Malcolm Hunt Associates

noise and environmental consultants

Ph 04 472 5689
Fax 04 473 0456
email mha@noise.co.nz

First Floor Arco House
47 Cuba Street
PO Box 11-294
Wellington

Nelson Arterial Transport Study [NATS]

Stage 3: Evaluation of Options
Noise Effects Study

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Prepared by

Malcolm Hunt Associates
NOISE & ENVIRONMENTAL CONSULTANTS
First floor, Arco House, 47 Cuba Street, PO Box 11-294, Wellington
Telephone 04 472 5689 Fax 04 473 0456
mha@noise.co.nz www.noise.co.nz

Prepared For

MWH
BUILDING A BETTER WORLD

Att: Mr Phil Peet, Team Leader
Transportation Planning and Traffic Engineering
MWH New Zealand Ltd

Level 1, 123 Taranaki Street
PO Box 9624, Te Aro
WELLINGTON

Nelson Arterial Transport Study
Stage 3: Evaluation of Options
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This study has examined potential traffic noise and vibration effects associated with four preferred roading options set out in the Stage 2 NATS report. The options are based on roading designs and traffic estimates provided by the project's traffic engineers, MWH, and is based on future calculated traffic noise levels. The assessment takes into account expected changes of traffic noise levels in the local environment, and the recommendations of NZS6806:2010 Acoustics – Road traffic noise – New and altered roads. The assessment is based on a comparison of the expected pattern of future effects with the current patterns of noise and vibration effects associated with the existing network.

All options will likely need to incorporate appropriate noise mitigation given that the NZ standard to be applied deals with noise from new and altered roads, however this standard will have important ramifications for the design of Option B. Where Options A, I and H involve works outside the designation, NZS6806:2010 will apply in those areas. Construction noise issues are also identified for Option B which are not likely to exist for other options.

Although some changes in noise and vibration effects may arise at some locations, overall this study finds the existing pattern of effects are unlikely to be departed from under Options A, I and H, with Option B requiring specific comment in terms of noise associated with the proposed new alignment included in this option.

In all cases it is considered that the current state of the urban environment in this sensitive part of the district, and the standards able to be applied to control adverse noise and vibration effects, all options can be made acceptable from a noise and vibration perspective. However, the comparative analysis set out below indicates Option A as having 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.

MalcolmHuntAssociates
first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
noise and environmental consultants

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MalcolmHuntAssociates
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1.0 Introduction

Malcolm Hunt Associates [MHA] have been commissioned by Montgomery Watson Harza [MWH] on behalf of Nelson City Council [NCC] to carry out the Stage 3 evaluation of traffic noise effects for the selected arterial roading options.

Noise from road traffic has the potential to cause disturbance and is an important consideration in the assessment of the environmental effects associated with such area-wide arterial transport studies. This assessment is not a detailed study of the environmental noise effects of each option [for example, as may be prepared pursuant to the RMA Fourth Schedule] however, an option-specific forecast of potential noise and vibration effects is provided, based on the noise sensitivity of the current receiving environment.

This assessment takes into account the recommendations of NZS 6806:2010 *Acoustics – Road traffic noise – New and altered roads* which by its own definition, applies to new roads and those altered roads where the noise effects will be significant. Where the standard applies, the criteria within NZS6806:2010 only recommend dwellings or "protected premises and facilities" be considered for noise mitigation if the forecast 'Do Minimum' level of increase in daily traffic noise is 3 dB or more compared to current day [or at least 1 dB L_{Aeq} [24h] or more in high noise environments above 68 dB L_{Aeq} [24h]]. Where traffic noise threshold levels are forecast to be exceeded, the Standard recommends an assessment of mitigation options using a balanced procedure used to ensure the resultant recommended noise mitigation is applied in accordance with the 'Best Practicable Option' [BPO] as required by the Resource Management Act [RMA].

Investigations to date have comprised assessment of the noise and vibration associated with the existing network as described within the *NATS Stage 1 report: Assessment of Noise Effects Existing Roading Network*, dated 8 April 2010 Report Reference: 998-776-06[FIN-2] with the subsequent MWH Stage 2 report *Arterial Traffic Study - Selection of Best Arterial Route Options* Prepared for Nelson City Council MAY 2010Project number: Z1843900 setting out FOUR roading options for comparative assessment in terms of traffic noise and vibration in this report.

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Importantly, the current assessment takes into account future 'Do Minimum' levels of noise effects currently experienced within the existing patterns of land use activities, comprising a range of non-sensitive land uses [such as commercial or industrial areas] and noise-sensitive land uses [such as schools, a hospital and residential dwellings].

Being a strategic evaluation of options, this assessment has not considered effects at the individual property level. In some cases without a site-by-site analysis, the effects of noise and vibrations differences between the options are difficult to identify however the assessment below has highlighted the differences. This is because the options presented for analysis have only very minor differences between three of the four options. Thus, for one option involving a new stretch of carriageway, comparison of "new" noise and vibration effects must be made against situations where these effects are already associated with the existing roading network [with very little differences between the three options that are based on the existing network].

This report assesses each route option according to the descriptions provided [width and location of traffic lanes, traffic flows, speeds, etc] with current types of land uses in place that have developed over time in these areas.

The noise affected areas are initially depicted for the 'Do Minimum' situation with this forming the basis of the assessment of effects for Options A, I and H. Option B which involves constructing a new link and has attendant noise and vibration effects that will affect "new" areas. Thus, a special assessment of this option is provided.

2.0 Traffic Noise Predictions

The traffic noise prediction model used to predict road traffic noise in New Zealand is the Calculation of Road Traffic Noise model [CRTN] originally prepared in the United Kingdom. This model has been validated for use in Australia and in New Zealand with minor modifications. In New Zealand alternative corrections for the effects of road surface are applied.

Inputs to computer models generally require the following data:

[a] Traffic flows as AADT;

[b] Heavy vehicle percentage;

[c] Road surface;

[d] Average vehicle speed [not posted speed limit if different from average];

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The predictions were used to derive a "distance to noise contour" suitable for overlaying over aerial photographs to show the areas affected. Traffic noise is quantified using a 24 hour "A weighted" L_{Aeq}, in decibels [dB] reflecting the overall subjective response on a daily basis, rather than reaction to isolated noise events [e.g. the passage of individual heavy vehicles]. This is the unit of measurement recommended in the traffic noise guidelines, the only available criteria in use in New Zealand.

The generalised contour method used to derive traffic noise contours in this assessment:

- Do not include detailed local terrain information;
- A typical smooth asphalt road surface has been assumed;
- The screening effects of vegetation have not been taken into account.

3.0 NZS6806:2010

NZS 6806:2010 *Acoustics – Road traffic noise – New and altered roads* sets criteria for road traffic noise from those roads, as well as providing a consistent methodology for the assessment and mitigation of that noise. The noise criteria contained in the Standard have been developed taking into account health effects associated with noise; the effects of noise levels on people and communities; affordability considerations; and the potential benefits of new and altered roads to people and communities.

The approach of NZS6806:2010 requires assessment whether the Standard should apply to any particular roading works[1]. Within NZS 6806:2010 an altered road means any existing road that is subject to alterations of the horizontal or vertical alignment and the alterations cause a change in the noise environment that is in excess of one of the following thresholds at any one or more protected premises or facilities: ['Protected premises and facilities' is defined in the Standard to include a range of noise sensitive activities, such as residential activities.]

1. the level of noise at least 10 years after the alterations are complete would be greater than or equal to 64 dB L_{Aeq}[24h] and if no specific noise mitigation was undertaken, the alterations would cause an increase in road-traffic noise of at least 3 dB L_{Aeq}[24h] or more,

   or;

2. the level of noise at least 10 years after the alterations are complete would be greater than or equal to 68 dB L_{Aeq}[24h] and, if no specific noise mitigation was undertaken, the

[1] To simplify the process of understanding whether or not alterations to an existing road constitute an altered road as defined in the Standard, the NZ Transport Agency has developed a web-based screening tool which can be accessed on the website www.acoustics.nzta.govt.nz under the 'Tools' tab.

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first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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alterations would cause an increase in road-traffic noise of at least 1 dB L_{Aeq}[24h] or more.

As a general rule, a change in noise of 3 dB L_{Aeq} [24h] or more would occur if there was a doubling of the traffic flow, or the distance between the existing road and any protected premises and facilities was halved as a result of alterations.

Section 6 of NZS 6806:2010 describes the noise criteria applied to road traffic noise from new and altered roads received at 'protected premises and facilities' [that is, noise sensitive activities such as residential activities which exist, or for which building consent has been obtained, at a specified time]. There are two sets of criteria in the Standard: one set for altered roads and new roads

a) The criteria for new roads are set out for new roads estimated traffic flows between 2000 and 75 000 AADT. This applies to the new southern arterial road included as Option B.

b) For existing roads, the noise limits are set at a higher level than for new roads reflecting noise levels in these areas often already exceed the noise criteria for new roads. In these circumstances noise mitigation options, which could reduce noise levels to those provided for in the criteria for new roads with lower traffic flows, are very limited and generally uneconomic.

The basis of the noise criteria set out in NZS6806:2010 is the concept that the Best Practicable option [BPO], as contained in the Resource Management Act, should be used to mitigate road traffic noise effects.

Both sets of criteria [*a* and *b* above] include three categories – Category A, which provides the best option for reducing noise, and Categories B and C, which allow higher levels of noise. Wherever possible, Category A should be achieved. Where this is not possible then Category B should apply, and where achievement of neither Category A or B is possible, then Category C should apply.

MalcolmHuntAssociates
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4.0 Option Assessment

4.1 Do Minimum

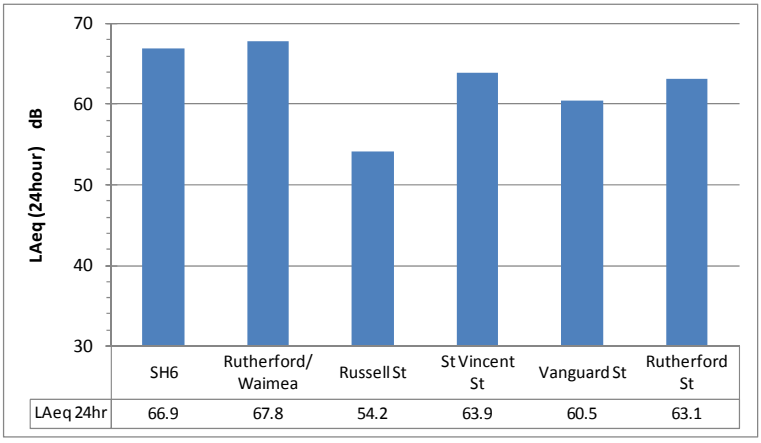
The traffic engineers projected daily AADT traffic flows for 'Do Minimum' are summarised as follows;

Estimated AADT	2006	2016	2036
Rocks Rd	21047	21033	22919
Waimea Rd	26495	28600	30030

The 'Do Minimum' parameters are defined within the main report, suffice to say that the traffic modelling has a low traffic growth[2] trajectory and consequentially few changes are expected as a result of any traffic increases over the 'Do Minimum' planning period. Regarding traffic speed, we are advised of the following predictions for average traffic speeds for the Do Minimum' situation;

Annesbrook Via Rocks Rd			
2006	**2016**	**2036**	**Used in modelling**
46 km/hr	46 km/hr	45 km/hr	45 km/hr
via Waimea Rd	**2016**	**2036**	**Used in modelling**
44 km/hr	39 km/hr	38 km/hr	39 km/hr

Predicted L_{Aeq} [24h] traffic noise levels based on the above 24 hour traffic volumes and average vehicle speed are set out as follows for the main traffic routes assessed as part of the 'Do Minimum'. These are the expected L_{Aeq} [24h] noise levels at 10m from the edge of the nearside traffic lane [3] set out in the following graph:



[2] 'low traffic growth' in this context refers to a comparison within growth rates set out within NZTA's *Economic Evaluation Manual* Table A2.5 which indicates default annual percentage arithmetic traffic growth rates of 2.5% for arterial routes in the nelson region. Also the rates are quite low considering the average values adopted in many other local authority areas as set out within *Traffic Growth Prediction*, Transfund 2000, New Zealand Research Report No. 191 G.F. Koorey, T.J. Mitchell Opus Central Laboratories, Lower Hutt, New Zealand C.R.Fisk, S.F.Moynihan Opus International Consultants, Wellington, New Zealand.

[3] This assessment location represents a typical location of 1 metre in front of the dwelling facade, the traditional location for assessing the effects of road traffic noise on residential dwellings.

MalcolmHuntAssociates
first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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The extent of land areas adjacent the major traffic routes under the various options are shown below as noise contour diagrams. The diagrams [below] indicate expected areas affected by traffic noise at year 2036 for the following levels;

A. >65 L_{Aeq} [24 h]
B. 55 to 65 L_{Aeq}[24h]

The diagrams below show the most important areas affected by noise and vibration (>65 L_{Aeq} [24 h]) as marked by the pink line which is located at 15 to 18 metres from the nearside edge of the closest traffic lane.

The area covered in pink in the 2036 assessment represent areas where noise and vibration from passing traffic are classified as relatively extensive. This area is quite broad indicating a significant numbers of residential dwellings affected in some way. Most dwellings affected are due the closer portion of the dwelling being affected with very few dwellings entirely engulfed within a >65 L_{Aeq} [24 h] contour. The outer shaded area represents noise levels at L_{Aeq} [24h] 55 dB or greater. This is an even greater land area. Within this broad area the effects of traffic noise and vibrations are noticeable within noise sensitive premises and facilities experiencing some adverse impacts, but generally the effects are received at an acceptable level.

Due to only modest growth in traffic volumes, the above affected areas very closely align with areas currently experiencing noise and vibration effects from the existing network. For the existing situation [2010, based on 2006 AADT's], L_{Aeq} [24h] noise levels will only be little as 1 dB or lower compared to the 2036 levels due to relatively flat growth in traffic volume and slightly reduced average network speeds.

Option A: Part Time Clearways

Option A provides an additional peak-hour clearway lane on the existing road corridors between the Haven Road roundabout and the Annesbrook Drive roundabout. A clearway lane would be provided northbound on SH6 [Annesbrook Drive, Tahunanui Drive, Rocks Road and Wakefield Quay] and southbound on Rutherford Street and Waimea Road [these clearway locations simplify traffic management at the key intersections at each end of the corridors].

The cross sections used are as follows:

<u>In general:</u>
4.2m traffic lane in peak periods [2.1 parking, 2.1m cycleway off peak], 3.8m traffic lane, 4.0m traffic lane, 2.0m cycle lane.

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first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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At junctions:
4.2m traffic lane in peak periods [2.1 parking, 2.1m cycleway off peak], 3.5m traffic lane, 2.6m turning lane, 3.5m traffic lane, 1.5m cycle lane.
Along the waterfront: 2.0m parking or cycle lane, 3 x 4.0m traffic lane [possibly use the centre lane as the "clearway" in peak periods and flush median at other times], 4.0m combined footway / cycleway.

The clearway lanes would become available for parking during off-peak hours. Works within designation with an additional lane provided along the waterfront three within the existing carriageway. Part time clearways would operate in both peaks with lanes available for all vehicles, rather than just high occupancy vehicles [cars with two or more occupants], buses and freight

Clearway noise effects have been studied in relation to the 2008 Mana Esplanade consent order which found that the effect on 24 hour daily traffic noise levels [an extra lane of traffic closer to the dwelling] generated a small change of less than 1 dB where clearways apply both sides of the road.

Overall, under Option A the 2036 noise and vibration effects will be very similar to those depicted for 'Do Minimum' [**Figure 1**]. This is because;

Analysis shows traffic volumes are within a few percent of the predicted 'Do Minimum' scenario.

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Figure 1 Predicted L_{Aeq} [24h] traffic noise levels based on the above 24 hour traffic volumes and average vehicle as per 'Do Minimum' 2036. Not to Scale

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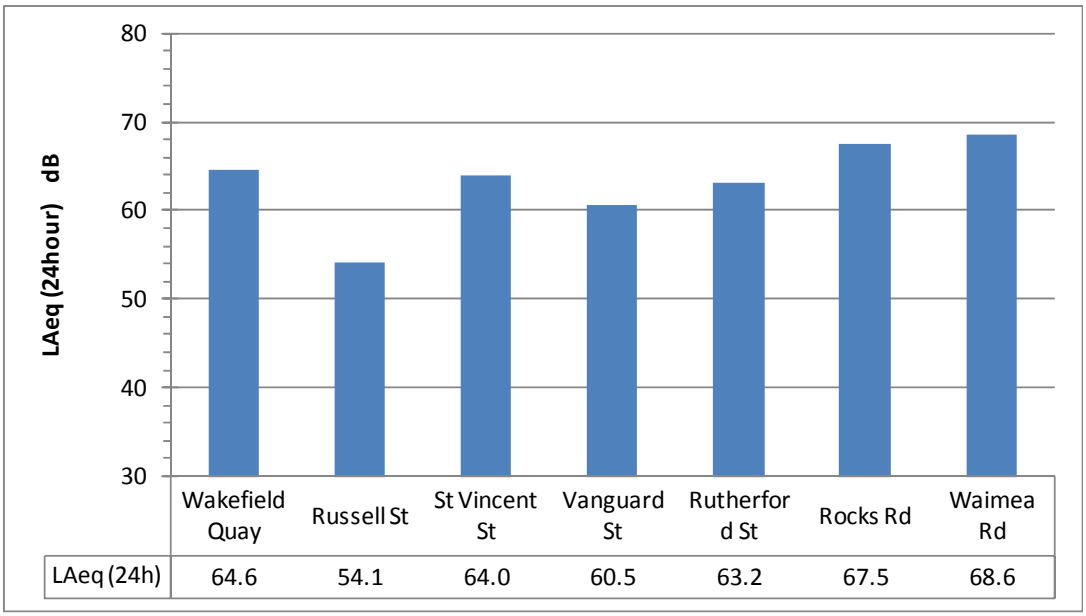
	2016 Percent of 2006	2036 Percent of 2006
Rocks Rd	95.3%	94.6%
Waimea Rd	101.9%	102.6%

This translates to very minor changes, resulting in a level of change which would not be noticeable.

Also, vehicle speed changes on the network are not considered significant;

	2016 Percent of 2006	2036 Percent of 2006
Rocks Rd	94.4%	95.7%
Waimea Rd	98.0%	100.0%

Traffic noise levels across the key routes of this option are set out as follows;



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first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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Basically, Under Option A vehicle traffic is managed in a way that may result in a slight increase noise and vibration effects compared to Do Minimum, however site specific mitigation could be applied to reduce the effects to current [or 2006] levels.

Noise level changes in the order of 1 dB over 'Do Minimum' are likely, with no wholesale changes in the current levels of noise and vibration changes on average across the network. For specific sites, the creation of new lanes and the street realignment works required may result in some localised effects for individual properties; however this would generally be limited in extent and amenable to mitigation.

Option B: Southern Arterial

Option B involves the construction of a new Southern Arterial along Beatson Road, the Railway Reserve and up St Vincent Street. This would be a two-lane two-way local road with at-grade intersections. A separate 3m wide footpath/cycleway will also be provided along the Railway Reserve.

As a base option, traffic signals would be installed at the St Vincent Street/Toi Toi Street intersection. A new roundabout would be constructed at the southern end of the route adjacent to the existing Waimea Road/Beatson Road roundabout.

The cross-section generally is as follows: 1.8 m cycle lane, 2 x 3.5 m traffic lanes, 1.8m cycle lane. Through the existing abandoned rail track 2 x 3.5m traffic lane [will need 1.0-1.5m shoulders adding later] and 3.0m combined 2-way walkway/cycleway

Analysis shows traffic volumes vary significantly in some areas from the 'Do Minimum' scenario due to the traffic taking the new link.

	2016 Percent of 2006	**2036 Percent of 2006**
Rocks Rd	62.9%	68.1%
Waimea Rd	60.3%	65.1%

This translates to some lowering of the levels of noise emissions from the existing network, around 2 to 3 dB less noise from the existing network at 2036 is estimated as a result of the operation of the proposed new link. The resulting reduction may just be noticeable. Significant increases in noise and vibration effects will arise at receiver locations adjacent to the proposed alignment which currently experiences low ambient sound levels. Without any specific mitigation, nearby receiver locations will experience an increase in daily sound levels by 15 to 20 dB above 'Do

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first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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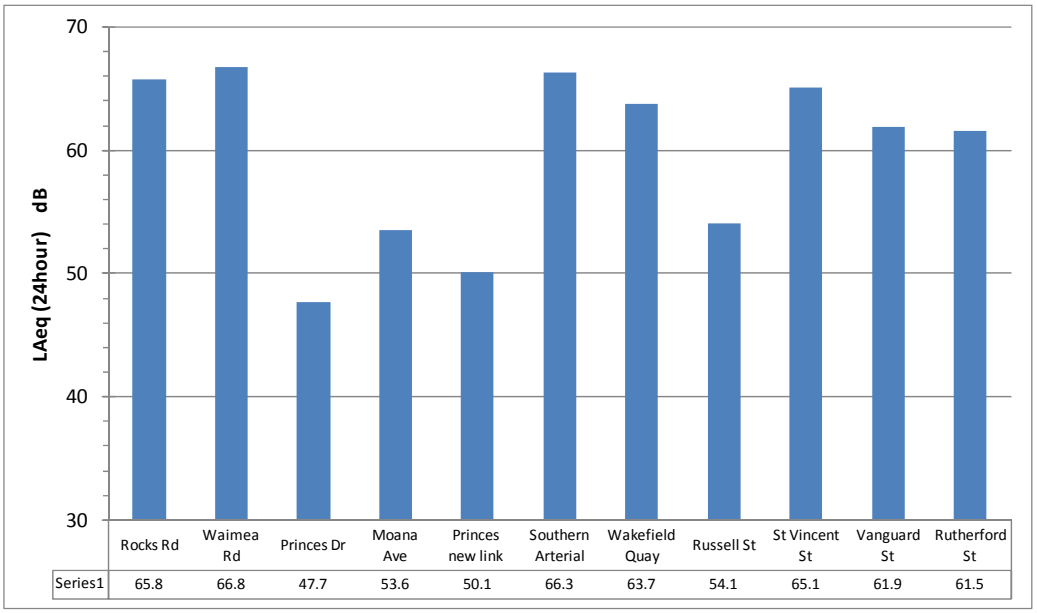
Minimum' noise levels in the most adversely affected locations. Thus, the new link introduces "new" noise and vibration effects which will be significant and erode the current acoustic amenity of this area.

Traffic noise levels across the key routes of this option are set out as follows;



It is likely that the designation required for this link to proceed would be the vehicle through which the agreed level of noise mitigation would be specified, as per the recommendations of NZS6806:2010. Although identifying sufficiently effective noise mitigation within the narrow alignment may prove challenging, however the methods set out in NZS6806:2010 will assist in developing the best practicable option. Given the fallback position of acoustic treatment of dwellings most affected, it is clear that the available Standards will mean link can be constructed incorporation reasonable mitigation of noise, vibration.

Figure 2 [below] sets out the areas covered in pink in the Option B 2036 assessment which represents areas where noise and vibration from passing traffic are classified as significant. The outer shaded area represents noise levels at L_{Aeq} [24h] 55 dB or greater. These are the effects of traffic noise and vibrations are noticeable with noise sensitive premises and facilities experiencing some adverse impacts.

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Figure 2 Predicted L_{Aeq} [24h] traffic noise levels based on Option B 2036 24 hour traffic volumes and average vehicle. Not to Scale.

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first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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It appears Option B will introduce significant levels of "new" noise into areas that currently experience little or no noise from the roading network. Mitigation of traffic noise in the community is basically one of economic optimization of four factors being:

- the design and use of the road and environs;
- the layout and detailed design of the buildings;
- the levels of noise criteria to be met

Effects of traffic noise can be managed within a site using a number of site-specific approaches. The following summarises possible mitigation options.

Distance from Road Edge

Noise levels reduce with distance from the road and are an obvious form of mitigation. Traffic noise attenuation as a function of distance from roadway is only effective when there is sufficient distance between the road edge and receiver locations. The Option B alignment appears to have limited width. Thus only modest reductions due to setback distance can be achieved with Option B.

Noise Barriers and Bunding

Noise propagating from a road may be significantly reduced by acoustical screening provided either by a barrier at the road edge, or by constructing the road in a cut, or by some combination of the two. The reduction of propagated noise depends on the extent of the sound shadow which in turn depends on the total effective height of the obstruction. The sound shadow can be increased either by increasing the effective height of the obstruction or by moving it closer to the noise source.

Among the factors to be considered in the design of barriers, apart from the attenuation of sound, are the safety of road users (both drivers and pedestrians), the appearance from the road and from the protected regions behind the barrier, and the increase of noise on the road due to reflection from the barrier. Barriers can take the form of various materials, shapes and forms [i.e. fencing with mural or earth bunds are two examples].

Barriers and bunds need specific design to provide the required noise reduction for receiver locations and can have other effects such as safety and visual impacts. Planting and design can be used to assist with visual effects. It appears that acoustic barriers and screening may play a potential key role in mitigating the noise effects of the Option B alignment if the noise limits set out within NZS6806:2010 are to be complied with at residential locations and schools.

MalcolmHuntAssociates
first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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Road Surfaces [Low Noise Road Surfaces]

Different road surfaces have different noise characteristics associated with tyre-road interaction. Low-noise surfaces have been used for many years and their development is continuing. Tyre/road noise is a significant component of the total noise output for vehicles. In general, coarse textured surfaces are associated with increased noise emission and smooth or porous surfaces with reduced levels. In terms of bituminous surface treatments commonly used in New Zealand sprayed seal coats vary from coarse to medium textured, while asphalt may be fine textured dense graded material or a porous open graded mix (e.g. friction course). These later low noise surface types may be required to be adopted along the Option B alignment to help control the levels of noise emission to acceptable levels.

Acoustic insulation

Indoor traffic noise levels in noise sensitive buildings can be reduced by modifying the design of new buildings and altering existing buildings to enhance the acoustic insulation provided by the building envelope. However, noise in outdoor areas is not altered [this would be achieved with acoustic noise barriers]. Ventilation needs to be considered for indoor environments, where windows are needed to be closed to attenuate noise.

The ability of a material to limit the transmission of sound is quantified using the term, 'sound transmission loss'. The higher the 'sound transmission loss the better the sound insulation performance. The sound transmission loss and hence performance of materials generally increases with increasing mass. By doubling the mass/area, the theoretical increase expected by the mass- law alone is 6 dB but, in practice, somewhat lower increases are observed. Also, higher frequencies are attenuated more readily than lower frequencies. In composite construction, the overall sound insulation is governed by the weakest link.

Although no details can be provided at this time, it appears that some of the closer existing dwellings to Option B alignment may require acoustic insulation s a “measure of last resort”, as recommended within NZS6806:2010.

Traffic Management, Road Configuration and Control

Speed limits or traffic-calming measures can be used to reduce vehicle speeds, and travel demand management can be used to reduce vehicle numbers. Reducing vehicle speed or numbers can reduce traffic noise levels, although significant changes are needed to have an appreciable impact.

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first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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Option H: Rocks Road Four Laning

Option H would involve widening the existing SH6 between Annesbrook roundabout and the Haven Road roundabout to provide four lanes; two in each direction. Along the Rocks Road section of the route, the requirement for additional width would require a new seawall to be constructed to the northwest of the existing one. This would be constructed to allow dedicated pedestrian and cycle facilities to be separated from the through traffic.

The cross-section generally used throughout the length of this option is as follows: 1.5 m footpath, 2.0 m indented parking bay, 1.8 m cycle lane, 2 x 3.7 m traffic lanes, 0.5 m shoulder, 3.5 m median [mirrored on the opposite side of the median].

Where the alignment is adjacent to the sea, on the side of the road closest to the sea, the path/parking bay/cycle lane will be replaced with a 4.0m wide shared boardwalk path.

New intersections have been drawn to the sizes indicated on the Opus plans as follows:

- Haven Road intersection – 48 m diameter Central Island;
- Bisley Ave – new traffic signals;
- Annesbrook Drive intersection– to remain at current size.

All T-intersections have currently been designed with right-turn bays in the central median, with 15 m long diverge tapers and 15 m stacking length.

Predicted L_{Aeq} [24h] traffic noise levels based on the above 24 hour traffic volumes and average vehicle speed are set out as follows for the main traffic routes assessed as part of Option H. These are the expected L_{Aeq}[24h] noise levels at 10m from the edge of the nearside traffic lane [without the effect if widening where this brings the traffic closer to the dwelling:

Analysis shows traffic volumes are within a few percent of the predicted 'Do Minimum' scenario.

	2016 Percent of 2006	**2036 Percent of 2006**
Rocks Rd	91.5%	93.6%
Waimea Rd	104.4%	103.3%

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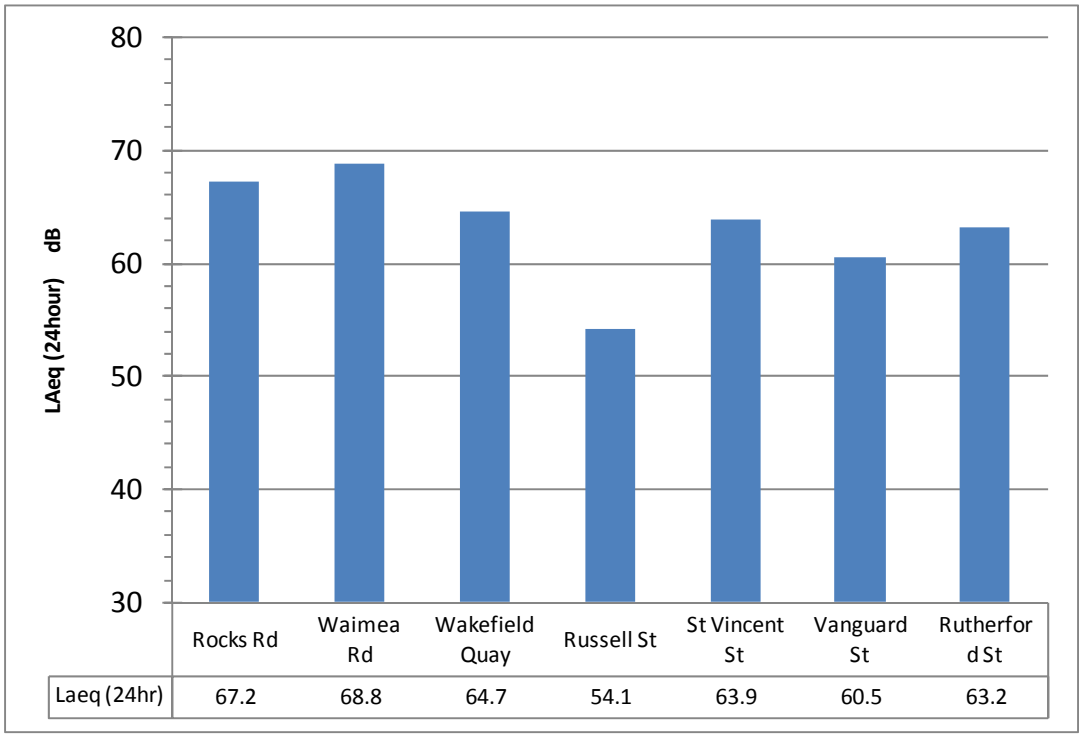
This translates to very minor changes, resulting in a level of change which would not be noticeable. Also, vehicle speed changes on the network are not considered significant;

	2016 Percent of 2006	2036 Percent of 2006
Rocks Rd	94.2%	94.2%
Waimea Rd	98.3%	99.1%

Traffic noise levels across the key links are set out as follows;



Noise and vibration effects of the proposal to provide four lanes; two in each direction, along Tahunahnui Drive & Rocks Road will require land take at the front of a number of dwelling along the route however using the seawall has some advantage in keeping increases in noise at sensitive receiver sites on the east side of the road will be beneficial in a few cases only. In many cases this option increases noise and vibration effects due to the traffic lane coming closer to the dwelling or commercial buildings, e.g. land taken in the Tauhunanui Drive area. It is not possible to define exactly which properties will be affected, suffice to say that some increase in noise and vibration effects can be expected where the designation boundary is required to be adjusted closer to existing dwellings or noise sensitive facilities. In these circumstances the application of NZS6806:2010 will ensure the best practicable option is implemented to mitigate any potential significant adverse noise or vibration effect.

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first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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Basically, Under Option H vehicle traffic at similar volumes to 'Do Minimum' are managed in a way that may result in a slight increase noise and vibration effects for some specific properties affecting by the road widening such as in the Tahunaunui Drive area. Approximately 32 noise receiver sites would likely to experience [unmitigated] increases in traffic noise as well as a at least 14 commercial properties. Within the designation boundaries, realignment of the carriageway will cause noise to decrease or increase depending upon the distance to the new alignment compared to the existing alignment. Where increases are significant site specific mitigation can be applied using NZS6806:2010 be applied to reduce the effects to current [or 2006] levels.

Option I: Waimea / Rutherford Four Laning

This option involves providing four lanes on the existing Waimea Road and Rutherford Street from the Annesbrook Drive roundabout to the Haven Road roundabout. Whilst four lanes will be required at the southern end of the route, the need for the additional lanes decreases towards the northern end of the route. Where the alignment is adjacent to the sea, on the side of the road closest to the sea, the footpath/parking bay/cycle lane will be replaced with a 3.5 m wide shared boardwalk path.

The extent of four laning required indicates some significant property requirements and intersection that may increase noise levels, however improved screening associated these works can offset any increase.

The cross-section generally used throughout the length of this option is as follows: 1.5 m footpath, 2.0 m indented parking bay, 1.8 m cycle lane, 2 x 3.7 m traffic lanes, 0.5 m shoulder, 3.5 m median [mirrored on the opposite side of the median].

Intersections
New intersections have been drawn to the sizes indicated on the Opus plans as follows:

- Haven Road roundabout – 48 m diameter central island.
- Bisley Ave – new traffic signals
- Annesbrook Drive roundabout – to remain at current size.

Noise effects at intersections would not be great unless the land take becomes significant, estimated to be with a maximum increase of 2 to 3 dB above 'Do Minimum' levels.

MalcolmHuntAssociates
first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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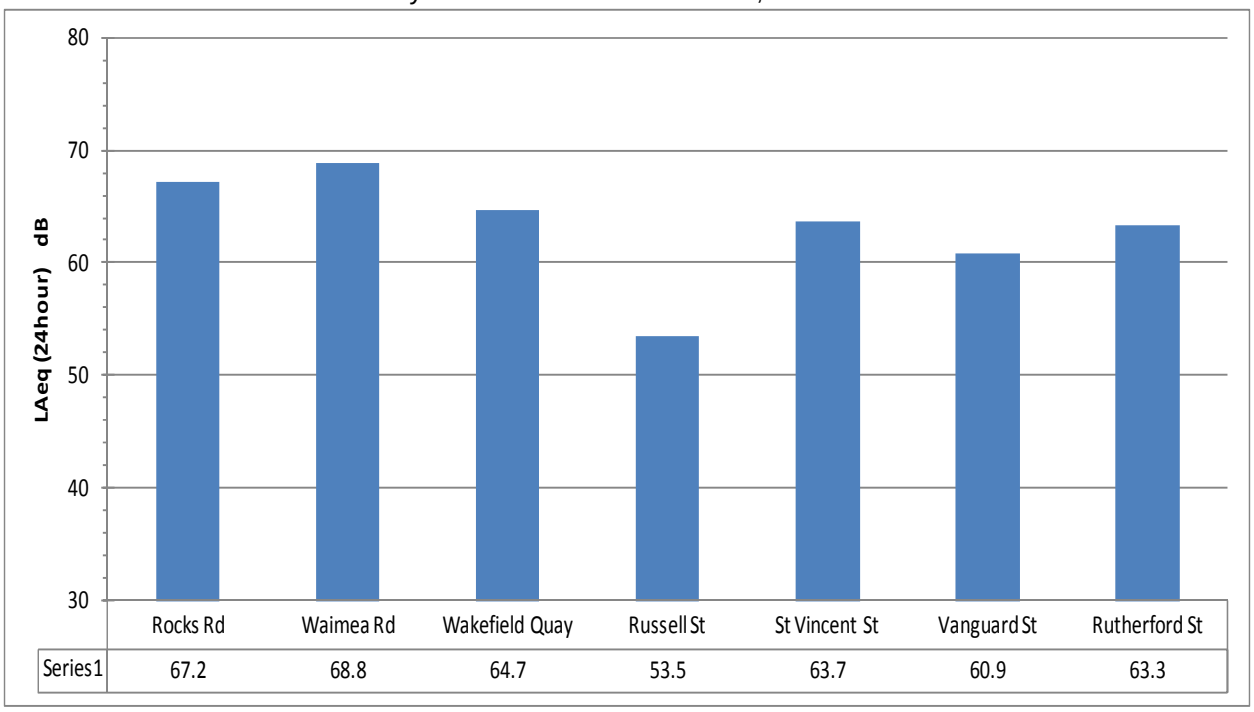
Analysis shows traffic volumes are within a few percent of the predicted 'Do Minimum' scenario.

	2016 Percent of 2006	2036 Percent of 2006
Rocks Rd	94.6%	93.7%
Waimea Rd	104.2%	105.0%

This translates to very minor changes, resulting in a level of change which would not be noticeable. Also, vehicle speed changes on the network are not considered significant;

	2016 Percent of 2006	2036 Percent of 2006
Rocks Rd	101.0%	101.0%
Waimea Rd	108.9%	111.2%

Traffic noise levels across the key links are set out as follows;



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The noise and vibration effects of the proposal to provide four lanes; two in each direction, along Waimea road and Rutherford Road will require some land take at the front of a limited number of dwelling along the route however using the seawall has some advantage in keeping increases in noise at sensitive receiver sites on the east side of the road will be beneficial in a few cases only. In some cases increase noise and vibration effects due to the traffic lane coming closer to the dwelling or commercial buildings, e.g. land taken along Waimea Road and Rutherford Road. The properties affected include schools, hospitals, parks, residential and commercial properties.

At this stage it is not possible to define exactly which properties will be affected and the exact extent of the effects, suffice to say that some increase in noise and vibration effects can be expected where the designation boundary is required to be adjusted closer to existing dwellings or noise sensitive facilities. In these circumstances the application of NZS6806:2010 will ensure the best practicable option is implemented to mitigate any potential significant adverse noise or vibration effect.

Basically, Under Option I vehicle traffic at similar volumes to 'Do Minimum' are managed in a way that may result in a increases in noise and vibration effects for some specific properties affecting by the road widening in the Waimea Road and Rutherford Road area. Approximately 35 dwellings would be involved as well as a number of commercial properties. Within the designation boundaries, realignment of the carriageway will cause noise to decrease or increase depending upon the distance to the new alignment compared to the existing alignment. Where increases are significant site specific mitigation can be applied using NZS6806:2010 be applied to reduce the effects to current [or 2006] levels.

5.0 Overall Assessment

FOUR identified options for the Nelson arterial roading study have been evaluated in terms of noise and vibration effects. The scenarios are compared to the 'Do Minimum' option, at year 2036.

Overall the investigation has found traffic noise and vibration levels are not forecast to increase significantly under any option as the traffic model assumes only low growth factors on the roading network. This means the existing pattern of noise and vibration effects associated with the existing network will not be significantly deviated from, except where new works are undertaken, such as where the option promotes taking the traffic lane closer to dwellings or noise sensitive locations.

The options that involve the most significant changes to the alignment of traffic lanes are Option B, Option I and Option H. Each is discussed in turn;

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first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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- The Option B involving a new link along a currently vacant alignment has the potential to increase the area of significant noise and vibration effects. This is because the increase in noise and vibration in the currently vacant alignment will increase manifold, yet the reduction of noise due to attracting vehicles off the existing network will only result in a roadside noise reduction of 2 to 3 dB

- Option B will also involve significant noise impact during construction owing to the narrow alignment and lack of unfettered access. These effects are beyond the scope of this study; however they can be appropriately managed by the use of a Construction Noise & Vibration Management Plan.

Options H and I involve site specific noise and vibration impacts. The network model does not show major shifts in traffic volumes or speeds [compared to the 'Do Minimum'] for these options, however the process of introducing extra traffic lanes means that some properties will receive increased noise and vibration effects. Without site specific investigations there is insufficient evidence to confidently choose between Option H and Option I.

Considering the design of the clearways option and its inherent 'tidal' action of traffic flows only temporarily closer to sensitive receiver locations and ability of this option to be implemented largely within the existing road reserve, Option A is the preferred option. On this basis Option A is assessed as having the least potential to give rise to adverse noise and vibration effects compared to the other three options.

6.0 Summary

In summary the four options produce a range of outcomes, none of which are assessed as likely to result in a completely unacceptable outcome from a noise and vibration effect perspective. This study has identified the general scale of the noise and vibration effects is moderate with no large scale network wide increases in traffic volumes or speed that would give rise to large increases in adverse effects on overall community. Instead the options represent a range of interventions which themselves will cause the scale of follow-on noise and vibration effects to be quite varied.

In cases where there is likely to be significant realignment of the arterial road or where a new or altered designation is required, the application of NZS6806:2010 will ensure the Best Practicable Option is implemented to mitigate any potential significant adverse noise or vibration effect. Possible mitigation measures include [but not limited to] road surface, distance factors, noise barrier, acoustic insulation, traffic management, road design, traffic control.

MalcolmHuntAssociates
first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
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Option B appears to be the least attractive due to the increase in effects area compared to the 'Do Minimum'. Option H and Option I involve significant land take and, subject to the final design alignment, will increase noise and vibration effects for a number of residential and commercial properties in both cases. This leaves Option A which involves re-arrangement of the existing roading assets within largely the existing designation. This means that while some minor changes in noise and vibration effects will arise [for example, in the vicinity of altered intersections and during the peak flows where the clearway is operating closer to dwellings than the current alignment], on balance the effects of Option A will be less overall.

Option A is therefore promoted as the most benign option among the four options tested.

Malcolm Hunt Associates

Prepared by

Malcolm Hunt
Principal
B.Sc. M.E.(*mech*), Dip Pub. Health. RSH Dip. Noise Control.

Reviewed by

Lindsay Hannah
Senior Consultant
BBSc. PGDipSci (Acoustics (dist))

MalcolmHuntAssociates
first floor, arco house, 47 cuba st, PO box 11-294, wellington, telephone 04 472 5689, fax 04 473 0456, www.noise.co.nz
noise and environmental consultants