STAGE 3 REPORT

Arterial Traffic Study
Evaluation of Best Arterial Route Options

Prepared for Nelson City Council

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NELSON CITY COUNCIL

Arterial Traffic Study
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Executive Summary

The objective of the Nelson Arterial Traffic Study is to determine the best transport system configuration between Annesbrook and the QEII/Haven Road roundabouts that will improve the city as a whole.

This report covers the third stage of the study, that being the evaluation of the best arterial route options, that were identified in Stage 2. All four options comprise a package of works which include roading improvements to increase the capacity of the arterial traffic routes, improvements to public transport ($2.1-$3.1M per year) and implementation of travel demand management measures ($450k per year). The roading elements have been developed in more detail in this stage and concept designs with cost estimates have been prepared. The four options and their estimated costs are as follows:

Option A: Peak Hour Clearways seeks to provide additional road capacity using the current arterial routes by providing clearway lanes northbound on SH6 and southbound on the Waimea Road / Rutherford Street routes. This option also includes the construction of a 4m wide walkway / cycleway along the waterfront. The expected cost of these elements is $28.8M

Option B: Southern Arterial creates a new road along the railway reserve with an expected cost of approximately $32.1M (excluding any form of grade separation at Toi Toi Street)

Option H: SH6 Four Laning provides four lanes along the existing state highway, requiring a new seawall along the entire waterfront section. The expected cost is approximately $99.2M.

Option I: Waimea Road / Rutherford Street Four Laning provides four lanes along the other arterial route and has an expected cost of approximately $55.4M.

The Nelson-Tasman transport model has been used to determine the likely traffic impacts of the options. Overall, there is very little difference between the options in relation to a large number of output statistics including network distance travelled, network mean speed, average trip length and average trip time, although Option B does provide some slightly improved results in comparison to the remaining options.

When looking at traffic volumes on the arterial routes in particular, Options A, H and I do not show large changes when compared to the existing network. This is because the improvements would not significantly reduce travel time as there are currently only low levels of congestion but also the need to introduce traffic signals at key intersections to safely manage turning movements. Option B does provide a noticeable shift from both the SH6 route and the Waimea Road /Rutherford Street route to the new arterial.

The costs and the modelling results were then used to determine the benefit cost ratio for each option. The benefits were primarily based on modelling results and overall are relatively low; Options A and H yield negative BCRs, Option I a BCR of 0.2 and Option B a BCR of 1.3. These results, along with other information were input into the funding assessment which identified that no option would rank high enough to currently justify funding from the National Land Transport Fund.

Assessments of the economic, noise, heritage, social, air quality and water quality impacts of the options have been undertaken, along with an assessment of how the options would fit into the current policy framework of Nelson City Council. These assessments are detailed later in this report and they show that there are positive benefits as well as adverse impacts associated with all options.

This Stage 3 report, including the modelling results, the specialist assessments, consultation feedback and other information will be used in Stage 4 of the study to determine the preferred arterial route configuration for Nelson City.

1 Introduction

1.1 Study Objective

The objective of the Nelson Arterial Traffic Study is to determine the best transport system configuration between Annesbrook and the QEII/Haven Rd roundabouts that will improve the city as a whole.

This includes an assessment, not just of transport related impacts, but also of other economic, social, environmental and cultural impacts.

The final deliverable from this study will be a preferred transport system configuration that can be adopted by Nelson City Council and NZ Transport Agency.

1.2 Study Structure

This study methodology is divided into four distinct stages, as follows:

- Stage 1: Selection of best arterial route options: present and future conditions
- Stage 2: Selection of best arterial route options
- Stage 3: Evaluation of best arterial route options
- Stage 4: Determination of preferred arterial transport configuration.

Stages 1 and 2 have already been completed and published.

1.3 Stage 3 Report

This report covers the third stage of the study, that being the evaluation of the best arterial route options. In doing so this document reports on:

- the best arterial route options (see Section 2)
- a summary of the traffic modelling (see Section 3)
- the economic evaluation and funding assessment (See Sections 4 and 5)
- the consultation undertaken (see Section 6)
- an assessment of the proposed arterial route options(see Section 7)

2 The Best Arterial Route Options

From the Stage 1 and Stage 2 reports, four options have been brought forward for evaluation:

- **Option A**: Part Time Clearways
- **Option B**: Southern Arterial
- **Option H**: State Highway 6 Four Laning
- **Option I**: Waimea Rd / Rutherford St Four Laning

A concept design for each of these options has been developed. This is discussed in the sections below and drawings are presented in Appendix A.

It should be noted that these options have been developed to account for traffic volumes beyond the modelled future year of 2036. Accordingly, it may be that some of the intersection treatments presented in the options below do not need to be progressed at the same time as the majority of the scheme and could be deferred to a later date; i.e. the intersection treatments for each option could be staged. Nevertheless, they are included at this stage for the sake of completeness and to give an understanding of the overall effect of the options at a future date.

The options also need to be considered in comparison to the Do Minimum, which was developed in Stage 1 of the study, and included intersection upgrades and public transport improvements. The full extent of the Do Minimum is reported in Section 4.3 of the Stage 1 Report.

2.1 All options

Each option is considered a package of works which include roading based improvements to increase the capacity of the existing arterial traffic routes, improvements to public transport and implementation of a number of travel demand management measures. The public transport and travel demand management measures are common to all options and are presented below.

2.1.1 Public Transport

Some substantial public transport improvements have been included in the package of works for all options. The improvements adopted correspond to that of Phase A from the Regional Land Transport Strategy (RLTS). This provides a significant increase in the level of service provided at the moment, and if proved successful, could be expanded upon to Phase B, C or D in the future.

Phase A includes the provision of one express bus service and two secondary bus services between Nelson and Richmond operating at least every 30 minutes in the peak, with a lesser frequency outside these times, Monday to Saturday 6.30am to 6.30pm. One secondary service will operate to the west and one will operate to the east of the corridor. The existing local access service (branded “The Bus”) is to retain its existing level of service, subject to regular review of routes and timing.

The RLTS suggested that the infrastructure improvements include bus stop upgrades, on-street bus interchanges at Nelson, Stoke and Richmond and bus priority measures within Richmond, Nelson CBD and on Waimea Road. Park and Ride facilities will also be considered to improve the bus service, and although unlikely to be viable in the short-medium term may be viable in the longer term. The estimated cost of these infrastructure improvements was estimated to be approximately $1.5M in addition to the cost of the service improvements outlined below; however the cost could be substantially higher than this, depending on the facilities proposed.

The annual operating cost of the Phase A public transport improvements is expected to be a minimum of $2.1M (of which $0.8M would be local share[1]) and a maximum of $3.1M (of which $1.32M would be local share).

2.1.2 Travel Demand Management

A number of travel demand management initiatives have also been included in the packages. These include:

2.1.2.1 Increase parking pricing/public parking restrictions and controls

This involves regulating the cost and availability of public parking spaces. This would give lesser priority to all-day parking and higher priority to short stay parking in the CBD to support the local economy (refer C.36 in Heart of Nelson Strategy).

2.1.2.2 School travel plans

Ensuring all secondary, intermediate and primary schools have travel plans that encourage alternative modes of transport for all pupils to travel to and from school. These plans include training for safe walking, cycling and using school buses and also infrastructure improvements for key routes to and from the school. These plans will be monitored and reviewed over time to ensure ongoing effectiveness.

2.1.2.3 Workplace travel plans

Ensuring all workplaces with more than 50 staff have travel plans. This will later be extended to workplaces with lower staff levels.

2.1.2.4 Promotion of alternative forms of travel

Regular promotion of alternative forms of travel through various mediums. Specific forms of promotion could include publicity campaigns, promotional events and information packs.

2.1.2.5 Car-pooling

Improvements to the current car-pooling programme to attract more registered users.

2.1.2.6 'TravelSmart' targeted travel choices programme

Implementing a TravelSmart programme within NCC which contacts around 5% of households annually. This programme helps individuals make informed travel choices about how to get to places by using their cars less and walking, cycling and using public transport more.

2.1.2.7 Review resource management plan rules

Review Nelson Resource Management Plan rules with regard to:

- the location requirements for new developments and activities;
- promoting the co-location of urban developments which reduce the overall demand for travel and which are conveniently located to bus, walking and cycling networks
- through intensification and mixed use developments and control of developments which adversely impact on the efficiency of transport routes

The overall cost of the Travel Demand Management programme is estimated to be in the order of $450,000 per annum, which could be partially offset by increased public parking revenue.

[1] Local share shown after fare box revenue and a 50% funding assistance rate (FAR) from NZTA

2.2 Option A: Part Time Clearways

2.2.1 Design Philosophy

This option seeks to provide additional road capacity using the road along the current arterial routes. This would be in the form of a clearway lane northbound on SH6 from the Annesbrook Roundabout to the Haven Road roundabout and another clearway lane southbound on the Waimea Road / Rutherford Street route from the top of Rutherford Street to the Annesbrook Roundabout. These clearway lanes would be available to traffic during weekday peak periods but would revert to on-street parking outside of these peak times.

The existing sealed carriageway, without widening, would be used wherever possible. Where additional space is needed, this would typically use the road reserve and public land rather than purchasing property from adjacent landowners.

2.2.2 Cross Sections

Two different cross sections account for the majority of the length; a general cross section and a cross section along the waterfront. This cross section changes at intersections where additional turning lanes are required.

The general cross section comprises:

- 2.0m footpath
- 4.2m traffic lane (peak); 2.1m parking and 2.1m cycle lane (off peak)
- 3.8m traffic lane
- 3.8m traffic lane
- 2.0m cycle lane / parking
- 2.0m footpath

Along the waterfront the cross section comprises:

- 4.0m cantilever footway/cycleway (two-way)
- 3.5m traffic lane (peak); parking off-peak
- 3.0m traffic lane
- 3.5m traffic lane
- 2.0m cycle lane / parking
- 1.5m footpath where appropriate

The waterfront cross section also reduces at local pinch points, such as the Boatshed restaurant, to avoid impacting on property and buildings. This would require removal of the 2.0m southbound cycle lane / parking and a reduction of the 4.0m seaward footway / cycleway down to around 3.0m.

The clearway lane would be 4.2m in width which allows additional space for cyclists whilst it is used as a traffic lane.

2.2.3 Intersection treatments

This option proposed an increased number of traffic signalised intersections to better manage the multiple lanes at the locations where there are high turning flows. Many of these intersection treatments are included in the Do Minimum (i.e. they would be progressed regardless of the option chosen at some stage in the next 30 years), but are shown on the plan for completeness.

Signalised intersections are proposed at Parkers Road, Muritai Road and Richardson Street on the SH6 route and Haven Road/ Halifax Street, Van Diemen Street, Motueka Street, Market Road and The Ridgeway on the Waimea Road / Rutherford Street route.

In addition, traffic movements at other intersections would be restricted to left in and left out only to improve the safety by reducing the number of conflicts and improving efficiency of the arterial route. This would be considered at Hay Street[2], Collins Street, Poynters Crescent, Victoria Road, Rui Street, Tosswill Road, Green Street, and Blackwood Street on the existing SH1 and Examiner Street East, Cox Lane, Hampden Street, Franklyn Street, Tukuka Street, and Tuckett Place on the Waimea Road route.

These alterations will result in decreases in traffic volumes on those side roads with only left in and left out access and increases in traffic volumes on those roads with signalised intersections with the arterial routes.

2.2.4 Property impacts

The only location where the concept drawings show property purchase may be required is the Girls College sports fields at the northern end of Waimea Road. However, manipulation of the design at a later stage and a possible reduction in lane widths may negate the need for this encroachment. Conversely, when more detailed design is undertaken in later stages, some additional property purchase may be deemed necessary.

2.2.5 Option Description

2.2.5.1 State Highway 6

For the SH6 route, this option starts at the Annesbrook Roundabout, where no changes are proposed to the intersection itself. The clearway lane starts on the SH6 exit from this intersection and continues north for the entire length of the option. The general cross section arrangement is proposed for this stretch as the existing road corridor width can generally accommodate the additional clearway lane. This would be confirmed during the detail design stage as there could be geotechnical issues constraining widening between Tosswill Road and Rui Street. Some of the intersections along Annesbrook Drive and Tahunanui Drive would be modified, including Parkers Road and Muritai Street where traffic signals are proposed.

From Tahunanui to Haven Road, the waterfront cross section is adopted, which includes constructing a cantilever footway/cycleway from the existing seawall out over the water to provide a 4m wide facility for these users and enough space for landscaping and recreational activities. The extent to which this cantilever protrudes from the existing seawall will vary along the length of the route depending on the width constraints. The current design intention is that a 300mm thick pre- or post-tensioned concrete slab will be installed over the existing seawall and will extend a greater distance back into the roadway than out over the sea to provide the cantilever effect. It has also been assumed that ground anchors will need to be used to strengthen the existing seawall to ensure that it can take the additional loading. Shaping underneath the cantilever extension will be required to protect against wave action. These assumptions have been used in preparing the cost estimate for this option.

Along the waterfront, the cross section adopted includes a parking lane / cycle lane southbound which will allow some space for manoeuvring at driveways[3]. As mentioned above, the cross section will need to be locally reduced, in particular at the Boatshed restaurant, so that this building is not physically affected by the proposal. This could potentially involve reduction in lane widths down to 3.0m and a reduction in footpath width to 1.5m on the landward side and a reduction in the footway/cycleway to 3m on the seaward side. Traffic signals are proposed at Richardson Street.

Once on Haven Road, the general cross section is again adopted until the northbound and southbound carriageways are split by the existing grassed median area.

[2] This would need further discussion with the Port before progressing.
[3] Some of these driveways are quite steep and occupy road reserve. The 2m lane was not part of the "Option 1" proposal consulted upon in the North Nelson to Brightwater Strategic Study but has been added into this option to allow for these uses and also to give better access for adjacent properties.

2.2.5.2 Waimea Road / Rutherford Street Route

From the north, the existing two lanes on Haven Road would continue to operate as they currently do, without adding clearway restrictions. Instead, the clearway lane would start at the top of Rutherford Street and progress south to the Annesbrook Roundabout.

The general cross section would be implemented for much of this route, as it could fit within the existing cross section. However this would be altered at intersections to provide additional lanes for turning traffic.

Moving into Waimea Road, the carriageway may need to extend into the Girls College sports fields at the northern end of Waimea Road due to the constrained carriageway and the vertical profile of the cross section at this location. The extent of this encroachment would be confirmed during detailed design. Additional traffic signalised intersections are proposed at Van Diemen Street, Motueka Street, Market Road and the Ridgeway; it is noted that all these were also included in the regional transport model Do-Minimum network for construction between 2016 and 2036.

The existing passing lane sections over Bishopdale Hill would be replaced by the general cross section. The route finishes by connecting to the existing Annesbrook Drive roundabout.

2.2.6 Cost

The cost of this option has been estimated to be $28.8M. The major components of the cost estimate include the construction of the cantilevered footway/cycleway and the new traffic signalised intersections. A breakdown of the cost estimate is included in Appendix B.

There are also significant additional ongoing operational and maintenance costs associated with this option specifically around monitoring and enforcement of the clearway[4] and the cantilevered walkway/cycleway.

Reducing the cantilever footway/cycleway down to 3.0m wide or installing piles rather than supporting it by cantilever could reduce the cost of this option by $0.6 to $1.2M. However, using alternative construction methods was not considered appropriate primarily due to aesthetic reasons, and possible additional impacts on the shoreline and seawall which may increase the difficulty in consenting such a facility.

No specific cost has been included in this option for overcoming the cliff instability issues along the Rocks Road as it is considered that this would need to be undertaken regardless of the option progressed as a result of this study. This is because all options would still result in some form of arterial route being present around the waterfront.

2.2.7 Option Variations

A number of possible variations to this option were considered as outlined in the Stage 2 report:

- Using the clearway lanes for longer than just the peak periods
- Full time three lanes on both routes
- Using the clearways for certain vehicle types only (i.e. one or more of; high occupancy vehicles, freight, buses, taxis)

The modelling undertaken in Stage 1 showed that the highest traffic flows were experienced northbound in the AM peak period and southbound in the PM peak period. It is therefore considered that limiting the clearways to peak hour and peak direction is the appropriate format at this stage. However, the modelling showed that in future years only modest increases in peak hour peak direction flow are forecast

[4] Management of the clearways may also be problematic as experienced at the Tahunanui intersection and along SH1 in Mana, Porirua. Management and operation of the clearways on both routes would typically lie with Council.

in comparison to greater increases in the inter peak and the traditional "off-peak" direction. Accordingly, whilst it is not recommended currently, the clearway option does give the flexibility to extend the clearway periods at some stage in the future (i.e. 20 years plus) if this is warranted by the traffic flows, especially if the ability to progress with Options B, H or I is removed.

Full time three laning was not considered further as it would not be warranted with the forecast traffic flows and could have significant impacts including but not limited to availability of parking for businesses and safety of vulnerable road users.

Restricting the clearways for certain vehicle types was also not considered further as after initial modelling, it was determined that the clearway lane would not provide any travel time benefits in comparison to the standard traffic lane. Accordingly, restricting the clearway lane to certain vehicle types would not provide incentives for travel demand measures or benefits for freight.

2.3 Option B: Southern Arterial

2.3.1 Design Philosophy

This option aims to create a third arterial corridor along the route previously used by the railway and now called the railway reserve. This option would create a single carriageway road, i.e. one lane in each direction from a new roundabout intersection near the Beatson Road roundabout in the south, through the railway reserve and tying into St Vincent Street which would be upgraded to appropriately cater for the additional traffic.

All intersections would be at-grade. Discussion in regards to grade separated treatments at Toi Toi Street are discussed later in this section.

2.3.2 Cross Sections

This option also has two different cross sections; one for the railway reserve and another for the St Vincent Street part of the route.

The cross section along the railway reserve comprises:

- 1.0m shoulder
- 3.5m traffic lane
- 3.5m traffic lane
- 1.0m shoulder
- Variable width berm
- 3.0m separate footway / cycleway (two-way)

The cross section along St Vincent Street comprises:

- 2.0m footpath
- 2.0m parking
- 1.8m shoulder / cycle lane
- 3.5m traffic lane
- 3.5m traffic lane
- 1.8m shoulder / cycle lane
- 2.0m parking
- 2.0m footpath

No passing / overtaking lanes are currently included in this option.

2.3.3 Intersection treatments

New traffic signalised intersections would be constructed at Haven Road / Halifax Street, Washington Road / Gloucester Street, Toi Toi Street and Totara Street to better manage crossing and turning movements in these locations.

Minor modifications would be made to other intersections along St Vincent Street to tie-in with the proposed improvements.

At the southern end of the route, where the arterial joins the existing road network, a new small diameter roundabout (similar to the Beatson Road roundabout) would be constructed between the Annesbrook Roundabout and the Beatson Road roundabout to facilitate movements to and from the new route. Northbound vehicles from Whakatu Drive to the Southern Arterial would travel on a slip lane past the roundabout and therefore not be subject to any delay.

2.3.4 Property impacts

The majority of property required for this option is already owned by NZTA with some owned by NCC and a few sections still in private hands. Some land purchase would be required at the southern end of the route along with minor land purchase at intersections to adequately cater for upgrades at these locations.

2.3.5 Option Description

From the north, this option starts at Haven Road / Halifax Road roundabout, which would be replaced with traffic signals. Travelling south, the route along St Vincent Street would utilise the existing road reserve to provide one traffic lane in each direction with cycle lanes, parallel parking and footpaths on both sides of the road.

The existing roundabout intersection with Washington Road and Gloucester Street would be replaced with traffic signals and other intersections from here to Toi Toi Street only subject to minor modifications to suit the new layout.

At Toi Toi Street, a new signalised intersection would be provided with signalised pedestrian crossings across all approaches. At Totara Street, signals would also be required to provide for the new link which leaves the existing road at this point to proceed down the railway reserve.

As the new arterial leaves the existing road formation, a new cross section is provided. As there would be no access to any development alongside the route, no parking is required. The corridor also gives the opportunity to separate the pedestrians and cyclists from the motor vehicle traffic and accordingly, a three metre wide combined walking and cycling facility is provided adjacent to the new road. This is narrower than the facility provided in Option A, however landscaping would be provided separately and there is much less demand for recreational activities adjacent to this road than along the waterfront. A pedestrian and cycle link from the end of Vanguard Street is also proposed under the new arterial road to link up with Jenner Road.

The route progresses along the railway reserve until it deviates from the previous rail alignment by running adjacent to, and north of, Beatson Road. The route terminates at a new roundabout near the Beatson Road roundabout, which then provides connections back to the Beatson Road roundabout and onto Whakatu Drive. This configuration does not allow for southbound traffic from Waimea Road to travel north onto the Southern Arterial; however this movement would not be common.

Pedestrians and cyclists would also be provided a grade separated facility near the new roundabout to link into the existing route adjacent to Whakatu Drive.

It is noted that the planned extension of Princes Drive onto Waimea Road would traverse around the hillside and an underpass would be constructed under the new road in the vicinity of Bishopdale Hill. There would be no access on or off the Southern Arterial at this point.

2.3.6 Cost

The cost of this option has been estimated to be $32.1M. The major component of the cost estimate is the physical construction of the new road along the railway reserve. A breakdown of the cost estimate is included in Appendix B.

2.3.7 Option Variations

Due to concerns about the possible adverse impacts of the Southern Arterial travelling through the Victory community, some preliminary investigations were undertaken into grade separated options at the Toi Toi Street intersection. Three options were considered:

- Southern Arterial overpass at Toi Toi Street
- Southern Arterial underpass at Toi Toi Street
- Southern Arterial tunnel at Toi Toi Street

Drawings of these variations are included in Appendix A.

The overpass option would involve at least a 300m long elevated structure over Toi Toi Street with a roundabout intersection retained below. This would require some property purchase to incorporate the width requirements of the overbridge and parallel lanes adjacent to the ramps. While this property purchase is minimised on the attached drawing to reduce the impact on the local properties, it does not provide enough width for parking or cycle lanes.

The underpass option would involve a 300m long open trench which would run underneath an at-grade roundabout. Again property purchase has been minimised with this option to reduce the physical impact of the construction. There are a number of very large risks with this option including managing the water table, and relocation of a large number of services including the culverted York Valley Stream, a water main, stormwater and electricity infrastructure, amongst others.

Neither of the above two options would necessarily reduce many of the adverse impacts that have been raised by the community in this location such as noise[5] and severance. Accordingly an additional option was considered which involved a 600m long tunnel that would run from south of Victory Primary School to north of Victory Square. This would completely remove through traffic from this part of the community, and their associated impacts; however it does impose extraordinary costs including dewatering during construction, fire suppression systems, tunnel control infrastructure, intelligent transport systems infrastructure, communications and monitoring devices, uninterruptable power supply and ventilation systems.

Feasibility cost estimates have been undertaken for these variations. The overpass option has an expected cost of around $15M, the underpass an expected cost of around $20M[6] and the tunnel an expected cost in excess of $200M.

Other variations along this route were also outlined in the Stage 2 report. These included:

- Constructing a route with four lanes and/or grade separated interchanges
- Using the link for certain vehicle types only (i.e. one or more of; high occupancy vehicles, freight, buses, taxis)

Constructing a higher specification route, i.e. four lanes, was not considered further due to the traffic modelling showing that this would not be required within at least the next 30 years. Nevertheless, if this option is progressed, the need for future proofing the corridor should be further considered during the designation process.

[5] The underpass should result in less traffic noise but the overpass could increase noise at nearby residences

[6] The cost estimates are less than those initially presented in the Stage 2 report as they are minimum cost options based on a reduced scope; i.e. minimum property purchase and reduced length.

Restricting the clearways for certain vehicle types was also not considered further as limiting the vehicle types that can use it would significantly reduce the benefits available to justify the cost of constructing such a route. Nevertheless, the idea to make the link compulsory for freight to remove heavy vehicles from the waterfront was further investigated and this is discussed in Section 3.8.

2.3.8 Status of Route

The Stage 3 assessment is based on the route being a two-lane local road and not a state highway. This study does not seek to determine whether this route should be a state highway or a local road. However, the following points need to be noted:

- The cost estimate above has been prepared using local authority standards and specifications; if full state highway standards are used then the cost could increase by up to 25%. This is principally due to the increased shoulder and clear zone requirements.
- The status of the southern arterial would not impact upon the traffic volumes using the route and therefore it would not result in any other significant impacts over and above those which are discussed later in this report.
- The status of the southern arterial would not impact upon its attractiveness to heavy vehicles; it is likely that the waterfront route would still be used by many heavy vehicles due to it being flat, having fewer intersections and its good connection to the port and airport.
- If the southern arterial was to be built, a heavy vehicle ban could be placed upon the existing waterfront route and/or traffic calming used to deter it being used as a through route. This is not part of the current option, but is discussed further in Section 3.8.
- If the southern arterial was to be built and designated a state highway, Nelson City Council could seek significant expenditure from NZTA prior to transfer to reduce ongoing maintenance expenditure on the waterfront route by undertaking, for example, substantial cliff stabilisation works. It is understood that the annual maintenance costs for Rocks Road over the last five years have averaged around $76k per km. However, NZTA have stated that these costs should not be taken as an indication of what the maintenance costs might be should the highway in question become a local road.

2.4 Option H: SH6 Four Laning

2.4.1 Design Philosophy

This option creates four lanes along the existing state highway following the existing alignment. Widening has been completed typically on only one side of the road as follows, commensurate with the four laning option considered by NZTA when assessing the alternatives to the Southern Link:

- Between Russell Street and Bisley Ave – on the western (sea) side.
- Between Bisley Ave and Rawhiti Street – on the eastern (inland) side.
- Between Rawhiti Street and Whakatu Drive – on the western (sea) side.

The exception to the above is throughout the Haven Road section, where widening typically occurs within the road boundaries by narrowing the median.

Widening around the waterfront will require a new seawall to be constructed along the entire length of the coastal section, approximately 10-15m away from the existing seawall.

2.4.2 Cross Sections

Again two cross sections would be utilised for the majority of this option, one along Tahunanui Drive and Annesbrook Drive and one along the waterfront.

For the section along Tahunanui Drive and Annesbrook Drive, the following cross section has been adopted:

- 1.5m footpath

- 2.0m parking
- 2.0m cycle lane
- 2 x 3.5m lanes
- 0.5m median shoulder
- 3.5m raised median
- 0.5m median shoulder
- 2 x 3.5m lanes
- 2.0m cycle lane
- 2.0m parking
- 1.5m footpath

Along the waterfront, the following cross section has been adopted:

- 4.0m footway / cycleway
- 2 x 3.7m lanes
- 0.5m median shoulder
- 3.5m raised median
- 0.5m median shoulder
- 2 x 3.7m lanes
- 1.8m cycle lane
- 2.0m parking
- 1.5m footpath

2.4.3 Intersection treatments

A number of intersections would need to be modified to safety and efficiently cater for turning movements across a four lane arterial route.

It is not considered best practice, and is considered unsafe, to allow right turns from a median across two lanes of through traffic. Accordingly, right turns at intersections would be rationalised under this option by providing traffic signalised intersections at a number of locations whilst many other side roads would only allow left in and left out movements.

Traffic signals would be provided at Parkers Road / Maire Street, Muritai Street and Richardson Street. The traffic signals at Bisley Avenue would be retained.

2.4.4 Property impacts

This option would have major property impacts with upwards of 80 properties likely to be affected by various degrees. A large number of buildings would also need to be demolished to provide for the above cross sections.

2.4.5 Option Description

This route starts at the QEII Drive / Haven Road Roundabout, which would not be altered by the proposal. The cross section from Haven Road to the waterfront would provide for a footpath, parallel parking and a cycleway on both sides of the road. A minimum of a 3.5 metre median strip would be provided to separate traffic flows, but this median strip would be wider through the Haven Road section where a large grasses median is already present.

Right turns would be prevented at Fountain Place and Collins Street but the gap in the median at Russell Street would provide for turning movements. No property purchase is required from the Haven Road roundabout up to around Collins Street as the widening can be undertaken within the existing median.

From Collins Street around Wakefield Quay to the coastal section of the route, property purchase would be required, on at least one side of the route, to provide the width to construct a four lane road. This would have significant impacts on many of the buildings on the seaward side of the highway.

Along the waterfront, the cross section changes slightly by removing the parking on the seaward side but providing a four metre pedestrian and cycle facility adjacent to the sea. The significant additional width requirements for this option would involve a new seawall being constructed approximately 10 to 15m away from the existing seawall and in-filled to provide the formation for the widened road. Traffic signals would be provided at Richardson Street to safely cater for turning movements at this location. Traffic signals would also be retained at Bisley Avenue in Tahunanui.

From Bisley Avenue down to Rawhiti Street the cross section reverts back to the typical section described above and widening would occur to the east of the highway. From Rawhiti Street to Annesbrook Drive the widening would occur on the western side. Traffic signals would be provided at Muritai Street, and Parkers Road / Maire Street. Other intersections on Tahunanui Drive and Annesbrook Drive would be altered to only allow left in and left out movements.

2.4.6 Cost

The cost of this option has been estimated to be $99.2M. The major components of the cost estimate include the construction new seawall and the new traffic signalised intersections. A breakdown of the cost estimate is included in Appendix B.

2.4.7 Option Variations

Two possible variations to this option were considered as outlined in the Stage 2 report:

- Providing three lanes with tidal flow
- Building an expressway and retaining the existing route as a local access road

Tidal flow involves creation of an additional lane in the centre of a road that can be used by one direction of travel in the AM peak and the opposite direction in the PM peak. This traffic management measure has been used successfully in a number of situations including on the Auckland Harbour Bridge. However, it was not considered further in this case as it is not appropriate for non-expressway type situations. Concerns primarily relate to safety and the ability for this lane to be accessed from the high number of accessways and intersections along the route by drivers who may not be aware of the direction of the tidal flow. It also creates difficulty in intersection design and requires large gantries to be installed at regular intervals along the route to indicate the availability and direction of the tidal flow lane.

Building and expressway was also not considered further as the initial modelling of the base option indicated that such an increase in scope would not be justified.

2.5 Option I: Waimea / Rutherford Four Laning

2.5.1 Design Philosophy

This option creates four lanes along the Waimea Road and Rutherford Street arterial route following the existing alignment. Widening has been considered as follows:

- Between Halifax Street and Bronte Street – on the eastern side.
- Between Bronte Street and Hampden Street – on the western side.
- Between Hampden Street and Motueka Street – on the eastern side.
- Between Motueka Street and Annesbrook Drive – on the western side.

2.5.2 Cross Sections

The cross section adopted for this route is as follows:

- 1.5m footpath

- 2.0m parking
- 2.0m cycle lane
- 2 x 3.5m lanes
- 0.5m median shoulder
- 3.5m raised median
- 0.5m median shoulder
- 2 x 3.5m lanes
- 2.0m cycle lane
- 2.0m parking
- 1.5m footpath

2.5.3 Intersection treatments

A number of intersections would need to be modified to safety and efficiently cater for turning movements across a four lane arterial route.

As with the SH6 four laning option, right turns at intersections would be rationalised by providing traffic signalised intersections at a number of locations whilst other side roads would only allow left in and left out movements.

In addition to the traffic signals already present on Rutherford Street, new traffic signals would be provided at Van Diemen Street, Hampden Street (replacing the existing pedestrian signals), Franklyn Street, Motueka Street, Market Road and The Ridgeway.

2.5.4 Property impacts

This option would have major property impacts with upwards of 150 properties likely to be affected by various degrees. A large number of buildings would also need to be demolished to provide for the above cross sections.

2.5.5 Option Description

This option has been designed for four lanes for the entire length from the Rutherford Street / Halifax Street intersection to the Annesbrook Street roundabout. However, the northern end of the route may not require four laning at the same time as the rest of the route due to the significant number of trips which access the schools and also the trips to the CBD which leave the arterial route at Selwyn Place and Hardy Street etc, and trips which leave the route at Motueka Street and head to Vanguard Street and the western side of town. Nevertheless the entire route has been shown and costed as four lanes at this stage to provide for the long term needs of the city. If this option is progressed further a staging strategy would need to be considered.

The cross section for this option is consistent for the entire route, providing a footpath, parallel parking and cycle lanes on each side of the road in addition to the two lanes in each direction separated by a raised median.

From Halifax Street to Bronte Street, i.e. the Rutherford Street section of the route, the widening to provide for the four lanes would be undertaken on the eastern side of the road to avoid many of the heritage properties that have been identified on the western side. However, this widening still affects a large number of properties and buildings. Along this stretch, the existing signalised intersections would be upgraded to cater for the four lanes of traffic plus turning movements. Right turning restrictions would be implemented at Achilles Avenue, Montgomery Square, Nile Street West and Examiner Street to prevent these turning movements over multiple lanes of traffic.

Along Waimea Road from Bronte Street to Hampden Street the route would involve widening on the western side of the road due to topographical constraints. A new traffic signalised intersection would be

constructed at Van Diemen Street with other intersections along this stretch restricted to left in and left out movements.

From Hampden Street to Motueka Street the widening would again shift to the eastern side of the route which has fewer buildings that would be affected, although it does encroach onto school grounds. New signalised intersections would be provided at Hampden Street, Franklyn Street and Motueka Street which will help with access to the Hospital.

Widening would occur on the western side of the existing road from Motueka Street to the southern end of the route at the Annesbrook roundabout, although the existing road reserve is typically wide enough to provide for the widening south of Bishopdale Hill. Traffic signals would be provided at Market Road and the Ridgeway (a signalised seagull type arrangement) with other intersections becoming left in left out only.

The Beatson Road roundabout would be replaced with a larger diameter roundabout to cater for the additional lanes that would enter this intersection. This would also involve a minor realignment of Beatson Road to allow this arm to enter the roundabout at an appropriate angle. The route finishes by tying into the existing Annesbrook roundabout.

2.5.6 Cost

The cost of this option has been estimated to be $55.4M. The major component of the cost estimate is the land purchase and property mitigation works. A breakdown of the cost estimate is included in Appendix B.

2.5.7 Option Variations

Again tidal flow was raised as a possible variation to this option in the Stage 2 report. However, this was discarded early for the same reasons presented under Option H.

2.6 Other options

One option, entitled “Option 5”, was raised by a section of the community during the deliberative decision making workshops. This option does not involve any roading improvements, but involves the following:

- providing public transport improvements to a greater extent than the Phase A proposed in the other options
- providing a greater level of Travel Demand Management than proposed in the other options
- constructing a 4m wide waterfront footway/cycleway (similar to that proposed in Option A) as well as other new cycle and pedestrian facilities

The decision making team, as part of Stage 2 of the study, clearly saw benefits in providing public transport improvements and travel demand management measures as part of all options, and therefore these are included in the packages above. However, the team, and NZTA, agreed that options purely involving these elements would not achieve the ultimate outcome required of the study.

In making this decision the decision making team acknowledged that:

- there are concerns in regards to the political acceptableness of some of the travel demand management measures
- there are large uncertainties in regards to the effectiveness of both public transport and travel demand management measures
- the modelling shows that it is possible for travel demand management measures to have benefits
- travel demand management and public transport can be implemented early and the effectiveness determined before proceeding with a roading option.

Accordingly, the team agreed that a staged approach is necessary, especially for public transport, and therefore Phase A is included in all the options. If further improvements to public transport are needed

once this is well established, then additional phases can be implemented relatively easily. None of the options would preclude such a scenario occurring. In addition, the decision making team, in Stage 4 of the study will be considering timings of the preferred option, including the public transport and travel demand management elements. Phasing could allow these items to be progressed initially, and the effectiveness of them determined, before a decision is made in regards to the timing of the roading element of the package.

Based on all the above, the decision making team considers that elements of the "Option 5" are included in all other options and therefore this option has not been brought forward for further consideration.

3 Summary of Traffic Modelling

3.1 Model Form

To recap from Stage 1, the study has used the Tasman-Nelson Regional Transport Model, which is based on the TRACKS software and was initially prepared by Gabites Porter Limited for the North Nelson to Brightwater Strategic Study and used regularly since that study.

The model has been calibrated to weekday 2006 for morning (AM), interpeak (IP) and afternoon (PM) peak hour periods, based on the land transport network and land use activities for that Census year. The PM peak model is a 3-step model only (refer the Model Building Report) and consequently the public transport impacts are only assessed for the AM and IP periods.

In Stage 1, future model runs were undertaken for the 2016 and 2036 Base networks[7], with and without the planned improvements to public transport by 2013. For Stage 3 of the study, new networks were created to reflect the changes proposed by Options A, B, H and I.

3.2 Trip Matrices and Convergence

The model runs for the base network and the options were all based on the same trip matrix, which means that there is no difference in the total number of trips between the options. This was undertaken for a number of reasons:

- There are no differences in land use, public transport routes or major additional road links in the network (the southern arterial is not considered major as it lies within the existing roading network; a road/bridge across the bay would be considered major)
- There is not a significant level of congestion in the do-minimum, therefore trip behaviour is unlikely to significantly change as a result of the roading changes

This approach is consistent with NZ Transport Agency's Economic Evaluation Manual (EEM) which states that "the same trip matrix shall then normally be used for evaluating the do-minimum and the activity options" (Section A2.6). It also states that variable trip matrices should be used only when high levels of congestion exist in both the Do-Minimum and activity options (Section A11.11); this is not the case for this network.

In addition, if the same trip matrix was not used and each option was converged[8], modelling inaccuracies can be introduced as the options may converge at different levels of similarity. Accordingly, differences between options may be a result of convergence differences rather than network changes.

It should be noted that for the sensitivity testing around fuel price (discussed later in this report), convergence was undertaken as it is necessary for modelling competition between the different travel modes.

3.3 Modelling Results

Summary results for the 2036 base calibration network and the options are given in the tables below for the AM, Interpeak and PM peak periods.

[7] These networks are also referred to as the Do Minimum. They include a number of improvements that would be necessary to retain a reasonable level of service for motorists without unacceptable delays. Further information is provided in Section 4.3 of the Stage 1 report.

[8] Convergence: The model is run iteratively; for each "loop", the time and distance matrices from the previous run are input into the distribution step and the trips re-assigned until the difference in the time and distance matrices between consecutive runs are sufficiently small (less than 1% for EEM compliance but usually less than 0.1%), this is called convergence. Complete convergence is therefore when there is no difference in time and distance matrices between runs, however in practice this often cannot be achieved or takes a very long time.

It is recognised that, due to the inherent nature of modelling in both trying to replicate an existing situation and trying to predict what will happen in the future, there will be uncertainty in model outputs. Accordingly, any modelling results need to be read with the understanding that there is a degree of uncertainty in the results. These uncertainties are less for overall model results and screenline[9] results compared to traffic volumes on individual links. Accordingly, these wider scale figures have been reported where possible.

It is noted that the values displayed in this section for the base model may be slightly different to those reported in the Stage 1 and Stage 1B reports. This is due to the model being updated to take account of new information coming available subsequent to these earlier reports being published. These alterations in no way alter any of the results or conclusions reached in those reports in regards to the existing network now and in the future. However, the updates were considered necessary to accurately determine the differences between the options for this stage.

Some summary statistics for the transport modelling are provided below in Figure 3-1 and Figure 3-2, showing the projected change in vehicle kilometres travelled on the network for the different options, and the change in average speeds for the same time periods.

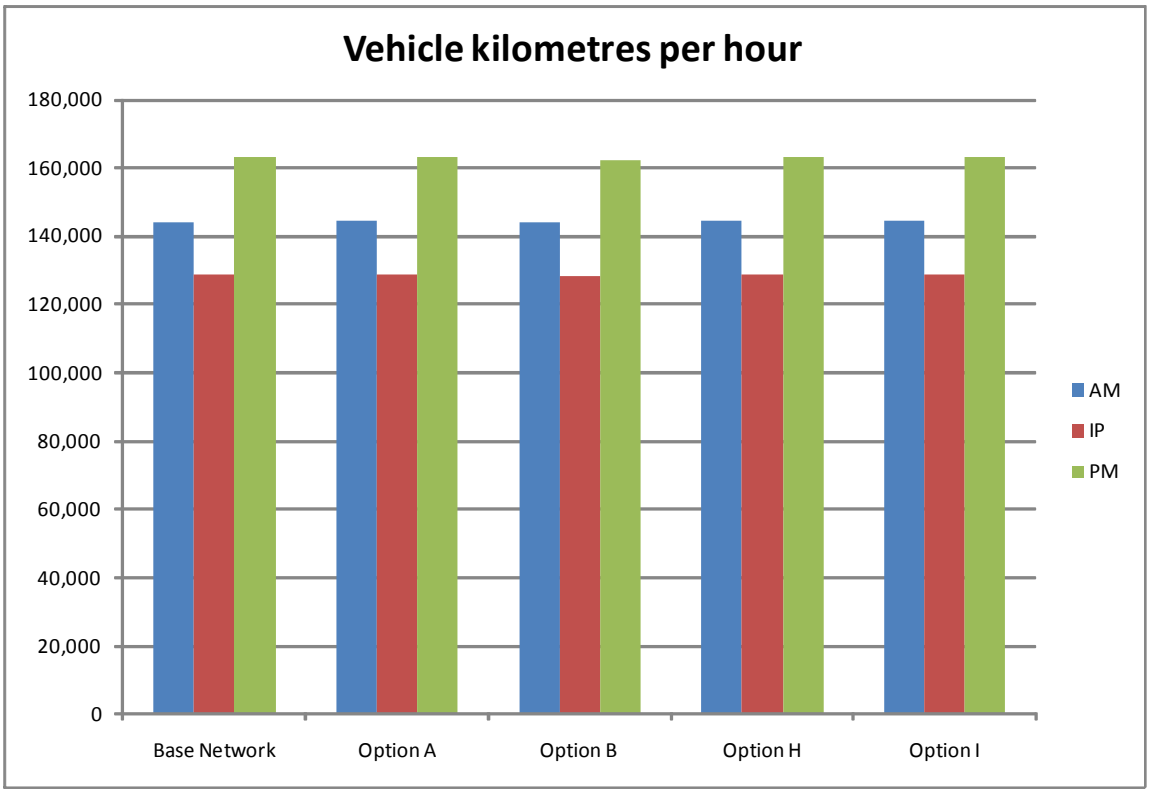

Figure 3-1: Vehicle kilometres travelled in the model study area in 2036

The figure above shows that there is virtually no change in the number of vehicle kilometres travelled when considering the options compared to the base network if new routes are provided. This shows that providing additional capacity on the arterial routes south of Nelson does not release a suppressed demand for more travel.

[9] A screenline in this instance is an east-west line across the entire network. Analysing the traffic movements on all routes that cross this screenline gives a very good indication of the total north-south traffic flow at that location.

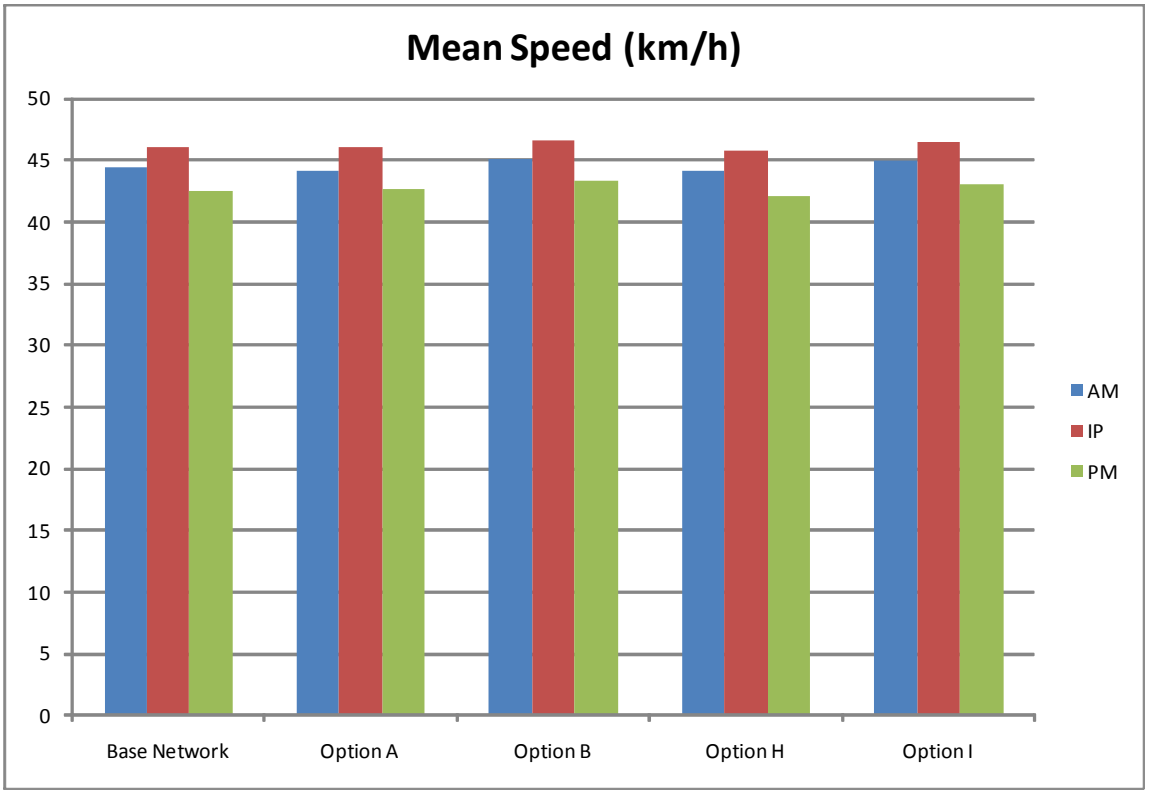

Figure 3-2: Mean speed on the model study area in 2036

The figure above shows that none of the options show great changes in mean travel speeds across the model study area. Some improvement is found with Option B: Southern Arterial and Option I: Waimea Road / Rutherford Street Four Laning.

Some more detailed travel statistics are shown in the tables below. The first table below outlines the characteristics of trips within the study area.

Table 3-1: 2036 Model Statistics

TRAVEL	Average Trip Length (km)			Average Trip Time (minutes)			Road User Cost ($)		
1 hour	AM	IP	PM	AM	IP	PM	AM	IP	PM
Base Network	6.84	7.01	7.04	7.79	8.13	9.29	123,420	107,074	144,385
Option A	6.86	7.02	7.04	7.83	8.19	9.32	124,033	107,660	143,616
Option B	6.83	6.99	7.01	7.70	8.05	9.19	121,771	105,825	141,518
Option H	6.85	7.01	7.05	7.82	8.18	9.35	123,851	107,588	145,307
Option I	6.85	7.02	7.03	7.73	8.11	9.26	122,153	106,567	142,751

As with the other graphical presentations of network statistics in the figures above, Table 3-1 shows that there are very minor changes in the network statistics relating to average trip length, average trip time and road user costs.

Road user costs are summation of the costs of running a vehicle for all the trips that are generated in the model and is primarily based around fuel consumption which alters with travel time, travel speed and time delayed.

Option B appears to provide the greatest benefit in relation to improving these network statistics. The extent to which the improvement in road user costs relates to a fundable project in terms of the Benefit Cost Ratio is discussed in Section 4.

It is noted that some of the other options actually increase overall trip length and trip time. This is primarily due to three factors;

- the limited amount of congestion on the current network means that providing additional capacity does not remove a "bottleneck";
- the need to install additional traffic signal controlled intersections on the arterial routes for turning movements to occur safely; and
- the need to limit turning movements at some intersections along those arterials that would be four laned, again for safety reasons.

3.4 Corridor Results Comparison

As with the Stage 1 Report, summary results for key screenlines are provided. These show the traffic volumes on the different options for the 2036 future year.

This data is shown in the figures below and provides information as to how much traffic is travelling north-south on the network across a certain 'screenline'. The screenlines are:

- Wakefield Quay / Rutherford Street at the northern end of the arterial routes
- Rocks Road / Waimea Road at the middle/southern end of the arterial routes

From analysis of the model outputs presented below, some conclusions can be reached in regards to the effect that the options would have on the traffic volumes on the arterial routes.

For Option A: Peak Hour Clearways, there would be a negligible change in traffic volumes on the arterial routes. The model outputs show that traffic would not to be attracted to the SH6 clearway in the AM peak hour. This could be due to the fact that there are many destinations on and around Waimea Road and Rutherford Street, such as schools, the hospital and workplaces which could not be transferred to the alternative route on SH6. However, traffic would transfer to the clearway on Waimea Road /Rutherford Street in the PM peak hour to take advantage of the additional capacity that the clearway would provide.

Providing a third arterial route into Nelson from the south via the Southern Arterial (Option B) would obviously reduce traffic volumes on the two other arterial routes. From the modelling undertaken, there would be a 20-35% reduction in trips on the SH6 route, depending on the time of day, and a 30-40% reduction in trips on the Waimea Road/ Rutherford Street corridor.

Option H: SH6 Four Laning would result in only negligible change in traffic volumes. Whilst an increase in traffic on SH6 may be expected, the model does not show this occurring. This is likely due to the fact that there is only a small amount of congestion currently and opening up additional capacity does not release a latent demand. Furthermore, this option proposes additional traffic signalised intersections to safely accommodate turning traffic at key locations but which also introduce delay for traffic on the arterial route.

Again with the small amount of current congestion, providing four lanes on the Waimea Road / Rutherford Street route (Option I) also does not provide large alterations in traffic volumes. This option does see some transfer of trips in the peak hour and peak direction onto the widened corridor, but this is generally a minor amount.

The above results show that the widening of the current road corridors are unlikely to move large amounts of traffic from the other arterials as the introduction of intersection improvements mean that travel times along the upgraded corridor are unlikely to be significantly better and drivers will continue to use their existing routes, regardless of the upgrade as the routes they currently travel provide them with the best access to their intended destination.

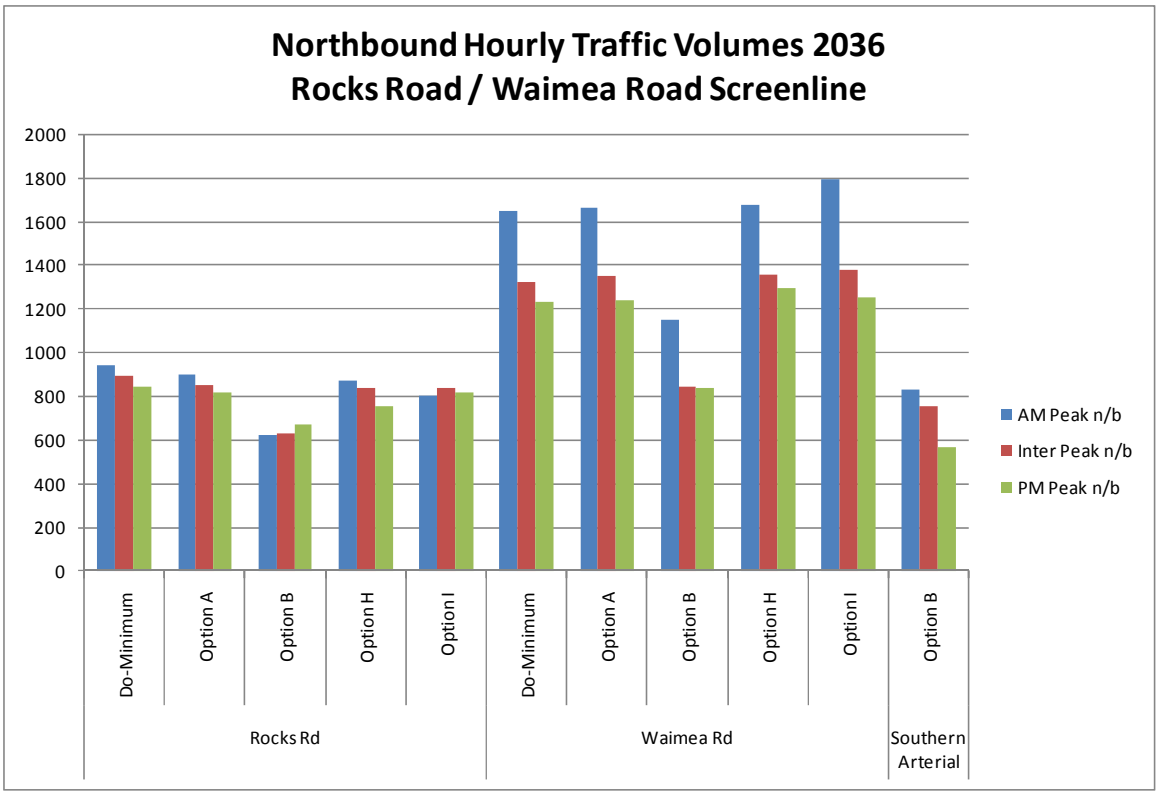

Figure 3-3: Northbound Hourly Traffic Volumes 2036

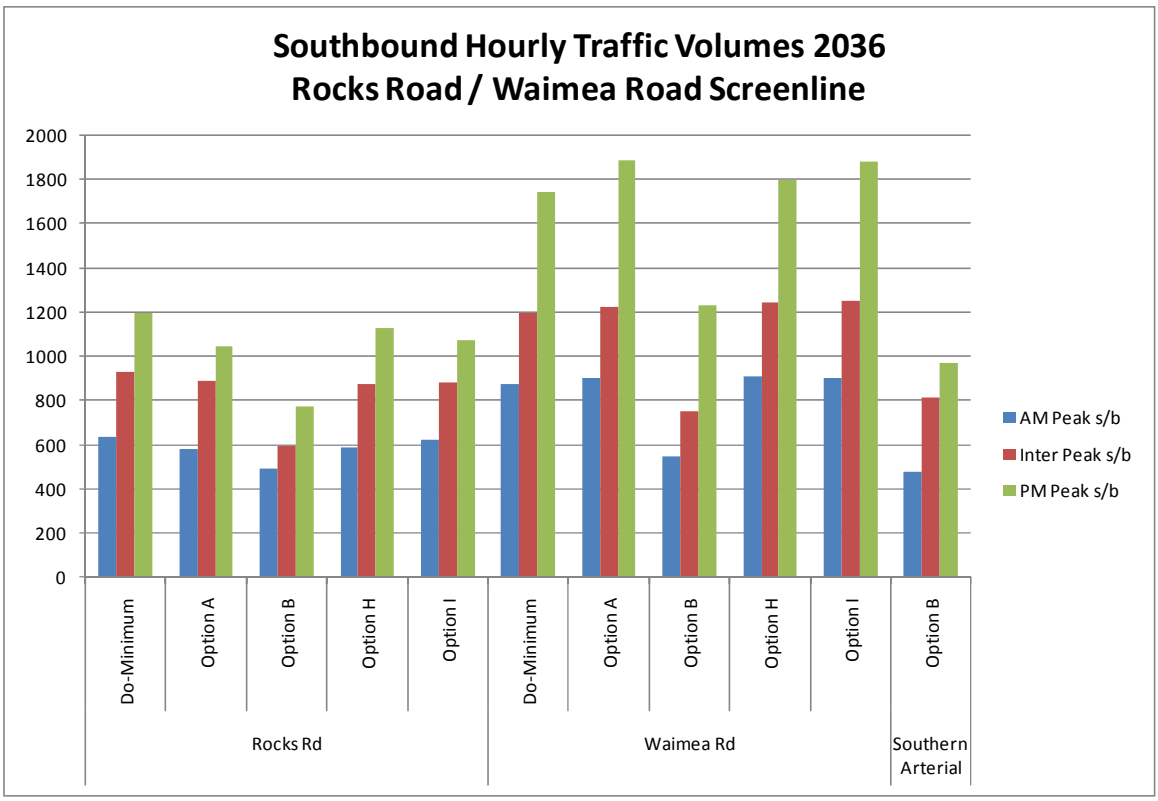

Figure 3-4: Southbound Hourly Traffic Volumes 2036

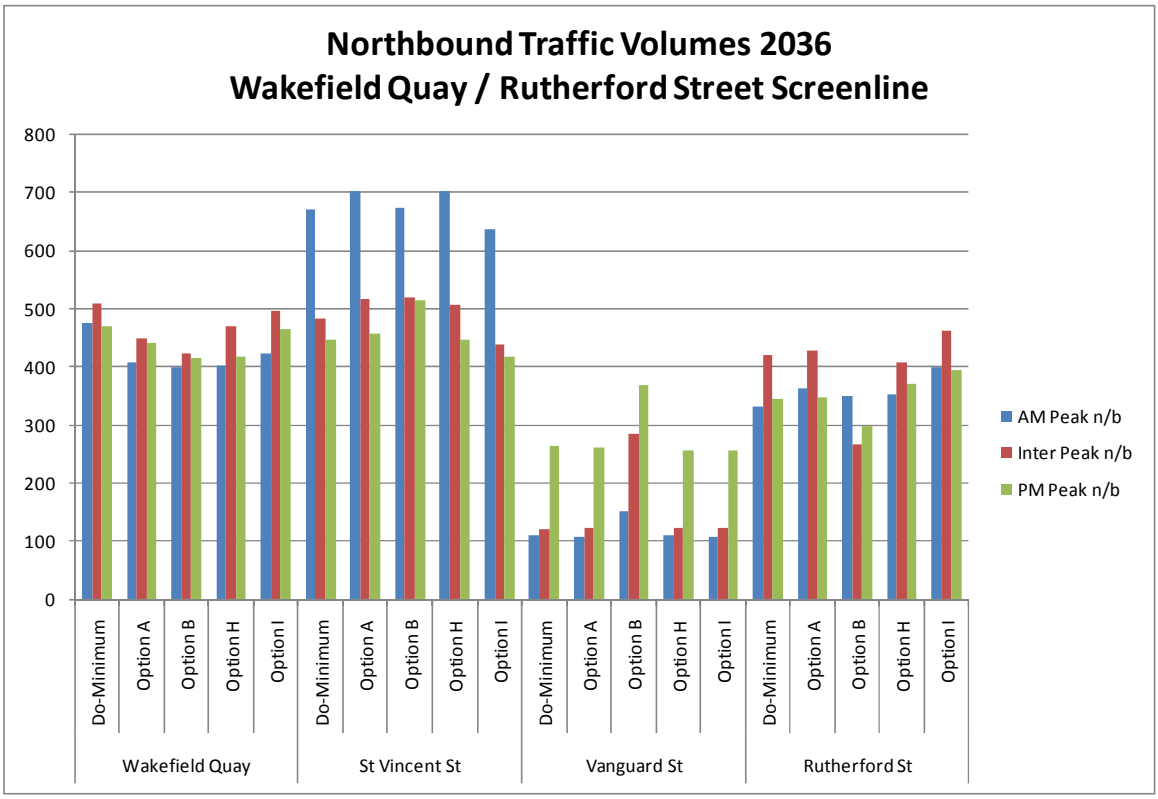

Figure 3-5: Northbound Hourly Traffic Volumes 2036

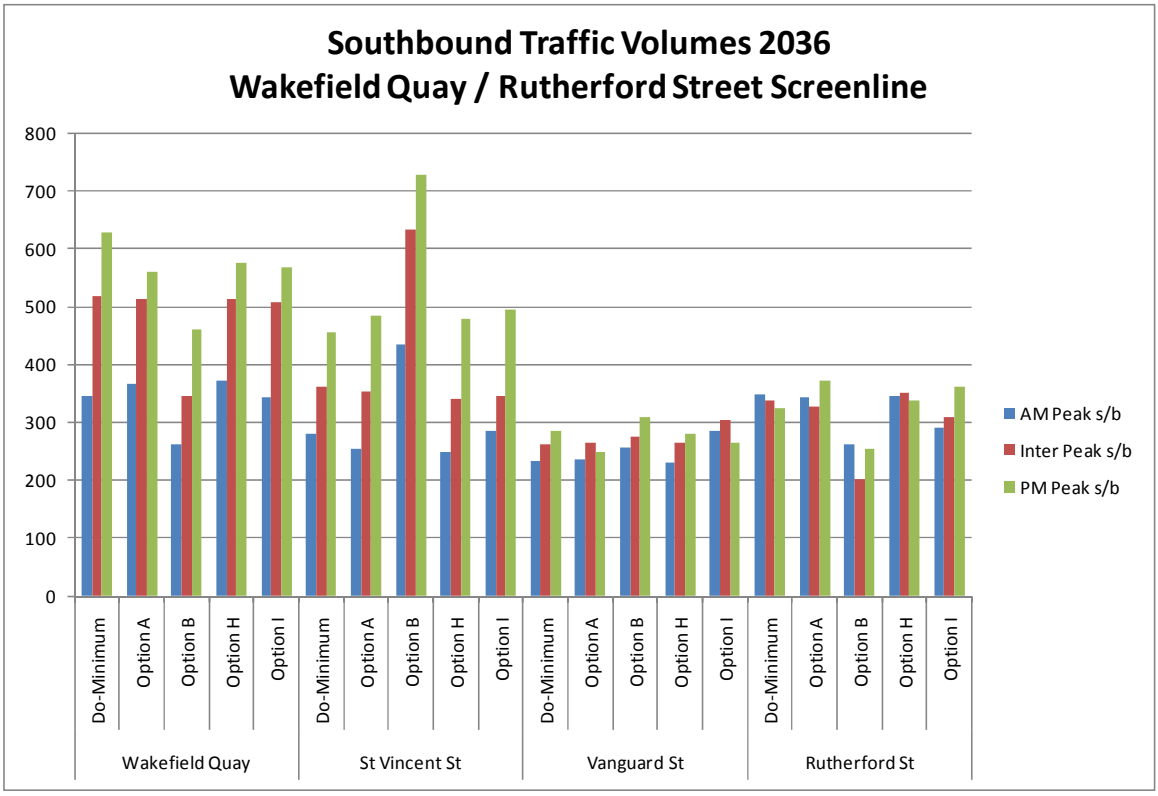

Figure 3-6: Southbound Hourly Traffic Volumes 2036

As with the Stage 1 report, these traffic volumes have been considered in light of whether they are likely to result in significant capacity issues.

Austroads Guide to Traffic Management Part 3 Traffic Analysis states that one-way mid-block urban traffic capacity is typically 900 vehicles per hour per lane for an undivided road with low side friction. However, it also states that peak period mid-block traffic volumes may increase to 1200 to 1400 vehicles per lane per hour on any road when the following conditions exist or can be implemented:

- adequate capacity at major upstream intersections;
- uninterrupted flow from the carriageway upstream;
- minimal number of crossing or entering traffic movements at intersections;
- control or absence of parking;
- control or absence of right turns by banning turning at difficult intersections;
- good co-ordination of traffic signals along the route.

The Stage 1 report stated that the current traffic counts on Waimea Road show higher volumes than theoretically expected by Austroads; and went on to say that this could be due to the semi-urban 70km/h nature of the route at the location of the count station. This location also has two lanes in the southbound direction which contributes to why the southbound volumes are greater than northbound.

Overall the graphs on the preceding pages do not show significantly greater traffic volumes than the Do Minimum. On the Rocks Road / Waimea Road screenline, the traffic volumes on Rocks Road on the options are similar or less than the Do Minimum whilst the traffic volumes on Waimea Road show a slight increase in Option I for the AM peak northbound and Options B and I in the PM peak southbound. As both these options provide an additional lane in the time periods mentioned, there will be no resulting capacity issues.

On the Wakefield Quay / Rutherford Street screenline, the only significant change in traffic volumes would be as a result of Option B which will obviously result in fewer vehicles on the existing arterials and an increase on St Vincent Street. However, these volumes are around or below 700 vehicles per hour and therefore will not present capacity issues.

3.5 Level of Service

The model outputs also provide an assessment of the level of service for each link or intersection within the model area. Level of Service is an index of the operational performance of traffic on a particular link or intersection; LOS A indicates free flow conditions whilst LOS F indicates severe congestion with extensive queuing and delays. In terms of defining whether a link or intersection is performing badly, the criteria for the AM and PM peaks is often level of service D.

The output plots for both 2016 and 2036 are included in Appendix C. To make the output plots more readily discernible, only links and nodes (intersections) operating at LOS D or worse were highlighted. A standard colouring convention was adopted, namely LOS D (green); LOS E (blue); and LOS F (red).

3.5.1 Base Network 2016 Peak Periods

For the 2016 AM peak the Do-Minimum network, the model predicts some stretches of Waimea Road northbound between The Ridgeway and Franklyn Street operating at level of service E or F. In addition, the intersection of Waimea Road and Tukuka Street would operate at LOS E. No other links or intersections within the study area were assessed as operating at level of service E or F.

For the 2016 PM peak, a similar pattern is seen to the AM peak with stretches of Waimea Road southbound between Hampden Street and The Ridgeway operating at level of service E or F. The Franklin Street and Tukuka Street intersection would operate at LOS E and F respectively.

3.5.2 Base Network 2036 Peak Periods

Very little change is seen to the levels of service in 2036 in comparison to 2016 on the base network as the model shows no significant increase in traffic volumes in the peak hour in the peak direction. This is the case in both the AM and the PM peaks.

3.5.3 Option A 2036 Peak Periods

For Option A in the AM peak; the provision of a clearway lane northbound on SH6 improves the level of service on this route when compared to the base network. However, on Waimea Road, there is little change for the link level of service, commensurate with the only minor change in vehicles using this route predicted by the model. The intersection improvements proposed as part of the option result in only one intersection at LOS D and none with LOS E or F.

For the PM peak, the clearway lane southbound on Waimea Road provides significant benefit by ensuring that almost all southbound links down this route operate better than LOS D. In addition, some improvement is also seen at the intersections along this route in this time period as a result of the proposed intersection modifications.

The modelling shows that the rationalisation of turning movements at intersections would not result in capacity issues at those locations with increased turning movements.

3.5.4 Option B 2036 Peak Periods

The Southern Arterial does show that splitting the traffic over three routes ensures that only very few locations would be subject to LOS E at the worst. Both SH6 and Waimea Road see a significant improvement in LOS along links and intersections in both the AM peak and PM peak. It is noted that LOS E would still be experienced for a short stretch of Waimea Road southbound in the PM peak and the level of service for St Vincent Street progresses to LOS D for a short stretch.

3.5.5 Option H 2036 Peak Periods

Providing four lanes on SH6 means that there are no capacity issues along the highway in either time period. However, as discussed above, this option does not attract many vehicles from the Waimea Road / Rutherford Street route and therefore this route continues to operate with poor levels of service similar to that shown under the base network.

3.5.6 Option I 2036 Peak Periods

Option I provides the best outcome in regards to improving the level of service experienced by road users around the whole network. The model outputs show very few locations with capacity constraints as the issues primarily identified in the base network are on Waimea Road which would be significantly upgraded as part of this option.

It is noted that even with these improvements, the modelling presented above does not show a significant improvement in travel time. This is due to there being more intersections at which drivers are required to stop; even though the delay at these individually is small and therefore well within the good level of service parameters, the overall effect is that the journey along the arterial route is not significantly faster.

3.6 Fuel Price Modelling

Sensitivity tests were undertaken to consider the effect of increasing fuel prices on future trip behaviour. For these tests, both fuel price and public transport provision were modified for the 2036 future year. As

only two tests were undertaken, limited effect and maximum effect scenarios (in terms of total trips[10]) were modelled. These were:

- Low effect: increasing fuel price by 50% and providing public transport to Phase A
- High effect: increasing fuel price by 100% but no additional public transport over the current situation.

It is not possible to precisely state what the actual cost of petrol is in the model other than to say it is a typical price for 2006[11] which is the base year upon which the model is validated. This is because the travel costs in the model are based on generalised cost formulations and it is the relativity between the cost of travel and the value of driver time which dictates the impact on modelled travel behaviour. This is in line with NZTA guidelines within the Economic Evaluation Manual.

Vehicle ownership, numbers of commercial vehicles and trips to/from points external to the model have also been adjusted for the increase in fuel cost. The adjustments have been based on work undertaken for the Ministry Of Transport in 2007 (Implementing the New Zealand Transport Strategy - INZTS). The changes were:

Table 3-2: Modelling Adjustments for Fuel Price Increases

Variable	Adjustment for +100%	Adjustment for +50%
Vehicle ownership	-20%	-10%
Commercial vehicles	-25%	-12.5%
External trips	-25%	-12.5%

Using the above values, the models responded in line with the responses shown in the INZTS study (and other publications) with elasticity's in the range -0.15 to -0.20 for vehicle trips and kilometres travelled with respect to fuel cost increases.

The key changes to travel behaviour are shown in the table below. It is noted that the model runs are compared against the base network without Phase A public transport (which is included in the base network model runs reported in the remainder of this report)

Table 3-3: Model Statistics

TRAVEL (whole network)	Total Driver Trips			Average Trip Length (km)		
1 hour	AM	IP	PM	AM	IP	PM
Base Network (no add PT)	31,037	26,689	33,972	6.84	7.01	7.04
Fuel +50% + Phase A PT	28,853	25,035	30,965	6.40	6.62	6.94
Fuel +100% no add PT	26,968	23,420	28,628	6.18	6.33	6.99

The table above shows that by increasing fuel price by 50%, the total number of trips on the network decreases by around 6-9% depending on the time of day. By increasing fuel price by 100%, a 12-16% decrease in trips is predicted by the model, which brings the total number of trips down towards the 2016 forecast figures.

It should be noted that as the PM peak model does not include the mode choice "step", the data above does not take account of the fact that people may transfer to public transport, walking and/or cycling. Accordingly, the trip data may not be as robust as the other modelled time periods.

[10] Increasing fuel price by 50% and providing public transport is considered to have the least amount of impact on total number of trips as public transport provides a viable alternative. Increasing fuel price by 100% and not providing public transport is considered to have the greatest effect on peoples mobility as more people may chose not to travel as few alternatives are available

[11] According to the Ministry of Economic Development, the average of the weekly petrol price survey in 2006 was approximately $1.55. However, this is not to say that only petrol prices are considered by the model; it could be that with the advent of alternative fuels, the cost of these fuels is 50% or 100% more expensive than the cost of petrol in 2006.

In addition to the total number of trips decreasing, the increases in fuel price also result in the trips that are being made being shorter in length, especially in the interpeak period.

The table below shows the impact in regards to mode choice.

Table 3-4: Mode Changes with fuel price changes

TRAVEL (study area)	Car Passenger		Public Transport		Walk / Cycle	
2 hour	AM	IP	AM	IP	AM	IP
Base Network (no add PT)	7,843	16,014	252	200	16,380	27,700
Fuel +50% + Phase A PT	7,884	16,027	344	224	16,901	28,048
Fuel +100% no add PT	7,961	15,939	253	197	17,464	28,105

The table above shows relatively little change in the number of car passengers when the fuel prices are altered. Also, even by increasing fuel prices by 100%, no increase is seen on the existing public transport services. When Phase A public transport is introduced with a 50% increase in fuel price, additional public transport patronage is seen when compared to the base network with the current level of public transport. However, this is actually less than the number of trips when Phase A is provided without the fuel price increase. Overall the number of public transport trips predicted is still very low.

Some increase in walking and cycling is shown, although again this is relatively small, but is a reflection of the shorter trip lengths predicted by the model.

In terms of the actual effects on the arterial routes themselves, the following table provides the traffic volumes across the Rocks Road / Waimea Road screenline.

Table 3-5: 2036 Screenline Hourly Traffic Volumes

	AM Peak		Inter Peak		PM Peak	
Vehicle Flows (per hour)	n/b	s/b	n/b	s/b	n/b	s/b
Rocks Road / Waimea Road Screenline						
Do-Minimum						
Rocks Rd	941	637	895	929	842	1193
Waimea Rd	1646	875	1320	1198	1230	1741
Fuel +50% +PT						
Rocks Rd	754	517	751	770	757	1038
Waimea Rd	1532	763	1185	1086	1148	1662
Fuel +100% no add PT						
Rocks Rd	622	430	622	643	694	927
Waimea Rd	1412	664	1074	966	1094	1581

The table shows that by increasing fuel prices by 50%, the number of vehicles on Rocks Road decreases by approximately 10-20% and the number of vehicles on Waimea Road decreases by around 5-15%. For the +100% scenario, the number of vehicles on Rocks Road decreases by approximately 15-40% and vehicles on Waimea Road decreases by around 10-25%. This brings the number of vehicles travelling on these routes back to around or below the 2006 modelled traffic volumes.

In both situations, the greatest decrease in vehicle percentages is on SH6 Rocks Road.

3.7 Travel Demand Management (TDM) Modelling

Some of the factors within the transportation model were altered to try to determine the effects of the travel demand management measures described in Section 2.1.2.

Unfortunately, transport modelling cannot have, for example, "undertake school travel plans" as an input into the model. Accordingly, the likely effect of undertaking the school travel plans and other TDM measures were modelled by adjusting other variables. The variable had to allow for the movement of trips to other modes and therefore the following alterations were adopted:

- Reduce vehicle ownership by 10% (likely to be an overestimate)
- Double the long term parking prices in the Nelson CBD[12]

The effect of the TDM measures was modelled on the Do-Minimum network; however the effects would be similar with the options. Phase A Public Transport is included in both the Base Network and the TDM model run.

It must be noted that the proxy alterations above are recognised as not being accurate and are considered too coarse to have a large degree of faith in the results. Nevertheless, they are the best possible in the transport model and give an indication as to the likely type of changes. The alterations result in the following statistics:

Table 3-6: Model Statistics

TRAVEL (whole network)	Total Driver Trips			Average Trip Length (km)		
1 hour	AM	IP	PM	AM	IP	PM
Base Network (incl. PT)	31,035	26,686	33,970	6.84	7.01	7.04
Travel Demand Management (incl. PT)	28,841	25,030	30,965	6.40	6.62	6.94

The table above shows that the total number of trips significantly decreases, however the more remarkable factor is the large reduction in trip length; this shows that people are, for example, accessing goods and services closer to their homes.

The model also shows how many private car trips are transferred to other modes and these are shown in the table below (note that these refer to trips between zones; trips within a zone are not captured).

Table 3-7: Mode Changes with TDM measures

TRAVEL (study area)	Car Passenger		Public Transport		Walk / Cycle	
2 hour	AM	IP	AM	IP	AM	IP
Base Network (incl. PT)	7,805	15,999	383	340	16,310	27,613
Travel Demand Management (incl. PT)	7,904	16,043	343	226	16,900	28,034

The travel demand management measures are shown to have minor increases of around 1% for car passengers and walking and cycling trips. Counter-intuitively, decreases are shown for public transport trips; this could be due to people undertaking shorter trips for which they do not need public transport. A similar result was seen when undertaking fuel price increase modelling above; that modelling also showed a significant reduction in vehicles on the arterial routes which is also reflected in the public transport patronage as they run on similar routes.

[12] In practice, this would involve limiting the amount of long term parking as well as increasing the cost of the council owned long term parking. Short term pricing could also be increased to encourage mode shift away towards walking, cycling and public transport

3.8 Heavy Vehicle restriction on waterfront route

One of the possible advantages of building a Southern Arterial would be that it would take some of the heavy vehicle traffic off the waterfront route. Whilst the route in itself would attract some heavy vehicle traffic, a model run was undertaken to determine the travel time and vehicle operating cost impacts of placing a ban[13] on all heavy vehicles using the current SH6. The traffic volumes expected on the arterial routes, as output from the model are shown in the table below.

Table 3-8: 2036 Heavy Vehicle Volumes in AM Peak[14]

2036	AM Peak	
Heavy Vehicle Flows (per hour)	**n/b**	**s/b**
Southern Arterial	95	74
Rutherford Street (south of Hardy)	14	13

The table above shows that, if a ban was to be put in place on the existing State Highway 6, the Southern Arterial would be the favoured option for heavy vehicles. Unfortunately these heavy vehicle traffic volumes cannot be readily compared to the traffic modelling for the other options as the other model runs were not undertaken as multi-user classified and therefore individual vehicle types were not modelled specifically.

The specific model outputs in terms of economic factors are shown in the table below.

Table 3-9: 2036 Model Study Area Statistics

TRAVEL (study area)	Average Trip Length (km)			Average Trip Time (minutes)			Road User Cost ($)		
1 hour	AM	IP	PM	AM	IP	PM	AM	IP	PM
Base Network	6.84	7.01	7.04	7.79	8.13	9.29	123,420	107,074	144,385
Option B	6.83	6.99	7.01	7.70	8.05	9.19	121,771	105,825	141,518
Option B & HGV restriction	6.88	7.06	7.07	7.75	8.14	9.24	122,352	106,575	141,528

Overall, it can be seen that preventing heavy vehicles from using the current SH6 would result in increase in trip lengths, increase in trip times and an increase in road user costs compared to providing the Southern Arterial without such a ban. It is noted that the above figures are for the entire study area; no figures are available for the specific routes by themselves.

3.9 SIDRA modelling

SIDRA intersection traffic modelling was undertaken to specifically address two questions related to Option B: Southern Arterial:

- What would be the travel time and vehicle operating cost benefits in grade separating the intersection of Toi Toi Street intersection? (as discussed in Section 2.3.7)

[13] Legislating for this ban would need to be in the form of a bylaw. Creation, monitoring and enforcement of such a bylaw may prove complicated and costly. An alternative could be to reduce the speed of the route by implementing traffic calming measures and therefore making it unattractive for heavy vehicles.
[14] Data from the traffic count site on SH6 Rocks Road shows that just over a third of the heavy vehicle traffic in the AM Peak comprises vehicles with 5 or more axles (HCV2 classification; typically >16m in length). This is similar in the interpeak and PM Peak periods.

- Considering the additional traffic that would be travelling down St Vincent Street to access the CBD, when would the additional traffic require changes to be made at the three roundabouts that link Hardy Street, Vanguard Street and Gloucester Street?

3.9.1 Toi Toi Street Grade Separation

SIDRA intersection traffic modelling was undertaken for both installing traffic signals at this location and a flyover. It has been assumed that a tunnel or an underpass would have very similar travel time and vehicle operating costs as the flyover as they both involve grade separation of the traffic movements and a vertical grade up and down for the traffic on the arterial route.

The SIDRA modelling showed that the traffic signals are likely to impart an average delay of approximately 23 seconds per vehicle. This compares to 7 seconds per vehicle approaching the intersection if the grade separation was constructed.

When evaluated using the NZTA Economic Evaluation procedures, the grade separation gives approximately $6.1M of travel time savings but vehicle operating cost (and CO_2 cost) benefits of approximately -$0.8M; i.e. an overall benefit of approximately $5.3M. Overall this would result in a BCR well below 0.3 for the flyover option and even less for the underpass or tunnel options.

3.9.2 Three roundabouts near Vanguard Street / Gloucester Street

SIDRA traffic modeling was also undertaken to determine the design life for the following three roundabouts:

- St Vincent Street / Gloucester Street / Washington Road
- Gloucester Street / Vanguard Street
- Vanguard Street / Hardy Street

Traffic surveys were commissioned to get accurate data in regards to current traffic movements at the intersection with 15 minute surveys undertaken from 7:30 to 9:00am in the AM peak period. The modelled flows from the 2006 and 2016 Regional Transport Model were used to derive the future flows for the existing road network as well as for Option B Southern Arterial which is likely to increase flows in this location.

The results for the existing 8:00-9:00 am peak reveal level of service (LOS) A, B or C for all movements, which suggests that considerable future traffic growth could be accommodated without any need for upgrading the intersections. Analysis of the 2016 and 2036 predicted flows for the Do-Minimum revealed that the two Gloucester Street roundabouts would perform adequately, operating at LOS B and the Vanguard Street / Hardy Street intersection operating at slightly lower level of service[15]. On this basis there would be no need to signalise the roundabouts.

The results for the 2016 Option B morning peak reveal LOS F for the Washington Road / St Vincent Street / Gloucester Street intersection. The Vanguard Street / Gloucester Street roundabout for the Option B 2016 morning peak performs adequately from a level of service point of view, with overall LOS C. However, the Gloucester Street western approach operates at LOS D and the 95 percentile queue length of 240 m exceeds the available 170 m block length. Furthermore the roundabout performance might be worse with signals installed at the Gloucester Street / St Vincent Street intersection. The Vanguard Street / Hardy Street intersection overall operates at LOS C but the southbound approach has LOS F and queues on the northbound approach extend over 110m.

On the basis that the surveyed morning peak flows and the regional transport model flow predictions are reliable, it is concluded that the existing three roundabouts should continue to operate satisfactorily for the base network assumptions in the AM peak. It is understood that the level of service in the PM peak is slightly worse on some approaches to these roundabouts. However, the low traffic growth rates predicted

[15] Detailed modelling of the future years for this roundabout was not able to be undertaken as the regional transport model does not include the fourth leg which accesses The Warehouse and Countdown.

will not see these getting appreciably worse in the near future. Nevertheless, there are a number of minor roundabout modifications that could be undertaken to extend the design life of the intersections.

Should Option B: Southern Arterial proceed and be commissioned by 2016, it is concluded that an upgrade of the roundabouts would be warranted as an integral part of the option. The St Vincent Street / Gloucester Street and Vanguard Street / Hardy Street intersections would perform better with traffic signals, and as these would have queuing impacts on the Vanguard Street / Gloucester Street intersection, this should also be signalised and the three intersections connected by SCATS to improve their operational efficiently and co-ordination.

4 Economic Evaluation

Economic analysis was carried out in accordance with NZTA's Economic Evaluation Manual (EEM) using the outcomes of the TRACKS transportation model.

The following assumptions have been made in the calculation of the Benefit Cost Ratio. They are:

1. The base year is 2010 and time zero is 2012.

2. The travel time and vehicle operating costs have been calculated from the TRACKS transportation modelling. The travel time benefits were determined by using the "Total Travel Time" output and the vehicle operating cost benefits determined from the "Total Travel Distance" output.

3. As presented earlier in this report, the model was run for the years 2006, 2016 and 2036 and for the AM, Interpeak and PM periods. The daily benefits were calculated by using an assessed number of hours per day for each time period. Annual benefits were interpolated between modelled years.

4. The model runs for the Do Minimum include a number of roading improvements that would be required as well as Phase A public transport as discussed in the Stage 1 report.

5. The model runs for the options also included Phase A public transport improvements in addition to the roading aspects of the options. Because both the Do Minimum and the options contain the same public transport provision, the benefits for this aspect are not apparent in the options[16]. The model runs for the options did not include travel demand management measures and therefore these have been excluded from the economic analysis; a note on this is presented later in this section.

6. No benefits associated with crash savings, walking and cycling facilities or congestion reduction has been claimed. Safety has specifically not been considered in this economic analysis as it was not a driving force for this study and has not specifically been considered in the development of the options[17]. Safety and other benefits streams could increase the BCRs slightly but would not alter the overall outcomes of the economic analysis in terms of option selection. Nevertheless these should be assessed fully during the investigation phase of the preferred option.

7. The economic assessment has determined the full range of costs for all aspects of the options and the Do-Minimum, including the public transport components over the 30 year analysis period.

8. The opportunity cost of selling land already owned for the Southern Arterial has been included in the economic analysis for this option. This has been given a value of $5 million.

[16] The costs are included in both the Do-Minimum and the options.
[17] The safety of each option will be most affected by the choice of intersection treatments adopted and these can be altered whichever option is chosen. Accordingly the safety benefits of each option can be maximised at a later date if required, but it would not be appropriate to compare the options on this basis for the current analysis.

A summary of the economic analysis is detailed in the following sections.

4.1 Travel Time Savings

The TRACKS model outputs were used to determine the overall travel time values for the Do-Minimum and each of the project options. The travel time benefits and dis-benefits for each option, when compared to the Do-Minimum are shown below.

Table 4-1: Travel Time Benefits

Option Description	Travel Time Savings
Option A: Peak Hour Clearways	-$8.67M
Option B: Southern Arterial	$33.33M
Option H: SH6 Four Laning	-$14.34M
Option I: Waimea Road / Rutherford Street Four Laning	$10.56M

The analysis shows that Option B: Southern Arterial would provide the most travel time benefits. This is commensurate with the discussion in regards to model outputs in the previous section.

It is noted that two of the options involve travel time dis-benefits. This is due to the provision of signalised intersections on the arterial routes for accessibility and safety, but which introduce delay to through traffic.

4.2 Vehicle Operating Cost Savings

The vehicle operating cost savings for each option, when compared to the Do-Minimum, are shown below. Carbon dioxide emission benefits are included in the numbers reported in the table.

Table 4-2: Vehicle Operating Cost Savings and CO_2 Benefits

Option Description	Vehicle Operating Cost and CO_2 Savings
Option A: Peak Hour Clearways	-$3.51M
Option B: Southern Arterial	$4.57M
Option H: SH6 Four Laning	-$0.91M
Option I: Waimea Road / Rutherford Street Four Laning	$3.08M

Analysis of the total travel distance also determines that the Southern Arterial is the favoured option in terms of reduced vehicle operating costs.

4.3 Benefit Cost Ratio Results

The Benefit Cost Ratios for each option are shown below. The net present value (NPV) costs and benefits include those associated with the roading improvements and the public transport improvements.

Table 4-3: Economic Analysis Summary

Option Description	NPV Costs	NPV Benefits	Benefit Cost Ratio
Option A: Peak Hour Clearways	$22.33M	-$12.18M	<0
Option B: Southern Arterial	$29.44M	$37.90M	1.3
Option H: SH6 Four Laning	$76.67M	-$15.25M	<0
Option I: Waimea / Rutherford Four Laning	$43.30M	$7.48M	0.2

The analysis shows that the Southern Arterial option obtains the highest BCR with a value of 1.3.

The economic analysis is detailed in Appendix D.

4.4 Public Transport and Travel Demand Management

No specific economic analysis has been undertaken for Public Transport or Travel Demand Management Measures.

As presented previously in this study, the modelling for Phase A Public Transport shows only limited transfer of trips to public transport, and this is not large enough to show significant differences in the economic outcomes for the analysis.

The transfer of trips to public transport would increase with Travel Demand Management and this could have a measureable effect as shown in the modelling. However, as mentioned previously, the method used to determine the likely impact of this in the model was not accurate and is too coarse to be used in an economic analysis.

Nevertheless, there are non-economic benefits in both Public Transport and Travel Demand Management measures and this is demonstrated by the Decision Making Team including these aspects in all options considered.

The scale and timing of the implementation of these aspects will be discussed further in the Stage 4 report. Economics do have an important role in determining the scale and timing as it is a key element considered by NZTA and Council when allocating funding. The likely contribution from fares to the overall operating costs is also a key consideration for funding.

5 Funding Assessment

This project has been assessed against the following documents to get a better indication of the likely funding profile:

- the Land Transport Management Act (LTMA);
- the New Zealand Transport Strategy (NZTS);
- the 2009 Government Policy Statement on Land Transport Funding (GPS); and

The assessment was undertaken in accordance with the NZTA Investment and Revenue Strategy and the Planning, Programming and Funding Manual.

The funding profile is based on the three areas of Strategic Fit, Effectiveness and Economic Efficiency, which are each assigned a value of High, Medium or Low. The resultant funding profile determines the likely priority of the activity which is then prioritised nationally.

5.1 Strategic Fit

The strategic fit rating is "a measure of how an identified problem, issue or opportunity that is addressed by a proposed activity or combination of activities, aligns with the NZTA's strategic investment direction".

The identified problem for this study is the need "to determine the best transport configuration between Annesbrook and the QEII/Haven Road roundabouts that will improve the city as a whole".

The strategic fit is an assessment of the current situation, not of potential solutions, and is presented on a scale of High, Medium or Low.

A rating of High can only be given if the project is on a Road of National Significance (RoNS), including local roads critical to the operation of RoNS, or activities with potential to provide a major contribution to economic growth and productivity on freight routes or tourism routes.

A rating of Medium can be given if there is potential for significant improvements in:

- Safety
- Journey time reliability
- Congestion in main urban areas
- Capacity constraints
- Network security and resilience

Unfortunately, this project does not satisfy the criteria for either a High or Medium strategic fit as there is not potential for significant improvement in any of the above areas, as described below:

- These routes are not considered to be safety concerns; there have been no fatal crashes and the serious crashes largely occur at intersections which could be addressed by localised improvements regardless of the option progressed.
- Variations in journey time, as shown in the Stage 1 report, are not considered to be significant
- Although Nelson is a "main" urban area, the extent of congestion forecast by the model in future years would not be sufficient to meet the criteria of "the volume to capacity ratio exceeding 80% for 5 days per week over at least a 1 hour time period that affects at least 1.5 km of a route".
- The modelling has also shown that the current arterial routes are not imparting a particular capacity constraint on the network
- Whilst Rocks Road is closed on occasion due to inundation and or rock falls, the network security and resilience criteria requires that there be no alternative route, and in this instance the Rutherford Street / Waimea Road arterial provides that alternative

Accordingly, the options identified would have a strategic fit rating of Low.

5.2 Effectiveness

The effectiveness rating is "a measure of the contribution that the proposed solution makes to achieving the potential identified in the strategic fit assessment and to the purpose of the Land Transport Management Act and the relevant New Zealand Transport Strategy objectives".

A wide range of assessment factors are available for use in this effectiveness rating and these draw from the five LTMA areas of:

- Economic Development
- Safety and Personal Security
- Access and Mobility
- Public Health
- Environmental Sustainability

A number of other key criteria can be considered including integration, consideration of options and responsiveness. Discussion is presented later in the report in relation to the areas above.

To obtain a Medium rating for effectiveness, the project must meet each of the following:

- is part of an accepted strategy, activity management plan or macroscope
- is significantly effective in achieving the potential identified in the strategic fit assessment
- provides a long-term solution with enduring benefits appropriate to the scale of the solution
- provides a solution that considers land use strategies and implementation plans, where appropriate to the activity.

There are a number of other criteria which all need to be met to obtain a High rating for effectiveness:

- meets the low and medium rating criteria
- improves integration within and between transport modes
- provides a solution that integrates land transport, land use and other infrastructure
- supports networks from a national perspective
- is an optimised transport solution.

All options meet most of the medium criteria outlined above as this study considered a range of options to meet the study objectives, considered these in relation to land use strategies via the transport model and the outcomes of the study will be used to define the transport strategy for the city. In addition, the options do provide long-term solution with enduring benefits. Options B, H and I will produce enduring benefits for arterial traffic, and Option A: Peak Hour Clearways, provides enduring benefits for walking, cycling and other transport modes which meet the future demands as predicted by the transport model.

Similarly the four options meet most of the high criteria outlined above. However, Option I would not provide the support network from a national perspective as it does not provide good access to the Port. Options B, H and I would not provide an optimised transport solution which seeks to make best use of the existing infrastructure; all would provide either new routes, or major modifications to existing routes. Option A does not provide a solution which integrates land use appropriately; the provision of peak hour clearways is almost counter to the changing traffic patterns which show increases in the off-peak direction and in the interpeak.

Accordingly, it is proffered that all options would have a strategic fit rating of Medium.

5.3 Economic Efficiency

Three of the options assessed have BCRs of less than 1. In this situation, further assessment of non-monetised benefits needs to be undertaken to determine whether the addition of such benefits could result in the total benefits outweighing the costs. If this were to be proven then a Low economic efficiency rating could be used. However, as the BCRs of these options are very low, and in two cases below 0, it is very unlikely that the total of the monetary and non-monetary benefits would outweigh the costs.

Accordingly, these options cannot be put forward to NZTA with a funding profile until further optimisation of the project scope and/or consideration of benefits proves that the benefits outweigh the costs.

However, Option B does result in an Economic Efficiency rating of Low which corresponds to a BCR of between 1 and 2. This BCR would be relatively robust as the inclusion of safety benefits, non-monetised benefits and/or optimisation of other benefits would likely raise the BCR slightly.

5.4 Assessment Profile

Based on the above information the likely funding assessment profiles for the options are presented below:

Table 5-1: Funding Assessment Profiles

Option Description	Strategic Fit	Effectiveness	Economic Efficiency
Option A: Peak Hour Clearways	Low	Medium	-
Option B: Southern Arterial	Low	Medium	Low
Option H: SH6 Four Laning	Low	Medium	-
Option I: Waimea / Rutherford Four Laning	Low	Medium	-

Based on this assessment, and current funding criteria, no options would rank high enough to justify funding from the National Land Transport Fund.

If Public Transport and Travel Demand Management measures were actioned independently of any option, they are likely to have a similar profile; Low for Strategic Fit as the problem is the same, Medium for effectiveness as whilst they provides an integrated solution, they does not meet the overall study objectives, and they would not have a rating for economic efficiency as the BCR would be less than 1.

6 Consultation

6.1 Process

Consultation was undertaken in a two-fold process involving both one-on-one consultation and community workshops.

The Nelson public have previously been subject to many rounds of consultation in earlier studies and responded in great number. It was considered that a great deal of information could be gained from the previous consultation responses and that the general public are keen to see action rather than further public consultation. To this end, this study undertook targeted consultation with key stakeholders and community groups. In addition, two community workshops were also held where a number of key stakeholders were invited to participate in helping the decision making team identify the preferred option.

The general public has been kept up to date throughout the study by having a webpage on the NCC website and through articles in Live Nelson (monthly community paper published by NCC) and the local media.

The targeted consultation was undertaken through the Social Impact Assessment, Economic Impact Assessment and Health Impact Assessment work streams and the results of that consultation are included in those reports.

This section reports on the community workshops, including the invitees, the structure and the outcomes from the two days.

6.2 Philosophy of Community Workshops

The aims of the workshops were:

- for attendees to gain a better understanding of the study and the options as they currently stand.
- for attendees to impart their point of view to both other attendees and the Decision Making Team, which includes representatives of and experts from Nelson City Council, Tasman District Council, the NZ Transport Agency, MWH (the project consultants) and an independent academic.

It was acknowledged that the workshop participants were not likely to agree to one particular option. However robust discussions were to be initiated in terms of the issues Nelson faces and the options that are being considered and it was hoped that some agreement would be reached in relation to options that should definitely not be progressed and/or changes that would be needed to a particular option to address adverse effects, should that option be progressed.

The workshop process was based on a series of questions that participants discussed and attempted to reach agreement on, first within their allocated group and then between different groups within the workshop.

The questions were ordered to move the discussion progressively from general aspirations to explicit solutions. Presentations were given to participants throughout the two days, so that full and accurate information was available for the group to determine outcomes based on rational deliberation. Decision Making Team members from Nelson City Council, NZ Transport Agency, the District Health Board, University of Canterbury and MWH were present to assist.

Attendees were not asked to bring any pre-prepared material to the workshop, as it was not a submission process. However, they were expected to have a good understanding of the reports produced to date and to have considered, in a preliminary way, the impacts that each option is likely to have on Nelson as a whole and on their organisation or geographical area.

6.3 Attendees

The following table outlines which groups and organisations were invited to the workshops and the attendees from each. The attendees were broken into discussion groups based on their main area of interest/support.

Table 6-1: List of Attendees

Group / Organisation	Attendee
Interests of Children (Yellow)	
Auckland Point School	Sonya Hockley
Early Childhood	Lyn Cadenhead
Enner Glynn School	Lianne Milne
Nelson Intermediate	Kilmeny Stephens
Tahunanui School	Rob Stevenson
Victory Primary	Helen Watson
Commuters and Freight (Grey)	
Automobile Association	Pat Pascoe
Port Nelson	Matthew McDonald
Road Transport Forum	Derek Nees
Bicycle Nelson Bays	Tony Stephens
Walk Nelson Tasman	Judy Cox
Accessibility for All	Donna Smith
Residents (Red)	
Auckland Point/Port Hills Residents Group	Denise Alderson
Positive Aging Forum	Ruby Aberhart
Nelson Residents Association	Kerry Neal
Tahunanui Community Centre	Joy Shackleton
Victory Residents Association	Mark Brown
Waimea Road Business and Residents Association	Alasdair Daines
Waterfront Association	Jeremy Matthews
Environment (Green)	
Friends of Nelson Haven	Dr Gwen Struik
Nelsust	Peter Olorenshaw
Sustainable Transport Futures	Katy Steel
Victory Community & Health Centre	Kindra Douglas
Nelson Historic Society	Tony Hunter
Ngāti Kuia	Christine Hemi
Commerce (Blue)	
Nelson Cycle Trail Trust	Chris Allison
Economic Development Agency	Liz Hegarty
Nelson Chamber of Commerce	Hugh Briggs
Nelson Motel Association	Paul Anderson
Tahunanui Business Association	John Gilbertson
Waterfront Redevelopment 2000 Trust	Addo Mulders
Invited but did not attend	
Boathouse Society	
Nelson Airport	
Nelson College	
Nelson College for Girls	
Nelson Tasman Tourism	
Ngāti Toa Rangatira	
SBL Group	
Tiakina te Taiao	
Waterfront Events	
Youth Council	

6.4 Day 1

Nelson City Council Transport Manager, Andrew James started the workshop by welcoming the participants, introducing the decision making team, outlining the purpose of the workshop and discussing how it relates to decision-making process. He also outlined the history of the arterial study, including the work that has been done since the Environment Court decision.

Di Buchan then outlined the workshop process and introduced the first questions.

Question 1. What do we value about Nelson now? What values will be important in the future?

The following responses were recorded. Overall there was strong agreement about the majority of these values both within groups and between groups.

Values – Now

- Human scale/compact city
- A safe place to live (comparatively)
- Access to recreation
- Waterfront/coast
- Access to natural environment
- Quality education and health care
- Acceptance of cultural diversity
- Diverse economy (comparatively)
- Arts, culture and heritage
- Climate
- Relatively healthy clean environment
- Geographically central location
- People including diversity and strength.

Values – Future

- All current values
- Planned growth (intelligent, integrated, regional, long term, strategic)
- Good governance structure (integrated, regional, co-operative)
- Strong primary and value added industries
- Strong diverse economy
- Community resilient to change
- Enhanced quality environment (water, air, bio.....etc)
- Accommodating all peoples – being inclusive.

Sylvia Allan presented on demographic and land-use trends before Stuart Woods discussed the traffic trends and the modelling results.

Question 2. Is there a problem with the arterial traffic flows in Nelson now? Is there likely to be a problem 20-30 years from now? For each time-frame:
- Those groups who agree there is a problem – define it
- Those groups who think there is not a problem, define reasons why not.

The following responses were recorded. It is noted that these were not consensus views but were statements presented by one or more groups.

Problems – YES

- Rocks Road structure/maintenance issues
- Too much traffic on Rocks Road (because waterfront)
- Lack of safety of pedestrians and cyclists on arterials
- Signals and merging on Waimea Road – safety and congestions
- Pedestrians and vehicles crossing Waimea Road
- Congestion – pollution on Waimea Road
- Design of arterials especially for safety
- Severance
- Space and delineation for pedestrians, cyclists and others
- Disjoined cycle network
- Rat-running – including pedestrian and children crossing of those routes
- Amenity alongside arterials
- Impact on businesses – parking, access, heavy flows
- Not suitable for heavy traffic
- Not best use of space (e.g. single-occupancy vehicles)
- Lack of direction/planning in terms of future route.

Problems - NO

- 1 – 3 minute delay not significant
- Speeds are acceptable.

Future Problems – YES

- Existing problems will get worse
- Increasing traffic volumes
- Roads at capacity now – conflict with other uses
- Freight movement
- MAYBE - (Too many variables that we don't know)

Future Problems – NO

- Modelling shows traffic OK

Question 3. What should the city's arterial transport policies be aiming to achieve in the long term?

- **For pedestrians**
- **For cyclists**
- **For motorists**
- **For public transport users**
- **For freight**

This is what you think the overall vision should be in relation to what we want to achieve as the outcome of our decision-making on a strategy to manage Nelson's arterial transport.

The following responses were recorded. Overall there was strong agreement about the majority of these values both within groups and between groups.

For pedestrians

- Safe, continuous and accessible services, integrated network
- Separate from cyclists and motor vehicles
- Safe crossings across arterial routes, including adequate time to cross , and also including upgrading existing uncontrolled crossings
- Adequate width (i.e. push chairs), surface on both sides of the road and maintenance/cleaning
- Recognition that pedestrians are valid users of the transport system
- Funding for education, walking school buses, travel plans

- Short-cuts, linkages, signage
- Lower speed zones at schools, preschools
- Pleasant environment, rules for shared paths.

For cyclists

- As above
- Safe routes to schools
- More off-road facilities
- Cater for all types of cyclists
- Cycle around contour (not up and down); i.e. reduce gradients where possible
- Bike stands/lockers at destinations, showers
- Recognise eco potential/tourism identity

For motorists

- Safe corridors
- Reliable traffic times
- Maintenance – surface, cleaning, potholes
- Short-term destination parking
- Easy access to facilities on routes (e.g. schools, hospitals)
- Encourage multi-occupancy, car-pooling
- Minimise impact on communities and the environment
- Ability for motorist to access and cross arterials
- Improve driver education and behaviour.

For public transport

- More frequency – longer hours
- Cheap (flat fee)
- Range of routes – express and local – integrated
- Rail in future, keep rail corridors
- Easy ticketing
- Low-floor buses, take bikes and prams
- Improved stations/shops, cycle facilities
- Real time information
- Park and Ride @ Richmond, Stoke, Tahunanui
- Accessible routes
- Clean safe buses
- Bus priority

For freight

- Efficient and safe movement of freight
- Minimise impact on communities
- Separate freight from cyclists/pedestrians
- Well-maintained and quiet
- Nominated route, built and maintained to HGV standards
- Keep options for light rail
- Prefer no stopping
- Flat geography
- Adequate lane width
- Parking for local delivery

Andrew James then closed the day with a discussion around the funding situation.

6.5 Day 2

The workshop began with a presentation from Andrew James summarising the responses from the first workshop. Di Buchan then posed a series of statements and asked the participants to indicate agreement/disagreement or don't know by putting up their hands. This was to provide a rough approximation of where the participants were in their thinking after participating in the workshop the week before. The responses were (roughly) as follows:

Table 6-2: Statements put to participants

Statement	Yes	No	Don't Know
Walking and cycling facilities on the arterials are poor	95	0	5
There is too much traffic on the Tahunanui Drive/Rocks Road (SH6) route and this is causing congestion	50	40	10
There is too much traffic on the Waimea Road route and this is causing congestion	50	40	10
There is too much traffic on the Tahunanui Drive/Rocks Road (SH6) route and this is causing problems with safety and severance	60	30	10
There is too much traffic on the Waimea Road routes and this is causing problems with safety and severance	45	35	20
The current impacts from light traffic on the arterials are manageable by taking measures to reduce severance and reduce traffic volumes	50	40	10
The existing arterial routes are not suitable for freight	50	40	10
Structural problems on Rocks Road make this road unsuitable for heavy traffic	60	15	25
Road-side parking is important for business viability	90	0	10
All arterial roads will have some negative impacts on the community that they run through	90	10	0
It's important to plan ahead for the future	100	0	0
Without action now, the transport situation will be worse in the future	60	35	5

Phil Peet then provided responses to the questions posed at the previous workshop and Alan Nicholson gave a short presentation explaining the term "road capacity", confirming his assessment that the modelling methods being used by the team were sound. Andrew James then reviewed his report (previously circulated) on the funding position. (Selwyn Blackmore from NZTA was unable to attend the second day).

Phil Peet then provided an outline of the four options and the reasons for discarding the other options and emphasised that PT and TDM were to be included in all the four options selected.

The first question was then put to the participants who divided into their original groups to discuss and report back.

Question 1: Taking into account the outcomes of the previous workshop, which options do you think should be discarded now and why?

Four groups discarded Options H and I. The fifth group (Grey - commuters and freight) initially thought Option H should be kept in the mix for the following reasons:

- Don't like other options
- Could provide for all modes
- Want to keep options open
- Could have positive "add-ons".

The grey group also wished to keep Option I if it involved tidal flow. On further discussion they decided that Option I with tidal flow should also be discarded as there would be safety issues; tidal flow is not

suitable in an urban area and the projected flows were becoming more even in the peak and off-peak directions.

After their additional discussion taking on board the views of the other groups, grey group agreed to discard both Options H and I.

Response to Discard Question (ticks indicate group agreement to discard)

Table 6-3: Table of Responses

Option	*Blue*	*Grey*	*Yellow*	*Red*	*Green*
A	✓				
B					
H	✓	✓	✓	✓	✓
I	✓	✓	✓	✓	✓

This resolved on a result of further discussion

Option H: Reasons given for discarding (all groups combined)

- Not economic
- Couldn't mitigate effects – i.e. vulnerability to storms
- Damage "special" waterfront
- Community severance, especially Tahunanui and waterfront
- Historic features
- Costs including mitigation
- Safety concerns
- Tourism impact
- Environmental impact
- Not necessary for traffic.

Option I: Reasons given for discarding (all groups combined)

- Overall costs – including mitigation
- Impact on local businesses and residents
- Severance
- Wouldn't deal with heavy freight on Rocks Road
- Safety concerns
- "Sledge hammer to a nut"
- Heavy traffic diverted into middle of city
- Impact on schools/hospitals/retirement villages
- Inappropriate scale for Nelson
- Property impacts

Question 2: For the remaining options, rank in terms of ability to address adverse impacts on the environment, the economy and affected communities:

The table that follows shows the responses from the groups undertaking a comparison between Options A and B in terms of the three aspects discussed. (✓ = best option; dash means the group could not choose between the two).

Table 6-4: Responses to Question 2

Option	Aspect	Commerce Group (Blue)	Commuters & Freight Group (Grey)	Interests of Children Group (Yellow)	Residents Group (Red)	Environ-mental Protection Group (Green)
A	Natural Environment		✓	-		-
	Community		✓	✓		-
	Economy		-			-
B	Natural Environment	✓		-	✓	-
	Community	✓			✓	-
	Economy	✓	-	✓	✓	-
Favoured option overall		**B**	**A**	**Equal**	**B ***	**Equal⁺**

* The residents' group asked for it to be recorded that there was a 4/2 split in this group with the majority in favour of Option B
⁺The environmental protection group did not chose between the two options as they supported "Option 5"

Question 3: What should be done to mitigate the impact of each option to make each more acceptable?

The following responses were recorded. It is noted that these were not consensus views but were statements presented by one or more groups.

Option A:

- Minimal disruption to sea wall
- Enhancements – create jetties, etc
- World class design (urban, aesthetics, quality, technical)
- Appropriate use of chain link fence
- Good access across clearways for pedestrians and vehicles
- Increase number of pedestrian crossings (or underpasses)
- Off-street parking for business (likely to require property purchase) and on-road parking
- Buses, freight, high-occupancy vehicles, trade vehicles given priority on clearways
- Reduce speed limit (for safety), particularly around schools
- Trucks/cars that meet European emission and noise standards
- Ensure enforcement of clearways and shared paths
- Co-ordination of traffic signals
- Maybe have traffic flow in both directions in both peaks
- Relocate seafront businesses on Rocks Road to ensure space for cycle and walking paths
- Improve rock fall control - especially to protect cycle-lane
- Wider clip-on to provide for a range of facilities (15m)

- Plantings
- Off-road cycleway to serve Tahunanui linking to Rocks Road
- Access arrangements for businesses and residential properties
- Physically separate walkers, cyclists and vehicles
- Mitigation for storm surge.

Option B:

- High quality design for each problem faced
- Move, isolate or relocate Victory Kindergarten, play centre and kohanga reo plus other school buildings (class-rooms, gyms) as required
- Air quality mitigation – keep traffic moving, reduce speed, Euro-standard specifications for vehicles plus planting
- Off-road high quality pedestrian and cycle facilities along route
- Good access across road for pedestrians and vehicles – especially at intersections
- Over or underpasses for pedestrians and cyclists
- Replanting and landscape rehabilitation
- Noise mitigation
- Pull-in bay for Auckland Pt School
- Trench/cut and cover sections
- Cut and cover (or shed structure) behind Victory Primary and Nelson Intermediate
- Rocks Road to stay State Highway
- Improve pedestrian/cycle facilities on other routes
- Grade-separate cycleways/pedestrian paths
- Road restricted to buses only
- Road restricted to non-motorised transport
- Overpass from Victory School and kindergartens
- Improve access to schools and kindergartens
- Berms/banks to reduce visual, planting, noise effects
- Physically separated “through” lane.

Following this question, the participants were asked if there was any additional information that they would like to be provided with at a later date.

Information requests from participants to the decision-making team

- Link to NCC Arterial Study blog
- Modelling for “Option 5” and costing
- Effect of Ridgeway extension on modelling
- Economic effects on Nelson if no improvements to arterial routes and parking (re Richmond CBD Growth)
- Link to 2009 Road Safety Issues Report (NZTA)
- How safety is considered
- How options would be staged – timing
- Impact of Heart of Nelson Strategy on flows, especially Rutherford
- Impact of increased traffic volumes from Option B into CBD
- Given current funding requirements, when could options be progressed?
- What projects are being stalled, waiting on outcomes of this study?
- What is driving the growth in freight in the model

Responses to these requests were circulated to all participants.

Andrew James thanked the participants for their time and input to the two workshops and explained how the information from the workshops would be used to inform the decision-making process.

Presentations made by the Decision Making Team at the workshops are attached as Appendix E.

7 Assessment of Best Arterial Route Options

A detailed assessment of the options was undertaken in regards to a number of specific areas:

- Economics
- Noise
- Social
- Air Quality
- Water Quality
- Heritage
- Cultural

In addition, this section also contains a discussion of additional safety aspects, a summary of the relevant NCC's policies in relation to the options proposed and a discussion on the impacts of sea level rise due to climate change.

These aspects are discussed in turn below.

7.1 Economics

The economic impact report is attached as Appendix F. This report considers any additional economic benefits and costs over and above those that would be included in the benefit cost ratio analysis using NZTA's project evaluation procedures. The report considers economic benefits and costs from a region-wide perspective, rather than from the perspective of smaller sub-districts within the City; this is not to say localised effects are not important; they are considered in the MCA analysis, however where a localised dis-benefits is offset by a localised benefit in another area, it does not necessarily affect the city as a whole.

The report quotes the Nelson Regional Economic Development Strategy as stating that the five key economic drivers in the region are horticulture, forestry, seafood, pastoral farming and tourism.

With respect to the first four drivers, the report states that there will be a continuing need for road freight services to the Port of Nelson. This predominantly involves the movement to and from the port to the south of Nelson City and to Tasman District. As a consequence, road improvement options involving access to and/or from the port via Waimea Road are not favoured; analysis by the NZ Road Transport Association using 2008 data estimated the use of Waimea Road instead of Rocks Road would cost an extra $1 million per annum for port traffic. This takes no account of through traffic and any future increases in tonnage.

In terms of tourism, the report outlines two broad types of economic impacts from the proposed arterial improvements. Firstly, the Tahunanui/Rocks Road area is considered to be "the jewel in the crown," for tourism in Nelson City. Beaches, seascapes and proximity to the water are of fundamental importance to Nelson's promotion of itself as a tourism destination as other cities with these attributes do worldwide. Secondly, the Nelson Motel Association has estimated that approximately 50% of the available accommodation in Nelson is located on Tahunanui Drive, Waimea Road and Rutherford Street. Should road improvements on these routes result in further increases in traffic flows, there is an increased risk that "drive by" customers (i.e. those who do not pre-book) would find it too difficult to access these properties and simply decide to keep going to the next destination. As a consequence visitor expenditure will be lost from Nelson City's economy, not just on accommodation but on an additional wide range of goods and services.

The report raises concerns from other business owners that road upgrades on the existing arterials will result in more traffic, more noise, less parking and the possibility of losing land. To the extent that economic activity as a consequence of road upgrades is diverted to businesses located elsewhere within Nelson City, from a Nelson-wide perspective there is no net loss in economic activity. However to the extent business activity is transferred to other existing or new enterprises located outside the City (e.g. in

Richmond, elsewhere in Tasman District or Marlborough District) there will be a loss of economic activity from a Nelson City perspective.

Conversely the report states that reductions in traffic volumes along Tahunanui Drive and Rocks Road may be a contributing factor to greater commercial development in this area. To the extent that such development would not otherwise have located within Nelson City this will increase overall economic activity in the City's economy, however this is not able to be quantified as there are a large number of other factors which influence urban renewal and development in this area. It is not possible to say that removing traffic from Tahunanui Drive and Rocks Road will definitely and immediately lead to redevelopment or new development. However reductions in traffic volumes in the area and easier access for local residents and tourists may be a contributing factor.

The report concludes that there are significant economic benefits to the tourism sector, and therefore the wider Nelson economy, from the proposed new southern arterial option especially if its construction is in conjunction with it becoming the designated route for HCVs and significant economic costs from the other three options involving clearways and the widening of the existing two arterial routes.

For the other four key drivers of the Nelson economy, use of the Waimea Road arterial route would result in significant additional economic costs.

There are a range of other economic benefits which favour the proposed new southern arterial option. These include the possible retention and expansion of business activity within Nelson City, agglomeration benefits for Nelson's CBD, recreational benefits for local Nelson residents, reductions in road closure costs and potentially improved public transport services.

7.2 Noise

The noise impact report is attached as Appendix G. The report examined the potential noise and vibration effects of the four options by predicting future noise levels and comparing them with the current patterns of noise and vibration on the existing network.

Overall the report finds that the noise and vibration effects of all options would be able to be mitigated to comply with the current standards.

The comparative assessment undertaken indicates that Option B would be the least attractive, and therefore require the greatest level of noise mitigation as it increases the overall area of effects by creating a new roading link. Option H and Option I involve significant land take and will increase noise and vibration effects for a number of residential and commercial properties in both cases. Option A would have the least potential to generate significant levels of noise and vibration effects compared to the existing environment and the environment likely to result from the Do Minimum scenario.

7.3 Social

The social impact report is attached as Appendix H. It was undertaken through the social impact assessment process which analyses projects in regards to their possible effects (both positive and negative) on individuals, groups and communities. A wide range of information sources was drawn upon including observations, statistical data, interviews and written reports to assess potential social effects.

Consultation was a very important part of the process; it was undertaken with a wide range of groups and communities to increase the assessor's understanding of the values and practices in the community affected by a proposal.

The likely social impacts (positive or negative) of each of the four short-listed options affect different parts of Nelson in different ways. Three broad geographical areas (or local communities) are affected by one or more of the options:

- Tahunanui, Moana and Britannia Heights– the Tahunanui and Rocks Road community - which would be affected either negatively or positively by all the options;
- Bishopdale, Braemar, Bronte and Trafalgar – the Waimea/Rutherford Community - which would be adversely affected by the changes to Waimea and Rutherford Roads; and
- Washington Valley, Broads and Toi Toi – the Washington Valley/Victory community - which would be adversely affected by the Southern Arterial route linking St Vincent Street and Beatson Road.

An outline of the potential issues as identified through the social impact assessment is presented below. It is noted that many of these could be mitigated through changes to the preferred option before construction.

Option A: Peak Hour Clearways

Effects on Tahunanui / Rocks Road Community

- Increased severance and reduction in pedestrian safety
- Increased delay at intersections for motorists
- Reduction of on-road parking at peaks
- More difficult access to properties on Rocks Road
- More difficult access to local businesses
- Potentially compromise development of a waterfront visitor destination/ regional recreation facility
- Increased roadside parking available in off-peak period when most facilities and services on Tahunanui Drive and Rocks Road being used
- Opportunity to improve access from side streets and properties through light-controlled crossings and intersections
- Improved safety for pedestrians and cyclists

Effects on Waimea Road/ Rutherford Street Community

- Increased severance and reduced safety for pedestrians
- Increased delay at intersections for motorists
- Reduced on-road parking at peaks
- Increased roadside parking in off-peaks
- Improved access from side streets and roadside properties if more traffic lights installed
- Addition of cycleway on Waimea Road/Rutherford Street

Effects on Victory Community

- Increase in property values – currently suppressed by threat of Southern Arterial
- Opportunity to further develop area as a model community
- Alleviation of community stress with decision finally made

Option B: Southern Arterial

Effects on Tahunanui / Rocks Road Community

- Opportunity to enhance cultural, social and recreational attributes of waterfront
- Increased property values along SH6 if traffic reduced
- Small reduction in traffic on SH6 but could increase speeds
- Possible removal of heavy traffic from SH6 – i.e. reduction in noise and fumes

Effects on Waimea Road / Rutherford Street Community

- Reduction in traffic levels on Waimea Road and Rutherford Street but could increase speeds

Effects on Victory Community

- Less pleasant environment for cyclists and pedestrians on Railway Reserve
- Increased danger for pedestrians and cyclists in St Vincent Street
- Reduced air quality
- Increase in traffic reduces amenity for houses at southern end of route (including Beatson Road)
- Increased traffic noise for residents, schools and community facilities
- Reduced amenity in Toi Toi shopping area and Victory Square
- Reduction in property values
- Renters wanting to move may find difficulty getting comparable accommodation
- Cycle-lane constructed on St Vincent Street (albeit on-road)
- Creation of a direct, more efficient route for Nelson Fire Service and St John Ambulance to Stoke and Tasman in case of emergency

Option H: SH6 Four Laning

Effects on Tahunanui / Rocks Road Community

- Significant property purchase – residential and commercial
- Renters may have difficulty finding comparable, affordable accommodation
- Significant reduction in amenity for remaining home owners – proximity to traffic, loss of vegetation –lower property values
- Impact on Suburban Club and Nightingale Library buildings
- Removal of shops and facilities south of Bisley Avenue could compromise achievement of town centre vision
- Traffic closer to classrooms at Tahunanui School
- Access difficulties for residents on Rocks Road
- Increased physical and social severance esp. on Tahunanui Drive for residents accessing facilities, services and neighbours
- Possible increase in traffic effects on SH6

- Faster traffic speeds could lead to increased severance. Raised median strip could address this by providing a pedestrian refuge
- Reduced effectiveness of measures to encourage modal shift (bus, walking, cycling)

Effects on Waimea Road / Rutherford Street Community

- Possible reduction in traffic on Waimea Road and Rutherford Street

Effects on Victory Community

- Increase in property values – currently suppressed by threat of Southern Arterial
- Opportunity to further develop area as a model community
- Alleviation of community stress with decision finally made

Option I: Waimea Road / Rutherford Street Four Laning

Effects on Tahunanui / Rocks Road Community

- Possible reduction in traffic on SH6

Effects on Waimea Road/ Rutherford Street Community

- Property purchase - homes, commercial premises, community services and facilities
- Loss of residential amenity for remaining homes – proximity of traffic, removal of vegetation
- Removal of some health services, road closer to health administration in Braemar buildings
- Road closer to Hampden Street School and Nelson College; removal of vegetative buffer
- Removal of swimming pool and playing courts at Nelson Girls College
- Loss of small retail outlets
- Motels between Hampden Street and Bronte Street would lose front buildings and road closer to remaining accommodation
- Faster traffic speeds could increase severance. Raised median strip could address this by providing a pedestrian refuge
- Adverse impact on viability of alternative transport modes
- Provision of cycle lanes – albeit on-road
- Improved bus services

Effects on Victory Community

- Increase in property values – currently suppressed by threat of Southern Arterial
- Opportunity to further develop area as a model community
- Alleviation of community stress with decision finally made

7.4 Air Quality

The air quality impact report is attached as Appendix I. This report reviews the likely air quality impacts for each route option, based on fine particulate monitoring data (PM_{10}) as the best available indicator for air quality, and on projections from traffic modelling of likely changes in vehicle numbers and traffic speeds over time.

The air quality spreadsheet model used in the assessment provides a relatively simple and straightforward means of predicting pollutant concentrations associated with road traffic emissions. Overall, whilst there are some differences, the modelled PM_{10} concentrations are quite similar.

The assessment shows that Option A will make increased contributions of PM_{10} as a road-associated component to total Airshed PM_{10} concentrations. For Rocks Road, Annesbrook Drive and Waimea Road in particular these PM_{10} contributions in Option A are higher than for the other three options.

The Option B model outputs indicate a moderate reduction in PM_{10} contributions for Rocks Road and Waimea Road but an increased PM_{10} contribution in Wakefield Quay and St Vincent St, in particular, and a small increase also in PM_{10} for Vanguard St and Rutherford St.

In comparison with Options A and B, it can be deduced from the model results that Options H and I (the four-laning options) are generally favoured in terms of the lessened extent to which they will contribute a road-associated PM_{10} component to the total PM_{10} concentrations along various sections of these route options.

The assumptions inherent in the spreadsheet model result in a degree of inflexibility in the outputs. It is important therefore to provide some local context to the results by an at least qualitative consideration of the ways in which various constraints of locality, contaminant dispersion and population densities should be factored in to the way in which the model results should be viewed. The table below presents the model outputs along with other characteristics of the study area.

Table 7-1: Air Quality Characteristics

	Option A	Option B	Option H	Option I
Background Existing PM_{10} Concentrations Along Route (in general)	Low / Moderate	High (but reducing)	Low / Moderate	Moderate
Road-Associated PM_{10} Contributions to Local Airshed ($\mu g/m^3$;from model outputs)	1.59	1.30	1.38	1.28
Dispersion Characteristics Along Route (in general)	Good / Moderate	Poor	Good / Moderate	Moderate
Human Exposure to Contaminants in Ambient Air	Moderate	Moderate-High	Moderate	Moderate-High

Overall it can be seen that the options which traverse inland routes fair worse in regards to current concentrations, dispersion characteristics and human exposure and are therefore considered poor in terms of overall air quality.

7.5 Water Quality

The water quality impact report is attached as Appendix J. A summary of the main points in relation to assessment is presented below.

The report states that the potential adverse effects of Option A are probably little different from the Do-Minimum in that very little change to the road footprint is required and traffic is spread over both of the existing arterial routes rather than being concentrated on one route.

Option B:'Southern Arterial' requires construction of a new 'green-fields' road which will increase the total area of impervious surface, and consequently affect the hydraulic functions of Jenkins Creek and York Stream, albeit by a small proportion in terms of the overall catchment. Short term construction impacts include likely increases in sediment loads discharged in stormwater runoff to both streams. In the longer term this option will also increase traffic and contaminant run-off in the York Stream catchment. On balance these effects will probably be minor provided appropriate mitigation measures are implemented during both construction and operational phases.

Option H: 'Rocks Four Lane' requires a new seawall and reclamation of intertidal seashore, including approximately 17,000m^2 of rocky shore habitat. While the benthic biota of this area is relatively sparse the rocky outcrops supports a simple benthic community typical of Tasman Bay, including the barnacle, little black mussel, limpet, tubeworm and a number of algae and sponges. The benthic communities found in the footprint of the expanded seawall are not unusual or rare. Nevertheless the loss of habitat on this scale is a significant issue.

Option I: 'Waimea/Rutherford Four Lane' will require widening of existing roadways and modifications of existing stream crossings and will tend to increase traffic and contaminant run-off in the York Stream catchment. Road widening will increase the total area of impervious surface, and consequently affect the hydraulic functions of Jenkins Creek and York Stream, albeit by a small amount. These effects can be mitigated by a variety of methods to reduce runoff rates, increase groundwater recharge and reduce contaminant loads to the Stream.

The report concludes by stating that, on the basis of existing information, Option A: 'Part time clearways' has the least potential for causing adverse effects on water quality and aquatic ecology. The three other options all have some potential to cause adverse effects, but most can be mitigated by engineering design and careful management. The loss of rocky shoreline caused by Option H is the most significant of the adverse effect identified.

7.6 Heritage

The heritage impact report is attached as Appendix K. This report identifies the potential impact of the four preferred options on historic sites such as archaeological sites, buildings and structures. A summary of the main points in relation to the assessment is presented below.

Option A: Peak Hour Clearways

The additional lane along Annesbrook Drive, Tahunanui Drive, Haven Road, Rutherford Road and Waimea Road will be constructed within the existing carriageway. The effects of the option on historic sites in these areas are minor, if any. There may be some minor effects on pre-1900 road surfaces or structures if any excavation occurs. However, this could be mitigated by information retrieval.

Along Rocks Road and Wakefield Quay, the new footpath and cycleway will have serious effects on the physical structure, historic integrity and aesthetic values of the Rocks Road seawall, stanchions and chains.

Option B: Southern Arterial

Option B could have some minor heritage impacts in relation to the area around an historic house at 92 Beatson Road and slightly greater impacts on the Railway Reserve itself as it is likely to affect the old Bishopdale Station and any remaining railway formation along the route. Other impacts could likely be avoided by refinement of the design.

Option H: SH6 Four Laning

Option H will have very significant effects on historic heritage. Between Annesbrook and Tahunanui, the widening would affect some pre-1900 buildings, as well as the Tahunanui Town Hall. There is an early Maori occupation site at Tahunanui into which the option would encroach.

Option H will extend the road out across the seawall, stanchions and chains. This will have significant adverse effects on the physical structure, historic integrity and aesthetic values of the seawall, stanchions and chains. The proposed wider road will also have significant affects on other historic sites. The Boat Shed, the Boat House, the former Anchor Shipping Company office and the Custom House will be significantly damaged or destroyed. These are listed buildings in the Nelson Resource Management Plan. The remains of historic structures along the waters edge will be disturbed, for example, the slip, the site of the marine baths and a slip under the Boat House.

The increase in traffic and the visual intrusion of a large road will greatly detract from the maritime historic landscape and the views of the historically significant harbour, Boulder Bank, Haulashore and Fifeshire Rock. It will intrude on the amenity values and spiritual qualities of the Seafarers and Settlers memorials.

Option I: Waimea Road / Rutherford Street Four Laning

Option I will have considerable impacts on historic places, most notably along Rutherford Street. This part of Nelson contains existing and recognized historic buildings. The extended carriageway will remove the listed Kelvin's Cycle building (109 Rutherford) and Pomeroys (corner of Hardy and Rutherford). It will also damage the architecturally significant Church of Christ at 173 Rutherford Street and 2-6 Bridge Street. There is also likely to be pre-1900 sub-surface archaeological evidence of commercial and domestic activity. The new carriageway will also remove a small part of the western side of Anzac Park, which is a significant heritage and spiritually significant site.

7.7 Cultural

The following iwi have been consulted as part of Stage 3 of the Nelson Arterial Traffic Study:

- Ngāti Kuia
- Ngāti Toa Rangatira
- Ngati Koata
- Ngāti Rārua
- Ngāti Tama
- Te Ātiawa

} Tiakina te Taiao

A consultation document was prepared that summarised the Stage 1a, 1b and Stage 2 reports and was used as the basis of consultation. The document was emailed and posted to Ngāti Kuia and Ngāti Toa Rangatira with a request for feedback. The other four iwi are represented by Tiakina te Taiao and two weeks prior to their July hui copies of the document were emailed and posted to Tiakina.

7.7.1 Tiakina te Taiao

Juliet Westbury (MWH), Amanda Young (Consulting Archeologist) and Andrew James (NCC) attended the Tiakina hui on Monday 28 June 2010.

Tiakina believe it is important that they prepare a Cultural Impact Assessment specifically assessing their concerns and preferences relating to the four options presented at the hui.

7.7.2 Ngāti Kuia

A follow up phone call was made to the Ngati Kuia resource management representative and the following feedback was given.

Both pre-European and European historical sites and structures are important to Ngati Kuia. They would prefer to see minimal impact on these sites and structures. Their preference is for Option A: Peak Hour Clearways, with a second preference of Option B: Southern Arterial.

Option H: SH6 Four Laning is considered to have significant impact on historical sites and structures while this could be minimised with Option A. Ngati Kuia see a benefit to having a third route out of the city but are aware of the perceived impact to the Victory community.

7.7.3 Ngāti Toa Rangatira

A follow up phone call was made to the Ngati Toa resource management representative and they oppose Option H: SH6 Four Laning but would be comfortable with Option A or B. Ngati Toa is concerned about the impact of any option on cultural and archaeological sites and the effects on the coast and sea wall. Option I may be acceptable if the road is retained within the existing road formation but would probably not be acceptable if more land would be required.

7.7.4 Comments

The main concerns of local iwi are typically:

- protection of archeological and cultural sites,
- protection and improvement of waterways
- protection and enhancement of coastal area
- protection of natural landscapes

The heritage report contains more specific information on the location and impact of each option on the archaeological sites.

If vegetation has to be removed during construction, iwi prefer to see at least an equivalent amount of native vegetation is replanted nearby.

Control of sediment and contaminant run off from new roads (or widened roads) into waterways and coastal waters is important. Returning waterways back to a more natural state with meandering low flow paths, provision for fish passage and improved fish habitat is also important.

7.8 Additional Safety Considerations

In addition to the safety aspects presented in the Social Impact Assessment, a high level engineering approach was undertaken in relation to the likely crash benefits of constructing the four options. The sources for much of the information presented below are the NZTA Economic Evaluation Manual and the Austroads' Road Safety Engineering Toolkit.

Option A would result in an additional traffic lane being available in the peak periods. The EEM states that research currently indicates that there would be a 60% increase in injury crashes for a peak period lane; however it does not provide specific recommendations. The provision of a separate footway/cycleway would however provide measureable benefits for vulnerable road users who would no longer have to travel in close proximity to motor vehicle traffic. The clearway lanes themselves also provide space for cyclists both when they are used for parking and when they are used as traffic lanes. In addition, a number of traffic signalised intersections are proposed. Where these replace priority intersections, they would decrease the number of pedestrian crashes but may increase the number of motor vehicle only crashes, albeit mostly rear-end type crashes which tend to only result in minor injury or damage only crashes.

Option B would provide a new 'greenfield' arterial for much of its length which would likely have a very low crash rate as vehicles travelling along this section would not be subject to the same hazards such as intersections, driveways and parked vehicles. In addition, the vulnerable road users would be separated from the motor vehicles along this stretch. The new traffic signals on St Vincent Street may have a minor adverse safety impact on motor vehicle users as discussed above. In addition, traffic would be spread over three routes rather than two which would mean safety implications in more locations.

Options H and I would involve four laning existing arterial routes and the prediction models in the EEM suggest that this would have no change in the injury crash rate. However, the current designs involve providing a raised median island which should reduce crashes overall by 20 to 30%. This, along with the rationalisation of turning movements at a number of intersections could see a reduction in the number of crashes occurring on the arterial routes. Installation of traffic signals would also have a safety impact as discussed above. However, the potential for additional vehicles and higher speeds in urban areas is of particular concern for pedestrians, especially for Option I along Waimea Road with the hospital, schools and the start of the commercial area.

Implementing the public transport and travel demand management components of the options should also reduce casualties by reducing the number or vehicles travelling on the road network. However, care should be taken in regards to the increased numbers of pedestrians and cyclists as these vulnerable road users are already over represented in Nelson's crash statistics.

It is considered that Nelson's biggest opportunity to reduce crashes lies in undertaking safety improvements consistent with the Regional Land Transport Strategy, rather than relying on an arterial traffic solution. Many of the safety improvements that would be progressed when considering the approach in the Strategy could be undertaken regardless of the option chosen in this study.

7.9 Summary of Relevant Policy

A summary of the current relevant policies is attached as Appendix L. The conclusions of the report are presented below:

Nelson City has a well-developed set of strategies and policies relating to the city's environment, its land use and transport systems, and its community. The present suite of relevant documents has been developed over the past two decades, in line with statutory and associated requirements. Some of the separate strategies are not binding in a statutory sense, but help to elucidate the Council's intended directions or approaches.

The strategies and policies have been developed with significant community input, and can be said to reflect the directions which the community wishes to follow.

There is a strong focus on the central city area and its importance as an economic and community powerhouse with very high environmental amenity values. Managing transport and roading within this context requires careful consideration and attention to detail.

There is a strong policy thrust towards providing for non-vehicular transport – walking, cycling and public transport, in preference to catering for private vehicles. The role of heavy vehicles and the importance of their movement is the subject of some policy. The need to and ability to access the port and airport are regionally significant matters.

There is no strategic or policy direction relating to the protection of the waterfront or Wakefield Quay. While Tahunanui is recognized as an important recreational destination, its structure plan is directed at reorganising and consolidating land uses to manage and minimise conflict with traffic on the State highway system.

7.10 Effects of Sea Level Rise on Rocks Road

A simple assessment was undertaken to determine how inundation and flooding of Rocks Rd by sea water may increase due to the predicted effects of climate change. This is presented in Appendix M.

Whilst a number of assumptions are made especially in regards to wave action, the assessment discusses the likely effects for three different predicted levels of sea level rise for 2100: 0.5m, 0.8m, and 1.0m

- If a 0.5m sea level rise occurs, then waves are likely to encroach onto Rocks Rd for 3% of time, or 11 days per year
- If a 0.8m sea level rise occurs, then waves are likely to encroach onto Rocks Rd for 6.5% of time, or 24 days per year
- If a 1.0m sea level rise occurs, then waves are likely to encroach onto Rocks Rd for 14% of time, or 51 days per year

This is a simplistic analysis and the occurrence of inundation is likely to be more frequent as smaller (and therefore more frequently occurring) wave set-up and run-up events will be required to overtop the road as sea level rises. This does, however, shows how the frequency of inundation would increase given a certain wave action.