

1 Technical Note – Environmental Health Consultation Response

Introduction

- 1.1 Arun District Council are currently determining a planning application (A/39/21?DOC) seeking the discharge of Condition 9 of the outline planning permission granted for a new residential development on Land South of Water Lane, Angmering (outline permission ref. A/99/17/OUT).
- 1.2 The application to discharge the condition was accompanied by a “*Sound Insulation Assessment*” prepared by Mayer Brown Limited.
- 1.3 The report has been reviewed by the District Council’s Environmental Health Team who have made a number of comments (as set out in the EH Team’s email response to the planning case officer on 16th April 2021).
- 1.4 The comments raised by the EH Team essentially focus on two matters:
- The determination of $L_{Amax,fast}$ values and their opinion that the noise levels predicted justify a need for mechanical forced ventilation to those houses/flats adjacent to the A280; and
 - Some general queries relating to the orientation of habitable rooms in dwellings.
- 1.5 The EH Team’s response concludes by inviting the submission of further details/clarification to enable the discharge of condition application to be considered further.
- 1.6 This Technical Note seeks to provide additional clarification. It is also accompanied by an updated version of the Sound Insulation Assessment previously submitted to ensure that the EH Team’s comments are comprehensively addressed.

Determination of $L_{Amax, fast}$ noise level

- 1.7 The EH Team comment:
- “The report states that analysis was carried out of the 1 minute $L_{Amax, fast}$, at 2 positions where the corrected figures were found to be 73 $L_{Amax,f}$ (A1, A280 south) and 72 $L_{Amax,f}$ (A2, A280 north), although the meaning of ‘the 10th highest individual event value,’ used to determine these figures is not described.”*
- 1.8 Paragraph 5.22 of the submitted noise assessment states:

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“Analysis of the 1 minute $L_{Amax,fast}$ values for Positions A1 and A2....for the complete night-time monitoring period has been undertaken and the 10th highest individual event value has been established.....”

- 1.9 To help further explain this, the measurement data at Positions A1 and A2 (at which long term monitoring has been undertaken) has been analysed to determine 1 minute samples throughout each night (i.e. a total of 480 one minute samples per night).
- 1.10 The measurement data has then been “ranked” in order of magnitude and the “design” $L_{Amax,fast}$ value has been taken as the 10th higher value, i.e. the value that will be exceeded by 9 highest other 1 minute periods, but will not be exceeded by the other 470 samples.
- 1.11 This approach is directly aligned with industry standard guidance including:
- The World Health Organisation’s “*Guidelines for Community Noise*” (which presents guidance on sleep disturbance on the basis of a recommendation that there should be no more than 10-15 “events” per night exceeding the indicated sleep disturbance threshold);
 - Figure 1 of ProPG Guidance (and accompanying commentary) which proposes $L_{Amax,fast}$ guidance on the basis of a “10 event” level.
- 1.12 The adopted approach is also entirely consistent with the ANC/IOA’s AVOG guidance for assessing night-time event noise. In that regard, we would highlight that paragraph 3.17 of the AVOG guidance includes reference to a paper published in Acoustics 2019, IOA Proceedings Volume 41 titled “*Assessing L_{max} for residential developments: the AVO Guide Approach*” (authored by Paxton, Conlan, Harvie-Clark, Chilton and Trew). This paper provides a detailed summary of studies that assist in identifying procedures to quantify noise events associated with road traffic and concludes:

“A typical approach to identifying individual noise events in a measurement is to split the night-time period is into short intervals of length T and identify the L_{Amax} level in each. Using a probability-based approach, clearly the choice of the time interval length T will significantly affect the expected number of noise event induced awakenings. There is no value of T that will give absolute equivalence to the undisturbed individual event-based approach described above. Some factors affecting the choice of a suitable time interval T are discussed in Table 1.

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“Based on the discussion above, it is proposed that a measurement duration of between 1 and 3 minutes may be appropriate, this corresponds to the evaluation of between 160 and 480 maximum noise levels over the course of an 8-hour night-time period”.

- 1.13 The approach set out in our Sound Insulation Assessment therefore implements the more precautionary 1 minute value inferred by this current good practice guidance and is considered to present a robust basis for assessment.

Requirement for increased noise mitigation

- 1.14 The EH Team comment:

“This level of $L_{Amax,f}$ indicates a medium risk of potential for sleep disturbance and therefore the need for increased noise mitigation in the form of mechanical forced air ventilation to those houses/flats adjacent to the A280.”

- 1.15 We would generally concur with the EH Team’s view that the noise levels characterising the western side of the site would be categorised as having a “medium” noise risk, based on ProPG and AVOG guidance. The noise constraint created by the A280 is readily acknowledged in the scheme design proposals and mitigation is implemented by: seeking to create a buffer zone between the A280 and dwellings; generally orientating “front row” buildings such that they face towards the A280 (thereby providing a “screened” rear elevation and to external amenity space) and the provision of appropriate double glazing and alternative means of ventilation (compliant with System 1 of Approved Document F).
- 1.16 Notwithstanding the above, the EH Team’s response indicates that they expect alternative mitigation to be included for the houses/flats adjacent to the A280, i.e. that these should be provided with “mechanical forced ventilation”. Based on details approved for other recent development in the locality¹, it is understood that the required ventilation should be provided to the standard of “System 3” or “System 4” of Approved Document F of the Building Regulations. For the avoidance of doubt:
- “System 3” is “Continuous mechanical extract (MEV)”; and
 - “System 4” is “Continuous mechanical supply and extract with heat recovery (MVHR).”

¹ Arun District Council Planning Ref. A/85/20/DOC – Manor Nurseries, Angmering (previous A/38/18/RES)

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- 1.17 Appendix A of the ProPG guidance presents a detailed review of the potential sleep disturbance effects of noise and this is further amplified by guidance set out in AVOG. Based on this guidance, it is routinely accepted that a external sound level of 60dB $L_{Amax,fast}$ (not exceeded by more than 10 events) represents a “Lowest Observed Adverse Effect Level” (LOAEL), and that a level of 78dB $L_{Amax,fast}$ (not exceeded by more than 10 events) represents a “*Significant Observed Adverse Effect Level*” (SOAEL).
- 1.18 As highlighted in the submitted Sound Insulation Assessment accompanying the discharge of condition application, the “worst case” $L_{Amax,fast}$ sound levels for the proposed dwellings are estimated to be around 72-73dB $L_{Amax,fast}$. It can therefore be concluded that future dwellings would not experience $L_{Amax,fast}$ sound levels above SOAEL and therefore satisfy the objective set out in paragraph 180 of the NPPF that “*noise giving rise to significant adverse impacts on health and quality of life*” should be avoided.
- 1.19 Internal noise levels can be reduced to below a LOAEL through the use of the proposed glazing and alternative means of ventilation, which is also considered to appropriately discharge the other limb of paragraph 180, i.e. for noise to be “*mitigated and reduced to a minimum*”.
- 1.20 Notwithstanding the above, it is clear the future residents would experience a higher level of noise intrusion when windows to their property are open. The potential “effect” of this would be largely determined by extent of time a resident may wish to open their windows. A detailed overheating risk assessment of the scheme has not been undertaken, however, the broadly north-south alignment and orientation of dwellings essentially means that facades most exposed to road traffic noise will be east facing. It would therefore be reasonable to assume that they will be less likely to experience significant solar gain and thus the associated risk of overheating.
- 1.21 In order to seek to take a precautionary approach to this, reference can be made to Note 7 which accompanies Figure 2 of the ProPG guidance. This states:
- “Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal LAeq target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal LAeq levels start to exceed the internal LAeq target levels by more than 5 dB, the more that most people are likely to regard them as “unreasonable”. Where such exceedances are predicted, applicants should be required to show how the*

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relevant number of rooms affected has been kept to a minimum. Once internal LAeq levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as “unacceptable” by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing “unacceptable” noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form.”

- 1.22 The above guidance clearly indicates that increased internal noise levels can still provide reasonable living conditions, but may become unacceptable at higher noise magnitudes and/or if windows are open from longer periods. Whilst the above guidance is given in the context of the LAeq noise index, a similar rationale can be applied to LAmax,fast sound levels.
- 1.23 To help inform this, reference can be made to research by Griefahn B, Scheuch K, Jansen G, Spreng M. “*Protection goals for residents in the vicinity of civil airports*” (Noise Health 2004; 6: 51-62). This research suggests that the need to protect or avoid noise impacts can be considered on the basis of three noise effect values - a “threshold” value which represents a long term value that should not result in any long term health effects; a “protection” value (which should protect the majority of the population from potential noise related health hazards and a “critical load” values which should be tolerated for a limited time only. The more detailed definitions of these values is set out below:
- **Threshold values.** *These values cause significant effects, but do not bear a pathogenic risk in the long run. Nevertheless, to increase the quality of live these values constitute a long-term goal.*
 - **Protection guides.** *Excess of these noise loads gives reason for counter measures. Their undercut is expected to exclude health hazards for the average person, whereas impairments may be still observed in sensitive groups.*
 - **Critical loads.** *As health hazards are no longer excluded, any excess of these loads forces the establishment of noise abatement measures. These loads shall be tolerated only as an exception during a limited time.*
- 1.24 The research presents the following summary of possible evaluation criteria:

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Evaluation criteria			
Noise level	Threshold value	Protection guide	Critical load
Hearing damage			
L_{max}	90 dB(A)	95 dB(A)	115 dB(A)
$L_{eq,24h}$	70 dB(A)	75 dB(A)	80 dB(A)
Communication			
$L_{eq,16h}$ indoor	35 dB(A)	40 dB(A)	45 dB(A)
$L_{eq,16h}$ outdoor	56 dB(A)	59 dB(A)	62 dB(A)
Sleep, two-phase model 2/3 of flights between 22.00 and 1.00			
$L_{max,22h-1h}$, indoor	23 x 40 dB(A)	8 x 56 dB(A)	6 x 60 dB(A)
$L_{max,1-6h}$, indoor	23 x 40 dB(A)	5 x 53 dB(A)	6 x 60 dB(A)
$L_{eq,22-1}$, indoor	30 dB(A)	35 dB(A)	40 dB(A)
$L_{eq,1-6h}$, indoor	30 dB(A)	32 dB(A)	40 dB(A)
Sleep, one-phase model			
$L_{max,22-6h}$, indoor	23 x 40 dB(A)	13 x 53 dB(A)	6 x 60 dB(A)
$L_{eq,22-6h}$, indoor	30 dB(A)	35 dB(A)	40 dB(A)
High annoyance			
$L_{eq,16h}$, indoor	55 dB(A)	62 dB(A)	65 dB(A)
Chronic diseases			
$L_{max,16h}$, outdoor	-	25 x 90 dB(A)	19 x 99 dB(A)
$L_{eq,16h}$, outdoor	-	65 dB(A)	70 dB(A)

Table 1: Threshold, Protection and Critical Load Values after Griefahn et al.

- 1.25 In terms of possible sleep disturbance effects, it can be seen that the “*Protection Guide*” values (in terms of the $L_{Aeq,T}$ noise index) are typically 5dB higher than “*Threshold Value*”, whilst “*Critical Load*” values are typically 10dB higher.
- 1.26 The situation in relation to L_{max} values is slightly more complex in that criteria are presented in terms of both noise level and the number of events. However, in terms of noise magnitude, it can be seen that for the simplest one phase sleep model, “*Protection Guide*” values are around 13dB(A) higher than the “*Threshold Value*”, whilst “*Critical Load*” values are typically 20dB(A) higher.
- 1.27 When considering the L_{max} values set out in the table above, it is important to note these are presented in terms of measurements with a ‘slow’ time weighting (L_{ASmax}), rather than the ‘fast’ time weighting (L_{AFmax}) (used in BS 8233, WHO Guidelines, etc.). The difference between the two indices may typically be around 2dB(A). As such, the maximum values indicated in Table 5.1 above would typically be around 2dB(A) higher if they were expressed in terms of the $L_{Amax,fast}$ noise index. This would generally indicate a night-time “*Protection Guide*” value of 55dB $L_{Amax,fast}$ (indoors). This would imply a protection guide

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value of around 70dB $L_{Amax,fast}$ outside (allowing an outside to inside sound reduction of 15 dB(A) for an open window.

- 1.28 As noted earlier, the WHO, ProPG and AVOG guidance routinely referenced imply that a value of 60dB $L_{Amax,fast}$ represents LOAEL and 78dB $L_{Amax,fast}$ represented SOAEL, so the Protection Value determined from the Griefahn is approximately mid-way between LOAEL and SOAEL. A value of 69-70dB $L_{Amax,fast}$ therefore appears to represent a reasonable basis for reviewing the potential need for mechanical ventilation suggested by the Council's EH Team.
- 1.29 In order to identify dwellings, a more detailed assessment of $L_{Amax,fast}$ noise levels across the proposed development by creating a computational three dimensional noise model. The building evaluation software has then been used to identify building facades exceeding 69dB $L_{Amax,fast}$. The output of the model is presented below:

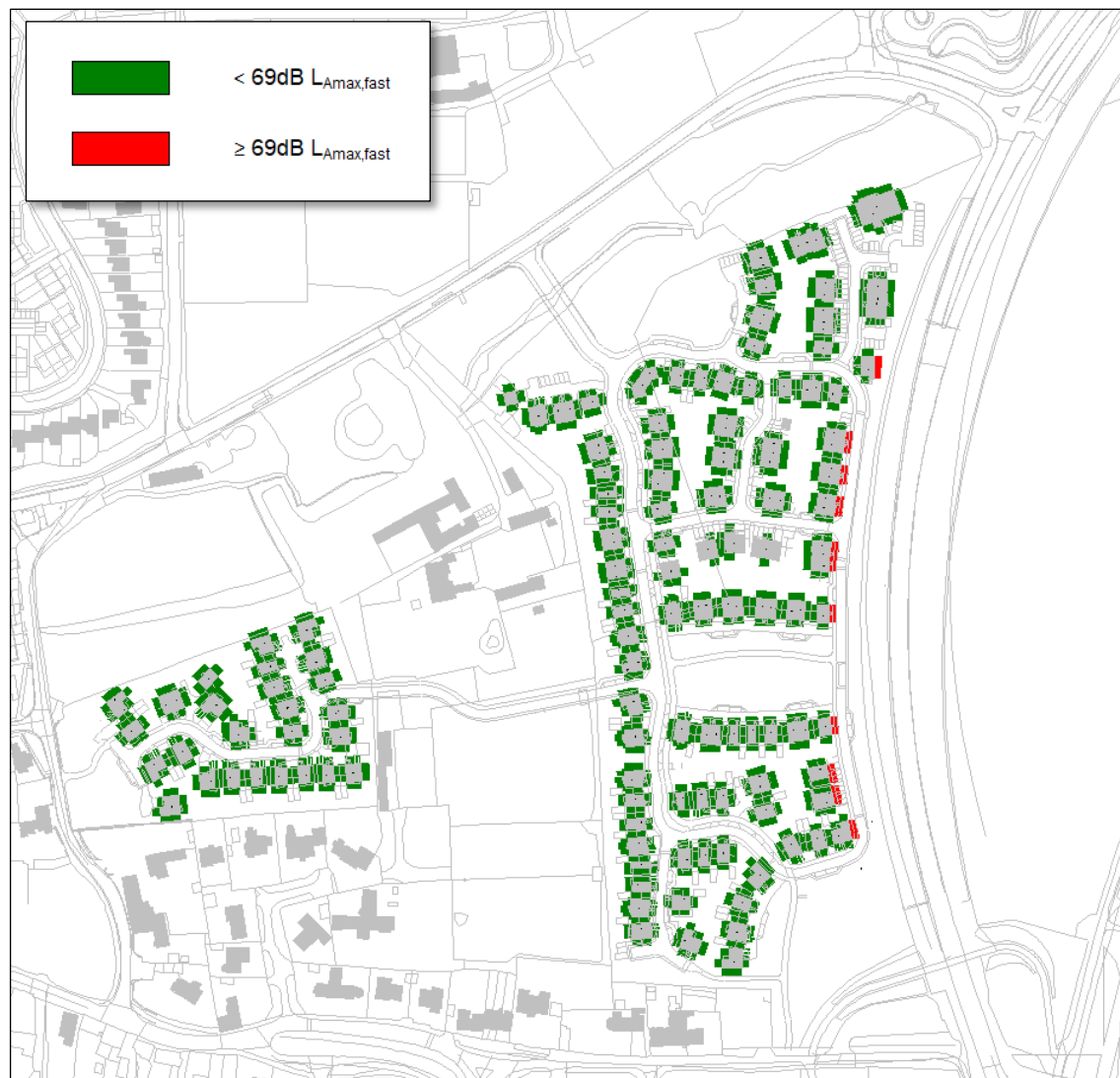


Figure 1: Facades with $L_{Amax,fast} > 69$ dB

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- 1.30 Based on the above, BDW have agreed to install System 3 (MEV) mechanical ventilation to Plots 72, 73, 74, 75, 76, 77, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 160 – 167 (Flats), 168-169, 170 – 173 and 174 – 175, as highlighted in red on **Figure 2** below:

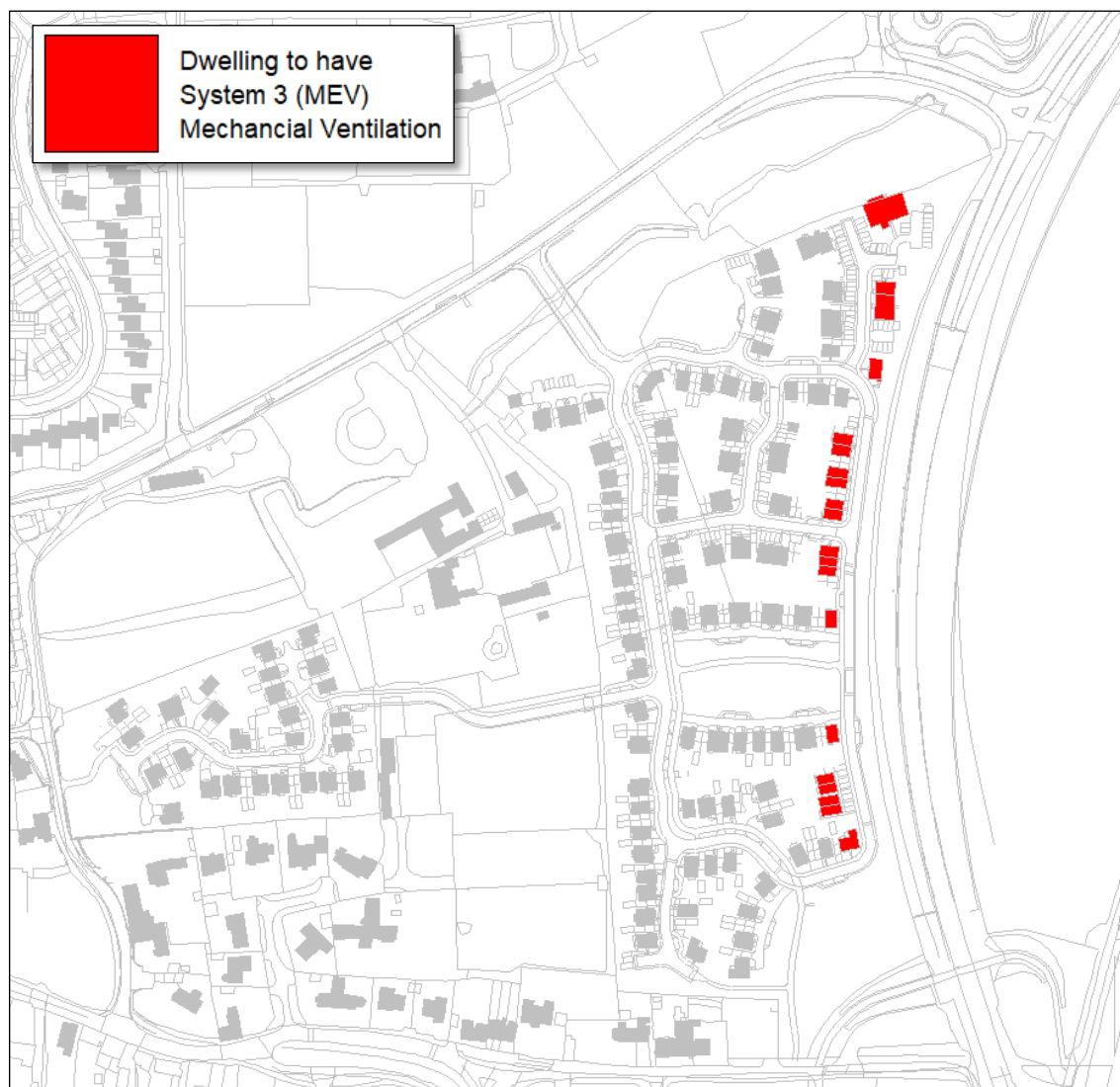


Figure 2: Plots to Have System 3 (MEV) Ventilation

- 1.31 The recommended acoustic performance requirements for windows and trickle ventilators will remain as set out in the Sound Insulation Assessment.

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Calculation Sheet Clarification

1.32 The EH team comments state that:

“Exceptions may be where the internal layout means that bedrooms do not face this road. Appendix C: Calculation Sheets provided in this case, do not always make this clear. For example,

**the outline of the 8 flats, 159 to 167 (actually 160 – 167) does not accord with the outline of the room layout plan. The second floor (not described) is presumed to have the same noise exposure as the first floor.*

** Flats 174 to 175 – does not show that the longer ‘stairs’ façade will face the A280, in which case bedrooms on the opposite flank would be protected from road noise*

** Flats 168-169 and 170 – 173 should be included in this Appendix at least in that the orientation of habitable rooms should be described*

** Plot 72 – Will this drawing will be reversed so that the longest façade, including bedrooms, will face the A280”*

1.33 The above comments have been addressed in the updated report (attached), which relate to the presentation of the noise modelling Building Evaluation images and house type plans on the calculation sheets.

- Flats 160 – 167 – Block plan updated. The block is only 2 storey;
- Flats 168 – 169 and 170 – 173 have been included;
- Flats 174 – 175 - House type plan has been re-orientated relative to the A280; and
- Plot 72 – House type plan has been reversed relative to A280.

1.34 Resultant incident noise levels and design recommendations are unaltered as a result of these changes:

Conclusion

1.35 We trust that with the above comments fully address the Environmental Health team’s comments and that Condition 9 can now be fully discharged.

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