Nelson City Council

2008 Crash Reduction Study

April 2009

Traffic Design Group

PO Box 30 721
Lower Hutt 5040
P: +64 4 569 8497
www.tdg.co.nz
New Zealand

10033report.doc

Nelson City Council

2008 Crash Reduction Study

Quality Assurance Statement

Prepared by:

Chris Pawson

Project Transportation Engineer

Reviewed by:

Andrew Prosser

Senior Associate

Approved for Issue by:

Dave Petrie

Senior Associate

Status: Final

Date: 3 April 2009

Table of Contents

Nelson City Council

2008 Crash Reduction Study

1. Introduction

This report summarises the findings of the 2008 Crash Investigation Study undertaken to evaluate the causes of crashes at the sites identified by Nelson City Council where there have been a high incidence of crashes over the last five years. The principal objective of the study is to identify low cost remedial treatments that are specifically directed toward eliminating or reducing identified patterns of crashes to improve the overall traffic safety environment within the city.

The Nelson City Crash Reduction Study (CRS) team was comprised of the following:

- Andrew Prosser (Traffic Design Group), Team Leader
- Chris Pawson (Traffic Design Group)
- Eddie Annand (NZ Transport Agency)
- Margaret Parfitt (Nelson City Council)
- Les Denia (Nelson City Council)
- Phil Wooding (Nelson Police).

2. Outline of the Study

The 2008 CRS comprised of the following stages:

- a general review of the accident history and NZTA safety report
- identification of intersections requiring specific investigation
- evaluation of previous crash investigations completed for Nelson City Council
- diagnosis of problems at identified sites and identification of remedial measures
- preliminary design of remedial measures and preparation of CAD plans
- assessment of costs and benefits accruing from the remedial measures
- establishing priorities and recommendations
- establishment of monitoring strategies.

These matters are discussed in detail as follows.

2.1 Accident History

The law requires all traffic accidents incurring injury to be reported to the Police. The Police officer who attends the accident completes a Traffic Crash Report (TCR) and this information is coded and entered onto a national database. These records have been integrated in the course of preliminary investigations comprised in this study from which copies of the original TCR's have been downloaded to provide verification as well as additional and more comprehensive details.

2.2 Identification of Intersections

Nelson City Council supplied Traffic Design Group with a list of four intersections that it had identified as having the highest crash rate and/or the worst sites that had not previously been studied or been upgraded. These sites identified for the study were:

1. Waimea Road/Boundary Road/Market Road
2. Waimea Road/Motueka Street
3. Haven Road/Halifax Street
4. Nile Street/Tasman Street.

Having fully reviewed the two Waimea Road sites the CRS team agreed that it was necessary to consider these intersections within the wider context of Waimea Road between Market Road and Motueka Street.

While this crash investigation study has concentrated on the four sites identified by Council in the project brief, Traffic Design Group has also completed a wider review of the Crash data across Nelson's road network to ascertain if any other intersection and/or site(s) also warranted in-depth analysis with a view to cost effective improvements to the local road safety environment. This network review involved a desk top review of the NZ Transport Association (NZTA): 'Nelson City Road Safety Report' (2003 - 2007) published in June 2008, and of the associated computer database for the same period. The findings of this review are summarised in the following section.

3. Network Wide Review

3.1 Overall Crash Trends in Nelson City

The NZTA 'Nelson City Road Safety Report' (2003 - 2007) indicates crash patterns and trends, including where these are over-represented as compared with similar local authority areas. The report lists crash sites in order of the cost of crashes and identifies those sites with a significant increase in crashes in 2007.

It was noted that in the urban environment of Nelson City, the main contributing factors to crashes at intersections were:

- poor observation, and
- failure to give way or stop.

The high incidence of these factors is consistent with other similar cities and the range of factors that were over-represented in Nelson included:

- loss of control at bends
- crossing/turning
- rear-end/observation
- alcohol
- cyclists and motorcyclists.

Similarly, for the rural situation, Nelson was over-represented by the same causal factors of 'failed to give way or stop', 'alcohol involved' and 'excessive speed'.

Subsequently, a copy of the Road Safety Issues pamphlet was tabled during the desktop study for the information of the Study team. Briefly, this report identifies that:

- intersection crashes accounted for approximately 80% of all crashes reported in the district
- the number of recorded crashes at intersections during 2005 were:
  - 34% occurred at tee junctions
  - 30% occurred at crossroads
  - 18% occurred at entranceways to properties
  - 15% occurred at roundabouts.

3.2 Accident Rates and Social Costs

In conjunction with the review of the Nelson City Road Safety Report, an independent crash search of the wider Nelson City urban area was also undertaken for the most recent five year period from 2003 to 2007. This search has been useful in identifying the accident rates at all urban intersections, from which direct comparisons were made with the sites highlighted in the NZTA issues report and those chosen by Nelson City Council to form part of this crash investigation study. The following ten intersections were identified as having an accident rate above the recognised threshold of three injury accidents and/or ten accidents in total over the last five years. These sites have then been ranked according to the social cost of road crashes and injuries report released in June 2008 by the Ministry of Transport, as shown in the following Table 1.

Intersection	Fatal	Serious	Minor	Non-Injury	Total	Cost ($)
Waimea Rd & Motueka St	0	1	15	16	32	$1,910,800
Haven Rd & Halifax St	0	2	5	8	15	$1,741,400
Main Rd Stoke & Annesbrook Dr	0	2	5	8	15	$1,741,400
Main Rd Stoke & Saxton Rd	0	2	2	8	12	$1,498,400
Bridge St & Trafalgar St	0	2	2	4	8	$1,489,200
Waimea Rd & Boundary Rd	0	0	9	5	14	$740,500
Halifax St & Paru Paru Rd	0	0	6	8	14	$504,400
Nile St & Tasman St	0	0	5	6	11	$418,800
Waimea Rd & Rutherford St	0	0	5	3	8	$411,900
Main Rd Stoke & Songer St	0	0	4	7	11	$340,100

Table 1 : Intersections Identified With High Crash Rates

The accident costs shown in the table above are based on the following social costs per reported

urban crash:

- fatal $3,635,000
- serious $659,000
- minor $81,000
- non-injury $2,300.

It should be noted that all state highway and rural accidents have been excluded from this search, and using the same criteria as used in the road safety issues report.

Of the ten intersections identified, the four chosen by NCC for the 2008 Crash Investigation Study are ranked first, second, sixth and eighth. The detail of accidents at these intersections is extensively covered later in this report and hence will not be addressed in this summary.

Of the remaining six intersections, two have recently had improvement works completed. These sites include the intersection of Main Road Stoke and Saxton Road (roundabout) and the intersection of Waimea Road and Rutherford Street (additional traffic islands have been installed and the right-turn movement banned on Waimea Road). The reported crash data for the remaining four intersections were then reviewed, and the findings of this analysis are attached in Appendix 1.

As a summary of these findings, it is recommended that subsequent CRS include three further intersections, and for the future monitoring programme to specifically also include the Trafalgar/Bridge Street intersection.

4. Identification of Problems and Remedial Treatments

4.1 Site 1: Waimea Road/Boundary Road/Market Road Intersections

4.1.1 Site Description

This intersection is made up of two off-set 'tee' intersections, comprising a right-left stagger arrangement. The side roads are GIVE WAY controlled, and each intersection has a 'seagull' arrangement whereby a separate lane is provided on Waimea Road to accommodate the right-turning traffic from the side roads.

Market Road is classified as a Collector Road in the NRMP and provides the main link between Waimea Road and the residential suburb of Bishopdale. The NCC landfill and a private quarry are also located in the same area and Market Road is used by the heavy vehicles transporting waste and aggregate. The speed limit on Market Road is 50km/h. The total carriageway width is 9.5m with a single lane in each direction and parking allowed in limited sections.

Boundary Road is classified as a Local Road in the NRMP and provides access to Waimea Road from the residential area to the west of Waimea Road. The speed limit on Boundary Road is 50km/h. The total carriageway width is 10.0m with a single lane in each direction and parking on both sides. Although having the status of a local road, it is connected to the wider road network in such a manner that it has become an attractive 'rat-run' to some motorists wishing to avoid queuing in congested conditions along Waimea Road.

Waimea Road is classified as an Arterial Road in the NRMP and functions as one of only two main commuter links between central Nelson and the wider region to the south including Stoke and Richmond.

Waimea Road has an AADT of between 24,000vpd and 27,000vpd and has a speed limit of 50km/h in the vicinity of the intersection with Boundary Road and Market Road. The carriageway cross-section in this location consists of four lanes, (all 3.5m in width) two through lanes adjacent to the kerb and two central merge lanes for right-turning traffic from the side roads. In addition, a narrow (2.5m) left-turn taper is provided for vehicles turning into Market Road. There are separate right-turn bays provided on Waimea Road for vehicles turning into each of Market Road from the north and Boundary Road from the south.

Throughout the intersection there are a total of six islands intended to provide limited protection to right-turn vehicles from the side roads. The existing intersection layout is shown in the aerial photographic plan attached as Figure 1 of Appendix 2.

4.1.2 Crash History

A total of 13 crashes were reported during the last complete five year period (2003 - 2007), of which nine involved injury.

4.1.3 Problem

- there are a high number of crossing/turning crashes, particularly involving cyclists, principally at the Market Road intersection
- 46% of the reported crashes involved failure to give way
- during on-site observations, the study team concluded that the general complexity of the staggered tee intersection layout within a very high trafficked corridor and the large number of conflicting movements was the major factor contributing factor to the high number of crashes at this location.

These issues are identified in the following photographs 1 and 2.

Photograph 1 : Looking west on Boundary Road showing vegetation obscuring signage

Photograph 2 : Looking south showing complexity of intersection layout with poorly delineated islands

4.1.4 Solutions

Option 1 : Minor improvements to signage, road markings and inter-visibility of the intersection by:

1. re-marking all existing road markings with waterborne paints containing 'Visi' beads[1]
2. re-painting (using the same grade paint as above) at least the noses of each of the traffic islands to ensure night time conspicuity of the islands
3. improving the intersection lighting to meet AS/NZS1158: Street Lighting standards
4. trimming back the trees in the reserve on the southeast corner of the Waimea/Market intersection to ensure the give way sign is visible
5. marking a green cycle lane with cycle symbol across the intersection with Market Road

These details are identified in Figure 2 of Appendix 2.

Cost: $19,000
Benefit Cost Ratio: 2.7

Option 2 : Simplify intersection arrangement by minimising turning movement conflicts, ie:

1. close the Boundary Road approach and creating a cul-de-sac. This will require that the recommended signalising of the Waimea Road/Motueka Street intersection be adopted in order to provide safe and convenient access to Waimea Road for existing right-turners from Boundary Road
2. as a result of the above changes there is surplus space within the intersection to create a flush median separating the left turn lane into Market Road from the through traffic and in doing so increasing visibility for vehicles turning out of Market Road
3. shift the start of the passing lane to the south of Market Road so right-turners from Market Road only need to cross one lane of traffic
4. improve road markings, signage and street lighting.

[1] Noted Council advice that the remarking was completed in December 2008, soon after the audit inspection

These details are identified in Figure 3 of Appendix 2.

Cost: $81,000
Benefit Cost Ratio: 2.6

A third (high cost) option of replacing the existing 'staggered-tee' intersection arrangement with a cross-roads by diverting the Market Road traffic via Gardiner Place, and signalising the intersection was not considered, due to its high cost, and would warrant a specific study.

4.1.5 Comments

It is considered that Option 2, while not being 'low cost', will provide a more significant safety improvement by virtue of significant simplification of this intersection, where motorists are currently presented with an overload of information to take in the intersection layout and operation in what is often a highly congested environment. However, implementation of this option will be contingent on the evaluation of effects and redesign as needed at each of the Waimea/Tukuka and Waimea/Motueka intersections.

The study team acknowledges that while Option 2 eliminates the right-turn conflict at Boundary Road, there remains a conflict between right-turns out of Market Road and right-turns from Waimea Road, in particular. This could be addressed by introducing a signalised 'seagull' intersection arrangement, but this would likely require widening of the pavement and/or associated earthworks and property acquisition, and would properly form part of a wider detailed study of the Waimea Road arterial route.

Once the recommended low-cost treatment has been implemented, the CRS Team recommends that a more detailed evaluation of intersection options be undertaken, in conjunction with other intersections along Waimea Road with a view to optimising the safety and capacity of the arterial route and to discourage 'rat-runs'.

4.2 Site 2: Waimea Road/Motueka Street

4.2.1 Site Description

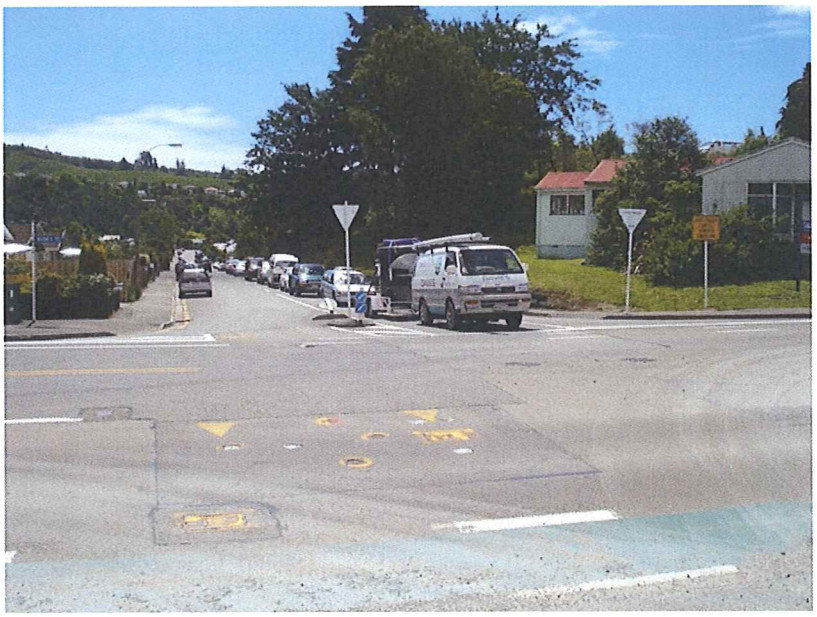
This is a crossroads intersection controlled by give way signs and pavement markings on both Motueka Street approaches, as shown in the aerial photographic plan attached as Figure 4 of Appendix 2.

Motueka Street is classified as a Collector Road in the NRMP and provides a transport link from Waimea Road to the Victory Square residential area and the light industrial activities along St Vincent and Vanguard Streets. The speed limit on Motueka Street is 50km/h. The total mid-block carriageway width is 11.5m with a single lane in each direction and parking on both sides of the road. Adjacent to the intersection the eastbound approach of Motueka Street remains the same width but with three traffic lanes, one westbound and two eastbound providing for left and right turners separately.

Waimea Road, in the vicinity of this intersection, has a total carriageway width of 13.5m to the north of Motueka Street and 16m to the south of Motueka Street. To the north there are a total of five lanes, cycle lanes against each kerb, one northbound lane, one southbound lane and one northbound merge lane for vehicles turning right out of Motueka Street. To the south there are a total of six lanes, two cycle lanes, a left-turn vehicle lane, one through lane in each direction and a central southbound merge lane for vehicles turning out of Motueka Street.

Photographs 3 and 4 show the Waimea Road and Motueka Street approaches, respectively.

Photograph 3 : Looking south on Waimea Road showing vehicle waiting to turn right from Motueka Street and one vehicle having just completed movement



Photograph 4 : Looking west on Motueka Street showing queued vehicles and difficult starting conditions with vertical grade

4.2.2 Crash History

A total of 33 crashes were reported during the last five year period (2003 - 2007). These included 2 serious and 15 injury crashes.

4.2.3 Problem

- 55% of reported crashes involved a vehicle turning right into Waimea Road, from the western approach of Motueka Street, failing to give way to a northbound through vehicle. This may be exacerbated by the separate left-turn lane, in which left-turning vehicles can obscure through vehicles to motorists waiting on the Motueka Street west approach
- the investigation team were unanimous in their conclusion that there was no 'low cost' solution available that would address the existing safety issue.

4.2.4 Solution(s)

1. establish a signalised seagull control at the intersection to improve right-turn facilities. This allows the southbound vehicles unimpeded flow through the intersection but stops the northbound through vehicles for short periods to allow right turning vehicles access from the western Motueka Street approach
2. limit access to and from the eastern leg of Motueka Street to 'left-in, left-out' vehicle movements only, to allow the signals to operate in a suitably efficient manner and limit delays to northbound through vehicles on Waimea Road
3. paint the northbound cycle lane for the length that it conflicts with left-turn vehicles crossing into the left-turn lane.

These details are included in Figure 5 of Appendix 2.

Cost: $185,000
Benefit Cost Ratio: 11.0

4.2.5 Comments

In the absence of any low cost solution to the crash problem, consideration was given to how to simplify the intersection and clarify priorities at what is a very busy cross-roads, without changing existing kerblines and/or requirements for property acquisition. As shown in Figure 5 of Appendix 2, the preferred solution identified by the team is to restrict the number of available movements while retaining priority for through traffic, including cyclists on the critical Waimea Road arterial route. While the existing lane widths are minimal for both cyclists and vehicles, they have been retained since there is no evidence of them being significant causal factors of the accidents, and with a view to keeping the costs of the 'solution' as low as practicable. Clearly, more substantive solutions could be developed, but these would require property take. It was considered that safely providing for the high right-turn demand for Motueka Street was most cost-effectively managed by introduction of traffic signal control, that could if necessary, be synchronised with the signalised pedestrian crossing further along Waimea Road. The removal of the provision for right-turn manoeuvres from Waimea Road into Motueka Street and from Motueka Street (east) into Waimea Road can be expected to greatly simplify the intersection and minimise any capacity reduction/delays that would otherwise be introduced by the traffic signals. Clearly, there will be some resulting traffic redistribution, but the priority has to be maintenance of priority of the through traffic capacity on Nelson's major arterial route.

It has to be emphasised that no modelling has been undertaken at this intersection in order to check the effects of the recommended safety treatment on the capacity of Waimea Road. It is therefore recommended that the intersection described is modelled to confirm the proposed improvements will not cause excessive delays and/or further congestion than currently occurring, and that any wider redistribution effects are identified.

As will be evident, such a 'solution' is really beyond the scope of a simple safety fix. Rather, this CRS has identified the need for an in-depth study of the Waimea Road route and the intersection

treatments along its length. Such a study will require not only modelling, but detailed consideration of servicing and access, including consultation with adjoining land-owners so as to ensure that access for both domestic and commercial (eg hospital laundry) activities is able to be provided in a manner that does not adversely effect either the safety or capacity of the Waimea Road arterial.

4.3 Site 3: Haven Road/Halifax Street

4.3.1 Site Description

This is a 'T' intersection controlled by a roundabout as shown in Figure 6 of Appendix 2.

Halifax Street is classified as an Arterial Road in the NRMP and links central city traffic on Rutherford Street and beyond to Haven Road which in turn links through to the port and waterfront on the one hand and to St Vincent Street (including light industrial and major retail outlets) on the other. Halifax Street has an AADT of approximately 12,000vpd and has a speed limit of 50km/h. Existing carriageway provisions on Halifax Street are provided in the form of two 5m lanes with parallel parking on both sides of the road. At the intersection there are two 3.5 entry lanes (one shared left and right-turn lane and one right-turn lane) and one 5m exit lane (toward the CBD).

Haven Road is classified as an Arterial Road to the north of the intersection and as a Principal Road to the south. It provides a dual function of linking traffic from the light industrial area to the south with the port and waterfront and links central Nelson traffic to the same area.

The northern section of Haven Road between the port and Halifax Street has existing carriageway provisions in the form of four lanes in total (two lanes in each direction), varying between 3.5 and 4.0m in width and separated by a wide grassed median. The southern section of Haven Road has two 4.m wide lanes, one in each direction, with the northbound approach lane widening to two lanes at the intersection.

Each of the three approaches to the intersection is split by a central traffic island. The small central roundabout island is approximately 3.5m in diameter, with two circulating traffic lanes marked for right turning traffic between Halifax Street and Haven Road.

4.3.2 Crash History

A total of 18 crashes were reported during the last complete five year period (2003-2007) of which two resulted in serious injury and five involved minor injury.

4.3.3 Problem

- the majority of the crashes recorded at the site were attributed to drivers failing to give way at the intersection. Approaching vehicle speeds were observed to be high through the intersection. This is due to the poor deflection provided by the small centre island and alignment of the approach lanes
- a total of five crashes involving cyclists were also recorded, with the majority of these approaching the intersection from the north on Haven Road.

The following photographs 5, 6 and 7 illustrate the issues identified on each approach to this existing roundabout.

Photograph 5 : Looking north on Haven Road showing poor deflection for through traffic on this approach

Photograph 6 : Looking south on Haven Road showing poor deflection for through traffic on this approach

Photograph 7 : Looking south on Haven Road showing cycle path hidden from left turning vehicles

4.3.4 Solution(s)

Preliminary Option Investigation

Due to the limited space available at the intersection for improving the alignment of each of the approaches, the idea of reducing the roundabout to single lane circulating was investigated in brief. Turning count surveys were undertaken during peak hours, and the resulting data entered into a SIDRA model of the intersection both as existing and with a single circulating lane. The resulting outputs from the SIDRA model showed that the worst Level of Service (LOS) for any approach reduced from LOS B to LOS E and delays increased from around the ten second mark to up to 65 seconds for the single lane layout.

The predicted reduction in performance as described above is considered to be unacceptable at this location. Therefore, a simplified single lane layout option was abandoned in favour of the following options.

A summary of the SIDRA analysis is attached as Appendix 3.

Option 1: *Low Cost*

1. Reconstruct the central roundabout island to increase its size in an oval shape in order to improve deflection with associated 'skirt' to accommodate large vehicles.

The details of this option are shown in Figure 7 of Appendix 2.

Cost : $20,000

Benefit Cost Ratio : 6.2

Option 2 : Medium Cost

1. Reconstruct the central roundabout island to increase its size in an oval shape in order to improve deflection with associated 'skirt' to accommodate large vehicles.
2. Cut down splitter island on Haven Road south approach and move approach lanes to centre to increase deflection for this approach.
3. Remark cycle lanes in a position between left and right-turn lanes in order to clarify cyclists' position and approach travel route at the intersection.

The details of this option are illustrated in Figure 8 of Appendix 2.

Cost: $59,000
Benefit Cost Ratio: 4.2

Option 3: *High Cost*

1. Relocate the centre of the intersection to the south-east by approximately 10m. This provides excellent alignment but requires that a 3-4m wide corner of land is taken from Anzac Park in order to accommodate the proposed lane configuration.
2. Remark the cycle lanes in a position between the left and right-turn lanes.

The details of this option are illustrated in Figure 9 of Appendix 2.

Cost of Solution: $112,000
Benefit Cost Ratio: 6.7

Option 4 : Higher Cost

1. An alternative, and likely higher cost option than roundabout options would be to replace the roundabout with a simple tee intersection controlled by traffic signals. This has not been modelled, but would likely require two lanes on each approach and a potentially simple phasing arrangement. This option has not been costed.

4.3.5 Comments

1. peak hour traffic surveys have been undertaken at the intersection together with a SIDRA analysis of roundabout options, from which it has been established that two circulating lanes are required for the PM peak right-turn movements from Halifax Street to Haven Road
2. if the recommended low-cost treatment is adopted as a short-term safety measure, the CRS team recommends the intersection be monitored to identify the extent to which crashes are reduced and the extent of any ongoing accident trends at this site
3. If other than the low cost option is to be adopted, then a more detailed scheme assessment report is likely to be justified in order to ascertain the most cost-effective option, to ensure that safe and convenient property access is maintained, identify any requirements for property, and the like
4. Council staff have separately queried whether safety along Haven Road, particularly in the vicinity of Auckland Point School, could be enhanced by reducing Haven Road to a single lane in each direction. While this is beyond the scope of this study, the study team has concluded that this would certainly be possible, subject to maintaining two lanes adjoining the roundabouts at each end, then merging to single lane. Options for improving safety without compromise to capacity, with benefits for the school, for cyclists, and for property access

along this route could usefully be considered as a separate study.

4.4 Site 4: Nile Street/Tasman Street

4.4.1 Site Description

This is a crossroads intersection controlled by a roundabout, as shown in the attached aerial plan in Figure 10 of Appendix 2.

Nile Street is classified as a Collector Road in the NRMP and provides the main road link between the Maitai Valley and Nelson Central. Nile Street as an AADT of between 4,000vpd and 5,000vpd and has a speed limit of 50km/h. Existing carriageway provisions on Nile Street are provided in the form of 2 x 3.5m traffic lanes with a mixture of parallel and angle parking on both sides of the road.

Tasman Street is classified as a Collector Road to the south of Nile Street and a Local Road to the north of the intersection. It forms part of the route linking the residential area in the Brook Valley to the rest of the central Nelson area. Tasman Street has an AADT of between 3,000vpd and 3,500vpd and has a speed limit of 50km/h. The existing carriageway provisions on Tasman Street are provided in the form of 2 x 3m wide traffic lanes with parallel parking on both sides of the road.

Each of the four approaches to the intersection are split by a central traffic island. The central roundabout island is approximately 12m in diameter.

4.4.2 Crash History

A total of 12 crashes were reported during the last completed five year period (2003 – 2007), of which five involved injury.

4.4.3 Problem

- General observations on-site showed that speeds through the intersection were high for this type of intersection control. Specifically, vehicles travelling straight through the intersection travelling either east to west or west to east on Nile Street were not slowing adequately. The primary cause of this excess speed is caused by the minimal deflection and geometric layout of the roundabout control.

The minimal deflection and channelisation is illustrated by Photo 8.

Photograph 8 : Looking west on Nile Street showing poor deflection for through traffic. The photo also shows the lack of islands on the left side of the lane that would assist in channelizing the traffic. This is typical of the whole intersection

Photograph 9 : Tree Close to Edgeline on Roundabout Approach

4.4.4 Solution(s)

1. construct traffic islands on the left-hand side of the Nile Street approach lanes. This will ensure vehicles enter the intersection on an alignment suitably close to the central island
2. increase the size of the central roundabout island to further increase deflection for through movement west-bound on Nile Street
3. upgrade lighting to AS/NZS 1158: Street lighting standards and/or paint the noses of all

traffic islands with reflective paint

4. consider desirability of protecting motorists from large Plane tree in very close proximity to road carriageway outside shop on the east-bound Nile Street approach to the intersection.

These details are shown in Figure 11 of Appendix 2.

Cost: $61,000
Benefit Cost Ratio: 3.4

4.4.5 Comments

There is no low-cost option to address this issue.

Once the recommended treatments have been installed, the study team recommends the intersection is monitored to observe accident trends and rates at this site.

5. General Observations

The CRS team noted from the details recorded in the TCR's a consistent problem where drivers did not observe other approaching motorists at the sites investigated. Drivers appeared to be inattentive, complacent and travelling too fast. They generally did not appear to observe the existing signage or pavement markings that identify each intersection's location, layout and/or priority control. At the two Waimea Road sites, these behaviour characteristics are further exacerbated by the relatively high levels of congestion that occur during peak operational periods.

Many of the intersections investigated are considered to have inappropriate street lighting. Based on these observations, the CRS team recommends Nelson City Council undertake further checks of its street lighting outputs, particularly over splitter / central islands, to confirm overall compliance with AS/NZS 1158: Street Lighting Standards.

The CRS team also noted several of the regulatory control signs were faded and had poor night-time reflectivity. On site observations confirmed at least one of these signs consisted of 'Engineering' grade, non-reflective material. While the CRS team is aware Nelson City Council has a signs replacement/maintenance programme and regularly upgrades its regulatory control signs from 'Engineering' to 'High Intensity' grade material, it is recommended that Council undertakes a signs audit to ensure all regulatory signs have indeed been upgraded to 'High Intensity' material.

During the on-site investigations, the Study team also noted a high proportion of pavement markings were well worn and markings appeared to consist of alklyd (oil based) paint. Many road controlling authorities within New Zealand, including NZTA, now use waterborne paints containing glass 'Visi' beads on their roading networks. This product has been trialled nationally by the New Zealand Roadmarkers Foundation and has proven to provide greater delineation during daylight and night-time conditions, is more durable, and has a longer life span compared with alklyd type products. It is however accepted that waterborne paint is more expensive to install and maintain, and introducing this product will increase Council's annual pavement marking maintenance costs. In this regard, it is understood that the potential safety improvements gained by introducing waterborne paints on all major road routes has been considered by Council's engineers; however, they have adopted 'Beadlock' on the basis that it exhibits better characteristics for colour and bead retention. That being the case, it may be that more frequent re-marking is desirable on strategic routes, in particular.

6. Costs and Benefits

6.1 Economic Evaluation

For the four sites included in the 2008 Crash Reduction Study to date, the economic evaluations (simplified method) are attached in Appendix 4. The CRS team estimated potential accident savings for each site relative to the remedial work recommended, whereby the extent of potential accident savings have been derived from the published literature, from experience in NZ and other countries including the industry recognised Austroads guidelines. Additionally, the combined engineering and judgement of the CRS team members was used to reach a consensus for the expected savings from the low-cost remedial works proposed for each site.

Studies carried out by NZTA indicate that only about 60% of all injury accidents are actually reported and the ratio on non-injury to reported injury accidents is in the vicinity of 10:1. The NZTA Economic Evaluation Manual (Vol. 1, Simplified Procedures) takes these and other factors into account to calculate the average cost of a road accident to the community.

The costs to the community for each traffic accident are shown on Table 2 below, from figures that were supplied by NZTA and compiled in June 2007.

The Nelson City community has in effect suffered a total cost of $17.78 million in the urban and $1.68 million in the rural areas in 2007.

Area	Fatality ($)	Serious ($)	Minor ($)
Urban	3,539,000	626,000	79,000
Rural	4,016,000	735,000	88,000

Table 2:

For each site the Benefit Cost Ratio is defined as:

$$BCR = \frac{\text{Present value of project benefits}}{\text{Present value of project costs}}$$

Future costs and benefits are discounted at a rate of 8% per annum over a 30 year period.

For simplicity, it is assumed that:

- all costs are incurred at the outset
- only accident benefits are counted. Other benefits or disbenefits to vehicle operating costs and travel time are not included
- accident benefits accrue at a uniform rate. For example, a saving of three accidents over a 25 year period is calculated as an annual saving of 0.12 accidents per year for 25 years
- only the benefits accruing over the next 25 years are taken into account. Using the 10% discounting rate, 25 years of benefits are equivalent to 9.57 times the first year's benefit.

6.2 Monitoring

The Study team has diagnosed accident problems at specific locations and has recommended engineering solutions to reduce these accident problems.

After implementation of the works, it is important to monitor each site to ensure that::

- the works are completed expeditiously and as recommended by the team
- the works function as intended by the team
- the effect on accident numbers can be evaluated.

If work undertaken is ineffective, monitoring will alert the team to reconvene and to re-evaluate the situation. In addition, monitoring on a national basis will provide accurate data to assist in predicting accident savings on future studies.

This crash reduction study has identified a range of solutions at the sites requested to be investigated by NCC. Implementation of the proposed improvements is therefore expected to reduce the incidence of injury and non-injury crashes at these sites in the future.

7. Implementation Programme

The total costs to implement the recommended physical safety improvements covered in this report are estimated to cost $377,000. The annual savings in accident costs, if the recommendations are implemented, are estimated to be in the order of $2,752,000.

It should also be noted that the rough order of cost estimates have been completed as part of the desktop analysis and will be subject to a final design and/or field survey work. The values presented in the economic evaluations have accordingly been provided as Rough Order of Costs (ROC) with an approximate accuracy of ±25%.

B/C Priority	Site No.	Site Location	Cost of Solution	B/C Ratio
1	2	Waimea Rd/Motueka St Intersection	$185,000	11.0
2	3	Haven Rd/Halifax St Int. (Option 2)	$112,000	6.7
3	4	Nile St/Tasman St Intersection	$61,000	3.4
4	1	Waimea Rd/Boundary Rd/Market Rd Int. (Option 1)	$19,000	2.7

Table 3: Priority Ranking by B/C

All of these medium cost improvements are recommended, irrespective of their B/C ranking.

8. Recommendations

The Crash Reduction Study team recommends:

- the Council adopts a programme of remedial improvement works, taking account of the priority ranking as outlined in this report
- the remedial measures proposed by the CRS team and recorded in this report be adopted by the Nelson City Council and programmed for completion as soon as practicable
- the Council further consider the need for an audit of street lighting, signage and signage throughout the urban area, and review its policies in relation to pavement marking
- that in view of the potentially high return on investment, Council extend this study to include the next four to five intersections with the highest accidents costs at which improvements have not been carried out during the most recent five year period.

9. Acknowledgements

The assistance of the NZ Transport Agency, Nelson City Council and Nelson Police is gratefully acknowledged for providing the necessary resources and allowing their officers to contribute to the success of this study.

10. References

- Austroads Guide : Treatment of Crash Investigations Part 4, August 2004
- Nelson City Road Safety report 2003 to 2007, NZTA July 2008
- Nelson District Road Safety issues, LTNZ, March 2007
- Crash Reduction Study Monitoring reports, LTSA (October 2003 to February 2007)
- NZTA Traffic Crash Reports
- NZTA Economic Evaluation Manual : Vol. 1 Simplified Procedures.

Traffic Design Group Ltd
April 2009

Appendix 1

Additional Intersections with High Crash Rates:

- Waimea Rd/Annesbrook Dr/Main Rd Stoke
- Trafalgar/Bridge
- Halifax/Rutherford/Paru Paru
- Songer St/Main Rd Stoke

Intersection of Waimea Road/Annesbrook Drive/Main Road Stoke

This priority intersection is ranked third on the list of intersection accidents in Nelson City, with two serious, five minor and eight non-injury accidents in the last five years. This site was also identified in the Road Safety Issues Report prepared by NZTA.

From the accident data, 11 of the 15 accidents were found to be caused by vehicles turning right from Annesbrook Drive failing to give way to northbound vehicles on Main Road Stoke. Not surprisingly, ten of these accidents occurred between 3:00 and 6:30pm when southbound flows on Waimea Road and Main Road Stoke are highest. Cyclists also featured amongst these turning accidents with five injury accidents recorded.

The four remaining accidents consisted of one loss of control, one failure to give way from right turning merging vehicles and two failure to give way accidents as a vehicle turned right from Waimea Road into Annesbrook Road.

From the crash statistics, a right-turning problem has been identified and it is recommended that this intersection be the subject of a more detailed study.

Intersection of Trafalgar Street and Bridge Street

The intersection of Trafalgar Street and Bridge Street is a give way intersection with priority afforded to Bridge Street. Some eight accidents have been recorded at this intersection in the last five years consisting of two serious, two minor and four non-injury accidents. The four injury accidents occurred in 2003 and 2004, and since 2004 only one further accident has been recorded, which was in 2006.

On the Bridge Street approaches, three accidents were rear-end collisions resulting from vehicles slowing for pedestrians, and the fourth was caused by a van failing to give way to a cyclist as it turned into Bridge Street. On the Trafalgar Street approaches, two accidents were rear-end collisions as vehicles stopped for through traffic on Bridge Street; another involved a pedestrian being hit as they stepped out onto a crossing, and the fourth involved collision of a turning vehicle with a through vehicle. All these accidents are typical of the slow speed environment in the centre of the CBD.

The accident rate at this intersection has noticeably decreased in the last three years and therefore it is recommended that this site be closely monitored.

Intersection of Halifax Street with Rutherford Street and Paru Paru Road

A total of 14 accidents were recorded at this signalised intersection during the past five years. The leading cause of these accidents was turning vehicles failing to give way to through vehicles, which resulted in seven of the accidents. No other particular trends were noticeable amongst the remaining accidents.

It is recommended that this signalised intersection and its phasing arrangements be the subject of a separate study.

Intersection of Songer Street and Main Road Stoke

Some 11 accidents have been recorded at this signalised intersection over the last five years. Turning vehicles failing to give way to through traffic accounted for six of these accidents. A further four accidents were rear-end collisions as vehicles stopped suddenly for the signals and the remaining accident was caused by a vehicle changing lanes suddenly. All accidents occurred in dry conditions.

It is understood that Council adopted two-phase signalised control at this intersection in mid-2006 (ie within the five year evaluation period) with a view to improving capacity and efficiency at this intersection. Two 'right-turn-against' crashes have been reported since then. Accordingly, it is recommended that the safety and operational characteristics of this intersection be kept under review, with a view to adjusting phasing arrangements, as needed.

Appendix 2

Existing layouts and proposed improvements