

**BEFORE THE HEARINGS PANEL
FOR THE QUEENSTOWN LAKES PROPOSED DISTRICT PLAN**

IN THE MATTER of the Resource
Management Act 1991

AND

IN THE MATTER Hearing Stream 06
- Residential chapters

**STATEMENT OF EVIDENCE OF DR STEPHEN GORDON CHILES
ON BEHALF OF QUEENSTOWN LAKES DISTRICT COUNCIL**

ACOUSTICS ENGINEER

14 September 2016

 **Simpson Grierson**
Barristers & Solicitors

J G A Winchester / S J Scott
Telephone: +64-3-968 4018
Facsimile: +64-3-379 5023
Email: sarah.scott@simpsongrierson.com
PO Box 874
SOLICITORS
CHRISTCHURCH 8140

TABLE OF CONTENTS

1. INTRODUCTION.....	2
2. EXECUTIVE SUMMARY	4
3. NEW ZEALAND BUILDING CODE	5
4. PARAMETERS	5
5. INTERNAL SOUND LEVEL CRITERIA	6
6. AIRPORT AND ROAD-TRAFFIC NOISE CONTROLS	8
7. NATURE OF ACOUSTIC TREATMENT	9
8. EXTENT OF ROAD-TRAFFIC NOISE EFFECTS.....	10
9. FRANKTON MDRZ.....	11

1. INTRODUCTION

- 1.1 My name is Dr Stephen Gordon Chiles.
- 1.2 I am an acoustics engineer and independent commissioner, self-employed by my company Chiles Ltd. I am a visiting academic at the University of Canterbury Acoustics Research Group.
- 1.3 I have a Doctorate of Philosophy in Acoustics from the University of Bath, and a Bachelor of Engineering in Electroacoustics from the University of Salford, UK. I am a Chartered Professional Engineer, Fellow of the UK Institute of Acoustics and Member of the Resource Management Law Association.
- 1.4 I have been practising in acoustics since 1996, as a research officer at the University of Bath, as an acoustics specialist at the NZ 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 previously been responsible for acoustics assessments and design for numerous different activities including infrastructure, industrial, commercial, recreational and residential developments. I routinely work for central and local government, companies and individual residents.
- 1.5 I have worked extensively on acoustics issues in the Queenstown Lakes District (**District**) over many years. Recently my role has primarily been as a consultant to the Queenstown Lakes District Council (**QLDC**) and in the last two years I have provided advice on over 50 resource consent applications.
- 1.6 I am convenor of the New Zealand industry reference group for the international standards committee ISO TC43 (acoustics), which is responsible for approximately 200 published "ISO" standards relating to acoustics. I was Chair of the 2012 Standards New Zealand acoustics standards review group; 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).

- 1.7** This is the third statement of evidence I have prepared on behalf of QLDC for the Stage 1, Proposed District Plan (**PDP**). The first was in the Rural Hearing, related specifically to informal airports, dated 6 April 2016¹ and the second was in the District Wide Hearing, primarily related to the Noise Chapter, dated 17 August 2016.²
- 1.8** I have now been engaged by QLDC to provide acoustics evidence in relation to the Residential Chapters 7, 8 and 9 of the PDP, being for the Low Density Residential Zone (**LDRZ**), Medium Density Residential Zone (**MDRZ**) and High Density Residential Zone (**HDRZ**), respectively. I was not previously involved in the preparation of these chapters. This evidence relates to possible controls requiring buildings in residential zones to be built with acoustic treatment to reduce external sound, such as from State highway road-traffic noise.
- 1.9** With respect to this evidence I declare that I was previously employed by the NZ Transport Agency (NZTA) and my role included technical aspects of land use controls relating to noise around state highways. However, I had no involvement in NZTA's submission (#719) on the PDP. I now consult to NZTA for various matters including land-use controls around state highways in other districts, but not with respect to the PDP or any other matters in this District.
- 1.10** Although this is a Council hearing, I confirm that I have read the Code of Conduct for Expert Witnesses contained in 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 this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

1 <http://www.qldc.govt.nz/assets/Uploads/Planning/District-Plan/Hearings-Page/Hearing-Stream-2/Section-42-A-Reports/Expert-Evidence/QLDC-02-Rural-Stephen-Chiles-Evidence.pdf>

2 <http://www.qldc.govt.nz/assets/Uploads/Planning/District-Plan/Hearings-Page/Hearing-Stream-5/Section-42A-Reports-and-Council-Expert-Evidence/QLDC-05-District-Wide-Stephen-Gordon-Chiles-Evidence-.pdf>

1.11 The key documents that I have used, or referred to, in forming my view while preparing this brief of evidence are:

- (a) QLDC Operative District Plan (**ODP**);
- (b) QLDC Proposed District Plan (**PDP**), in particular Chapters 7, 8 and 9; and
- (c) New Zealand Standard NZS 6806:2010 *Acoustics – Road-traffic noise – new and altered roads* (**NZS 6806**).

2. EXECUTIVE SUMMARY

2.1 The key findings from my evidence are that:

- (a) The New Zealand Building Code does not include any requirements to reduce external noise entering houses;
- (b) Road-traffic noise controls in the PDP should be specified in terms of the $L_{Aeq(24h)}$ parameter. The criterion inside habitable spaces should be 40 dB $L_{Aeq(24h)}$;
- (c) The most common acoustic treatment required for road-traffic noise is the provision of mechanical ventilation/cooling, and typical costs are in the order of \$10,000 for a new build three-bedroom house;
- (d) Acoustic treatment for road-traffic noise could be required within 80 metres of most state highways in the District (and beyond). There are three discrete sections of state highway in the District where treatment should only be required to lesser distances of 40 and 60 metres; and
- (e) Acoustic treatment requirements in the Frankton MDRZ may be required for road-traffic noise, but should not be required for noise from commercial/industrial sites. Potentially, acoustic treatment may be required for sites in the MDRZ near the Transpower Frankton substation, but this would require further investigation to determine an appropriate distance for controls.

3. NEW ZEALAND BUILDING CODE

- 3.1** The New Zealand Building Code does not contain any requirements for the control of external noise entering houses. Other Building Code requirements, such as thermal insulation requirements,³ might indirectly result in a certain level of sound insulation, but this is undermined as soon as a window is opened for cooling or ventilation.
- 3.2** Over many years, there have been several proposals to revise Clause G6 of the Building Code to include requirements to provide protection from external noise entering new houses. The most recent proposal was released for public consultation in 2010. Since that time, I have been engaged by the Ministry of Business Innovation and Employment as a technical advisor in relation to that proposal, but no further information about possible changes has been published. It is therefore unknown whether or not the Building Code will be revised in future to control external noise entering houses.
- 3.3** I note that Plan Change 1 to the ODP was going to require sound insulation of houses in the Town Centre Zone from external noise. However, that plan change was withdrawn in 2004 on the basis that the matter would be addressed by an expected revision to the Building Code, which never materialised.

4. PARAMETERS

- 4.1** Requirements relating to acoustic treatment are potentially specified in terms of three parameters, that differ from those used for the general noise limits in the PDP. The following is a brief summary of these parameters:
- (a) the L_{dn} is the day/night sound level. It is essentially an average level over 24 hours, with any sound occurring at night penalised by +10 dB before being included in the average. This parameter is used in New Zealand

3 Building Regulations 1992, Schedule 1, The Building Code, Clause H1.3.1.

Standards⁴ and most district plans for sound from airports, helicopter landing areas and ports;

- (b) the $L_{Aeq(24h)}$ is the 24-hour time-average sound level. It is essentially an average level over 24 hours. It is identical to a L_{dn} other than it does not include a penalty for sound occurring at night. Therefore, for the same source a $L_{Aeq(24h)}$ will always be slightly lower than a L_{dn} . Or conversely, a L_{dn} limit of the same numerical value as an $L_{Aeq(24h)}$ limit would be more stringent. The $L_{Aeq(24h)}$ is used in New Zealand Standard NZS 6806 (and its predecessor document) for road-traffic noise; and
- (c) the $L_{Aeq(1h)}$ is the 1-hour time-average sound level. It is essentially an average level over 1 hour. This parameter is not specified in New Zealand Standards, but is often used for railway noise in New Zealand. I am aware that in some places where controls have been set for road and rail noise this same parameter has been used for both.

4.2 In my opinion, any rules in the PDP relating to road-traffic noise should use the $L_{Aeq(24h)}$ parameter and any controls relating to airport noise should use the L_{dn} parameter. This is because these parameters are consistent with New Zealand Standards and allow use of normal prediction and measurement practices, and direct use of published data. This makes these parameters more efficient to apply than alternatives, and will also result in more robust assessments as sound levels will be in familiar ranges.

5. INTERNAL SOUND LEVEL CRITERIA

5.1 Requirements for acoustic treatment primarily relate to protecting sleep and residential amenity inside houses. In some cases, requirements might also be set to avoid disturbance in other noise sensitive spaces such as classrooms. In general, requirements can be specified in terms of a maximum level of internal noise resulting in

⁴ NZS 6805:1992 Airport noise management and land use planning.
NZS 6807:1994 Noise management and land use planning for helicopter landing areas.
NZS 6809:1999 Acoustics – Port noise management and land use planning.

each type of space. This then allows flexibility in terms of a building location, orientation and construction to achieve that criterion in the most efficient manner.

- 5.2** The PDP as notified includes acoustic treatment requirements for new houses around Queenstown and Wanaka Airports, to achieve an internal level of 40 dB L_{dn} . In my opinion, this is an appropriate criterion for airport noise.
- 5.3** The submission by NZTA (#719) refers to internal sound levels from AS/NZS 2107:2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors*, and also proposes rules requiring specific levels of 35 dB $L_{Aeq(1h)}$ in bedrooms and 40 dB $L_{Aeq(1h)}$ in other habitable spaces.
- 5.4** In general, I consider that AS/NZS 2107 contains appropriate guidance for internal sound levels in different types of spaces. However, for any particular space it does not contain a single criterion, rather it states satisfactory and maximum levels. Therefore, in my opinion a simple reference to AS/NZS 2107 is not sufficient when specifying criteria in the PDP. I consider that policies and rules in the PDP should not reference AS/NZS 2107, as it would provide more certainty for rules to set specific noise limits and it would avoid unnecessary reference to an external document.
- 5.5** With respect to the two levels proposed for road-traffic noise of 35 dB $L_{Aeq(1h)}$ and 40 dB $L_{Aeq(1h)}$, as I have set out above I consider that the $L_{Aeq(1h)}$ is not appropriate and the $L_{Aeq(24h)}$ should be used. NZS 6806 and NZTA's published guidance⁵ (that I was involved in preparing) both recommend a criterion of 40 dB $L_{Aeq(24h)}$ in all habitable spaces including bedrooms. In my opinion it is appropriate for this criterion to apply to visitor accommodation as well as permanent residential accommodation. To some extent people in visitor accommodation may be more sensitive to external noise as they will not have habituated to it.

5 NZ Transport Agency, 2015, Guide to the management of effects on noise sensitive land use near to the state highway network, <http://nzta.govt.nz/resources/effects-on-noise-sensitive-land/>.

- 5.6 A single criterion of 40 dB $L_{Aeq(24h)}$ in all habitable spaces is less stringent than criteria of 35 dB $L_{Aeq(1h)}$ in bedrooms and 40 dB $L_{Aeq(1h)}$ in other habitable spaces, as proposed in submission #719.
- 5.7 Rule 8.5.2 in the PDP as notified refers to “activity sensitive to road noise”, and NZTA's submission referred to “noise sensitive activities”. Neither of these terms are defined in the PDP as notified or in AS/NZS 2107. However, there is a definition in the PDP of Activity Sensitive to Aircraft Noise (**ASAN**). As an aside, the PDP as notified also includes a separate slightly different definition of ASAN for Wanaka Airport, but technically these ASAN definitions could be combined. The same activities that are sensitive to aircraft noise are also sensitive to road-traffic noise. Therefore, it would be appropriate to replace both definitions of ASAN in the PDP as notified with a single definition of “Noise Sensitive Activities”, and refer to this same definition in rules relating to road-traffic noise. The definition of Noise Sensitive Activities could be identical to the ASAN definition for Queenstown Airport in the PDP as notified.
- 5.8 For most noise sensitive activities, the criterion of 40 dB $L_{Aeq(24h)}$ proposed inside houses is also appropriate. In some particularly sensitive spaces, such as lecture theatres or music rooms, a slightly lower criterion would be preferable. However, for the purposes of providing an efficient and practical control in the PDP, a single criterion of 40 dB $L_{Aeq(24h)}$ for road-traffic noise could be a minimum standard for all noise sensitive activities.

6. AIRPORT AND ROAD-TRAFFIC NOISE CONTROLS

- 6.1 As a point of reference, I note that an internal criterion of 40 dB $L_{Aeq(24h)}$ for road-traffic noise is less stringent than the 40 dB L_{dn} criterion for airport noise in the PDP. This is justified partly on the basis of the different characteristics of the two sources and the lesser annoyance caused by road-traffic noise. Although the road-traffic internal criterion is less stringent, some houses will be exposed to relatively high levels of road-traffic noise and will therefore require more extensive acoustic treatment than houses only exposed to relatively low airport sound levels.

6.2 In some areas the PDP might specify controls for both airport and road-traffic noise, each in terms of different parameters. It is not practical to combine these requirements as each house will be exposed to airport noise and road-traffic noise to different extents. For each house, the exposure to each source would need to be assessed, and then acoustic treatment implemented to address the more onerous of the two requirements. This should then satisfy the less onerous requirement without additional treatment.

7. NATURE OF ACOUSTIC TREATMENT

7.1 Closing windows reduces sound levels inside a house by in the order of 10 dB. The most common form of acoustic treatment for airport and road-traffic noise is the provision of mechanical ventilation/cooling so that windows can be kept closed. In some cases, where houses are exposed to high external levels, upgrades to glazing and other building elements can also be required.

7.2 NZTA published a case study on costs of indicative acoustic treatment⁶ for road-traffic noise, showing them to be in the order of \$10,000 extra on the cost of a new build three-bedroom house. The costs primarily relate to ventilation/cooling systems.

7.3 NZTA's information on treatment costs does not cover higher density development such as apartments and joined townhouses. A conservative assumption would be that each unit is a similar cost to detached houses. For example, the costs for treating a three-bedroom apartment should still be in the order of \$10,000. In reality, the additional costs of treatment may decrease for higher density development as there are generally fewer facades with windows due to adjacent units, there may be mechanical ventilation/cooling fitted as standard, and there may be economies of scale.

6 <http://nzta.govt.nz/assets/Highways-Information-Portal/Technical-disciplines/Noise-and-vibration/Research-and-information/Other-research/NZ1-8305016-Building-Acoustic-Mitigation-Case-Study.pdf>

8. EXTENT OF ROAD-TRAFFIC NOISE EFFECTS

- 8.1** When road-traffic noise levels outside buildings are below approximately 57 dB $L_{Aeq(24h)}$, then internal levels will generally be at an acceptable level, even when windows are ajar for ventilation. Therefore, acoustic treatment might be required in all areas where levels exceed 57 dB $L_{Aeq(24h)}$. The point at which this level occurs depends on traffic volumes, speeds, road surfaces, terrain and any screening by intervening buildings or fences. NZTA has published maps showing an effects area which approximates where this level might extend to throughout the country.⁷
- 8.2** The NZTA maps show the extent of road-traffic noise effects typically extend to 100 metres or beyond for most of the State highway network in the District, including those areas with lower speed limits such as Frankton Road (SH6A). Therefore, in general, the proposed rules requiring assessment for acoustic treatment within 80 metres are targeting an appropriate area, where sound levels inside houses might otherwise exceed acceptable levels. This would need to be confirmed for each site within this area on an individual basis with consideration for the specific building proposed and any screening effects.
- 8.3** The NZTA maps show three discrete areas in the District where effects that might justify acoustic treatment are not likely to extend as far as 80 metres. These are:
- (a) Makarora-Lake Hawea Road (SH6) – the traffic volumes on this section of SH6 to the north of Lake Hawea township are relatively low and acoustic treatment would only need to be considered within approximately 40 metres of the road;
 - (b) Wanaka-Luggate Highway (SH84) – where the speed limit reduces to 50 km/h for the section of SH84 between Anderson Road and Ardmore Street, acoustic treatment

⁷ <http://nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/noise-and-vibration/planning/reverse-sensitivity-buffer-and-effects-areas/>

would only need to be considered within approximately 60 metres of the road; and

- (c) Shortcut Road and Luggate-Tarras Road (SH8A) – the traffic volumes on this road are relatively low and acoustic treatment would only need to be considered within approximately 60 metres of the road.

8.4 In many Residential Zones near to State highways, most sections already contain houses. In these areas new rules for acoustic treatment would not address any legacy issues. However, rules for acoustic treatment would apply to any redevelopments and infill housing, which would avoid compounding any legacy issues and could lead to progressive improvements in community noise exposure over time. The same rationale applies to rules for acoustic treatment for airport noise in the PDP.

9. FRANKTON MDRZ

9.1 The Jandel Trust and FII Holdings (#717 and #847) have submitted that acoustic treatment should be required for noise sensitive activities in MDRZ within 100 metres of existing non-residential activities. I understand the area potentially affected by this proposal would be the Frankton MDRZ, which is close to State Highway 6, the Transpower Frankton substation and the commercial/industrial areas at Glenda Drive and Frankton Flats.

9.2 As I set out in my previous evidence on the Noise Chapter (36), the noise limits in the PDP are generally set based on the receiving site. Therefore, Rule 36.5.4 sets noise limits in the MDRZ for sound coming from the commercial/industrial areas at Glenda Drive and Frankton Flats. The submissions have not sought to alter that rule. Although the noise limits in the new MDRZ would not necessarily apply to existing activities at Glenda Drive and Frankton Flats, there are existing receivers in the same area as the MDRZ and the same noise limits apply at them under the ODP.

- 9.3** The noise limits that apply to sound received in the MDRZ are relatively stringent and consequently, new houses should not require acoustic treatment for sound that is controlled by those limits, such as sound from commercial and industrial activities at Glenda Drive and Frankton Flats.
- 9.4** Sound from the State highway is not subject to the noise limits in Rule 36.5.4 and therefore acoustic treatment of houses in the Frankton MDRZ may be appropriate near the State highway as I have discussed above.
- 9.5** With respect to the Transpower Frankton substation I declare that in a previous employment I measured sound levels at this site for Transpower in 2005. I have had no involvement with the site since that time and do not have a record of the levels I measured.
- 9.6** The Transpower Frankton substation is a designated site and there are no designation conditions relating to noise. The same applies to the adjacent Aurora substation but that is further from the MDRZ. Both sites are not subject to the noise limits in Rule 36.5.4 and therefore potentially a control on new houses near the Transpower substation in the MDRZ might be appropriate.
- 9.7** Substations generally do not generate high sound levels but the transformers can be a continuous sound with tonal characteristics that can cause annoyance. I am not aware of the specific sound levels at this site, but it is likely that acoustic treatment would only be justified over a limited area in the MDRZ if at all. To confirm this advice, sound levels should be sought from Transpower or measured directly around the site.



Dr Stephen Gordon Chiles

14 September 2016