PLAN CHANGE 1 – MINOR IMPROVEMENTS – NON HERITAGE TOPICS

SECTION 42A REPORT

25 July 2025

APPENDIX C.5 ACOUSTIC EVIDENCE

BEFORE THE PLAN CHANGE 1 HEARING PANEL

IN THE MATTER of the Resource Management Act 1991

AND Plan Change 1 to the proposed Second Generation Dunedin City District Plan (2GP)

STATEMENT OF EVIDENCE OF JEREMY WILLIAM TREVATHAN ON ACOUSTICS FOR DUNEDIN CITY COUNCIL
Dated 13 May 2025

QUALIFICATIONS AND EXPERIENCE

1. My full name is Jeremy William Trevathan

2. I am the Principal Acoustic Engineer and Managing Director of Acoustic Engineering Services Limited (AES), an acoustic engineering consultancy with offices in Auckland, Wellington and Christchurch.

3. I hold the degrees of Bachelor of Engineering with Honours and Doctor of Philosophy in Mechanical Engineering (Acoustics) from the University of Canterbury. I am an Associate of the New Zealand Planning Institute, and a Member of the Acoustical Society of New Zealand (ASNZ). I am the AES Member Representative for the Association of Australasian Acoustical Consultants (AAAC), a judge for the Association of Consulting Engineers of New Zealand (ACE NZ) Innovate Awards, and a member of the MBIE College of Assessors. I was a member of the ASNZ working group advising the Ministry for the Environment (MfE) regarding the National Planning Standards (2019).

4. I have more than nineteen years' experience in the field of acoustic engineering consultancy and have been involved with a large number of environmental noise assessment projects on behalf of applicants, submitters and as a peer reviewer for Councils. I have provided expert evidence before Council Hearings Panels, the Environment Court and Boards of Inquiry.

5. I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023. This evidence has been prepared in accordance with it, and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE AND OVERVIEW

6. My evidence relates to Change PHS2, regarding the acoustic insulation requirements outlined in Rule 9.3.1.1 and Appendix 9A of the Second Generation Dunedin City District Plan, specifically for bedrooms to achieve an acoustic separation minimum requirement of $D_{nT,w} + C_{tr} \geq 35$ dB.

DATED this 13th day of May 2025

Jeremy William Trevathan

INTRODUCTION

1. This evidence is to support Change PHS2 in the Second Generation Dunedin City District Plan (2GP). PHS2 provides an increase to acoustic insulation for bedrooms to assist with music venue noise management. There are three key aspects to Change PHS2 summarised as follows:

    a. Change PHS2 increases the noise insulation requirements for bedrooms by 5 dB to achieve a minimum design standard of $D_{nT,w} + C_{tr} \geq 35$ dB in Rule 9.3.1.1 of the 2GP.

    b. Change PHS2 adds a requirement that the ventilation systems outlined in Rule 9.3.1.5 are to be designed and built so as to not compromise the acoustic insulation performance of the space.

    c. Change PHS2 also adds a list of acceptable solutions to Appendix 9A of the 2GP to achieve a noise reduction of 35 dB $D_{nT,w} + C_{tr}$.

2. The zones affected by Change PHS2 are the Central Business District (CBD) Zone, Warehouse Precinct (WP) Zone, and the Harbourside Edge (HE) Zone, as defined in Rule 9.3.1.1 in the 2GP.

3. My company has been involved with PHS2 at the development stage, and has provided the input described below, under my supervision:

    a. In November 2022 AES was engaged to undertake a review of whether acoustic insulation requirements in the 2GP should be increased to better manage reverse sensitivity effects on entertainment and exhibition activity from residential activity in zones where both activities are permitted, and provided a report on that review. The review referred to a report by Styles Group titled 'Managing Compatibility Between Music Venues & Noise Sensitive Land Use', dated the 27th of February 2022, in which some changes to the 2GP had been proposed. (AES report AC22354 – 02 – R1, dated the 16th of December 2022).

    b. In May 2023, a memorandum was provided to answer questions from the Dunedin City Council that arose from the report. (AES memo AC22354 – 03 – R2, dated the 31st of May 2023).

4. In addition to the changes listed above, the Styles Group report also suggested a mechanical cooling requirement be added to the rule. I consider this may be unnecessary given the climate in Dunedin and the ventilation requirement already in place – however heating, cooling and ventilation requirements are generally outside of my area of expertise.

5. I have summarised and expanded on the above assessment in the following sections, as follows:

    a. I have considered the expected noise levels received at buildings in the relevant zones.

    b. Discussed the applicability of increasing the acoustic insulation requirements and recommended acceptable solutions, including solutions for acoustic requirements of mechanical ventilation.

    c. Provided a summary of cost analysis of acoustic upgrades that my company has been involved in.

    d. I have commented on relevant submissions.

EXTERNAL NOISE LEVELS

6. The noise limit within the zones relevant to PHS2 is 60 dB $L_{Aeq(15\ min)}$ at all times, which is to be measured and assessed in accordance with NZS 6801:2008 *Acoustics – Measurement of environmental sound*, and NZS 6802:2008 *Acoustics – Environmental noise*. This limit is not proposed to be changed.

7. NZS 6802:2008 requires the application of a +5 dB penalty when assessing a noise source with Special Audible Characteristics (SAC), effectively making the noise limit 5 dB more stringent for noise sources with SAC. This is to compensate for any additional noise effects caused by the SAC. Noise from music may or may not have SAC depending on the nature of the music.

8. Louder music venues may have internal noise levels in the order of 100 dB $L_{Aeq(15\ min)}$, and the noise which breaks out to neighbours will have SAC. A noise reduction in the order of 45 dB will therefore be required before the noise reaches the closest receivers, in order for a given venue to comply with the noise limits.

9. To achieve this, doors and windows to venues will generally need to remain closed or have a noise lobby, and the building envelopes of venues with louder music will require a moderate level of acoustic insulation, including fibrous insulation to walls, and possibly some wall linings with a higher mass over typical building constructions.

10. While detailed analysis of the suitability of the noise limit was not in the scope of the work I have conducted for this plan change, a 60 dB L_{Aeq} noise limit is similar to that in many other New Zealand centres including Wellington, Christchurch and Queenstown Lakes – where 60 – 65 dB L_{Aeq} limits are common in the central city or entertainment districts.

11. In addition, in my experience, a 60 dB L_{Aeq} noise limit is one of the options often perceived as a reasonable balance between the costs for venues of lowering noise transmitted to the site boundary, and meeting expectations of neighbours in entertainment districts.

12. Cumulative noise levels for a given receiver may be greater than the maximum noise level permitted for a single venue, where there are multiple noise sources in close proximity. For two noise sources each producing 60 dB $L_{Aeq(15\ min)}$, cumulative noise levels at a receiver could be up to 63 dB $L_{Aeq(15\ min)}$, and with three noise sources the cumulative noise level could reach 65 dB $L_{Aeq(15\ min)}$.

13. Where there are high traffic noise levels or noise from uncontrolled sources such as people in public spaces, cumulative noise levels may be further increased.

GUIDANCE ON APPROPRIATE INTERNAL NOISE LEVELS

14. Appropriate indoor noise levels are required to provide protection to occupants from adverse health effects and annoyance.

15. The World Health Organisation (WHO) *Guidelines for Community Noise*, advises that continuous indoor noise should not exceed 30 dB L_{Aeq} for sleep protection. WHO also advises that when the noise source contains a large proportion of low-frequency noise (which is typical of break-out sound from music at hospitality venues), that an even lower bedroom noise level may be appropriate; however it is to be expected that noise levels could be louder in inner city areas than they would be in a more rural setting.

16. AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* guidance recommends guideline internal noise levels of 30 – 40 dB L_{Aeq} at night time within bedrooms in inner city areas or entertainment districts. 35 – 45 dB L_{Aeq}

guideline limits are given for living areas, and 45 – 50 dB L_{Aeq} limits are given for apartment common areas.

NOISE INSULATION REQUIREMENTS

17. As above, the level of noise insulation proposed for bedrooms in Change PHS2 is $D_{nT,w} + C_{tr} \geq 35$ dB.

18. The '$D_{nT,w} + C_{tr}$' noise insulation metric can be thought of in general terms as the difference between external and internal noise levels for a room, given an outdoor noise source with modest low frequency content. The higher the number, the greater the noise insulation performance.

19. Music noise breaking out from venues often contains significant low-frequency noise, which is not attenuated by typical building elements as effectively as a source with modest low frequency content.

20. This means that a $D_{nT,w} + C_{tr}$ 35 dB rating for a bedroom may result in an external to internal noise reduction of less than 35 dB for music noise – possibly only achieving a reduction in the order of 25 dB.

21. For the above situation, and cumulative external noise levels of 65 dB $L_{Aeq(15\ min)}$, internal noise levels could be in the order of 40 dB $L_{Aeq(15\ min)}$. This is the upper limit that is recommended for sleeping areas in AS/NZS 2107:2016.

22. If the level of required noise insulation was lower (for example, $D_{nT,w} + C_{tr}$ 30 dB), internal noise levels in the above scenario would be higher than recommended by all relevant guidance.

23. Compared to $D_{nT,w} + C_{tr}$ 30 dB, achieving $D_{nT,w} + C_{tr} \geq 35$ dB will require more significant building upgrades. For example, external walls will require thicker cladding materials and high density plasterboard (where exterior walls are not high mass), thicker double glazing or double windows, larger roof cavities, thicker ceilings, and thicker under-floor linings. While these upgrades will add cost to any new residential development (discussed further below), in my experience, achieving compliance is still practicable.

24. Ideally internal noise levels would be even lower than achieved by $D_{nT,w} + C_{tr}$ 35 dB, to provide better protection, and reduce the risk of complaints about venues. However, while an even higher level of noise insulation may be ideal in some circumstances (for example $D_{nT,w} + C_{tr}$ 40 dB), this further step up would see building envelope constructions restricted to high mass elements such as concrete or masonry only, window sizes limited, and the acoustic design would become one of the overriding design constraints for the building. As a result, this level of noise insulation would often be a significant barrier to residential development.

25. I therefore support the proposal that the noise insulation requirement for bedrooms is increased to $D_{nT,w} + C_{tr} \geq 35$ dB under Change PHS2, as it achieves a balance between the cost of building and appropriate internal noise levels.

26. An alternative noise insulation rule that allows for consideration of noise insulation on a case-by-case basis is a 'design internal noise level'. This is useful where there is a known assumed external source noise level and spectrum (such as noise from a road). However, in this case specific noise sources are not known, so this kind of rule would not be as easily implemented as the proposed noise insulation rule.

VENTILATION NOISE INSULATION REQUIREMENTS

27. A 'positive supplementary source of ventilation' is also required, as the above noise attenuation requirements cannot be achieved when windows are open for ventilation. However, there are some types of forced ventilation such as a simple fan installed in an external wall that would effectively result in a hole in the wall, and compromise the level of noise insulation provided by the external wall.

28. Therefore, the rule requiring ventilation systems to be designed to maintain acoustic separation in Change PHS2 is appropriate and necessary to ensure that the noise insulation performance will not be compromised.

NOISE INSULATION REQUIREMENTS FOR NON-BEDROOM SPACES

29. The noise insulation requirement for habitable spaces other than bedrooms in Rule 9.3.1.1 remains as $D_{nT,w} + C_{tr} \geq 30$ dB.

30. Guidance such as that cited above typically recommends an indoor noise level 5 dB higher for general habitable spaces than for sleeping areas. Therefore, other habitable spaces are likely to be adequately protected by a $D_{nT,w} + C_{tr} \geq 30$ dB noise insulation requirement.

31. There are no noise insulation requirements in Rule 9.3.1.1 for non-noise sensitive spaces such as bathrooms or hallways. The upper guideline noise limit given for common spaces (i.e. less noise-sensitive) in AS/NZS 2107:2016 is 50 dB $L_{Aeq(15\ min)}$. Even with windows open for ventilation to these spaces, an outside to inside noise reduction in the order of 15 dB is expected, and so internal noise levels in these spaces would typically be less than 50 dB $L_{Aeq(15\ min)}$.

THE COST OF ACOUSTIC INSULATION UPGRADES

32. I was involved in a research project relating to the cost of acoustic upgrades, undertaken by the NZTA[1]. The study reviewed 58 buildings where acoustic upgrades had been implemented during the design stage, and found that the upgrades increased the price of construction by 0 – 2% in a range of scenarios, including some which were similar to a $D_{nT,w} + C_{tr} \geq 35$ dB noise insulation requirement.

33. While it is not possible to be certain from that study as to the exact difference between the cost to implement a $D_{nT,w} + C_{tr} \geq 30$ dB versus a $D_{nT,w} + C_{tr} \geq 35$ dB noise insulation requirement in a Dunedin context, it appears that the overall relative cost impact is small either way.

COMMENT ON SUBMISSIONS

34. One submitter (Russel Lund (s58)) raises a number of specific points relating to acoustics including:

    a. The plan change is based on a reaction to a small number of complainants, and noise from music venues will not result in complaints from the majority of people.

    b. Noise generating music venues should bear the burden of providing noise insulation, rather than owners of nearby dwellings.

[1] Memorandum titled Cost of traffic noise mitigation measures, prepared by Clare Dykes of Acoustic Engineering Services and dated the 12th of June 2020.

c. Noise levels should be measured at the noise generating site boundary rather than the noise receiving site boundary.

d. The proposed rule focuses on music noise only, and does not consider other noise types experienced in the HE Zone and elsewhere.

e. The plan does not provide any protection for existing dwellings within the relevant zones.

35. There are also multiple other submissions with the following requests:

a. That the noise insulation requirement be increased to $D_{nT,w} + C_{tr} \geq 40$ dB.

b. That the noise insulation requirements apply to entire dwellings rather than only bedrooms.

36. As above, the Plan Change seeks to ensure noise levels are more likely to comply with the guidance in AS/NZS 2107:2016 – which is provided to control population level effects. As also described above, the proposed level of acoustic insulation in Change PHS2 will ensure that these guidelines are more frequently achieved, and anything less would result in the guideline noise levels for protection of health and sleep being exceeded more frequently. I accept that every new bedroom may not be exposed to music venue noise, however ensuring that the quality of new residential building stock is gradually improved over time, will allow for more functional 'mixed use' environments in the future, rather than these areas always being limited by interspersed low quality residential buildings (which may have reflected the external noise environment at the time). I also note a Resource Consent pathway would be available for developers who genuinely considered that their circumstances were unique, and a lower level of sound insulation was reasonable.

37. Irrespective of the acoustic insulation requirements, music venues still need to bear the cost of complying with the 60 dB L_{Aeq} noise limit within the CBD, WP and HE zones. Decreasing the noise limits (so that the noise insulation requirement for bedrooms can be lower) would mean that music venues need to install an even higher level of sound insulation, which is likely to be cost prohibitive. Some balance and compromise are always needed, if a true 'vibrant mixed use' zone is desired. The Plan Change proposal is consistent with current practice – where both noise producers and new noise receivers bear some of the cost – but it is not prohibitive for either side.

38. While existing apartments are not covered by PHS2, it is still important to ensure that new buildings are sufficiently insulated to ensure that occupants of new dwellings are provided sufficient amenity. As older apartments are replaced over time, a greater level of noise protection will be achieved.

39. Regarding the location of noise measurements, it is common to assess noise levels at the boundaries of receiving sites, rather than at the boundaries of the site where noise is generated. This is a plan wide rule and is consistent with the measurement and assessment given in NZS 6801:2008 and NZS 6802:2008, the use of which is directed by the National Planning Standards.

40. A noise insulation requirement of $D_{nT,w} + C_{tr} \geq 40$ dB is often impracticable to achieve, and effectively prohibits residential development – contrary to the objectives in most mixed use environments. As outlined above, the Rules as currently proposed will adequately protect all internal spaces of a residential building, and generally achieve the guidance of AS/NZS 2107:2016 which varies depending on the use and noise sensitivity of each space.

CONCLUSIONS

41. The proposed noise insulation requirement of $D_{nT,w} + C_{tr} \geq 35$ dB for bedroom spaces is an appropriate balance between achieving acceptable internal noise levels and the practicability of building such a space.

42. Other habitable spaces do not need to have an increased noise insulation requirement, as the current noise insulation requirement of $D_{nT,w} + C_{tr} \geq 30$ dB for those spaces already offers a sufficient level of amenity.

43. The rule requiring acoustic design of ventilation in PHS2 is an appropriate necessary addition to the 2GP, to ensure that a sufficient level of noise insulation is maintained.

44. The cost of developing a residential building within the CBD, WP, and HE zones will be increased compared to the original version of Rule 9.3.1.1 in the 2GP, however the increase is expected to be a small amount, compared to the overall cost of a development.