



Report pursuant to s42A Resource Management Act 1991

In the matter of:	A Notice of Requirement to construct and operate a new intermodal rail and freight hub on land between Palmerston North and Bunnythorpe
And:	A hearing by Palmerston North City Council pursuant to s100A
Requiring Authority:	KiwiRail Holdings Ltd
Hearing date:	9 August 2021

S42A Technical Evidence: Noise

By: Nigel Lloyd

1 Executive Summary

1. I have been asked by Council to assess the noise elements of the NoR.
2. KiwiRail seeks to designate approximately 177.7 hectares of land for marshalling yards, freight handling and storage facilities (including logs and bulk liquids). One of the issues with an acoustic assessment for this NoR is the unknowns associated with the exact nature of the activities and when and where they will be developed.
3. Noise and vibration issues arise from road traffic, construction activities and the operational activities.
4. Residents describe the existing environment as a *relatively quiet rural environment* which is mostly supported by the environmental noise monitoring.
5. The closest dwellings on the western side (Te Ngaio Road, Clevely Line) will experience an increase in road traffic on the new Perimeter Road where no road traffic previously existed. There is likely to be a high percentage of heavy traffic on this road. Noise mitigation measures include a "*stone mastic asphalt*" road surface and acoustic barriers. The acoustic barrier is shown on the boundary of the designation as it passes Te Ngaio Road but not on the opposite side of the new Perimeter Road as it passes Clevely Line. I recommend that the proposed noise barrier should screen dwellings from the noise of heavy vehicles on the new Perimeter Road.
6. Construction noise is to be measured, assessed and controlled by reference to NZS 6803:1999. Construction activity involves the use of heavy construction equipment for bulk earthworks over a three year period plus three years for the construction of Stage 1. There will be further construction for Stage 2 (2040) and Stage 3 (2050). This will represent a major change to the aural environment that is currently enjoyed by the people in this area.
7. No predictions have been made of construction noise, and 50 metres and 200 metre *buffer* areas have been developed based on *experience with comparable works on numerous other projects*. Buffer areas are normally empty tracts of land that are used to buffer noise sensitive neighbours but, in this case, there are dwellings inside the buffer area. Some of these dwellings may be exposed to noise levels that exceed the construction standard noise limits but there is no indication where or when this might occur.

8. Care needs to be taken that high construction noise does not become a regular feature at any noise sensitive location. The Acoustic Assessment identifies that *enhanced mitigation* might be required to maintain compliance with the construction noise and vibration limits but does not go into any detail on any of these measures or of the timing or their practicality.
9. Heavy vehicles associated with construction works will be significant and are difficult to control on the surrounding road network. Amended condition 57(a) seeks to do this by limiting numbers of heavy vehicles through key areas at night, but provides no guidelines around how this would be achieved.
10. The Acoustic Assessment considers that it is practicable for construction works to be undertaken during daytime only. This would limit the hours for noisier equipment to 7.30 am to 6.00 pm. If this is really intended, then, to remove any doubt, these hours of construction activity should be included in a condition. Given the size and the scale of this project, though, I anticipate that there would be pressure from earth moving contractors to operate on the fringes of daytime hours (especially during the summer months), and this might be possible while still meeting the noise limits in the construction noise standard (NZS 6803). This could shorten the overall duration of the construction works. There have been no predictions made in the Acoustic Assessment regarding construction noise, and this would need to be done if construction work was to be undertaken outside of daytime hours.
11. There are no predictions of construction vibrations or if and when the limits might be exceeded.
12. The Acoustic Assessment of the Freight Hub identifies that operational noise emissions will be a significant impact for the neighbours to the designation. No noise monitoring has been made of freight train marshalling and assembly, and further requests have been made for this information to determine if impact noise will cause sleep disturbance. This information is to be provided by KiwiRail as part of their evidence.
13. The Acoustic Assessment derives noise criteria specifically for the Freight Hub which are significantly less stringent than the District Plan Rural Zone limits. Category A criteria are claimed to be similar to the North East Industrial Zone noise limits except that penalties for special audible characteristics (such as bangs and squeals) are not applied when assessing any of the Categories.

Any noise with special audible characteristics will be more intrusive than noise without, and more likely to cause sleep disturbance.

14. A Noise Management Boundary is proposed by Dr Chiles that approximates (and smooths) the modelled 55 dB $L_{Aeq(1h)}$ noise contour. This is the daytime criteria for the derived Category C criteria in the Acoustic Assessment.
15. If the Category C criteria are exceeded, then (according to the Acoustic Assessment) *"Freight Hub noise is likely to be incompatible with residential activity"*. The night-time (10pm to 7am) Category C criteria are 55 dB $L_{Aeq(1h)}$ and 85 dB L_{Amax} .
16. There is some uncertainty in the Acoustic Assessment regarding how night-time noise will differ from daytime noise but, given the Freight Hub is proposed to operate 24/7, a worse case assessment would assume that a busy one hour would occur at night.
17. If that happened, then all of the dwellings located between the Noise Management Boundary (representing 55 dB $L_{Aeq(1h)}$) and the Designation Boundary would exceed the night-time Category C criteria and would be exposed to noise that is *likely to be incompatible with residential activity*. The range of Freight Hub noise levels modelled between the Noise Management Boundary and the boundary of the designation is predicted to be 55-65 dB.
18. The difference between the outside 55-65 dB $L_{Aeq(1h)}$ and the recommended bedroom criterion of 35 dB $L_{Aeq(1h)}$ is a reduction of 20-30 dB, which, ordinarily, is achievable with noise insulation and ventilation (to be able to keep windows closed). However, the noise will contain special audible characteristics and dwellings are currently located in mostly quiet semi-rural settings. The special audible characteristics penalty of 5dB should be added to the outdoor noise limits to ensure that the noise insulation performs effectively against that type of noise. As such, the retrospective fitting of noise insulation to dwellings inside the Noise Management Boundary is at the upper end of what is practicable. For those reasons, I agree with the Acoustic Assessment that dwellings located within the proposed Noise Management Boundary will be exposed to noise that is *generally incompatible with residential activity*.
19. There is a significant number of dwellings that will be exposed to unacceptably high levels of noise (that will not be able to be mitigated), and other dwellings that will receive lower noise levels but will need noise insulation and/or

ventilation to mitigate the noise to acceptable levels in bedrooms. Because of this, I suggest that as a minimum:

- a. noise limits be established as conditions so that:
 - Anywhere beyond the Designation Boundary, noise levels will not exceed 65 dB $L_{Aeq(1h)}$ (The daytime Category C criterion), and
 - Anywhere beyond the Noise Management Boundary, noise levels will not exceed 55 dB $L_{Aeq(1h)}$ and 85 dB L_{Amax} .
- b. Between the Designation Boundary and the Noise Management Boundary, KiwiRail should be responsible for installing noise mitigation in dwellings to achieve internal night-time noise levels in bedrooms of 35 dB $L_{Aeq(1h)}$ and 65 dB L_{Amax} .

20. The Multi Criteria Analysis identified that the current proposed designation site is close to the residential area of Bunnythorpe and to other residential properties, and mitigation measures were identified as including the designation and purchase of houses to the east of the site. I consider that this would have been the correct approach, but there is no follow through or explanation available as to why it was disregarded as an alternative configuration of the designation boundaries. I consider the Acoustic Assessment to be deficient because it has not been consistent in its approach to these dwellings, and I consider that the designation should have been extended over significantly affected properties. A larger designation would have provided landowners with legal opportunities to require KiwiRail to purchase their dwellings and prevented the further establishment of inconsistent land uses.

21. The Acoustic Assessment prescribes 5 metre high noise barriers to the east of the designation and 3 metre high barriers to the north (adjacent to Maple Street), and these have been included as noise management plan requirements. Land to the east of the designation is elevated above the finished ground level of the Freight Hub with the cross-sections provided as part of a Response to the s 92 Request indicating that these barriers will not effectively screen all dwellings. The noise barriers next to Maple Street will not effectively screen the upper storeys of dwellings. I consider that there needs to be some design input to optimise local barrier heights, rather than a blanket prescription.

22. No mention is made in the amended conditions of the size and locations of barriers along the western boundary, which is particularly relevant for dwellings on Te Ngaio Road and Clevely Line.
23. I have read the submissions regarding noise. Many of the submitters raise concerns about the noise and vibration impacts that will result from each aspect of the proposal. A proposal of this scale will inevitably have significant noise impacts on the semi-rural nature of this area. There are concerns about the lack of certainty in the Acoustic Assessment regarding the best level of mitigation for construction and operational noise, the timing of the instigation of any mitigation and who will be responsible for it.
24. The Mid Central Health Board submission seeks for the penalty for special audible characteristics to be applied. The submission seeks for an assessment to be made in accordance with NZS 6802:2008. This would result in the modelled contours increasing by 5 decibels e.g. the 55 dB $L_{Aeq(1h)}$ contour would become the 60 dB $L_{Aeq(1h)}$ contour.
25. Mid Central Health Board makes a compelling submission in this regard. I have tentatively accepted the approach taken by the Acoustic Assessment while recognising that the predicted noise levels will be more intrusive than they imply. The modelled levels need to be increased by 5 decibels when calculating the level of noise insulation for noise sensitive activities.
26. This submitter identifies the Acoustic Assessment's claim that it adopts the "conservative or worst case" is not supported by its approach, where it omits consideration for special audible characteristics.
27. I consider that the amended conditions offered by KiwiRail are deficient because:
- a. They do not offer noise or vibration limits for the construction or operational activities within the designation,
 - b. They do not establish appropriate internal noise levels for noise sensitive activities, other than dwellings,
 - c. They do not establish noise mitigation measures (other than barriers) for significantly affected dwellings or the process for providing the noise mitigation, including who should pay for it,

- d. The height of the barriers does not accommodate local variations and may not be appropriate at all locations and they do not describe the barriers on the west side of the designation.
- 28. I have suggested the nature of noise conditions that I consider should be included in an NoR of this type (as Appendix A) and which I consider would remedy some of these deficiencies with the Acoustic Assessment. The suggested conditions are not precisely drafted.

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2 Introduction

29. My full name is Nigel Robert Lloyd. I have a degree in mechanical engineering gained at the University of Wales University College Cardiff in 1976.
30. I am an acoustical consultant with Acousafe Consulting & Engineering Limited, a position I have held for 36 years. Prior to my current position, I was employed by the Industrial Acoustics Company in the UK as an acoustical consultant between 1977 and 1980 and then spent five years as the Department of Labour noise control engineer in New Zealand, advising the safety inspectorates on occupational noise management and control. I have a total of over 40 years' experience as a noise control engineer/acoustical consultant.
31. I have prepared this evidence on behalf of the determining authority, Palmerston North City Council, in relation to the Notice of Requirement ("**NoR**") for the KiwiRail Regional Freight Hub ("**the Freight Hub**") lodged by KiwiRail Holdings Ltd ("**KiwiRail**"). I understand that my evidence is prepared under section 42A of the Resource Management Act 1991 ("**the Act**").
32. I am a Member of the Acoustical Society of New Zealand and the Association of Australasian Acoustical Consultants and I have completed 'Making Good Decisions' courses.
33. I have advised Council on a range of noise matters since the early-1990s and I gave advice at that time on noise issues for the District Plan. I have advised Council on noise matters pertaining to their latest round of Sectional District Plan reviews including identifying the noise issues for the North East Industrial Estate and the extension and for the Rural Zone. I advised Foodstuffs on the consenting process for their North Island Distribution Centre on the corner of Railway Road and Roberts Line and similarly I advised DKSH NZ Ltd for their Head Office and Distribution Centre on Railway Road. I advised Higgins Family on the establishment of a Workshop and Office close to Railway Road which included undertaking an assessment of the noise from the North Island Main Trunk (NIMT) Railway Line. This included rail noise matters and reverse sensitivity issues for the District Plan.
34. KiwiRail has sought to include reverse sensitivity land use management controls into the District Plan including setbacks from railway lines and the

provision of noise insulation for new noise sensitive activities on land that is deemed to be adversely impacted by railway noise.

2.1 Expert Witnesses – Code of Conduct

35. I confirm that I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that except where I state I am relying on information provided by another party, the content of this evidence is within my area of expertise.

3 Background and Scope of Evidence

3.1 Background

36. KiwiRail is seeking to designate approximately 177.7 hectares of land between Palmerston North Airport and Bunnythorpe for a new Regional Freight Hub.
37. The Freight Hub will consist of a centralised hub incorporating tracks, marshalling yards, maintenance and service facilities, a train control and operation centre, freight handling and storage facilities (including for logs and bulk liquids), provision of access, including road and intersection upgrades where required, and specific mitigation works including noise walls/bunds, stormwater management devices and landscaping. In addition, the NIMT rail line will be relocated to sit within the new designation area and directly adjacent to the Regional Freight Hub. The activities that take place at KiwiRail's Tremaine Avenue freight yard (apart from the passenger terminal and the network communications centre) will be relocated to the new site to form part of the new Regional Freight Hub.
38. All activities will operate on a 24 hrs per day 7 days per week basis.
39. A detailed description of the Project is set out in 6.3 of the AEE submitted by the applicant and a summary description in section 3 of the s42A Planning Assessment.

3.2 Scope of evidence

40. I have been asked to assess the noise elements of the NoR. My assessment considers the following matters:

- a. Key issues in contention.
- b. The statutory context.
- c. An overview of the existing aural environment.
- d. Adequacy of the applicant's investigations and interpretation of the findings of those investigations.
- e. Likely key effects (positive and adverse) on the environment of allowing the Project.
- f. Appropriateness of any proposed mitigation measures or monitoring.
- g. Submissions relating to noise and vibration.
- h. Any other matters.

3.3 Reports and material considered

41. As part of preparing this statement of evidence, I have read the following reports and documents:
 - The Assessment of Environmental Effects ("**AEE**");
 - Acoustic Assessment by Chiles Ltd dated 23 October 2020 (Technical Report D of the AEE) ("**the Acoustic Assessment**");
 - Specialist Assessment – Noise and Vibration Criterion – Palmerston North Region Multi Criteria Analysis and Decision Conferencing Process (Appendix F5 of the AEE);
 - Response to Requests for further information relating to noise and vibration dated 12 February 2021;
 - Appendix B of KiwiRail's response to a request for further information under Section 92– The updated NoR Conditions ("**the Response**"); and
 - The Third Section 92 Response dated 28 May 2021 (**The Third Response**).

3.4 Assumptions

42. No assumptions have been made in my evidence, and I do not agree with some of the assumptions that have fed into the Acoustic Assessment, which I

address later in my evidence. This includes the impact on residential amenity of operational noise and the lack of any assessment of the noise from night-time train marshalling.

3.5 Site visit

43. I undertook site visits on 18 February 2020 and 2 November 2020 and, as explained above, I am familiar with the surrounding environment.

3.6 Statutory Context

44. The statutory documents and provisions relevant to the evaluation of the NoR have been set out in the s42A Planning Assessment. For the purposes of preparing this evidence, I have had regard to the Palmerston North City Council District Plan with the objectives and policies for the various zones within the NoR and, particularly, the relevant noise rules. The District Plan is guided by the current version of NZS 6802.¹
45. The southern portion of the NoR is zoned North East Industrial but is land that has yet to be developed. The Foodstuffs Distribution Centre is the northernmost development within the North East Industrial Estate (corner of Railway Road and Roberts Line). Nearly all of the northern portion of the NoR is rural zoned except for a number of residentially zoned sections at the extreme northern end on Maple Street (see Figure 1).

¹ NZS 6802:2008 Acoustics - Environmental noise.

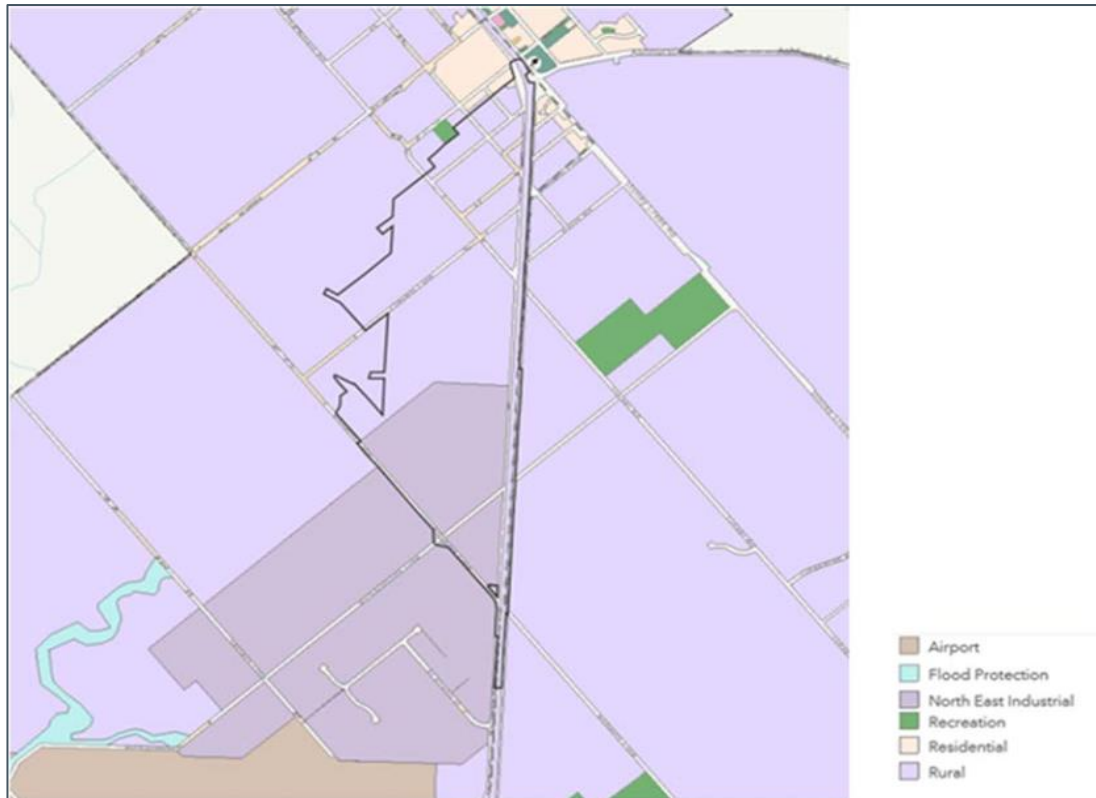


Figure 1. Site Zoning (Source Fig 5-5 of the AEE)

46. The Rail Freight Hub represents a major industrial development on land that is currently *greenfield*. There are no National Environmental Standards for environmental noise for railyards. New Zealand Standard NZS 6802:2008 (1.2.2) provides for sound from railyards *not attributable to vehicles on rails...* to be within the scope of the Standard. There is no separate New Zealand Standard for the management of rail-yard noise per se (as there is for ports, wind-farms and airports).

4 Existing Environment

47. The site is nearly 3 kilometres long from north to south and the sound environment varies over that distance. The zoning of the site to the south (NEIZ) gives a lesser expectation of the level of protection neighbours would receive than land to the north (which is mostly rural zoned).
48. The Acoustic Assessment² usefully includes comments from residents living near the site that, while they recognise the noise of passing trains and road traffic, they consider the area to be a *relatively quiet rural environment*. This

² Section 3 of the Acoustic Assessment.

experience is mostly supported by the environmental sound monitoring reported in the Acoustic Assessment.

49. Observation of the long-term monitoring shows a relatively normal diurnal sound variation with, often, quiet night-time levels between midnight and 6am and with daytime sounds being influenced by peak hour traffic. The graphs in Appendix A of the Acoustic Assessment tend to show some correlation between occasional night-time events at the different (widely spaced) sites which are likely to be passing trains. This is a single event on the night it occurs and does not occur on every night.
50. The Acoustic Assessment provides useful monitoring of local sound levels. The site is outside the Palmerston North Airport Airnoise contours and no closer than about 1 km to the flight path. Aircraft sounds are generally distant at any dwelling likely to be impacted by Freight Hub noise.
51. As identified in 45 and Figure 1 above, the southern part of the site is Industrially Zoned, albeit with no industrial development currently underway.
52. The District Plan noise limits for the North East Industrial Zone³ are the maximum guideline limits from NZS 6802:2008 of 55 dB LAeq(15min) day, 50 dB LAeq(15min) evening and night-time 45 dB LAeq(15min) and 75 dBA Lmax. These apply at or within the boundary of any land in the Rural or Residential Zone.

5 Data Collection and Assessment Techniques

5.1 Monitoring of the Existing Environment

53. Monitoring of the existing environment is described in the Acoustic Assessment.⁴
54. There were no train pass-byes on the NIMT during the attended measurements that took place. Mention is made of two train pass-byes: one occurring just before the day measurement and one just after the night measurement (as I interpret the Acoustic Assessment) at 672 Roberts Line. No LAeq measurement

³ Rule R12A.10.1

⁴ Section 3 of the Acoustic Assessment.

seems to have been made of either of these pass-byes and only the L_{Amax} is reported as 79 dB and 82 dB at 672 Roberts Line.

55. Otherwise, only general sound recordings were made of existing road noise and existing rail noise, and no measurements were made of existing vibration levels.
56. The footnote to Table 2 in the Acoustic Assessment indicates that attended measurements were made generally between 5 and 10 minutes "*to obtain stable readings*". I would consider 5 minutes to be too short a duration for ambient sound monitoring, particularly where no long-term unattended monitoring was being undertaken (as was the case for 672 Roberts Line). There is no indication in the Acoustic Assessment where the monitoring was undertaken at 672 Roberts Line, but the property is more than 100 metres from the NIMT and Railway Road.

5.2 Operational Noise Forecasting

57. Computer modelling has been undertaken of noise generated by operational activity to predict indicative sound levels at nearby properties.
58. Modelling has been undertaken using recognised computer software using an appropriate algorithm⁵.
59. Further Information Request 21⁶ sought noise measurements or predictions for shunting rolling stock (including short term impulsive noise of the freight wagon couplings on small shunts) and starting and stopping noise of assembled trains.
60. The Response from Chiles Ltd stated that *no trains were observed being assembled so sound levels are not available*. I consider that it is paramount that noise monitoring be undertaken of train assembly and that the predictions and assessment are deficient without them. I appreciate that braking noise is included in the modelling, but I consider that it is important to know how much noise will be involved in shunting trains and consider that this aspect of the noise should have been included in the noise modelling given that a prime reason for the NoR is train marshalling.

⁵ ISO 9613-2:1996 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation

⁶ Issued December 2020

61. A subsequent request was made⁷ for monitoring of train assembly noise and advice sought on whether any impact noise associated with train assembly is likely to impact on sleep at night.
62. The Third Response (Question 11) opines that the noise contours are dominated by locomotive noise and that explicit inclusion of train assembly is not anticipated to materially alter noise contours. An additional survey is being arranged, though, to capture this specific source. The results are going to be provided in evidence. This survey should be designed to demonstrate whether short term impact noise will cause sleep disturbance beyond that modelled using noise contours, i.e. using a short term descriptor of any impulsive noise, such as L_{Amax} .
63. I cannot review this information at the time of writing this evidence.

5.3 Proposed Noise Criteria

64. Section 4 of the Acoustic Assessment discusses the various noise criteria in the District Plan (Table 3) and compares these to Port and Airport noise criteria (Table 4). The Acoustic Assessment then formulates its own noise criteria (Table 5).

Table 5 – Proposed Freight Hub noise criteria		
	Noise criteria	Comments
Category A	Day: <55 dB $L_{Aeq}(1h)$ Evening: <50 dB $L_{Aeq}(1h)$ Night: <45 dB $L_{Aeq}(1h)$ Night: <75 dB L_{AFmax}	Similar to existing noise allowed from the NEIZ. A change from existing Rural Zoned activity (R9.11.1), but noise would remain compatible with residential activity in both rural and residential zones.
Category B	Day: 55-65 dB $L_{Aeq}(1h)$ Evening: 50-60 dB $L_{Aeq}(1h)$ Night: 45-55 dB $L_{Aeq}(1h)$ Night: 75-85 dB L_{AFmax}	Houses may need to be acoustically treated and mechanically ventilated as necessary to meet a level of 35 dB $L_{Aeq}(1h)$ in bedrooms and 40 dB $L_{Aeq}(1h)$ in other habitable spaces.
Category C	Day: >65 dB $L_{Aeq}(1h)$ Evening: >60 dB $L_{Aeq}(1h)$ Night: >55 dB $L_{Aeq}(1h)$ Night: >85 dB L_{AFmax}	Freight Hub noise is likely to be incompatible with residential activity.

Figure 2. Table 5 from the Acoustic Assessment

⁷ On 7 May2021.

65. Table 5 provides for three different categories of noise which I consider need to be analysed.
66. The Category A criteria are numerically the same as the Guideline Residential Upper Noise Limits recommended by NZS 6802:2008. These criteria are generally numerically five decibels less stringent than the District Plan noise limits for the Rural Zone.
67. Category B criteria provide for noise levels numerically 5-15 decibels greater than the District Plan noise limits allow. Table 5 comments that houses may need to be acoustically treated and mechanically ventilated as necessary to meet a level of 35 dB $L_{Aeq(1h)}$ in bedrooms and 40 dB $L_{Aeq(1h)}$ in other habitable spaces. No mention is made of outdoor amenity.
68. Category C criteria are 15 decibels or more above the District Plan Rural Zone noise limits and Table 5 comments that residential activity is incompatible with this noise.
69. These three sets of criteria are subject to the following dispensations:
- a. Trains on the new NIMT alignment within the designation will be excluded;
 - b. Vehicle noise on the Perimeter Road is excluded;
 - c. The criteria apply at the notional boundaries⁸ of houses existing at the date of the NoR (rather than at or within other site boundaries as in the District Plan);
 - d. No corrections for special audible characteristics are to be applied.
70. Normally, if there are special audible characteristics present in the sound of interest, then NZS 6802:2008 provides for that sound to be penalised by up to 5 decibels. Special audible characteristics are tonal sounds, such as brake squeal or the hum of a blower, and impulsive sounds such as crashes and bangs. These special audible characteristics are assumed to be inherently part of noise from the Freight Hub activities and, following that reasoning, no penalty for special audible characteristics is to be applied. It should always

⁸ The notional boundary is defined in NZS 6802:2008 as a line 20 metres from any side of a dwelling, or the legal boundary where this is closer to the dwelling.

be remembered, though, that this effectively causes the assessed noise level to be 5dB less stringent than a straight assessment using NZS 6802:2008 would provide and if special audible characteristics were to be penalised.

71. Because the Freight Hub operates on a 24/7 basis, the night-time (10pm to 7am) criteria of each Category becomes the defining factor. The 45 dB $L_{Aeq(1h)}$ contour, which represents the Category A night-time limit, extends for a distance of approximately 900 metres from the boundary of the designation towards the west, south and east.

5.4 Noise Descriptors

72. The noise descriptors chosen for the operational noise assessment are $L_{Aeq(1h)}$ and L_{Amax} .
73. $L_{Aeq(1h)}$ - this descriptor was selected primarily because it is used by KiwiRail to manage the noise of passing trains. L_{Aeq} is the energy averaged noise level which requires an averaging duration, in this case one hour. Different activities tend to be averaged in different ways, with road noise averaged over 24 hours (during which the diurnal variations of road noise are assumed) and airports using L_{dn} , which is the day/night averaging level for which the night-time noise is penalised by 10 decibels. Airports are often averaged over a 3 month period. To be successfully assessed in the long-term, an activity must be fairly similar in its day-to-day activities otherwise high levels of short term noise tend to be averaged out over the longer term. Care needs to be taken when averaging night-time noise where sleep disturbance is the issue. Night-time $L_{Aeq(15min)}$ levels are not otherwise averaged when assessed using NZS 6802:2008.
74. The averaging time for individual measurements used in the District Plan is 15 minutes.⁹ During the daytime (7am to 7pm), averaging of individual measurements is provided for by NZS 6802:2008 over the daytime-duration within limits. No averaging is allowed at night. The District Plan noise limits in the Rural Zone, the Residential Zone and the North East Industrial Zone (for properties outside the Zone) all apply at other site boundaries.

⁹ The District Plan (R.6.2.4) noise limits are assessed in accordance with NZS 6802:2008 *Acoustics – Environmental Noise*

75. This allows the spill of noise contamination onto adjoining land to be assessed and provides the ability to also assess the consequences of that contamination in the event that it is inevitable.
76. The Acoustic Assessment for the Freight Hub determines that noise will inevitably contaminate surrounding land and will expose residents of dwellings to noise levels that will exceed District Plan noise limits and the maximum guideline limits recommended by NZS 6802:2008.
77. L_{Amax} is the maximum (fast weighted) noise level at any time and is not averaged. L_{Amax} is utilised at night to measure and control short term impulsive noise (crashes and bangs) that can cause sleep disturbance and which are not well assessed and controlled using $L_{Aeq(1h)}$ (which averages the noise over one hour).
78. The perception of the change in sound levels is often described as follows:
- | | |
|---------------------------|------|
| Imperceptible Change | 1dB |
| Barely Perceptible Change | 3dB |
| Clearly Noticeable Change | 5dB |
| About Twice as Loud | 10dB |
79. Noise Impact Assessment Noise can be thought of as unwanted sound. The effects of environmental noise are usually expressed in terms of:¹⁰
- annoyance;
 - speech interference - high levels of noise can make normal speech difficult to hear;
 - performance - some noises can make concentration difficult and interfere with tasks such as learning, checking fine details (such as any job with a large mathematical component or where the meaning of words is critical) or work where small, precise, movements or intense concentration is required;
 - mental health (including noise-induced stress-related effects);

¹⁰ <https://qualityplanning.org.nz/node/799>

- sleep disturbance - in addition to fatigue and mental health effects, disrupted sleep patterns can leave people irritable, change their behaviour, and reduce their ability to work or perform tasks.

5.5 Road Traffic Noise

80. The AEE considers the transportation effects in terms of a staged approach, with the base year being the Freight Hub build at 2031 as a first stage of development and the full buildout at 2051.
81. The Acoustic Assessment has undertaken an assessment for the new Perimeter Road on the nearest affected house at 245 Te Ngaio Road. Based on a future (2031) scenario.¹¹ The modelling assumes a low noise surface (stone mastic), although there is no control or current indication of what surface would be used.¹²
82. The closest dwellings on Te Ngaio Road, Clevely Line and Maple Street will experience an increase in road traffic noise from the busy Perimeter Road where no noise previously existed. A noise barrier will be constructed between the Perimeter Road and Maple Street and it seems reasonable to provide for the barrier to screen other dwellings from the Perimeter Road noise (at Clevely Line and Roberts Line).
83. Table 13 of the Acoustic Assessment discusses the future change in road traffic noise. The main increase in noise will result from the increased use of these roads by trucks. Truck noise could increase by up to 350% on forecast volumes in 2031 as a result of the Freight Hub's operation. The forecasts are based on future 2031 volumes with and without the Freight Hub, and no assessment has been made based either on current or 2041 volumes.

5.6 Construction Noise Effects

84. The main construction effects will be associated with the preparation of the site prior to any operation commencing. This work will involve heavy earthmoving equipment over a large area of the site and will take approximately three years to complete.

¹¹ Page 29 of The Acoustic Assessment.

¹² Response to Request 17.

85. I agree with the Acoustic Assessment that NZS 6803¹³ is the appropriate standard for establishing noise criteria and managing construction noise.
86. The long-term construction activity will generate noise that will represent a qualitative change in aural environment for the neighbours to this designation.
87. The Acoustic Assessment¹⁴ discusses that it is sometimes impracticable for large infrastructure projects to fully comply with the long-term noise criteria set out in NZS 6803.¹⁵ On page 31 and in Figure 10, the Acoustic Assessment identifies "buffer distances" of 50 metres and 200 metres from the NoR boundary. *Buffer distances* are normally taken to be land that should remain undeveloped to prevent noise impacting on dwellings, but, in this case, it identifies areas within which the people in houses may be affected by construction noise and vibration to some extent. The report goes on to state that compliance with the noise and vibration criteria will generally be achieved using standard practices.
88. The "buffer" distances of 50 and 200 metres are approximate distances which, according to the Acoustic Assessment, *are based on experience with comparable works on numerous other projects*¹⁶. No calculations or modelling has been undertaken for construction works and no noise or vibration levels predicted.
89. In the foreword to NZS 6803, it is recognised that construction noise usually cannot be kept within limits specified by NZS 6802:1999.¹⁷ Given that construction noise is an inherent part of the progress of society, it considers that construction noise, while undesirable, is not necessarily unreasonable when all the relevant factors are taken into consideration. One of the assumptions made in NZS 6803 is that construction projects are generally of limited duration and that people and communities will usually tolerate a higher noise level provided it is no louder than necessary and occurs within appropriate hours of the day.
90. In the case of the Freight Hub, construction noise levels will be generated over at least three years for the bulk earthworks plus three years for the construction

¹³ New Zealand Standard NZS 6803:1999 Acoustics – Construction Noise.

¹⁴ At the top of page 22.

¹⁵ The long term NZS 6803 criteria are set out in Table 7 of the Acoustic Assessment.

¹⁶ Page 31 of the Acoustic Assessment.

¹⁷ Now superseded by NZS 6802:2008 Acoustics – Environmental Noise.

of Stage 1.¹⁸ There will need to be further construction for Stage 2 (2040) and Stage 3 (2050).

91. While this construction activity may be spread over a wide area, care should be taken that construction noise does not become regular at any one location, should haul roads pass close to dwellings, for example. NZS 6803 allows up to 70 dB L_{Aeq} to be generated at dwellings, and this would be an issue for the community if noise was to reach that level consistently over many years. The areas that are particularly vulnerable have been identified by the Acoustic Assessment at Figure 3 below.
92. It is not totally clear exactly which dwellings are included in the "buffer areas" shown in Figure 3, but my assessment is that the 50m buffer includes:
- AREA 1 – All dwellings fronting Maple Street,
- AREA 2 – Dwellings within 50 metres of the boundary on Te Ngaio Road (241, 242 and 245 Te Ngaio Road),
- AREA 3 Clevely Line and Roberts Line - 163 Clevely Line, and dwellings on Roberts Line south of Clevely Line,
- AREA 4 – Dwellings fronting Sangsters Road and Nathan Place (9, 15, 25, 27, 43, 59, 73, 91, 95 and 111 Sangsters Road and 2, 3, 4, 5, 6, 7, 8 Nathan Place).
93. Significantly more dwellings will experience adverse construction noise further afield (up to 200 metres in the Acoustic Assessment).
94. These buffer distances have been "approximated" in the Acoustic Assessment based on "experience with comparable works on numerous other projects".¹⁹ The Acoustic Assessment recognises that "enhanced mitigation" might be required to maintain compliance with construction noise and vibration criteria for houses within 50 metres of the Designation extent. There is no indication of what these enhanced mitigation measures might be, when they would be determined, or who would be responsible for them.
95. No noise modelling or predictions have been undertaken for the dwellings situated in the 50-200m construction noise "buffer". The Acoustic Assessment is silent on whether any mitigation is required for these dwellings or whether the

¹⁸ Page 22 of the Design, Construction and Operation Report.

¹⁹ Page 31 of the Acoustic Assessment.

sequencing of the noise mitigation measures proposed should take these properties into account, e.g. whether noise barriers should be constructed prior to construction works commencing.

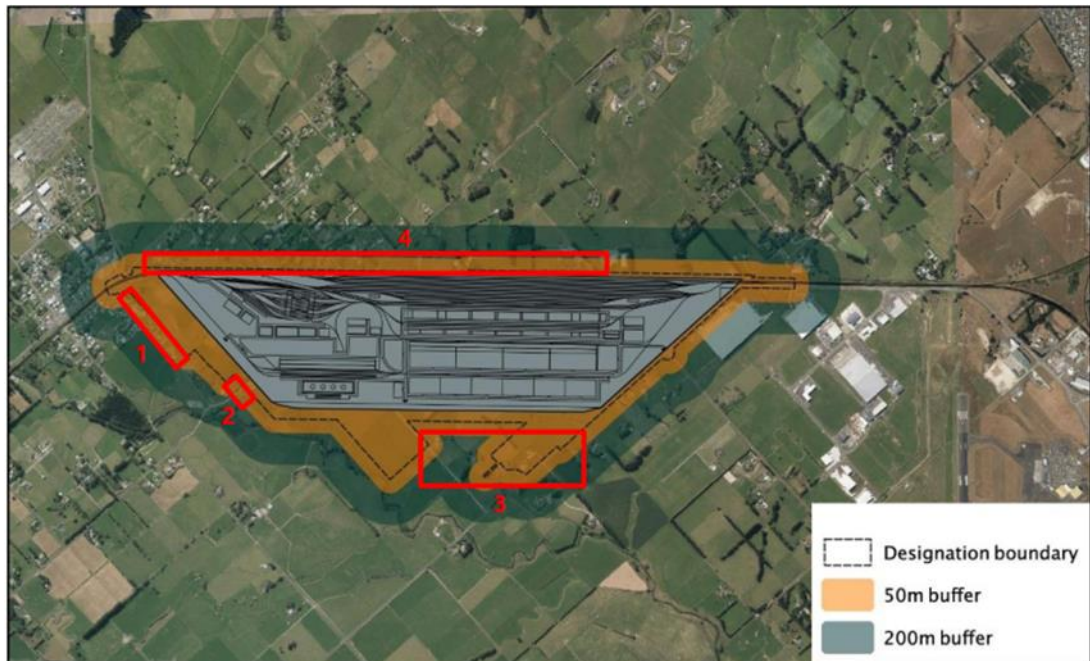


Figure 3. Areas Significantly Impacted by Construction Noise (ref Fig 11 of the Acoustic Assessment)

5.7 Construction Vibration Effects

96. The Acoustic Assessment predicts that houses within 50 metres of construction works may be affected by construction vibration to the extent that "*enhanced mitigation*" might be required to maintain compliance with construction noise and vibration criteria.²⁰ It is not clear from the Acoustic Assessment what "*enhanced mitigation*" would involve if vibration levels were to exceed the criteria at houses near to the construction works.
97. The construction activities most likely to cause vibration issues are identified as *rock removal (breaking blasting)*, *driven piling and compaction*.²¹ There is no indication if or where such construction works would be required.
98. The Acoustic Assessment relies on construction vibration criteria for vibration control and I recommend that such criteria be included in the NoR conditions.

²⁰ Page 31 of the Acoustic Assessment.

²¹ Page 22 of the Acoustic Assessment.

5.8 Operational Noise Effects

99. The noise from the Freight Hub will inevitably exceed reasonable criteria for the nearest dwellings, and if the Freight Hub designation is confirmed, successful management of those adverse noise impacts will be critical in my opinion. The important components of such a management programme are to:
- a. Establish the likely maximum noise emissions from the proposed rail/industrial activities;
 - b. Establish which parts of surrounding land will be adversely impacted by noise (cumulatively with other adverse effects);
 - c. Identify the appropriate noise mitigation measures on and at the boundaries of the NoR;
 - d. Provide for noise mitigation measures for land outside the designation that will be impacted by Freight Hub noise.
100. There are complicating factors with this approach. Firstly, the NoR provides for the site to be designated for rail/industrial use and that use will develop into the future. It is important that any conditions associated with the NoR provide limits on the levels of noise that can be generated. Limits give some certainty about what level of off-site noise mitigation (such as noise insulation) is required. In my recent experience of a designation,²² an aspect of noise was not regulated, which in turn made it difficult for stakeholders to agree on the level or extent of noise management required in surrounding areas.
101. I do not agree that reliance can be placed solely on a noise and vibration management plan to limit noise (and vibration) into the future (as currently proposed by the Requiring Authority), although such a plan could form an integral part of a noise management regime.
102. The premise of the Acoustic Assessment is that the future operation of the Freight Hub will require further measurement and modelling to determine actual noise emissions at different points in time. The current Acoustic Assessment is virtually a placeholder for future assessments to take place

²² Proposed Auckland Council Whenuapai 3 Precinct and the issues with aircraft engine testing noise.

during the development of the Freight Hub. This is unsatisfactory because the adverse noise impacts of the project need to be understood as part of the NoR process and appropriately mitigated. I would also suggest that additional land management provisions will be needed to prevent unsuitable development from taking place between now and Freight Hub development commencing.

103. For example, development of noise sensitive activities near to the Freight Hub needs to be controlled in the interim, particularly as:
- a. The Freight Hub development will not occur for some time and will continue into the future once it is started,
 - b. There are large tracts of land where dwellings can be developed as permitted activities,
 - c. The noise mitigation as currently mooted in the NoR would only benefit existing dwellings, leaving future dwellings constructed in the interim period, unprotected.
104. To understand the noise impacts associated with the Freight Hub, it is important to place limits on the levels of noise that can be generated to apply sensible controls on what can take place on the site. As currently proposed, there is no limit (noise-wise) on what could be established in the Freight Hub. Such noise limits would signal what future noise levels are to be expected from the Freight Hub and will also allow land use management provisions to be included in the District Plan as a separate process.
105. It is critical, therefore, to establish Freight Hub daytime and night-time noise criteria at established noise boundary locations around the site (which are further from the site than the actual NoR boundary).

5.9 Noise Effects at initial opening (2031) and full build-out (2050)

106. The anticipated Stage 1 of the Freight Hub development²³ is to provide sufficient track and facilities for rail operation to fully demobilise from the Tremaine Ave area. This would involve:

²³ Response #139 dated 15 February 2021 to S92 RFI.

- 2 Arrival/Departure Tracks No1 & No2 both electrified; including 2 setoff tracks
- 12 Marshalling Yard Tracks; tracks 1 to 12. Diesel powered trains will arrive & depart into the Marshalling yard on Tracks 1 & 2.
- 1 Wagon Storage Yard Track; tracks 2 & 4.
- 1 Log Loading Track; Track 2 and storage track
- Container area - pad tracks 1, 2 & 3
- Intermodal track
- Freight forwarding area all tracks but only 50% of primary buildings and 33% of secondary buildings.
- Maintenance facility - all tracks including turning triangle.

107. The Acoustic Assessment does not provide graduated modelling of noise levels at different stages of the development, but the Stage 1 development would represent the primary onset of the predicted noise. The additional noise impacts of subsequent staged developments are likely to plateau with time. This is because the initial onset of the noise tends to cause the greatest impact, with additional activities tending to cause less impact unless they include a particularly noisy activity.

5.10 Operational Noise Assessment

108. The Acoustic Assessment identifies that the noise from the Freight Hub will exceed criteria that would normally be deemed acceptable or reasonable levels by noise insulating dwellings or by any other means. The current modelling indicates that these levels will not be reached, but there is a high level of uncertainty about what noise generating activities will actually take place on this site once the detailed design work commences, whenever that may be. Currently, there is nothing to limit the noise exceeding the Category C criteria.

109. The Acoustic Assessment²⁴ discusses suitable internal noise levels and recommends 35 LAeq(1h) in bedrooms and 40 dB LAeq(1h) in habitable rooms. This

²⁴ Page 38.

is based on KiwiRail Internal Policy Documents. There is the potential for these levels to be stricter,²⁵ but I consider these internal criteria appropriate in the context of dwellings located next to a busy Freight Hub.

110. Because no special audible characteristics are to be applied to the Freight Hub noise, an adjustment of +5 decibels needs to be made to the calculated noise insulation that is determined for any noise sensitive activity.

5.11 Operational Vibration

111. The issues with vibration standards as they relate to New Zealand are usefully canvassed by acoustician James Whitlock.²⁶ This 2010 paper discusses the historical issues between the different international vibration standards. Unfortunately, there is no New Zealand Standard for vibration.
112. The Acoustic Assessment cautions about how a vibration criterion of 0.3mm/s V_{w95} might be met and refers to Norwegian Standard NS 8176:2017. The criterion of 0.3mm/s V_{w95} is Class C in NS 8176, which relates to about 15% of receivers being disturbed by vibration.
113. The Acoustic Assessment indicates that this criterion can be achieved by the new railway line, although no specific assessment of the distances or geology has been undertaken.²⁷ In my opinion, this vibration criterion should be included in conditions and it should apply to the trains on the new alignment of the NIMT.

6 Noise Mitigation

6.1 Construction Noise Mitigation

114. The Acoustic Assessment identifies four areas where construction works in the proposed designation could potentially be closer than 50 metres to houses:

1. Houses on Maple Street;

²⁵ Indoor sound level targets (e.g. World Health Organisation (WHO) sleep protection measures) should be considered when setting both noise limits and acoustic insulation standards. Indoor sound level guideline values set by WHO for bedrooms are 30 dBA Leq for continuous noise and 45 dBA Lmax for single sound events. Standards to reduce noise inside residential dwellings in mixed-use environments could use these as a target. (source <https://qualityplanning.org.nz/node/800>).

²⁶ https://www.acoustics.org.nz/sites/www.acoustics.org.nz/files/journal/pdfs/Whitlock,_J_NZ_A2011.pdf

²⁷ Page 21 of the Acoustic Assessment.

2. Houses on Te Ngaio Road;
3. Around the stormwater retention ponds/wetlands to the west; and
4. At various locations near the east site boundary.

115. These four areas are marked in red in Figure 4 below.

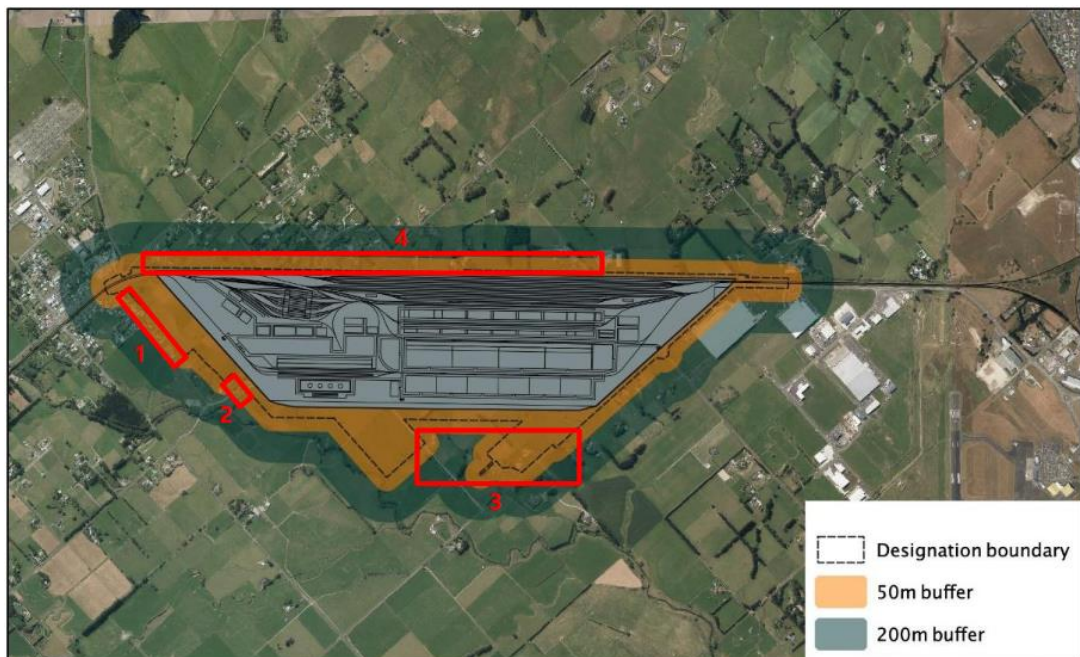


Figure 4. Construction Noise Buffer Areas (Figure 11 of the Acoustic Assessment)

116. It is difficult to ascertain exactly which dwellings are impacted by construction noise from Figure 4 but the Chiles response dated 12 February 2021 provides different sections at 1:5000 scale which provide much greater detail.

Construction Noise Area 1

117. Construction Noise Area 1 is for dwellings on Maple Street. The nearby construction works identified in the Acoustic Assessment are relatively short-term, involving the construction of the permanent noise barrier and associated planting. This work should only occur during daytime.

Construction Noise Area 2

118. For Construction Noise Area 2, the Acoustic Assessment (p34) identifies that a permanent noise wall is recommended on the boundary between the houses on Te Ngaio Road and the new Perimeter Road. The landscape plans (section 3) show two roads proposed for this area. The first is the new Railway Road (or

Perimeter Road) and the second is the Internal Hub Road. An acoustic barrier is shown on the boundary of the designation besides the new Railway Road. I note that the dwelling at 245 Te Ngaio Road has immediate boundaries with the designation on that property's northeast and southeast sides and will experience high levels of construction noise.

Construction Noise Area 3

119. For Construction Noise Area 3, my main concern is with how construction noise will impact on 163 Clevely Line. This dwelling is located in the gap with the stormwater attenuation ponds both to the north and to the south. This dwelling is within the 50 metre "buffer" from the northern stormwater attenuation pond construction works but will also experience noise from construction of the southern pond, the Perimeter Road and the Distribution Facility Building.
120. There are dwellings on Roberts Line that are also within the 50 metre "buffer" zone for the southern stormwater attenuation pond. All of these dwellings are in the Rural Zone. The Acoustic Assessment considers that the earthworks associated with the ponds to be "standard"²⁸. The permitted standard for earthworks in the Rural Zone²⁹ is 1,000 m³ in any 12 month period; therefore, the earthworks on this site will be extraordinary.³⁰ The duration of the earthworks will extend well beyond what would normally be provided for. It will be imperative that temporary barriers be installed and that construction haul roads be carefully located to minimise noise and vibration impacts on neighbours.

Construction Noise Area 4

121. Dwellings on Sangsters Road and Nathan Place are located close to the designation boundary. This area is generally raised above the railway line and Railway Road and it is therefore difficult to mitigate construction (and operation) noise using noise barriers, for example.

6.2 Construction Work at Night

122. The Acoustic Assessment premises much of its findings on construction work being able to be undertaken during the day. This is when construction noise

²⁸ Acoustic Assessment P34.

²⁹ District plan Rule R6.3.6.1(a).

³⁰ AEE 6.3.5 states that the total fill for the earthworks will be of the order of 2,340,000 m³.

levels are relaxed. Night-time noise limits are much stricter and are designed to protect sleep. In my experience, it is a straightforward matter to state that day-time limits will be complied with but can be a different matter when the contractor wishes to take advantage of the fair weather and early daylight in the summer and is often dismayed to discover that the construction noise standards do not allow them to commence their noisier aspects of work until 7.30am and that they cannot work on Sundays and public holidays. This can be an issue when the requirement is to move 2,340,000m³ of earth.

123. In anticipation of the need to work at times other than "daytime" as defined by NZS 6803:1999, I recommend that provision be made for this eventuality, provided that a proper assessment be made of the noise impacts and noise mitigation measures. Compliance will still need to be achieved with NZS 6803 noise criteria as they may otherwise apply.

6.3 Operational Noise Mitigation

124. The primary noise mitigation measures would be returned from the layout and built form of the Freight Hub. This is identified in the introduction of the Acoustic Assessment under "*Project Shaping*". The indicative layout that assists with minimising noise and vibration include:
- a. establishing noisier activities as far south (marshalling yards and container terminal) and west (log yard) on the site as possible;
 - b. designing the warehouse buildings as a continuous built form providing noise screening to the west;
 - c. extending the NoR boundary to allow high noise barriers to be constructed;
 - d. locating the Perimeter Road to reconnect to Railway Road and be screened by the perimeter noise barrier (at Maple Street).
125. It is important that these recommendations flow through into the detailed design and construction of the Freight Hub.
126. One aspect of the noise mitigation that remains unclear is the size and location of the noise barriers and how effective these will be. This uncertainty occurs at two locations:

- a. Sangsters Road, and
- b. Maple Street.

127. Dealing with Maple Street first, Figure 2 shows No.9A Maple Street, which is a two-storey dwelling on a rear section that will be located close to the boundary with the NoR. No.11A Maple Street can also be seen to the right of Figure 2 and is also a two-storey dwelling on a rear section. Because the noise barrier at the rear of these dwellings is 3 metres high, this means that the upper stories of both dwellings will be exposed directly to Freight Hub noise and to noise of traffic on the Perimeter Road. Upper storey rooms are mostly bedrooms. The predicted noise for these dwellings (with the noise barrier) is 49 dB $L_{Aeq(1h)}$ ³¹ but the upper storey noise level is 50-55 dB $L_{Aeq(1h)}$ ³².



Figure 5. No. 9 (& 11) Maple Street

128. The response to s 92 **Request 16**³³ is for further investigation to determine whether Category A criteria would be exceeded and to determine whether acoustic treatment is required. Reference is then made to Technical Report D, page 38 (The Acoustic Assessment). The Acoustic Assessment recognises that additional measures will be required when the Category A criteria are not fully achieved and discusses an investigation of all houses where this is predicted to occur. It also discusses treatment to achieve internal noise levels of 35 dB $L_{Aeq(1h)}$ in bedrooms and 40 dB $L_{Aeq(1h)}$ in other habitable rooms. This is also discussed in the AEE³⁴.

³¹ Fig 2 Chiles Ltd response to RFI 12 February 2021.

³² Fig 9 Acoustic Assessment.

³³ Issued December 2020.

³⁴ 9.4.1 and 9.4.4 of the AEE.

129. However, neither the AEE nor the Acoustic Assessment sets out at what stage the noise investigation should be undertaken regarding the need for treatment of dwellings, who should undertake the assessment (other than a suitably qualified and experienced person (draft condition 77³⁵)) or, critically, who should pay for the treatment. There is nothing in the conditions specific to this other than the need for an Operational Noise and Vibration Management Plan and draft condition 72 is silent on this aspect.
130. Any noise treatment required for dwellings should be put in place as early as possible, e.g. prior to construction works taking place and should be designed to mitigate against the maximum noise levels the Freight Hub will generate.
131. Turning to the uncertainty I have regarding Sangsters Road, Figure 6 was provided as part of the Response and shows a cross section through the proposed elevation of the Freight Hub (to the left) and the dwelling (to the right). I take it that the vertical line is what is being modelled as the 5m high acoustic barrier. My concern is that the windows of the dwelling would have line-of-sight into the Freight Hub and the barrier will therefore not be effective at screening the Freight Hub (and NIMT) noise.

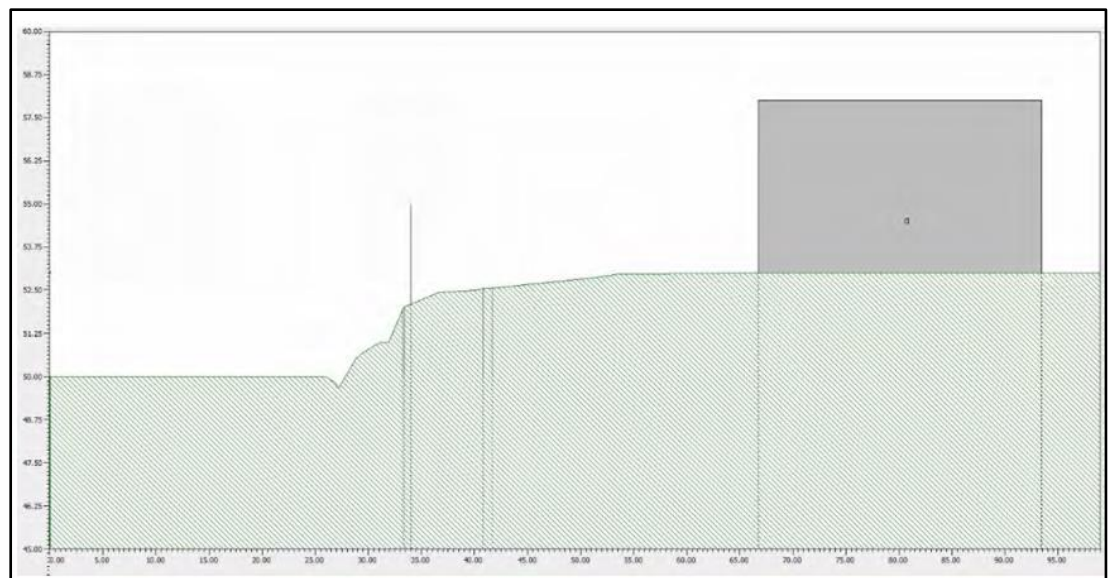


Figure 6. Extract from Response to RFI for Section Through #90 Sangsters Road

132. I have a similar concern with the other cross section shown in Figure 11 of the attachments to the Response for 27 Sangster Road. While this dwelling is

³⁵ The draft conditions I refer to are those amended draft conditions included as Appendix B of the First s 92 Response which are different from those attached to the AEE.

slightly better screened, there is still likely to be a line of sight into the Freight Hub from windows in the dwelling.

133. It needs to be understood that the height of the barrier at 5 metres above the Freight Hub³⁶ may not screen the nearest dwellings where these are elevated on land that is higher than that. It is unclear to me at this stage how the height of this barrier will be determined against what criteria, when it will be constructed and how the impacts (noise, visual, light) will be determined.

6.4 Road Noise Mitigation

134. There are submissions on noise generated by road traffic, including noise on the Perimeter Road, and KiwiRail has not proposed any mitigation for road traffic noise effects.
135. The Acoustic Assessment identifies that the noise from the new Perimeter Road will be 54 dB $L_{Aeq(24h)}$ at 24 Ngaio Road (the nearest dwelling), which it considers³⁷ will comply with the most stringent Category A criteria for new roads as recommended by NZS 6806³⁸.
136. The Acoustic Assessment states that the predictions are made "*with no specific noise mitigation*" then goes on to say that "*a low noise road surface (stone mastic asphalt)*" is included – which is a specific noise mitigation. If stone mastic asphalt is assumed, then requiring its use should be conditioned. No consideration is given to the high night-time use of the road by heavy vehicles at locations that currently receive little (if any) road noise.
137. I therefore recommend that the noise barrier on the western side of the Freight Hub be located between the Perimeter Road and dwellings wherever this is practical. I discuss this further in 158 below for submission 27.

7 Review of Submissions

138. There are 72 noise submission points.

³⁶ First bullet point page 37 of the Acoustic Assessment.

³⁷ Page 29 of the Acoustic Assessment.

³⁸ NZS 6806:2010 Acoustics – Road traffic noise – New and altered roads.

139. Many of the submitters raise concerns about the impact that will result from construction noise and vibration and the consequent operational noise and vibration. Issues raised in the submissions related to noise include:
- a. The size and scale of the Freight Hub;
 - b. Changes that will result from the Freight Hub noise and the impacts on the quiet semi-rural nature of the area;
 - c. The impacts on the health of residents, some of whom have conditions that make them sensitive to noise;
 - d. The impacts of construction noise and vibration over long periods of time, including concerns about hours of operation, and a lack of information in the Acoustic Assessment;
 - e. Concerns about the impacts of operational noise and vibration on amenity levels including night-time impacts on sleep;
 - f. Concerns about the increase in traffic and particularly the increase of heavy trucks on the immediate Perimeter Road and in the wider area;
 - g. Concerns about a lack of certainty in the Acoustic Assessment regarding the best level of mitigation for construction and operational noise, the timing of the instigation of that mitigation, and who will be responsible for it;
 - h. Concerns about the assessment methodology e.g. the use of $L_{Aeq(1h)}$, a lack of duration correction, and no penalties for special audible characteristics.
140. There is merit to a number of these submissions. Significant adverse noise impacts will result from the Freight Hub.
141. The Acoustic Assessment identifies that the Freight Hub will generate noise levels that will impact in an adverse way on the surrounding community but does not provide any certainty as to what the noise mitigation measures will be or the final outcomes. The proposed draft conditions in the AEE rely on noise management plans to be written at some time in the future but with no limits on potential noise levels and, other than the prescription for 3 metre and

5 metre noise barriers,³⁹ no specific noise mitigation measures that submitters can rely upon.

142. I recommend that these limits and mitigation measures be provided for and I have included suggestions for these as Appendix 1 of my evidence.
143. The proposed Freight Hub is a major development in an area that is currently greenfield. It is inevitable that there will be a significant change in the aural environment for the neighbouring community. The noise limits will assume the presence of the Freight Hub (rather than trying to maintain or protect the current environment) and many submitters will remain unsatisfied about this.
144. I will discuss the technical matters which have been raised in a number of submissions.

Submission 7 Rochelle & Rex McGill – 9 Sangsters Road

145. This submission is representative of many of the submissions received from the Sangsters Road Area and beyond.
146. The submitters identify that both the change in land use and construction phase will have long term implications with regards noise impacts on their property. The predicted noise level at 9 Sangsters Road⁴⁰ is 55 dB L_{Aeq(1h)}. The dwelling is located less than 100 metres from the maintenance building and there will be ramifications from any night-time maintenance works that takes place. Dwellings further south on Sangsters Road are predicted to receive greater than 55 dB L_{Aeq(1h)} because (I assume) they are closer to the marshalling area.
147. Figure 8 of the Chiles response to the RFI shows the comparisons for different heights of barrier at this dwelling and Figure 11 shows the (5 metre) east wall cross section for 27 Sangsters Road, which is nearby. The sections show that the land to the east of Sangsters Road is raised above the proposed ground level of the freight hub and that the effectiveness of the barrier will depend on the local topography. It could be that dwellings will get line of sight over a 5 metre barrier which means that the barrier will be less effective than predicted or that it may need to be taller.

³⁹ Proposed Amended Draft Condition in Appendix B of the Third Response – 72(b).

⁴⁰ Figure 2 of the Chiles Ltd Response to requests for information relating to noise and vibration 12 February 2021.

148. With a predicted noise level of 55 dB $L_{Aeq(1h)}$ the night-time noise will significantly exceed the equivalent District Plan night-time noise limit (40 dB $L_{Aeq(15min)}$) and the Category A noise limit of 45 dB $L_{Aeq(1h)}$). As identified by the submitter, the night-time noise will be at the upper limit of the Category B criterion used in the Acoustic Assessment and bordering on the Category C criterion which states that the freight Hub is likely to be incompatible with residential activity.
149. I recommend that where dwellings are predicted to exceed the Category C criteria or actually receive noise that exceeds those criteria in a rolling 12 month period then KiwiRail should consider offering to purchase those dwellings.
150. Indeed, I consider that it would have been appropriate for the designation to extend over properties within potential Category C areas to enable the option of either KiwiRail purchasing those properties or for residents to formally ask for their properties to be purchased using the mechanisms of the RMA.
151. The Proposed Noise Management Boundary is approximately 100 metres beyond this submitter's dwelling, which will allow noise levels to be significantly greater than the 55 dB $L_{Aeq(1h)}$ that is predicted.
152. The submitter identifies the issues with the assessment of Freight Hub noise and monitoring. I would caution here that the presence of special audible characteristics (brake squeal and banging sounds) will also cause noise to have a greater impact on the community than the predicted noise levels would otherwise imply. Noise with special audible characteristics would be more likely to cause sleep disturbance.
153. The submitter is concerned that the ambient sound levels were monitored during a period when Covid-19 lockdown was in place. I do not see this as an issue because, if anything, the ambient sound levels would be quieter during lockdown than would otherwise be the case. There seems to be no dispute that the measured ambient sound levels are representative of a quiet semi-rural environment (particularly at night).
154. Concern is also expressed about vibration. The submitter is concerned that, with longer trains and loading and loading activities, the vibrations will increase beyond those currently experienced from the NIMT. I propose that vibration limits be included as conditions for the Freight Hub.

155. These vibration limits should sensibly apply to the NIMT where it is inside the designation as the impact on residents would be the same whether the vibration came from the NIMT or otherwise from the Freight Hub.

Submission 18 – Kevin and Yvonne Stafford – 684 Roberts Line.

156. This submitter seeks that noise mitigation measures should be put in place prior to the start of any development. This includes the noise mitigation for dwellings and noise bunds/barriers. I consider this to be a reasonable request given the extent of the construction works and inevitable noise impacts that will result.
157. I recommend that, where practical, noise mitigation measures be installed prior to construction works on the Freight Hub commencing.

Submission 27 – Helen and Pita Kinaston – 824a Roberts Line

158. This submitter identifies that the noise barrier is between the new Perimeter Road and the Freight Hub and will do nothing to screen traffic noise at their dwelling. According to the landscape plan,⁴¹ the new Perimeter Road will be further from the submitter's dwelling than Roberts Line. Placing the noise barrier on the west side of the Perimeter Road will also reduce the road traffic noise on that road. I recommend that the submission be accepted in this respect and that provision for the noise barrier to be on the western side of the perimeter road should be made. I note that this submitter's dwelling is close to the southern stormwater attenuation pond.

Submission 47 – Dr Aaron P Fox – 10 Kairanga-Bunnythorpe Road

159. This submission seeks a recommendation for the NoR be withdrawn.
160. Alternatively, this submitter seeks that the hours of operation of the Freight Hub be restricted to standard working hours and not the 24/7 operation proposed. I agree that night-time noise will result in adverse effects. Whether or not there is a functional necessity for 24/7 operation is beyond my expertise, but imposing limits on night-time activities is an obvious and simple method of preventing night-time noise from causing a nuisance or impacting on the health of residents.
161. Options for controlling night-time noise issues include:

⁴¹ Appendix C of the AEE.

- a. Increasing the size of the Designated land to include land that should be used as a buffer to construction and operational noise and to provide landowners with lawful opportunities to require KiwiRail to purchase their dwellings.
 - b. Decreasing the developed area of the Designation to achieve the same outcome as (a) above,
 - c. Provide noise mitigation for dwellings that are adversely impacted by noise, ideally funded by KiwiRail.
162. I accept that these options cannot be made into valid conditions, but I consider that they should be considered by KiwiRail given the scale of this project.
163. I recognise there may be difficulties in devising lawful conditions to address the options referred to above. This is in large part a consequence of the NoR not being sufficiently sized to account for appropriate noise management (including possible purchase) of some of these dwellings.
164. This submitter requests that the acoustic assessment be revisited. The submitter questions:
- a. The use of $L_{Aeq(1h)}$ as the noise descriptor,
 - b. The lack of a duration adjustment,
 - c. The change in ambient noise levels that will occur,
 - d. The impacts on outdoor amenity levels that cannot be mitigated by noise insulated and ventilated buildings,
 - e. That the noise assessment is only indicative,
 - f. That KiwiRail reserves the right to determine permissible noise levels once future requirements are known and to review and update its own standards for noise management at the Freight Hub.
165. With respect to reliance on $L_{Aeq(1h)}$, I have discussed its use above. Noise events tend to control averaged sound levels, but it is important that short term high level noise is controlled separately at night-time (using L_{Amax} in combination with $L_{Aeq(1h)}$) to protect against sleep disturbance. L_{Amax} is not

generally used during day-time assessment (except in the construction noise standard) because short term noise is not as critical during that time and is generally well controlled using L_{Aeq} .

- 166. The lack of a duration adjustment in this case means that daytime noise cannot be averaged over the whole day but is assessed on a 1 hour basis. This is potentially stricter than if the duration adjustment was to apply.
- 167. The Freight Hub will be a significant development and there will inevitably be a change in ambient sound levels in the area.
- 168. The submitter recognises that any noise mitigation for dwellings will not protect outdoor amenity. This can only be helped by ensuring that noise generated within the Designation is as quiet as reasonably practicable and for the proposed noise barriers to be designed and built in an optimal manner.
- 169. The Acoustic Assessment is quite transparent that it is only based on indicative scenarios and that circumstances may change when the detailed design takes place (and beyond that).
- 170. In discussion with Dr Chiles at the outset of the project, I suggested a Noise Management Boundary (similar in concept to airports) that would provide limits on noise levels and allow land use planning to take place. The land use planning would have to be included in the District Plan through a separate plan change process. I recommend that noise limits apply at the Noise Management Boundary and this is important if land use planning controls are to be separately provided for.

Submission 57 – J D B Austin and R M Wapp – 41B Clevely Line

- 171. The predicted noise level at this submitter's property is 54 dB $L_{Aeq(1h)}$ and they seek noise mitigation for their dwelling, including triple glazing.
- 172. The submitter quotes the comparative noise and vibration impact assessment⁴² for which the current Option (3c) scored (5) which was the greatest noise and vibration impact rating available. The assessment for Option 3c was that this site was closer to the residential area of Bunnythorpe

⁴² Specialist Assessment – Noise and Vibration Criterion – Palmerston North Region Multi Criteria Analysis and Decision Conferencing Process (Appendix F5 of the AEE).

and to other residential properties and mitigation measures were identified as including the designation and purchase of houses to the east of the site.

- 173. As identified in this submission, the Acoustic Assessment does not consider the purchase of any dwellings, while I consider that it should have. Further, I consider that the MCA was correct to identify that extending the designation to the east of the site would have been an appropriate matter for consideration in a location specific assessment of alternative options, given the significant adverse noise effects on properties in that location. I have seen no evidence of the recommendation in the MCA being further considered in the site-specific development of the NoR, and in that respect, I consider the assessment of alternatives (including extending the NoR over significantly affected properties) to be deficient.
- 174. The submitter is concerned about the health and wellbeing of the locals that would result from the noise impacts, which is a common thread of a number of submissions.
- 175. The recommended guidelines noise limits in NZS 6802:2008 have been established to protect health and amenity, and exceeding the noise limits will have a deleterious effect. This will be different for different people (at different locations) but will be particularly onerous for those who are vulnerable. The higher noise levels will impact on health and amenity.

Submission 61 – Peter Gore and Dale O'Reilly – Te Ngaio Road

- 176. This submitter is concerned about existing, permitted and consented houses, including (but not limited to) those on Te Ngaio Road. A particular concern is that the designation boundary is close to existing and future dwellings and that log yard noise will be an issue. Noise effects will be significant and standards for the reasonable protection of acoustic amenity will be breached.
- 177. The submitter is concerned that, despite the emphasis on 24/7 operations, no modelling has been undertaken of many other significant noise sources in the area.
- 178. There is a concern with KiwiRail's assertion that noise will decrease at night, given the emphasis on 24/7 operation.
- 179. Other concerns include the Acoustic Assessment not applying corrections for special audible characteristics.

180. All of the above are valid concerns. I have identified the dwellings in Te Ngaio Road as of particular concern given the closeness of the designation boundary to them.

Submission 92 - Ministry of Education -

181. The Ministry asks for an appropriate condition in place for managing noise and vibration associated with construction, including the requirement for the development and implementation of a Construction Noise and Vibration Management Plan with suitable monitoring conditions in place to manage any potential noise and vibration effects on the surroundings, including Bunnythorpe School. I have included schools in my recommended draft conditions.
182. Further information was sought on the potential impact of increased noise on the school and an appropriate condition is requested to manage and monitor noise associated with the operation of the Freight Hub on the surroundings, including Bunnythorpe School. This condition may include the establishment of noise boundaries that protect the existing noise environment at the school. I have included schools in my examples of conditions with noise limits applied at the Noise Management Boundary and internal noise limits for classrooms.

Submission 94 – Mid Central Health Board ("**MCHB**")

183. The MCHB opposes the provision to the extent it does not require normal assessment of sound in accordance with NZS 6802:2008 and, specifically, consideration of the provisions related to adjustments for special audible characteristics.
184. MCHB identifies that the second to last paragraph of the AEE Conclusion states in '*assessing the effects the works (sic), a conservative or worst case approach has been adopted in terms of the activities to be undertaken on the land.*'
185. MCHB considers that this statement is not supported by the approach taken to noise assessment for noise modelling purposes where a non-conservative non-worst case assessment method is utilised, i.e. omission of consideration of adjustments for special audible characteristics.
186. MCHB identifies that the s92 response by KiwiRail to Request 9 relating to maximum predicted noise levels re-affirms that the $L_{Aeq(1h)}$ noise contours represent a busy hour during the daytime, without duration adjustment for

scenarios with and without perimeter barriers. The noise contours are expected to reduce for night operations, but the Response says that exact contours at night cannot be reliably predicted at this stage because future operational requirements are unknown. The submission identifies that there is no consideration of impulsive events associated with, for example, night-time log handling, an inherently noisy activity, even with the most careful handling by skilled operators. Similarly, shunting coupling activities will often include significant impulsive events which might cause sleep disturbance in off-site environs.

187. The proposed Operational Noise and Vibration Management Plan requires the plan be reviewed prior to any significant changes in activity that might reasonably be expected to affect the noise and vibration levels generated, which would require the noise contours to be updated prior to any night operations. I consider this to be a reasonable approach.
188. The Response to Request 9 simply reaffirms the noise levels that have been assessed in the Acoustic Assessment and does not address the issues raised in the s92 request. I agree with this submission in this respect. A further s92 request for a train marshalling impact noise assessment has been made, and a response is forthcoming.
189. MCHB concludes that present modelling may under-estimate the extent of off-site noise effects by modifying standard noise assessment methodologies by excluding consideration of adjustments for special audible characteristics.
190. I agree with MCHB's submission and hold similar concerns regarding the lack of information available to all parties and the disconnect with NZS 6802:2008 regarding the non-application of special audible characteristics in the noise assessment.
191. By not including penalties for special audible characteristics, the Acoustic Assessment anticipates that these will be present on the site on a regular basis. The danger here is that the noise criteria are taken on face value rather than being treated as having a greater impact than an assessment using NZS 6802:2008 (or the District Plan which is based on NZS 6802:2008) would provide. If the assessment included the NZS 6802:2008 adjustments for special audible characteristics, then this would add 5 decibels to each of the predicted noise contours. This would cause them to be much larger than shown in the Acoustic Assessment. I recommend that 5 decibels is added to the modelled noise

levels before determining the level of noise insulation required for dwellings and noise sensitive activities.

192. MCHB requests that a condition be included that requires the best practicable option to be applied to address unreasonable noise. This is already a statutory requirement pursuant to s 16 of the RMA and the inclusion of this requirement would therefore be superfluous.
193. MCHB seeks a requirement for a condition obliging KiwiRail to meet the costs of necessary off-site mitigation. I consider this to be reasonable because the mitigation measures would not be required if the Freight Hub was not to be built.

8 Draft Requirement Conditions

194. Proposed conditions are included in Appendix 3 of the NoR with provisions for a Construction Noise and Vibration Management Plan ("**CNVMP**") as conditions 58-61 and provisions for an Operational Noise and Vibration Management Plan ("**ONVMP**") as conditions 69-74.
195. I have included these provisions as Appendix 1 of my evidence and have offered suggested examples of how conditions might appear, while noting that these are not necessarily precise drafting suggestions.
196. As Appendix B, I include the KiwiRail's desired District Plan Provision recommendations dated October 2018 provided to Council as part of the Whakarongo residential development. These are examples of the type of land use controls that might be expected for land surrounding rail activity.
197. I have also used certain examples of basic noise mitigation strategies from the Nelson Unitary Plan for the Nelson Port,⁴³ which is an example of a comprehensive noise mitigation plan setting out how the Port Company must noise insulate neighbouring dwellings. My recommendations for matters to be incorporated in noise management plans, and for the construction noise and vibrations standards were informed by conditions developed for the Te Ahu a Turanga: Manawatū Tararua Highway project.⁴⁴

⁴³ <http://www.nelson.govt.nz/assets/Environment/Downloads/RMP-PDFs/2012-plan-changes-2/Appendix-29-Port-Noise.pdf>

⁴⁴ <https://www.nzta.govt.nz/assets/projects/sh3-manawatu/nzta-nor-decision-conditions.pdf>

8.1 Comment on Proposed Construction Noise & Vibration Conditions

198. Draft Condition 58 requires the preparation of a CNVMP prior to the commencement of construction and for the plan to be implemented.
199. Draft Condition 59 promotes two documents that should be used to control construction noise and vibration *where applicable to the relevant works* with the objective of the CNVMP to be to demonstrate how compliance with the documents will be achieved. The first standard is NZS 6803:1999 *Acoustics – Construction Noise*, which is appropriate, but the second is the Waka Kotahi, State Highway Construction and Maintenance Guide, 2019.
200. I am unclear what the intention is here because I am not aware of the roading system inside the Freight Hub being State Highways and therefore how the Waka Kotahi *guide would be relevant*. It is unclear to me therefore what this guide should be used for.
201. I have read draft condition 57 in Appendix 3 of the AEE. This aims to provide a management plan for construction traffic. Given the lengthy time span for construction works, there is real potential for heavy construction vehicles to cause nuisance noise and vibration issues both on the site and on the local network. This may not be adequately dealt with by the construction noise and vibration conditions although the addition of draft condition 57(a) goes some way towards ameliorating my concerns in this respect. I recommend that the Construction Traffic Management Plan be strengthened with respect to haul road locations and off-site routes commonly used to ensure that noise and vibration are mitigated as far as is reasonably practicable.

8.2 Comment on proposed Operational Noise & Vibration Conditions

202. The noise from the operational aspects of the Freight Hub will spill over the boundary and beyond neighbouring dwellings. This means that some artifice needs to be used to control the Freight Hub noise.
203. In the first instance, the Acoustic Assessment modelling predicts that there will not be any properties outside of the proposed designation to be exposed to greater than 65 dB $L_{Aeq}(1hr)$, and I recommend that a condition to that effect

be included. This is the daytime Category C criterion above which Freight Hub noise is likely to be incompatible with residential activity.

204. Request 10 in Council's s92 Report (December 2020) asked for noise management boundaries to be provided. Stephen Chiles response (dated 12 February 2021) was to propose a single noise management boundary of 55 dB $L_{Aeq(1h)}$ (see Figure 7). The Response recognised that such an approach would not be adequate to control night-time noise and that "*houses might be required to be treated over a wider area*". If night-time noise is going to impact on dwellings outside the noise management boundary, then that boundary needs to be further from the designation (or a separate night-time boundary located appropriately).
205. The critical point about the land between the 55 dB $L_{Aeq(1h)}$ noise management boundary and the designation boundary is that all houses on that land will be exposed to allowable noise levels that exceed the Category C night-time criterion and will be exposed to noise levels that are likely to be incompatible with residential activity. These houses can be noise insulated and mechanically ventilated to help protect against sleep disturbance, but they will be significantly impacted upon by noise.

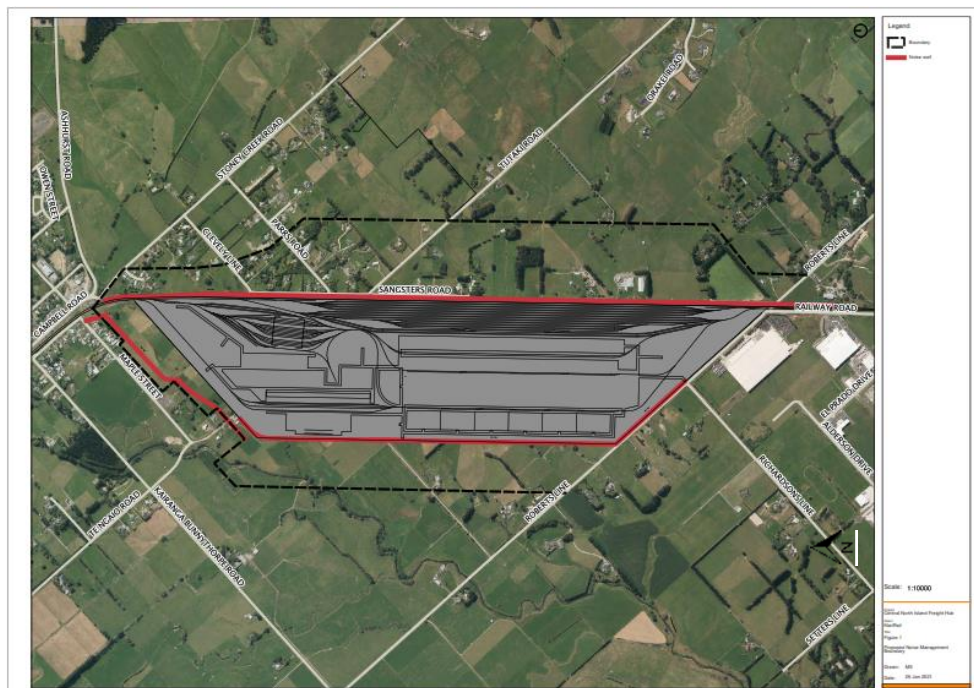


Figure 7. 55 dB LAeq(1h) Noise Management Boundary (from Chiles Response 12 February 2021)

206. Given that the Freight Hub is to operate on a 24/7 basis for 365 days of the year, then a single noise management boundary is theoretically appropriate but must be designed to protect against night-time noise.
207. On pages 37/38 of the Acoustic Assessment, mention is made that *"many elements of the Freight Hub would be primarily daytime activities, such as workshops, the contours would decrease at night"*. However, when asked to qualify this statement (request 9 of the S92 RFI) the Chiles response is that the noise contours are based on a busy hour but that the reduction in night operations *"cannot be reliably predicted"*. It would seem reasonable to assume that, if a train needed to be marshalled, this would occur on an as required basis, including night-time operation.
208. The noise modelling contours in Figure 8⁴⁵ shows the extent of the 45 dB $L_{Aeq(1h)}$ contour for a *busy hour*. If the *busy hour* was to occur at night, then the outer edge of the contours indicates the extent of the night-time noise impact.⁴⁶

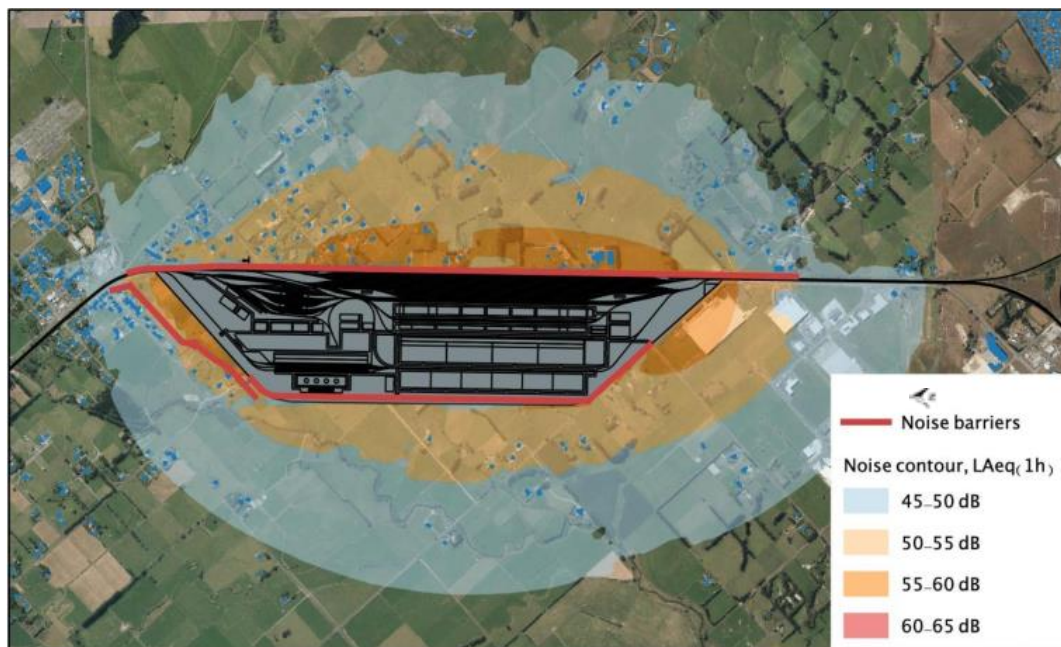


Figure 8. Indicative noise contours with noise barriers (Acoustic Assessment Fig 12)

⁴⁵ Figure 12 of the Acoustic Assessment.

⁴⁶ 45 dB $L_{Aeq(1hr)}$ represents the Freight Hub night-time noise criteria (Category A and B) below which noise insulation would not be required. The District Plan night-time noise limit for the Rural Zone (R9.11.1) is 40 dB $L_{Aeq(1hr)}$ (and 70 dB L_{Amax}).

209. Figure 8 is difficult to read and a series of 1:10,000 plans are shown as part of the Chiles response dated 12 February 2021 on which individual dwellings can be identified.
210. As a guide to levels of noise insulation the current expectation for most dwellings is the outdoor environment protected by observance of Rural zone Rule (R9.11.1). The night-time limits in this Rule are 40dB $L_{Aeq(15\text{ mins})}$ and 70dBA L_{max} .
211. As a general guide, the noise level inside a room with a wide-open window is approximately 10 decibels less than the outside noise level. So the indoor expectation for dwellings in the Rural Zone are the numerical limits in R9.11.1 less 10 dB. These would be applied to the Freight Hub as $L_{Aeq(1h)}$ instead of $L_{Aeq(15min)}$. This also applies to the L_{Amax} .
212. The Category A night-time criteria in the Acoustic Assessment are 45 dB $L_{Aeq(1h)}$ and 75 dB L_{Amax} which I have accepted as pragmatic for dwellings next to a Railway Hub.
213. Applying the Category A night-time criteria, the indoor noise limit for bedrooms would be 35 dB $L_{Aeq(1h)}$ and 65 dB L_{Amax} (rather than the District Plan implied 30 dB $L_{Aeq(15min)}$ and 60 dB L_{Amax}). This is determined by applying a 10dB reduction achieved in a dwelling with open windows.
214. These recommendations align with the Acoustic Assessment and accept the practicality of establishing noise limits for noise sensitive activities next to a Freight Hub.
215. I therefore recommend that the indoor criteria for dwellings would be:
- a. Bedrooms – 35 dB $L_{Aeq(1h)}$ and 65 dB L_{Amax}
 - b. Other habitable rooms and classrooms – 40 dB $L_{Aeq(1h)}$
216. Including these indoor criteria in the designation conditions allows the level of noise insulation to be determined, i.e. if the outdoor noise level is predicted to be 55 dB $L_{Aeq(1h)}$ then the noise insulation required for a bedroom will be 55 – 35 = 20 dB. As discussed in 110 above, this needs to be adjusted by +5 decibels because special audible characteristics have not been factored into the acoustic modelling. In this example, therefore, the noise insulation required is 25 decibels. It is also necessary to know the noise characteristic when doing

a calculation and this could vary depending on what activities are taking place in the Freight Hub. A representative noise would be the characteristic of a locomotive, which is the dominant source and is similar either if the locomotive is idling or moving.⁴⁷

217. At the higher predicted noise levels, the noise insulation would need to include improvements to the acoustic performance of the building structure (such as upgrading windows with acoustic glazing) and with ventilation to allow windows to be kept closed.
218. Beyond the outer edge of the modelled contours, where the predicted noise level is less than 45 dB $L_{Aeq(1h)}$, then dwellings can be naturally ventilated with windows ajar to provide the requisite (10 dB) reduction in noise.
219. I consider that night-time impact noise needs to be controlled and mitigated. I recommend an L_{Amax} noise limit of 85 dB L_{Amax} that should apply at the Noise Management Boundary in my suggested conditions. If the Freight Hub noise emissions were restricted to this maximum level, my recommended maximum internal noise levels for bedrooms (65 dB L_{Amax}) could be achieved for dwellings at the Noise Management Boundary by adding mitigation that achieves a 20 dB noise reduction.
220. Further information is to be provided in evidence by KiwiRail about the L_{Amax} noise levels that marshalling trains will generate. This control would also apply to other operational impact noise that might occur on the site, such as log and container handling.
221. At noise levels greater than 65 dB $L_{Aeq(1h)}$ or 95 dB L_{Amax} , it becomes impracticable for noise insulation to meet the above internal standards. If that situation arises, the Requiring Authority should either increase the size of the designation to provide a noise buffer for dwellings or purchase dwellings that are impacted. In my opinion, the NoR boundaries should have been appropriately sized to allow for this possibility from the outset to account for noise impact.
222. The noise insulation (or potential house purchase) should occur prior to construction work starting on the Freight Hub.

⁴⁷ Chiles Ltd 12 February 2021 response to S92 Request 21.

223. I recommend that the conditions include a requirement for quiet (stone mastic) road surfacing of new Perimeter Road and that the noise barrier close to new Perimeter Road be located between the road and dwellings.
224. The Acoustic Assessment has not considered noise and vibration effects associated with the operation of trains on the existing NIMT. I have three issues with this:
- a. The NIMT will move as part of the NoR,
 - b. The noise and vibration of the Freight Hub will accumulate with the existing effects of passing trains on the neighbours, and
 - c. Assessment and monitoring of the Freight Hub noise will be complicated by the need to extract noise and vibration of trains that pass on the NIMT line during the monitoring period.
225. In my opinion, it would have been a more complete and accurate noise assessment process to have included the noise of these trains, even if it were just as a matter of identifying with precision what effects the existing environment currently includes.
226. I have read the standalone document – Effects and Recommendations Summary Table, which accompanies the s 42A planning report. The noise and effects section appropriately summarises the recommendations I have made for noise and vibration conditions and the reasons for those conditions.



Nigel Robert Lloyd

18 June 2021

APPENDIX A

DRAFT RECOMMENDED NOISE & VIBRATION CONDITIONS

WW Limits and assessment – construction noise

All construction works must be designed and conducted to ensure that, as far as practicable, construction noise does not exceed the limits in Table WW. Sound levels must be measured and assessed in accordance with NZS 6803:1999 Acoustics – Construction noise as follows (at occupied dwellings).

Table WW: Construction Noise Limits

Time of Week	Time Period	L _{Aeq}	L _{AFmax}
Weekdays	0630 – 0730	55 dB	75 dB
	0730 – 1800	70 dB	85 dB
	1800 – 2000	65 dB	80 dB
	2000 – 0630	45 dB	75 dB
Saturdays	0630 – 0730	45 dB	75 dB
	0730 – 1800	70 dB	85 dB
	1800 – 2000	45 dB	75 dB
	2000 – 0630	45 dB	75 dB
Sundays and Public Holidays	0630 – 0730	45 dB	75 dB
	0730 – 1800	55 dB	85 dB
	1800 – 2000	45 dB	75 dB
	2000 – 0630	45 dB	75 dB

N.B. Shading indicates *night-time* hours.

XX Limits and assessment – construction vibration

a) Construction vibration must, as far as practicable, comply with the criteria in Table 3, where:

- i) Measurement is in accordance with ISO 4866:2010 Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures; and

- ii) BS 5228-2 is British Standard BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

Table XX. Vibration Criteria

<i>Receiver</i>	<i>Location</i>	<i>Details</i>	<i>Category A PPV</i>	<i>Category B PPV</i>
<i>Occupied dwellings and schools</i>	<i>Inside the building</i>	<i>2000 – 0630</i>	<i>0.3 mm/s</i>	<i>1 mm/s</i>
		<i>0630 – 2000</i>	<i>1 mm/s</i>	<i>5 mm/s</i>
<i>Other occupied buildings</i>	<i>Inside the building</i>	<i>0630 – 2000</i>	<i>2 mm/s</i>	<i>5 mm/s</i>
<i>Unoccupied buildings</i>	<i>Building foundation</i>	<i>Vibration transient</i>	<i>5 mm/s</i>	<i>BS 5228-2 ⁴⁸ Table B.2</i>
		<i>Vibration continuous</i>		<i>50% of BS 5228-2 Table B.2⁴⁹</i>

- b) The Category A construction vibration criteria in the table above must be complied with as far as practicable. If measured or predicted vibration from construction activities exceeds the Category A criteria, an independent, suitably qualified and experienced person must assess and manage construction vibration during those activities. If measured or predicted vibration from construction activities exceeds the Category B criteria those activities must only proceed if vibration effects on affected buildings are assessed, monitored and mitigated by an independent, suitably qualified and experienced person.

Construction Noise and Vibration Management Plan

58. Prior to the commencement of construction, the Requiring Authority shall prepare a Construction Noise and Vibration Management Plan, and implement the plan for the duration of construction.
59. The objective of the Construction Noise and Vibration Management Plan is to demonstrate how compliance with Conditions WW and XX ~~with the following~~ will be achieved for the duration of construction of the Freight Hub, ~~where applicable to the relevant works~~ No night-time work is to take place unless a specific noise assessment from a suitably qualified and experienced person certifies that this work will comply with the limits in Table WW and Table XX.

⁴⁸ 50 mm/s for reinforced, framed structures and heavy commercial buildings. For light framed structures and residential or light commercial buildings the limits increase from 15 mm/s @ 4 Hz to 20 mm/s at 15 Hz and again to 50 mm/s at 40 Hz and above.

⁴⁹ 25 mm/s for reinforced, framed structures and heavy commercial buildings. For light framed structures and residential or light commercial buildings the limits increase from 7.5 mm/s @ 4 Hz to 10 mm/s at 15 Hz and again to 25 mm/s at 40 Hz and above.

- ~~(a) NZS 6803:1999 Acoustics – Construction Noise; or~~
- ~~(b) Waka Kotahi, State Highway Construction and Maintenance Noise and Vibration Guide, 2019.~~

60. The Construction Noise and Vibration Management Plan shall be prepared by a suitably qualified and experienced person and in general accordance with the requirements of Annex E2 of NZS 6803:1999.
61. The Construction Noise and Vibration Management Plan shall include:
 - (a) a description of the projected construction noise and vibration levels;
 - (b) a description of the construction works and processes;
 - (c) a description of anticipated equipment and any noise or vibration suppression devices;
 - (d) the hours of operation, including times and days when activities causing noise and/or vibration would occur;
 - ~~(*) the construction noise and vibration criteria for the project~~
 - (e) identification of dwellings and other noise sensitive locations and projected noise and vibration levels for those dwellings and locations;
 - (f) methods and frequency for monitoring and reporting on construction noise and vibration;
 - ~~(*) procedures for maintaining contact with stakeholders, notifying or proposed construction activities and handling noise and vibration complaints (consistent with the Communications Management Plan and complaints register);~~
 - ~~(*) a description of alternative mitigation strategies where compliance with the criteria in Conditions XX or YY may not be achieved;~~
 - (g) construction equipment operator training procedures and expected construction site behaviours: and
 - ~~(*) contact numbers for key construction staff, staff responsible for noise assessment and the Responsible Officer(s).~~

YY Limits and Assessment Operational Noise and Vibration

- YY1. All operational activities on the Freight Hub must be designed and conducted to ensure that noise does not exceed 65 dB $L_{Aeq(1h)}$ at any point within any site zoned Rural or Residential outside the designation.

YY2 All operational activities on the Freight Hub must be designed and conducted to ensure that noise does not exceed the limits in Table YY1 when measured at or beyond the Noise Management Boundary shown in Fig YY. Sound levels must be measured in accordance with NZS 6801:2008 *Acoustics – Measurement of environmental sound* and assessed in accordance with NZS 6802:2008 *Acoustics – Environmental noise* except that no corrections shall be made for the presence of Noise Characteristics (6.3) or for duration (6.4):

Table YY1	
All times	55 dB $L_{Aeq(1h)}$
10pm to 7am	85 dB L_{Amax}

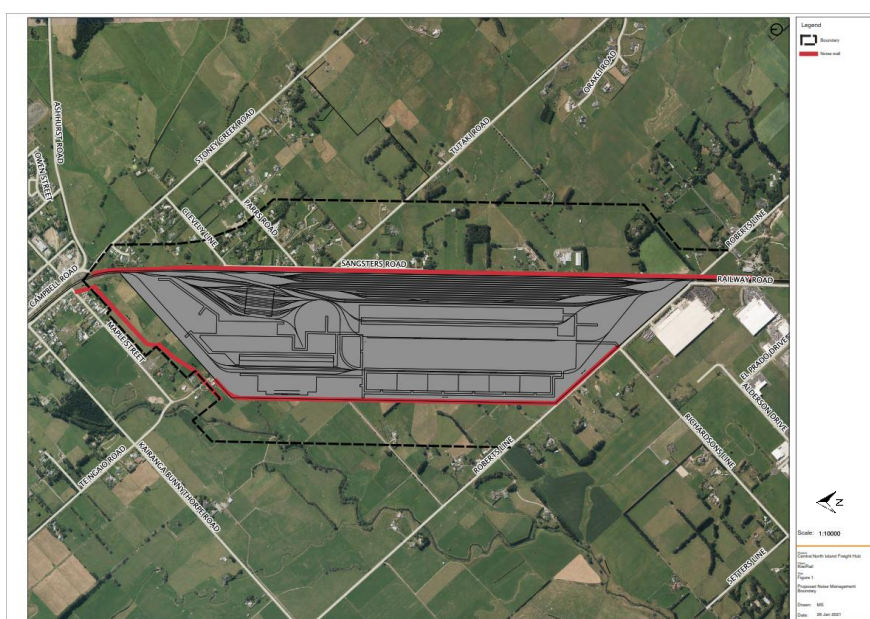


Figure YY Noise Management Boundary
(Note the 45 dB $L_{Aeq(1h)}$ contour in Fig 12 of the Acoustic Assessment needs to be added to this Figure)

YY2 All operational activities on the Freight Hub must be designed and conducted to ensure that vibration at any occupied building outside the Freight Hub does not exceed 0.3 mm/s $v_{w,95}$.

ZZZ Noise Insulation

Z1 The Requiring Authority shall offer to noise insulate and ventilate any occupancy/activity (existing at the date of confirmation of the Designation??) within the 45 dB $L_{Aeq(1h)}$ contour in Fig YY to meet the internal sound levels in Table ZZ1 and ZZ2. Note that 5 decibels must be added to calculated noise insulation requirements to account for special audible characteristics:

Table ZZ1		
Building type	Occupancy/activity	Maximum Internal Sound Levels $L_{Aeq(1h)}$
Residential	Sleeping spaces	35 dB
	All other habitable	40 dB

	rooms	
Education	Lecture rooms/theatres, music studios, assembly halls	35 dB
	Teaching areas, conference rooms, drama studios, sleeping areas	40 dB
	Libraries	45 dB
Health	Overnight medical care, wards	40 dB
	Clinics, consulting rooms, theatres, nurses' stations	45 dB
Cultural	Places of worship, marae	35 dB

Table Z22	
Sleeping Spaces	65 dB L_{Amax}

The noise insulation shall assume maximum noise levels from either the current or any future Freight Hub operational noise contour map and the noise characteristic shall be that of a representative locomotive.

Operational Noise and Vibration

69. The Requiring Authority shall prepare and implement an Operational Noise and Vibration Management Plan.
70. The objective of the Operational Noise and Vibration Management Plan is to detail mitigation and ongoing measures to control noise and vibration effects from the operation of the Freight Hub.
71. The Operational Noise and Vibration Management Plan shall be prepared by a suitably qualified and experienced person.
72. The Operational Noise and Vibration Management Plan shall outline:
 - (a) the noise and vibration limits for both day and night-time activities within the Freight Hub must operate;
 - (b) the details and location of any noise mitigation structures required to manage the noise effects including:
 - i. a continuous barrier, including bunds and/or natural elevation on the eastern boundary of the designation extent to 5 metres above the finished ground level of the Freight Hub; and
 - ii. a barrier 3 metres above finished ground level of the Freight Hub on the northern boundary of the designation extent.

iii. Placing a quiet (stone mastic) road surface on the new Perimeter Road

- ~~(c) the outcome of investigations undertaken for dwellings existing as at [23 October 2020] that are predicted to be subject to exceedance of Category A noise criteria contained at Table 5 of Technical Report D – Acoustic Assessment;~~
- ~~(d) the acoustic treatment that is necessary to achieve acceptable internal noise levels of 35 dB $L_{Aeq(1h)}$ in bedrooms and 40 dB $L_{Aeq(1h)}$ in other habitable spaces of dwellings as at [23 October 2020];~~

Note – See Table ZZ1 Above for these criteria

- (e) the process for undertaking modelling and monitoring of operational noise and vibration;
 - (d) the location of permanent noise monitors which shall include one in the northern area and one in the eastern area of the Freight Hub; and
 - (e) site noise management measures including operation of machinery and equipment in a manner to avoid unreasonable noise.
63. The Requiring Authority shall make the current version of the Operational Noise and Vibration Management Plan publicly available.
64. The Requiring Authority shall review and update (including with any additional noise modelling as required) the Operational Noise and Vibration Management Plan:
- (a) annually; and
 - (b) prior to any significant changes in activity at the Freight Hub that might reasonably be expected to alter or otherwise affect the noise and vibration levels generated from the Freight Hub.



Appendix B

KiwiRail Plan Provisions 2018

Plan Provisions October 2018

Definitions:

Noise Sensitive Activity:

encompasses any use of land and/or buildings which is likely to be susceptible to the effects of noise emitted from nearby land uses in the course of their legitimate operation and functioning; and for the purposes of this plan, includes the following activities (or similar): dwelling, minor unit, building designed for large gatherings of people, education and childcare facility, including early childhood, primary, intermediate, secondary schools and tertiary education facilities (but not any trade training or other industry-related educational facility), hospital, health clinic, residential care facility, commercial office, visitor accommodation and places of assembly including churches, community facilities, restaurants and recreational facilities.

Reverse Sensitivity:

means the legal vulnerability of an established activity to complaint from a new or altered land use. It arises when an established use is causing adverse environmental impact to nearby land, and a new activity that is sensitive to those impacts is proposed for that land.

Rules:

A. A vehicle crossing is a permitted activity provided:

XX It is not within 30m of a railway level crossing.

B. All level crossings must be maintained in accordance with the sight triangles provided in Appendix XX Railway Level Crossing Sight Triangles and Explanations.

C. All buildings shall be setback a minimum of 5m from the rail corridor boundary.

D. Replanting activities – 10 metres from rail corridor boundary (**Forestry NES – afforestation 10m setback in NES, replanting 10m setback not required under NES**)

E. Noise Sensitive Activities within 100m of a Rail Network Boundary:

Activity sensitive to noise near a railway network		
All zones – at any point within 100 metres from the legal boundary of any	Activity status: Permitted	Activity status when compliance not achieved: Restricted discretionary Matters of discretion are restricted to: 1. Whether the activity sensitive to noise could be located further from the
	<u>Indoor railway noise</u> 1. Any new building or alteration to an existing building that contains an activity sensitive to noise where the building or alteration:	



<p>railway network</p>	<p>(a) is designed, constructed and maintained to achieve indoor design noise levels resulting from the railway not exceeding the maximum values in the following table; or</p> <table border="1" data-bbox="300 383 951 1400"> <tr> <th>Building type</th><th>Occupancy/activity</th><th>Maximum railway noise level LAeq(1h)</th></tr> <tr> <td rowspan="2">Residential</td><td>Sleeping spaces</td><td>35 dB</td></tr> <tr> <td>All other habitable rooms</td><td>40 dB</td></tr> <tr> <td rowspan="3">Education</td><td>Lecture rooms/theatres, music studios, assembly halls</td><td>35 dB</td></tr> <tr> <td>Teaching areas, conference rooms, drama studios, sleeping areas</td><td>40 dB</td></tr> <tr> <td>Libraries</td><td>45 dB</td></tr> <tr> <td rowspan="2">Health</td><td>Overnight medical care, wards</td><td>40 dB</td></tr> <tr> <td>Clinics, consulting rooms, theatres, nurses' stations</td><td>45 dB</td></tr> <tr> <td>Cultural</td><td>Places of worship, marae</td><td>35 dB</td></tr> </table> <p>(b) is at least 50 metres from any railway network, and is designed so that a noise barrier completely blocks line-of-sight from all parts of doors and windows, to all points 3.8 metres above railway tracks, or</p> <p>(c) is a single-storey framed residential building with habitable rooms designed, constructed and maintained in accordance with the construction schedule in Schedule XX.</p> <p><i>Mechanical ventilation</i></p> <p>2. If a building is constructed in accordance with 1(c), or if windows must be closed to achieve the design noise levels in clause 1(a), the building is designed, constructed and maintained with a mechanical</p>	Building type	Occupancy/activity	Maximum railway noise level LAeq(1h)	Residential	Sleeping spaces	35 dB	All other habitable rooms	40 dB	Education	Lecture rooms/theatres, music studios, assembly halls	35 dB	Teaching areas, conference rooms, drama studios, sleeping areas	40 dB	Libraries	45 dB	Health	Overnight medical care, wards	40 dB	Clinics, consulting rooms, theatres, nurses' stations	45 dB	Cultural	Places of worship, marae	35 dB	<p>railway network.</p> <ol style="list-style-type: none"> 2. The extent to which the noise and vibration criteria are achieved and the effects of any non-compliance. 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, 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 KiwiRail. <p><i>Notification:</i></p> <p>Application for resource consent under this rule will be decided without public notification. KiwiRail are likely to be the only affected person determined in accordance with section 95B of the Resource Management Act 1991.</p>
Building type	Occupancy/activity	Maximum railway noise level LAeq(1h)																							
Residential	Sleeping spaces	35 dB																							
	All other habitable rooms	40 dB																							
Education	Lecture rooms/theatres, music studios, assembly halls	35 dB																							
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	Libraries	45 dB																							
Health	Overnight medical care, wards	40 dB																							
	Clinics, consulting rooms, theatres, nurses' stations	45 dB																							
Cultural	Places of worship, marae	35 dB																							

	<p><i>ventilation system that</i></p> <p><i>(a) For habitable rooms for a residential activity, achieves the following requirements:</i></p> <ul style="list-style-type: none"> <i>i. provides mechanical ventilation to satisfy clause G4 of the New Zealand Building Code; and</i> <i>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</i> <i>iii. provides relief for equivalent volumes of spill air;</i> <i>iv. provides cooling and heating that is controllable by the occupant and can maintain the inside temperature between 18°C and 25°C; and</i> <i>v. does not generate more than 35 dB L_{Aeq(30s)} when measured 1 metre away from any grille or diffuser.</i> <p><i>(b) For other spaces, is as determined by a suitably qualified and experienced person.</i></p> <p><i>Indoor railway vibration</i></p> <p><i>3. Any new buildings or alterations to existing buildings containing an activity sensitive to noise, closer than 60 metres from the boundary of a railway network:</i></p> <p><i>(a) is designed, constructed and maintained to achieve rail vibration levels not exceeding 0.3 mm/s_{vw,95} or</i></p> <p><i>(b) is a single-storey framed residential building with:</i></p> <ul style="list-style-type: none"> <i>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</i> <i>ii. vibration isolation separating the sides of the floor slab from the ground; and</i> <i>iii. no rigid connections between the building and the ground.</i> <p><i>Design report [may be replaced with a construction schedule]</i></p> <p><i>4. A report is submitted to the council demonstrating compliance with clauses (1) to (3) above (as relevant) prior to the construction or alteration of any building containing an activity sensitive to noise. In the design:</i></p> <p><i>(a) railway noise is assumed to be 70 L_{Aeq(1h)} at a distance of 12 metres from the track, and must be deemed to reduce at a rate of 3 dB per doubling of</i></p>	
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	<p><i>distance up to 40 metres and 6 dB per doubling of distance beyond 40 metres.</i></p> <p><i>Where the activity complies with the following rule requirements:</i></p> <p><i>Nil</i></p>	
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Schedule XX Construction schedule for indoor noise control

Elements	Minimum construction for noise control in addition to the requirements of the New Zealand Building Code	
External walls	Wall cavity infill of fibrous insulation, batts or similar (minimum density of 9 kg/m ³)	
	Cladding and internal wall lining complying with either Options A, B or C below:	
	Option A - Light cladding: timber weatherboard or sheet materials with surface mass between 8 kg/m ² and 30 kg/m ² of wall cladding	Internal lining of minimum 17 kg/m ² plasterboard, such as two layers of 10 mm thick high density plasterboard, on resilient/isolating mountings
	Option B - Medium cladding: surface mass between 30 kg/m ² and 80 kg/m ² of wall cladding	Internal lining of minimum 17 kg/m ² plasterboard, such as two layers of 10 mm thick high density plasterboard
	Option C - Heavy cladding: surface mass between 80 kg/m ² and 220 kg/m ² of wall cladding	No requirements additional to New Zealand Building Code
Roof/ceiling	Ceiling cavity infill of fibrous insulation, batts or similar (minimum density of 7 kg/m ³)	
	Ceiling penetrations, such as for recessed lighting or ventilation, shall not allow additional noise break-in	
	Roof type and internal ceiling lining complying with either Options A, B or C below:	
	Option A - Skillion roof with light cladding: surface mass up to 20 kg/m ² of roof cladding	Internal lining of minimum 25 kg/m ² plasterboard, such as two layers of 13 mm thick high density plasterboard
	Option B - Pitched roof with light cladding: surface mass up to 20 kg/m ² of roof cladding	Internal lining of minimum 17 kg/m ² plasterboard, such as two layers of 10 mm thick high density plasterboard
Glazed areas	Aluminium frames with full compression seals on opening panes	
	Glazed areas shall be less than 35% of each room floor area	
	Either, double-glazing with:	
	<ul style="list-style-type: none"> a laminated pane of glass at least 6 mm thick; and a cavity between the two panes of glass at least 12 mm deep; and a second pane of glass at least 4 mm thick 	
	Or, any other glazing with a minimum performance of Rw 33 dB	
Exterior doors	Exterior door with line-of-sight, to any part of the state highway road surface or to any point 3.8 metres above railway tracks	Solid core exterior door, minimum surface mass 24 kg/m ² , with edge and threshold compression seals; or other doorset with minimum performance of Rw 30 dB
	Exterior door shielded by the building so there is no line-of-sight to any parts of the state highway road surface or any points 3.8 metres above railway tracks	Exterior door with edge and threshold compression seals

Insert the following as new Appendix XX – Railway Level Crossing Sight Triangles and Explanations:

Level Crossing Sight Triangles and Explanations

Developments near Existing Level Crossings

It is important to maintain clear visibility around level crossings to reduce the risk of collisions. All the conditions set out in this standard apply during both the construction and operation stages of any development.

Approach sight triangles at level crossings with Give Way signs

On sites adjacent to rail level crossings controlled by Give Way Signs, no building, structure or planting shall be located within the shaded areas shown in Figure 1. These are defined by a sight triangle taken 30 metres from the outside rail and 320 metres along the railway track.

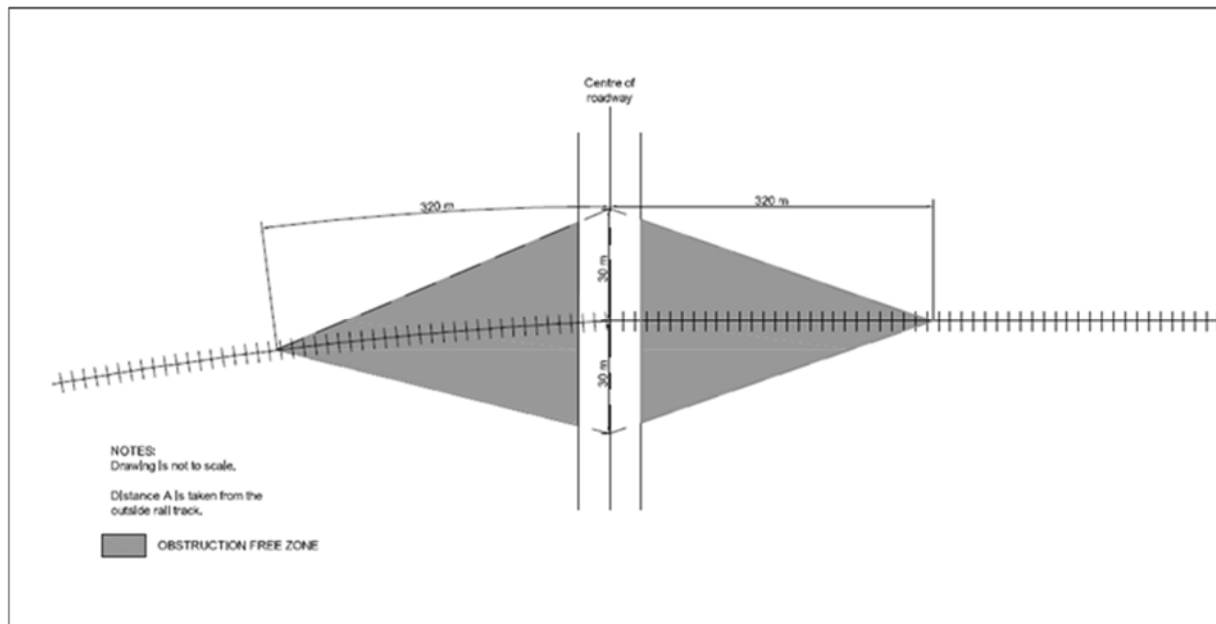


Figure 1: Approach Sight Triangles for Level Crossings with “Give Way” Signs

Advice Note:

The approach sight triangles ensure that clear visibility is achieved around rail level crossings with Give Way signs so that a driver approaching a rail level can either:

- See a train and stop before the crossing; or*
- Continue at the approach speed and cross the level crossing safely.*

Of particular concern are developments that include shelter belts, tree planting, or a series of building extensions. These conditions apply irrespective of whether any visual obstructions already exist.

No approach sight triangles apply for level crossings fitted with alarms and/or barrier arms. However, care should be taken to avoid developments that have the potential to obscure visibility of these alarm masts. This is particularly important where there is a curve in the road on the approach to the level crossing, or where the property boundary is close to the edge of the road surface and there is the potential for vegetation growth.

Restart sight triangles at level crossings

On sites adjacent to all rail level crossings, no building, structure or planting shall be located within the shaded areas shown in Figure 2. These are defined by a sight triangle taken 5 metres from the outside rail and distance A along the railway track. Distance A depends on the type of control (Table 1).

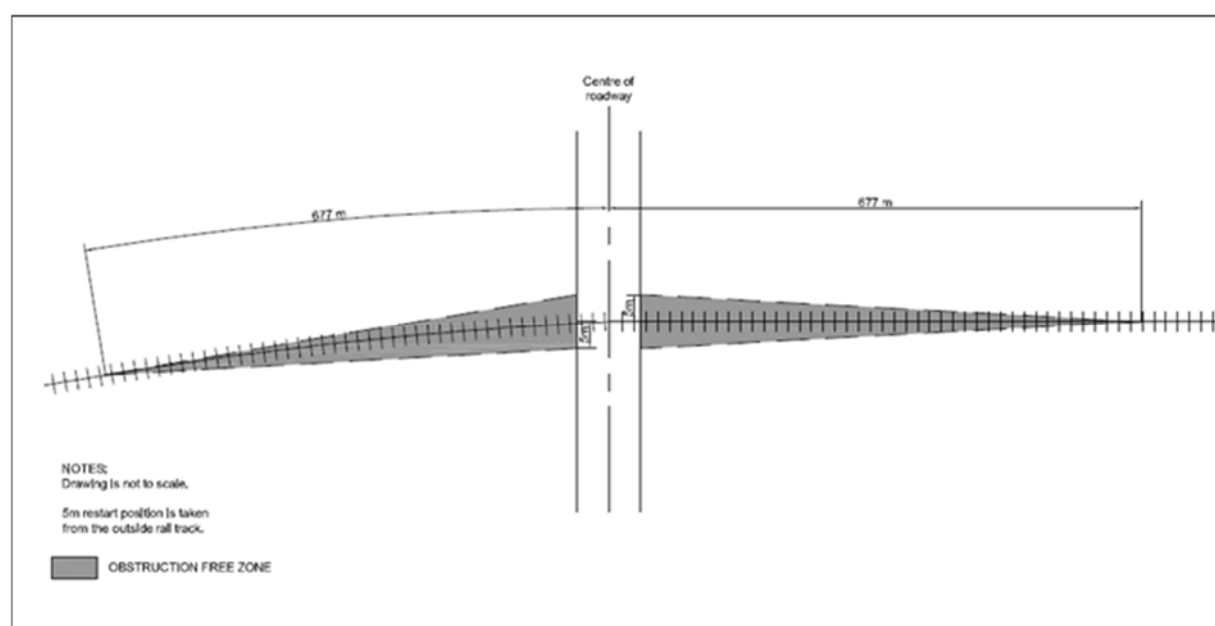


Figure 2: Restart Sight Triangles for all Level Crossings

Table 1: Required Restart Sight Distances For Figure 2

Required approach visibility along tracks A (m)		
Signs only	Alarms only	Alarms and barriers
677 m	677 m	60 m

Advice Note:

The restart sight line triangles ensure that a road vehicle driver stopped at a level crossing can see far enough along the railway to be able to start off, cross and clear the level crossing safely before the arrival of any previously unseen train.

Of particular concern are developments that include shelter belts, tree planting, or a series of building extensions. These conditions apply irrespective of whether any visual obstructions already exist.

Notes:

1. *Figures 1 and 2 show a single set of rail tracks only. For each additional set of tracks add 25 m to the along-track distance in Figure 1, and 50 m to the along-track distance in Figure 2.*
2. *All figures are based on the sighting distance formula used in NZTA Traffic Control Devices Manual 2008, Part 9 Level Crossings. The formulae in this document are performance based; however, the rule contains fixed parameters to enable easy application of the standard. Approach and restart distances are derived from a:*
 - *train speed of 110 km/h*
 - *vehicle approach speed of 20 km/h*
 - *fall of 8 % on the approach to the level crossing and a rise of 8 % at the level crossing*
 - *25 m design truck length*
 - *90° angle between road and rail*