

NZ Transport Agency (submitter DPC39/4)
KiwiRail Holdings Limited (submitter DPC39/5)

Primary evidence – Stephen Chiles

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Plan Change 39 to the City of Lower Hutt
District Plan

**STATEMENT OF EVIDENCE OF DR STEPHEN GORDON CHILES
FOR THE NZ TRANSPORT AGENCY AND KIWIRAIL HOLDINGS LIMITED
IN RELATION TO ACOUSTICS**

19 SEPTEMBER 2017

1. QUALIFICATIONS AND EXPERIENCE

- 1.1 My full name is **Dr Stephen Gordon Chiles**.
- 1.2 I am an acoustics engineer and independent hearings commissioner, and am self-employed by my company Chiles Ltd.
- 1.3 I have the qualifications of Doctor of Philosophy in Acoustics from the University of Bath, and Bachelor of Engineering in Electroacoustics from the University of Salford, UK. I am a Chartered Professional Engineer (NZ), Fellow of the UK Institute of Acoustics and Member of the Resource Management Law Association.
- 1.4 I have been employed in acoustics since 1996, as a research officer at the University of Bath, a principal environmental specialist for the NZ Transport Agency ("Transport Agency"), and as a consultant for the international firms Arup, WSP, and URS, and for the specialist firms Marshall Day Acoustics and Fleming & Barron. I have been responsible for acoustics assessments and design for numerous different activities including infrastructure, industrial, commercial, recreational and residential developments.
- 1.5 I am convenor of the New Zealand industry reference group for the international committee responsible for approximately 200 published "ISO" acoustics standards. I was Chair of the 2012 New Zealand acoustics standards review, Chair for the 2010 wind farm noise standard revision (NZS 6808), and a member for the 2008 general environmental noise standards revision (NZS 6801 and NZS 6802).
- 1.6 I have been involved in many situations relating to noise sensitive activities establishing near existing infrastructure. I was an Independent Commissioner for plan changes for Queenstown and Wanaka Airports and a plan variation for Port Nelson, which dealt particularly with noise effects on neighbours. I jointly led a review of the Transport Agency's policy relating to activities establishing near

state highways and development of its guide¹. I have presented evidence for the Transport Agency and KiwiRail on numerous plan changes and reviews. I was responsible for draft provisions under the New Zealand Building Code for protection from environmental noise.

1.7 I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014. This evidence is within my area of expertise except where I state that I am relying on facts or information provided by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

2. SCOPE OF EVIDENCE

2.1 Plan Change 39 to the City of Lower Hutt District Plan (“**PC39**”) includes controls on new noise sensitive activities that locate near state highways and railways, to manage adverse effects on those new activities. The Transport Agency and KiwiRail submitted broadly in support of these provisions, subject to some amendments.

2.2 I have been involved in discussions with Marshall Day Acoustics which has been engaged by the Council to advise on these issues. I reached agreement with Marshall Day Acoustics on all technical matters, and subsequently the Officer’s Report dated 6 September 2017 has recommended amendments to the notified provisions that give effect to the submissions by the Transport Agency and KiwiRail. I agree with these recommendations in the Officer’s Report, and if they are accepted there are no outstanding matters raised in my evidence.

2.3 Although I agree with the amendments to the relevant provisions recommended in the Officer’s Report, for completeness my evidence will set out the necessity for controls on noise sensitive activities near roads and railways, and the context of broader sound and vibration management for these activities. I will also discuss the technical

¹ NZ Transport Agency, *Guide to the management of effects on noise sensitive land use near to the state highway network*, September 2015.

reasons for the amendments to the notified provisions sought by the Transport Agency and KiwiRail, relating to:

- (a) Application of vibration requirements,
- (b) Internal criteria for railway sound levels, and
- (c) Mechanisms to achieve compliance with sound level criteria.

2.4 I have prepared my evidence based on my experience assessing and managing future and existing state highway and railway sound and vibration at numerous locations throughout New Zealand. This includes my experience developing the Transport Agency's current guide for managing noise sensitive land-use development near state highways¹ and a draft code for KiwiRail to manage sound and vibration from the railway network. I have also drawn from my broader experience assessing other environmental sound sources.

3. SOUND AND VIBRATION EFFECTS

3.1 Road and railway sound and vibration can cause a range of adverse effects on people living, working, or studying nearby. These effects are well researched and have been comprehensively documented by authoritative bodies such as the World Health Organisation.^{2,3} Some commonly referenced adverse effects are sleep disturbance, communication interference, annoyance, and distraction. Some of these are correlated with cardiovascular disease and cognitive impairment, amongst other effects. Environmental sound and vibration can affect both health and amenity.

3.2 Adverse effects from road and railway sound and vibration occur at many existing properties by the state highway and railway networks. I have been involved in numerous different activities the Transport Agency and KiwiRail undertake, which manage and reduce this sound and vibration where practicable. This has included development of

² World Health Organisation, Guidelines for community noise, 1999.

³ World Health Organisation, Burden of disease from environmental noise, 2011.

quieter road surfaces, installation of noise barriers, installation of ballast mat, rail grinding and tamping, ballast cleaning and replacement, investigation into engine braking noise, repair of road surfaces to address vibration issues, automated monitoring of rolling stock wheel condition and many more. However, practicable improvements are often constrained, and state highway and railway sound and vibration remain above desirable levels and adverse effects still occur.

- 3.3 For new buildings being constructed near to the state highway and railway network it is relatively straight-forward to control internal sound and vibration through the building location and design. In some cases, it is not practical to achieve appropriate external amenity, but in most cases it is practical to achieve acceptable internal sound and vibration levels. Thus, with careful design the future occupants of the building can be protected from the most significant adverse health and amenity effects associated with state highway and railway sound and vibration.
- 3.4 While controls on new buildings cannot address existing state highway and railway sound and vibration issues, they can avoid compounding and extending the issues. In my opinion ensuring new buildings are appropriately designed to protect their future occupants from road and railway sound and vibration is an important and effective noise management action.
- 3.5 In my opinion, PC39 includes an appropriate framework for managing adverse effects on new noise sensitive activities by state highway and railway corridors. However, I consider that within this framework the specified controls in PC39 as notified are not stringent enough to appropriately address the issues; particularly with respect to the area over which the controls apply, the internal sound level criterion, and the ventilation requirements. I understand that potential amendments are constrained by the scope of submissions and therefore in my evidence I will only discuss those aspects that are subject to submissions.

4. APPLICATION OF VIBRATION REQUIREMENTS

- 4.1 PC39 as notified includes a requirement for road and railway vibration to comply with Class C of NS 8176⁴. This standard is based on research specifically into human response to vibration from land transport, and is the recommended minimum criteria for new residential buildings near existing roads and railways. It does not provide absolute protection from adverse vibration effects, and even at this level about 15% of affected people can still be expected to be disturbed by vibration. In my opinion this is an appropriate balance between enabling development and protecting the majority of the population.
- 4.2 The wording of the vibration requirement in the notified version of PC39 is not clear on whether the vibration criteria applies to the source or receiver of the vibration. For existing roads and railways, practicable options to reduce vibration are generally constrained and in that situation NS 8176 recommends more lenient criteria. However, for new activities establishing beside existing roads and railways the Class C criteria are practical to achieve. I therefore consider that PC39 should be amended in accordance with the submission by KiwiRail to clarify that the vibration requirement is to be achieved by appropriate design and construction of new buildings rather than through alterations to the existing road and railway infrastructure.
- 4.3 The Officer's Report recommends an appropriate amendment to Standard 6(a) which makes clear that the vibration criterion applies to buildings.

5. INTERNAL CRITERIA FOR RAILWAY SOUND LEVELS

- 5.1 The notified version of PC39 specifies an internal design level of 45 dB $L_{Aeq(24h)}$ for road and railway sound. This level is higher than recognised thresholds for protection from sleep disturbance and other adverse effects.^{2,3} District plans often include noise limits at similar

⁴ Norwegian Standard NS 8176:2005 Vibration and shock - Measurement of vibration in buildings from land based transport and guidance to evaluation of its effects on human beings.

levels for night-time sound outside buildings, but these result in lower levels inside buildings. I consider the specified road and railway design sound level in PC39 as notified to be too high to provide reasonable protection from adverse noise effects.

5.2 KiwiRail has submitted that more stringent design levels should apply to railway sound. In my opinion the amended design sound levels set out in the submission by KiwiRail are appropriate values to manage adverse noise effects inside buildings, and are consistent with international and national practice.

5.3 KiwiRail has also submitted that railway sound design levels should be specified as an average over 1 hour rather than over 24 hours. Road-traffic comprises thousands of vehicles following consistent patterns, and it is therefore reliable to predict and assess road-traffic noise on the basis of 24 hour average levels. However, there are relatively small numbers of rail freight movements and I consider that averaging sound levels over long periods does not accurately represent the adverse noise effects. Therefore, I consider that a one hour period ($L_{Aeq(1h)}$) is appropriate when assessing rail sound levels as this avoids understatement of effects by averaging over longer periods.

5.4 The Officer's Report recommends amendments to Standard 6(b) which set appropriate criteria for railway sound levels.

6. MECHANISMS TO ACHIEVE COMPLIANCE WITH CRITERIA

6.1 PC39 as notified specifies an internal design level for road and railway sound. In my opinion, this method of using a performance standard is the most appropriate framework for the control. Using this approach any treatment required will be directly related to the potential adverse effects and the desired outcome in terms of the internal environment occupants will experience. It also allows the criteria to be achieved in the most efficient manner. This might be by building an external fence or orientating the main living spaces away from the road or railway, and in both cases no other treatment costs might then be required.

- 6.2 The Transport Agency submitted that PC39 should provide two pathways to comply with the internal performance standard. These pathways are either through certification by a specialist, or by use of minimum building construction materials. The first pathway allows compliance to be achieved in any manner, providing it can be shown that the internal design sound levels are achieved. This is a standard provision and I consider it to be efficient and practical.
- 6.3 The second pathway of using specific constructions sometimes proves problematic where it is not clear if alternative constructions are sound insulation equivalents. Also, in many cases the constructions specified would be excessive, such as on the sides of buildings facing away from a road or railway. However, use of the constructions would not be mandatory and in some instances this provision may provide an easy pathway that avoids the need for specialist assessment. I therefore consider it appropriate to include both pathways.
- 6.4 The Officer's Report recommends appropriate additions to Standard 6 that allow compliance to be demonstrated by either of the two pathways described above. I note that the proposed amendments set out in the Officer's Report appear to have a typographical error with the pathways numbered 3 and 4 rather than 1 and 2.
- 6.5 For the pathway of using specific constructions, provisions recommended in the Officer's Report reference a schedule in a new Appendix Transport 4. I collaborated with Marshall Day Acoustics in the preparation of this schedule and I consider it sets out appropriate constructions that should generally result in compliance with the sound and vibration performance criteria in Standard 6.

Dr Stephen Gordon Chiles

19 September 2017