BEFORE INDEPENDENT HEARING COMMISSIONERS
AT RANGIORA / WAIMAKARIRI

I MUA NGĀ KAIKŌMIHANA WHAKAWĀ MOTUHAKE
KI RANGIORA / WAIMAKARIRI

IN THE MATTER	**of the Resource Management Act 1991**
AND	
IN THE MATTER	**of the hearing of submissions and further submissions on the Proposed Waimakariri District Plan**
HEARING TOPIC:	Stream 5 – Te orooro - Noise

STATEMENT OF PRIMARY EVIDENCE OF JON ROBERT STYLES ON BEHALF OF KĀINGA ORA – HOMES AND COMMUNITIES

ACOUSTICS

7 AUGUST 2023

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1. EXECUTIVE SUMMARY

1.1 My full name is Jon Robert Styles. My evidence relates to the Waimakariri Proposed District Plan (**PDP**) provisions relating to noise sensitive activities adjacent to transport corridors and the railway network (the **road and rail network**) and Christchurch International Airport and Rangiora Airfield (the **airports)**. I address the relief sought in the submissions and further submissions of Waka Kotahi and KiwiRail (the **transport authorities**) and Christchurch International Airport Limited (**CIAL**).

1.2 From my reading of the Section 32 and Section 42A Report, the basis for the controls appears to be predominantly focussed on protecting transport corridors from reverse sensitivity effects (NOISE-O2 and NOISE-P3). I consider that the focus of these controls should be to avoid exposing people to unreasonable levels of noise from the operation of the transport infrastructure.

1.3 Proposed NOISE-R16 and Waka Kotahi and KiwiRail's submissions all seek to apply standard setback distances for the noise-related road and rail controls. In my view, the standard setback approach will invariably capture land that should not be included in the controls. I consider that they are a blunt instrument and will not manage the potential adverse effects of land transport noise on people effectively or efficiently.

1.4 I am aware that Waka Kotahi has prepared noise level contours for their network across the entire country. This work used computer modelling software to map the spatial extent of noise effects across the national state highway network, taking into account all relevant variables such as topography, screening by noise barriers and other built form, the speed environment, road surface, traffic flows and other physical attributes.

1.5 I am involved in several other very recent District Plan review and plan change processes where the road traffic noise levels from the 2019 Project Report have been produced and incorporated into the District

Plan maps as overlays with the associated rules and standards. The noise level contour approach is a far more accurate and meaningful way to determine the extent of noise effects that warrant controls in the receiving environment.

1.6 The noise level contour approach has been adopted in the Whangarei District Plan[1], and the decisions version of the New Plymouth District Plan[2] and is being developed in several other proposed plans that I am involved with. The modelled contours in these plan review processes have shown that they are much smaller than the standard setbacks in many areas. The modelled contours therefore represent a more efficient and appropriate approach to defining the extent of the controls.

1.7 I consider that the contour approach should be adopted in this case, and for the reasons set out above.

1.8 I consider that there are likely to be parts of the District's rail network that do not carry sufficient trains at sufficient speed and frequency to justify rail noise and vibration controls. I consider that KiwiRail need to justify that the noise and vibration effects are great enough to warrant the imposition of any noise or vibration controls. If the effects are great enough, the noise levels should either be modelled or crafted with care and attention to ensure that the specific features of the rail network and surrounding physical environment are accurately reflected.

1.9 The cost to homeowners (the community) of the mitigation measures that would be required by the various provisions have not been properly quantified or assessed. In particular, there is no assessment of the significant costs associated with vibration assessments in the relief sought by KiwiRail. The costs range from $3k to $8k for the assessments and ≈$100k for the base isolation of dwellings. I detail the costs of the various vibration assessments in Appendix A of this evidence. I also consider that the estimate of additional cost to

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[1] https://www.wdc.govt.nz/files/assets/public/documents/services/property/planning/district-plan/operative/pt2/noise-and-vibration.pdf

[2] https://districtplan.npdc.govt.nz/eplan/rules/0/15/0/0/0/137

mitigate traffic noise as set out in Attachment three to Ms Heppelthwaite's evidence is unreliable.

1.10 NOISE-R17 manages development inside the 50dB L_{DN} contour for CIAL. The PDP controls extending to CIAL noise levels below 55dB L_{DN} and down to 50dB L_{DN} are lower / more onerous than any similar provisions I am aware of in New Zealand. I am only aware of acoustic treatment controls in New Zealand extending as low as 55dB L_{DN}.

1.11 I consider that a level of 50dB L_{DN} is too low for such acoustic controls, and that they should only begin to apply when aircraft noise levels reach 55dB L_{DN}.

1.12 Notwithstanding, I note that the provisions of NOISE-R17 do not apply in the Residential Zone and will therefore have a very limited application.

1.13 I consider that the requirement to achieve a 35dB noise reduction as set out in NOISE-R18 is excessive and will add significant and unnecessary cost to building a noise sensitive activity in the TCZ, LCZ, NCZ and MUZ. A requirement of 35dB is generally only seen in high or very-high noise areas such as the inner-city centres of larger cities or very close to airports or major roads.

1.14 I consider that the acoustic treatment required should be reduced to 25dB based on the Dtr method.

1.15 I have provided some recommended modifications to NOISE-R20 and NOISE-RX that deal with frost fans. I acknowledge that these comments are not addressed by the Kāinga Ora submission. I have provided the comments in the hope of assisting the Panel. My comments improve the certainty and enforceability of the rules if they are retained (given that there are currently no frost fans in the district).

2. INTRODUCTION

2.1 My full name is Jon Robert Styles. I am an acoustic consultant and director and principal of Styles Group Acoustics and Vibration Consultants. I lead a team of 8 consultants specialising in the

measurement, prediction and assessment of environmental and underwater noise, building acoustics and vibration working across New Zealand and internationally.

2.2 I have approximately 22 years of experience in the acoustics and noise control industry. For the first four years I was the Environmental Health Specialist – Noise at the Auckland City Council, and for the latter 18 years I have been the Director and Principal of Styles Group Acoustics and Vibration Consultants. I have a Bachelor of Applied Science (EH) majoring in Environmental Health.

2.3 I am the past-President of the Acoustical Society of New Zealand. I have completed two consecutive two-year terms as the President from 2016 to 2021. I have been on the Council of the Society for approximately 15 years. Styles Group is a member firm of the Association of Australasian Acoustical Consultants (AAAC) and I am on the Executive team of the AAAC. My role on the Executive is to oversee the development of guidelines for acoustical consultants to follow in their day-to-day work and to participate in the governance of the AAAC generally.

2.4 Most recently I have advised Kāinga Ora on similar noise-related issues (noise from road, rail and airports) in the review of the Wellington, Selwyn, Porirua, Waikato, New Plymouth, Christchurch and Central Hawkes Bay District Plans. I advised the Whangarei District Council through the recent Urban and Services Plan Change process and appeal process that dealt with the District Plan provisions for managing exposure to road and rail noise.

2.5 I been directly advising the Gore District, Kaipara District, Napier City Council, Taupō District Council and Whangarei District through full District Plan review processes. I assisted Auckland Council through the development of the Auckland Unitary Plan and continue to provide advice to Auckland Council on both Council initiated and private plan change requests. I have also assisted many private clients through plan change and review processes across New Zealand.

2.6 In preparing this evidence I have read the Section 32 and Section 42A reports and acoustic evidence prepared by Mr Camp (for the Council) and Dr Chiles (for the transport authorities).

2.7 I have worked closely with Mr Lindenberg on the development of appropriate provisions in areas where the technical noise and vibration matters overlap with planning considerations.

2.8 The recommended amendments to the provisions under consideration in Hearing Stream 5 that are included in Attachment B to Mr Lindenberg's statement of evidence include my input and recommendations.

Code of Conduct

2.9 Although this is a Council hearing, I confirm that I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and agree to comply with it while giving evidence.

2.10 Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

3. FOCUS ON REVERSE SENSITIVITY EFFECTS

3.1 From my reading of the Section 32 and Section 42A Report, the basis for the controls appears to be predominantly focussed on protecting transport corridors from reverse sensitivity effects (NOISE-O2 and NOISE-P3).

3.2 I consider that the PDP's focus on avoiding reverse sensitivity effects on the transport operators addresses only a part of the issue.

3.3 I consider that the focus of these controls should be to avoid exposing people to unreasonable levels of noise from the operation of the transport infrastructure.

3.4 It is my experience that if the noise levels are managed to be reasonable, there can be no legitimate reverse sensitivity effect.

3.5 I accept that the provisions could address reverse sensitivity effects as a potential consequence of not addressing unreasonable noise levels, but I consider that reverse sensitivity should not be the focus.

4. THE PROPOSED CONTROLS FOR ROAD AND RAIL NOISE

4.1 Proposed NOISE-R16 applies to all land within 80m of the Districts' state highways, arterial and strategic roads and railway corridors. NOISE-R16 requires that any residential unit or minor residential must be acoustically treated to achieve a minimum external and internal noise reduction of 30dB to a habitable room, based on the Dtr,2m,nT,w + Ctr method (referred to as the Dtr method throughout this evidence).

4.2 Waka Kotahi and KiwiRail's submissions seek that the standard 80m setback distance is increased to 100m. The Section 42A Report recommends that the 80m distance is retained for rail and road corridors, provided that the road setback distance is measured from the boundary of any site adjoining the road.

4.3 In my view, any PDP controls applying to the receiving environment need to be developed based on a strong evidential basis of the effects.

4.4 I am aware that Waka Kotahi has prepared noise level contours for their network across the entire country through The National Land Transport (Road) Noise Map 2019 Project Report[3] (the 2019 Project Report). The 2019 Project Report used computer modelling software to map the spatial extent of noise effects across the national state highway network, taking into account all relevant variables such as topography, screening by noise barriers and other built form, the speed environment, road surface, traffic flows and other physical attributes.

4.5 The 2019 Project Report states that noise contour maps and noise exposure data "will initially be an internal resource for Transport Agency

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[3] https://www.nzta.govt.nz/assets/Highways-Information-Portal/Technical-disciplines/Noise-and-vibration/Research-and-information/Other-research/national-land-transport-road-noise-map-2019-05-16.pdf

staff and would likely be made available for access by other regulatory authorities".

4.6 I am involved in several other District Plan review and plan change processes where the road traffic noise levels from the 2019 Project Report have been produced and incorporated into the District Plan maps as overlays with the associated rules and standards. The contours take into account the physical environment and specific characteristics of the road network. The main factors include:

(a) The effects of topography and its ability to provide screening in some cases;

(b) The effects of screening from buildings, mainly in built-up areas where it can significantly reduce noise levels beyond the first row of buildings, (but still within the setback distances of 80m or 100m);

(c) The effects of other features of the networks, such as:

(i) the road surface,

(ii) any designation conditions that manage noise,

(iii) roadside barriers,

(iv) the speed limits for traffic and trains

4.7 The noise level contour approach is a far more accurate and meaningful way to determine the extent of noise effects that warrant controls in the receiving environment.

4.8 The noise level contour approach has been adopted in the Whangarei District Plan[4], and the decisions version of the New Plymouth District Plan[5] and is being developed in several other proposed plans that I am involved with.

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[4] https://www.wdc.govt.nz/files/assets/public/documents/services/property/planning/district-plan/operative/pt2/noise-and-vibration.pdf

[5] https://districtplan.npdc.govt.nz/eplan/rules/0/15/0/0/0/137

4.9 The modelled contours in these plan review processes have shown that they are much smaller than the standard setbacks in many areas. The modelled contours therefore represent a more efficient and appropriate approach to defining the extent of the controls.

4.10 I consider that the contour approach should be adopted for the PDP, and for the reasons set out above.

4.11 I note that paragraph 65 of Mr Camp's evidence states:

"*The notified rules represent industry best practice for managing reverse sensitivity noise effects in New Zealand".*

4.12 I disagree with Mr Camp on this point. I consider that the use of modelled contours in the very recent New Plymouth and Whangarei District Plans and the associated rules and standards represent a considerable improvement in the appropriateness and efficiency of controls managing road and rail noise and should be considered to be best practice.

4.13 I consider that the same approach should be adopted in the Waimakariri PDP.

5. ROAD TRANSPORT CORRIDORS CAPTURED BY THE CONTROLS

5.1 NOISE-R16 applies to the land surrounding any arterial road, strategic road and rail designations. This is broader than most other recent District Plan provisions that typically only deal with state highways and rail designations. The addition of Council-controlled roads is unusual.

5.2 I support the provisions extending to Council-controlled roads provided the traffic flows and speeds are such that the noise effects are high enough to warrant controls in the receiving environment.

5.3 I understand that the method for defining the setbacks from Council-controlled roads will not be able to be modelled by Waka Kotahi and it is unlikely that the Council will have or would be able to model the noise emissions from local roads.

5.4 Accordingly, I consider that the setbacks from Council-controlled roads will need to be determined separately from the modelling approach I recommend for state highways. The procedure for Council-controlled roads should take account of the specific features of each area the roads are in, the built-form that can provide screening, the speed environment and any other significant features.

6. RAIL NOISE CONTROLS, AND DEFINING THE EXTENT OF RAIL NOISE BY MODELLING OR FURTHER ASSESSMENT

6.1 I consider that controls requiring acoustic treatment for noise sensitive activities near to rail lines could be appropriate. However, such controls should only apply to land where evidence demonstrates that the effects are great enough to justify the controls.

6.2 For example, if there are only two freight train movements per week and they are during the day, I consider that the effects would not be great enough to justify acoustically treating dwellings.

6.3 The noise generated by the rail network can vary depending on the characteristics of the network in any particular area. Train speed and type (freight or passenger) are perhaps the two greatest variables.

6.4 As with the road noise controls, reliance on standard setback distances that are based on a worst-case scenario can ignore a range of factors that can influence the rail noise effects at any particular property. These factors include:

i. The time of day of the train movements

ii. Train speed on each part of the network

iii. Train type on each part of the network (freight and passenger or passenger only)

iv. Screening by topography

v. Screening by buildings

vi. The effects of tunnels, bridges and other structural features

6.5 KiwiRail appears to have adopted a very generic approach to defining the requested rail-noise effects area. These do not appear to be

informed by evidence relating to the Waimakariri network. I consider that the following information is necessary for the Midland and Main South lines before the noise and vibration effects can be properly understood:

i. The number of trains likely in an average 24 hour period in the future (where the distance into the future is defined by others)

ii. The number of trains likely in the daytime period (between 7am and 10pm) and in the busiest hour during that time after the BPO has been adopted

iii. The number of trains likely in the nighttime period (between 10pm and 7am) and in the busiest hour during that time after the BPO has been adopted

iv. The mix of freight trains and passenger trains for both lines.

v. The approximate speed environments for trains across the network, but especially in the urban areas.

6.6 Once KiwiRail have provided this information, the need for noise (and vibration) controls can be determined, and if noise and vibration controls are deemed appropriate, the nature and extent of the controls can be determined.

7. THE COSTS OF THE ACOUSTIC TREATMENT CONTROLS

7.1 My reading of the Section 42A Report and Section 32 Noise Report (the s32 Report) is that the cost of the various acoustic assessments and treatments required by NOISE-R16 have been considered sparingly.

7.2 I have read the report prepared by AES at Attachment three to the evidence of Ms Heppelthwaite for Waka Kotahi. The AES Report provides an estimate of the building costs of complying with acoustic treatment controls in other districts.

7.3 I consider that there are a number of problems with the AES Report that culminate in the total additional cost of compliance with the acoustic controls being unreliable and too low. The main problems are:

i. Some of the sample projects had no requirement for mechanical ventilation or cooling, and others had variable requirements. The cost of a proper ventilation and cooling system (as detailed in the evidence of Mr Jimmieson) is likely to be the greatest cost for many projects;

ii. The sample of projects was relatively small; and

iii. The total cost of traffic noise mitigation presented in table 1.1 of the report has been averaged across all units that required acoustic treatment, plus the units in some of the developments that were not subject to traffic noise controls. I consider that averaging the costs in this way is a major flaw.

7.4 I have worked on a considerable number of projects where acoustic treatment and mechanical ventilation and cooling systems have been required. In my experience there is a significant cost to the community in implementing acoustic mitigation. My experience is that the total cost of upgrading the building envelope and providing a mechanical cooling and ventilation system as set out in the evidence of Mr Jimmieson will be considerably greater than the figures provided in the AES Report and relied on by Waka Kotahi.

7.5 For this reason, I consider is even more important that the road and rail noise effects are modelled to ensure that any controls only apply to the land where the effects are great enough to justify them. This ensures that the burden of mitigation does not extend any further into the community than is absolutely necessary.

8. RAIL VIBRATION

8.1 The PDP noise chapter contains no controls to manage vibration from the operation of the State Highway and rail networks.

8.2 KiwiRail's submission seeks rail vibration controls to all sites within 60m of rail corridors. The Section 42A Report recommends that KiwiRail's relief is refused on the basis that the proposed rule is "overly complex… expensive and difficult to implement"[6]. Mr Camp's evidence does not address rail vibration.

8.3 I agree with the Council that there should be no rail vibration controls.

8.4 The controls sought by KiwiRail essentially require that buildings are located and designed so that vibration generated by rail traffic does not exceed a level of 0.3 mm/s Vw95 when measured inside a range of defined noise / vibration sensitive activities. KiwiRail's proposed rule includes a standard construction specification for a vibration isolating bearing as an alternative to undertaking a site-specific vibration assessment.

8.5 The proposed control would essentially require the receiving environment to manage the potential and variable effects of vibration generated by rail. The controls sought by KiwiRail do not encourage or require any effort to reduce vibration at the source.

8.6 Based on my previous investigations, occurrences of unreasonable levels of vibration from the rail corridor are directly attributed by the condition of the track and rolling stock in the localised area, whereby vibration effects can be largely avoided (or significantly reduced) through regular and effective network maintenance. This aligns with KiwiRail's online guidance on managing vibration effects from the rail network which states:

> *"We work hard to minimise the impacts of our operations, including noise and vibration.*
>
> *We do this by inspecting our tracks, locomotive and wagons regularly and maintaining them in good condition so that train wheels can move over our tracks as safely and smoothly as possible.*
>
> *We are continuing to invest in the network to update our infrastructure and rolling stock and using new technology to ensure trains run smoothly.*[7]

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[6] Paragraph 281 of Section 42A

[7] https://www.kiwirail.co.nz/how-can-we-help/report-something/noise-and-disturbance/vibration/

8.7 Dr Chiles' table of vibration measurements includes data from Hornby, Christchurch where measurements were obtained pre and post renewal. The measurements show:

(i) Vibration levels of 2.2/2.9 mm/s $v_{w,95}$ at 8.4m *before* the renewal.

(ii) Vibration levels of 0.5/0.4 mm/s $v_{w,95}$ at 8.4m *after* the renewal.

8.8 The example above clearly shows the significant reduction in vibration from the renewal.

8.9 This correlates with my experience that the level of ground vibration will be influenced by the degree and timing of network maintenance. A dwelling that has been designed and constructed to meet the indoor vibration design controls may not achieve ongoing compliance due to deterioration or lack of maintenance to the network or rolling stock over the following years.

8.10 Conversely, if in the unlikely event there is a vibration issue that requires a developer to implement isolation measures, the vibration issue may reduce or disappear when KiwiRail undertakes the next round of routine maintenance on the rail line or rolling stock. The issue may have been caused by a simple defect such as excessive wheel flats, deteriorated track beds, old or worn rails and could be very easily rectified.

The evidence for rail vibration controls in the Waimakariri District

8.11 KiwiRail's submission is not accompanied by any information that demonstrates that vibration from rail movements across the Waimakiriri District networks is an issue that requires control in the receiving environment to distances of up to 60m.

8.12 Dr Chiles' table of vibration measurements includes a selection of measurements from across New Zealand (except Waimakariri). Dr Chiles' concludes that the vibration measurement data "illustrates the significant variation that is inherent in railway vibration."

8.13 I consider that rail vibration controls should only be considered for the PDP if there is relevant and robust evidence on the actual and likely

effects of rail vibration beyond the boundaries of KiwiRail's rail corridors in Waimakariri. Such evidence would address:

i. Whether or not it is typical for vibration levels to exceed 0.3mm/s V_{w95} beyond the boundaries of the corridor;

ii. How often would the vibration levels exceed 0.3mm/s Vw95 and is it likely to be an issue at night, in the day or only infrequently?

iii. Would the adoption of the BPO and KiwiRail's own policies for reducing vibration still result in vibration levels outside the rail corridor typically complying with a level of 0.3mm/s Vw95 and if so why, at what level and at what distance; and

iv. If the vibration levels are found to typically exceed 0.3mm/s Vw95 beyond the rail corridor, at what rate does the vibration attenuate over distance and how large does the effects area need to be.

The cost of the vibration controls to the community

8.14 The design, construction and compliance costs of implementing the requested vibration controls will be significant. This cost has not been quantified by KiwiRail.

8.15 If a new noise sensitive activity or an alteration to an existing noise sensitive activity is proposed within the vibration effects area, the following procedure would generally be necessary:

i. The applicant would need to engage a suitably qualified vibration expert to carry out vibration measurements at the location of the proposed noise sensitive activity.

ii. The vibration measurements would need to be set up and left in place for several days to capture at least 15 pass-bys to capture 15 freight train pass-bys. The instrument would need to be secured and a power source arranged for the week or two of measurements required. This may include solar power and in some instances additional security and enclosures if the site is otherwise open. The time and cost of this work would be significant.

iii. The pass-by data would need to be analysed against the requirements of NS8176E and a brief report prepared an acoustic consultant that sets out the measured vibration levels and confirming whether the vibration levels in the proposed noise sensitive activity would be less than 0.3mm/s V_{w95}.

8.16 I estimate that the cost of a rail vibration assessment would be in the order of $5k to $8k +GST, and possibly more if security, solar panels and extensive travel is required.

8.17 If the vibration assessment demonstrates that the vibration level in the proposed noise sensitive activity will be greater than 0.3mm/s Vw95, the options for the applicant would generally be to:

i. Isolate the building from the ground vibration by using base isolation techniques. My experience is that the cost of this treatment would typically be $100k +GST for a single-level dwelling on top of the cost of the build itself.

ii. Build a larger building from heavy masonry construction. The additional mass of the structure (compared to a lightweight structure) would assist in reducing the vibration level inside the noise sensitive activity. This option is high-risk and, in my experience, high-cost compared to normal dwelling construction methods and materials.

iii. Abandon the proposal due to cost. In my experience, this option is commonly adopted when applicants find out the true cost and difficulty of dealing with the vibration issues.

8.18 In my experience, option (iii) above is often found to be the only viable option.

8.19 In some cases, the applicant has only found out the implications of the vibration controls after resource consent has been granted. The vibration assessment might be required by a condition of consent to be addressed before the building is occupied. By the time the vibration survey has been undertaken and results provided, plans to build are well underway and construction has started in some cases. My

experience is that this has lead to the abandonment of the development in some cases and significant financial losses.

8.20 In summary, I agree with the PDP as-notified and I do not support the rail vibration controls requested by KiwiRail until or unless KiwiRail can justify that the effects are great enough to warrant them based on sufficiently robust vibration data that represents forecast train volumes and the various train speeds found on the Waimakariri rail network, and after the BPO has been adopted to reduce the effects at or near the source.

9. NOISE-R17 NOISE SENSITIVE ACTIVITIES WITHIN THE 50DB LDN CONTOUR FOR CIAL

9.1 NOISE-R17 manages development inside the 50dB L_{DN} contour for CIAL.

9.2 The PDP controls extending to CIAL noise levels below 55dB L_{DN} and down to 50dB L_{DN} are lower / more onerous than any similar provisions I am aware of in New Zealand. I am only aware of acoustic treatment controls in New Zealand extending as low as 55dB L_{DN}.

9.3 I consider that a level of 50dB L_{DN} is too low for such acoustic controls, and that they should only begin to apply when aircraft noise levels reach 55dB L_{DN}.

9.4 In addition, the Indoor Design Sound Levels in NOISE1 state that the lowest indoor noise level that needs to be achieved is 40dB L_{DN} in bedrooms.

9.5 Notwithstanding, I note that the provisions of NOISE-R17 do not apply in the Residential Zone and will therefore have a very limited application.

10. NOISE-R18 ACOUSTIC TREATMENT CONTROLS FOR BEDROOMS IN BUSINESS ZONES

10.1 NOISE-R18 requires that bedrooms in the Town Centre Zone (**TCZ**), Local Centre Zone (**LCZ**), Neighbourhood Centre Zone (**NCZ**) and Mixed Use Zone (**MUZ**) must achieve an external to internal noise

reduction of not less than 35 dB based on the Dtr method. Ventilation must be provided where windows must be closed to achieve the indoor noise levels.

10.2 Table NOISE-2 Noise limits identifies the noise levels authorised between sites in business zones. The table shows:

i. Night time noise levels of 50 dB L_{Aeq} and 80 dB $L_{AF(max)}$ are authorised between any sites in the TCZ and MUZ.

ii. Night time noise levels of 40 dB L_{Aeq} and 70 dB $L_{AF(max)}$ are authorised between any sites in the LCZ and NCZ

10.3 An external noise level of 45 dB L_{Aeq} is commonly accepted as the uppermost threshold for non-acoustically treated residential activity. This means that acoustic treatment is not necessary in zones where permitted noise levels are at or less than 45 dB L_{Aeq}.

10.4 The permitted night time noise level of 50 dB L_{Aeq} in the TCZ and MUZ would only require an external to internal noise reduction of 15 dB to comply with the indoor noise levels of 35 dB. Most newly constructed dwellings will comfortably achieve an external noise level reduction of 25 dB with windows closed. The extent of acoustic treatment for bedrooms would be limited to mechanical ventilation to enable occupants to close windows at night.

10.5 I consider that the PDP's required outside to inside noise level reduction of 35 dB at night in the Town Centre Zone and Mixed Use Zones is excessive. In my experience, the 35dB acoustic insulation requirement set out in R18 is typically only required in areas where external noise levels could be 30dB or-so higher than a desirable internal noise level of 30dB or 35dB.

10.6 As above, in this case the permitted external noise level is only 15-20dB above a desirable internal noise level. Reducing an external noise level of 50dB L_{Aeq} (as permitted at night in the TCZ and MUZ) by the 35dB Dtr requirement will reduce the internal noise level to somewhere in the range of 15-20dB L_{Aeq} – even allowing for the cumulative effect of several permitted noise generators all operating to their respective

noise limits. This is a very low level of noise, and much lower what is required for a typical reasonable level of sleep protection and amenity.

10.7 Reducing an external noise level of 40dB L_{Aeq} (as permitted at night in the LCZ and NCZ) by the 35dB Dtr requirement will reduce the internal noise level to somewhere in the range of 5-10dB L_{Aeq} – even allowing for the cumulative effect of several permitted noise generators all operating to their respective noise limits. This is an extremely low level of noise, and significantly lower than what is typically required for a reasonable level of sleep protection and amenity.

10.8 I consider that the requirement to achieve a 35dB noise reduction is excessive and will add significant and unnecessary cost to building a noise sensitive activity in these zones. A requirement of 35dB is generally only seen in high noise areas such as the inner-city centres of larger cities or very close to airports or major roads.

10.9 I consider that the acoustic treatment required should be reduced to 25dB based on the Dtr method.

10.10 My recommended amendments to the rule are attached to the evidence of Mr Lindenberg.

11. RURAL DWELLINGS ARE NOISE SENSITIVE ACTIVITIES

11.1 The PDP definition of noise sensitive activities includes “residential activities other than those in conjunction with rural activities that comply with the rules in the relevant District Plan as at 23 August 2008”.

11.2 The definition above would mean that rural dwellings (used in conjunction with permitted rural activities) would be exempt from compliance with standards that seek to protect noise sensitive activities.

11.3 I disagree with this approach. There is no reason why rural dwellings are less sensitive to external noise. I recommend this definition is amended such that rural and residential dwellings are treated equally.

12. NOISE-R20 OPERATION OF FROST CONTROL FANS AND NOISE-RX NOISE SENSITIVE ACTIVITIES NEAR FROST FANS

12.1 I acknowledge that this issue is not addressed by the Kāinga Ora submission. Nonetheless, in the hope of assisting the Panel I provide some comment on the frost fan rule following my involvement in a number of recent and very contentious and expensive frost fan cases in other districts.

12.2 I have identified several issues with NOISE-R20 and proposed rule NOISE-RX from both a technical perspective, and in terms of recognised acoustical best-practice. I consider that amendments to NOISE-RX and NOISE-R20 are required.

12.3 I note that the lack of any frost fans in the District (according to Mr Camp's evidence) conflicts with the s32 finding that management of noise sensitive activities near to frost fans are a key resource management issue for the District.

12.4 My position is that the onus lies on the frost fan operator to ensure that their noise levels are reasonable for the rural dwellings that are permitted on adjacent sites. NOISE-R20 and NOISE-RX suggest that access to a reasonable level of noise amenity is on a first-in, first-served basis. I fundamentally disagree with this approach.

12.5 I consider that the noise limits on frost fans should apply on all neighbouring sites where a noise sensitive activity physically exists and where it is permitted by the PDP. If the frost fan operator cannot comply with a noise performance standard where a noise sensitive activity could be established, that should be a reason for consent and the effects on the adjacent landowner should be assessed. This encourages good design of orchards in the district (all of which would be new) and the internalisation of noise effects as far as practicable.

12.6 I consider that if some kind of 'first-in, first-served' approach was adopted, it would need to be structured in a clearer and more certain way than it is currently expressed in NOISE-RX. The specific issues are:

i. Part 1 of the rule applies to all frost fans measured cumulatively. These can be on different orchards and owned separately. Determining the individual noise emissions of each fan and orchard and the total level from all fans on all nearby orchards would be a significant undertaking. I consider that the cumulative assessment should apply to each individual orchard – not all.

ii. Following on from (i), if all nearby orchards individually complied with the limit of 55dB L_{Aeq} at the affected dwelling, but cumulatively they exceeded, what would the Council enforce, and against whom?

iii. Part 1 of NOISE-RX entitled "Noise sensitive activities near frost fans" requires some modification. I consider that it should read:

Any new noise sensitive activity located on a separate site ~~of different ownership~~ within 1000m of any consented frost control fan must be designed and constructed to ensure that the noise level from frost fans inside any bedroom of the dwelling will not exceed 30 dB LAeq with all consented fans within 1km operating at normal duty.

Jon Styles
7 August 2023

APPENDIX A – Brief note on the cost of mitigation

In my experience, the costs of complying with the proposed noise standards may include:

1) Acoustical design work to achieve the specified internal noise levels. This is generally straightforward and for a typical dwelling the cost would generally be between $500 and $1000 +GST.

2) Additional construction costs to achieve the specified internal noise levels, such as thicker glass or double-glazing, a heavier façade materials, sarking under the roof, additional layers of plasterboard, solid core doors in the façade. Based on my experience, the extra costs of building materials and labour can be significant (>$50,000 +GST) for dwellings very close to major roads or dwellings close to railway lines. The cost is typically less for a new-build compared to retrofitting insulation to an existing building.

3) Installing mechanical cooling (air conditioning) and a mechanical fresh air supply to enable people to keep their windows and doors closed to keep the noise out. In my experience the cost of this ranges considerably based on the size of the building and the number of rooms. For a typical single-level dwelling, it is my experience that either a ducted heat pump system would be required, or a system comprising at least two indoor high-wall or cassette units, as well as a one or more small, silenced fans to provide an exchange of fresh air. In my experience, the cost of these systems can range from approximately $1000 +GST for the supply and install of a fresh air fan, (or fans) where air conditioning is already proposed, or $10k to $20k +GST for an air conditioning system and silenced fans where none were otherwise proposed.

4) Resource consent processes. The estimation of these costs is beyond my area of expertise.

The cost of meeting the proposed vibration standards is generally much greater than for noise.

If a new noise sensitive activity or an alteration to an existing noise sensitive activity is proposed within the vibration effects area, the following procedure would generally be necessary:

1) The applicant would need to engage a suitably qualified vibration expert to carry out vibration measurements at the location of the proposed noise sensitive activity.

2) The vibration measurements would need to capture at least 15 pass-bys of the vibration source of interest. If it were for road vibration, the measurements could probably be conducted in a few hours (to capture 15 trucks in the lane(s) of interest).

3) If it was rail vibration, the seismograph would need to be set up and left for several days to capture 15 freight train pass-bys. The time and cost of this work would be significant. The instrument would need to be secured and a power source arranged for the week or two of measurements required. This may include solar power and in some instances additional secure enclosures if the site is otherwise open.

4) The pass-by data would need to be analysed against the requirements of NS8176E and a brief report prepared that sets out the measured vibration levels and confirming whether the vibration levels in the proposed noise sensitive activity would be less than 0.3mm/s V_{w95}.

Based on my experience, the cost of an initial road vibration assessment would be in the order of $3k to $4k +GST. There are few consultants with the necessary equipment and expertise to do this work in New Zealand, so it is likely that many assessments would be completed by consultants from outside the region.

The cost of a rail vibration assessment would be considerably greater given the likelihood that the assessment period would be for at least a week and probably longer. I estimate that the cost of a rail vibration assessment would be in the order of $5k to $8k +GST, and possibly more if security, solar panels and extensive travel is required.

If the vibration assessment demonstrates that the vibration level in the proposed noise sensitive activity will be greater than 0.3mm/s V_{w95}, the options for the applicant would generally be:

1) Isolate the building from the ground vibration by using base isolation techniques. My experience is that the cost of this treatment would typically be $100k +GST for a single-level dwelling on top of the cost of the build itself.

2) Build a larger building from heavy masonry construction. The additional mass of the structure (compared to a lightweight structure) would assist in reducing the vibration level inside the noise sensitive activity. This option is high-risk and, in my experience, high-cost compared to normal dwelling construction methods and materials.

3) Abandon the proposal due to cost. In my experience, this option is commonly adopted when applicants find out the true cost and difficulty of dealing with the vibration issues.

In my experience, option (3) above is often found to be the only viable option.

In some cases, the applicant has only found out the implications of the vibration controls after resource consent has been granted. The vibration assessment might be required by a condition of consent to be addressed before the building is occupied. By the time the vibration survey has been undertaken and results provided, plans to build are well underway and construction has started in some cases. My experience is that this has lead to the abandonment of the development in some cases and significant financial losses.