisional)</p>				
			40	m	290	11600
			60	m	310	18600
			100	m	330	33000
			50	m	380	19000
			50	m	510	25500
			20	m	180	3600
2	C2	<p>SUMPS</p> <p>a)Excavate, supply, connect and backfill sumps in accordance with Nelson City Council standard details. Rate to include disposal of excavated material and backfilling with imported hardfill material. Locate existing services and confirm invert levels and grades prior to construction.</p> <p>i)Back entry sumps</p> <p>ii)Berm sumps</p> <p>b) Remove existing sumps to waste. To include excavation and backfill and reinstatement to NCC Standards</p> <p>c) Supply, deliver, connect standard toothed connector in accordance with NCC Standard Detail Nos SD508 and SD509. Rate to include removal and replacement of kerb and channel.</p>				
				Each		
				Each		
				Each		
			12	Each	2350	28200
3	C2	<p>MANHOLES</p> <p>Supply, deliver, connect manhole and cover as NCC Standard Detail No SD602.</p>				

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
4	C2	a) 1050 mm dia i) Exceeding 1.5m	4	Each	3500	14000
		b) 1350 mm dia i) Exceeding 0m up to 1.5m	8	Each	4500	36000
		INLET STRUCTURE Supply, deliver and connect intakes (with grills) on ***dia pipes, in accordance with NCC Standard Detail Nos SD503, SD504, SD505 and SD506.		Each		
5	C1	SUBSOIL DRAIN OF SERVICE TRENCH Excavate and dispose of excess material and construct cutoff wall and drain in trench in accordance with NCC Standard Detail No SD614.				
		a) Trench drain with trench barrier b) Provide subsoil drainage to kerb and channel on direction of engineer. (PROVISIONAL)	125 500	m m	20 16	2500 8000
7	C3	SERVICE CONNECTIONS Excavate and dispose of excess material, supply, deliver, lay, bed, connect and backfill service connections, fixtures and fittings with imported/approved materials in accordance with NCC Standard Detail No SD616. Rate to include all reinstatements up to finished level as per NCC Standard Drawings SD801, SD802 and SD803, as well as PMB Bandaging. a) 225mm dia RCRRJ class X pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m b) 100mm dia PVC SN6 pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m	100	m m m m	180	18000
8	C3	EXCAVATE UNSUITABLE MATERIAL BELOW SUBGRADE LEVEL Excavate below subgrade level of trench for pipeline or associated structure where directed by the Engineer and dispose of unsuitable material. (PROVISIONAL)	50	m ³	45	2250
9	C3	IMPORTED HARDFILL MATERIAL Supply, deliver, place and compact approved hardfill below the subgrade level of trench for pipeline or associated structure where directed by the Engineer. (PROVISIONAL)	50	m ³	55	2750

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
10	C3	REMOVAL OF CONCRETE INTAKE STRUCTURE Remove existing Concrete Intake to an approved dumpsite.		Each		
C5.	C3	INVESTIGATIONS Allow for investigations and digging to locate EXISTING SERVICES (power, telephone, water stormwater and sewer) . (PROVISIONAL)	1	LS	5000	5000
		SUBTOTAL CARRIED TO SUMMARY				\$ 228,000.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
D		SEWERAGE				
3	D1	LATERALS (New) Excavate and dispose of excess material, supply, deliver, lay, bed, connect and backfill pipes, fixtures and fittings with imported/ approved material. Rates to include all reinstatement up to finished level as per NCC Standard Drawings SD801, SD802 and SD803, as well as PMB Bandaging. a) DN100 PVC SN6 Pipe i) Exceeding 0m up to 1.5m (PROVISIONAL) ii) Exceeding 1.5m up to 2.0m	40	m m	280	11200
		SUBTOTAL CARRIED TO SUMMARY				\$ 11,200.00

* Tenderer to note requirements of clause 105.7.10

(Contracts writer : This note is only required for sewer renewal contracts)

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
E		EARTHWORKS				
1	E1	CUT TO WASTE a) Excavate to reduced levels, stockpile selected soils for batter filling / landscaping and dispose of excess excavations to the tip site. This item includes stripping topsoil and unsuitable material, removing redundant manholes, culverts, retaining wall, kerbs, chambers, kerb and channel, concrete nibs, etc, not covered under other items.	900	m ³	30	27000
	E3	b) Cut down, dispose of existing shrubs and trees require to construct new formation.	100%	LS	-	4500
2	E1	CUT TO FILL Excavate to reduced levels and reuse excavation material to form batters and landscaping. This item includes excavation down to bottom of sub-base layer and removal of vegetation and trees, shaping and spreading and compacting of fill material. Solid measure.	250	m ³	30	7500
3	E1	HARDFILL Supply, deliver, place and compact approved imported hardfill material.	90	m ³	70	6300
4	E1	BATTER FILL Supply, deliver, place and compact approved selected soil from stockpile to fill batters.	400	m ³	20	8000
5	E3	GRASS SOWING Supply all grass seed and fertiliser, sow topsoil batters with grass seed and maintain	4000	m ²	5.5	22000
6	E1	CUT TO WASTE (EXTRA) Allow to excavate below subgrade level where approved by the Engineer and dispose of unsuitable material. (Provisional)	90	m ³	30	2700
7	E2	GEOFABRIC Supply Bidim A12, Terram 2000, or similar approved fabric and lay to manufacturers specifications to bottom of subbase layer. PROVISIONAL	2780	m ²	4	11120
8	E3	TOPSOIL Supply, deliver and spread topsoil to a consolidated depth of 100mm.	400	m ²	15	6000

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
E		EARTHWORKS				
1	E1	CUT TO WASTE a) Excavate to reduced levels, stockpile selected soils for batter filling / landscaping and dispose of excess excavations to the tip site. This item includes stripping topsoil and unsuitable material, removing redundant manholes, culverts, retaining wall, kerbs, chambers, kerb and channel, concrete nibs, etc, not covered under other items.	900	m ³	30	27000
	E3	b) Cut down, dispose of existing shrubs and trees require to construct new formation.	100%	LS	-	4500
2	E1	CUT TO FILL Excavate to reduced levels and reuse excavation material to form batters and landscaping. This item includes excavation down to bottom of sub-base layer and removal of vegetation and trees, shaping and spreading and compacting of fill material. Solid measure.	250	m ³	30	7500
3	E1	HARDFILL Supply, deliver, place and compact approved imported hardfill material.	90	m ³	70	6300
4	E1	BATTER FILL Supply, deliver, place and compact approved selected soil from stockpile to fill batters.	400	m ³	20	8000
5	E3	GRASS SOWING Supply all grass seed and fertiliser, sow topsoil batters with grass seed and maintain	4000	m ²	5.5	22000
6	E1	CUT TO WASTE (EXTRA) Allow to excavate below subgrade level where approved by the Engineer and dispose of unsuitable material. (Provisional)	90	m ³	30	2700
7	E2	GEOFABRIC Supply Bidim A12, Terram 2000, or similar approved fabric and lay to manufacturers specifications to bottom of subbase layer. PROVISIONAL	2780	m ²	4	11120
8	E3	TOPSOIL Supply, deliver and spread topsoil to a consolidated depth of 100mm.	400	m ²	15	6000

Contract No 9999

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
		SUB TOTAL CARRIED TO SUMMARY				\$ 95,120.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
F		ROAD CONSTRUCTION				
1	F1	KERB AND CHANNEL Supply, deliver and construct standard mountable kerb on minimum 50mm AP 20 basecourse and channelling (excluding residential and pram crossings) as per NCC Standard Detail No SD407. Cut to waste scheduled separately (E1).	800	m	75	60000
2	F5	Supply, deliver and construct standard unmountable kerb on minimum 50mm AP20 basecourse. Hand Poured. PRAM CROSSINGS Supply, deliver and construct pram crossings complete as per NCC Standards No SD408.	0	m	110	0
			10	Each	200	2000
4	F7	FOOTPATH CONCRETE a) Construct minimum 25mm asphaltic footpaths on 150mm compacted AP40 basecourse as shown on NCC plans. Weed killer and tack coat to be applied.	825	m ²	51	42075
		b) Supply, deliver, place and compact AP65 sub-base ready for basecourse (solid measure)	83	m ³	65	5395
	F7	c) 100 x 25mm timber edges and 50 x 50mm pegs	1000	m	15	15000
6	F3	CARRIAGEWAY (CONSTRUCTION) a) Supply, deliver, place and compact AP40 basecourse, average 200mm thick ready for sealing, (solid measure).	556	m ³	105	58380
	F3	b) Supply, deliver, place and compact AP65 sub-base ready for basecourse (solid measure).	420	m ³	95	39900
7		CARRIAGEWAY (SEAL) a) Prepare for, supply and construct a two coat Grade 3/5 chipseal on the completed basecourse. Rate to include removal and disposal of excess chip from site.	2780	m ²	15	41700
8	F6	GRASS BERMS Utilise existing topsoil, place and supply new topsoil, deliver, seed and fertiliser, construct, sow and maintain grass berms where disturbed during the course of the Contract. Allow to supply all topsoil to a consolidated depth of 100mm. Compliance criteria set out in Technical Specification.	720	m ²	10	7200

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
9	H1	RETAINING STRUCTURE Supply, deliver and construct retaining structure (including handrail) as shown on NCC plan inclusive of all costs.	100%	LS	55000	55000
10	E1	EXCAVATE UNSUITABLE MATERIAL Excavate below subgrade level of pavement construction where directed by Engineer and dispose of unsuitable material to an approved dumpsite.	70	m ³	30	2100
	F2	DRIVEWAY REINSTATEMENT				
	F2	Supply construct and reinstate driveways to match into existing road surface.				
	F2	a) 150mm depth AP40 basecourse	250	m ²	94	23500
14	F2	f) M10 asphalt 20mm thick including tack coat on grade 5 chip seal.	250	m ²	23	5750
		SUB TOTAL CARRIED TO SUMMARY				\$ 358,000.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
G		ROADMARKING AND SIGNAGE WORKS				
1	G1	SIGNS (NEW) Supply and erect posts, rate to include fixing signs and white plastic or galvanised pressed caps for poles. All Signs	100%	LS	2000	2000
3	G1	ROADMARKING Allow for all "Give Way", centreline, no-stopping, limit and continuity, hatched, converging-diverging and road hump marking shown on the plans.	100%	LS	5000	5000
		SUB TOTAL CARRIED TO SUMMARY				7000

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
H		MISCELLANEOUS				
1	H3	SERVICE LIDS a) Rise /lower sanitary sewer and stormwater manhole lids to new finished levels.	4	Each	885	3540
	H3	b) Raise/lower services lids, boxes for valves, hydrants, and survey standard lids to new finished levels.	6	Each	450	2700
2	H3	TELECOM a) Adjust large Telecom MH Tops to fit new square lids supplied by Telecom to match finished levels.	3	Each	885	2655
	H3	b) Allow to work adjacent to Telecom services and liaise / co-operate with Telecom staff (supervision required when working adjacent to new fibre optic cables). (PROVISIONAL)	100%	LS	7500	7500
13	H3	IRON WORK MARKING Marking of all fire hydrants, hose points and valves as per Nelson City Council standards.	7	Each	25	175
	H4	Demolish and remove existing shed structure including fees to tip asbestos containing material.	100%	LS	17000	17000
		Construct new shed within private property as agreed with property owner or provide compensation for same	100%	LS	35000	35000
		SUBTOTAL CARRIED TO SUMMARY				68570

Appendix D – Standard Compliant Estimate

**SECTION E : SPECIFICATION
SUB SECTION FOUR : SCHEDULES**

Airlie Street Shared Path Upgrade Estimate

PART 1 : SCHEDULE SUMMARY

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

ITEM	DESCRIPTION	Amount
A	PRELIMINARY AND GENERAL	\$ 91,000.00
B	WATERWORKS	\$ 18,825.00
C	DRAINAGE WORKS (STORMWATER)	\$ 228,000.00
D	SEWERAGE	\$ 11,200.00
E	EARTHWORKS	\$ 68,270.00
F	ROADWORKS / CYCLEWAY CONSTRUCTION	\$ 240,750.00
G	ROADMARKING AND SIGNS	\$ 5,500.00
H	MISCELLANEOUS	\$ 7,335.00
J	UNSCHEDULED WORKS	\$ -
	TOTAL THIS TENDER (carried to Form of Tender – Excl. GST)	\$ 670,880.00
	DAY WORKS TOTAL	\$ -
	TOTAL FOR TENDER COMPARISON	\$ 670,880.00

CONTRACTOR: _____

ADDRESS: _____

NAME: _____

SIGNED: _____

The schedule is to be read in accordance with the drawings. All work is to be done in accordance with Nelson City Council standards and/or manufacturers specifications irrespective of whether this is referred to in the schedule or not. Should the contractor be unsure of any item they must contact the Engineer for clarification prior to submission.

The basis of payment reference is to clauses detailed in Section E : "Specification" Sub Section Three "Basis of Measurement and Payment".



PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
A		PRELIMINARY & GENERAL				
1	A1 / A2	TIME RELATED COSTS Allow for all time related costs including operation and maintenance of all facilities on site, supervision, company and head office overhead costs, insurances and all other time related obligations	24	Weeks	1500	36000
2	A1 / A2	FIXED COSTS Allow for all fixed costs including site establishment and disestablishment, moving on to site and removing from site all plant and equipment, construction set out, contractual requirements, accommodation of traffic permits, tidy up site on completion and all other fixed costs	100%	LS	-	55000
		SUB TOTAL CARRIED TO SUMMARY				\$ 91,000.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
B		WATERWORKS				
1	B1	<p>PIPE LAYING Excavate and dispose of excess material, supply, deliver, lay, anchor, bed, test, disinfect, connect and backfill pipeline, fixtures and fittings with imported/approved materials and any inspection potholing required. Rate to include all reinstatement up to finished level as per NCC Standard Drawings SD801, SD802 and SD803, as well as all PMB Bandaging.</p> <p>a) DN150 PN12 PVC pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m b) DN100 PN12 PVC pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m c) DN50 PN12.5 PE80 type B pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m d) DN50 PN15 PVC pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m e) saw cutting and PMB bandaging</p>	50	m m m m m m m	230	11500
2	B1	<p>SERVICE CONNECTIONS Excavate and dispose of excess material, supply, deliver, lay, bed, test, disinfect, connect and backfill service connections, fixtures and fittings with imported/approved materials. Rate to include all reinstatements up to finished level as per NCC Standard Drawings SD801, SD802 and SD803, as well as PMB Bandaging.</p> <p>a) DN25 PN125 type B pipe as extension of existing water service lateral to new water main or ridermain. i) Exceeding 0m up to 1.5 ii) Exceeding 1.5m up to 2.0m b) DN25 PN12.5 PE80 type B pipe to replace existing service connection pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m</p>	25	m m m m	165	4125

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
3	B2	HYDRANT Supply and construct hydrant in accordance with NCC Standard Detail No SD706. a) 150mm dia b) 100mm dia	2	Each Each	1600	3200
		SUB TOTAL CARRIED TO SUMMARY				\$ 18,825.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
C		DRAINAGE WORKS (STORMWATER)				
1	C1	PIPE LAYING Excavate trench, and dispose of excavated material, supply, deliver, lay, bed, connect (including all bends junctions, fittings etc) and backfill with imported hardfill material to underside of basecourse. The pipe laying rates are to include the provision of shoring to protect and support existing services when excavating within 2.0m of services. Locate existing services on SW pipe runs confirm invert levels and grades prior to construction. Connections for pipes into other pipes, manholes, sumps or other structures, new or existing, to be allowed for in rate. a) 300 dia RCRRJ Class 2 pipe b) 375 dia RCRRJ Class 2 pipe c) 450 dia RCRRJ Class 2 pipe d) 600 dia RCRRJ Class 2 pipe e) 750 dia RCRRJ Class 2 pipe f) 100 dia lateral extensions (Provisional)				
			40	m	290	11600
			60	m	310	18600
			100	m	330	33000
			50	m	380	19000
			50	m	510	25500
			20	m	180	3600
2	C2	SUMPS a)Excavate, supply, connect and backfill sumps in accordance with Nelson City Council standard details. Rate to include disposal of excavated material and backfilling with imported hardfill material. Locate existing services and confirm invert levels and grades prior to construction. i)Back entry sumps ii)Berm sumps b) Remove existing sumps to waste. To include excavation and backfill and reinstatement to NCC Standards c) Supply, deliver, connect standard toothed connector in accordance with NCC Standard Detail Nos SD508 and SD509. Rate to include removal and replacement of kerb and channel.				
				Each		
				Each		
				Each		
			12	Each	2350	28200
3	C2	MANHOLES Supply, deliver, connect manhole and cover as NCC Standard Detail No SD602.				

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
4	C2	a) 1050 mm dia i) Exceeding 1.5m	4	Each	3500	14000
		b) 1350 mm dia i) Exceeding 0m up to 1.5m	8	Each	4500	36000
		INLET STRUCTURE Supply, deliver and connect intakes (with grills) on ***dia pipes, in accordance with NCC Standard Detail Nos SD503, SD504, SD505 and SD506.		Each		
5	C1	SUBSOIL DRAIN OF SERVICE TRENCH Excavate and dispose of excess material and construct cutoff wall and drain in trench in accordance with NCC Standard Detail No SD614.				
		a) Trench drain with trench barrier b) Provide subsoil drainage to kerb and channel on direction of engineer. (PROVISIONAL)	125 500	m m	20 16	2500 8000
7	C3	SERVICE CONNECTIONS Excavate and dispose of excess material, supply, deliver, lay, bed, connect and backfill service connections, fixtures and fittings with imported/approved materials in accordance with NCC Standard Detail No SD616. Rate to include all reinstatements up to finished level as per NCC Standard Drawings SD801, SD802 and SD803, as well as PMB Bandaging. a) 225mm dia RCRRJ class X pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m b) 100mm dia PVC SN6 pipe i) Exceeding 0m up to 1.5m ii) Exceeding 1.5m up to 2.0m	100	m m m m	180	18000
8	C3	EXCAVATE UNSUITABLE MATERIAL BELOW SUBGRADE LEVEL Excavate below subgrade level of trench for pipeline or associated structure where directed by the Engineer and dispose of unsuitable material. (PROVISIONAL)	50	m ³	45	2250
9	C3	IMPORTED HARDFILL MATERIAL Supply, deliver, place and compact approved hardfill below the subgrade level of trench for pipeline or associated structure where directed by the Engineer. (PROVISIONAL)	50	m ³	55	2750

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
10	C3	REMOVAL OF CONCRETE INTAKE STRUCTURE Remove existing Concrete Intake to an approved dumpsite.		Each		
C5.	C3	INVESTIGATIONS Allow for investigations and digging to locate EXISTING SERVICES (power, telephone, water stormwater and sewer) . (PROVISIONAL)	1	LS	5000	5000
12	C3	BOX CULVERT Saw Cut edge of existing surface, excavate and dispose of excess material, supply, deliver, lay, bed, connect, lay blinding concrete, and backfill with imported/approved material (including 400mm free draining material against culvert walls).				
		a) 2.0m x 1.8m Reinforced Concrete Box Culvert		m		
		SUBTOTAL CARRIED TO SUMMARY				\$ 228,000.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
D		SEWERAGE				
3	D1	LATERALS (New) Excavate and dispose of excess material, supply, deliver, lay, bed, connect and backfill pipes, fixtures and fittings with imported/ approved material. Rates to include all reinstatement up to finished level as per NCC Standard Drawings SD801, SD802 and SD803, as well as PMB Bandaging. a) DN100 PVC SN6 Pipe i) Exceeding 0m up to 1.5m (PROVISIONAL) ii) Exceeding 1.5m up to 2.0m	40	m	280	11200
		SUBTOTAL CARRIED TO SUMMARY				\$ 11,200.00

*** Tenderer to note requirements of clause 105.7.10**

(Contracts writer : This note is only required for sewer renewal contracts)

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
E		EARTHWORKS				
1	E1	CUT TO WASTE a) Excavate to reduced levels, stockpile selected soils for batter filling / landscaping and dispose of excess excavations to the tip site. This item includes stripping topsoil and unsuitable material, removing redundant manholes, culverts, retaining wall, kerbs, chambers, kerb and channel, concrete nibs, etc, not covered under other items.	675	m ³	30	20250
	E3	b) Cut down, dispose of existing shrubs and trees require to construct new formation.	100%	LS	-	
2	E1	CUT TO FILL Excavate to reduced levels and reuse excavation material to form batters and landscaping. This item includes excavation down to bottom of sub-base layer and removal of vegetation and trees, shaping and spreading and compacting of fill material. Solid measure.	41	m ³	30	1230
3	E1	HARDFILL Supply, deliver, place and compact approved imported hardfill material.	41	m ³	70	2870
4	E1	BATTER FILL Supply, deliver, place and compact approved selected soil from stockpile to fill batters.	250	m ³	20	5000
5	E3	GRASS SOWING Supply all grass seed and fertiliser, sow topsoil batters with grass seed and maintain	4000	m ²	5.5	22000
6	E1	CUT TO WASTE (EXTRA) Allow to excavate below subgrade level where approved by the Engineer and dispose of unsuitable material. (Provisional)	60	m ³	30	1800
7	E2	GEOFABRIC Supply Bidim A12, Terram 2000, or similar approved fabric and lay to manufacturers specifications to bottom of subbase layer. PROVISIONAL	2280	m ²	4	9120
8	E3	TOPSOIL Supply, deliver and spread topsoil to a consolidated depth of 100mm.	400	m ²	15	6000

Contract No 9999

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
		SUB TOTAL CARRIED TO SUMMARY				\$ 68,270.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
F		ROAD CONSTRUCTION				
1	F1	KERB AND CHANNEL Supply, deliver and construct standard mountable kerb on minimum 50mm AP 20 basecourse and channelling (excluding residential and pram crossings) as per NCC Standard Detail No SD407. Cut to waste scheduled separately (E1).	800	m	75	60000
2	F5	Supply, deliver and construct standard unmountable kerb on minimum 50mm AP20 basecourse. Hand Poured. PRAM CROSSINGS Supply, deliver and construct pram crossings complete as per NCC Standards No SD408.	186	m	110	20460
			20	Each	200	4000
4	F7	FOOTPATH CONCRETE f) 100mm thick 25MPA Concrete footpath on 100mm compacted AP40 basecourse as shown on NCC plans.	150	m ²	81	12150
6	F3	CARRIAGEWAY (CONSTRUCTION) a) Supply, deliver, place and compact AP40 basecourse, average 200mm thick ready for sealing, (solid measure).	320	m ³	105	33600
7	F3	b) Supply, deliver, place and compact AP65 sub-base ready for basecourse (solid measure). CARRIAGEWAY (SEAL)	400	m ³	95	38000
8	F6	a) Prepare for, supply and construct a two coat Grade 3/5 chipseal on the completed basecourse. Rate to include removal and disposal of excess chip from site. GRASS BERMS Utilise existing topsoil, place and supply new topsoil, deliver, seed and fertiliser, construct, sow and maintain grass berms where disturbed during the course of the Contract. Allow to supply all topsoil to a consolidated depth of 100mm. Compliance criteria set out in Technical Specification.	1860	m ²	15	27900
			720	m ²	10	7200
9	H1	RETAINING STRUCTURE Supply, deliver and construct retaining structure (including handrail) as shown on NCC plan inclusive of all costs.	100%	LS	7000	7000
10		EXCAVATE UNSUITABLE MATERIAL				

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
	E1	Excavate below subgrade level of pavement construction where directed by Engineer and dispose of unsuitable material to an approved dumpsite.	70	m ³	30	2100
12		SPEED TABLES				
	F4	a) Supply, deliver, reshape and compact AP40 basecourse, minimum 150mm thick ready for concrete (solid measure)	75	m ²	30	2250
		c) Supply all materials and construct 200mm thick N30 raised table and ramps with 665 WWF centrally laid. Table to have exposed aggregate finish. Price to include formwork.	75	m ²	94	7050
	F2	SAWCUTTING	120		25	3000
	F2	Saw cut edge of existing seal to give a neat and true edge to receive new seal.				
	F2	DRIVEWAY REINSTATEMENT				
	F2	Supply construct and reinstate driveways to match into existing road surface.				
	F2	a) 150mm depth AP40 basecourse	120	m ²	94	11280
	F2	e) 100mm x 25 timber edges and 50 x 50 pegs	80	m	25	2000
14	F2	f) M10 asphalt 20mm thick including tack coat on grade 5 chip seal.	120	m ²	23	2760
		SUB TOTAL CARRIED TO SUMMARY				\$ 240,750.00

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
G		ROADMARKING AND SIGNAGE WORKS				
1	G1	SIGNS (NEW) Supply and erect posts, rate to include fixing signs and white plastic or galvanised pressed caps for poles. All Signs	100%	LS	3000	3000
3	G1	ROADMARKING Allow for all "Give Way", centreline, no-stopping, limit and continuity, hatched, converging-diverging and road hump marking shown on the plans.	100%	LS	2500	2500
		SUB TOTAL CARRIED TO SUMMARY				5500

PART 2 : SCHEDULE OF PRICES (CONTD)

(Rates and Prices in accordance with the Goods and Services Tax Act and shall exclude GST)

Item	Basis of payment	Description	Qty	Unit	Rate	Amount
H		MISCELLANEOUS				
1	H3	SERVICE LIDS a) Rise /lower sanitary sewer and stormwater manhole lids to new finished levels.	1	Each	885	885
	H3	b) Raise/lower services lids, boxes for valves, hydrants, and survey standard lids to new finished levels.	3	Each	450	1350
2	H3	TELECOM a) Adjust large Telecom MH Tops to fit new square lids supplied by Telecom to match finished levels.		Each		
	H3	b) Allow to work adjacent to Telecom services and liaise / co-operate with Telecom staff (supervision required when working adjacent to new fibre optic cables). (PROVISIONAL)	100%	LS	5000	5000
13	H3	IRON WORK MARKING Marking of all fire hydrants, hose points and valves as per Nelson City Council standards.	4	Each	25	100
		SUBTOTAL CARRIED TO SUMMARY				7335

Appendix E – Net Present Value Analysis

SP1 Road Renewals

Spreadsheet v 3 (01-Jan-2016)

Worksheet 1 – Evaluation summary

Worksheet 1 provides a summary of the general data used for the evaluation as well as the results of the analysis. The information required is a subset of the information required for assessment in terms of the NZ Transport Agency's Planning and Investment Knowledge Base.

1	Evaluator(s)	Stephen Russell	
	Reviewer(s)		
2	Activity/package details		
	Approved organisation name	Nelson City Council	
	Activity/package name	Na	
	Your reference	Airlie Street Shared Zone Upgrade	
	Activity description	Upgrade of Airlie Street to a shared zone with 30km/h speed limit and design features provided to achieve this speed.	
	Describe the issues to be addressed	Narrow road reserve, rough road surface due to repeated pavement repairs, steep longitudinal grade.	
3	Location		
	Brief description of location	Airlie Street Glenduan. From Seafeld Terrace to culdesac	
4	Alternatives and options		
	Describe the existing maintenance strategy (do-minimum)	Continue undertaking reactive maintenance, repairing slips and pavement repair as well as damage caused through under capacity stormwater drainage system.	
	Summarise the options assessed	Provide Upgrade in accordance with Shared Zone Principles or undertake upgrade in accordance with LDM 2010.	
5	Timing		
	Time zero (assumed construction start date)	1 July	2017
	Expected duration of construction (months)		5
6	Economic efficiency		
	Date economic evaluation completed (mm/yyyy)		10-2016
	Base date for costs and benefits	1 July	2016
	AADT at time zero		542
	Traffic growth rate at time zero (%)		2.00
	PV cost of existing maintenance strategy (do-minimum)	\$	954,357 A
	PV cost of preferred option	\$	806,218 B
7	Present value cost saving	(A - B) = \$	148,139
	Note: The preferred option is justified if the PV cost saving is positive.		

SP1 Road Renewals

Spreadsheet v 3 (01-Jan-2016)

Worksheet 2 – Cost of existing maintenance strategy

1 Historic maintenance cost data (indicate whether assessed or actual)

Maintenance costs for the site over the last three years

Year 1	2014	\$	15,000
Year 2	2015	\$	15,000
Year 3	2016	\$	15,000
Maintenance costs for the site this year	2017	\$	20,000
Assessed future maintenance costs		\$	550,000

2 PV of annual maintenance costs (year 1 to 40 inclusive)

$$\text{Total} = \$ 45,000 \times 15.49 = \$ 697,050 \quad (\mathbf{a})$$

3 PV of periodic maintenance costs

Time zero

1st July in the year 2017/18

Year	Type of maintenance	Amount \$	SPPWF	Present value
5	Reseal	25,000	0.75	18,681
10	Major Pavement Repairs	75,000	0.56	41,880
17	Reseal	25,000	0.37	9,284
20	Major Pavement Rehabilitation (Stab.)	375,000	0.31	116,927
29	Reseal	25,000	0.18	4,614
30	Moderate Pavement Repairs	25,000	0.17	4,353
40	Reseal	25,000	0.10	2,431
15	Slope Stability Maintenance	100,000	0.42	41,727
30	Slope Stability Maintenance	100,000	0.17	17,411

$$\text{Sum of PV of periodic maintenance costs } \$ 257,307 \quad (\mathbf{b})$$

4 PV cost of existing maintenance strategy

$$(\mathbf{a}) + (\mathbf{b}) = \$ 954,357 \quad \mathbf{A}$$

Transfer the PV cost of the existing maintenance strategy **A**, to **A** in worksheet 1.

SP1 Road Renewals

Spreadsheet v 3 (01-Jan-2016)

Worksheet 3 - Cost of the option(s)

Worksheet 3 is for calculating the PV costs of the proposed option. Cost items to include are: investigation, design, construction, annual maintenance, periodic maintenance (eg, resealing).

Name the option being considered		Shared Zone Treatment Upgrade		
1 PV of estimated cost (as per attached estimate sheets)				
	\$	674,000	x	0.94 = \$ 633,560 (a)
2 PV of annual maintenance in year 1 (enter actual dollar amount) = \$ 2,500 (b)				
3 PV of annual maintenance and inspection costs following completion of works (year 2 to 40 inclusive)				
	\$	10,000	x	14.52 = \$ 145,200 (c)
4 PV of periodic maintenance costs (including second coat seal if appropriate)				
Time zero		1st July in the year		2016/17
Year	Type of maintenance	Amount \$	SPPWF	Present Value
16	Reseal	25,000	0.39	9,841
28	Reseal	25,000	0.20	4,891
40	Reseal	25,000	0.10	2,431
20	Moderate Pavement Repairs	25,000	0.31	7,795
Sum of PV of periodic maintenance costs \$				24,958 (d)
5 PV of total costs of option				
				(a) + (b) + (c) + (d) = \$ 806,218 B
Transfer PV of total costs for the preferred option B, to B on worksheet 1				

SP1 Road Renewals

Spreadsheet v 3 (01-Jan-2016)

Worksheet 3 - Cost of the option(s)

Worksheet 3 is for calculating the PV costs of the proposed option. Cost items to include are: investigation, design, construction, annual maintenance, periodic maintenance (eg, resealing).

Name the option being considered		Full LDM Compliant Upgrade		
1 PV of estimated cost (as per attached estimate sheets)				
	\$	974,000	x 0.94 = \$	915,560 (a)
2 PV of annual maintenance in year 1 (enter actual dollar amount) = \$ 2,500 (b)				
3 PV of annual maintenance and inspection costs following completion of works (year 2 to 40 inclusive)				
	\$	15,000	x 14.52 = \$	217,800 (c)
4 PV of periodic maintenance costs (including second coat seal if appropriate)				
Time zero		1st July in the year		2016/17
Year	Type of maintenance	Amount \$	SPPWF	Present Value
12	Reseal	35,000	0.50	17,394
24	Reseal	35,000	0.25	8,644
40	Reseal	35,000	0.10	3,403
20	Moderate Pavement Repairs	35,000	0.31	10,913
Sum of PV of periodic maintenance costs \$				40,354 (d)
5 PV of total costs of option				
				(a) + (b) + (c) + (d) = \$ 1,176,214 B
Transfer PV of total costs for the preferred option B, to B on worksheet 1				

Appendix F – Nelson City Council Shared Zone Guidance

Shared Zone use and Assessment Guidelines

Nelson City Council

DRAFT

Introduction

The purpose of this document is to provide a tool for Nelson City Council officers to assess whether a shared zone treatment is a suitable option and to provide guidance on the techniques and features that make for a successful shared zone.

It is intended that the guidance document provides a guide rather than prescriptive design standards. Each potential site will vary in the way in which it performs and should be assessed on an individual basis using the parameters within this document.

Objectives

The objectives of shared zone use should reflect the outcomes identified as part of the Nelson 2060 plan, The Nelson City Council Transport activity management plan and the outcomes of the current Nelson City Council long term plan.

Typically the requirements of these documents can be met by achieving all of the following objectives when implementing a shared zone.

- Provide a safe space for residents, pedestrians, cyclists and motor vehicles, with priority given to pedestrians;
- The space is safely navigable through negotiation between road users;
- Creates a space that is appealing and retains or improves the character of the area;
- Provides a level of economic benefit to adjacent properties;
- Encourages the use of active modes of transport;
- Provides a sense of placemaking;
- Road users understand what is required of them within the space and actively demonstrate this behaviour;
- 85th percentile speed within 5km/h of the desired 30km/h speed limit is achieved or bettered.

This list is by no means exhaustive and the user should reference current strategies, guidelines and legislation specific to the implementation of a residential shared zone.

Features

The features within a Nelson City Council shared zone should aim to achieve or enhance the objectives of the spaces. Design of the zones should take into consideration all of the following, however the designer should not consider this an exhaustive list of options.

The road site chosen should be assessed on the particular merits it presents and treatments outside of those within this document are acceptable as long as they contribute to the overall objectives of the zone.

Design Speed

The speed within the zones should be as low as practicably achievable to improve pedestrian and cyclist safety. The highest speed within the zone should be within 5km/h of the posted speed limit of 30km/h.

This design speed should be achieved through the combination of methods appropriate to the candidate site including:

- Calming Devices
- Road width narrowing
- Limitation of forward visibility
- Provision of on street parking
- Changes in vertical and horizontal alignments

Threshold Treatment

It is important that the shared zones are clearly distinguished from other areas of the road network. This is to be achieved by utilising a threshold treatment consisting of a raised speed table at the entrance combined with the approved shared zone sign and a 30km/h speed limit sign (RS1B). The signage arrangement is to be provided both sides of the speed table. Figure 1 shows the gated signage arrangement and speed table approved for use.



Figure 1 – Shared Zone Threshold Treatment

The following components shall be the minimum threshold treatment employed for a new shared zone:

- 5m long speed table with exposed aggregate top. The table should be clearly distinguishable from the surrounding road surface and will differ from the tables utilised in the central business district of Nelson.
- Planted buildouts are to be provided to narrow the space.
- If queueing space is available prior to the threshold treatment then the entry shall be narrowed to a single trafficked lane. If a lack of space is present then the threshold treatment will be wide enough to enable two vehicles to pass.

Longitudinal Details

Mid-block treatments shall be incorporated where deemed appropriate depending on the nature of the road to which the treatment is being applied. They should be provided at regular intervals no greater than 90m and may or may not include speed tables as part of their design. When implementing mid-block treatments the following shall be considered:

- Forward visibility
- Impediment to driveway access and parking
- Stormwater drainage requirements
- Consideration of grade in relation to buildout locations and difficulty slowing and giving way.

Width Details

The road width in shared zones should typically be aligned with the existing constraints of the street. Ambiguous road widths should be avoided to ensure that motorists are provided clear guidance on whether it is clear to pass or not. Typically the road width will either be 3m at narrow sections or 5.5m at two way locations.

If the existing road width is wider than 6m then it should be reduced through the provision of landscaping features or provision of on street parking. Maximum lane width within these spaces shall be 2.7m.

Footpaths

Footpaths should only be provided within the zones where the road environment presents risks to vulnerable pedestrians that cannot be overcome through other means. Examples of this include provision at locations where the road edge has a steep drop or sheer wall in conjunction with a one way section of the street (3m wide).

The presence of footpaths within the shared zones reduces the ability of the zone to function as true shared space. Pedestrians may see a footpath provided in some locations as limiting their ability of negotiating right of way with other road users. The extra earthworks and retaining likely required is a further negative outcome of the provision of footpaths within these zones.

Kerb and Channel

Kerb and channel should only be used as necessary and should be of mountable type. Kerb and channel provides a visual barrier to the free movement of pedestrians into the road space and as such may increase uncertainty, particularly with vulnerable road users.

Where appropriate to the stormwater catchment requirements, low impact stormwater collection should be employed through the use of:

- Swale collection drains;
- Unobtrusive collection structures;
- Rain gardens and landscaping to disguise drainage infrastructure;
- Providing an understanding of secondary flow paths and modification to prevent affects to adjacent properties.

Parking

Parking consideration is of particular importance to shared zones. It should be clear where parking is and is not allowed in an effort to ensure that at least a single lane exists in all locations and passing opportunities are provided regularly. With clever planning, the provision of on street parking can add to the shared space environment through limiting forward visibility in the space and providing side friction to vehicle drivers.

There is potential to create reluctance from pedestrians to utilise the full road area when they encounter a travelling and parked vehicle restricting available space. To avoid this consideration should be given to pedestrian escape routes at points of potential conflict. Subtle variation to road width and clever use of parking space location can provide a sense of space whilst not reducing the desire to utilise the entire road area. By widening the road space from 5.5 metres to 6 metres in locations where parking is allowed, provision is made for extra manoeuvring space particularly relevant to larger emergency vehicles and small heavy vehicles like rubbish collection trucks.

The width should return back to designated width at driveway locations. Not only will this provide a level of side friction in its own right, but it will also tend to discourage vehicles from parking and obstructing property access.

Landscaping

The provision of landscaping, particularly at kerb buildout locations, is critical to ensuring that the shared zone looks and feels like shared space. This is designed to not only provide a place making sense, but is also important for forward visibility reduction and adding to reduction of speed within the zone.

Varieties of plants selected should be suitable for the particular growing conditions in the areas required. This might mean extra thought and change in planting variety along the length of and upgrade as the conditions change.

The planting should also aim to minimise future maintenance requirements as they are generally located outside routinely maintained locations. Figure 2 shows poor performing landscaping in the Locking Street shared zone. It can be seen there is a lack of side friction being created and even the potential for the kerb buildout to be overlooked by vehicles due to the lack of defining feature outside the kerb line.



Figure 2 – Poorly implemented landscaping in a shared zone

Safety and Crime Prevention

It is important that consideration be given to the principles of crime prevention through environmental design (CPTED) when implementing shared space. The nature of the spaces can be conducive to these principles through providing a tight space meaning closer proximity of observers to anti-social behaviour. There is, however, the potential to create issues in the same way. Reducing forward visibility and planting of vegetation has the potential to create dark spots in the road environment and obscure observer visibility.

An overall balance should be found between the provision of shared zone infrastructure and the requirement for providing a safe space for road users. This might mean measures such as:

- Increase in street lighting
- Providing a higher level of maintenance to the space than would normally be considered;
- Consider security measures that could be employed as part of the upgrade

For more information relating to the CPTED principles refer to A1340746.

Lighting

Potential difficulty lies in determining the level of lighting necessary for the shared zone. Whilst safety in route for pedestrians at night is paramount, it is also important to recognise the residential nature of the street and the issues that over lighting can cause.

The approach to determine lighting location and levels should take into account the likely travelled path of a pedestrian within the space. This will allow the designer to determine the most economic distribution of lighting in the area whilst also ensuring that proper coverage is provided.

Assessment Checklist

A quality control checklist has been developed to assist the document user to assess whether an existing zone meets the needs of a shared zone approach. The document also provides prompts in the areas of the key objectives identified as being critical to the success of a residential shared zone treatment:

- Placemaking
- Catering for a range of road users
- Economic Impetus
- Road user behaviour change

The checklist document is attached as an appendix to this guide.

Conclusion

In implementing a shared zone the designer should consult documentation well beyond the scope of this guideline. A variety of references are available for further information. The following is a list of some of the most informative

- Manual for Streets – United Kingdom Department for Streets (Specific reference is made to the Home Zone concept)
- Shared Space Guidance Note – Flow Transportation and IPENZ
- Civilised Streets Briefing Paper - Commission for Architecture and the Built Environment
- Austroads Guide to Traffic Management – Part 8 – Local Area Traffic Management (LATM)

Appendix A – Checklist for proposed shared zone

Residential Shared Zone – Implementation Checklist

This checklist should be used to assess whether a residential shared zone approach is suitable for a proposed upgrade. The purpose of the document is to engage thought processes in the main objectives that a shared zone should intend to achieve.

PARAMETERS FOR DESIGN SUITABILITY				
No	Description	Yes / No	Reference	Comments
	Is the AADT on the proposed site less than 1000v.p.d.			
	Is the current 85% speed within 10 of 30km/h. (N.B. if the current 85% speed is greater than 50km/h, the use of a shared zone approach should be reconsidered)			<i>If the 85% speed is greater than 50 you should consult with transport asset managers in relation to methods of reducing this speed or the suitability of the shared zone approach.</i>
	Is the proposed road a through route in the network?			
	Is the upgrade likely to divert traffic to alternate routes? Have the impacts of this been considered at a network level?			<i>Discuss with transport asset managers and roading operations team leader.</i>
	Is the proposed upgrade in an area with high proportion of elderly residents or other vulnerable road users?			<i>Consideration should be given to providing a safe route through the shared zone. This doesn't necessarily require footpaths but travelled path of pedestrians should be considered in design.</i>
	Is there potential for the implementation of low impact stormwater features allowing kerb and channel to be excluded from the design?			
	Has feedback been sought from residents in the potential street to obtain their views?			<i>Local knowledge is crucial in this type of project and getting affected residents on board with the project will contribute greatly to its success.</i>
PLACEMAKING				
No	Description	Yes / No	Reference	Comments
	Will the proposed design provide for resident interaction?			
	Does the proposed upgrade contribute to increasing active modes of transport?			

	Have Crime Prevention through Environmental Design principles been considered?			<i>Refer A1340746 for further information</i>
	Have aesthetic considerations been made for the project?			<i>Planting schemes, garden and tree position and choice of construction materials all contribute to the placemaking objective.</i>

CATERING FOR A RANGE OF ROAD USERS

No	Description	Yes / No	Reference	Comments
	Is there a defined safe route through the proposed upgrade for vulnerable road users?			<i>Consider:</i> <ul style="list-style-type: none"> - Elderly - Vision impaired - Children
	Does the potential upgrade cater for cyclist use and expectations?			
	Have Cycle Nelson Bays been consulted in relation to the project?			<i>Interested stakeholder group</i>
	Have measures for passively enforcing the design speed been considered?			<i>Consider:</i> <ul style="list-style-type: none"> - Side friction - On street parking - Calming devices - Threshold treatments - Choice of pavement materials
	Does the proposed upgrade relegate vehicle movement to a secondary function? Does the potential zone still have a dominance toward vehicles?			

ECONOMIC IMPETUS

No	Description	Yes / No	Reference	Comments
	Does the proposed upgrade contribute to the value of adjacent properties?			

ROAD USER BEHAVIOUR CHANGE

No	Description	Yes / No	Reference	Comments
	Has the public education associated with the proposed project been considered?			<i>Develop detailed communications plan</i>
	Is there potential for community forum on the project?			
	Have councillor views on the project been considered?			
	Is the potential upgrade site prone to poor road behaviour currently?			<i>Seek anecdotal information. Potential contacts include Operations staff, New Zealand Police and local residents.</i>

Appendix G – Project Specification

ENG4111/4112 Research Project

Project Specification

For: Stephen William Russell

Title: Review of “Shared Zones” as a solution to grade and space restrictive residential streets

Major: Civil Engineering

Supervisors: Trevor Drysdale
Chris Pawson – Nelson City Council
Sue McAuley – Nelson City Council

Enrolment: ENG4111 – EXT S1, 2016

ENG4112 – EXT S1, 2016

Project Aim: To evaluate the existing Nelson City Council use of shared zones in grade restrictive residential streets and to undertake a benefit analysis of the zones.

Programme: Issue B, 5 April 2016

1. Literature review based on the use of shared zones worldwide and domestically (New Zealand)
2. Resident survey – Undertake a resident survey within the existing shared zones streets to obtain public perception information.
3. Safety data collection and collation – Undertake manual counts at each of the three shared zones identified and relate to existing data.
4. Desktop study of candidate shared zone sites and selection of proposed study site.
5. Preliminary design of traditional and shared zone approach and estimate of costs to construct.
6. Data collation and analysis
7. Report Writing is to run alongside project.

If time permits:

8. Develop report to Council advising of findings of dissertation
9. Develop a section for consideration as part of Land Development Manual review to include a standard approach to determining the suitability of the shared zone treatment and how this treatment should be developed.