Appendix D Narrative on AVO Guide

D.1 The *Residential Design Guide on Acoustics Ventilation and Overheating (version 1.1)* ("the AVO Guide") was published in January 2020 by the Association of Noise Consultants (ANC) and the Institute of Acoustics (IoA).

D.2 The AVO Guide states that it "*is intended to be used by acoustics practitioners as well as all those involved in the planning, development, design and commissioning of new dwellings. It recommends an approach to acoustic assessments for new residential development that take due regard of the interdependence of provisions for acoustics, ventilation, and overheating*".

D.3 It seeks to "assist in educating clients, environmental health/planning officers and other stakeholders of the interdependence of design for acoustics, ventilation and overheating" and recognises that:

> *To enable designers and planners to make fully informed decisions, however, requires two further pieces of information. The first is to know how long windows will need to be open, which may be determined from a dynamic thermal model, or more qualitatively from the GHA Overheating Risk Tool. The second requires a better understanding of the potential adverse impact of combined exposure to noise and overheating. Crucially, how long will people tolerate higher noise levels in order to stay cool? One suggestion is to consider the overall average day (16h) and night (8h) time average noise levels.*

D.4 It notes that there "... is a need to address how ... the strategy for mitigating overheating impacts on the acoustic conditions, and whether a more detailed overheating assessment is required to inform this".

D.5 Section 2 of the AVO Guide sets out the relevant legislation and guidance and notes that "*it is important to differentiate between the need to provide 'purge ventilation' as required occasionally under ADF (i.e. to remove smoke from burnt food etc.); against the provision of ventilation to help control overheating, which is not covered by The Building Regulations*".

D.6 On the subject of overheating it states:

> *2.7 There are no specific requirements relating to overheating in The Building Regulations. Both ADF and Approved Document L1A of The Building Regulations briefly mention overheating but do not provide details on what constitutes overheating*
>
> *2.13 Developments will normally (but not always) require additional ventilation (above ADF whole dwelling ventilation provisions) in order to mitigate overheating. Where*

an overheating assessment is undertaken, it should provide details as to the duration and rate of any additional ventilation required to meet overheating compliance criteria. Where this additional ventilation is provided passively, the overheating assessment should also provide information about the required size of façade openings

2.16 An overheating assessment might not always be undertaken for a project and without this information it is difficult to identify noise impacts that may occur during the overheating condition.

D.7 With regard to acoustic criteria it notes that "*where a development is considered necessary or desirable, the levels in [BS 8233:2014, Table 4] may be relaxed by up to 5dB and reasonable internal conditions still achieved.*" It should be noted that this approach is not accepted by most local authorities, who require the guidance in BS 8233:2014 to be met.

D.8 Section 3 sets out guidance for internal ambient noise levels and recommends that a two-stage process is followed. The Level 1 assessment assumes that opening windows is the primary means of mitigating overheating, while a Level 2 assessment "considers the potential for adverse effect on occupants based on internal ambient noise level".

D.9 The AVO Guide notes:

3.9 It is suggested here that the desirable internal noise standards within Table 4 of BS 8233:2014 should be achieved when providing adequate ventilation as defined by ADF whole dwelling ventilation. However, it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.

D.10 Table 3-3 in the AVO Guide, reproduced below, identifies the suggested highest permissible internal noise levels in the overheating condition:

Table 3-3 Guidance for Level 2 assessment of noise from transport noise sources[Note 1] relating to overheating condition

Internal ambient noise level [Note 2]			Examples of Outcomes [Note 5]	
$L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{Af,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
Increasing noise level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 8]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{Af,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response[Note 9]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

Note 1 The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.

D.11 The explanatory notes include:

3.15 For the daytime period, the upper category in Table 3-3 is defined on the basis that $L_{Aeq,T}$ 50 dB represents the upper end of the range for reliable speech communication.

3.16 For the night-time period, the upper category in Table 3-3 is defined with reference to the WHO Night Noise guidelines, which state that for external levels above $L_{Aeq,T\ 55\ dB}$: "adverse health effects occur frequently and a sizeable proportion of the population is highly annoyed and sleep-disturbed".

3.18 In the case of the overheating condition, the effect of increased internal ambient noise from external noise sources will depend both on the absolute noise level and the amount of time for which the overheating condition occurs. A good design process should therefore, as a priority, seek to minimise heat gains thereby reducing the amount

and duration of ventilation required to control overheating and the consequential effect from increased ingress of noise.

D.12 Paragraph 3.26 notes that "The Level 2 assessment suggests that assessment of the adverse effect from noise exposure should include an estimate of how frequently and for what duration the overheating condition occurs.".

D.13 Appendix B in the AVO Guide sets out an example application of the guide, and includes examples of passive ventilation solutions and the attenuation each provides. This is set out in Table B-5, reproduced overleaf. It should be noted that in the majority of cases there is a wide range of potential performance values and the actual performance achieved will be depend on the precise design used.

Table B-5 Examples of passive ventilation solutions providing enhanced sound insulation

Design option	Description and references	Approximate Level Difference (external free field level – internal reverberant level)	Improvement relative to a window providing a similar amount of ventilation
Standard opening windows	Window(s) open sufficiently to provide a ventilation free-area equivalent to 2% of the floor area. [42]	13 dB	0 dB
Open windows with sound attenuating balconies	Window(s) as above. Balconies may have a solid balustrade or be enclosed to a further degree (maintaining an open area for ventilation). Absorption may be provided to the balcony soffit or potentially to other surfaces. [49, 50, 51]	17 – 23 dB	4 – 10 dB
Attenuated or plenum windows	Dual windows (spaced by around 200mm) with staggered openings and absorptive linings to the cavity reveals. Various other configurations also possible in principle. [52, 53]	17 – 24 dB	4 – 11 dB
Attenuated vents/ louvres	Ventilation openings with integral means of attenuating sound. Typically this may be acoustic louvres or acoustically lined ducts/plena. [54, 55]	17 – 29 dB	4 – 16 dB
Attenuated windows or vents/ louvres with sound attenuating balconies	Combined use of balconies to provide screening and acoustically attenuated windows or vents. Refer to above for description of each element.	21 – 39 dB	8 – 26 dB