

Cross Homes (Sussex) Ltd

Rocky Lane, Haywards Heath

Acoustic Assessment

**REPORT REF.
2503580-ACE-XX-00-RP-C-0601A**

May 2025

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Document Control Sheet

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
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Distribution



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1. Introduction

- 1.1. Ardent Consulting Engineers have been instructed by Cross Homes (Sussex) Ltd undertake a Noise Assessment for the development to the north of Rocky Lane, Haywards Heath (hereafter referred to as the development).
- 1.2. A report was initially prepared and submitted for the site in October 2019¹ where it was proposed to provide 5 dwelling houses. An amended report was prepared and submitted in June 2020² based upon a revised scheme providing 9 residential apartments. A further amended report was prepared and submitted in August 2021³ for 9 residential apartments, with minor changes to the site layout.
- 1.3. This report is based upon the most recent updates to the scheme, as described later in this section.

Site Location

- 1.4. The site is located in a largely residential area at southern edge of Haywards Heath, north of the A272 and to the west of the railway line. The approximate site boundary and surrounding area are shown in Figure 1-1.

¹ Report ref: X274-01 Noise and Vibration Assessment, Rocky Lane – October 2019 - FINAL

² Report ref: X274-01A Noise and Vibration Assessment, Rocky Lane – June 2020 - FINAL

³ Report ref: X275-01 Noise and Vibration Assessment, Rocky Lane – August 2021- FINAL



Figure 1-1: Development Boundary and Surrounding Area

Proposed Development

- 1.5. The proposed development comprises 6no. apartments within a new 3-storey block situated at the western side of the existing development site, together with associated parking, cycle storage and landscaping. The site layout is shown in Figure 1-2.



Figure 1-2: Site Layout Plan

2. Local Authority Guidance

2.1. Permitted applications in the area have been accepted based on guidance and criteria included Annex A. Ardent prepared a noise and vibration assessment in December 2015 (reference X270-01A) to support the adjacent development, which was approved by the local planning authority under planning reference DM/15/5107.

2.2. The condition attached to said approval is presented below:

"No development shall commence until a scheme for protecting any residential units of the development from noise generated by road and rail noise, has been submitted to, and approved in writing by, the local planning authority. All works that form part of the scheme shall be completed before any part of the noise sensitive development is occupied. Unless otherwise agreed in writing, the submitted scheme shall demonstrate that the maximum internal noise levels in bedrooms and living rooms in residential properties post construction will be 30 dB $L_{Aeq T}$ (where T is 23:00 - 07:00) and 35 dB $L_{Aeq T}$ (where T is 07:00 - 23:00). Noise from individual external events typical to the area shall not exceed 45dB L_{Amax} when measured in bedrooms and living rooms internally between 23:00 and 07:00, post construction."

2.3. Therefore, providing the assessment methodologies are in accordance with the aforementioned guidance, it is considered that the proposals will satisfy Mid Sussex District Council's planning policy.

3. Environmental Noise Levels

- 3.1. A previous noise survey was carried out between 2nd and 6th July 2015. The main noise sources are passing rail and road traffic noise along the A272. Since the survey was carried out, there have been a number of residential developments implemented in the area.
- 3.2. There have been no substantial changes that will significantly influence the acoustic environment in this time. Therefore, it is considered that the previous measurement data remains valid, which will be used to aid in mitigation design.
- 3.3. The survey was undertaken during representative conditions. Measurement locations were chosen in order to obtain representative noise levels from the main observed noise sources and to represent exposed areas where equipment could be securely positioned. Measurement positions are shown in Figure 3-1.



Figure 3-1: Measurement Positions

3.4. The equipment used for the survey was as follows:

- Svantek Type 957 Sound Level Meter;
- Norsonic 1251 Calibrator;
- Svantek Type 958 Sound and Vibration Level Meter;
- Dytran accelerometer Model 3233A.

3.5. All equipment used has been professionally calibrated. Field calibration of the sound level meter (and complete measurement signal chain) was undertaken before and after measurement to ensure no drift of the calibration signal. Weather conditions were generally suitable with a light breeze and no precipitation.

3.6. A summary of the long term measurements are shown in Table 3-1 and a time history of measured noise levels is shown in Appendix A.

Monitoring Position	Ambient Sound Level dB LAeq, T Range (Average)		Night dB LAFmax Range (generally exceeded fewer than 10 times per night)
	Day	Night	
P1	63	55	73

Table 3-1: Summary of Measured Noise Levels

3.7. The representative LAmax level is the value which has been exceeded fewer than 10 times in the 8-hour night-time period, i.e. one which can be considered to be ‘not normally exceeded’ as per the World Health Organisation (WHO) guidelines.

3.8. Based on the measured noise levels, the site would be considered low to medium risk in accordance with ProPG guidance. This would not prohibit the development as good acoustic design processes will be followed to reduce sound levels to as low as practical across the site.

3.9. Representative octave band levels are provided in Table 3-2. Where appropriate, these are used in glazing calculations to ensure a robust assessment of internal noise levels.

		Octave Band Centre Frequency, dB							
		63	125	250	500	1k	2k	4k	8k
P1	L _{eq,T} (day)	68	65	60	56	61	53	44	36
	L _{eq,T} (night)	59	57	52	47	53	44	33	27
	L _{Fmax,T} (night)	79	80	74	66	71	61	53	46

Table 3-2: Octave Noise Data

Vibration Survey

- 3.10. The VDV X, Y and Z vibration axis parameters were measured during the day. Vibration measurements were taken approximately 25m to the north of the railway line on a concrete slab at ground level.
- 3.11. Rail movements will be less frequent during the night, however there may be some occasional freight movement at night, though levels are unlikely to be significantly different.
- 3.12. Therefore, to provide a worst-case robust assessment, the levels measured during the day have been compared with both the day and night criteria set out in BS6472, as shown in Table 3-3.

		VDV (X), ms ^{-1.75}	VDV (Y) , ms ^{-1.75}	VDV (Z) , ms ^{-1.75}	BS6472 (low probability of adverse comment) , m/s ^{1.75}
P1	Day	0.012	0.009	0.003	0.2 – 0.4
	Night				0.1 – 0.2

Table 3-3: Measured Vibration Dose Values

- 3.13. The measured vibration levels are significantly lower than the criteria for a low probability of adverse comment. No further mitigation would be required with regards to vibration from nearby rail movements.

4. Construction Phase

- 4.1. Given the proximity of proposed construction to neighbouring noise sensitive properties such as residential areas, it is possible that site clearance, preparation and construction noise may impact nearby receptors.
- 4.2. A detailed demolition and construction programme, specific plant data and operations are not available at this stage of the project. Therefore, it is not possible to undertake a detailed assessment of likely impact at this stage.
- 4.3. It is understood that construction operations will be carried out during weekdays (08:00 – 18:00) and on Saturdays (08:00 – 18:00) only.
- 4.4. To assess the limits for reasonable construction noise experienced at the nearest residential properties, Example Method 1 (the ABC Method) of BS 5228, within section E.3.2, will be used. Table E.1 from the standard is reproduced at Table 4-1.

Table E.1 Example threshold of significant effect at dwellings			
Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23.00–07.00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75
NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity. NOTE 3 Applied to residential receptors only.			
^{A)} Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. ^{B)} Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. ^{C)} Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values. ^{D)} 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

Table 4-1: Table E.1 – BS5228 Part 1

- 4.5. Measurements taken in the area indicate that the ambient level is within Category A of Table E.1. Therefore, the noise level which construction activities should not exceed, so that no significant effect occurs, is set out in Table 4-2.

Time Period	Construction Noise Level dB LAeq
Monday to Friday (08:00 – 18:00) & Saturday (08:00 – 13:00)	65

Table 4-2: Construction Noise Levels

Best Practice Recommendations

- 4.6. Noise control should follow the hierarchy whereby control at source is the preferred approach followed by noise control in the transmission path and then lastly noise control at the receiver.
- 4.7. Noise control at source will comprise the selection of appropriate plant, the position and orientation of the plant, the correct operation of plant (through training), appropriate timing of operations and servicing of the plant in accordance with the manufacturer's instructions.
- 4.8. No construction activity should be carried out during the night, on Sundays or on bank holidays without additional consideration to controlling noise and with the prior approval of the Mid Sussex District Council. Restrictions on the operational hours can be considered so that construction activities which will generate significant noise levels do not occur during quieter and most sensitive periods of the day.
- 4.9. Noise control in the transmission path is often limited to screening structures that interrupt the direct path between the source and the receiver. Where practicable plant will be located behind screens, site buildings and material stockpiles.
- 4.10. Noise control at the receiver is rarely an option on such schemes as they are beyond the control of the developer but in extreme cases where all other options have been exhausted these measures can include secondary glazing and other mitigation of the property. It is not anticipated that these measures would be required at the proposed development.
- 4.11. Piling operations have the potential to generate ground borne vibration in the immediate surroundings. Mitigation methods and techniques will be employed during these periods and other vibration generating activities to minimise any potential impacts from the operations. This can include (but is not limited to) use of drilled (CFA) piles rather than impact driven piles.

4.12. When undertaking vibration monitoring during construction works, a limit of around 5mm/s PPV can be set as an action level. The effects at nearby residential receptors due to vibration would be controlled accordingly.

5. Acoustic Design And Mitigation

- 5.1. The aim of this section is to discuss the acoustic design considerations and to demonstrate that mitigation measures are available to meet the guidance criteria.
- 5.2. Good acoustic design principles have influenced the design of the development. The separation distance between dwellings and noise sources has been maximised by as much as possible and more noise sensitive rooms, such as bedrooms, are located on the shielded side of buildings in relation to Rocky Lane where possible.
- 5.3. To achieve suitable internal amenity sound levels the design of dwellings will enable residents to keep windows closed and an alternative means of ventilation will be provided. It is important to note that windows would not be sealed shut and residents will have the choice of opening them, whilst noting noise levels will slightly increase.
- 5.4. Calculations of glazing and ventilation specifications have been conducted based on the measured noise levels and the noise model. The calculations are presented in Appendix F.

External Building Fabric - Non-Glazed Elements

- 5.5. Non-glazed external building fabric elements comprise masonry cavity walls or constructions of equivalent acoustic performance. This would typically provide a sound reduction performance of at least the figures shown in Table 5-1 when tested in accordance with BS EN ISO 10140-2:2010⁴.

Element	Octave band centre frequency SRI, dB					
	125	250	500	1k	2k	4k
Masonry Cavity Wall	34	43	55	66	77	85

Table 5-1: Non-glazed Elements Sound Reduction Performance

External Building Fabric – Glazing & Ventilation

- 5.6. Table 5-2 sets out the required glazing performance types, these specifications take into account the glass, frame, seals and associated fittings.

⁴ Figures derived from: Representative Values of Airborne SRI for Some Common Structures: Appendix B of Flakt Woods 'Guide to Noise Control'

Glazing Type	Sound Reduction Index, dB R _w	Octave band centre frequency SRI, dB					
		125	250	500	1k	2k	4k
Type 1	37	26	27	34	40	39	46

Table 5-2: Minimum Required Sound Reduction for Glazing

5.7. Table 5-3 sets out the required ventilation performance.

Ventilation Type	Element Normalised level difference, D _{new}	Octave band centre frequency SRI, dB					
		125	250	500	1k	2k	4k
Type 1	35	36	34	31	34	38	38

Table 5-3: Minimum Required Sound Reduction for Ventilation

5.8. Where non-sensitive rooms and sensitive rooms form part of an open plan area, for example a living room, dining and kitchen area, the glazing specification for the more sensitive room should be used across the combined area.

5.9. All major building elements should be tested in accordance with BS EN ISO 10140-2:2010. Glass performance data alone would not necessarily demonstrate compliance with this specification.

5.10. It should be noted that there may be additional considerations for glazing requirements such as overheating, security, thermal performance, and air quality. Alternative glazing could be used assuming the minimum acoustic performance is met.

External Amenity Areas

5.11. External sound levels across the site are above those set out in the guidance. The guidance in BS8233:2014 notes that a compromise between elevated noise levels and other factors, including other planning requirements, should be considered.

5.12. Screened balconies (not open balustrade) up to a height of 1.5m can reduce sound levels by around 5dBA - 10dBA. Sound levels will be reduced to as low a level as practicable in accordance with the principles of good acoustic design.

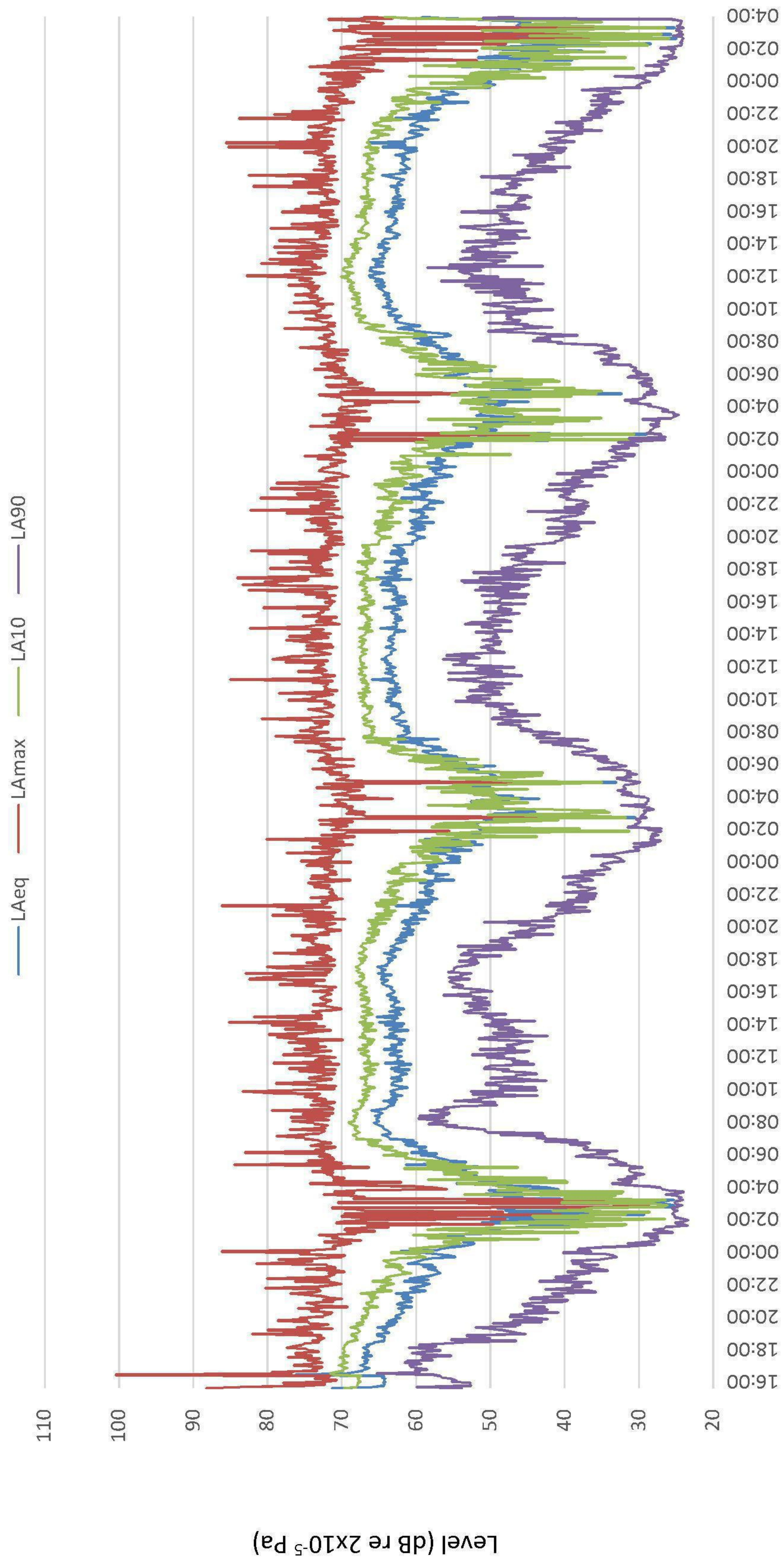
6. Conclusions

- 6.1. A noise and vibration survey has been undertaken, the measured noise levels and results of the noise model have been used to calculate and assess suitable glazing and ventilation specifications, demonstrating the guidance values of the standards can be met.
- 6.2. Good acoustic design principles have been taken into account within the design of the site layout as much as possible to reduce noise levels. These principles include maximising the separation distance between dwellings and noise sources and the placement of more noise sensitive rooms on the shielded side of buildings where possible.
- 6.3. The measure vibration levels are significantly below than the criteria for a low probability of adverse comment. Therefore no further consideration of vibration is required.
- 6.4. Where necessary control measures will be implemented to manage potential adverse effects due to construction noise and vibration.
- 6.5. To achieve suitable internal amenity sound levels there will be some reliance on the design of dwellings to enable residents to keep windows closed and an alternative means of ventilation will be provided. It is important to note that windows would not be sealed shut and residents will have the choice of opening them, whilst noting noise levels will slightly increase.
- 6.6. With suitable design and mitigation external sound levels in private amenity spaces are expected meet the guidance criteria. BS8233:2014 notes that a compromise between elevated noise levels in private amenity spaces and other factors, including other planning requirements should be considered.
- 6.7. Subject to the recommendations included in this report, it is considered that the site can be made suitable for development and it is considered that the proposals will satisfy Mid Sussex District Council's planning policy.

APPENDIX A

Land North of Rocky Lane, Haywards Heath

Measured 2 July 2015 to 6 July 2015



APPENDIX B

ARDENT CONSULTING ENGINEERS	
Noise Break-in Calculation	

Description	
Ardent CE Project No.	2503580
Property Address	Rocky Lane
Room Type	Bedroom
Parameter	LAeq, 16h

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	6.95
Roof façade area	0.00
Glazing area	1.80
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	8.75
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Room Absorption Calculation							
	63	125	250	500	1000	2000	8000
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27
10Log S/A	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10

Façade level							
	63	125	250	500	1000	2000	8000
Measured Noise Level	63	65	60	56	61	53	36
Façade to free field	0	0	0	0	0	0	0
Angle of view	0	0	0	0	0	0	0
Screening (Maekewa)	0	0	0	0	0	0	0
Distance correction	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Noise level at façade (Leq)	68	65	60	56	61	53	36
							63

Composite SRI							
	63	125	250	500	1000	2000	8000
Glazing SRI	20	26	27	34	40	39	46
Transmission Coefficient	0.010000	0.002512	0.001995	0.000398	0.000100	0.000126	0.000025
Wall SRI	28	34	43	55	66	77	85
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000
Roof SRI	23	26	43	52	60	65	65
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000
Ventilation, Dne	36	36	34	31	34	38	38
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158
Average Transmission Coeff	0.003603	0.001120	0.000905	0.000992	0.000476	0.000207	0.000183
Average SRI	24	30	30	30	33	37	37
							34

Pilkington 10/16/6

Typical masonry cavity wall (300mm - 380kg/m2)

Standard Trickle Vent

Calculated Internal Noise Level, dB							
	63	125	250	500	1000	2000	8000
Lp (Reverberant), line source	43.9	35.3	29.9	26.0	28.1	15.7	-1.8
Lp (Direct)	44.0	35.4	30.0	26.1	28.2	15.8	-1.7
Lp (Rev & Direct)	47	38	33	29	31	19	1
BS8233	46	37	32	28	30	18	0
							33

Criteria

≤ 35

≤ 35

ARDENT CONSULTING ENGINEERS	
Noise Break-in Calculation	

Description	
Ardent CE Project No.	2503580
Property Address	Rocky Lane
Room Type	Bedroom
Parameter	LAeq, 8h

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	6.95
Roof façade area	0.00
Glazing area	1.80
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	8.75
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Room Absorption Calculation									
	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	

Façade level									
	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	59	57	52	47	53	44	33	27	55
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	59	57	52	47	53	44	33	27	55

Composite SRI									
	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	20	26	27	34	40	39	46	50	37
Transmission Coefficient	0.010000	0.002512	0.001995	0.000398	0.000100	0.000126	0.000025	0.000010	
Wall SRI	28	34	43	55	66	77	85	85	55
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000	
Roof SRI	23	26	43	52	60	65	65	65	51
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000	
Ventilation, Dne	36	36	34	31	34	38	38	38	35
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158	0.000158	
Average Transmission Coeff	0.003603	0.001120	0.000905	0.000992	0.000476	0.000207	0.000186	0.000183	
Average SRI	24	30	30	30	33	37	37	37	34

Pilkington 10/16/6

Typical masonry cavity wall (300mm - 380kg/m2)

Standard Trickle Vent

Calculated Internal Noise Level, dB									
	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	34.9	27.4	21.6	17.1	19.6	7.3	-3.9	-10.9	22
Lp (Direct)	35.0	27.5	21.7	17.2	19.7	7.4	-3.8	-10.8	22
Lp (Rev & Direct)	38	31	25	20	23	10	-1	-8	25
BS8233	37	29	24	19	22	9	-2	-9	24

Criteria

≤ 30

≤ 30

ARDENT CONSULTING ENGINEERS	
Noise Break-in Calculation	

Description	
Ardent CE Project No.	2503580
Property Address	Rocky Lane
Room Type	Bedroom
Parameter	LAmx

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	6.95
Roof façade area	0.00
Glazing area	1.80
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	8.75
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Room Absorption Calculation							
	63	125	250	500	1000	2000	8000
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27
10Log S/A	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10

Façade level							
	63	125	250	500	1000	2000	8000
Measured Noise Level	79	80	74	66	70	61	46
Façade to free field	0	0	0	0	0	0	0
Angle of view	0	0	0	0	0	0	0
Screening (Maekewa)	0	0	0	0	0	0	0
Distance correction	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Noise level at façade (Leq)	79	80	74	66	70	61	46
							73

Composite SRI							
	63	125	250	500	1000	2000	8000
Glazing SRI	20	26	27	34	40	39	46
Transmission Coefficient	0.010000	0.002512	0.001995	0.000398	0.000100	0.000126	0.000010
Wall SRI	28	34	43	55	66	77	85
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000
Roof SRI	23	26	43	52	60	65	65
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000
Ventilation, Dne	36	36	34	31	34	38	38
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158
Average Transmission Coeff	0.003603	0.001120	0.000905	0.000992	0.000476	0.000207	0.000183
Average SRI	24	30	30	30	33	37	37
							34

Pilkington 10/16/6

Typical masonry cavity wall (300mm - 380kg/m2)

Standard Trickle Vent

Calculated Internal Noise Level, dB							
	63	125	250	500	1000	2000	8000
Lp (Reverberant), line source	54.5	50.2	43.5	35.6	37.1	24.3	8.6
Lp (Direct)	54.6	50.3	43.6	35.7	37.2	24.4	8.7
Lp (Rev & Direct)	58	53	47	39	40	27	12
BS8233	57	52	46	38	39	26	11
							43

Criteria

≤ 45

≤ 45

ARDENT CONSULTING ENGINEERS	
Noise Break-in Calculation	

Description	
Ardent CE Project No.	2503580
Property Address	Rocky Lane
Room Type	Living Room
Parameter	L _{Aeq} , 16h

Room Dimensions and Areas	
Room volume	50.00
Total Surface area	85.00
Wall façade area	8.20
Roof façade area	0.00
Glazing area	1.80
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	10.00
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Room Absorption Calculation							
	63	125	250	500	1000	2000	8000
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Alpha bar	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Total Absorption	16.10	16.10	16.10	16.10	16.10	16.10	16.10
10Log S/A	-2.07	-2.07	-2.07	-2.07	-2.07	-2.07	-2.07

Façade level							
	63	125	250	500	1000	2000	8000
Measured Noise Level	63	65	60	56	61	53	36
Façade to free field	0	0	0	0	0	0	0
Angle of view	0	0	0	0	0	0	0
Screening (Maekewa)	0	0	0	0	0	0	0
Distance correction	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Noise level at façade (Leq)	68	65	60	56	61	53	36
							63

Composite SRI							
	63	125	250	500	1000	2000	8000
Glazing SRI	20	26	27	34	40	39	50
Transmission Coefficient	0.010000	0.002512	0.001995	0.000398	0.000100	0.000126	0.000010
Wall SRI	28	34	43	55	66	77	85
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000
Roof SRI	23	26	43	52	60	65	65
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000
Ventilation, Dne	36	36	34	31	34	38	38
Transmission Coefficient	0.000251	0.000251	0.000398	0.000794	0.000398	0.000158	0.000158
Average Transmission Coeff	0.003351	0.001030	0.000798	0.000869	0.000416	0.000181	0.000160
Average SRI	25	30	31	31	34	37	38
							34

Pilkington 10/16/6

Typical masonry cavity wall (300mm - 380kg/m2)

Standard Trickle Vent

Calculated Internal Noise Level, dB							
	63	125	250	500	1000	2000	8000
Lp (Reverberant), line source	42.7	33.9	28.4	24.4	26.5	14.2	-3.3
Lp (Direct)	43.7	35.0	29.4	25.5	27.6	15.2	-2.3
Lp (Rev & Direct)	46	38	32	28	30	18	0
BS8233	45	36	30	26	29	16	-1
							31

Criteria

≤ 35

≤ 35

APPENDIX C

ACOUSTIC TERMINOLOGY

The effects of noise on human beings may be expressed in terms of physiological damage and annoyance. It is, however, only the annoyance impacts that need to be considered in detail when addressing environmental noise impacts. Annoyance also includes the immediate effects of activity interference, for example sleep disturbance and speech interference.

The practice has become to measure sound levels in decibels (dB). The decibel scale is logarithmic rather than linear and it is useful to bear in mind that a noise level change of 3dB would be equivalent to doubling the energy level (for example doubling the volume of traffic) and that an increase of 10 dB is perceived, subjectively, as a doubling of loudness. The human ear responds differently to sounds of different frequency. The ear perceives high frequency sound of a given sound pressure level more loudly than a low frequency sound at the same level. The A-weighted sound level, dB(A), takes this response into consideration and is commonly used for measurement of environmental noise in UK. It thus indicates the subjective human response to sound.

Environmental noise levels vary continuously from second to second, it is clearly impractical to specify the sound level continuously and thus time averaging is required. In practice human response has been related to various units which include allowance for the fluctuating nature of sound with time. For the purpose of this report these include:

L_{Aeq,T} : the equivalent A-weighted continuous sound level.

This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hours for daytime noise. It contains all the sound energy of the varying sound levels over the same time period and expresses it as a continuous sound level over that period.

LA10,T : the A-weighted level of sound exceeded for 10% of the time period T.

This unit is used for traffic noise measurement and is the preferred unit for prediction of traffic noise in the publication, 'Calculation of Road Traffic Noise'.

LA90,T : the A-weighted level of sound exceeded for 90% of the time period T.

This unit is commonly used to represent the background noise and is used in assessing the effects of industrial noise in UK.

LAm_{ax} : the maximum A-weighted level of sound over a period of measurement.

L_Ar,T : the rating level.

The specific Noise plus any adjustments for the characteristic features of the noise. Used for comparison between background levels with the noise source off.

SEL : the Sound Exposure Level.

Sound exposure level abbreviated as SEL and LAE, is the total noise energy produced from a single noise event condensed into a 1 second time period.

R_w : weighted sound reduction index.

A laboratory-measured value as defined in ISO717 Part 1.

D_nT_w :

The equivalent of R_w, but measured onsite as oppose to in a laboratory

ANNEX A

RELEVANT POLICY & GUIDANCE

National Planning Policy Framework (NPPF) – December 2024

Under the NPPF: paragraph 198 of Section 15, with regard to environmental noise; Planning policies and decisions should aim to: -

- mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Noise Policy Statement for England (NPSE)

To avoid and mitigate adverse noise effects on health arising from and impacting on new development, the NPPF makes reference to NPSE. The NPSE was published in March 2010 and covers all forms of noise, other than occupational noise. For the purposes of this report, “Neighbourhood Noise” is most relevant as NPSE defined at paragraph 2.5:

“neighbourhood noise which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street. ”

NPSE introduces three concepts to the assessment of noise in the UK:

- NOEL – No Observed Effect Level – This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.
- LOAEL – Lowest Observable Adverse Effect Level – This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – Significant Observed Adverse Effect Level – This is the level above which significant adverse effects on health and quality of life occur.

NPSE does not numerically define levels for the NOEL, LOAEL or SOAEL rather it makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc.

National Planning Practice Guidance (2014)

The purpose of the guidance is to complement the NPPF and provide advice on how to deliver its policies.

The purpose of the guidance is to complement the NPPF and provide advice on how to deliver its policies.

The guidance includes a table (as shown in Table 1) that summarises "the noise exposure hierarchy, based on the likely average response" and which offers "examples of outcomes" relevant to the NOEL, LOAEL and SOAEL effect levels described in the NPSE.

Perception	Examples of outcomes	Increasing effect level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, eg turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, eg avoiding certain activities during periods of intrusion; where there is no alternative ventilation, 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.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, eg regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, eg auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 1: Noise Exposure Hierarchy, Based on the Likely Average Response.

Calculation of Road Traffic Noise – 1988

For new developments, road traffic noise levels should be predicted in accordance with CRTN. This prediction method uses the traffic flow, vehicle speed, and percentage of heavy-duty vehicles (HDVs, over 3.5 tonnes), road gradient and other factors to calculate noise levels at receptor points.

Design Manual for Road and Bridges, Volume 11 (LA111 – Noise and Vibration

Changes in noise level as a result of additional vehicles on the public highway can be assessed using methodologies presented in Design Manual for Road and Bridges (DMRB LA111),

This guidance document sets out the requirements for noise and vibration assessments from road projects. The construction, operation and maintenance of highway projects can lead to changes in noise and vibration levels in the surrounding environment.

The magnitude of change (in sound level) is defined in Table 3.54a of the guidance for short term and Table 3.54b for long term, as presented in Table 2:

Short term magnitude	Short term noise change (dB L _{A10,18hr} or L _{night})
Major	Greater than or equal to 5.0
Moderate	3.0 to 4.9
Minor	1.0 to 2.9
Negligible	less than 1.0

Long term magnitude	Long term noise change (dB L _{A10,18hr} or L _{night})
Major	Greater than or equal to 10.0
Moderate	5.0 to 9.9
Minor	3.0 to 4.9
Negligible	less than 3.0

Table 2 (Table 3.54a and b DMRB, LA 111 - Magnitude of Change)

Control of Pollution Act 1974

The local authority has powers under the Control of Pollution Act 1974 to control noise from construction sites. Section 60 of the Act allows a local authority to serve a notice of its requirements for the control of site noise. This notice may include specification of plant that is or is not to be used, hours during which the construction works can be carried out and levels of noise emission. Section 61 of the Act allows a contractor or developer to take the initiative and agree with the local authority the methods of construction, steps to minimise noise and hours of work.

The Environmental Protection Act 1990

Local authorities have a duty to deal with statutory nuisances under the Environmental Protection Act 1990. For noise to amount to a statutory nuisance, it must be "prejudicial to health or a nuisance" as outlined in Section 79 of the Act. Any proposed development should not result in a statutory nuisance being declared.

Should the Local Authority declare a development to cause a statutory nuisance, an abatement notice can be served to the developer who has up to 21 days to appeal to Magistrates' Court, as detailed in Section 80 of the Act.

The Building Regulations 2010

Building Regulations approvals are required for most new buildings and for most types of works on existing buildings. Part 10 of The Building Regulations 2010 contains provisions, including power for local authorities to test building work, take samples, and provision to ensure compliance. Part E of the Regulation 'Resistance to the passage of sound' is expanded in Approved Document E, which provides robust details to control and mitigate noise within buildings. This Document is separated over four parts which include:

- E1: Protection against sound from other parts of the building and adjoining buildings;
- E2: Protection against sound within dwelling-house etc.;
- E3: Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes;
- E4: Acoustic conditions in schools.

World Health Organisation

The WHO document Guidance on Community Noise specifies additional information for noise affecting noise sensitive receptors and forms the basis of many noise limitations and design ranges for internal and external ambient noise levels. It defines noise as 'a class of sounds that are considered unwanted' (by the listener), 'that adversely affects, or may affect the physiological and psychological wellbeing of people.' Much of the research around this study is based on transportation noise.

Further guidance on the recommended levels is given in the World Health Organisation (WHO) Guidelines for Community Noise. In this document it is stated that:

"To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq} ."

WHO also states the following paragraph with regard to the effects of L_{Amax} events in a night-time period:

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991)."

WHO guidance 'Night Noise Guidelines for Europe' is concerned with the longer-term average noise levels that are covered by the EU Directive on Environmental Noise, although this does appear to suggest external maximum noise levels of around 57dBA outside bedrooms during the night to achieve internal maximum levels of 42dBA.

The World Health Organisation has recently published Environmental Noise Guidelines – for the European Region (2018) to provide recommendations for protecting human health from exposure to noise sources such as transportation (road traffic, railway and aircraft), wind turbine noise and leisure noise.

The guidance document defines the 'strength' of recommendation (for protecting against noise exposure) as either 'strong' or conditional', outlined below.

Strength of Recommendation

*"A **strong** recommendation can be adopted as policy in most situations. The guideline is based on the confidence that the desirable effects of adherence to the recommendation outweigh the undesirable consequences. The quality of evidence for a net benefit – combined with information about values, preference*

and resources – inform this recommendation, which should be implemented in most circumstances.”

*"A **conditional** recommendation requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply.”*

External (free-field) recommendations included in the Environmental Noise Guidelines for the European Region are presented in Table 3 for specific noise sources.

Noise Source	dB L _{den}	dB L _{night}	dB L _{Aeq, 24hr} (yearly average)	Recommendation
Road Traffic	53	45	-	Strong
Railway	54	44	-	Strong
Aircraft	45	40	-	Strong
Wind Turbine	45	-	-	Conditional
Entertainment	-	-	70	Strong/Conditional

Table 3: Extract from Environmental Noise Guidelines for the European Region

BS8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings

Formerly a Code of Practice, the 2014 revision of BS8233 is now presented and intended as a guidance document. The standard is mainly concerned with building design from an acoustic standpoint. It does however, contain information relevant to environmental noise more specifically by stating guidance for desirable internal noise levels for dwellings and other buildings.

Table 2 of BS8233:2014 provides suitable internal levels for spaces such as open-plan offices and restaurants and notes that an upper and lower noise levels should be considered, as presented in Table 4.

Objective	Typical Situation	Design range dB LAeq,T
Typical noise levels for acoustic privacy in shared spaces	Restaurant	40 - 55
	Open plan office	45 - 50
	Night club, public house	40 - 45
	Ballroom, banqueting hall	35 - 40

Table 4: Extract from Table 2 – Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important

An extract of Table 4 of the document relevant for residential development is reproduced in Table 5.

Activity	Location	07:00 to 23:00 dB LAeq, 16hour	23:00 to 07:00 LAeq, 8hour
Resting	Living room	35	-
Dining	Dining room / area	40	-
Sleeping (daytime resting)	Bedroom	35	30

Table 5: Extract from Table 4 – Indoor ambient noise levels in dwellings

The guidance of BS8233:2014 with regards to external amenity spaces is as follows:

“For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport

network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."

ProPG: Planning and Noise - May 2017

Guidance in ProPG Planning and Noise provides an approach which aims to inform developers, practitioners and local authorities on how potential residential sites should be assessed.

The guidance also builds upon government planning policy that noise should not be treated in isolation and there should be a holistic approach to good acoustic design.

ProPG sets out a 2-stage approach; the first of which is a risk assessment to identify the likelihood of significant adverse impact, then depending on the outcome of this risk assessment the extent of the acoustic design statement required. The graphic in Figure 1 is an extract from ProPG and indicates the level of risk associated with ranges of sound levels and provides some guidance on the likely extent of work associated with progressing a development exposed to these sound levels.

In relation to maximum noise levels, ProPG states that:

"In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events."

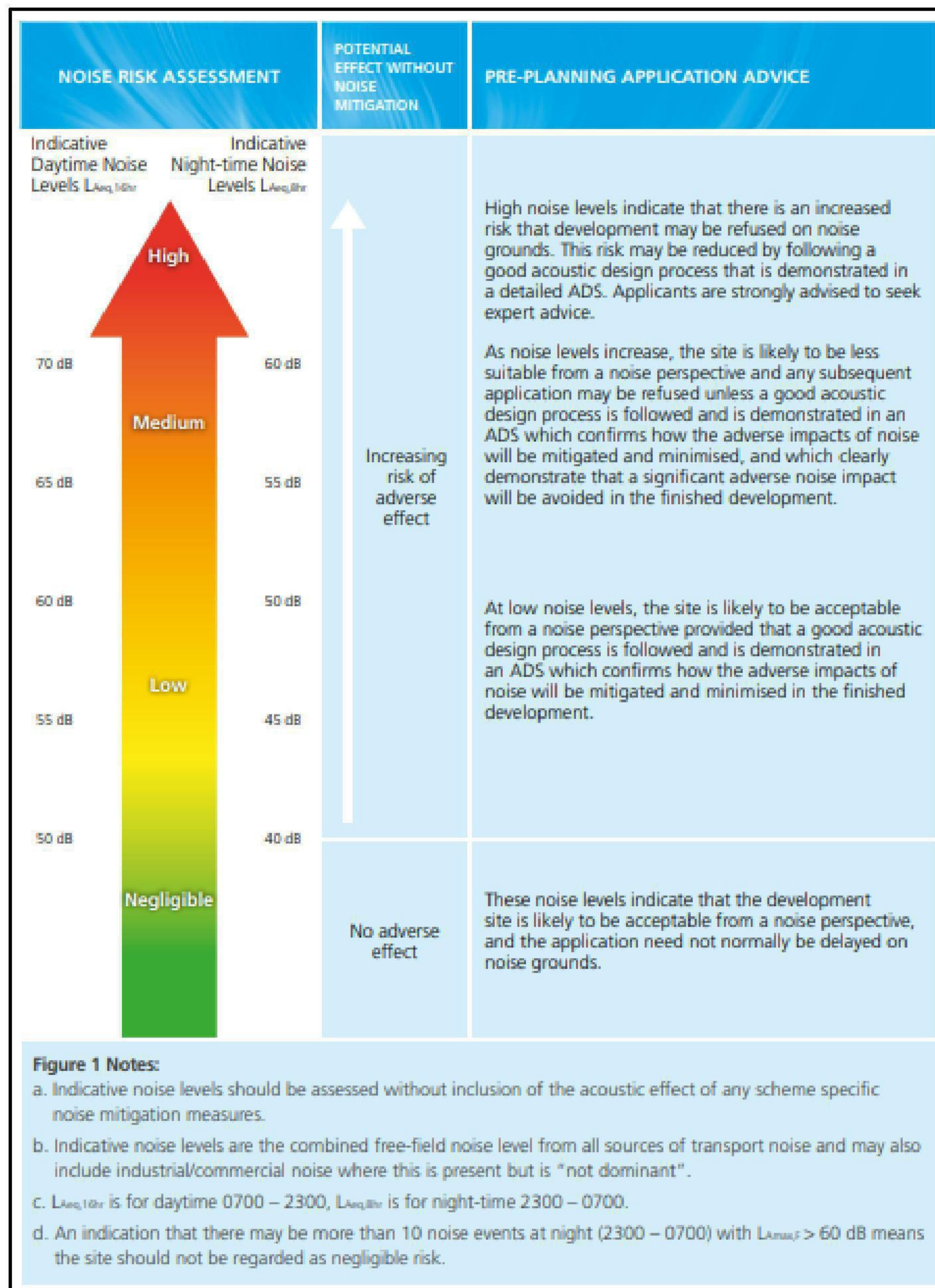


Figure 1: Extract from Figure 1 in ProPG – Initial Site Noise Risk Assessment

The second stage involves four key elements where discussion is expanded on:

- Element 1 – Good Acoustic Design Process
- Element 2 – Internal Noise Level Guidance
- Element 3 – External Amenity Area Noise Assessment
- Element 4 – Assessment of Other Relevant Issues

Having worked through the approach practitioners can present a recommendation to the decision maker.

***Acoustics Ventilation and Overheating - Residential Design Guide,
January 2020***

Acoustics Ventilation and Overheating (AVO) recommends an approach to acoustic assessments for new residential development taking consideration for acoustics, ventilation, and overheating.

Section 3 involves a two-level risk assessment approach to estimate the potential impact on occupants in the case of overheating.

The Level 1 site risk assessment is based on external free-field noise levels and the assumed scenario where a partially open window is used to mitigate overheating (Table 3-2 of the guidance).

The sound level reduction from outside to inside for a partially open window is 13dB in this instance. A Level 1 site risk assessment is considered adequate if the site falls within the 'Negligible risk' category. A Level 2 assessment can optionally be undertaken to give more confidence in the case of Low or Medium risk sites, where appropriate. The Level 2 assessment is strongly recommended for 'High' risk sites.

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 (Table 3-3 of the guidance)

Figure 2 explains the two-level noise assessment procedure for overheating conditions.

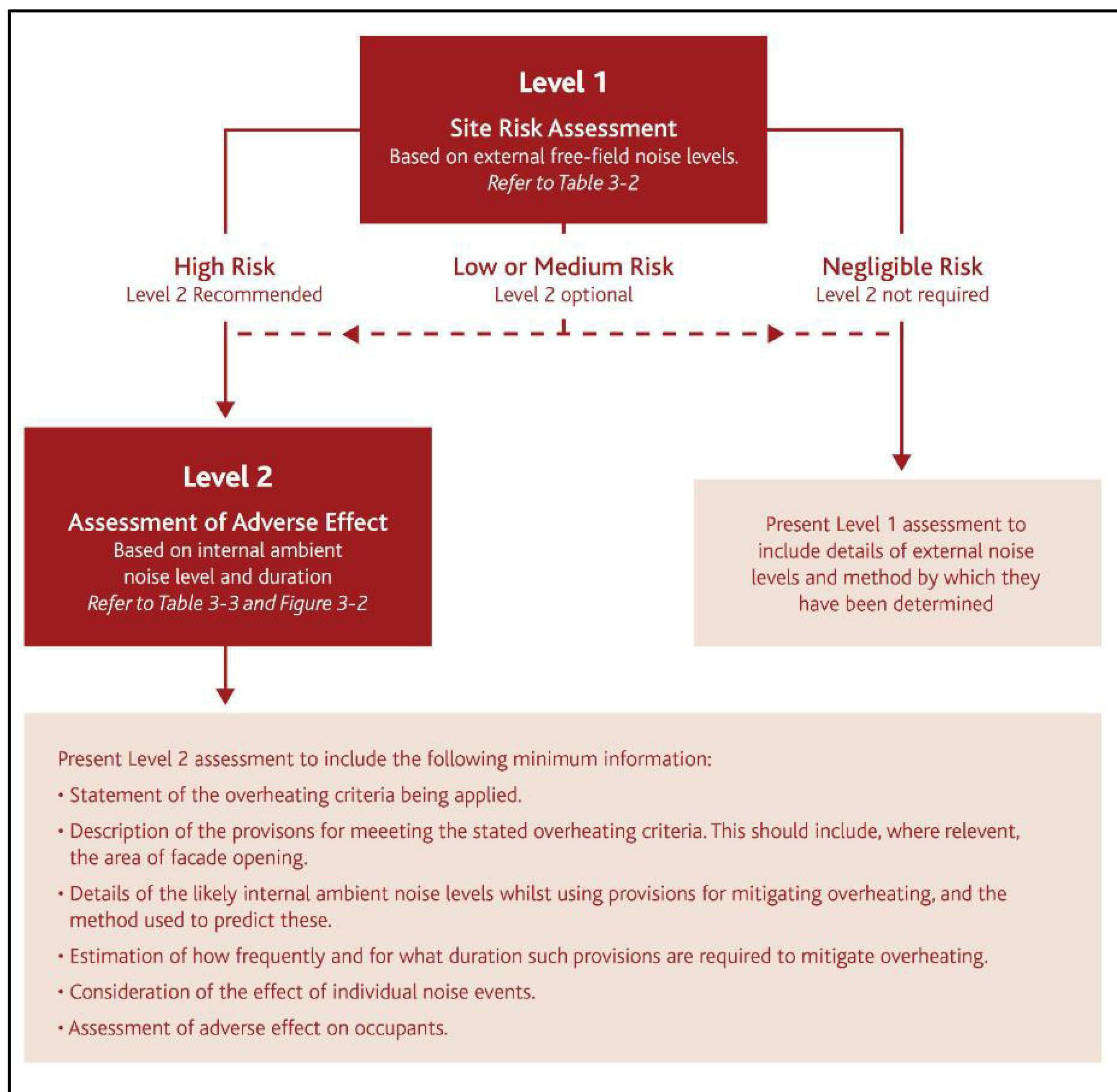


Figure 2: Two-level Assessment Procedure (Figure 3.1 of AVO Guidance)

Figure 3 shows the Level 1 site risk assessment of noise, relating to overheating conditions.

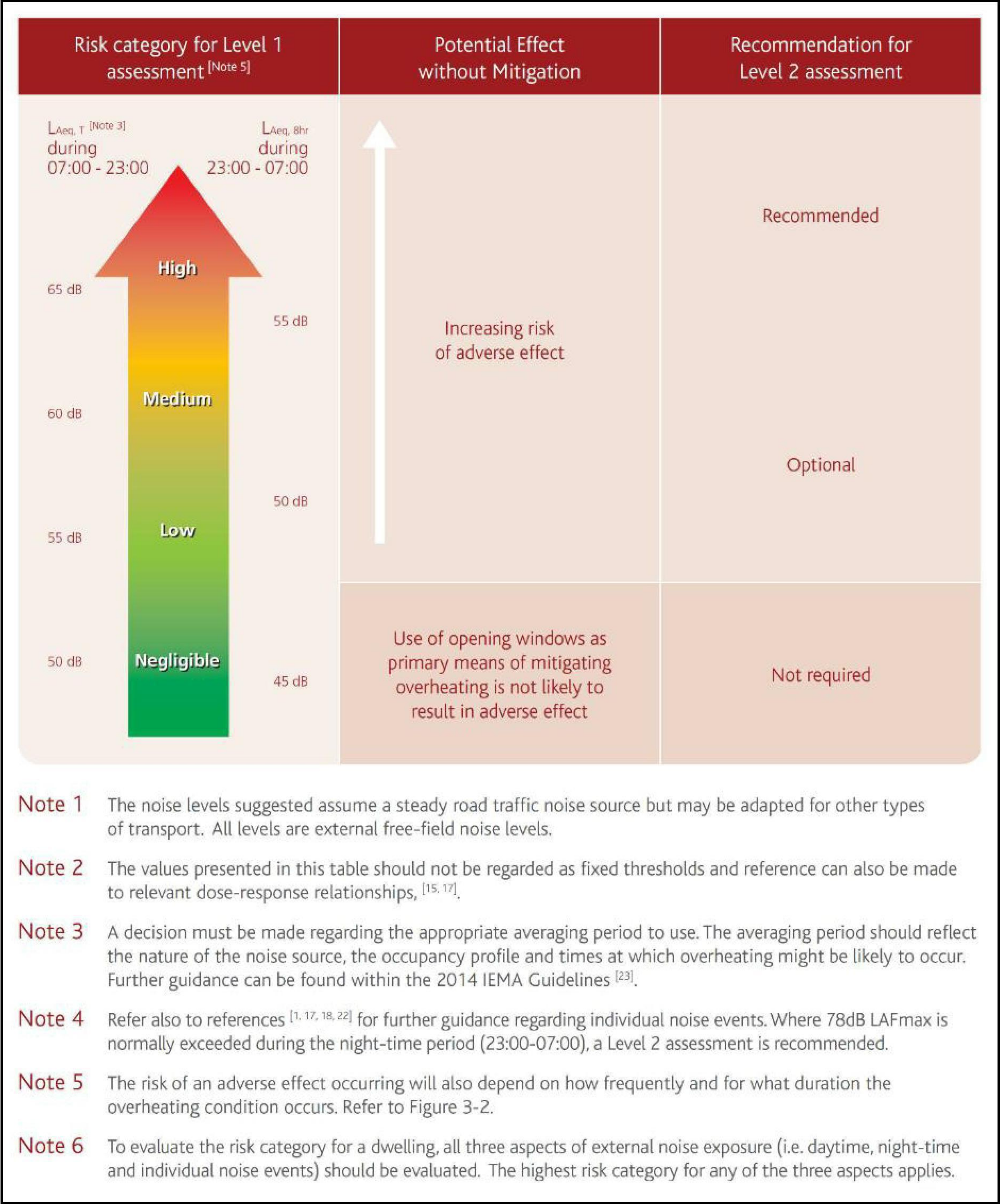


Figure 3: Level 1 Risk Assessment (Figure 3.2 of AVO guidance)

Figure 4 shows the Level 2 site risk assessment of noise, relating to overheating conditions.

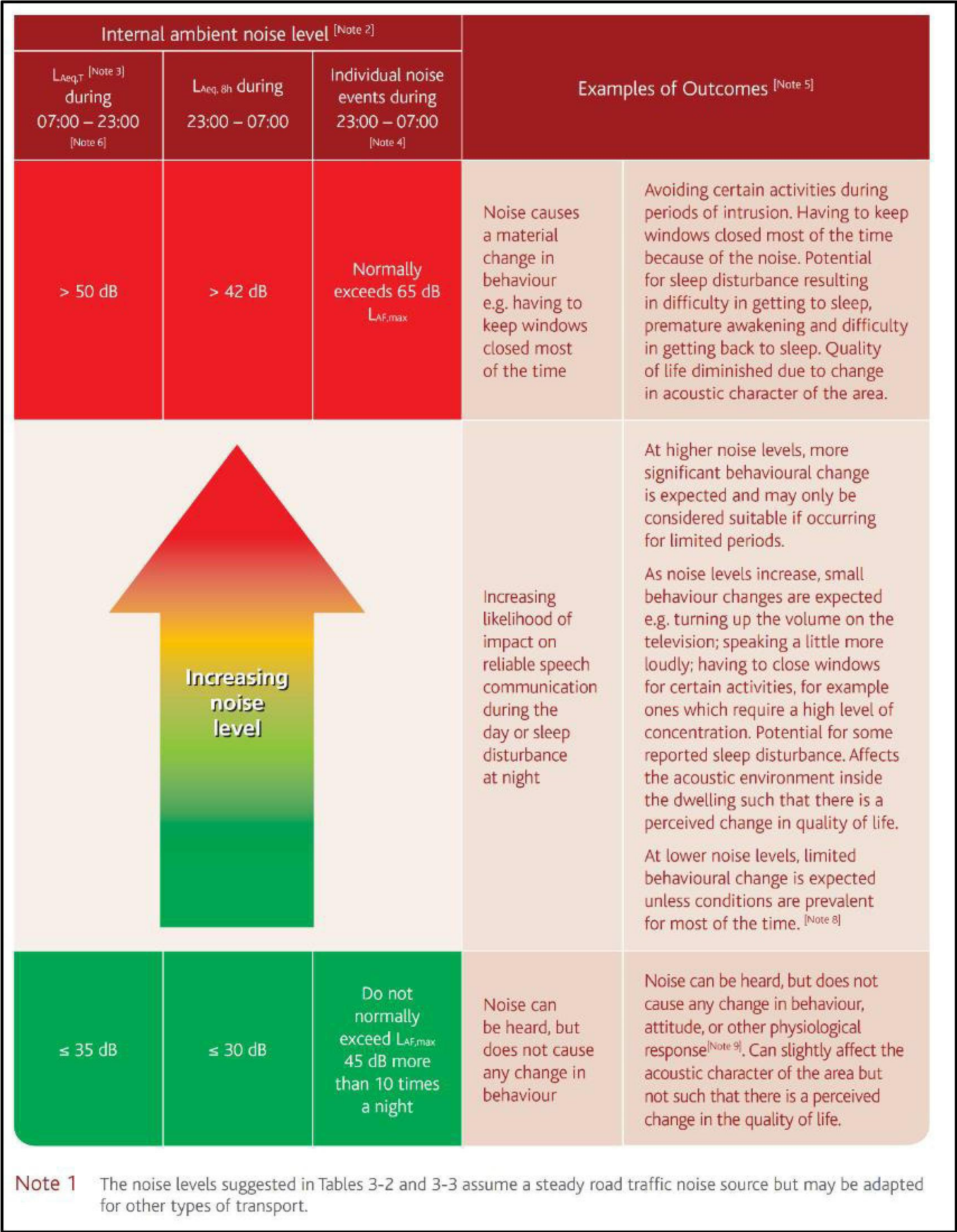


Figure 4: Level 2 Risk Assessment (Figure 3.3 of AVO guidance)

The noise levels suggested in Figure 3 and Figure 4 assume a steady road traffic noise source but may be adapted for other types of transport by taking account of the differing responses to different transport sources.