MWH

BUILDING A BETTER WORLD

STAGE 1B REPORT

Arterial Traffic Study
Evaluation of Existing Arterial Traffic Routes

Prepared for Nelson City Council

APRIL 2010

927044

QUALITY ASSURANCE STATEMENT

PROJECT MANAGER	REVIEWED BY
Phil Peet	Stuart Woods
PREPARED BY	**APPROVED FOR MWH ISSUE BY**
Sylvia Allan, Phil Peet and Dave Wanty	Stuart Woods
DECISION MAKING TEAM	**NZTA ACCEPTANCE BY**
Andrew James, Martin Workman, Chris Ward, Selwyn Blackmore, Les Milligan, Gary Clark, Alan Nicholson, Sylvia Allan, Di Buchan, Geoff Ward, Stuart Woods and Phil Peet	Selwyn Blackmore

WELLINGTON
Level 1, 123 Taranaki Street, Wellington 6011
PO Box 9624, Te Aro, Wellington 6141
TEL +64 4 381 6700, FAX +64 4 381 6739

REVISION SCHEDULE

Rev No	Date	Description	Prepared By	Reviewed By	Approved By
1	May 10	Final	Phil Peet	Stuart Woods	Phil Peet

NELSON CITY COUNCIL

Arterial Traffic Study
Evaluation of Existing Arterial Traffic Routes

CONTENTS

Executive Summary

This report is part of Stage 1 of the Nelson Arterial Traffic Study being undertaken by MWH New Zealand Limited for Nelson City Council. It is an addendum to the Stage 1 Report of the study and includes a background discussion and an explanation as to why the findings of recent transport modelling used for this study differ from the findings of the earlier North Nelson to Brightwater Strategic Study; further information about the criteria proposed for the multi-criteria analysis and their weighting; and a summary of the available information on the existing situation in relation to each of the criteria.

For this study, an updated transport model has been developed and applied, based generally on previous models used for earlier Nelson-Tasman strategic transport studies. One of the main update processes involved reviewing and revising future population and employment growth projections and geographical distributions.

The land use assumptions used for this study involve significantly lower (and probably more realistic) population and employment forecasts in comparison to the previous model which was used for the North Nelson to Brightwater Strategic Study. They include changes in land use distribution assumptions arising from strategic planning for both Nelson and Richmond, and adjustments in regional demographic trends.

The revised land use assumptions, along with the modified population and employment forecasts, and demographic trends result in a lower number of trips being generated, and a reduction in trip length. That the length of trips decreases over the study period indicates that people are expected to preferentially access jobs and services closer to their homes. Changes in off-peak flows relate to changing demographics and a higher proportion of retired people.

The general results of the modelling comparing the present situation with the situation in 2036 indicate:

- an increase of 26-28% in trips over the entire network by 2036;
- a significant increase in total vehicle kilometres, but a reduction in trip length;
- a significant increase in inter-peak traffic;
- a significant increase in traffic moving in the off-peak direction during AM and PM peak periods; and
- little or no increase in trips for peak direction travel along the current arterial routes in Nelson.

The Stage 1 report contained some discussion in regards to the development of criteria for the multi-criteria analysis to be undertaken in Stage 4. This report presents the further development and confirmation of these criteria by the Decision Making Team, as well as the relative weightings to be assigned to each of the criteria, as shown in the table below. These criteria were developed to ensure that they considered the requirements of the Resource Management Act, the Local Government Act, the Land Transport Management Act and the Nelson City LTCCP (particularly as expressed through the study's brief). Full descriptions defining each criterion have been developed in this report.

Criterion	Weighting Outcome
1. Impacts on Cultural / Heritage Values	4
2. Impacts on Natural Environment	6
3. Co-benefits	4
4. City Future	10
5a. Impacts on Communities - Physical	8
5b. Impacts on Communities - Social	9
5c. Impacts on Communities - Economic	5
6. Robustness/Future-proofing	7
7. Degree of Difficulty	10
8. Economic Efficiency	9

The final part of this report uses the above criteria to assess the current situation and the possible impacts on the City of no major transport improvements over the next 30 years. Whilst the results are presented in tabular form it is stressed that this is only a preliminary assessment, as the criteria are not yet fully developed, further evaluation of the 2036 situation is required, and the application of the criteria needs to be undertaken in a consistent way relative to the other options in a workshop setting involving assessment by all members of the Decision Making Team. Unsurprisingly this initial assessment which is based on the wide range of initial assessments already to hand in Stage One indicates that there are a number of adverse impacts and negative issues related to transport in the study area, and if no action or improvements are implemented, these matters generally deteriorate. A further assessment of this "do-minimum" situation will be undertaken during the Stage 4 workshops and analysis.

1 Introduction

This report is part of Stage 1 of the Nelson Arterial Traffic Study being undertaken by MWH New Zealand Limited for Nelson City Council.

This report is an addendum to Stage 1 of the study and includes the following:

- A background discussion and an explanation as to why the findings of recent transport modelling (undertaken between 2009 and 2010, using 2006 base information and reported in the Stage 1 report) differ from the findings of the earlier North Nelson to Brightwater Strategic Study (between 2005 and 2007, using 2001 base information).
- Further information about the criteria proposed for the multi-criteria analysis and their weighting.
- A summary of the available information on the existing situation in relation to each of the criteria, which will assist in undertaking both the cost benefit assessments of the options and the multi-criteria analysis in Stage 4 of the study.

2 Transport Issues Arising from changing Circumstances

2.1 Modelling Context

The Stage 1 report notes a number of predicted outcomes from the transport modelling undertaken in 2009 which are different from those anticipated from the earlier modelling undertaken for the North Nelson to Brightwater Strategic Study. The general results of the modelling are summarised in section 4.8 of the Stage 1 report. These compare the present situation with the situation in 2036, and indicate:

- an increase of 26-28% trips over the entire network by 2036
- a significant increase in total vehicle kilometres, but a reduction in trip length
- a significant increase in inter-peak traffic
- a significant increase in traffic moving in the off-peak direction during AM and PM peak periods
- little or no increase in trips for peak direction travel along the current arterial routes in Nelson.

While some of these changes were identified in previous modelling exercises and are a continuation of earlier trends and of same order, others were new and not immediately obvious. This demonstrates that changes in the region and its population and economy since 2001 are likely to cause changes to travel patterns which may require specific responses in the present arterial route study.

Aspects which show marked changes from previous modelling are set out below:

- The percentage increase in number of trips is only slightly greater than the percentage increase in population over the period.
- No increase in average trip length, with a slight reduction in average peak hour trip lengths, and a very slight increase in average off-peak trip length.
- No increase in average trip time, with a reduction in the morning peak hour time.
- Little or no growth in peak direction flows and a reduction in peak flows on some routes (e.g. Rocks Road in the AM peak, and Waimea Road in the PM peak).
- “Peak hour” volumes on some roads for longer in the day (as a result of increasing flows inter-peak or in the off-peak direction).
- Some, but a relatively low uptake of public transport.

As noted in the Stage 1 report, the modelling includes a number of assumptions about the future situation in Nelson, such as the roading improvements and public transport services provided, the population growth and where the growth in residential, commercial and industrial areas will occur. It also assumes

no major changes in fuel cost, and no travel demand management measures (such as parking pricing). The model used provides information for weekday typical travel patterns for morning, inter-peak and evening peak hours, and whilst predicting private vehicle travel for all three periods, only assesses public transport impacts for the morning and inter-peak periods.

Appendix 1 provides a detailed examination of the changes between the two models and the assumptions on which they are based. Key factors which have influenced the changes are discussed below. (As outlined in the Stage 1 report, the models are predictive and are not necessarily a guarantee of what will happen. They are, however, based on the best available information).

2.2 Study Area

The study area for the regional transport model is unchanged from earlier versions. It extends from Hira in the north-east to Kawatiri Junction in the south and Riwaka in the north-west. The Nelson City arterial routes which are the subject of the present study are located close to the centre of this wider region and changes in modelled volumes and patterns are not significantly affected by traffic generated beyond the boundaries of the regional transport model. Rather, they are the result of a range of changes internal to the regional model area, including assumptions about population, employment, economic activity, education and other variables that may affect future travel.

Figure 2.1 on the following page shows the regional transport model boundaries and transport model area, and the area of the present study.

2.3 Baseline Traffic Information

From Appendix 1, Table A1, it can be seen that the 2006 baseline information is not dissimilar to the 2001 baseline used in earlier modelling. However, there has been an increase in private car trips, especially during peak periods, and trips are tending to be shorter in both time and distance on average.

This traffic growth between 2001 and 2006 was less than expected and provides a lower starting point for the present modelling exercise. This contributes, in general terms, to lower traffic volumes at later dates in the projections.

2.4 Total Population

The assumptions relating to total population growth in the current model are shown in Figure 2-2 below, and are substantially reduced from those in the previous models – a 24% increase above the 2006 figures compared to a 63% increase projected above the 2001 figures. This is reflective of relatively low growth between 2001 and 2006, and lower expectations of future population growth (from Statistics NZ information), and it has a substantial impact on the projections of traffic growth.

Appendix 1 explains that the total population projections used in the earlier models were “aspirational”, rather than “business as usual”, which applies to the current model. Alternatively, the projections used in the current model could be considered to be reflective of the reduced growth rates experienced between 2001 and 2006 census periods over the previous trends experienced, particularly in Richmond. The adjustments have been made, however, in the context of a much more informed planning framework, including the undertaking of significant growth planning strategy exercises for Richmond and Nelson.

2.5 Demographic Changes

Demographic changes are not commented on in Appendix 1, but generally the region’s population is aging, household sizes are reducing and the local demographic profile includes a “gap” in the 18 to 35 year cohorts (such trends are found nationwide with the gap being typical of provincial cities). This is likely to contribute to more off-peak journeys and slightly reduced traffic growth over time, due to the travel patterns of the growing number of older people.

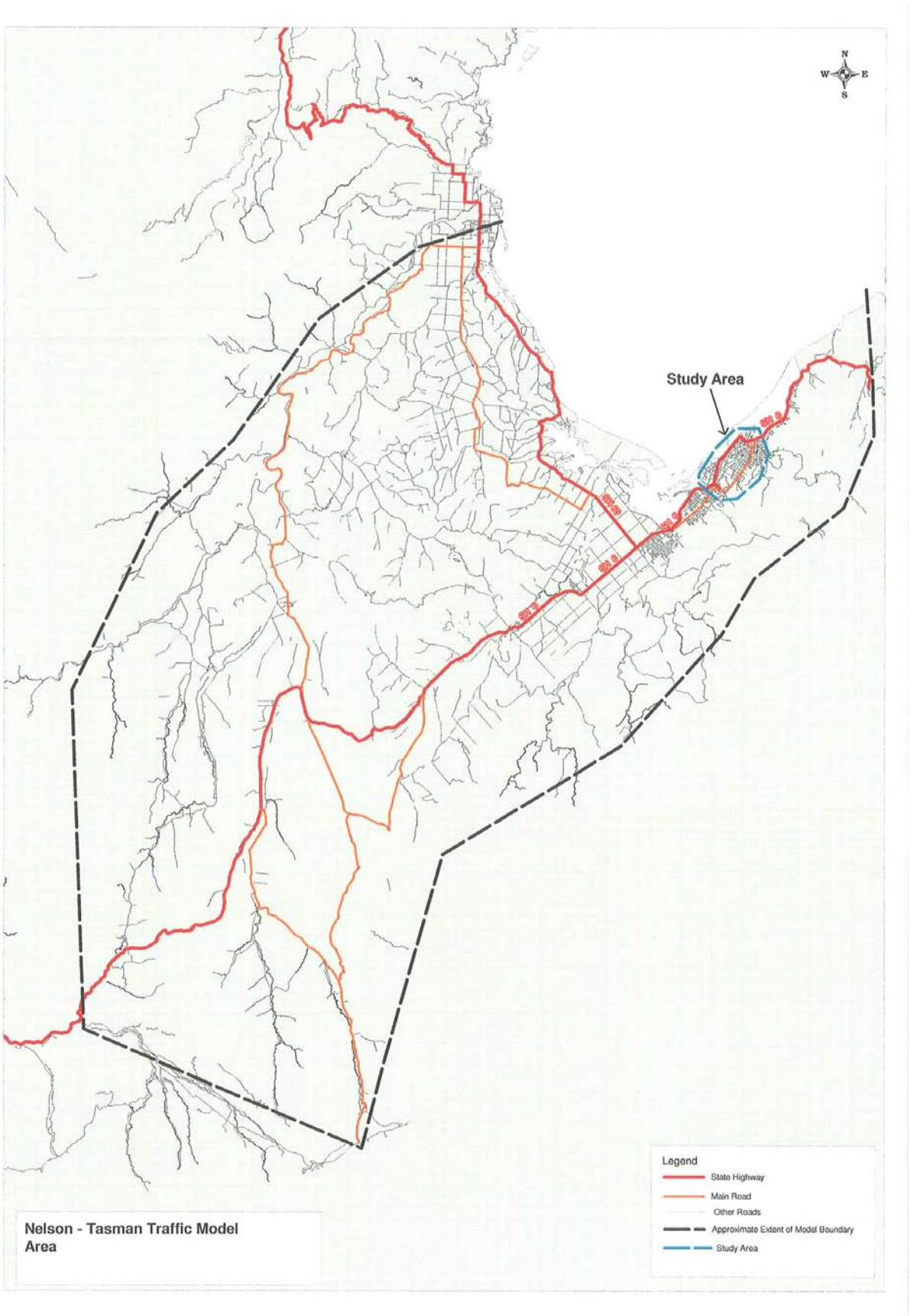

Figure 2-1 : Boundaries of Nelson-Tasman Transport Study Model and Nelson Arterial Study

These trends are reflected in some elements of the transport model such as household size/type and vehicle ownership which influence the number and timing of trips in the model, and thus recognise the general demographics of the model area population. To the extent to which these trends are incorporated within the modelling, these will be slightly more pronounced in the present model than in the previous model.

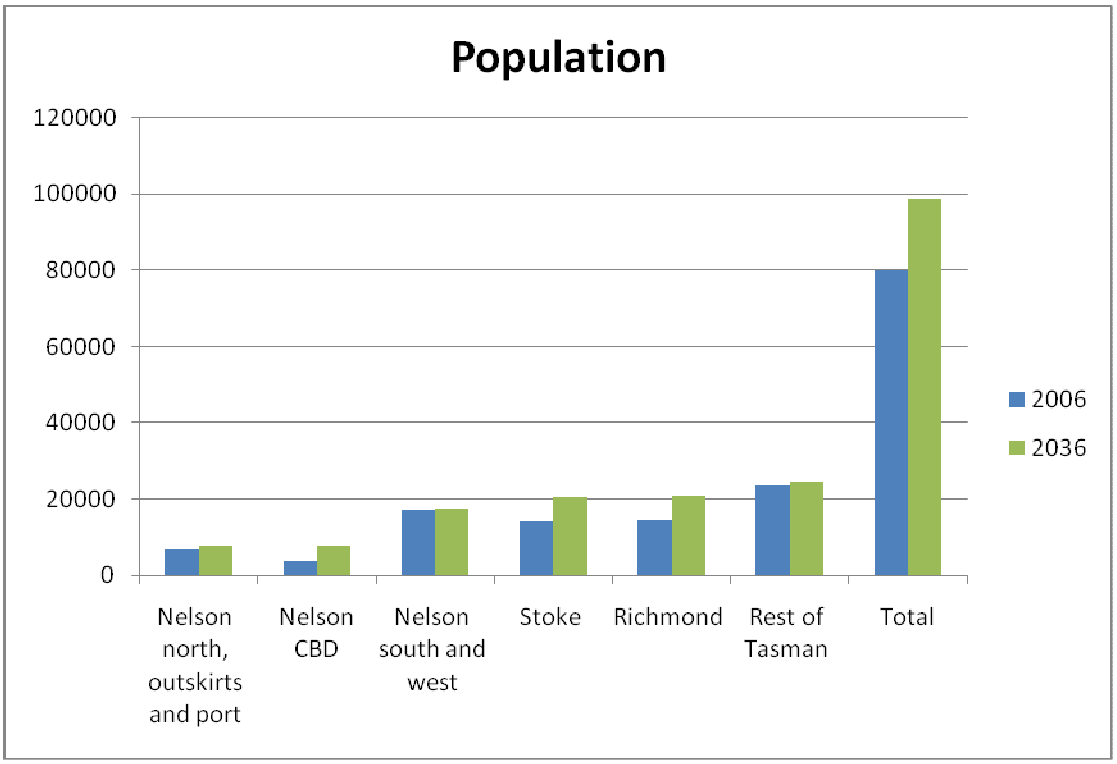

Figure 2-2 : Population estimates used in current transport model

2.6 Land Use Changes

Figure 2.3 shows the main planned areas available for future greenfields residential development to 2036 and the areas for urban intensification promoted in current policy plans. Despite the substantial reduction in overall population growth between the models and a strong policy framework encouraging growth in and around Nelson's CBD, the majority of growth is still expected to occur south of Annesbrook.

The growth in residential activity in Nelson's CBD proposed in the Council's growth plans, which is expected to be matched by a growth in CBD employment opportunities, is anticipated to contribute over time to reduced journey lengths and less use of vehicles for the journey to work shown in the outputs of the current model.

A significant shortage of industrial land for the Nelson and Richmond areas was identified in the late 1990's, buffered only by the release of the former Whakatu freezing works land. Planning since 2000 has identified substantial new industrial land in the vicinity of Richmond. This was included in the earlier transport modelling exercises, but again strategic planning has clarified its extent and the timing of its availability. The area is shown on Figure 2.3 and it will provide ongoing opportunities for employment for Richmond and south Nelson residents, and thus contribute to shorter journeys to work.

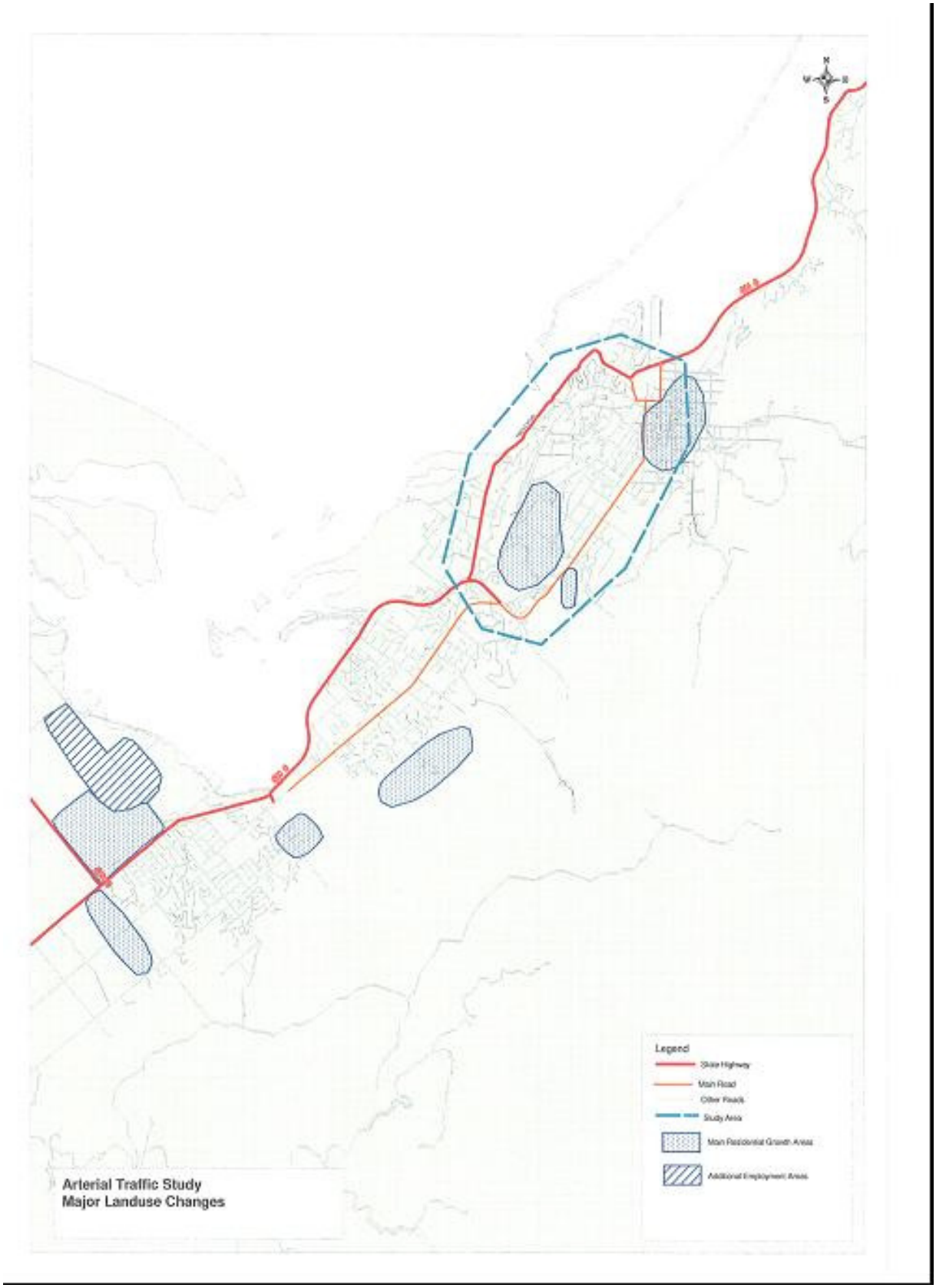

Figure 2-3 : Main Areas of Expected Land Use Change 2006-2036

2.7 Employment Patterns

As with overall population, the current model includes a substantially reduced expected number of new jobs compared to the previous model. The employment numbers and growth are shown in Figure 2-4 below. Additionally, the distribution of the new jobs also strongly favours Richmond, in part redressing previous imbalances. The employment predictions, however, are not limited to employment in industrial land use areas and both Nelson's CBD and nearby areas, and Richmond's CBD contribute to the growth.

The change in land use assumptions has a particular impact on the Nelson CBD to Annesbrook section. The considerable increase in population in the vicinity of the Nelson CBD means a reduction in the number of commuting trips from further afield. Further, whilst there is significantly lower growth in population proposed in Richmond, a significant increase in employment is still forecast, which means that the model indicates that there is less need for residents to travel into Nelson, or other areas, for work.

With a greater spread of employment opportunities, and a closer match between areas of population growth and local employment areas, it could be expected that journeys to work would be reduced in length, and more may involve walking or cycling, over time.

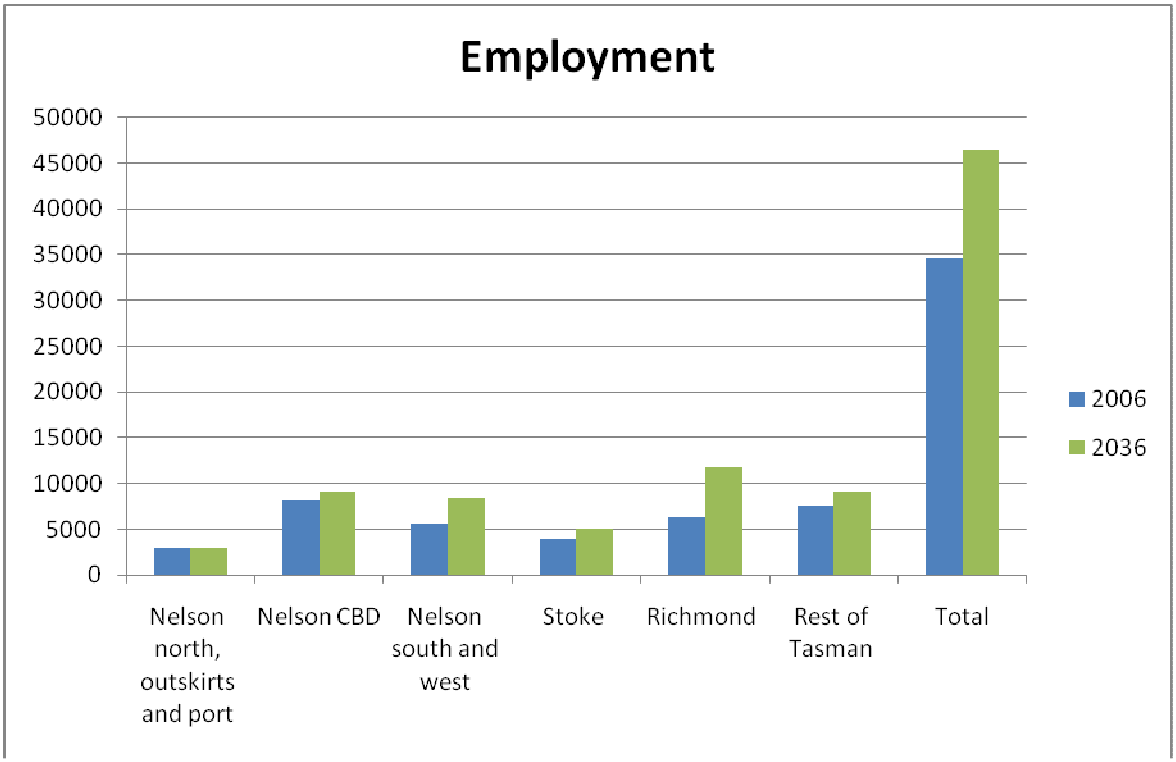

Figure 2-4 : Population estimates used in current transport model

2.8 Changes in the Model

There were relatively limited changes to the construction and operation of the regional transport model between the earlier and present study.

The current model uses a new set of volume-delay curves which have been updated to better reflect what happens in the real world. These relate volume of traffic on a road to the operating traffic speeds on that road, and are likely to favour situations of free-flowing traffic between major intersections such as

Whakatu Drive. However, most delay occurs at intersections. Any difference as a result of this minor improvement to the model in the Nelson situation is also likely to be minor.

Public transport is now also included in the inter-peak period, contrary to the situation with previous modelling. The trip demands from this change indicate significant growth in private inter-peak travel, despite the availability of public transport.

The model has also been updated to take into account more recent information on commercial vehicle trips in urban areas.

Some summary statistics for the transport model are provided below in figures 2-5 and 2-6, showing the projected growth in vehicle kilometres travelled on the network into the future, and the change in average trip speeds for the same periods.

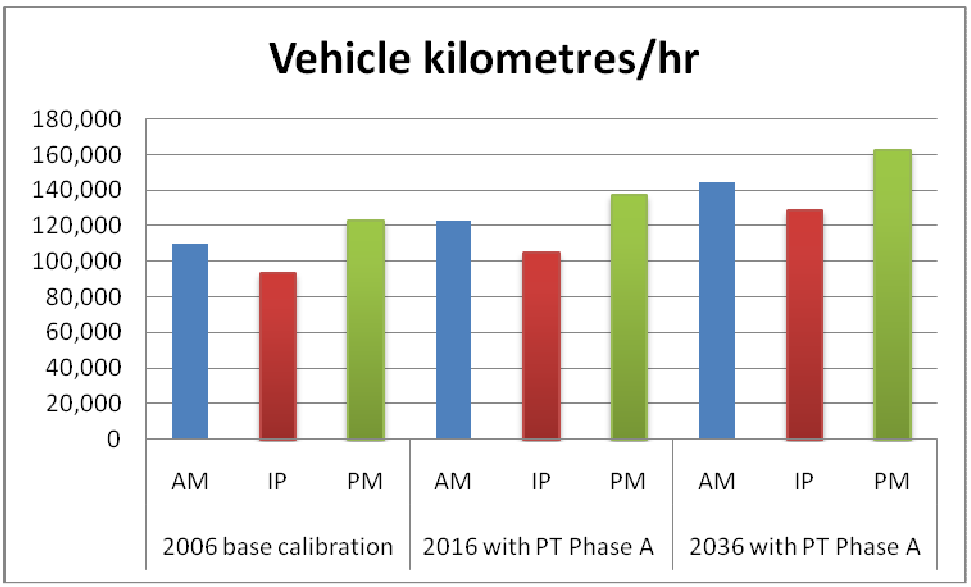

Figure 2-5 : Main Areas of Expected Land Use Change 2006-2036

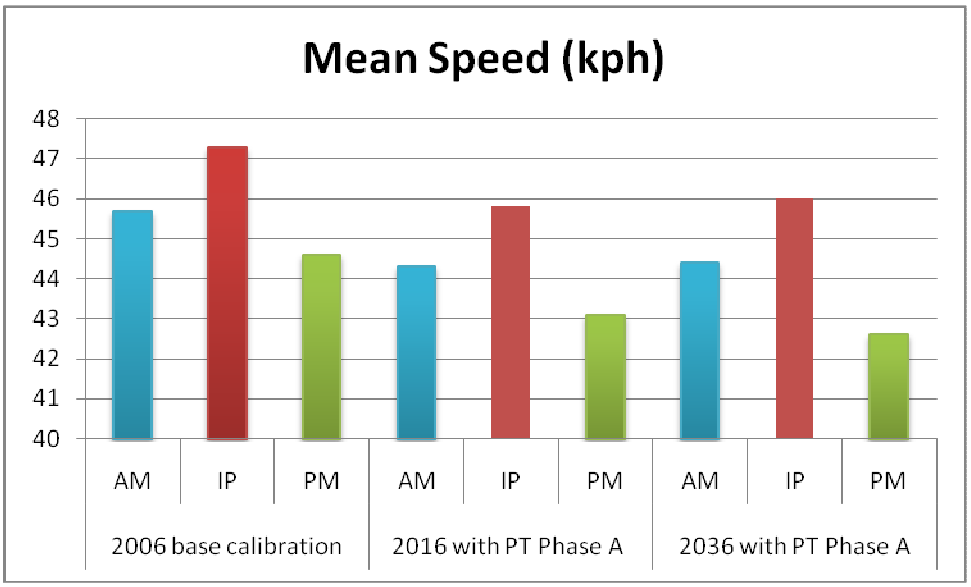

Figure 2-6 : Main Areas of Expected Land Use Change 2006-2036

2.9 Anticipated Outcomes of Previous Preferred Corridor Strategy

The latter part of Appendix 1 and Tables A8 and A9, report on the preferred strategy model outputs analysis for the previous Nelson to Brightwater corridor study which relate to the Peak Hour Clearways option that was consulted on alongside the SCLAR (Southern Corridor Local Arterial Rod) options during the final consultation round of that study, and compare against a do-minimum option. Substantial benefits in terms of travel time resulting from reduced delays and increased mean speeds are inferred. It is, however, pointed out that with a reduced number of trips and a modified land use pattern associated with the findings of the present model, the degree of change in performance would be unlikely to be repeated in the current model. The current model, as reported in Table A11 in Appendix 1 does, however, show increasing travel costs on the network with only the minor network improvements that are included.

Tables comparing traffic volumes on the Rocks Road/Waimea Road screenlines are included in Appendix 1 as Tables A12 and A13, applying both the previous model and the former preferred strategy and the current model with the assumed minor changes. The current model shows lower peak volumes, but pronounced inter-peak and reverse peak volume increases. As discussed in Appendix 1, increases in peak hour flows on Waimea Road may be curtailed due to it already being close to capacity, but this is not the case on other roads and cannot help explain the low growth or reductions in peak flows that the model indicates. Rather, they are likely to be the result of land use changes over the study period and trips being made locally in preference to longer inter-urban trips.

2.10 Model Comparison Summary and Conclusions

This section has endeavoured to briefly explain the background to differences in travel predicted in earlier models and the present model. More details are given in Appendix 1. The current land use assumptions provide for significantly lower (and probably more realistic) population and employment forecasts in comparison to the previous model which was used for the North Nelson to Brightwater Strategic Study. It also includes some changes in land use distribution assumptions, arising from strategic planning for both Nelson and Richmond, and adjustments in regional demographic trends.

The revised land use assumptions, along with the modified population and employment forecasts, and demographic trends result in a lower number of trips being generated, and a reduction in trip length.

That the length of trips decreases over the study period indicates that people are expected to preferentially access jobs and services closer to their homes. Changes in off-peak flows relate to changing demographics and a higher proportion of retired people.

The study and investigation of the two models and their outputs (detailed in Appendix 1) confirms that the current model is fit for purpose.

3 Multi-Criteria Analysis

3.1 Development of Criteria

3.1.1 Context

The initial Stage 1 report contained some discussion in regards to the development of criteria for the multi-criteria analysis to be undertaken in Stage 4. This section adds to this discussion and provides the list of criteria discussed and adopted by the Decision Making Team.

The assessment criteria need to be scoped to reflect matters that are important within the Resource Management Act, the Land Transport Management Act and Local Government Act, taking into account the considerations that will eventually be brought to bear by funding agencies and statutory consent

processes. They should be able to be categorised across all of the "four well-being" considerations - social, environmental, cultural and economic - which are foundation considerations under the Local Government Act.

For any designations for new works to be included in the Resource Management Plan, those making recommendations back to the requiring authority, or the Environment court on appeal, must take into account the process that has been undertaken in identifying the specific option chosen, including consideration of alternatives. Because of this, the decision criteria that are applied to help choose between options must be clear and transparent. As well, they need to relate to matters in Part 2 of the Resource Management Act, which include the social, cultural and economic wellbeing of people and communities, and their health and safety, and effects on natural and physical[1] resources as well as the needs of future generations.

To satisfy NZTA funding requirements, the options will need to be assessed by determining the following:

- Strategic fit of the problem, issue or opportunity which is being addressed. Guidance on this is given in the NZTA Planning Programming and Funding Manual; however, as the Strategic Fit is essentially a statement of the problem, this will be the same for all options.
- Effectiveness of the option. This considers how the option contributes to the purpose of the Land Transport Management Act and the New Zealand Transport Strategy (and Government Policy Statement on Land Transport Funding (GPS)) objectives.
- Economic efficiency of the option. This is primarily the benefit cost ratio, calculated in accordance with the NZTA Economic Evaluation Manual.

To this, Nelson City Council in its brief for the study has added the following item:

- Community wellbeing considerations, focussing on the best achievement of Community Outcomes.

In regards to the effectiveness of the option, the Land Transport Management Act, New Zealand Transport Strategy and the Government Policy Statement on Land Transport Funding all refer to the following five objectives:

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

In addition, Nelson City Council has also requested that the options be assessed against a “Community Wellbeing” assessment factor to assess how well they will improve the City as a whole in the long term. This would determine how well the options contribute to the outcomes presented in the Community Plan. It can be regarded as an expansion of the community wellbeing item noted above. The components of this consideration for Nelson are:

- Healthy Land, Sea, Air And Water
- People-Friendly Places
- A Strong Economy
- Kind, Healthy People
- A Fun, Creative Culture
- Good Leadership.

Together, these considerations provide context and some general assistance as to the attributes of the various options which will be important in identifying this study’s preferred option. They are, however, very broad in scope and require further refinement to make them relevant in the context of this study.

[1] The term “physical resources” usually refers to the existing built environment, such as existing infrastructure, buildings, development patterns.

The other important element of a multi-criteria analysis framework is the weighting to be applied to the individual criteria. This was not discussed initially, as it was considered most important to define and agree the criteria first. In the analysis, a range of weightings will be able to be used not just to identify the preferred option, but also as a means of checking the sensitivity of the analysis. The preferred weighting has however been identified within Stage 1 processes, as discussed in section 3.2 of this report below.

3.1.2 Method to Determine Criteria

Ideally, there should be approximately ten criteria used in the analysis of options, and no more than twelve[2]. It is important that the criteria are relevant, but also that they are acceptable to and agreed by those who will later apply them. Thus multi-criteria analysis best practice involves discussion, consideration and agreement on criteria, usually through a facilitated workshop process. A suggested first cut of criteria was provided to a workshop meeting of the Decision Making Team held on 22 March 2010. This first set of criteria was as follows:

- Impacts on cultural/heritage values - tangata whenua and heritage
- Impacts on natural qualities/values in affected areas
- Co-benefits
- Urban form, long term community development impacts
- Impacts on present communities – physical; including road safety, air quality and noise
- Impacts on present communities – social
- Impacts on present communities – economic development and growth, freight routes and business accessibility
- Adaptability/scalability in medium/long term
- Capacity
- Cost / Affordability
- Economic Efficiency / BCR

It was recognised at the time of initial circulation that each of the above criteria incorporated a multitude of factors, and would need to be further defined following the group discussion. It was also recognised that the discussion may identify other important criteria, and/or remove some of those initially suggested. After the initial discussion it was intended that the list would be reviewed and the criteria expressed in a way that could be clearly applied later in the process, with the intention of having the Decision Making Team sign off on a final list of criteria in May.

In the intervening period, drafts of the criteria and their descriptions would be circulated for further comment.

At a meeting of Nelson City Councillors on 2 March 2010, it was emphasised by the Councillors that they wished the criteria to be as “measurable” as possible. This is discussed later.

3.1.3 Criteria Identified

Bearing in mind that the options to which the criteria are to be applied are likely to impact across wide geographic areas and affect different communities within Nelson differently, it was acknowledged that the criteria as a whole need to be scoped sufficiently widely to take into account both adverse and beneficial effects on different people and communities, and to take into account aspects such as funding and likely efficiency. As the assessment will involve assumptions about future needs and trends, which may not actually occur as predicted, it is important to consider how well any option would serve the community if the anticipated effects are different (e.g. if expected traffic volumes do not occur or are exceeded). It was also considered important that any side benefits, not directly associated with transport needs which may result from any option, are identified and taken into account.

[2] This is because with an increase in number of criteria, each criterion reduces in significance and it can become difficult to choose between options.

The criteria will be applied to the affected urban area and community as a whole, or to identifiable communities within the urban area, rather than to individuals or specific interests.

Based on the list of items earlier circulated, the Decision Making Team have identified and provided a preliminary scope for the following criteria:

1. **Impacts on cultural and heritage values.** This is defined to include direct impacts on protected items such as trees, buildings and historic sites, along with other physical effects on valued characteristics such as the inherited pattern of streets and open spaces. It also includes less tangible cultural and spiritual values such as effects on any waahi tapu or other values of tangata whenua, and any effects on other cultural sites which may not be historic sites.

2. **Impacts on the natural environment.** This is defined to include general effects on air quality (including particulates and greenhouse gases), water quality (including coastal water), biodiversity values and an associated range of aspects of "naturalness" such as coastal naturalness, and effects on topography, natural landforms, landscapes and seascapes.

3. **Co-benefits.** This criterion provides the ability to take into account any positive contributions to the community that an option may yield, which are not directly associated with transport. Examples of co-benefits could be freeing up of land for other uses, health benefits, or opportunities for multiple use of road or transport facilities.

4. **Impacts on the city's future.** This criterion provides a measure of the extent to which an option contributes to or detracts from the achievement of known policies and plans. It applies to the community as a whole, and involves an analysis of all relevant documents. This will include consideration of areas and facilities which have specific policy recognition such as the port, the airport and the central city. It will also take into account spatial variability and inequalities in levels of service.

5. **Impacts on communities.**[3] These are assessed as three separate criteria, which will take into account the presence of geographically identifiable communities, and those in the community with specific needs such as the transport disadvantaged. It covers issues not covered under other criteria. These criteria will be assessed on the basis of the following:

   a. physical effects on communities – for example, effects of changes in air quality, noise and physical safety (including safety of road users) on the community;

   b. social effects on communities – assessment of concepts such as severance/social cohesion, convenience/loss of access, freedom of movement, amenity values (including effects on open space and recreation) and security, as well as direct effects on community land uses such as schools and meeting venues;

   c. economic effects – potential effects on local businesses (such as their development and promotion, local employment, and business convenience).

   (Note: In order to aid transparency, the assumptions behind the assessments of "Impacts on Communities" will be documented, and items (a) to (c) will be assessed separately.)

6. **Robustness/Future-proofing.** This criterion identifies and assesses how well an option will perform if the medium to long-term assumptions turn out to be incorrect due to changes in demand and/or transport types. It requires consideration of the implications of the physical changes involved (for example to a road corridor), if demand either does not eventuate, or exceeds that predicted, in the medium or long-term. Can the option be scaled up or scaled down

[3] There are identifiable communities at Tahunanui, Waimea Road, Rocks Road, Victory and the Central City, and others may be identified in the next stages of the project.

in the future? In broad terms, it involves the consideration of physical and economic sustainability and the needs of future generations in a situation where the future is uncertain.

7. **Degree of Difficulty** – this criterion introduces the concept of practicability in terms of achieving an option. It takes into account aspects such as technical ability to undertake the option, affordability, any legislative issues, consentability and complexity.

8. **Economic Efficiency/Benefit-cost ratio.** This criterion applies NZTA's Economic Evaluation procedures to determine the economic efficiency of each option (which recognises, for example, costs associated with travel time, vehicle operation, road safety, and trip time reliability).

Criterion 5 integrates a range of considerations which may need to be elaborated on later in the process (for example, during any consenting stages). For this reason, it is anticipated that the scoring of criterion 5 will involve a well-documented process of analysis of each of the sub-criteria.

Whilst being included in the multi-criteria analysis, it is also proposed to separately consider and provide an initial evaluation of criteria 7 and 8, as these two items may identify early specific major difficulties in achieving an option.

Further scoping of each criterion will be undertaken in future Stages of the study[4]. A detailed description of the scope of each criterion and its measurement (as far as practicable)[5] will be incorporated in the first part of the decision workshop in Stage 4.

3.1.4 Time Considerations in the Application of Criteria

The terms of reference for the study requested an assessment of options "in the long term". This is an undefined term which requires specific consideration.

The multi-criteria analysis outcomes may differ, depending on the time scale being applied. The modelling provides information for years 2016 and 2036. The analysis will therefore focus around the 2036 date, which is an appropriate period in terms of planning frameworks under RMA and LGA (but which is shorter than the 50 to 100 years now taken into account for management of some existing assets, and for climate change effects).

However, if it is found that any criteria are likely to be awarded scores which could be significantly different in either the short term (around 2016) or the substantially longer term (50 years +), this will be noted for further consideration following the analysis. Such implications may add to the degree of difficulty, indicate that an option may become more or less effective over time, or reveal a potential unidentified fatal flaw.

3.2 Weighting

As noted earlier, a range of weightings can be applied to the criteria. Weightings were discussed by the Decision Making Team in Stage 1 and later determined from the initial ranges to preferred weightings by agreement (assuming an available maximum 10 weight for each criterion). The resulting preferred weighting is shown in Table 3-1 and more graphically in Figure 3-1 over page.

The weightings reflect the high importance that this study places on the social impacts, effectiveness in terms of the city's future, and achievability of the options. Also of particular note is the high importance placed on degree of difficulty. As discussed earlier, this could be assessed separately using a high threshold to provide a type of "fatal flaw" analysis separate and additional to use in the multi criteria

[4] The consultation processes, including the deliberative decision-making workshops, further investigations being undertaken, and the results of additional modelling will all inform the final scope of the criteria.

[5] Some criteria lend themselves to assessment on the basis of measurable criteria whereas others require qualitative assessment. The table in section 3.5 (Table 3.3) sets out the types of information (quantitative and qualitative) which will be brought to bear in the application of the criteria.

analysis, or simply be included as an integral part of the overall analysis. Even if used for "fatal flaw" analysis and a criterion in the multi-criteria main framework, it still justifies a high weighting in the latter because if a preferred option is chosen that is difficult or impossible to achieve for any one of the matters included within the criterion in section 3.1.3, it would undermine the purpose of the study.

Table 3-1 : Initial and Agreed Weightings

Criterion	Initial Workshop Weightings	Weighting Outcome
1. Impacts on Cultural / Heritage Values	4/5	4
2. Impacts on Natural Environment	6/7	6
3. Co-benefits	4/5	4
4. City Future	9/10	10
5a. Impacts on Communities - Physical	8/9	8
5b. Impacts on Communities - Social	8/9	9
5c. Impacts on Communities - Economic	4/5	5
6. Robustness/Future-proofing	6/7	7
7. Degree of Difficulty	10	10
8. Economic Efficiency	9/10	9

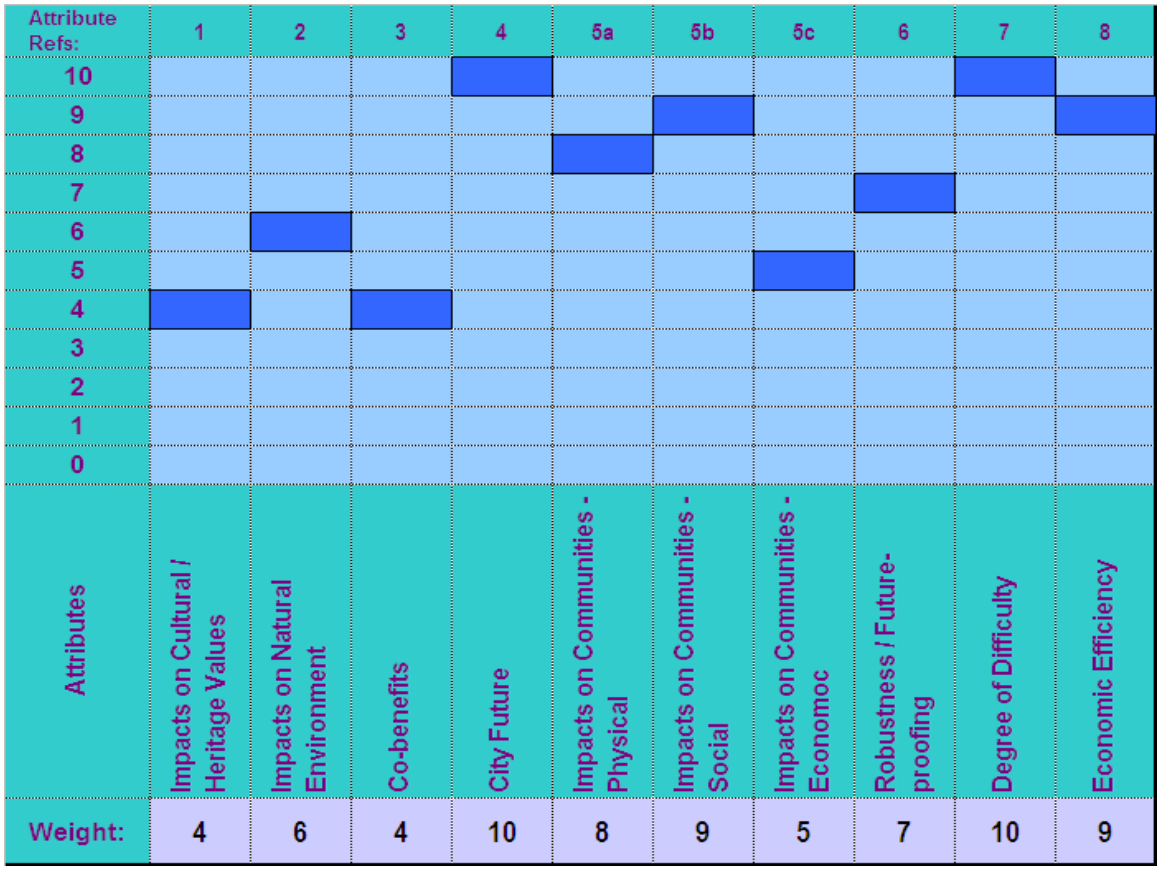

Figure 3-1 : Graphic Presentation of Agreed Weightings

As part of the multi-criteria analysis workshop in Stage 4, once the scores for each option under each criterion have been determined, sensitivity analysis can be undertaken using different weightings to determine the impacts on the analysis performed, and the robustness of the preferred option.

3.3 Scoring System

The next step in the multi-criteria analysis process will be the allocation of scores to each of the options. This will be done in a workshop framework involving all the decision-making team, and there are two fundamental requirements which must be met:

- Each option is sufficiently described and defined for those involved in the analysis to be able to form judgements in terms of each criterion.
- The participants are sufficiently informed about the details of each criterion in terms of each option to be able to form a judgement and allocate a score for each option under each criterion.

While it would be desirable, if possible, to award scores on the basis of “hard” and measurable information, many of the criteria are not amenable to such assessment, and the process can only proceed on the basis of including qualitative, relative evaluations, using the combined judgement of well-informed people. This is the strength of multi-criteria analysis, as it enables decisions on the basis of criteria which address intangible as well as tangible aspects of options.

It is intended that, as far as practicable, consensus will be reached through the scoring process. Where differences of opinion are identified, they will be recorded and the information can be used in subsequent sensitivity analysis.

Key considerations in reaching the scores allocated will also be noted – i.e., each criterion is likely to involve positive and negative aspects in terms of each option, and these will be recorded.

It is proposed to apply a scoring system of 1 to 5. This provides sufficient breadth for meaningful variations between options. It also provides for extremes (1 and 5) and a relatively neutral mid-point. The scoring system is set out below. It is important that the scoring is aligned in the same way in terms of each criterion. The score is applied to the whole of the option.

1	Very low negative impacts or degree of difficulty, and/or very high benefits, in terms of the criterion.
2	Minor negative impacts or degree of difficulty, and/or high benefits, in terms of the criterion.
3	Moderate negative impacts or degree of difficulty, and/or moderate benefits, in terms of the criterion.
4	High negative impacts or degree of difficulty, and/or minor benefits, in terms of the criterion.
5	Very high negative impacts or degree of difficulty, and/or nil or very low benefits, in terms of the criterion.

In undertaking the analysis, it is not necessary to use the whole suite of scores, and more than one option may receive the same score in terms of any criterion.

3.4 Assignment of Criteria to Generic Evaluation Frameworks

To confirm the adequacy of coverage of the criteria in terms of the various generic considerations set out in section 3.1.1 of this report, the scope of each criterion has been assessed in terms of these considerations and the criteria assigned to one or more of them.

The purpose of this exercise is to ensure that the criteria are sufficiently comprehensive to address all the possible frameworks that the preferred option may later encounter (including funding considerations at

central and local government level, consents issues and later asset management issues). Table 3-2 on the following page sets out the assignment of criteria under the various frameworks.

As can be seen, the criteria identified relate comfortably to all relevant evaluation frameworks. Only in one area, the degree of difficulty in terms of RMA considerations, is there no specific fit.

Some criteria may relate to more than one of the more generic considerations. This is not a disadvantage or problem: rather, it demonstrates the breadth and generic nature of the evaluation frameworks.

Also notable are the following (from left to right across Table 3-2).

- the emphasis on community wellbeing and effectiveness in terms of the study evaluation framework, in line with the intentions of NCC
- general comprehensiveness of criteria in terms of LTMA and NZTS considerations
- comprehensive coverage of Part 2 RMA considerations[6]
- comprehensive coverage in terms of "quadruple bottom line" (QBL) considerations under the LGA
- an effective mix of criteria relating to one or more of NCC's "Community Wellbeing" factors.

3.5 Application of Criteria to the Existing Situation

As part of the Stage 1 process to identify the possible impacts on the City of no major transport improvements over the next 30 years (a "do-minimum" option which includes PT Phase A), the criteria that will be used in the multi-criteria analysis in Stage 4 of the study have been initially applied to the current (2009) situation and the likely situation in 2036 should no significant changes be made to the arterial routes – shown in Table 3-3 below. This is only a preliminary assessment, as the criteria are not yet fully developed, further evaluation of the 2036 situation is required, and the application of the criteria needs to be undertaken in a consistent way relative to the other options in a workshop setting involving assessment by all members of the Decision Making Team.

Information was gathered from the following sources in developing this preliminary assessment:

- Stage 1 report including the preliminary work done to date on:
  - Economic Impact Assessment
  - Social Impact Assessment
  - Noise Assessment
  - Air Quality Assessment
  - Water Quality Assessment
  - Modelling outputs
- discussions with the Cultural and Heritage expert on the study team, Amanda Young
- a preliminary assessment of statutory requirements and policies.

Note that it is intended that the "do minimum" option will be further assessed as part of the multi-criteria analysis process on a consistent scoring and weighted basis. The difference in the results of the analysis for the preferred option and the do minimum option will demonstrate the need and urgency for action, but may also indicate the opportunity to meet future needs by other means such as travel demand management and/or enhanced public transport.

[6] Resource Management Act 1991 and amendments, NZ Government. Part 2 covers the purposes and principles of the statute.

Table 3-2 : Assignment of Criteria to Generic Evaluation Frameworks

Criterion	NZTA Funding Assessment Factor[7] (+ NCC Project Addition)	LTMA and NZTS Objective	RMA Aspect	LGA QBL Aspect	NCC "Community Wellbeing" Factor
1. Impacts on Cultural / Heritage Values	Community wellbeing	Environmental Sustainability	S5, S6(e) and (f), S8	Cultural	Creative culture / people-friendly places
2. Impacts on Natural Environment	Community wellbeing	Environmental Sustainability	S6(a), (b), (c), S7(d)	Environmental	Healthy land, sea, air and water
3. Co-benefits	Community wellbeing	Economic Development / Public Health / Environmental Sustainability	S5	All aspects	All factors
4. City Future	Community wellbeing / Effectiveness	All objectives	S104, S171	All aspects	All factors
5a. Impacts on Communities - Physical	Community wellbeing / Effectiveness	Environmental Sustainability / Public Health	S5	Social	People-friendly places
5b. Impacts on Communities - Social	Community wellbeing	Safety and Personal Security / Access and Mobility / Public Health	S5, S7(c)	Social	People-friendly places / Kind, healthy people / Creative culture
5c. Impacts on Communities - Economic	Community wellbeing / Economic efficiency	Economic Development	S5, S7(b)	Social / Economic	Strong economy
6. Robustness/Future-proofing	Effectiveness	All objectives	S5	All aspects	All factors
7. Degree of Difficulty	Effectiveness	Environmental Sustainability	-	All aspects	All factors
8. Economic Efficiency	Economic efficiency	Economic Development	S5, S7(b)	Economic	Strong economy

[7] All options are expected to relate to and achieve the Strategic Fit factor (see section 3.1.1).

Table 3-3 : Preliminary Assessment of Existing Situation and Do Minimum Future Option (to be further developed in Stage 3)

				Existing Situation (2006)		Future Do-Minimum Scenario (2036)	
No.	**Criteria**	**Sub-Criteria**	**Aspect**	**SH6**	**Waimea/Rutherford**	**SH6**	**Waimea/Rutherford**
1	Impacts on cultural and heritage values	-	Heritage	Maintenance issues associated with the historic features such as the seawall and fence implemented by early settlers.	No specific known current issues	No additional issues	No additional issues
			Cultural	Some cultural sites nearby but unaffected by operation of road.	Some cultural sites nearby but unaffected by operation of road	No additional issues	No additional issues
2	Impacts on the natural environment	-	Air Quality	CO emissions from model in tonnes: 2006 AM 1.16, IP 0.93, PM 1.32 Fuel consumption from model: 2006 AM 12, IP 10, PM 13		30-39% increase in CO emissions from model: 2036 AM 1.51, IP 1.29, PM 1.76 32-38% increase in fuel consumption from model: 2036 AM 15, IP 14, PM 18	
			Water Quality	Existing routes have little impact on water quality compared to urbanisation.		Will be increase in run-off contaminants due to increase in traffic volumes on the arterial routes.	
			Biodiversity	As existing so no additional issues		Existing situation remains, so no additional issues.	
			Naturalness	RMA S6 matter re natural character of the coastal environment. Some natural character values, but affected by existing road/port/residential development.	No significant naturalness values, other than valley form, topography and existing open space.	No significant changes are predicted in this category	No significant changes are predicted in this category
3	Co-benefits	-		N/A		N/A	
4	City Future	-	LT Council Community Plan Regional Policy Statement Resource Management Plan Heart of Nelson Central City Strategy MfE UD Guidelines	Existing situations are neutral in terms of the relevant policies and plans. Concepts relating to urban form in the RPS, Nelson RMP and Heart of Nelson Strategy emphasise quality of development, containment, accessibility and connectivity, development in harmony with context, and identification and protection of areas of specific quality, along with recognition and enhancement of the functions of the Airport, the Port Industrial Area and enlivenment of the Central City.		No change as existing situation is retained.	
5	Impacts on communities	Physical	Air Quality[1]	PM10 Airshed B 2009 average 24.9 with 33 exceedences.	PM10 Airshed A 2009 average 22 with 7 exceedences.	Overall decrease in PM10 likely but some unquantifiable increase in vehicular emissions. However, comparative differences between options will be able to be determined.	Overall decrease in PM10 likely but some unquantifiable increase in vehicular emissions. However, comparative differences between options will be able to be determined.
			Noise	Significant noise generated by arterial road traffic and some noise sensitivity is likely adjacent to the current route due to current land uses. However environment has evolved in presence of this noise.	Significant noise generated by arterial road traffic and some noise sensitivity is likely adjacent to the current route due to current land uses. However environment has evolved in presence of this noise.	Overall increase in daily traffic including heavy vehicles, and interrupted traffic flows will increase noise levels	Overall increase in daily traffic including heavy vehicles, and interrupted traffic flows will increase noise levels
			Physical Safety	Current issues for pedestrians crossing SH6, narrow shoulders or lack of facilities for cyclists; cyclists and parking vehicles in close proximity to significant numbers of heavy vehicles. High traffic volumes encourage short-cutting on local streets.	Red light running, pedestrian safety and vehicles short cutting on local streets are concerns.	Increase in traffic volumes will exacerbate the current issues on SH6.	Increase in traffic volumes will exacerbate the current issues on Waimea Road and Rutherford Street.
		Social	Severance	Amount of traffic past Tahunanui School. Severance through Tahunanui. Difficult access across Rocks Road especially for pedestrians and cyclists.	Difficulty crossing Waimea Road in the vicinity of schools, shops and hospital due to amount of traffic and limited crossing facilities.	Increase in traffic volumes will exacerbate the current issues on SH6.	Increase in traffic volumes will exacerbate the current issues on Waimea Road and Rutherford Street.

[1] Consideration and commentary of PM 2.5 and ultrafine particulates will be given in future stages.

				Existing Situation (2006)		Future Do-Minimum Scenario (2036)	
No.	**Criteria**	**Sub-Criteria**	**Aspect**	**SH6**	**Waimea/Rutherford**	**SH6**	**Waimea/Rutherford**
			Accessibility[2]	In general the current routes provide good accessibility. However, poor levels of service at some intersections and property access difficulties impede accessibility. The limited number of PT services and associated infrastructure limit the number and range of people able to access/utilise facilities. Severance may play a part in accessibility however this is covered above.		In general the routes will continue to provide good accessibility, with an increase in public transport services and infrastructure improving accessibility.	
			Mobility	In general the current routes provide good mobility as they provide for all traffic movements and a range of modes.		In general the routes will continue to provide good mobility as they provide for all traffic movements and a range of modes.	
			Amenity	Waterfront has high amenity value which is affected by traffic volumes/types. Tahunanui also perceived to be a high amenity area which is also affected by the current arterial route.	Limited amenity impacts in comparison to SH6 route.	Increasing traffic volumes (particularly heavy traffic) on Rocks Road could impact on the potential of this area to be developed for passive recreation and as an area with high aesthetic values.	No significant changes are predicted in this category
		Economic	Employment	Current arterial routes are not considered to have a significant effect on employment either in local communities or in the region as a whole as congestion is not at a level which would impact these decisions.		Future modelling shows that congestion is unlikely to significantly increase in peak periods. Accordingly, the routes are not considered to constrict the growth policies of NCC and TDC.	
			Tourism	Some tourism activities around Tahunanui and Wakefield Quay at the northern end of Rocks Road. Tourism opportunities of waterfront constrained by location of SH traffic.	No specific tourism impacts.	Increased traffic volumes along the waterfront throughout the day and restrictions of SH classification may result in tourism and hospitality opportunities deciding not to locate in this area. However, it is probable that they will still locate around the Nelson region thereby not having an overall economic impact.	No specific tourism impacts.
			Port and Airport	Some travel time delay and travel time variability in peak periods on Rocks Road under current situation.	N/A	Some slight deterioration in travel times on Rocks Road in future years especially in the interpeak and off-peak directions.	N/A
6	Robustness/ Futureproofing	-	Capacity across screenline	Capacity approx 2400vph Traffic volumes are nearing capacity for peak hours peak direction	Capacity approx 2800vph Traffic volumes are essentially at capacity for peak hours peak direction	Capacity approx 2400vph	Capacity approx 2800vph
			Is it future-proof?	N/A		The current situation does not provide for any simple upgrading to provide additional capacity. Rocks Road route also susceptible to sea level rise and extreme weather events.	
7	Degree of difficulty	-	Technical complexity	N/A		N/A	
			Affordability (Cost)	N/A		N/A	
			Legislative Issues	N/A		N/A	
			Consentability	N/A		N/A	
8	Economic Efficiency (BCR)	-	Travel Time Costs	2006 Model Outputs for Total Travel Time (min): AM 145371, IP 119152, PM 164986		2036 Model Outputs for Total Travel Time (min): AM 195038, IP 167266, PM 228891 (a 34-40% increase)	
			Vehicle Operating Costs	2006 Model Outputs for Total Travel Distance (km): AM 110255, IP 93585, PM 122712		2036 Model Outputs for Total Travel Distance (km): AM 144259, IP 128349, PM 162678 (a 31-37% increase)	
			Crash Costs	2006 Model Outputs for Crashes per 100Mvkt: AM 90.70, IP 85.48, PM 89.64		2036 Model Outputs for Crashes per 100Mvkt: AM 97.05, IP 85.7, PM 92.2 (a 0.3-% increase)	

[2] Accessibility is the ability to get to a destination, mobility is the ease with which that trip is made (speed, cost, mode options available, etc.)

Appendix 1: Model Comparison

Base Network Results Comparison

The 2006 base calibrated model[i] is compared to the earlier North Nelson to Brightwater (NN2B) Strategic Study model which used the earlier 2001 calibrated base network with forecasts for 2011, 2021 and 2031 based on different future land use projections.

Table A1 : Comparison of travel statistics for current and previous model

TRAVEL (whole network)	NN2B 2001 calibrated base			Current 2006 calibrated base			NN2B 2011 forecast		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Vehicle kilometres	172,454	146,840	189,101	171,702	142,934	191,396	208,404	174,493	223,969
Private car trips	21,660	19,409	22,493	24,650	20,840	26,256	25,963	23,424	27,411
Link mean speed (km/h)	59.8	62.1	53.5	56.0	62.1	55.7	51.4	60.8	45.2
Average Trip Length (km)	7.96	7.57	8.41	6.97	6.86	7.30	8.03	7.45	8.17
Average Trip Time (minutes)	9.11	8.31	10.7	8.40	8.01	8.89	10.74	8.51	12.55

Note that the subtle differences for the 2006 calibrated base figures above is due to differences in the number of trips from the trip generation and distribution models and those remaining after assignment convergence

Examining the table, it can be seen that the 2006 base calibrated network has similar vehicle kilometres of travel for the whole network compared to the earlier 2001 base network. However, the number of private car trips has increased by 14% (AM peak), 7 % (inter-peak) and 17% (PM peak) from those for 2001. The average annual rate of increase in private car trips is greater than previously envisaged (2001 to 2011) for the AM and PM peaks, but lower for the inter-peak.

Comparing future years of the current model to the 2006 base year, the average increase in trips is similar for all three periods, with 10-11% increase for 2016 compared to 2006 and 26-28% for 2036 compared to 2006, which equates to an average annual growth rate of private car trips of about 0.8% per annum. It must be recognised that this relates to the study area and there will be a considerable variation in the number of trips in the main different districts of north Nelson (including outskirts of Nelson city), Nelson CBD, Nelson suburbs, Stoke, Richmond, and Hope and beyond, due to different growth in residential development and employment activities. The land use values and comparisons with those used in previous studies for these districts are discussed below.

Land use data

The future land use activities for the current model were obtained from:

- Nelson 2009-19 Community Plan
- Nelson City Council “Transport Study Future Yield Map” (http://www.nelsoncitycouncil.co.nz/assets/Our-council/Downloads/transport-study-nelson-tasman-gabites-porter-model-update-MAY2009.pdf)
- Tasman Growth, Supply-Demand Model
- May 2009 Nelson-Tasman Transport Model Update files: http://www.nelsoncitycouncil.co.nz/assets/Our-council/Downloads/transport-study-future-yield-map.pdf

[i] The periods analysed by the current model are the morning (AM) and afternoon (PM) peak hours and an inter-peak (IP) hour; the PM peak model is a 3-step model only (refer the Model Building Report) and consequently the impacts of the PT improvements can only be assessed for the AM and IP periods. The previous model did not include inter-peak public transport.

Reference was also made to

- Nelson Urban Growth Strategy (NUGS Dec 2006)
- Nelson Resource Management Plan
- Tasman Resource Management Plan.

The land use activities for the previous North Nelson to Brightwater (NN2B) Strategic Study were developed by Boffa Miskell in conjunction with Nelson City and Tasman District Councils. Following some preliminary modelling results the project steering team agreed that the future land use which encapsulated intensive development required adjustment. This adjustment was then firstly applied by Boffa Miskell and revised by MWH to re-distribute households principally into Richmond. The land use activities applied for the NN2B Strategic Study could be construed to have been "aspirational" or "full realisation potential" whereas the current land use values in the current model can be considered to be the "likely outcome" or "business as usual" scenario values. These land use activities for the six key districts are summarised in the tables below.

Population

The population projections as a result of the land use assumptions for the previous model and the current model are shown in the tables below.

Table A2 : Population Changes from 2001 to 2031 for the previous NN2B model

	Persons					
Area	2001		2031		Increase	% Increase
Nelson north, outskirts and port (zones 479-528)	6620	(10%)	7977	(7%)	1357	21%
Nelson CBD (zones 1-160)	3898	(6%)	4808	(4%)	910	23%
Nelson south and west (zones 161-304)	17504	(25%)	24062	(22%)	6558	37%
Stoke (zones 305-400, 529-540,625-632)	12843	(19%)	20732	(19%)	7889	61%
Richmond (zones 401-478,541-579,633)	12965	(19%)	30040	(27%)	17075	132%
Rest of Tasman (zones 580-624)	21441	(31%)	31121	(28%)	9680	45%
Total	**75271**		**118740**		**43469**	**63%**

Note that "Rest of Tasman" refers to the remainder of the Tasman District that is included in the model; the model does not cover the entire Tasman District.

For the previous model, a 63% increase in population was forecast. Large increases in population were forecast to occur around the Stoke and Richmond areas and the rest of Tasman District. Almost 80% of the population growth in the region would have occurred south of Annesbrook.

Table A3 : Population Changes from 2006 to 2036 for the current model

	Persons					
Area	2006		2036		Increase	% Increase
Nelson north, outskirts and port (zones 479-528)	6687	(8%)	7871	(8%)	1184	18%
Nelson CBD (zones 1-160)	3879	(5%)	7606	(8%)	3727	96%
Nelson south and west (zones 161-304)	17319	(22%)	17437	(18%)	118	1%
Stoke (zones 305-400, 529-540,625-632)	14055	(18%)	20586	(21%)	6531	46%
Richmond (zones 401-478,541-579,633)	14427	(18%)	20752	(21%)	6325	44%
Rest of Tasman (zones 580-624)	23499	(29%)	24627	(25%)	1128	5%
Total	**79866**		**98879**		**19013**	**24%**

Table A3 above shows that the land use assumptions for the current model will result in a 24% increase in population over the 30 year period. The increases in population are forecast largely around the Nelson

CBD, Stoke and Richmond areas. Almost 75% of the population growth in the region will be occurring south of Annesbrook.

The linearly interpolated 2006 population figure[ii] for the old model is 82516, which is 3.3% higher than the current model figure. The linearly extrapolated 2036 population figure[iii] for the old model is 125985 which is 27.3% higher than the current model figure. The current model has a much more modest population growth increase.

Employment

The employment projections as a result of the land use assumptions for the previous model and the current model are shown in the tables below.

Table A4 : Employment Changes from 2001 to 2031 for the previous NN2B model

	Jobs					
Area	2001		2031		Increase	% Increase
Nelson north, outskirts and port (zones 479-528)	2991	(11%)	3304	(7%)	313	10%
Nelson CBD (zones 1-160)	7250	(27%)	8313	(19%)	1063	15%
Nelson south and west (zones 161-304)	4986	(18%)	7299	(16%)	2313	46%
Stoke (zones 305-400, 529-540,625-632)	2813	(10%)	6775	(15%)	3962	141%
Richmond (zones 401-478,541-579,633)	4873	(18%)	11519	(26%)	6646	136%
Rest of Tasman (zones 580-624)	7340	(27%)	10586	(24%)	3246	44%
Total	**30253**		**47796**		**17543**	**58%**

Table A4 above shows that a 58% increase in jobs was forecast with the previous model. Over half the additional jobs forecast in 2031 would be in Tasman, with a significant but smaller amount in south and west Nelson. Almost 80% of new jobs in the region would be south of Annesbrook.

Table A5 : Employment Changes from 2006 to 2036 for the current model

	Jobs					
Area	2006		2036		Increase	% Increase
Nelson north, outskirts and port (zones 479-528)	2914	(8%)	2997	(6%)	83	3%
Nelson CBD (zones 1-160)	8162	(24%)	9116	(20%)	954	12%
Nelson south and west (zones 161-304)	5620	(16%)	8424	(18%)	2804	50%
Stoke (zones 305-400, 529-540,625-632)	3972	(11%)	4994	(11%)	1022	26%
Richmond (zones 401-478,541-579,633)	6352	(18%)	11719	(25%)	5367	84%
Rest of Tasman (zones 580-624)	7552	(22%)	9147	(20%)	1595	21%
Total	**34572**		**46397**		**11825**	**34%**

Table A5 above shows that a 34% increase in jobs is forecast in the current model. Over half the additional jobs forecast in 2036 will be in Tasman, with a significant but smaller amount in south and west Nelson. Over 65 % of new jobs in the region will be south of Annesbrook.

The linearly interpolated 2006 employment figure for the old model is 33029, which is 4.5% lower than the current model figure indicating that reasonable growth in employment in the region occurred from 2001 to 2006. The linearly extrapolated 2036 employment figure for the old model is 50794, which is 9.5% higher than the current model figure. The current model has a much more modest employment growth increase.

[ii] Based on the average annual growth between 2001 and 2011
[iii] Based on the average annual growth between 2011 and 2031, extrapolated to 2036. Note: these methods have been used for other "linear extrapolations" referred to elsewhere in this Appendix.

Network Statistics

The number of trips and summary travel characteristics are given in the tables that follow.

Table A6 : Model Network Statistics for the previous model

TRIPS (whole network)	2001 base calibration			2031 Base			2031 Preferred Strategy		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Total person trips (2 hours)									
Car driver	40455			66858			62549		
Car passenger	5275			8694			8710		
PT : all services	284			431			1619		
Walk / cycle	13984			22044			25145		
Private cars trips (2 or 7 hours)									
Total driver trips (incl. park)	43771	153038	47432	71584	255740	79001	66841	237661	73317
Increase relative to 2001	-	-	-	63.5%	67.1%	66.6%	52.7%	55.3%	54.6%

The total person trips and private car trips are for 2 hours, apart from 7 hours for private car trips during the inter-peak (IP).
No data for IP and PM person trips as only the AM period had a 4-step model.

Table A6 shows that the average increase in private car trips is similar for all three periods, with a 64-67% increase for the base network and 53-55% for the preferred corridor strategy for 2031, compared to the 2001 base calibration. Examination of the values for 2011 and 2021 also reveals that the increase in trips is similar for each ten-year period with the slight drop-off in the 2021-2031 period. The preferred strategy is that adopted for the draft combined regions RLTS at the conclusion of the North Nelson to Brightwater study.

Table A7 : Model Network Statistics for the current model

TRIPS (whole network)	2006 base calibration			2016 with PT Phase A			2036 with PT Phase A		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Total person trips (2 or 3 hours)									
Car driver	37037	39433		40881	43425		45888	50427	
Car passenger	6836	12775		7236	13873		7805	15999	
PT : Richmond ←→ Nelson	143	72		230	151		256	182	
PT: Other Nelson services	95	84		121	156		127	158	
Walk / cycle	14120	21609		15106	23897		16310	27613	
Private cars trips (1 hour)									
Total driver trips (incl. park)	24638	20823	26713	27253	22862	29581	31024	26645	33970
Increase relative to 2006	-	-	-	10.6%	9.8%	10.7%	25.9%	28.0%	27.2%

The total person trips are for 2 hours except for the Interpeak PT trips which are for 3 hours.
No data for PM person trips as only the AM and Inter-peak models are 4-step models.

Table A7 above shows that the average increase in private car trips is similar for all three periods, with a 10-11% increase for 2016 compared to 2006 and 26-28% for 2036 compared to 2006, which equates to an average annual growth rate of private car trips of about 0.8% per annum. These transport network statistics are more modest in the current model than in the previous model due to the lower population and employment growth rates, and differing distributions of residential and employment growth areas. The result is substantially fewer private car trips over the study period.

The tables below outline the characteristics of trips within the study area.

Table A8 : Model Study Area Statistics for the previous NN2B model

TRAVEL (study area)	2001 base calibration			2031 Base			2031 Preferred Strategy		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Vehicle kilometres	105,019	94,079	119,459	164,914	151,527	185,941	153,639	145,062	179,249
Mean delay per veh delayed(s)	4.9	4.2	4.8	7.4	6.5	15.0	7.6	5.1	11.9
Link mean speed (km/h)	52.3	57.3	46.6	25.7	52.7	29.9	54.2	54.9	44.9
Mean speed (km/h)	44.4	48.7	39.9	22.7	42.7	22.4	43.2	46.6	32.9

Table A8 above shows that the number of vehicle kilometres increases in future years under the previous model, which is to be expected. Examination also of the Table A9 values for 2011 and 2021 reveal that the increase in trips is similar for each ten-year period with a slight drop-off in the 2021-2031 period.

Table A9 : Model Study Area Statistics for the previous NN2B model (intermediate years)

TRAVEL (study area)	2011 Base			2011 Preferred Strategy			2021 Preferred Strategy		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Vehicle kilometres	127,809	114,003	143,033	121,716	111,873	140,153	136,914	128,014	162,362
Mean delay per veh delayed(s)	5.1	5.1	6.7	5.2	4.5	4.6	7.6	5.1	9.7
Link mean speed (km/h)	42.1	56.0	37.4	47.5	56.5	41.6	54.5	54.5	43.4
Mean speed (km/h)	36.7	46.6	31.5	40.7	47.8	36.4	44.8	46.1	33.4

The average trip length and time were not previously reported for the study area (only the whole network)

The above tables for the previous model also reveal the very good performance of the preferred corridor strategy network compared to the base networks, particularly for the AM peak when speeds for the 2031 base network are about half that of the 2001 calibration base network. However with a reduced number of trips for the current study and different land use pattern it is unlikely that that degree of change in performance would be expected to be repeated in the current study analysis.

Table A10 : Model Study Area Statistics for the current model

TRAVEL (study area)	2006 base calibration			2016 with PT Phase A			2036 with PT Phase A		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Vehicle kilometres	109,936	93,581	122,712	122,738	104,945	137,433	144,259	128,349	162,678
Average Trip Length (km)	6.96	6.88	7.28	6.90	6.87	7.13	6.85	7.00	7.03
Average Trip Time (mins)	8.37	8.01	8.88	8.07	8.20	9.48	7.83	8.13	9.26
Mean delay per veh delayed(s)	4.54	4.27	4.82	5.12	4.94	5.39	5.49	5.37	6.41
Link mean speed (km/h)	53.6	54.9	53.1	52.8	54.4	52.1	52.9	54.6	52.5
Mean speed (km/h)	45.7	47.3	44.6	44.3	45.8	43.1	44.4	46.0	42.6

Table A10 above shows that the number of vehicle kilometres increases in future years, which is to be expected. However the average trip length and trip time decreases which indicates that people are accessing services closer to their point of origin. This is likely to be due to opportunities resulting from land use changes.

The increase in trips and the increase in vehicle kilometres travelled transposes to an increase in average delay per delayed vehicle and a decrease in the mean speed both for mid-block travel and overall.

The next table shows the model study area annual undiscounted costs for the current network.

Table A11 : Model Study Area Costs for the current network

COSTS (study area)	2006 base calibration			2016 with PT Phase A			2036 with PT Phase A		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
Vehicle operating costs	$43.5k	$36.8k	$48.9k	$48.4k	$41.0k	$54.7k	$56.3k	$49.5k	$64.2k
In-vehicle occ. time cost	$47.8k	$39.3k	$54.5k	$55.0k	$45.4k	$63.3k	$64.5k	$55.3k	$75.7k
Added congestion cost	$1.9k	$1.3k	$2.4k	$2.3k	$1.7k	$3.0k	$2.7k	$2.1k	$3.5k
Total road user cost	$93.1k	$77.4k	$105.9k	$105.7k	$88.2k	$121.0k	$123.5k	$106.9k	$143.6k
Increase relative to 2006	-	-	-	13.5%	13.9%	14.2%	32.6%	38.1%	35.5%

Changes in the Economic Evaluation Manual (EEM) mean that it is not possible to compare this information with the previous NN2B study results

Information from Table A11 has been used as the basis for the figures shown under criterion 8 in Table 3-3, although the units of measurement have changed (monetary to time and exposure rates).

Table A11 above shows that the rate of increase of travel cost is greater than the increase in the number of trips, with a 14% increase for 2016 compared to 2006 and 33-38% for 2036 compared to 2006, which equates to an average annual growth rate of travel costs of about 1.1-1.2% per annum compared to the expected level for 2011.

Corridor Results Comparison

Summary results for the key screenline(s) for the 2006 base calibrated network and the 2016 and 2036 (with Public Transport Phase A) base networks are given in Table A13 below for the AM peak, Inter-peak (IP) and PM peak periods.

The same information is given for the North Nelson to Brightwater Strategic Study for the 2011 and 2031 updated Do-Minimum (May 2006) networks and for the 2031 Preferred Corridor Study (November 2006, adopted for the draft combined regions RLTS) option network in Table A12, noting however that the link information for Princes Drive was not included in the screenlines used for that study.

This data provides information as to how much traffic is travelling north-south on the network across a certain 'screenline'. The screenline is:

- Rocks Road/Waimea Road at the middle/southern end of the arterial routes (with screenline totals excluding flows on Princes Drive in between the two principal arterial routes).

For the current network model, on Rocks Road and Waimea Road there is modest growth from 2011 (interpolated) to 2036 in the inter-peak period but considerable growth in the off-peak direction in the AM and PM peaks. For the peak direction (those given in red), there is negative growth on some routes, namely Rocks Road in the AM peak and Waimea Road in the PM peak, which is similar to that occurring on Wakefield Quay and Rutherford Street.

This compares with the networks for the previous NN2B study where, with a distinctly different land use pattern and more dispersed activities and trips, there is significant growth on all routes for the 2031 networks compared to the 2011 base, ranging from 6% to 22%. The 2011 network had peak flows about 600-700 vehicles per hour (vph) higher than for the current model, and rising to about 900-1000 vph greater for 2031 than the 2036 values for the current model. As would be expected, this resulted in significant deterioration in the travel performance (increased delays and reduced average speeds). The current model has a new set of volume delay curves for which (link) delay does not increase as rapidly, but most delay occurs at the intersections (nodes) for which the same modelling approach has been applied (but with a different base network).

As discussed in the Stage 1 report, the peak hour/peak direction flows on Waimea Road are likely to be approaching theoretical capacity. This is possibly one of the reasons that the flows along this road do not increase over the study period. However, as flows do not increase on other roads along this screenline it

is also likely that the changes in land use over the study period are resulting in more trips being made locally as suggested from the land use activities, and therefore a flattening of trip growth between Nelson and Stoke/Richmond.

MWH

Table A12 : Rocks Road / Waimea Road Screenline for the previous NN2B model

SCREENLINE VOLUME (vph)				2011 Updated Do Min			2031 Updated Do Min			2031 Preferred Strategy		
No.	Road	Location	Dirn	AM	IP	PM	AM	IP	PM	AM	IP	PM
2.2a	Rocks Road	North of Bisley	n/b	1572	1057	848	1947	1243	947	1972	1027	905
			s/b	505	998	1578	534	1140	1725	534	1132	1760
2.2c 2.2d	Princes Drive	North of Moana	n/b s/b									
2.2b	Waimea Road	North of Beatson	n/b	1880	1003	876	1949	1218	1038	1965	1369	1194
			s/b	493	1132	2016	520	1378	2254	525	1285	2047
Screenline total flow (excluding Princes Dr)			n/b	3452	2060	1724	3896	2461	1985	3937	2396	2099
			s/b	998	2130	3594	1054	2518	3979	1059	2417	3807
% increase with respect to 2011			n/b	-	-	-	12.9%	19.5%	15.1%	14.0%	16.3%	21.8%
			s/b	-	-	-	5.6%	18.2%	10.7%	6.1%	13.5%	5.9%

Note the (Nov'06) Preferred Corridor Strategy (PCS) included here involved peak hour clearways on Rocks Road and Waimea Road. Base is May'06 updated Do Min.

Table A13 : Rocks Road / Waimea Road Screenline for the current model

SCREENLINE VOLUME (vph)				2006 Calibrated			2016 with PT Phase A			2036 with PT Phase A		
No.	Road	Location	Dirn	AM	IP	PM	AM	IP	PM	AM	IP	PM
2.2a	Rocks Road	North of Bisley	n/b	1128	862	685	1137	915	740	1007	980	902
			s/b	480	784	1162	531	899	1304	694	1001	1263
2.2c 2.2d	Princes Drive	North of Moana	n/b s/b	207 64	107 86	110 182	206 107	116 108	165 223	197 142	134 131	209 237
2.2b	Waimea Road	North of Beatson	n/b	1585	1114	1068	1639	1164	990	1582	1226	1154
			s/b	682	1072	1765	706	1059	1654	827	1122	1651
Screenline total flow (excluding Princes Dr)			n/b	2713	1976	1753	2776	2079	1730	2589	2206	2056
			s/b	1162	1856	2927	1237	1958	2958	1521	2123	2914
% increase with respect to average of the 2006 and 2016 flows, i.e. 2011 interpolated			n/b	-	-	-	1.1%	2.5%	-0.7%	-5.7%	8.8%	18.1%
			s/b	-	-	-	3.1%	2.7%	0.5%	26.8%	11.3%	-1.0%