IN THE MATTER
of the Resource Management Act 1991

AND

IN THE MATTER
of Hearing of Submissions and Further Submissions
on the Wellington City Proposed District Plan –
Hearing Stream 5

JOINT STATEMENT OF ACOUSTIC INSULATION EXPERTS (JWS 2)

Date of conferencing: 6 September 2023

INTRODUCTION

1. This joint witness statement relates to expert conferencing on the topic of standards for acoustic insulation, as requested by the Panel in Minute 33.

2. Acoustic experts in attendance as participants in the conferencing were:

    - Jon Styles engaged by Kāinga Ora – Homes and Communities
    - Stephen Chiles engaged by Waka Kotahi and KiwiRail
    - Darran Humpheson engaged by Wellington International Airport Limited
    - Malcolm Hunt engaged by Wellington City Council
    - Sean Syman engaged by Wellington City Council
    - Matthew Borich engaged by Wellington City Council

3. Planning experts in attendance as observers to this conferencing were:

    - Catherine Heppelthwaite engaged by Waka Kotahi and KiwiRail
    - Kirsty O'Sullivan engaged by Wellington International Airport Limited
    - Matthew Lindenberg engaged by Kāinga Ora – Homes and Communities

4. As observers, the planning experts are not signatories of this JWS.
5. The conferencing was in person at Wellington City Council's Boulcott Office and on-line (Microsoft Teams), facilitated by Mark Ashby as observer.
6. We confirm that we have read the Environment Court's Code of Conduct set out in the Environment Court's Practice Note 2023. We have complied with the Code of Conduct in

preparing this joint statement. Except where we state that we are relying on the evidence of another person, this evidence is within our area of expertise. We have not omitted to consider material facts known to us that might alter or detract from the opinions expressed in this evidence.

7. The primary data on which the opinions are based is:
    - The Wellington City Proposed District Plan (PDP)[1]
    - Section 42A report for Hearing Stream 5 relating to Noise. [2]
    - The statement of evidence of Jon Styles for Kāinga Ora – Homes and Communities (2023)[3]
    - The statement of evidence of Malcolm Hunt for Wellington City Council (2023)[4]
    - The statement of evidence of Sean Syman for Wellington City Council (2023)[5]
    - The statement of evidence of Stephen Chiles for KiwiRail and Waka Kotahi (2023)[6]
    - The statement of evidence of Darran Humpheson for Wellington International Airport Limited (2023)[7]

MATTERS COVERED BY THIS STATEMENT

8. At the conferencing session held on 06/09/2023, the following matters were assessed by the experts against both the Internal Sound Level (ISL) and Standardised Level Difference (SLD) methods:
    - Construction cost.
    - Assessment cost.
    - Council compliance processing.
    - All costs.
    - Physical testing using sound level measurement equipment.
    - Effects on occupants.
    - Assumptions required for assessment.
    - Low frequency noise.
    - Building design outcomes.
9. Some of these matters were directed by the panel in minute 33, whilst others were considered useful by the experts in attendance to address, within the scope of the directions in minute 33. Where necessary, Airport, Road and Rail noise were assessed separately.

[1] Wellington City Council Proposed District Plan
[2] Section 42A Report - Noise
[3] Statement of evidence of Jon Styles for Kāinga Ora
[4] Statement of evidence of Mr Malcolm Hunt on behalf of Wellington City Council
[5] Statement of evidence of Mr Sean Syman on behalf of Wellington City Council
[6] Statement of evidence of Mr Stephen Chiles for KiwiRail and Waka Kotahi
[7] Statement of evidence of Mr Darran Humpheson for Wellington International Airport (2023)

10. During the session, the matters were debated, and the text was recorded in a table. Notes were taken recording any matters that required further actions or direction and following the session the table was reviewed in sequence by the experts and have come to consensus on the matters and wording of the analysis.
11. The finalised table, attached in Appendix 1 - Joint Witness Statement analysis table, sets out the agreed facts, assumptions, and positions on the matters. Definitive answers to the matters above are noted in bold in the table.
12. As requested by the panel, the acoustic experts have also provided their individual preferred method in the table below:

Stephen Chiles (KiwiRail and Waka Kotahi)	Position unchanged from written and oral evidence. Prefers ISL for road and rail noise provisions.
Darran Humpheson (WIAL)	Position unchanged from written and oral evidence. Prefers ISL for aircraft noise provisions.
Sean Syman (WCC)	Position unchanged from written and oral evidence. Prefers SLD generally. Considers that ISL may be applied in cases where external noise levels are published in detailed (1 dB increment) contours and noise source spectra are provided in the plan.
Malcolm Hunt (WCC)	Position unchanged from written and oral evidence. Prefers SLD for highway noise, rail noise and aircraft noise provisions.
Matthew Borich (WCC)	Sees advantages and disadvantages in both options. Prefers ISL for Airport as they have published aircraft noise contours and sound spectra available, and there is potential construction cost savings and design benefits. Prefers SLD for road and rail as the same level of noise information is not available.
Jon Styles (Kāinga Ora)	Position remains unchanged from the hearing. Sees advantages and disadvantages in both options. SLD will often give lower indoor noise levels (than ISL) but in those cases will be more expensive than ISL, whereas ISL likely to give reasonable indoor noise levels in all cases but lower overall cost compared to SLD. Cost to be weighed by others.

PARTICIPANTS TO JOINT WITNESS STATEMENT

We confirm that we agree that the outcome(s) of the expert conferencing are as recorded in this statement and Appendix 1 – Joint Witness Statement analysis table.

15 September 2023

Jon Styles for
Kāinga Ora

Malcolm Hunt
for Wellington City Council

Matthew Borich
for Wellington City Council

M.J.Borich

Sean Syman
for Wellington City Council

Darran Humpheson
for Wellington International
Airport Limited

Stephen Chiles
for KiwiRail and Waka Kotahi

APPENDIX 1 – Joint Witness Statement analysis table

Internal noise insulation standards for the Air Noise Overlay and Major Transport Corridors

Terms used in this statement:

ISL or **Internal Sound Level** – Where a specific noise level must be achieved in the rooms subject to the rule. Referred to as the 'dBA method' in some statements of evidence.

SLD or **Standardised Level Difference** – Where the degree of acoustic treatment is specified using the Dtr,2m,nT,w+Ctr method according to ISO171-1:2020 *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation.* This is the method in the notified version of the PDP.

HNA or **High Noise Area** – As adopted in the notified version of NOISE-S4 in the PDP and the recommended definition in the Statement of supplementary evidence of Mark Ashby – Noise.

MNA or **Moderate Noise Area** – As adopted in the notified version of NOISE-S5 in the PDP and the recommended definition in the Statement of supplementary evidence of Mark Ashby – Noise.

Issue	ISL / Internal Sound Level	SLD / Standardised Level Difference
Construction cost – the cost of constructing a building incorporating acoustic treatment, where the 'additional cost' is the difference between constructing the rooms without any specific acoustic treatment, and the cost of constructing the rooms with acoustic treatment as it would be required using the ISL or SLD options.	The ISL option allows the designer to customise the design and construction of the building envelope depending on the level of noise that each part of the building might be exposed to. The design might confirm that certain elements of the building envelope will not require any specific treatment for acoustics, and / or some elements may require less treatment than others. **This is the lowest cost option.**	Performance of external building envelope is fixed by the two design standards that apply in the HNA and MNA. This means that the additional construction costs are inflexible for a given design. Part (4) of the notified versions of S4 and S5 (renumbered as S4.5 and S5.5 in the version attached to the s42A report) allow the applicant to avoid any acoustic treatment in certain circumstances where they can demonstrate that the external noise level outside any particular habitable room is sufficiently low. These circumstances will result in no additional construction cost for the rooms that qualify for the exemption. *For example, the most exposed façade of a bedroom facing away from the road might receive noise levels lower than 57dB $L_{Aeq(24hr)}$ and therefore qualify for the exemption (where no acoustic treatment is required). The noise level on the façade of all other habitable rooms might be higher to the point where they don't qualify for the exemption. These rooms are required to be acoustically treated.*
Assessment cost – the cost of input from a suitably qualified and experienced acoustic expert	Each building requires an acoustic design report. These reports are most-often a desktop assessment. The cost of a design report can range from $1000 - $2000 +GST for a typical freestanding single dwelling unit in an MNA. The cost can be proportionally less per unit for multi-unit developments. The cost of a design report may double for assessments in HNAs. Note - the WIAL drafting of ISL insulation standard (NOISE-S16) did not require an acoustic design assessment if compliance with the minimum construction requirements of Table I is achieved within the Inner Noise Overlay.	<u>Standardised level difference without using the construction schedules in Tables I or II of the notified PDP.</u> The SLD option avoids the need to calculate the external noise level incident on the building envelope, this means marginally less cost than the ISL assessment as there are fewer calculations involved. The cost for an assessment in the HNA will typically be slightly higher than an assessment in the MNA. <u>Standardised level difference using the construction schedules in Tables I or II of the notified PDP.</u> No acoustic specialist input required. **This is the lowest cost option.** <u>If external noise levels below the thresholds stated in S4(5) or S5(5) (s42A version numbering) justify exemption from acoustic treatment requirements</u> Assessment is limited to demonstrating external noise levels are below thresholds for rooms subject to the exemption. No calculation of sound insulation required. Similar cost to ISL assessment for these rooms.

Council compliance processing	Council processes and processing costs are similar for all approaches.	
All costs	Generally, differences in construction costs between the ISL and SLD will be greater than the differences in assessment costs across both HNA and MNA (note that the WIAL submission seeks that no noise insulation is required in the MNA). The additional construction costs will generally be far greater than the acoustic assessment costs. **Overall, generally ISL is the cheaper option.** We are unable to provide a meaningful indication of how much cheaper the ISL method might be, mainly because it will vary considerably between projects.	
Physical testing using sound level measurement equipment – this is not required by the notified rule or by any of the submissions lodged by any of the parties represented in this statement. Physical testing of the acoustic performance of building envelopes happens rarely, if ever in practice.	It is not easy to test in the field. Generally, it is not practical to directly measure the specified indoor noise level as a result of noise 'break-in' from the source (road, rail or aircraft) and therefore physical/field testing is only for one component, supplemented by desk-top calculations. The component that can be readily measured by a field test is the sound level difference of the building, which is the identical measurement used under the SLD method. The indoor level is then calculated based on the predicted outdoor noise levels (from future aircraft noise contours for example).	It is not easy to test in the field. The test is the same as for the ISL but does not require any subsequent calculations as measurements undertaken directly inform the acoustic performance (Dtr,2m,nT,w+Ctr) of the structure.
Effects on occupants	All occupants will experience noise levels no greater than the specified indoor noise level standard in all habitable rooms. The ISL method requires an acoustic design for each habitable room. The design process often includes an element of over-designing to provide for construction and design uncertainties (such as differences in materials, construction methods and contractor care). This can often result in indoor noise levels that are slightly lower than the standard specified in the rule. Note - the WIAL drafting of the ISL insulation standard (NOISE-S16) did not require an acoustic design assessment if compliance with the minimum construction requirements of Table I is achieved within the Inner Noise Overlay.	<u>Standardised level difference without using the construction schedules in Tables I or II of the notified PDP</u> A desirable indoor noise level may not always be achieved for habitable rooms exposed to the highest outdoor rail noise levels using the notified Proposed District Plan Standardised Level Difference standard. A desirable indoor noise level would be achieved in habitable rooms for air and road noise, and most cases of rail noise. The indoor noise levels will generally be lower (better) than a normally desirable level in most cases. An acoustic designer can include an element of over-designing to provide for construction and design uncertainties (such as differences in materials, construction methods and contractor care). This can often result in indoor noise levels that are slightly lower than what is typically intended. **The SLD option will generally result in quieter outcomes for the occupants.**
Assumptions required for assessment.	<u>Road and rail</u> Outdoor noise level and spectra need to be estimated by the acoustic expert in each case (the KiwiRail submission proposes fixed basic assumptions for rail noise levels, but does not provide spectra)	No assumptions needed for the standard design process or if using the standard construction schedules in Tables I or II of the notified PDP. Outdoor noise level and source spectra need to be estimated / predicted by the acoustic expert if the exemption in S4(5) or S5(5) (s42A version numbering) are going to be engaged (same as ISL method).

	<u>Airport</u> Outdoor noise level and spectra need to be estimated by the acoustic expert in each case. The estimations can be based on published aircraft noise contours. Sound spectra are available and can be provided by WIAL to reduce the need for assumptions.	
Low frequency noise.	Satisfactory indoor low frequency performance is dependent on the outdoor spectral assumptions outlined above. A suitably qualified and experienced acoustic expert should generally adopt a representative spectrum to achieve reasonable indoor low frequency noise levels. Frequency spectra specific to each mode of transport could be provided for in the PDP to reduce the need for assumptions to ensure that a reasonable indoor low frequency noise level is delivered in every case. The assessor may assess indoor low frequency specifically, and may assess frequencies lower than what is required by the metric adopted by the SLD method.	<u>Standardised level difference without using the standard construction schedules in Tables I or II of the notified PDP.</u> Satisfactory indoor low frequency performance (within the standardised range) is inherent in the SLD methodology prescribed by the rule. An assessor using the ISL method may consider sound insulation performance at lower frequencies than the frequency range prescribed within the Standard on which the SLD method is based.The indoor low frequency sound levels will be similar to the ISL method at the noisier extents of the HNA and MNA, but will be better (lower) than the ISL method when at the outer / quieter extents of the HNA and MNA. The standard construction schedules in Tables I or II of the notified PDP have been designed to deliver the Standardised Level Difference values prescribed in each rule (NOISE-S4 and NOISE-S5). These are intended to achieve a reasonable indoor low frequency performance.
	The ISL can provide a better indoor low frequency outcome depending on the methods used by the assessor. Whereas the SLD method will inherently deliver a reasonable performance in the indoor low frequency region in all cases.	
Building design outcomes	The ISL method incentivises designers to arrange the building layout to orientate habitable rooms and windows / doors away from road and rail noise sources where practicable because this reduces the cost of acoustic treatment. In some cases this may have benefits for the future occupants in terms of having the choice of opening windows and not having to use mechanical ventilation.	If external sound levels below the thresholds stated in S4(5) or S5(5) (s42A version numbering) justify exemption from acoustic treatment requirements there are similar incentives to orient habitable rooms away from roads and rail where a designer seeks to engage the exemptions under S4(5) and S5(5). However, this applies only to complete rooms and not separate building elements of the same room. If the thresholds enabling an exemption from acoustic treatment are exceeded, there is no acoustic reason to design buildings to place habitable rooms on quieter facades.