

BEFORE THE HEARING COMMISSIONERS

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of submissions by Waka Kotahi NZ Transport Agency ("Waka Kotahi") (submitter #805, further submitter #2103) on the Christchurch District Plan Proposed Housing and Business Choice Plan Change 14 ("PC14")

STATEMENT OF EVIDENCE OF STEVEN GORDON CHILES ON BEHALF OF

WAKA KOTAHI

NZ TRANSPORT AGENCY

20 September 2023

1. INTRODUCTION

1.1 My full name is Dr Stephen Gordon Chiles. 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 and Fellow of the UK Institute of Acoustics.

1.2 I am self-employed as an acoustician through my company Chiles Ltd. I have been employed in acoustics since 1996, as a research officer at the University of Bath, a principal environmental specialist for Waka Kotahi, and a consultant for Arup, WSP, URS, Marshall Day Acoustics and Fleming & Barron. I am contracted as the principal advisor to provide the Environmental Noise Analysis and Advice Service to the Ministry of Health and Te Whatu Ora.

1.3 I have been involved in many situations relating to noise effects on new or altered sensitive activities around 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. I have previously been engaged to advise Waka Kotahi and Auckland Transport (roads), KiwiRail (railways), Christchurch City Council (airport) and Environment Canterbury (port) on reverse sensitivity noise issues. I previously drafted potential environmental noise provisions for Clause G6 of the New Zealand Building Code for the Ministry of Business, Innovation and Employment.

1.4 I am convenor of the New Zealand reference group for "ISO" acoustics standards and a member of the joint Australian and New Zealand committees responsible for acoustics standards. I was Chair of the 2012 New Zealand acoustics standards review, Chair for the 2010 wind farm noise standard, and a member for the 2008 general environmental noise standards.

2. CODE OF CONDUCT

2.1 I confirm that I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and will continue to comply with it while giving oral evidence at the hearing. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

3. SCOPE OF EVIDENCE

- 3.1 My statement relates to PC14 and to potential limitations on housing intensification due to aircraft noise. I have prepared this statement on behalf of Waka Kotahi primarily in relation to its functions as a transport investor and planner of the land transport network.
- 3.2 Waka Kotahi made a further submission on PC14 opposing a submission of Christchurch International Airport Limited (“**CIAL**”), which seeks to prevent intensification in a proposed expanded 50 dB L_{dn}¹ airport noise contour.
- 3.3 My evidence addresses the implications of airport noise exposure on the community and appropriate controls, including in relation to noise contours. I do not have current experience in airport noise modelling and do not comment on the mechanics of generating the proposed 50 dB L_{dn} contour. I do, however, have concerns over some of the assumptions made in the process that I consider need to be tested.
- 3.4 My evidence will address:
- (a) adverse health effects from environmental noise;
 - (b) methods to manage effects for buildings containing sensitive activities;
 - (c) the existing Christchurch Airport 50 dB L_{dn} contour and associated land use controls;
 - (d) the proposed expanded 50 dB L_{dn} contour; and
 - (e) the potential effects of intensification in the proposed expanded 50 dB L_{dn} contour.

4. ADVERSE HEALTH EFFECTS FROM ENVIRONMENTAL NOISE

- 4.1 Environmental noise has been shown to cause significant adverse public health effects. This has been documented by authoritative bodies such as the World Health Organisation (“**WHO**”),² including a 2018 publication by WHO Europe (“**2018 WHO Guidelines**”), which sets out guidelines for managing environmental noise from sources including road, rail and aircraft.³ I am not aware of any fundamental disagreement in the acoustics profession regarding environmental noise being a significant public health issue.

¹ The “L_{dn}” noise metric is an average (logarithmic/energy average) value over 24 hours after the addition of 10 dB to sound at night between 2200h and 0700h

² World Health Organisation, Guidelines for community noise, 1999; World Health Organisation, Burden of disease from environmental noise, 2011.

³ World Health Organisation, Environmental noise guidelines for the European region, 2018.

- 4.2 Research published in 2019 found that international annoyance response curves are generally applicable for the New Zealand population, based on road and rail noise exposure.⁴ I am currently on the steering group for a largely complete research project that has further investigated this matter, including extension to aircraft noise.⁵
- 4.3 In Europe, significant work has been undertaken over two decades to determine population noise exposures in urban areas and by major transport routes and major airports. In urban areas it has been found at least a fifth of the population is exposed to noise levels harmful to health and this can reach half the population exposed in many cities.⁶ The majority of this noise exposure is from road-traffic.
- 4.4 While there are proven relationships between noise exposure and adverse health effects at the community level, there remain significant evidence gaps relating to individual circumstances. There have been numerous discrete studies into such matters, but not sufficient to determine robust relationships from repeated findings in the same manner that has occurred based on overall population exposure. Pertinent issues in relation to PC14 include:
- (a) The relative influence of noise exposure inside and outside a dwelling. Some adverse health effects such as sleep disturbance could be taken to relate to noise exposure inside buildings. However, other adverse health effects such as annoyance and ischemic heart disease may relate to a combination of noise exposure both inside and outside.
 - (b) The benefit of an acoustically treated building, including mechanical ventilation and temperature control so windows can be kept closed. If the noise levels inside a building in a noisy area are reduced to be equivalent to those inside a building in a quiet area, then it could be assumed that adverse health effects relating to indoor conditions would not arise.
 - (c) The difference in adverse effects for people living in different building types such as detached houses, town houses and apartments. The way in which people use their homes, and in particular outdoor areas, may be materially different depending on the type of building. For example, in high density apartment developments people might have a small balcony but no other private outdoor space, and hence the relative influence of outdoor amenity on adverse health effects might be reduced.

⁴ Humpheson D. and Wareing R., 2019. Evidential basis for community response to land transport noise, Waka Kotahi Research Report 656. <https://nzta.govt.nz/resources/research/reports/656/>

⁵ TAR 19/27 Community response to noise, <https://www.nzta.govt.nz/planning-and-investment/research-programme/current-research-activity/active-research-projects/>

⁶ <https://www.eea.europa.eu/en/topics/in-depth/noise>

- (d) The influence of “non-acoustic” factors on adverse health effects, such as a person’s attitude towards the operator of the noise source or the perceived necessity. There is ongoing work internationally to better understand and qualify the influence of non-acoustic factors. This is a material issue that can result in individual responses to a certain level of environmental noise exposure varying substantially.
- (e) The combined effect of multiple noise sources, or other factors causing adverse health effects such as air quality and vibration. The relationships between noise exposure and adverse health effects have primarily been determined based on exposure to individual sources, but research has shown there are combined effects from overlapping exposure from different sources or different emission types from the same source (e.g. noise, air quality, vibration).
- (f) The effect of different temporal patterns of noise exposure. Relationships are generally determined based on annual average noise exposure (with penalty weightings for evening and night exposure within that average). However, the adverse effect might vary depending on whether that exposure occurs regularly throughout the year or is concentrated in shorter periods.

4.5 In my opinion, it is important to remain cognisant of the above issues despite the evidential gaps. I consider that the evidential gaps relate primarily to the inherent complexity and consequent limitations of existing published research to provide sufficient depth of study across a wide range of potential factors, rather than absence of effects or changes in effects.

5. METHODS TO MANAGE ADVERSE EFFECTS

5.1 Given the significance of adverse health effects, the 2018 WHO Guidelines make “strong” recommendations to reduce exposure from road, rail and aircraft noise. Thresholds are recommended corresponding to levels associated with adverse health effects. These thresholds are generally lower than environmental noise criteria commonly applied in New Zealand and most other countries.

5.2 Findings of a review of the 2018 WHO Guidelines amongst European countries included:⁷ “...the recommended noise levels were regarded to be unattainably low and, therefore, not feasible” and “The economic costs of implementing noise limits aligned

⁷ World Health Organisation. Uptake and impact of the WHO Environmental noise guidelines for the European Region, Experience from Member States. 2023.

with the guideline exposure levels are too great, and would have implications for other public sectors (e.g. the transport or building sector)." In my opinion, these review findings do not mean the 2018 WHO Guideline criteria are inappropriate, but mean that a longer-term strategic approach is required to work towards them.

- 5.3 In my experience, simple solutions to address adverse health effects from environmental noise are rarely practicable. As such, in my opinion to give effect to the WHO guidance requires a strategic and nuanced approach to gradually reduce existing harm and minimise additional harm using a range of different approaches. An example of how this can be structured is the noise action plans required under the European Noise Directive.⁸
- 5.4 Acoustically, a potential approach to reducing new noise exposure and therefore harm, is to physically separate noise generating and noise sensitive activities, when one or other is being established. However, in my experience this approach has the potential to cause adverse effects in itself that might be worse than the effects avoided by separation of activities. In terms of noise, separating activities generally means dwellings, workplaces and community services are not spatially integrated and there is need for additional or extended transportation for people to access activities, which in turn may generate additional noise and potential harm from that noise. Essentially, separating activities can be a blunt tool that might result in a larger overall transportation noise footprint where adverse health effects may occur.
- 5.5 I am aware there are considerations outside my technical acoustics discipline relating to other potential disbenefits of separating activities. I jointly led the Waka Kotahi review of its preferred approach to land use controls for sensitive activities near the state highway network in 2015.⁹ Prior to 2015, Waka Kotahi pursued a 'separation' approach with 'no-build' setbacks sought for noise sensitive activities in buffer areas nearest to highways.¹⁰ Following that review Waka Kotahi proposed that sensitive activities should be permitted activities in all locations near state highways in urban areas, subject to performance standards relating to building designs. This position was reached due to consideration of promoting compact urban form with development near transport corridors, which was determined to outweigh the potential acoustic benefit of separating state highways and noise sensitive activities.
- 5.6 As an alternative to separating activities, I consider that a practical approach for new buildings being constructed, or existing buildings being altered, is to control internal sound through the building layout, design and systems (like acoustic insulation and

⁸ Directive 2002/49/EC of the European Parliament and of the Council of the European Union. 2002.

⁹ Waka Kotahi, Guide to the management of effects on noise sensitive land use near to the state highway network.

¹⁰ Transit Planning Policy Manual version 1, Appendix 5D – Reverse sensitivity, 2007.

mechanical ventilation). In most cases, it is practical to achieve acceptable internal sound levels using such measures. In some instances, screening can be used to achieve reasonable external sound levels, although opportunities can be limited for aircraft overhead. However, exposure on balconies can be addressed to some extent by provision of openable screening. For example, I am familiar with an apartment development near Wellington Airport that has used winter-garden balcony spaces to reduce aircraft noise.¹¹ Thus, with careful design of building location, orientation and materials, future occupants of the building can be protected from the most significant adverse effects associated with environmental noise.

Existing exposure

5.7 Separating new activities or treating new buildings does not address existing exposure from established noise sources and sensitive activities. In general, for major infrastructure I am not aware of practical methods to address such situations in a short timeframe. In these instances, in my opinion the operator of the noise source should continually seek to manage noise emissions and implement reductions where practicable. For airports this might include consideration of runway preferences, flight paths and traffic management. In my experience achieving practicable improvements can be a relatively long-term process for established infrastructure, and generally requires action across multiple facets as any individual action is unlikely to adequately reduce existing noise exposure alone.

6. EXISTING CHRISTCHURCH AIRPORT 50 dB L_{dn} CONTOUR

6.1 Land use controls for sensitive activities near different airports in New Zealand vary between district plans. Most apply guidance from NZS 6805¹² to some extent, although numerous adaptations have been made. To my knowledge, the most stringent adaptations, restricting new sensitive development have been made in relation to the Christchurch International Airport.

6.2 A significant aspect of the controls in Christchurch that is more stringent is the use of a 50 dB L_{dn} airport noise contour, which covers a much larger area than a 55 dB L_{dn} noise contour as recommended in NZS 6805 and used at most other airports. Airport noise contours step outwards from an airport covering progressively larger areas as the L_{dn} values decrease. The steps are not equal size, and generally increase in step distance for each step outwards as L_{dn} levels decrease.

¹¹ <https://www.solariarchitects.com/projects/ropa-lane-apartments/>

¹² New Zealand Standard NZS 6805:1992 Airport noise management and land use planning

- 6.3 I understand one difference between Christchurch and other airports is that Christchurch Airport does not have a curfew. However, this factor should not justify different criteria because the L_{dn} metric itself explicitly accounts for differing noise effects between day and night aircraft movements by penalising nighttime movements. This is implemented by a 10 dB adjustment to any aircraft noise occurring at night. In terms of the overall average L_{dn} levels this means that one night flight is equivalent to ten flights during the day.
- 6.4 Sensitive buildings exposed to aircraft noise above 55 dB L_{dn} often need to keep windows closed to comply with the indoor noise criterion of 40 dB L_{dn} specified in rule 6.1.7.2.2 of the Christchurch District Plan.
- 6.5 The Christchurch District Plan does include various provisions that restrict new sensitive activity or intensification of sensitive activities from occurring within the 50 dB L_{dn} contour. In some zones these provisions are essentially promoting separation of new/intensified activities, notwithstanding that existing activities are not separated. For example, in some Commercial Zones new sensitive activities inside the 50 dB L_{dn} contour are non-complying.
- 6.6 In the Residential Suburban Zone and Residential Suburban Density Transition Zone, sensitive activities in the 50 dB L_{dn} contour are restricted discretionary under rule 14.4.1.3, which refers to internal noise limits (Appendix 14.16.4) as a matter of discretion. However, for external aircraft noise below 55 dB L_{dn} , (i.e. between the 50 dB L_{dn} and 55 dB L_{dn} contours) an internal level of 40 dB L_{dn} is typically achieved even with windows ajar for ventilation. For this zone, the Christchurch District Plan does not impose blanket requirements to acoustically treat any new buildings for sensitive activities between the 50 and 55 dB L_{dn} contours; a site-by-site assessment is made to respond to the matter of discretion, despite the outcome highly likely to be that no treatment is required.
- 6.7 The Christchurch District Plan includes some provisions to address existing noise exposure in rule 6.1.6.2.7, including retrofitting treatment to the most exposed houses. However, while there is a requirement for a noise management plan and to investigate complaints, there is no requirement for CIAL to proactively reduce existing noise exposure as recommended by the 2018 WHO Guidelines. Thus, within the existing 50 dB L_{dn} contour there will be unmitigated aircraft noise effects on people and there is no adequate mechanism by which those are being addressed over time. This situation affecting existing sensitive activities will worsen if there is expansion of the contours.

7. PROPOSED EXPANDED CHRISTCHURCH AIRPORT 50 dB L_{dn} CONTOUR

- 7.1 CIAL has set out details of a qualifying matter which expands the Operative 50 dB L_{dn} contour. I understand the contour provides for desired/forecast commercial growth of the airport. CIAL propose that the expanded contour be used to provide separation of new/intensified activities from the airport under the same framework as the existing contour.
- 7.2 As I have set out above, in my opinion controls seeking separation can be acoustically effective for that specific issue, but can also have wider acoustic and other disbenefits. The balance between benefits and disbenefits can change depending on the resulting geographic size and location of the contour, rather than just being related to the L_{dn} value of the contour. Therefore, in the case of any proposal to expand noise contours, I consider it necessary to re-examine which L_{dn} value contour(s) should be adopted for land use controls.
- 7.3 While the benefits of an expanded 50 dB L_{dn} contour have been summarised by CIAL, in my opinion these need to be comprehensively considered against the disbenefits before that proposed expanded contour is adopted as a basis for land use controls.
- 7.4 A significant acoustic disbenefit of the proposed expanded 50 dB L_{dn} contour is that it could allow for airport activity that increases noise exposure of existing houses and increases the number of existing houses being exposed. Under the district plan most of these adverse effects would be largely unmitigated.

8. POTENTIAL EFFECTS OF INTENSIFICATION IN THE PROPOSED EXPANDED 50 dB L_{dn} CONTOUR

- 8.1 Regardless of whether the proposed expanded 50 dB L_{dn} contour is appropriate the following comments relate to potential intensification in such a noise environment between 50 and 55 dB L_{dn}.
- 8.2 As I have set out above, there are numerous evidential gaps that are pertinent to potential intensification. In particular, intensification will result in less private outdoor amenity area, potentially reducing the relative influence of outdoor aircraft noise effects. In terms of indoor noise effects, a potential option could also be to require acoustic treatment of new buildings so that a more stringent indoor noise criterion is met than the current district plan standard. Such treatment could comprise provision of mechanical ventilation and temperature control so that windows do not need to be opened. Such controls are commonly applied in district plans in mixed use and central zones. For example, there are existing 'blanket' sound insulation controls in various areas of Christchurch Central City (rule 6.1.6.2.9).

- 8.3 The 2018 WHO Guidelines indicate that unmitigated airport noise above 50 dB L_{dn} is likely to cause some degree of adverse health effects. I am not aware of an evidential basis to accurately determine how mitigating factors, such as building treatment and dense building types with reduced outdoor areas, will alter adverse health effects from airport noise. However, given that adverse effects should be primarily associated with indoor conditions and those can be controlled, it is likely that increased density would not result in material adverse health effects at these comparatively lower levels of airport noise.
- 8.4 I also note that contextually, in much of the Riccarton area, as for most urban areas, adverse health effects are also likely to arise from other environmental noise such as road-traffic (beyond the extent addressed by rule 6.1.7.2.1). Those effects may be similar to or worse than the airport noise sought to be controlled under the CIAL submission.
- 8.5 In section 12 of her report Ms Oliver refers to percentages and numbers of people highly annoyed by airport noise. Her analysis appears to be based on responses to unmitigated airport noise. For the reasons I have set out above, I consider this an unduly conservative assumption giving rise to unrealistically high estimates of potential adverse effects. Ms Oliver also does not address the context of other environmental noise affecting the area, and affecting any alternative areas for intensification. Ms Oliver's finding that limiting density is the most efficient control is based on her estimates of numbers of people affected, in turn based on the conservative assumptions that I consider unsound.
- 8.6 If the proposed qualifying matter with the 'expanded' 50 dB L_{dn} noise contour were adopted, for the reasons I have set out above, I consider adverse effects from aircraft noise can be appropriately managed in terms of residential intensification.

Stephen Chiles
20 September 2023