Before the Hearings Commissioners

Under	the Resource Management Act 1991 (the **RMA**)
In the matter of	a submission by KiwiRail Holdings Limited (submitter 408 and further submitter 72) and NZ Transport Agency Waka Kotahi (submitter 370 and further submitter 103) on Hearing Stream 5 – Noise and Subdivision
and in the matter of	Wellington City Proposed District Plan

Primary statement of evidence of Catherine Lynda Heppelthwaite for KiwiRail Holdings Limited and NZ Transport Agency Waka Kotahi regarding Hearing Stream 5 – Noise and Subdivision

Dated 18 July 2023

1 INTRODUCTION, QUALIFICATIONS AND EXPERIENCE

1.0 My full name is Catherine Lynda Heppelthwaite. I am a principal planner for Eclipse Group Limited. I am presenting this planning evidence on behalf of KiwiRail Holdings Limited (**KiwiRail**) and NZ Transport Agency Waka Kotahi (**Waka Kotahi**).

1.1 I hold a Bachelor Degree in Resource Studies obtained from Lincoln University in 1993. I am a full member of the New Zealand Planning Institute, a member of the Resource Management Law Association and the Acoustical Society of New Zealand. I have more than 25 years' experience within the planning and resource management field which has included work for local authorities, central government agencies, private companies and private individuals. Currently, I am practicing as an independent consultant planner and have done so for the past 18 years.

1.2 I have extensive experience with preparing submissions and assessing district plans provisions in relation to noise and vibration, most recently in relation to the New Plymouth, Upper Hutt, Porirua and Whangarei District Plans where I assisted Waka Kotahi and KiwiRail variously by providing specialist planning evidence on similar issues (noise and vibration).

2 CODE OF CONDUCT

2.0 I have read the Environment Court's Code of Conduct for Expert Witnesses (2023) and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my areas of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

3 SCOPE OF EVIDENCE

3.0 My evidence will address the following:

a. The statutory and higher order planning framework;

b. KiwiRail and Waka Kotahi submissions;

c. Councils s42A recommendations; and

d. Further amendments required.

3.1 In preparing my evidence, I have considered

a. the Section 42A Hearings Report on Noise prepared by Mr Mark Ashby, Mr Malcolm Hunt and Mr Sean Syman[1] (**the 42a Authors**) and the separate evidence briefs provided by Mr Hunt and Mr Syman[2]; and

b. the Section 42A Hearings Report on Subdivision prepared by Ms Hannah van Haren-Giles.

3.2 My evidence should be read in conjunction with that of Dr Stephen Chiles and Mr Michael Brown[3].

3.3 To assist the hearing process, I have attended one a meeting with Council officers, Mr Ashby, Mr Hunt and Mr Syman, in relation to Waka Kotahi submissions.

4 THE STATUTORY AND HIGHER ORDER PLANNING FRAMEWORK

4.0 In preparing this evidence I have specifically considered the following:

a. The purpose and principles of the RMA (sections 5-8);

b. Provisions of the RMA relevant to plan-making and consenting;

c. National Policy Statement on Urban Development 2020 (**NPS UD**);

d. Wellington Regional Policy Statement (**RPS**) with specific reference to:

i. Chapter 3.3 Introductory Text:

- Recognising rail as a significant physical resource[4];
- *The efficient use and development of such infrastructure can be adversely affected by development. For example,* ***land development can encroach on infrastructure or interfere with its efficient use****. Infrastructure can also have an adverse effect on the surrounding environment. For example, the operation or use of* ***infrastructure can create noise which***

[1] Dated 3 July 2023.
[2] Evidence of Malcolm Hunt and Sean Syman, both dated 3 July 2023.
[3] Evidence of Dr Stephen Chiles and Michael Brown, both dated 18 July 2023.
[4] RPS Introductory text, 3.3 Energy, infrastructure and waste, page 44*(b) Infrastructure.*

***may adversely impact surrounding communities**. These effects need to be balanced to determine what is appropriate for the individual circumstances*[5]*.* **[bold added]**

ii. Objective 10: *The social, economic, cultural and environmental, benefits of regionally significant infrastructure are recognised and protected*[6].

iii. Policy 8: *Protecting regionally significant infrastructure – regional and district plans*[7]. *District and regional plans **shall include policies and rules** that protect regionally significant infrastructure from incompatible new subdivision, use and development occurring under, over, or adjacent to the infrastructure*[8]*.* **[bold added]**

iv. Policy 8 Explanation: *Incompatible subdivisions, land uses or activities are those which **adversely affect the efficient operation of infrastructure**, its ability to give full effect to any consent or other authorisation, restrict its ability to be maintained, or restrict the ability to upgrade where the effects of the upgrade are the same or similar in character, intensity, and scale. **It may also include new land uses that are sensitive to activities associated with infrastructure**.* **[bold added]**

*Protecting regionally significant infrastructure **does not mean that all land uses or activities under, over, or adjacent are prevented**. The Wellington Regional Council and city and district councils will need to ensure that **activities provided for in a district or regional plan are compatible** with the efficient operation, maintenance, and upgrading (where effects are the same or similar in character, intensity, and scale) of the infrastructure and any effects that may be associated with that infrastructure. Competing considerations need to be weighed on a case by case basis to determine what is appropriate in the circumstances*[9]*.* **[bold added]**

[5] RPS Introductory text, 3.3 Energy, infrastructure and waste, page 44*(b) Infrastructure.*
[6] RPS Table 3: Energy, infrastructure and waste objectives and titles of policies and methods to achieve the objectives.
[7] RPS Table 3: Energy, infrastructure and waste objectives and titles of policies and methods to achieve the objectives.
[8] RPS Page 96.
[9] RPS Page 96.

v. Method 1 (for Policy 8) identifies district plans as an implementation method[10].

4.1 The s42A Authors have identified the relevant statutory, planning and strategic document provisions with which I generally agree and will not repeat here[11]. I have also considered Plan Change 1 to the Wellington Regional Policy Statement and have given this minimal weighting due to its progression through the Schedule 1 process.

4.2 For KiwiRail, The Emissions Reduction Plan is a matter to be had regard to by Council[12]; of particularly relevance within the Emissions Reduction Plan (for rail) is *Action 10.3.1: Support the decarbonisation of freight* which includes as a key initiative:

- *Continue to implement the New Zealand Rail Plan and support coastal shipping*.

4.3 For completeness, the New Zealand Rail Plan (NZRP) lists as strategic investment priorities:

- *Investing in the national rail network to restore rail freight and provide a platform for future investments for growth; and*
- *Investing in metropolitan rail to support growth and productivity in our largest cities.*

4.4 While the Emissions Reduction Plan is *to be had regard to*, its support for the NZRP (among other things) illustrates a strategic forward plan to generally improve and increase train services over time.

5 KIWIRAIL SUBMISSIONS AND FURTHER SUBMISSIONS

5.0 In summary, KiwiRail's primary submission seeks:

a. Amend the definition of *noise sensitive activity* to include boarding houses, residential visitor accommodation, papakāinga and hospitals[13];

[10] RPS Table 3: Energy, infrastructure and waste objectives and titles of policies and methods to achieve the objectives.
[11] S42A Report, Section 2.1-2.3, 2.5.
[12] RMA Section 74(2)(d).
[13] Submission 408.9

b. Support NOISE-O2, NOISE-P3[14] and NOISE-P6[15] as notified;

c. Include reference to vibration and refer to *all residential zones* within NOISE-P4[16];

d. Modify NOISE-R3, NOISE-R4 and NOISE-R5 to apply it within 100m of a rail corridor and introduce a vibration control within 60m of the rail corridor[17];

e. Include a new (simplified) Rule NOISE-SX which proposes a permitted activity for all noise sensitive activities which meet minimum internal noise levels[18];

f. Modify ventilation requirements within NOISE-S6[19];

g. Amendments to Subdivision SUB-01[20] to ensure development maintains the safety and efficiency of the transport network; and

h. Amendments to Subdivision SUB-P3 to ensure subdivision design manages effects of activities through setback and design to protect infrastructure[21].

5.1 KiwiRail has also made further submissions in opposition to a range of Kainga Ora submissions which seek to remove notification[22], modify objectives[23] or policies[24], and support Waka Kotahi[25] and Wellington International Airport[26].

6 WAKA KOTAHI SUBMISSIONS AND FURTHER SUBMISSIONS

6.0 In summary, the Waka Kotahi primary submission seeks:

a. Modification to SUB-O1[27] to reflect consideration of adverse effects of site development on the efficient use and operation of the roading and state highway network;

[14] Submission 408.107.
[15] Submission 408.109.
[16] Submission 408.108.
[17] Submission 408.110.
[18] Submission 408.105.
[19] Submission 408.113.
[20] Submission 408.97.
[21] Submission 408.98.
[22] Kainga Ora submission 391.285.
[23] For example Kainga Ora submission 391.288.
[24] For example Kainga Ora submission 391.290.
[25] For example Waka Kotahi submissions 370.211 and 370.219 to 370.221.
[26] Further submission FS72.60 in relation to SUB-O1.
[27] Submission 370.191.

a. New subdivision rule applying to new sites within 100m of State Highway[28] (noting that Waka Kotahi may seek a change to this standard to reflect modelling data instead of a metric setback);

b. Modification to SUB-R1 matters of control to include effects of the road and State Highway[29];

c. Amend[30] SUB-R4 *Subdivision to create a new allotment for infrastructure* to provide for network utility operators and remove minimum lots sizes;

d. Retain as notified NOISE-O1[31], NOISE-O2[32], NOISE-P2[33], NOISE-P3[34], NOISE-P6[35], NOISE-R2 and NOISE-S2.1;

e. Support NOISE-P4[36] with amendment; sought to include mapped noise contours along its entire network;

f. Amend NOISE-R3.1[37], NOISE-R3.3[38] and R3.4[39] to refer to NOISE-S6[40];

g. Amend NOISE-R3.2 to refer to 100m from State Highway or mapped noise contours[41];

h. Amend to NOISE-R3.3[42] and R3.4[43] to improve clarity;

i. Include vibration controls within 20m of State Highway within NOISE-S4[44];

j. Amend NOISE-S5 to add a note on how to calculate State Highway noise levels for the design and correct the noise metric for road noise to be consistent with the requirements of the National Planning Standards[45];

k. Amend assessment criteria within NOISE-S4[46] and S5; and

[28] Submission 370.189.
[29] Submission 370.195.
[30] Submissions 370.196 and 370.197.
[31] Submission 370.211.
[32] Submission 370.212.
[33] Submission 370.213.
[34] Submission 370.214.
[35] Submission 370.216.
[36] Submission 370.215.
[37] Submissions 370.218, 370.219.
[38] Submission 370.222, 370.223.
[39] Submission 370.224.
[40] Submission 370.5.
[41] Submissions 370.220, 370.221, 370.215
[42] Submission 370.222, 370.223.
[43] Submission 370.224.
[44] Submission 370.226, 370.227.
[45] Submission 370.229, 370.230, 370.231.
[46] Submission 370.228.

l. Modify ventilation requirements within NOISE-S6[47].

6.1 Waka Kotahi has also made further submissions in opposition to a range of Kainga Ora submissions[48] seeking to modify objectives and policies. The s42A Authors have generally not accepted[49] Kainga Ora's submission on these matters and I do not address these further.

7 SECTION 42A ASSESSMENT

KiwiRail

7.0 The S42 Authors have either adopted KiwiRail's submissions or proposed alternative relief which I support in relation to the following:

a. The definition of *noise sensitive activity*: I accept the s42 Authors view that *residential activity* would include visitor accommodation and papakainga and their recommended addition of hospital[50] to the definition.

b. It is recommended to retain NOISE-O2 as notified[51] and the majority of NOISE-P3[52]; I agree with this approach.

c. KiwiRail sought to include reference to *all residential zones* within NOISE-P4. I do not consider KiwiRail's change is necessary as notified P4(12) includes *Identified corridors adjacent to the State Highways and railway networks.* This will apply the policy to rail regardless of zone.

i. Modify NOISE-R3, NOISE-R4 and NOISE-R5 to apply it within 100m of a rail corridor (rather than 40m to 80m);

7.1 The S42 Authors have:

a. Retained a 40m High Noise Area for rail noise and 40m to 100m delineation for Moderate Noise Area rail noise in NOISE-R3;

[47] Submission 370.232.
[48] For example Kainga Ora submission points 391.287, 391.290 and 391.292.
[49] For example, Kainga Ora submission points 391.286, 391.287 and 391.288.
[50] S42A Report paragraphs 78 and 79.
[51] Section 42A Report, paragraph 125.
[52] S42A Report paragraph 160.

b. Rejected the request to include reference to vibration in NOISE-P4, unless a vibration standard for rail is included in the plan (which would then require provisions separate to airborne noise)[53].

c. Accepted that vibration was a matter to be managed, however did not support introduction of a vibration control within 60m of the rail corridor without further investigation[54].

d. Rejected a new (simplified) Rule NOISE-SX which proposes a permitted activity for all noise sensitive activities which meet minimum internal noise levels;

e. Modified NOISE-P6;

f. Modified ventilation requirements within NOISE-S6 but not in alignment with the submission;

g. Rejected changes to SUB-01[55] on the basis that other plan provisions (i.e. UFDO7, SCA-O1 and SCA-O2) address effects on infrastructure; and

h. Rejected changes to SUB-P3[56] on the basis that INF-O3 and INF-P7 address effects on infrastructure.

7.2 I address these points further in section 9 and for points 7.1 (g) and (h), in section 11 below.

Waka Kotahi

7.3 The S42A Authors have responded to the Waka Kotahi submissions as described below and where these require no further commentary, I have noted this.

a. It is recommended to retain NOISE-O1 and NOISE-O2 as notified[57] along with NOISE-P2[58], NOISE-P4[59] and the majority of NOISE-P3. I agree with this position with the exception of NOISE-P4 where I support inclusion of reference to vibration.

[53] S42A Report paragraph 152.
[54] S42A Report, paragraph 23.
[55] Section 42A Report, Subdivision, paragraph 192.
[56] Section 42A Report, Subdivision, paragraph 161.
[57] Section 42A Report, paragraph 125.
[58] Section 42A Report, paragraph 159.
[59] Section 42A Report, paragraph 161.

b. Retain as notified NOISE-R2 and NOISE-S2.1 (relative to construction noise). The use of NZS NZS6803:1999 is a common and widely accepted approach to construction noise.

c. Amend NOISE-R3.1, NOISE-R3.3 and R3.4 to refer to NOISE-S6[60], as noted by the S42A Authors, reference to compliance with S6 (ventilation) is necessary to achieve the purpose of the provisions; and

d. Update the noise metric (NOISE-S5) for road noise.

7.4 In respect of the Waka Kotahi submissions that the 42A Authors have recommended be rejected or accepted only in part, I have the following comments which I will address further in sections 9 to 11, below.

b. NOISE-P6, some amendments have been proposed but I do not support these;

c. Some amendments to NOISE-R3.3 and R3.4 are proposed but they do not adopt the changes I support;

d. Rejected application of a standard 100m setback from the State Highway, instead, recommended changing NOISE-R3.2 to amend State Highway distance from "40m and 80m" to "40m and 100m" and applying the provision only to those parts of a State Highway that have "a posted speed limit greater than 70 km/hour"[61].

e. Rejected including vibration controls within 20m of State Highway[62];

f. No amendments have been made to the assessment criteria within NOISE-S4 and S5;

g. NOISE-S5 has been amended to include a note on how to calculate State Highway noise levels for the design[63] however it refers to 2db rather than the Waka Kotahi submission of 3db;

h. Modify ventilation requirements within NOISE-S6[64].

[60] S42A Report, paragraph 182.
[61] S42A Report, paragraph 183.
[62] S42A Report, paragraph 29.
[63] Evidence of Mr Hunt, paragraph 84.
[64] Evidence of Mr Hunt, paragraphs 101 to 117.

i. Modification to SUB-O1 to reflect consideration of adverse effects of site development on the efficient use and operation of the roading and state highway network.

j. New subdivision rule applying to new sites within 100m of State Highway is not proposed;

k. Not accepted Modification to SUB-R1 matters of control[65]. I agree with Ms van Haren-Giles reason for rejecting this point (i.e.. it is addressed in the Noise chapter) and do not assess this point further; and

l. Rejected amendments SUB-R4 as other parties (beyond network utility operators) create allotments for infrastructure[66] and accepted deletion of reference to SUB-S6. I agree with Ms van Haren-Giles' recommendation.

8 NOISE AND VIBRATION

8.0 Dr Chiles[67] has provided evidence which demonstrates effects from noise and vibration and supports various amendments to provisions; I accept and summarise his key findings as:

a. Research confirms that noise and vibration have adverse health and amenity effects on people[68];

b. An internal noise level is a more appropriate method for addressing rail noise[69];

c. For road noise, the Waka Kotahi modelled noise contour may be suitable for setting alternative distances[70] however 'posted' speed limits will need clear definition as variable speed limits apply in some locations;

d. A 3 dB allowance is preferred for measuring road noise measurements/predictions (instead of the 2 dB preferred by Mr Hunt)[71]; and

[65] Section 42A Report, Subdivision, paragraph 351.
[66] Section 42A Report, Subdivision, paragraph 241.
[67] Evidence of Dr Chiles, 18 July 2023.
[68] Evidence of Dr Chiles, 18 July 2023, Section 4.
[69] Evidence of Dr Chiles, 18 July 2023, paragraphs 8.7 and 8.8.
[70] Evidence of Dr Chiles, 18 July 2023, paragraphs 8.2 to 8.4.
[71] Evidence of Dr Chiles, 18 July 2023, paragraph 8.5.

e. Vibration controls for both road and rail are warranted[72].

8.1 Overall, Dr Chiles has provided technical evidence which demonstrates health effects will occur as a result of noise and vibration and therefore it is appropriate to include noise and vibration control provisions.

8.2 The implementation of the MDRS and policies 3 and 4 of the NPS-UD will result in more people living near the rail and State Highway corridors in Wellington City. As a consequence, provisions to mitigate the effects of intensification (such as the noise and vibration controls) are necessary and appropriate to support the implementation of the MDRS and NPS-UD, as well as being consequential to the implementation of greater intensification.

8.3 I have considered other methods (limited noise control and no vibration control) to address heath, amenity and reverse sensitivity effects. For KiwiRail, this is assessed in the format of Section 32AA and included as Attachment B. I conclude that a 'permitted activity' setback for noise is the most efficient outcome to provide for health and amenity along with consequentially reducing potential reverse sensitivity effects.

8.4 For Waka Kotahi, I have appended a Section 32 Assessment for Noise as Attachment C. Dr Chiles and I were involved in the writing of the Section 32 Assessment, I am familiar with its content and agree with its recommendations.

8.5 For rail vibration, I accept Dr Chiles' assessment that vibration can have adverse health and amenity effects on people that requires avoidance, remediation or mitigation under the RMA. I also understand that the exact design requirements to ensure compliance with appropriate vibration levels depend significantly on site-specific factors, including ground condition / soil type, topography or other environmental features. As a result of this, the level of controls required and the associated cost of implementing such controls can therefore differ significantly on a site-to-site basis.

8.6 The s42A Authors have indicated general support for a vibration standard related to rail, but go onto say that due to the absence of technical evidence they recommend that no vibration control should be included in the Proposed

[72] Evidence of Dr Chiles, 18 July 2023, paragraphs 8.11 to 8.15.

District Plan unless the Panel directs Council to investigate and report on the issues (working closely with KiwiRail's noise experts) and provide a solution or solutions.[73]

8.7 I have provided (in my Attachment A) provisions which reflect my preferred outcome (a 60m vibration control) but also a (less preferred) alternative of a "Rail vibration alert overlay" (**Alert Overlay)** (further described in Mr Brown's evidence)[74]. The Alert Overlay would be included within the District Plan maps (100m from the rail designation boundary) along with an explanation in the introduction to the Noise Chapter. Its purpose is to ensure landowners and occupiers are aware that vibration effects may be present in this location.

8.8 There are no rules or other provisions associated with the Alert Overlay. Landowners can then make their own design and location decisions should they wish to mitigate such effects. This enables behaviour change and appropriate warning to landowners.

RPS Framework and District Plan Structure

8.9 The RPS framework accepts there will be effects from infrastructure (beyond its boundaries) and provides a policy framework in which to manage (balance) these (being Objective 10, Policy 8). The RPS does not require that all effects of infrastructure are internalised. The explanatory text in Chapter 3.3 gives a clear explanation:

> *The efficient use and development of such infrastructure can be adversely affected by development. For example, land development can encroach on infrastructure or interfere with its efficient use**. Infrastructure can also have an adverse effect on the surrounding environment. For example, the operation or use of infrastructure can create noise which may adversely impact surrounding communities**. These effects need **to be balanced to determine what is appropriate** for the individual circumstances[75].*[bold added]

8.10 The RPS also directs (by the use of the term "shall" within Policy 8 and its methods) district councils to include <u>policies and rules</u> that *protect regionally*

[73] S42A Report, paragraphs 219 and 220.
[74] Evidence of Mr Brown, 18 July 2023, paragraph 4.7.
[75] RPS Introductory text, 3.3 Energy, infrastructure and waste, page 44*(b) Infrastructure.*

significant infrastructure from incompatible new subdivision, use and development occurring under, over, or adjacent to the infrastructure. This is a very strong directive and the Proposed District Plan (as notified) provides a strong response to this within the Noise chapter. For example;

a. NOISE-O1 and NOISE-P1 reflects that health and amenity need to be protected from adverse noise effects; and

b. NOISE-P4 acknowledged that noise sensitive activities can be protected with appropriate acoustic insulation and ventilation.

8.11 In my opinion, the changes I propose will assist in refining this supportive response.

9 RELIEF SOUGHT NOISE

9.0 Waka Kotahi and KiwiRail requested respectively simplification or alternative rule structure for NOISE-R3. I consider the current structure of NOISE-R3 for State Highways / rail to be overly complicated and to result in over-regulation of noise sensitive activities within proximity to State Highway and rail corridor.

9.1 The S42A Authors propose the following (summarised) rule structure relative to State Highways and rail:

- R3.1 – permitted activity within 40m road and rail, one dwelling where S4 (high noise) and S6 (ventilation) are met
- R3.2 – permitted activity within 40m-100m road (>70km/h) and rail, up to three dwellings where S5 (moderate noise) and S6 are met
- R3.3(a) – restricted discretionary two dwellings meeting S4 and S6 on a site listed in 3.1
- R3.3(d) – restricted discretionary four + dwellings meeting S5 and S6 on a site listed in 3.2
- R3.3(e) – restricted discretionary any other noise sensitive activity meeting S5 and S6 on a site listed in 3.2
- R3.4(a) – discretionary activity more than three unit on R3.1
- R3.4(b) – discretionary activity if not meeting R3.3

9.2 I have the following concerns with this structure:

a. Consent is required for some residential activities (e.g. R3.3(a) and (d) and R3.4(a)) even where acoustic mitigation and ventilation standards are complied with. The number of dwellings constructed at any one

time does not change the need for an acoustic assessment and should not therefore be a 'trigger' for consent being required.

b. There are no permitted, non-residential, noise sensitive activities regardless of whether acoustic mitigation and ventilation standards are complied with; and

c. It is not clear what activity status a non-residential noise sensitive activity would have inside the NOISE-R3.1 area.

9.3 This rule structure will necessitate resource consent for all non-residential activities and, depending on the number of dwellings, some residential activities.

9.4 In my view, the following principles should be applied when managing noise (and vibration) effects in proximity to the State Highway and rail:

a. All noise sensitive activities (residential and non-residential) should be permitted where acoustic mitigation and ventilation standards are met;

b. Failure to meet acoustic mitigation and ventilation standards are appropriately addressed by requiring a restricted discretionary activity consent; and

c. Matters of discretion should include the outcome of consultation with the relevant road or rail requiring authority.

9.5 I consider that a permitted activity (with standards) is an appropriate response as it will deliver mitigation of the effect (by standards), is an achievable and enforceable outcome and will allow suitable development to progress with commensurate regulatory intervention.

9.6 Further, a restricted discretionary activity is appropriate where standards are not met as the matters of discretion can be clearly articulated and are known. I note that WIAL may hold a different view and prefer a discretionary activity.

9.7 More broadly, as described by Dr Chiles[76], the characteristics of transport noise differs from the characteristics of noise emitted by other sources. For

[76] Evidence of Dr Chiles, 18 July 2023, paragraph 8.8.

example, Dr Chiles explains that noise within the CBD may come from any direction; noise from road and rail generally originates from a single direction.

9.8 Additionally, Dr Chiles also sets out that the appropriate response for transport noise differs from that recommended within the S42A recommendation i.e.. use of internal noise levels is recommended By Dr Chiles instead of uniform sound insulation requirements for all façades S42A Authors (refer to by the *Dtr,2m,nT,w + Ctr* provision within, for example, the S42A Authors Appendix A NOISE-S5).

9.9 This sets transport noise apart from other noise generating activities and means that addressing transport noise can be achieved discreetly without impacting the implementation of other provisions recommended by the S42A Authors.

9.10 As a result of my proposed changes, I also consider an alteration to NOISE-P6 is necessary which reflects the alteration in rules, including a permitted activity approach to noise sensitive activities which comply with acoustic mitigation standards.

9.11 I have included in my Attachment A changes to NOISE-R3, NOISE-R4 and NOISE-R5 to remove reference to road and rail, a new NOISE S4A to specifically address transport network noise, a new NOISE S4B to address vibration with tailored assessment criteria, some minor amendments to the ventilation requirements in NOISE -S6 and a modification to NOISE-P4 (to address vibration) and NOISE-P6.

9.12 Finally, I note that Waka Kotahi sought changes to NOISE-R3 (to remove confusion) but its relief did not specifically seek introduction of a new road noise rule of a similar nature proposed by KiwiRail. Notwithstanding this, my Attachment A proposes changes to NOISE-R3 which groups road and rail together. This change is based on Dr Chiles' evidence that road and rail transport noise effects have similar characteristics and management responses and also a desire for consistency / plan administration for transport noise.

9.13 I acknowledge that Waka Kotahi did not make a direct submission requesting a new rule; I can however confirm that I have directly discussed this matter with Waka Kotahi representatives and my Attachment A proposal both

resolves their concerns on the confusion of notified NOISE-R3 and is supported as a general approach.

9.14 In the event the Panel is not minded to include roads into the new rule for transport noise, I would be able to produce a revised set of provisions for consideration.

10 RELIEF SOUGHT SUBDIVISON RULES

10.0 Waka Kotahi sought a new rule to manage effects of noise and vibration at the time of subdivision. KiwiRail submitted in support and to have rail included[77]. I support the intent of this rule as it as it can result in a holistic management response generally only available at time of subdivision design.

10.1 For example, at time of subdivision, construction of a noise wall or bund along the length of the relevant transport network boundary will result in reduced noise throughout the subdivision, provide amenity for outdoor areas and, if appropriately designed, could remove the need for additional acoustic mitigation at individual noise sensitive activities (and allow windows to be opened at the discretion of the occupants).

10.2 I consider the Waka Kotahi wording could however be better targeted to achieve these outcomes and that it also requires modification to reflect the technical evidence of Dr Chiles (in relation to the proposed application of rules within 40m / 100m for 70+km/hr).

10.0 In particular, I propose the following modifications (included in my Appendix A) to the Waka Kotahi provision so that it:

a. applies where development is within 40m or to the area between 40m and 100m of a State Highway with a posted speed limit or maximum variable speed limit greater than >70 km/hour (reflecting the changes to NOISE-R3 supported by Mr Hunt and Dr Chiles); and

b. has assessment criteria focused on the extent subdivision design minimising the need for site specific noise mitigation and provides for outdoor acoustic amenity.

[77] Further submission FS72.55.

10.1 I consider the S42A proposed Subdivision chapter[78] contains some policy support for the proposed new rule, in particular Policy 4:

> *SUB-P4 Integration and layout of subdivision and development Provide for the **efficient integration** and layout of **subdivision and associated development by**:*
> *1. Encouraging joint applications for subdivision and land use;*
> *2. Enabling **subdivision around development that has already been lawfully established**; and*
> *3. Ensuring standalone subdivision proposals **provide allotments that can be feasibly developed and are fit for the future intended purpose.** **[bold added]***

10.2 I have also recommended (Section 11) that changes to SUB-03 and SUB-P3 (in response to a Kiwi Rail submission) be made to increase policy support for this proposed rule.

11 RELIEF SOUGHT SUBDIVISION OBJECTIVE AND POLICY

Objective SUB-O1

11.0 KiwiRail and Waka Kotahi sought changes to SUB-O1 to ensure regionally significant transport infrastructure was considered at time of subdivision. In particular, both sought a new subclause (5); as did Wellington International Airport (WIAL)[79]

a. KiwiRail: *5. Maintains the safety and efficiency of the transport network.*

b. Waka Kotahi: *5. Any potential adverse effects of site development on the efficient use and operation of the roading and state highway network.*

c. WIAL: 5. *Avoids development that is incompatible with regionally significant infrastructure.*

11.1 I agree with Ms van Haren-Giles's view that a plan is to be read as a whole and that there are existing provisions (e.g. UFDO7, SCA-O1, SCA-O2 and INF-O3) which address the matters raised by KiwiRail.

11.2 However, in my experience, when resource consents are processed, despite sections at the start of chapters (e.g. *Other relevant District Plan provisions*),

[78] Appendix A Subdivision to Section 42A Report – Subdivision.
[79] Submission 406.264 and 406.265.

for the most part, it is only the objectives and policies of the chapters where rules are infringed that are considered in any detail.

11.3 More general chapters (e.g. Urban Form and Development (UFD) and Strategic City Assets and Infrastructure (SCA) which have no directly associated rules) are generally only addressed in limited circumstances for example; where a proposal is large scale, subject to public notification or poses a challenge to plan integrity.

11.4 Further, while the Infrastructure chapter does contain INF-O3 (Adverse effects on infrastructure) and INF-P7 (Reverse sensitivity), with the exception of INF-R22 (National Grid Yard) and INF-R23 (Gas Transmission Pipeline), rules which mange effects in relation to transport infrastructure are located elsewhere in the plan (Noise Chapter, Subdivision Chapter). In my opinion the specific rules in these chapters and should be supported by objectives and policies in the same chapters.

11.5 I have considered the Waka Kotahi, KiwiRail and WIAL submissions on SUB-O1 and, on balance, prefer the WIAL wording as it encompasses a wider range of infrastructure. I note that KiwiRail further submitted[80] in support of WIAL. While the WIAL amendment does include the use of 'avoid', it is tempered by use of 'incompatible' which in my view supports the rule structure proposed to address noise effects on respective infrastructure.

Policy SUB-P3

11.6 KiwiRail sought an amendment to SUB-P3 regionally significant transport infrastructure was considered at time of subdivision. Ms van Haren-Giles does not consider the change fits comfortably in the ambit of SUB-P3 which relates to sustainable design. I agree with her and consider the addition KiwiRail proposed for SUB-P3 would be better placed within SUB-P4 as P4 relates to Integration and layout of subdivision. Integration and layout directly reflects the matters raised in KiwiRail's submission (i.e.. how to balance sensitive land use and transport infrastructure proximity). I recommend the following change to SUBP-P4:

> *SUB-P4 Integration and layout of subdivision and development*
> *Provide for the efficient integration and layout of subdivision and associated development by:*

[80] Further submission FS72.60.

1. Encouraging joint applications for subdivision and land use;
2. Enabling subdivision around development that has already been lawfully established; and
3. Ensuring standalone subdivision proposals provide allotments that can be feasibly developed and are fit for the future intended purpose.
4. Manage adverse effects of activities through setbacks and design controls to achieve appropriate protection of infrastructure.

11.7 I support these changes for the same reasons I support changes to amend SUB-03 (i.e.. objective and policy support is needed in the chapter where rules are located to be most effective).

11.8 I have included changes to SUB-O3 and SUB-P4 within my Attachment A. These changes would also concurrently provide policy support for the Waka Kotahi proposed subdivision rule addressed in my Section 10.

12 CONCLUSION

12.0 In conclusion:

a. The RPS anticipates significant infrastructure will have effects (which may include noise) and that the infrastructure needs to be protected from incompatible activities (including by rules and policies within district plans). The RPS explanatory text also indicates a balance is necessary. The 'balance' is, in my opinion achieved by the cascade approach of applying controls only to sensitive development which does not meet acoustic standards.

b. Dr Chiles has provided evidence that noise and vibration have adverse health effects; the S42A Authors generally agree that both effects should be managed.

c. I have proposed a revised, simplified suite of provisions, including:

    a. permitted activities with specific transport network associated standards;

    b. appropriate assessment criteria tailored to effects from and on the transport networks, including consultation with the transport agencies;.

    c. vibration standards for the state highway and rail (including an alternative Rail Vibration Alert Overlay for the rail corridor);

d. consequential modifications to NOISE P4 and NOISE-P6;

e. a new subdivision rule relating to State Highways and rail; and

f. amendments to SUB-O3 and SUB-P4.

d. In my view these amendments are necessary to appropriately mitigate the effects identified by Dr Chiles and to implement the RPS and District Plan policy framework.

Cath Heppelthwaite
18 July 2023

Attachment A: Proposed Changes

Base text is taken from Appendix A – Planners recommendation with changes accepted.
All changes are in red text. New text is underlined and proposed deletions in ~~strike through~~.
Relief headings include whether the amendment sought is for KiwiRail, Waka Kotahi or both.
Blue text indicates chapter/plan section to which the amendments relate.

District Plan Maps (KiwiRail)

Insert mapping overlay which identifies a 100m buffer on each side of the railway designation boundary called "Rail Vibration Alert Overlay".

Noise Chapter

Introduction (KiwiRail)

Effective management of noise and vibration is a key aspect of achieving good environmental outcomes throughout the City.

Noise is well recognised […]

The provisions of this chapter […]

The objectives, policies, rules […]

A Rail Vibration Alert Overlay has been applied which identifies the vibration-sensitive area within 100 metres each side of the railway designation boundary as properties within this area may experience rail vibration effects. No specific district plan provisions apply in relation to vibration controls as a result of this Rail Vibration Alert Area. The Rail Vibration Alert Overlay is to advise property owners of the potential vibration effects but leaves with the site owner to determine an appropriate response.

Other than where expressly provided for […]

NOISE-P4 (KiwiRail and Waka Kotahi)
Protection of noise sensitive activities by acoustic and vibration treatment of buildings and provision of alternative ventilation

Require sound insulation and vibration isolation and / or mechanical ventilation for buildings housing new noise sensitive activities within:
[…]

NOISE-P6
Development restrictions on noise sensitive activities
~~Restrict the d~~Development of noise sensitive activities ~~within~~:
1. is provided for in High and Moderate Noise Areas where ventilation and acoustic insulation standards are met; and
2. ~~Buildings housing noise sensitive activities~~ is restricted in High and Moderate Noise Areas where ventilation and acoustic insulation standards are not met.

High and Moderate Noise Areas are listed in NOISE-R3.1 and NOISE-R3.2. The relevant acoustic insulation and ventilation standards are NOISE-S4, NOISE-S5 and NOISE-S6.

NOISE-R3	Noise sensitive activity in a new building, or in alterations / additions to an existing building

As specified in Rule	1. Activity status: Permitted Where: a. Compliance with NOISE-S4 (High Noise Areas) and NOISE-S6 (Ventilation) is achieved for one residential unit on a site within: ~~i. 40m of a State Highway;~~ ~~ii. 40m of a Railway corridor;~~ iii. Courtenay Place Noise Area; iv. General Industrial Zone; or v. Inner Air Noise Overlay. ~~Note: Distances from a state highway or railway corridor shall be measured from the closest habitable room to the closest point of a state highway or railway designation.~~
As specified in Rule	1A. Activity status: Permitted Where: a. Compliance with NOISE-S4A (Internal Noise Levels) and NOISE-S6 (Ventilation) are achieved for any noise sensitive activity on a site within: i. 40m of a State Highway; ii. The area between 40m and 100m of a State Highway with a posted speed limit or maximum variable speed limit greater than >70 km/hour; or iii. 100m of a Railway corridor; and b. Compliance with NOISE-S4B (Vibration) is achieved for any noise sensitive activity on a site within: i. 20m of a State Highway; ii. 60m of a Railway corridor Note: Distances from a State Highway or railway corridor shall be measured from the closest habitable room to the closest point of a State Highway or railway designation.
As specified in Rule	2. Activity status: Permitted Where: a. Compliance with NOISE-S5 (Moderate Noise Areas) and NOISE-S6 (Ventilation) is achieved for up to three residential units on a site within: ~~i. The area between 40m and 100m of a State Highway with a posted speed limit greater than >70 km/hour;~~ ~~ii. The area between 40m and 100m of a Railway corridor;~~ iii. City Centre Zone; iv. Mixed Use Zone; v. Commercial zone; vi. Neighbourhood Centre Zone; vii. Local Centre Zone; viii. Metropolitan Centre Zone; ix. Waterfront Zone; x. Outer Port Noise Overlay; and xi. Outer Air Noise Overlay. Note: Distances from a state highway or railway corridor shall be measured from the closest habitable room to the closest point of a state highway or railway designation. ~~Unless otherwise restricted by zone or overlay based rules, there is no limit on the number units per site on land further than 40m from a State Highway that has a posted speed limit equal to or less than 70 km/hour.~~
All Zones	3. Activity status: Restricted Discretionary Where: a. Compliance with the requirements of NOISE-S4 and NOISE-S6 is achieved for two residential units on a site listed by NOISER3.1; or

	d. Compliance with the requirements of NOISE-S5 and NOISE-S6 is achieved for four or more residential units on a site listed by NOISE-R3.2Four or more residential units are proposed on a site within the Outer Air Noise Overlay; or. e. Any other noise sensitive activity is proposed on a site within land subject to NOISE-R3.2 and the requirements of NOISE-S5 and NOISE-S6 are achieved. Matters of discretion are: 1. The matters of assessment in NOISE-S4, and NOISE-S5 and NOISE-S6; and 2. The extent and effect of non-compliance with any relevant standard as specified in the associated assessment criteria for the infringed standard. Wellington International Airport Limited will be considered an affected party for applications within the Inner Air Noise Overlay.
As specified in Rule	3A. Activity status: Restricted Discretionary Where: a. Compliance with the requirements of NOISE-S4A, NOISE-S4B, or NOISE-S6 are not achieved on within 100m of a State Highway or railway corridor. Matters of discretion are: 1. The matters of assessment in NOISE-S4A, NOISE-S4B, and NOISE-S6; and 2. The extent and effect of non-compliance with any relevant standard as specified in the associated assessment criteria for the infringed standard. Note: Distances from a State Highway or railway corridor shall be measured from the closest habitable room to the closest point of a State Highway or railway designation.

NOISE-S4	**Acoustic Insulation – high noise areas**	
~~Within 40m of a State Highway~~ ~~Within 40m of a Railway Corridor~~ General Industrial Zone Courtenay Place Noise Area Inner Air Noise Overlay	1. Any habitable room in a building used by a noise sensitive activity in a new building or alteration or addition to an existing building, must be designed, constructed, and maintained to achieve a minimum external to internal noise reduction for habitable rooms of not less than 35 dB Dtr,2m,nT,w + Ctr. […]	Assessment criteria where the standard is infringed: […]

NOISE-S4A	**Transport Network Noise**	
	Indoor road and railway noise *1.* Any new building, or alteration to an existing building, that contains an activity sensitive to noise where the building or alteration is: a. designed, constructed and maintained to achieve indoor design noise levels resulting from the road or railway not exceeding the maximum values in in Table-S7; or	Assessment criteria where the standard is infringed: 1. Whether the activity sensitive to noise could be located further from

b. at least 50 metres from the carriageway of any state highway r 50
metres from any railway corridor, and is designed so that a noise barrier entirely blocks line-of-sight from all parts of doors and windows, to the road surface and to all points 3.8 metres above railway tracks.

Table-S4A

Building type	**Occupancy / activity**	**Maximum road noise level LA_{eq}(24h)**	**Maximum railway noise level LAeq(1h)**
Residential	Sleeping spaces	40dB	35 dB
	All other habitable rooms	40dB	40 dB
Education	Lecture rooms / theatres, music studios, assembly halls	35 dB	35 dB
	Teaching areas, conference rooms, drama studios, sleeping areas	40 dB	40 dB
	Library	45 dB	45 dB
Health Clinics	Overnight medical care, wards	40 dB	40 dB
	Consulting rooms, theatres, nurses' stations	45 dB	45 dB
Cultural	Places of worship, marae	35 dB	35 dB

Design report

2. A report is submitted to the council demonstrating compliance wi th clause (1) above prior to the construction or alteration of any building containing an activity sensitive to noise. In the design report:

a. railway noise is assumed to be 70 LAeq(1h) at a distance of 12 metres from the track, and must be deemed to reduce at a r ate of 3dB per doubling of distance up to 40 metres and 6 dB pe r doubling of distance beyond 40 metres; and

b. road noise is based on measured or predicted noise levels pl us 3 dB.

the railway network or State Highway.

2. The extent to which the noise criteria are achieved and the effects of any noncompliance

3. The character of, and degree of, amenity provided by the existing environment and proposed activity.

4. The reverse sensitivity effects on the rail network or State Highway, and the extent to which mitigation measures can enable their ongoing operation, maintenance and upgrade.

5. Special topographical, building features which will mitigate impacts;

6. The outcome of any consultation with Waka Kotahi NZ Transport Agency (for proposals adjacent to the State Highway) or KiwiRail (for proposals adjacent to the rail designation).

NOISE-S4B	**Vibration**	
Within 20m of a State Highway Within 60m of a Railway Corridor	1. Any habitable room in a building used by a noise sensitive activity in a new building or alteration or addition to an existing building, must be designed, constructed, and maintained to achieve: (a) is designed, constructed and maintained to achieve rail or road vibration levels not exceeding 0.3 mm/s vw,95 or (b) is a single-storey framed residential building with: i. a constant level floor slab on a full-surface vibration isolation bearing with natural frequency not exceeding 10 Hz, installed in accordance with the supplier's instructions and recommendations; and ii. vibration isolation separating the sides of the floor slab from the ground; and iii. no rigid connections between the building and the ground. (c)The requirements of (a) or (b) above do not apply where a design certificate signed by a suitably qualified engineer confirming that vibration received at the site does not exceed 0.3 mm/s vw,95.	Assessment criteria where the standard is infringed: 1. Whether the activity sensitive to noise could be located further from the State Highway or railway network. 2. The extent to which the vibration criteria are achieved and the effects of any noncompliance. 3. The character of, and degree of, amenity provided by the existing environment and proposed activity. 4. The reverse sensitivity effects on the road or rail network, and the extent to which mitigation measures can enable their ongoing operation, maintenance and upgrade. 5. Special topographical, building features or ground conditions which will mitigate vibration impacts; 6. The outcome of any consultation with Waka Kotahi NZ Transport Agency (for proposals adjacent to the State Highway) and KiwiRail (for rail). 7. Human health effects on occupants and their ability to achieve an acceptable level of amenity as a result of the exceedance.

NOISE-S5	**Acoustic Insulation – moderate noise areas**	
City Centre Zone Mixed Use Zone Commercial Zone General Industrial Zone	1. Any habitable room in a building used by a noise sensitive activity in a new building or alteration or addition to an existing building, must be designed, constructed, and maintained to achieve a	Assessment criteria where the standard is infringed: 1. Background noise levels and any special character of noise from any existing activities, the nature and character of any

Neighbourhood Centre Zone Local Centre Zone Metropolitan Centre Zone Waterfront Zone ~~The area between 40m and 100m of a railway corridor~~ ~~The area between 40m and 100m of a State Highway with a posted speed limit >70 km/hour~~ Outer Port Noise Overlay	minimum external to internal noise reduction for habitable rooms of not less than 30 dB Dtr,2m,nT,w + Ctr. […]	changes to the sound received at any receiving site and the degree to which such sounds are compatible with the surrounding activities; […]

NOISE-S6	**Ventilation requirements**	
All zones	1. The minimum external to internal noise reduction levels in NOISE-S4 and NOISE-S5 must be achieved at the same time as the ventilation requirements. ~~of the New Zealand Building Code.~~ Minimum ventilation standards are set out below for habitable rooms classified into one of two possible categories as follows: a. Habitable rooms with openable windows sufficient in area to meet the ventilation requirements of the New Zealand Building Code; and b. All other habitable rooms requiring to be acoustically insulated under NOISE-S4 and NOISE-S5 2. 2. Where habitable rooms are provided with windows openable to the outside environment sufficient in area to meet the ventilation requirements of the New Zealand Building Code, and where these windows must remain closed to achieve compliance with NOISE-S4 and NOISE-S5 acoustic insulation standards, the room	Assessment criteria where the standard is infringed: 1. The ability to achieve acceptable indoor ventilation and acoustic amenity; 2. Any mitigation of the proposed ventilation noise, in accordance with a best practicable option approach; 3. The ability to mitigate adverse effects through the imposition of conditions; 4. In relation to a heritage building or a contributing building within a heritage area, the extent to which it is practicable to achieve ventilation to the required standard without detracting from identified heritage values 5. The outcome of any consultation with Waka Kotahi NZ Transport Agency (for proposals adjacent to the State Highway) or KiwiRail (for proposals adjacent to the rail designation). 7. Extent of the exceedance. 8. Human health effects on occupants and their ability to achieve an acceptable level of

	shall meet the following minimum requirements; a. The room is to be provided with a mechanical ventilation system with air flow rates adjustable by the occupant in increments up to a high air flow setting of at least six ~~three~~ air changes per hour; and b. […]	amenity as a result of the exceedance. 9. Reverse sensitivity effects to existing noise generating activities

Subdivision Chapter

SUB-O1 Efficient pattern of development
Subdivision achieves an efficient development pattern that:
1. Maintains or enhances Wellington's compact urban form;
2. Is compatible with the nature, scale and intensity anticipated for the underlying zone and local context;
3. Enables appropriate future development and use of resulting land or buildings; ~~and~~
4. Is supported by development infrastructure and additional infrastructure for existing and anticipated future activities.;and
5. Avoids development that is incompatible with regionally significant infrastructure.

SUB-P4 Integration and layout of subdivision and development
Provide for the efficient integration and layout of subdivision and associated development by:
1. Encouraging joint applications for subdivision and land use;
2. Enabling subdivision around development that has already been lawfully established; and
3. Ensuring standalone subdivision proposals provide allotments that can be feasibly developed and are fit for the future intended purpose.
4. Manage adverse effects of activities through setbacks and design controls to achieve appropriate protection of infrastructure.

SUB-R29A	**Subdivision within 100m of a State Highway or rail designation boundary**
All zones	1. Activity status: Restricted discretionary Where the subdivision is within: i. 40m of a State Highway; ii. The area between 40m and 100m of a State Highway with a posted speed limit or maximum variable speed limit greater than >70 km/hour; or iii. 100m of a Railway corridor. Matters of discretion are: 1. the extent that subdivision design removes or reduces the need for mitigation on a site-by-site basis for noise sensitive activities; examples include provision of mitigation on a subdivision wide basis (e.g. noise bund or wall) and placement of less noise sensitive activities adjacent to the transport corridor. 2. Whether building platform or development should be restricted on parts of the site. 3. Any special topographical features or ground conditions which may mitigate effects of the operation of the State Highway or rail on the proposed land uses.

	4. The outcome of consultation with Waka Kotahi (for State Highways) or KiwiRail (for rail).

Attachment B: KiwiRail S32AA Assessment of Noise and Vibration Controls

Having regard to section 32AA, the following is noted:

Effectiveness and efficiency

• The proposed changes will be more efficient and effective at balancing infrastructure and health and amenity resulting from intensification than other methods (such as existing 40m controls (noise) or no controls (vibration)). This fits RPS Objective 10 and Policy 8 as it provides development which can be, with mitigation, compatible where close to infrastructure.

• Retaining the current noise setback and providing no vibration control will not support an efficient outcome as effects on health and amenity will not be sufficiently addressed and new reverse sensitivity could arise (which could lead to inefficient operation of nationally significant infrastructure).

• The provisions apply to new and altered structures (not retrospectively).

• The provisions provide clear and specific matters of discretion which gives greater certainty to developers (and the Council) over the matters that will be assessed where resource consent is required.

Costs/Benefits

• The recommended amendments require additional assessments for some buildings and activities in some locations; the benefits are however improved health and amenity and reduced risk of reverse sensitivity effects. The rail network provides passenger transport which is a significant supporting factor for residential intensification proposed.

• There will be some compliance costs for the Council for monitoring and assessing applications for consent (if sought).

• The changes will enable greater certainty for homeowners as to their ability to live comfortably and free from the most significant health and amenity impacts when in close proximity to infrastructure.

• The regulatory burden is less than that recommended by Council provisions as consent will be required in fewer circumstances.

Risk of acting or not acting

• Heath and amenity effects will occur if no action is taken.

Decision about most appropriate option

• Based on the evidence of Dr Chiles, the recommended amendments as set out in my evidence are therefore considered to be more appropriate in achieving the purpose of the RMA (specifically health) rather than the notified provisions.

Attachment C: Waka Kotahi S32AA Assessment of Noise

Assessment of Plan Provisions to Provide for Human Health and Amenity in accordance with section 32 of the Resource Management Act

October 2021

VERSION 8

Table of Contents

Executive Summary

Waka Kotahi seeks a gradual reduction in health and amenity effects implemented as new activities are established or existing activities are altered in close proximity to the operational state highway network. This outcome aligns with *Toitū Te Taiao – Our Sustainability Action Plan*[1] which in turn implements the Government Policy Statement on Land Transport 2018/2019-2027/2028[2] and the enduring Transport Outcomes: *A framework for shaping our transport system: Enabling New Zealanders to flourish Transport outcomes and mode neutrality, Ministry of Transport*, June 2018.

Achieving these outcomes this will assist regulatory authorities achieving Part 2 of the RMA by providing for the use of natural and physical resources in a way which enables people and communities to provide for their health and safety[3] and the maintenance and enhancement of amenity[4].

There are various regulatory methods (within and outside of the RMA) to achieve this outcome. A district plan based method has been assessed as the most implementable method in the current environment. This assessment considers a range of district plan methods as required under section 32 of the RMA.

The assessment concludes that an integrated suite of district plan provisions is the most effective and efficient method to provide reasonable levels of amenity and health protection for sensitive activities. The recommended provisions are based on a (modelled) noise contour line being established with activities 'inside' the contour being subject to specific requirements to provide improved health and amenity outcomes.

The recommended provisions relate to new or altered (increased) sensitive activities located within the modelled noise contour and the usual operation of the transport network, they do not:

a. apply retrospectively to existing buildings or sensitive activities;
b. require land owner to address effects resulting from transport network defects (eg potholes), which are the responsibility of the road controlling authority; or
c. manage amenity effects from transport noise from new or altered roads where these fall within the ambit of NZS 6806:2010 (Acoustics – Road traffic noise – New and altered roads).

[1] https://www.nzta.govt.nz/assets/About-us/docs/sustainability-action-plan-april-2020.pdf
[2] See paragraphs 123-124 and Table 1 Action 25 – Environment.
[3] Section 5(2), RMA.
[4] Section 7(c), RMA.

1. Introduction

The report has been prepared by Waka Kotahi NZ Transport Agency in accordance with Section 32 of the Resource Management Act 1991 (RMA) to assess the inclusion of human health and amenity provisions within District Plans.

Managing health effects from road noise is a shared responsibility between the road controlling authority and adjacent land users. Territorial authorities also have an important role to play in ensuring that planning instruments appropriately acknowledge and address the issue. Waka Kotahi invests significantly in design, construction and ongoing maintenance to minimise the effects of road noise. It is appropriate that those establishing or modifying land uses adjacent to existing State highways also share responsibility for protecting the health of occupants.

Retrospective management of transport noise effects is generally more difficult and expensive to achieve once activities have established adjacent to transport corridors. Management options are also more limited once activities are in place. For example, some design responses (eg. locating outdoor living areas away from noise sources) are not easily implemented or are precluded, retrospective building improvements can be challenging to implement, costly and disruptive, and property constraints may also limit response options (eg. no land available for acoustic barriers or bunding).

This report evaluates opportunities to provide plan provisions in accordance with section 32 of the RMA (s32). Under the RMA, a section 32 evaluation must:

a. Examine whether the proposed objectives are the most appropriate way to achieve the purpose of the RMA (s32(1)(a));

b. Examine whether the proposed provisions are the most appropriate way to achieve the objectives by identifying other reasonably practicable options, assessing their efficiency and effectiveness and summarising the reasons for deciding on provisions (s32(1)(b));

c. Relative to considering the efficiency and effectiveness of the provisions in achieving the objective, include an assessment of the benefits and costs of the effects anticipated from implementing the provisions (s32(2)); and

d. Contain a level of detail that corresponds to the scale and significance of the environmental, economic, social, and cultural effects that are anticipated from implementing the proposal (s32(1)(c)).

e. For plan changes, evaluate the proposal against both the objectives of the proposed plan change and the objectives of the existing plan (s32(3)).

Each of these matters is addressed by examining the key issues pertaining to the human health and amenity, and how a range of responses could operate in order to achieve the desired outcomes. This report is supplemented by an 'issue identification' statement (Section 2) which describes the human health effects at issue and assesses the cost of implementing mitigation.

In addition to RMA Part 2 outcomes (including of providing for communities health[5]), Waka Kotahi seeks a gradual reduction in exposure as existing activities are altered or relocated. This outcome aligns with *Toitū Te Taiao – Our Sustainability Action Plan*[6] which in turn implements the Government Policy Statement on Land Transport 2018/2019-2027/2028[7] and the enduring Transport Outcomes: *A framework for shaping our transport system: Enabling New Zealanders to flourish Transport outcomes and mode neutrality, Ministry of Transport*, June 2018.

[5] Resource Management Act, Part 2, Section 5(1).
[6] https://www.nzta.govt.nz/assets/About-us/docs/sustainability-action-plan-april-2020.pdf
[7] See paragraphs 123-124 and Table 1 Action 25 – Environment.

2. Issue identification

It is widely accepted nationally and internationally that noise from transport networks have the potential to cause adverse health and amenity effects on people living nearby. That potential has been documented by authoritative bodies such as the World Health Organisation (WHO)[8] including the publication *Environmental noise guidelines for the European region* in October 2018 (WHO Europe Guidelines).[9] The WHO Europe Guidelines are based on a critical review of academic literature and followed a rigorous protocol to assess the evidence of adverse effects.

With respect to sound from transport networks, the WHO Europe Guidelines note the potential for the following adverse effects:

i. sleep disturbance;
ii. high annoyance;
iii. hypertension; and
iv. ischaemic heart disease.

Based on the strength of the evidence of adverse effects, WHO recommends that policymakers reduce sound exposure from transport networks to below a range of guideline values.

State highways[10] pass through both urban and rural areas and most have sufficient traffic volumes to generate sound above WHO Europe Guideline levels, indicating there will be impacts on human health and amenity where noise-sensitive activities locate nearby.

In New Zealand, Quality Planning's *Managing Land Transport Noise Under the RMA* 2013 Guidance Note[11] recognises that transport noise has potential health effects and identifies district plan responses (eg. managing sensitive activity location, setbacks, zoning (and re-zoning), and structural restrictions). The Guidance Note provides:

> *One of the environmental results expected with the management of noise in plans should be the protection of people and communities from the impacts of land transport noise exposure*[12].

Within the Guidance Note, five alternative (non-RMA) responses[13] are identified (urban design strategy, bylaws, NZ Standards, Building Code and Waka Kotahi guidance). Two of these (the Building Code and Waka Kotahi guidance) are addressed in this assessment.

It is acknowledged that the notified [plan review/plan change] includes provisions which address amenity; however, for the reasons set out below, these are not considered to fully address [the issue].

[8] World Health Organisation, Guidelines for community noise, 1999; World Health Organisation, Night noise guidelines for Europe, 2009; World Health Organisation, Burden of disease from environmental noise, 2011
[9] World Health Organisation, Environmental noise guidelines for the European region, 2018.
[10] May also apply to high traffic volume roads managed by other Road Controlling Authorities.
[11] https://www.qualityplanning.org.nz/node/825
[12] https://www.qualityplanning.org.nz/node/825 *4. Environmental Effects Expected – Optional*, page 12.
[13] https://www.qualityplanning.org.nz/node/825 *Local Approaches – other mechanisms,* page 14.

3. Objectives Assessment

Section 32(1)(a) of the RMA requires an examination of whether a proposed objective is the most appropriate way to achieve the purpose of the RMA. The purpose of the RMA is set out in Part 2, Section 5 of the Act.

5 Purpose

(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

(2) In this Act, sustainable management means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

Waka Kotahi has formulated proposed objectives and policies for inclusion in district plans. An assessment of the proposed objective against RMA section 5 is set out in Table 1, below.

Table 1: Assessment of Objective under Section 5

Proposed Provision	**Reason**
Objective 1 Protect sensitive activities from potential health and amenity effects that may arise from operational state highway noise. Policy 1 Locate and design new and altered buildings containing noise sensitive activities to minimise the potential for adverse effects from the designated state highway network. Policy 2 Manage subdivision which could contain noise sensitive activities through setbacks, physical barriers and design controls to ensure subsequent development can be located, designed and constructed to minimise exposure to noise.	Section 2 of this report describes likely adverse effects on sensitive activities where they are located in close proximity to the transport network. The objective (and supporting policies) will enable communities to provide for their social well-being and health by ensuring that noise sensitive activities located in close proximity to a state highway incorporate appropriate protection so as to ensure improved health outcomes and amenity levels.

The balance of Part 2 of the RMA provides the framework for the sustainable management of natural and physical resources. Section 6 lists matters of national importance that shall be recognised and provided for, section 7 lists other matters that all persons exercising functions and powers under the RMA shall have particular regard to and section 8 addresses matters relating to the principles of the Treaty of Waitangi. No relevant matters in sections 6 or 8 have been identified. The proposed objective has been assessed against the following provisions of section 7 in Table 2.

Table 2: Assessment of Objective under Part 2 Section 7	
RMA Provision	**Objective 1**
s7(b) (the efficient use and development of natural and physical resources)	Objective 1 will provide for the efficient use and development of physical resources (land and the State highway network) by enabling the proximity effects of land use and infrastructure to be managed appropriately.
s7(c) (maintain and enhance amenity values)	Objective 1 will give effect to s7(c) by enhancing amenity by reducing effects of noise on noise-sensitive activities.

It is considered that the proposed objective is consistent with Part 2, section 5 of the Act and will result in the sustainable management of natural and physical resources.

The notified [plan review/plan change] is considered to be a less appropriate or effective way to achieve the purpose of the RMA because …

4. Provisions Assessment

Sections 32(1)(b) and 32(2) require assessment of the proposed plan provisions to be undertaken. These are summarised as:

a. whether the proposed provisions are the most appropriate way to achieve the objectives by identifying other reasonably practicable options, assessing their *efficiency and effectiveness* and summarising the reasons for deciding on provisions; and
b. relative to considering the **efficiency and effectiveness** of the provisions in achieving the objective, include an assessment of the benefits and costs of the effects anticipated from implementing the provisions.

The cost and benefit assessment must identify and assess the costs and benefits associated with environmental, economic, social, and cultural effects including economic growth and employment that are anticipated to be provided or reduced. If practicable, these are to be quantified.

The notified [plan review/plan change] have been included in this assessment.

Section 32(2)(b) also requires an assessment of the risk of acting or not acting if there is uncertain or insufficient information. In this case, there is considered to be sufficient information about the subject to determine the range and nature of effects of the options set out, and so that assessment has not been undertaken.

4.1 Noise

4.1.1 Identifying options

Where the reasonably practical alternative options (assessed in Table 3) include plan provisions, they are framed in the following context:

a. The provisions apply to all new and altered (by increase in floor area) *Noise Sensitive Activities* (defined in **Attachment 1**) which, in addition to residential activities, includes activities such as student or retirement accommodation, educational activity (including in any child care facility), healthcare activity and any congregations within places of worship/marae.

b. Internal noise criteria of between 35 dB $L_{Aeq(24h/1h)}$ and 45 dB $L_{Aeq(24h/1h)}$ have been allocated to the *Noise Sensitive Activities* for the reasons described in **Attachment 2**. Specifications detailing how to achieve internal noise space can be either specified as a *Construction Schedule* included as part of **Attachment 1** or by a design certified by an acoustic consultant.

c. Provisions include ventilation requirements where internal noise criteria are to be met; without ventilation the effectiveness of built acoustic treatment is compromised (ie. windows open for ventilation compromise the performance of building envelope noise mitigation measures). Ventilation requirements are specified in **Attachment 1**.

d. Outdoor living space provisions apply only to areas specifically identified by the district plan as required outdoor living areas.

e. Provisions include a mapped extent to which the provision would apply. This is described as Noise Control Boundary Overlay (NCBO) in accordance with the National Planning Standards Mapping Standard or identified as a 'yard'.

f. The provisions:
   (i) do not apply retrospectively to existing sensitive activities;
   (ii) are not proposed to require a land owner to address effects resulting from transport network defects (eg potholes), which are the responsibility of the road controlling authority; and
   (iii) do not manage amenity effects from transport noise from a new or altered road; these generally fall within the ambit of NZS 6806:2010 (Acoustics – Road traffic noise – New and altered roads).

The reasonably practical alternative options identified include (a) to (d) above and are identified as:

a. **Do nothing:** No plan provisions to protect sensitive activities from potential health and amenity effects.

b. **Modelled setback:** Require specific response to manage noise based on a (modelled) noise contour line (NCBO) being established. Activities 'inside' the NCBO are a permitted activity (for the purposes of noise) if specific requirements are met. For the reasons set out in **Attachment 2**, the recommended extent of the NCBO is set at 57 dB $L_{Aeq(24h)}$. **Attachment 4** explains the basis of the acoustic model which takes into account environmental factors such as traffic volume, road surface, topography and buildings.

c. **Metric setback:** Require specific response to manage noise where a sensitive activity is located within a specific NCBO based on distance (eg 40m, 80m or 100m) from a state highway. The specific setback distance may be based on speed limit (eg 40m for <70k/hr or 80m or 100m >70k/hr). Activities 'inside' the NCBO are a permitted activity if specific requirements are met.

d. **Yard:** A 'no build' setback from state highways. All noise sensitive activities in the yard area are listed non-complying activities. Yard setback could be set based on road speed limit (eg 40m for <70k/hr or 80m or 100m >70k/hr).

e. **Notified Plan Provisions:** summarise these.

An assessment of the *efficiency and effectiveness* of the options assessed in terms of Sections 32(1)(b) and 32(2) is included in Table 3.

Table 3: Alternative Option Assessment

Option	Effectiveness and Efficiency	Costs	Benefits
Option A: Do Nothing	Highly efficient but not effective. This option requires no action from the regulatory authority or applicants so is efficient.	An increase in adverse health and amenity impacts (including costs). Poorer health and amenity outcomes fall on wider community and can be difficult to identify or	No additional regulatory cost or costs to land owners in terms of compliance or building cost increases.

Table 3: Alternative Option Assessment			
Option	Effectiveness and Efficiency	Costs	Benefits
	It is considered to be the least effective as it will allow an increase in adverse human health and amenity effects over time.	resolve at an individual level.	
Option B: Modelled Setback	Highly efficient and effective. Utilising a model based on existing environmental conditions to calculate expected noise levels provides a more effective and efficient approach to setting the extent that a noise control should apply compared with Options C and D (both of which are 'standard width' controls regardless of local conditions).	A range of compliance and construction costs will apply when compared with Option A. These range from building and compliance design costs to meet permitted activity standards through to resource consent costs should standards not be complied with. The costs will fall on applicants and compliance confirmation costs will be borne by the regulatory authority and/or the applicant. Costs of mitigation have been independently assessed by Acoustic Engineering Services Limited[14] and indicate typically a 0% to 2% increase in construction cost for new dwellings and additions[15] in new materials. Waka Kotahi will also bear the cost of maintaining up to date modelling data to	Better human health outcomes as there will be less exposure to the causes of negative health and amenity outcomes when compared with Option A. Option B provides a comprehensive regulatory approach which recognises the spatial extent of road traffic noise based on environmental factors (eg traffic volume, topography, road surface, existing building locations). This will result in a more accurate reflection of the extent of likely effects than Options C or D. The provisions do not aim to achieve 'zero' health effects (which is the outcome sought by the WHO Guidelines). Rather, the Modelled Setback/Option B provisions provide for a balance between health and amenity protection, cost and regulatory administration.

[14] **Attachment 3**: Acoustic Engineering Services Limited, Report Reference AC20063 – 01 – R2: Cost of traffic noise mitigation measures, 12 June 2020.

[15] **Attachment 3:** Acoustic Engineering Services Limited, Report Reference AC20063 – 01 – R2: Cost of traffic noise mitigation measures, 12 June 2020.

Table 3: Alternative Option Assessment			
Option	Effectiveness and Efficiency	Costs	Benefits
		support noise contour line establishment.	
Option C: Metric Setback	Moderately efficient and effective. Option provides a reasonable outcome but will 'capture' more sites than is necessary to be highly efficient.	Option C (especially where applied at 80m to 100m) is likely to affect a greater number of sites than Option B. It is a 'blanket' approach which does not reflect individual area conditions. Other costs are the same as for Option B.	Better human health outcomes as there will be reduced exposure to the causes of negative health and amenity outcomes when compared with Option A. Less costly to prepare (set distance rather than modelled) when compared with Option B.
Option D: Yard provision	Highly effective but not efficient. The 'no build' yard will provide a high level of health and amenity protection but does not result in an efficient use of land.	Limits construction on particular areas of a site; high cost borne by land owners as sensitive activity development is limited in these areas.	Good human health outcomes as there will be a reduced number of sensitive activities exposed to the causes of negative health and amenity outcomes.
Option E: Notified Plan Provisions	**This option [is / is not] effective and efficient, because […]**	**[complete assessment if plan includes amenity provisions]**	**[complete assessment if plan includes amenity provisions]**

4.1.2 Assessing reasonably practicable options

Based on the cost benefit analysis presented in Table 3, Table 4 summarises reasonably practicable options.

Table 4: Identifying Reasonably Practicable Options	
Option	Is it reasonably practicable?
Option A: Do nothing This option is currently applied in some District Plans.	✓
Option B: Modelled Setback Options similar to this are currently applied in some District Plans.	✓
Option C: Metric Setback Options similar to this are currently applied in some District Plans.	✓
Option D: Yard requirement Options similar to this are currently applied in some District Plans.	✓

Option E: Notified Plan Provisions Describe if provisions are considered to be a reasonably practicable alternative. Check the Council's s32 report for reasons and address whether you agree or not	**[✖ or ✓]**

4.1.3 Preferred option

Based on the analysis in Table 3 and the reasonably practicable options identified in Table 4, Table 5 rates each of the reasonably practicable options.

Table 5: Preferred Option				
Least Preferred				Most Preferred
Option A: Do Nothing.	Option E: Include notified provisions if applicable.	**Option D:** Yard setback	**Option C:**. Metric Setback	**Option B:** Modelled Setback

For the reasons set out in Tables 3 and 4, the Modelled Setback/Option B is considered to be the most efficient and effective method for addressing the health and amenity effects of transport noise. In accordance with National Planning Standards[16], should they be adopted, the provisions must be located in the district or city wide Noise chapter of the district / unitary plan.

Where there are Council proposed provisions and this is not the conclusion resulting from analysis, consider not utilising the s32 but instead making a submission to change Councils provisions.

5. Conclusion

The Modelled Setback/Option B is identified as the preferred approach to manage the potential health and amenity effects of transport network operations, and to and provide a reasonable and appropriate balance between cost and benefit. The provisions apply only where an existing noise-sensitive activity is extended or a new noise-sensitive activity is proposed adjacent to a designated transport corridor.

The Modelled Setback/Option B have been detailed and compared against a number of alternatives in terms of their costs, benefits, and efficiency and effectiveness in accordance with the relevant clauses of section 32 of the RMA.

The Modelled Setback/Option B are considered to represent the most appropriate means of achieving the proposed objective and of addressing the underlying resource management issues relating to the transport environment, human health and amenity.

[16] The District-wide Matters National Planning Standard requires at 33 that: *If provisions for managing noise are addressed, they must be located in the Noise chapter. These provisions may include: … c.sound insulation requirements for sensitive activities and limits to the location of those activities relative to noise generating activities.*

New or altered State highway transport projects will continue to be assessed under NZS 6806:2010 (Acoustics – Road traffic noise – New and altered roads).

Attachment 1: Provisions (Option B)

Objective 1

Protect sensitive activities from potential adverse health and amenity effects that may arise from designated state highway noise.

Policy 1

Locate and design new and altered buildings containing noise sensitive activities to minimise the potential for adverse effects from the designated state highway network.

Policy 2

Manage subdivision which could contain noise sensitive activities through setbacks, physical barriers and design controls to ensure subsequent development can be located, designed and constructed to minimise exposure to noise.

New Definition

Noise Sensitive Activity(s): Means any residential activity including visitor, student or retirement accommodation, educational activity including in any child care facility, healthcare activity and any congregations within places of worship/marae. Excludes those rooms used solely for the purposes of an entrance, passageway, toilet, bathroom, laundry, garage or storeroom.

1. Permitted Activity Rule Indoor Noise

a. Within the Noise Corridor Boundary Overlay, where:
   (i) a new building that contains a noise sensitive activity; or
   (ii) an alteration to an existing building resulting in an increase in floor area of a noise sensitive activity; or
   (iii) a new noise sensitive activity is located in an existing building;

   is proposed, it is to be:

   (iv) Designed, constructed and maintained to achieve indoor design noise levels not exceeding the maximum values in Table 1; and
   (v) If windows must be closed to achieve the design noise levels in (1)(a)(i), the building is designed, constructed and maintained with a mechanical ventilation system that:
      a. For habitable rooms for a residential activity, achieves the following requirements:
         i. Provides mechanical ventilation to satisfy clause G4 of the New Zealand Building Code; and
         ii. is adjustable by the occupant to control the ventilation rate in increments up to a high air flow setting that provides at least 6 air changes per hour; and
         iii. provides relief for equivalent volumes of spill air; and
         iv. provides cooling and heating that is controllable by the occupant and can maintain the inside temperature between 18^0C and 25^0C; and
         v. does not generate more than 35 dB $L_{Aeq(30s)}$ when measured 1 metre away from any grille or diffuser.
b. For other spaces, is as determined by a suitably qualified and experienced person.

c. A report is submitted by a suitably qualified and experienced person to the council demonstrating compliance with clauses (1)(a)(i) and (ii) above (as relevant) prior to the construction or alteration of any building containing an activity sensitive to noise.

Table 1

Occupancy/activity	**Maximum road noise level** [Note 1] $L_{Aeq(24h)}$
Building type: Residential	
Sleeping spaces	40 dB
All other habitable rooms	40 dB
Building type: Education	
Lecture rooms/theatres, music studios, assembly halls	35 dB
Teaching areas, conference rooms, drama studios, sleeping areas	40 dB
Libraries	45 dB
Building type: Health	
Overnight medical care, wards	40 dB
Clinics, consulting rooms, theatres, nurses' stations	45 dB
Building type: Cultural	
Places of worship, marae	35 B

Note 1: The design road noise is to be based on measured or predicted external noise levels plus 3 dB.

2. Permitted Activity Rule Outdoor Living Area

a. Where an outdoor living or outdoor activity space required by another rule in the Plan is within the Noise Corridor Boundary Overlay and the outdoor space is required for a noise sensitive activity, the required outdoor living space is to be designed and maintained to achieve noise levels not exceeding the maximum values in Table 2; and

b. A report is submitted by a suitably qualified and experienced person to the council demonstrating compliance with clauses (2)(a) above prior to the construction or alteration of the any building to which the outdoor living space relates.

Table 2

Activity	Maximum road noise level [Note 1] $L_{Aeq(24h)}$
Required Outdoor Living Space	57 dB

Note 1: The design road noise is to be based on measured or predicted external noise levels plus 3 dB.

3. Restricted Discretionary Activity Rule

Any new or altered noise sensitive activity which does not comply with Permitted Activity (1) or (2).

Restricted Discretionary Activity – Matters of Discretion

Discretion is restricted to:
(a) Location of the building and outdoor living space;
(b) The effects of the non-compliance on the health and amenity of occupants; and
(c) The outcome of any consultation with Waka Kotahi NZ Transport Agency.

Restricted Discretionary Activity – Assessment Criteria

Discretion is restricted to:
(a) Whether the location of the building minimises effects;
(b) Alternative mitigation which manages the effects of the non-compliance on the health and amenity of occupants; and
(c) The outcome of any consultation with Waka Kotahi NZ Transport Agency.

Attachment 2: Technical Basis of Noise Criterion

In preparing the Modelled Setback/Option B, Waka Kotahi has assessed existing research, standards and guidelines to guide selection of appropriate noise criteria.

Two documents are identified as providing national and international guidance and directives for transport noise: the WHO Europe Guidelines and NZS 6806:2010 *Acoustics – Road-traffic noise – New and altered roads* (NZS 6806).

In addition, AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS/NZS 2107) is a joint Australia and New Zealand standard which provides compliance measurement methods for background noise and recommends design criteria for occupied spaces.

WHO Europe Guideline

The WHO Europe Guidelines (the Guideline) contains key recommendations in regards to transport noise including:

Road[17]:

- For average noise exposure: recommends reducing noise levels produced by road traffic below 53 dB L_{den}; and
- For night time exposure: recommends reducing noise levels produced by road traffic during night time below 45 dB L_{night}.

The WHO Europe document contains guidelines; it does not set a fixed standard. The Guideline has been prepared as an international research document and its outcomes need to be considered within the New Zealand statutory context before reference or inclusion in planning or policy documents. WHO guidance regarding effects of noise on health (more generally) are reflected in NZS 6806[18].

NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads

NZS 6806 is the principal national document for management of noise in relation to new and altered roads. The purpose of NZS 6806 is to ensure noise effects on existing sensitive activities (described as Protected Premises and Facilities / PPFs) from new or altered roads are managed. It has been developed with the intention of being suitable to support RMA processes and to set *reasonable noise criteria* for road traffic noise (from new or altered roads) taking into account, among other things, health effects[19].

NZS 6806 is a national standard, has been specifically developed for inclusion within an RMA framework, has been adopted into district plans and utilised in designations for the specific purpose of transport noise management. It is accepted as current good practice in regards to setting requirements which result in *reasonable* noise outcomes.

[17] World Health Organisation, Environmental noise guidelines for the European region, 2018. Section 3.1.
[18] NZS 6806 :2010 Section 4.7.1.
[19] NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads, section 1.1.4.

NZS 6806 includes an external ("Category A") noise criterion[20] for altered roads (64 dB $L_{Aeq\ (24h)}$), and two criteria for new roads depending on design year traffic volumes (64 dB $L_{Aeq\ (24h)}$ for higher volume roads and 57 dB $L_{Aeq\ (24h)}$ for lower volume roads).

Higher volume roads are those which, at design year, are predicted to carry greater than 75,000 AADT (Average Annual Daily Traffic). Lower volume roads are those which, at design year, are predicted to carry between 2,000 and 75,000 AADT.

Internal noise criterion[21] for habitable spaces are set at 40 dB $L_{Aeq\ (24h)}$ for altered and new roads (regardless of AADT).

Analysis of 2018 AADT data[22] shows the majority of existing state highways carry less than 75,000 AADT. It also indicates that only central parts of the Auckland motorway network currently have an AADT greater than 75,000.

While NZS 6806 applies to new and altered roads (ie. the onus is on the road controlling authority to manage effects), it provides strong guidance as to *reasonable* levels and expectations of noise levels in these environs. If these (<75,000 AADT) state highways were constructed (new) or altered in the current statutory environment, the lower level (57 dB $L_{Aeq(24h)}$) of the NZS 6806 external noise limits would be applied.

For road-traffic noise averaged over 24 hours, the internal 40 dB $L_{Aeq(24h)}$ criterion in residential habitable spaces from NZS 6806 represents a reasonable level as at night the level should reduce (as traffic volumes reduce) so as to avoid undue sleep disturbance.

AS/NZS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors

The scope of AS/NZS 2107 is to recommend criteria for healthy, comfortable and productive environments and it applies to steady-state or quasi-steady-state sounds. The Standard is ambiguous whether it should apply to transportation noise; regardless it provides an indication of reasonable internal levels for different types of sensitive activities. The criteria adopted in the Modelled Setback/Option B are generally consistent with AS/NZS 2107.

Conclusion

For the Modelled Setback/Option B, Waka Kotahi selected the NZS 6806 external level of 57 dB $L_{Aeq(24h)}$ and internal levels of between 35 dB $L_{Aeq(24h/1h)}$ and 45 dB $L_{Aeq(24h/1h)}$. This is because:

a. the majority of state highway AADT fall within the lower AADT band for external noise within NZS 6806 (which requires external noise levels of 57 dB $L_{Aeq(24h)}$ for a new or altered road); and

[20] NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads, Table 2 – Noise Criteria, A (primary free-field external noise criterion).
[21] NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads, Table 2 – Noise Criteria, C (internal noise criterion).
[22] https://www.nzta.govt.nz/resources/state-highway-traffic-volumes/ 2018 data - *State highway volumes by region (in Excel format)*

b. the outdoor noise exposure level of 57 dB and an indoor noise threshold near the top of the design range[23] in AS/NZS 2107:2016 (40 dB) have been selected as these levels are considered to provide a reasonable level of health and amenity protection but are not the most stringent.

[23] *top of the design range* means that the noise limit is at the upper level of range - ie. allows more noise rather than less.

Attachment 3: Building Cost Assessment

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Memorandum

To:	Greg Haldane, Waka Kotahi
From:	Clare Dykes, Acoustic Engineering Services
File Reference:	AC20063 – 01 – R2
Date:	Friday, 12 June 2020
Project:	Cost of traffic noise mitigation measures
Pages:	6

Meeting ☐ Telephone ☐ Memorandum ☑ File Note ☐

Dear Greg,

In March 2020, Waka Kotahi NZ Transport Agency engaged Acoustic Engineering Services (AES) and O'Brien Quantity Surveying to undertake a study relating to the cost of traffic noise insulation measures. The project involved a review of a number of situations where traffic noise mitigation had been installed, including:

- Buildings which required upgrades to reduce traffic noise break-in as a result of their location in proximity to major roads, and;
- New residential neighbourhoods which were constructed near to major roads, where traffic noise barriers were integrated into the overall scheme design so that the upgrading of dwellings was no longer required (or was reduced) and noise in outdoor living areas was reduced.

This memorandum summarises the study, and the general trends visible in the results.

1.0 BUILDING UPGRADES

A common method of ensuring that noise from roads is not intrusive within buildings is to design the building envelope to provide a high level of sound insulation, and to provide a mechanical ventilation system so occupants do not need to open windows for cooling and fresh air.

The Christchurch District Plan contains a rule requiring the design of new noise sensitive buildings to be constructed in higher noise locations to include these sound insulation features. AES have previously completed a study related to the Christchurch District Plan sound insulation rule, which involved a review of the specific circumstances relating to a sample of building projects. The work described in this memo built on aspects of that previous study, and looked to quantify the cost of those building upgrades, to assist Waka Kotahi in understanding the potential financial implications of mandatory traffic noise insulation rules. A number of additional examples from various sources were added to the original sample, to increase the sample size and diversity.

We have also completed a review of the Proposed and Operative District Plans for the 67 New Zealand Districts. Two thirds of the District Plans throughout the country include requirements for sound insulation when dwellings are located in proximity to major roads. Of these, 10 % include a requirement which is very

similar to the Waka Kotahi Guidelines[1] centred around an internal noise level requirement of 40 dB $L_{Aeq\ (24\ hour)}$ in bedrooms and other habitable spaces, and the provision of mechanical ventilation. The remaining rules vary, with common variations including requiring different internal noise levels to be met, omitting any mechanical ventilation requirement (or a reduced mechanical ventilation requirement), and specifying a fixed level of sound insulation performance to be achieved by the building façade. As discussed below, all of these rule variations have a different cost impact.

1.1 The sample

A total of 58 buildings were considered for inclusion in the analysis. However, detailed costings were only completed on 23 of these, primarily because:

- A number of the building projects successfully obtained a Resource Consent to legitimise a partial or complete non-compliance with the relevant sound insulation rule, and so these results would not have assisted with understanding the cost of compliance.
- For a number of the building projects there was not sufficient publicly available information to complete an accurate costing.

The final 23 building projects included 11 detached residential dwellings, seven multi-residential units (such as terraced houses and duplexes), and five apartment buildings. These buildings were expected to experience worst-case traffic noise levels ranging from 55 dB $L_{Aeq\ (24\ hours)}$ to 71 dB $L_{Aeq\ (24\ hours)}$.

As discussed above, a variety of sound insulation rules are encountered throughout the country. The building projects in the sample had been assessed against the following rules:

- 12 of the sample has been assessed against a requirement which is similar to that described in the Waka Kotahi Guidelines, including an internal noise level requirement of 40 dB $L_{Aeq\ (24\ hour)}$ in bedrooms and other habitable spaces, and the provision of mechanical ventilation.
- Two of the sample were assessed using a rule which has a different internal noise level requirement with no mechanical ventilation required.
- Eight of the sample were assessed against rule with a façade reduction requirement or a provided set of constructions intended to provide a fixed façade reduction, and no mechanical ventilation required.
- One involved review against an internal noise level requirement of 40 dB $L_{Aeq\ (24\ hours)}$ for some spaces, and a façade reduction requirement for others.

Overall, the sample was relatively small – however a moderate number of examples could be assessed against a rule similar to that preferred by Waka Kotahi. Otherwise the variety within the sample is typical of the variety in sound insulation rules encountered in New Zealand.

Challenges of extending the sample included the lack of a centralised database to use for establishing a list of building projects of potential interest, and then the lack of availability of publicly available information for projects which provides sufficient detail for accurate costings.

1.2 Assumptions

Key assumptions embodied in this part of the study are as follows:

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[1] Waka Kotahi NZ Transport Agency, *Guide to the management of effects on noise sensitive land use near to the state highway network*, Version 1.0, September 2015

- The reported external noise levels are based on the available traffic numbers, road surface, and speed information for the road adjacent to the building project site at the time, and are for the most exposed building façade.
- The upgrades that were recommended by the acoustic engineers involved in each case were installed and alternative systems were not used.
- The systems where not specified were originally 10 mm Standard Gib plasterboard internal linings for walls, and 13 mm Standard Gib plasterboard linings for ceilings, and 4 mm float glass / 12 mm air space / 4 mm float glass for glazing.
- Where 7 mm Ecoply RAB board was specified for external walls it was assumed that this would have been included regardless of the acoustic upgrades, and so was not included in the upgrade costing.
- Where not specified, the mechanical ventilation system was assumed to be of similar or equal design and performance to those projects where this detail was provided.

1.3 Findings

We have summarised a number of key observations from the analysis below.

Table 1.1 outlines the increase in overall building cost associated with any upgrades to the building façade and/or the installation of mechanical ventilation system, to ensure compliance with the various sound insultation rules.

Table 1.1 – Summary of cost of traffic noise mitigation by building type

Building Type	Range of external noise levels (dB $L_{Aeq\ (24\ hours)}$)	Increase in overall cost of building (per residential unit)	Percentage increase in overall cost of building
Detached residential	55 – 68	$0 – $16,000	0 – 2 %
Residential units	58 – 69	$500 – $15,000	0 – 2 %
Apartment buildings	60 – 71	$500 – $16,000	0 – 1 %

These results illustrate that the overall percentage increase in building cost due to compliance with a sound insulation rule was 2 % or less (noting that none of the buildings in the sample were exposed to external traffic noise levels exceeding 71 dB $L_{Aeq(24\ hour)}$).

For the residential units and apartment buildings, the figures in table 1.1 are based on the total cost of upgrades, divided by the total number of residential units in the development. However, some units did not require any upgrades, as they experience lower external noise levels. If the total cost of upgrades is only divided by the number of units in the development which required upgrading, the percentage increase changes to 1 – 4 %.

In table 1.2 the results are presented based on the type of sound insulation rule that the assessment was undertaken against.

Table 1.2 – Summary of cost of traffic noise mitigation by rule type

Rule	Range of external noise levels (dB $L_{Aeq\ (24\ hours)}$)	Increase in overall cost of building per residential unit	Percentage increase in overall cost of building
Internal noise level of 40 dB $L_{Aeq\ (24\ hours)}$ and mechanical ventilation	55 – 71	$0 – $16,000	0 – 2 %
Alternative internal noise level requirement, no mechanical ventilation	64 – 65	$500 – $1,500	0 – 1 %
Façade reduction requirement or defined constructions, and no mechanical ventilation	55 – 69	$0 - $16,000	0 – 2 %

This summary appears to indicate that the costs associated with both the internal noise level and façade reduction rules are similar (noting that the sample size for the 'alternative internal noise level requirement, no mechanical ventilation' rule was very small, and the external levels were moderate). However, we note the following:

- For the methods which used internal noise levels, the increase in costs is very dependent on the external noise level. The developments which resulted in upgrade costs of less than 1 % typically experienced external noise levels below 65 dB $L_{Aeq\ (24\ hours)}$. There are exceptions to this depending on the layout of the units.

- While the 'façade reduction requirement or defined constructions' rules appear to attract a similar cost to the 'internal noise level' rules, those particular rules did not require mechanical ventilation to be installed. Occupants in some situations would therefore have still had to choose between thermal comfort, and noise. Additional cost should have been involved with installing mechanical ventilation in those situations, as was the case for the 'internal noise level of 40 dB $L_{Aeq\ (24\ hours)}$ and mechanical ventilation' examples. To put it another way, the cost may be been similar, but the benefit is likely to have been less in many cases.

- The required construction upgrades (and therefore the costs) of the 'façade reduction requirement or a defined set constructions' rules are not dependent on external noise levels. This means that while the range of cost increases is similar, in some situations the high costs lead to no benefit, as the external noise levels were low. For the 'internal noise level of 40 dB $L_{Aeq\ (24\ hours)}$ and mechanical ventilation' examples where the costs were high, that was at least in response to high external noise levels and so was justified.

For a small number of developments, no upgrades were required as either external traffic noise levels were very low, or the original design included high mass cladding with small window areas on key facades.

2.0 BARRIERS

An alternative method for reducing the levels of road traffic noise experienced by the occupants of new dwellings is for a barrier to be installed to screen a new residential neighbourhood from the road. This means that individual dwellings are less likely to need to be upgraded, and noise levels in outdoor living areas are also reduced. However, the developer of the new neighbourhood is likely to primarily bear the cost of the barrier, compared to the building upgrades discussed in section 1.0 above, which are paid for by the individual building owners.

2.1 The sample

10 new residential neighbourhoods were included in the analysis. All of these adjoined State Highways and were likely to have been designed with some regard to the Waka Kotahi Guidelines. Each of the neighbourhoods had been screened from the State Highway with a traffic noise barrier, including:

- Seven examples with 'acoustic' fences ranging in height from 2 – 3 metres
- Two examples where earth bunds had been constructed – these were 2 – 3 metres in height, and 8 – 9 metres wide
- One example with a combination of acoustic fencing and earth bund

For each example, we determined the number of dwellings which would have experienced traffic noise levels of greater than 57 dB $L_{Aeq\ (24\ hours)}$ without a barrier. These dwellings would have been the most likely to have required upgrading had the barrier not been constructed, in order to satisfy a traffic noise insulation rule of the type discussed in section 1.0 above. We note that it is possible that some dwellings still required upgrading even with the barrier – for example the upper level of two-storey houses. As above, the barrier also reduces the noise levels in outdoor living areas associated with dwellings – which is a benefit compared to the sound insulation rules discussed in section 1.0, which only modifies the environment within a dwelling.

The number of dwellings which would have experienced traffic noise levels of greater than 57 dB $L_{Aeq\ (24\ hours)}$ without a barrier ranged from 1 through to 120. The number of affected lots was dependent on the overall layout of the subdivision relative to the road, as well as the traffic numbers, road surface, and speed.

2.2 Assumptions

Key assumptions were as follows:

- The acoustic fences were constructed of 125 x 75 mm H4 posts, 75 x 50 mm H3 railings, 150 x 25 mm H3 palings with 50 x 25 mm H3 battens over joins and 150 x 50 mm H3 capping.
- In some cases, the effective height of fences was increased, because they were constructed on top of a retaining wall. It was assumed that the retaining walls would have been required for general site levelling and not specifically to enhance the acoustic effectiveness of the barrier. This was therefore not included within the upgrade cost.
- It was assumed that the subdivision layout without the barrier would have been exactly the same. In reality larger setback distances or other rearrangement of the layout may have been included if the traffic noise had not been largely mitigated by the barrier.
- The earth bund was assumed to be constructed with surplus excavated soil from the site, with a layer of imported topsoil 150 mm thick spread on top for grass.

2.3 Findings

We have summarised a number of key observations from the analysis below.

Table 2.1 shows the cost of each barrier, divided by the number of dwellings which would have experienced a noise level of greater than 57 dB $L_{Aeq\ (24\ hours)}$ without a barrier. We have grouped the results together for different barrier types, and have also shown the situations where are large and small number of dwellings benefited from the barrier separately.

Table 2.1 – Summary of cost of traffic noise mitigation by barrier type

Barrier Type	Approximate number of dwellings which benefited from barrier	Cost of barrier per dwelling
Acoustic fence	1 – 10	$15,000 – $30,000
	30	$10,000
	80 – 110	$3,000 - $5,000
Earth bund	10	$60,000
	50	$6,000
Combination	120	$4,000

Overall, this analysis shows that when the number of affected dwellings is low (i.e. the layout results in few lots near the road, or the volume of traffic is low etc.) the overall cost per dwelling is high. When these absolute costs are viewed as a percentage of the likely final value of each of the affected sections, the range is from 2 % (acoustic fence, benefiting a large number of sections) to 30 % (earth bund, benefiting a few sections). As above, in all of these examples for dwellings constructed on these sections, additional costs in the order of those presented in tables 1.1 and 1.2 above would be largely avoided, and traffic noise levels in outdoor living areas would also be reduced.

We note that a key decision in the above analysis is whether the loss of the land under the footprint of any earth bund is included as a 'cost'. In all of the examples the bund fell within an area which was ultimately sold to a homeowner as part of a site, or was within an area close to the State Highway which was unlikely to have been developed for residential use regardless – so the loss of the land under the bund has not been included as a cost. As an example, for the development with approximately 50 affected dwellings, if the cost of the land under the bund was included in the analysis, the total cost as a percentage of the likely final value of each of the affected sections would increase from 3 % to 16 %.

We trust this is of assistance. If you have any queries, please do not hesitate to contact us.

Kind Regards

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Attachment 4: Technical Basis of Model and Data Smoothing

Tonkin+Taylor

Memo

To:	**Stephen Chiles**	**Job No:**	**1014982**
From:	**John Carter**	**Date:**	**3 May 2021**
cc:	**Greg Haldane, Jovanna Leonardo**		
Subject:	**GIS advice on smoothing of noise contours around the state highway network**		

I am writing this memo to provide GIS advice on smoothing of noise contours around the state highway network, as you requested in our meeting on the 15th of April.

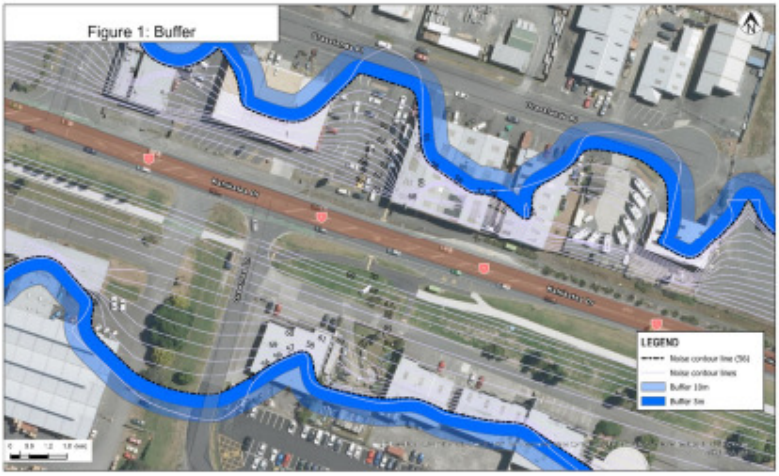
There are three main smoothing techniques that could be used to assist your work with Waka Kotahi, in refining rules for acoustic treatment of additions to existing houses or new houses being built near existing state highways. The three most relevant techniques are.

1. Buffer;
2. Simplify; and
3. Smooth.

Buffer

Buffering allows you to set the distance and the side of the line you want to create the buffer around. This is demonstrated in Figure 1 below. The buffer distance in metres can easily be modified based and depending on the distance used, the Figure shows how some of the smaller bends in the noise contour line (the dotted black line) are smoothed by the 5 metre (dark blue) and more so by the 10 metre (light blue) buffers.

Figure 1: Buffer



Pros:

With buffering you will still keep the general shape of the line and have a consistent distance along the entire contour. This can be easily built into models and automated for the entire country.

Cons:

The negatives of this techniques are you still get some unwanted bends/curves, despite an overall more consistent line. The result of a buffer is an area (polygon), so there are two small steps to convert the polygon into a line, then erase the original line to give one new contour line. The other downside is you push the line out (i.e. needlessly increasing the extent of the contour) in a large proportion of areas where it is already smooth, unlike the smoothing and simplifying methods detailed later in this memo. This can be negated relatively simply by offsetting the line back by buffering the results by the same amount as the original buffer but back towards the original line.

Overall, this is a viable option for your needs, but the main issue would be deciding on the appropriate distance to buffer. Buffering could be used in conjunction with the other methods to provide both a smooth and conservative contour line from the raw modelling results.

As discussed in our meeting, this can be done in ArcGIS, FME and QGIS, but I would only recommend ArcGIS or FME for this task and to allow for integration with automation/existing models. More detail is available from ArcGIS provider ESRI: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm.

Simplify Line

Simplify Line simplifies a line by removing points along the line and therefore unwanted bends/curves, while preserving its shape (depending on the degree of simplification set known as ***the tolerance***).

There are four available methods, when using ArcGIS Pro, the two most viable for this task are 'Wang-Muller' which retains critical bends and 'Zhou-Jones' which retains the weighted-effective areas. I have included the 'Wang-Muller' method on the 56 dB contour in Figure 2 below, with tolerance set at 10 metres and 50 metres.

Figure 2: Simplify Line

The Zhou-Jones method needs lower tolerance set in general, as the results of the simplify tool can vary quite a lot from the original line.

Simplify Line with a Barrier

Simplify Line includes an option of having a barrier, which is another layer or feature can be used to prevent the main simplify line touching or crossing the barrier.

Figure 3: Simplify Line with Barrier

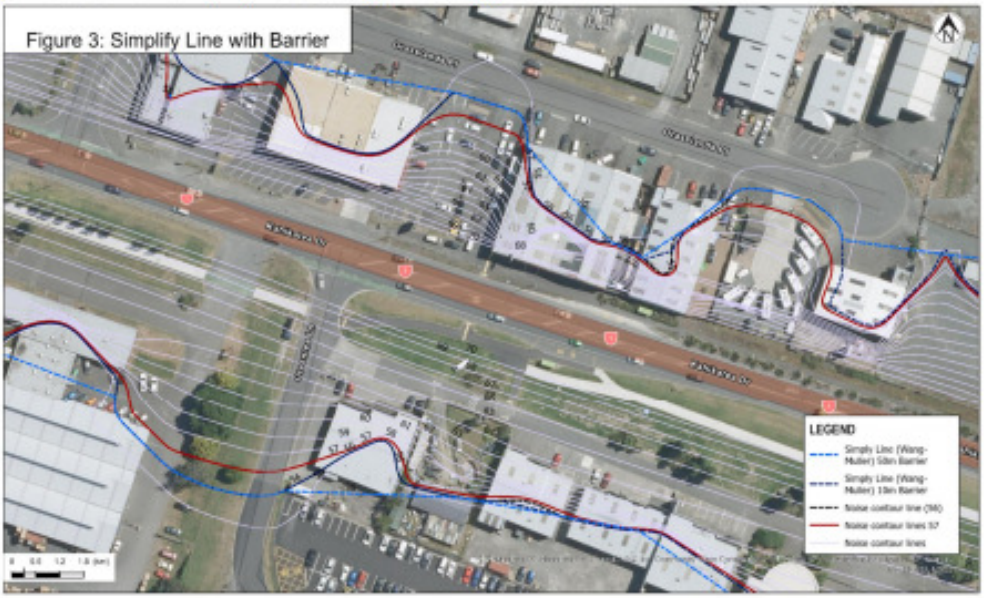


Figure 3 shows how this can be used. The Red line is the decibel (dB) 57 contour, it is included in the method as a barrier, to prevent the simplify line from the 56 dB contour line going across the 57 dB contour. The light Blue line has a tolerance of 50 metres and the dark blue line only has 10 metres tolerance. This should prove very useful when it comes to proving a planning line from noise contours.

Pros:

With simplifying you can set a tolerance to keep very true to the original contour line or really simplify it by setting a higher tolerance to cut out unwanted bends. The barrier should enable more sensible results by preventing modelled results of higher noise to be cut off by smoothing. You will keep the general shape of the line and where the line is already smooth or at least simply the line will match the modelled raw output. This can be easily built into models and automated for the entire country.

Cons

The negatives of this techniques are you still get some unwanted bends, but this can be overcome by adjusting tolerance to suit your wanted outcomes.

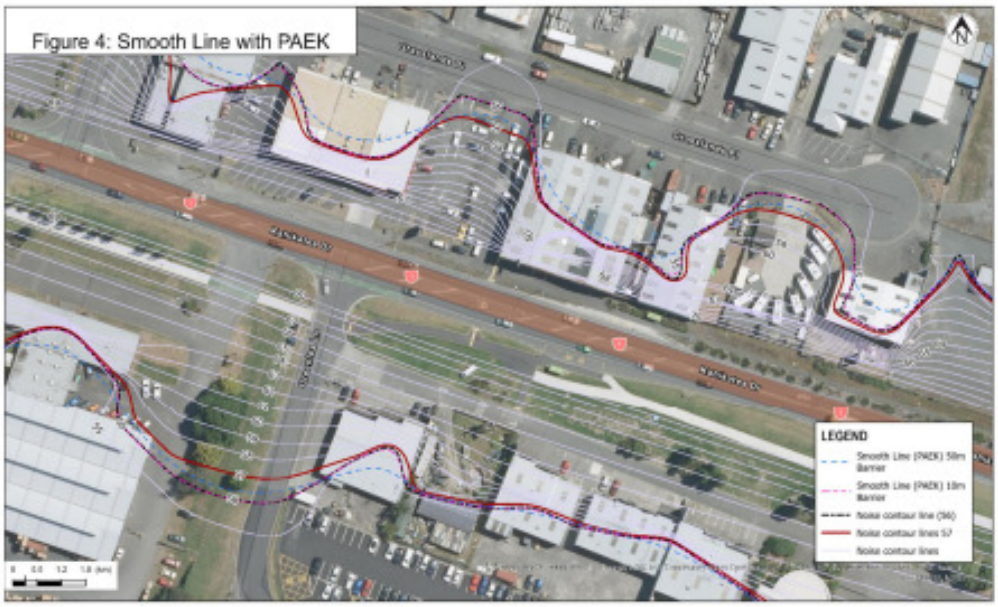
Overall, again this is a viable option for your needs, but the main issue would be deciding on the appropriate tolerance distance and barrier location.

More detail is available from ArcGIS provider ESRI: https://pro.arcgis.com/en/pro-app/latest/tool-reference/cartography/simplify-line.htm

Smooth Line

Smoothing lines removes the sharper angles with two main methods or algorithms. The Bezier interpolation method and the Polynomial Approximation with Exponential Kernel (PAEK) method. The Bezier method smooths the lines without using a tolerance, so it is not as viable for this task. The PAEK method, which like the simplify line tool allows you to set the tolerance, although the line may actually be more complicated, or have more points along it, which is something to think about for a national dataset. I have demonstrated the results of the PAEK method in Figure 4 below. The tolerance distance in metres can easily be modified based and barriers are also an option.

Figure 4: Smooth Line with PAEK



The Figure shows how the difference in the two tolerance values of 10 metres and 50 meters can vary greatly, where the 50 metre tolerance varies a lot from the original contour line.

Pros:

With smoothing you can keep use barriers and set tolerance. This can be easily built into models and automated for the entire country.

Cons

The negatives of this techniques are you may find it moves too much from the original contour. The valleys/peaks are removed, so you can get an overall more consistent line. The other downside is you again will have to set a tolerance that suits, and the line will move if that tolerance is pushed out or has higher values.

Overall, this could be a viable option for your needs, but the main issue would be deciding on the appropriate distance of tolerance.

As discussed in our meeting, this can be done in ArcGIS, FME and QGIS, but I would only recommend ArcGIS or FME for this task and to allow for integration with automation/existing models. More detail is available from ArcGIS provider ESRI: https://pro.arcgis.com/en/pro-app/latest/tool-reference/cartography/smooth-line.htm.

3-May-21

Attachment 5: Other Options Considered

For completeness, Waka Kotahi has also considered methods outside of the district plan to manage the issue; these include both regulatory (Building Code; National Environmental Standard) and private covenants ("no complaints" covenants) and built responses:

Regulatory

The **Building Act** (and Code) currently provides specifications to manage inter-tenancy noise (eg noise between residential apartments within the same building with shared tenancy walls). It does not, however, provide requirements for management of noise generated from outside a building (eg transport noise or nightclub noise from a separate building). A change to the Building Code would be needed to address the issue. While proposals for relevant changes to Clause G6 of the Building Code were circulated in 2016 and remain on MBIE's work programme, these are not imminent.

A **National Environmental Standard** (NES) would require promulgation by central government, there is no current plan to promulgate RMA-based national planning direction in relation to health and amenity effects relative to transport.

There are situations where **covenants** are entered into where parties acknowledge and accept particular types of effects in return for locating in an area; commonly referred to as "no complaints" covenants. There are a number of limitations with this approach:

a. it does not remove the actual effects on health and amenity therefore does not address the matters within Part 2 of the RMA;
b. it is reliant on both parties coming to agreement;
c. application of a covenant requires a 'trigger' to commence negotiations (eg. a request from a resource consent applicant to undertake works).

The primary limitation is however that it does not address actual health and amenity impacts.

Changes to the Building Act or promulgation of a NES are not directly within the control of Waka Kotahi; covenants require a 'trigger', agreement between parties and do not actually address the effects generated. None of these options are preferred.

Built Response

Waka Kotahi has undertaken a preliminary assessment of noise improvements across its network. It estimates a cost of at least $150M[24] to retrospectively manage noise exposure for approximately 50% of persons exposed to noise above 64 dB $L_{Aeq(24h)}$.

Responses could include retrofitting acoustic barriers and/or installing low noise road surfaces.

Retrofitting noise barriers by motorways by Waka Kotahi has been found to cost in the range of $4,000 to $10,000 per linear metre of barrier. Construction of noise fences by individuals or land developers generally have lower costs.

Retrofitting acoustic barriers has a number of limitations:

- available land and/or ground conditions;

[24] Not currently funded.

- potential visual dominance and shading;
- ongoing maintenance costs (eg graffiti, landscape maintenance); and
- may not be effective for buildings of more than one storey.

There are also some benefits:

- for barriers close to buildings (or close to the road) and comprehensively blocking the line-of-sight of sensitive land uses to the state highway carriageway, a reduction of 5-10 dB can be achieved;
- where applied to large land areas, cost of protecting multiple sites will aggregate to be less than cost of protecting a low number of sites;
- reduces the need for individuals building houses to have to consider road noise or to keep windows closed;
- can provide visual screening giving a benefit in reducing both perception of noise and actual noise level; and
- can provide improved amenity for outdoor areas.

A porous asphalt surface (low noise road surface) would be in the order of \$30+/m^2 (standard two coat chipseal surface would be in the order of \$6/m^2 to \$10/m^2). It cannot generally be laid directly on existing roads, because low noise (asphaltic) road surfaces require stiff underlying pavements, otherwise they fail prematurely. For much of the existing network, laying new asphaltic surfaces therefore first requires rebuilding of the structural pavement, which would increase the cost to over \$100/m^2. Low noise road surfaces can provide in the order of 5 dB reduction in noise generated from the tyre/road interface (although will not materially alter other sounds such as truck engine/air-braking noise). For traffic at highway speeds this is a meaningful improvement, although is often not sufficient to reduce sound to below guideline values.

Overall, while both built options provide some benefits, both options have significant costs and result in the full cost being borne by the road controlling authority in situations where the noise sensitive activity establishes after the state highway.