

BELLWAY HOMES LIMITED (THAMES VALLEY)

FORMER DEE ROAD FIRE STATION, READING

NOISE ASSESSMENT

**REPORT REF.
2107330-01A**

January 2023

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Document Control Sheet

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	DRAFT	CM	JG	DRAFT ONLY	22/07/22
-	FINAL	CM	CM	JG	29/07/22
A	Updated layout	CM	CM	LD	19/12/22
A	FINAL	CM	CM	LD	03/01/23



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1. INTRODUCTION

- 1.1. Ardent Consulting Engineers were instructed by Bellway Homes Limited (Thames Valley) to undertake a Noise Assessment to support the residential development at the Former Dee Road Fire Station, Dee Road, Reading (hereafter referred to as the site).

Site Location

- 1.2. The site is set in a predominantly residential area and is surrounded to the north, west, south and east by residential properties on Leven Street, Gairn Close, Dee Road and Spey Road. The surrounding area and approximate site boundary (shown in red) are shown in Figure 1-1.



Figure 1-1: Site Boundary and Surrounding Area

Site Proposals

1.3. The proposals are for 54 residential units with associated landscaping, parking and access. An extract of the proposals is shown in Figure 1.2.



Figure 1-2: Site Proposals (Extract)

2. LOCAL AUTHORITY LIAISON

2.1. Contact¹ was made with Reading Borough Council to discuss the proposals and approach to the assessment. The following assessment criteria was agreed:

- The suitability of the site for residential development in accordance with BS8233 and ProPG Noise;
- The survey methodology was agreed as acceptable.

2.2. A summary of relevant policy and guidance is shown in Appendix F.

¹ Email contact on 12/7/8/2022 and 18/7/2022 with Environmental Health Officers at Reading Borough Council

3. ENVIRONMENTAL NOISE LEVELS

- 3.1. An environmental noise survey was undertaken at two positions across the site between 8th and 12th July 2022 as shown in Figure 3-1.
- 3.2. Noise measurement positions were selected to obtain representative baseline noise levels due to the main observed noise sources around the site.



Figure 3-1: Measurement Positions

3.3. A description of the measurements positions is as follows:

- **Measurement Position 1** - The microphone was mounted at a height of approximately 4m above ground level. The microphone had an unobscured path to Dee Road and Spey Road.
- **Measurement Position 2** - The microphone was mounted at a height of approximately 4m above ground level. The microphone had an unobscured path to Leven Street.

3.4. The equipment used was as follows:

- Svantek 957 Sound Level Meter (serial number: 15385)
- Svantek 971 Sound Level Meter (serial number: 34787)
- Rion NC74 Calibrator (serial number: 34172694)

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. Calibration certificates are available upon request.

3.6. Observations regarding the prevailing weather condition were taken during the surveys, which noted no precipitation and low wind speeds and therefore considered suitable for environmental noise measurements.

3.7. A summary of the measured noise level taken at the site are summarised in Table 3-1. Time histories of measured data are shown in Appendix A.

Monitoring Position	Ambient Noise Level dB $L_{Aeq, T}$ Range (Representative)		Night-time dB L_{AFmax} Range (Representative)
	Daytime	Night-time	
MP1	49-82 (59)	30-65 (51)	38-90 (71)
MP2	35-63 (48)	26-51 (39)	36-79 (61)

Table 3-1: Summary of Measured Noise Levels

3.8. The representative L_{Amax} 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 WHO guidelines.

3.9. Based on the measured sound levels at the site, the site would be considered 'low risk' when compared with Figure 1 included in Section of ProPG, as shown in Appendix F.

3.10. 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.

3.11. 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
MP1	L_{Aeq,T} (day)	64	57	55	53	56	53	45	36
	L_{Aeq,T} (night)	56	50	46	46	48	44	36	28
	L_{Amax,T} (night)	79	71	66	66	69	63	56	47
MP2	L_{Aeq,T} (day)	48	43	40	37	34	30	25	17
	L_{Aeq,T} (night)	48	43	40	37	34	30	25	17
	L_{Amax,T} (night)	67	61	57	57	58	51	44	38

Table 3-2: Octave Band Data for Noise Monitoring Locations

3.12. Where appropriate, effects such as acoustic screening and distance attenuation have been considered.

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 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 time.
- 4.3. Reasonable construction noise limits can be derived using the Example Method 1 (the ABC Method) of BS 5228, within section E.3.2. Table E.1 from the standard is reproduced below in 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 from BS 5228: Part 1

- 4.4. Existing ambient noise levels at the site will place the site and surroundings within Category C of Table E.1.
- 4.5. Therefore, the following noise ambient noise levels (as a result of construction activities) should be considered as reasonable limits to adhere to during construction works.

Time Period	Construction Noise Limits L_{Aeq} (dB)
Weekdays 07:00 – 19:00 & Saturday 07:00 – 13:00	65

Table 4-2: Construction Noise Limits

5. ROAD TRAFFIC NOISE

- 5.1. This section considers traffic noise impact of the operational stage of the site against the current baseline traffic flows.
- 5.2. Traffic flow volumes provided by the project Transport Consultant, i-Transport, which are presented in Appendix D. These have been used to calculate the change in noise levels arising from road traffic during the operational stage of the site. The data is presented as daytime (07:00 – 23:00) and night time (23:00 – 07:00) traffic flows.
- 5.3. The current baseline traffic flow has been compared to the increase due to operational site traffic. Calculations of the change in noise levels are shown in Appendix E.
- 5.4. Tables 5-1 and 5-2 show the traffic flows and predicted changes in noise levels for the change in traffic flow between the future baseline and the operational site traffic site for the daytime and night-time periods respectively.

Road	Current Baseline	Operational Traffic	Change in Noise Level, dB
Dee Road (West of Spey Road)	5,484	81	0.1
Dee Road (East of Spey Road)	5,484	161	0.1

Table 5-1: Change in Noise Levels Due to Operational Traffic to Future Baseline – Daytime

Road	Current Baseline	Operational Traffic	Change in Noise Level, dB
Dee Road (West of Spey Road)	364	3	0.0
Dee Road (East of Spey Road)	364	7	0.1

Table 5-2: Change in Noise Levels Due to Operational Traffic Compared to Future Baseline – Night-time

- 5.5. The change in noise levels is negligible for all scenarios when compared to Table 3.54b of DMRB, LA 111.

6. MITIGATION RECOMMENDATIONS

- 6.1. The measured results and indicative layout were used to undertake calculations, presented in Appendix B, for suitable façade treatments, outlined as follows.
- 6.2. The aim of this section is to identify mitigation measures capable of providing suitable levels of attenuation to achieve the required internal sound levels based on the predicted noise levels and the planning noise assessment.
- 6.3. To achieve suitable internal amenity sound levels, windows must remain closed, but not sealed, and an alternative means (e.g. trickle ventilation) of ventilation provided during normal conditions for dwellings in close proximity to Dee Road. Residents will have the option to open windows, whilst noting sound levels will be elevated. Where dwellings are sufficiently screened from or set back from Dee Road, open windows will be suitable.

External Building Fabric - Non-Glazed Elements

- 6.4. It is assumed that the non-glazed external building fabric elements comprise masonry cavity walls. This would typically provide a sound reduction performance of at least the figures shown in Table 6-1 when tested in accordance with BS EN ISO 10140-2:2010 (figures derived from: Representative Values of Airborne SRI for Some Common Structures: Appendix B of Flakt Woods 'Guide to Noise Control').

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

Table 6.1: Non-glazed Elements Assumed Sound Reduction Performance

External Building Fabric - Glazing

- 6.5. Table 6-2 sets out the required glazing performance types, these specifications take into account the glass, frame, seals and associated fittings.

Glazing Type	Room Type	Sound Reduction Index, R_w	Octave band centre frequency SRI, dB					
			125	250	500	1k	2k	4k
Type 1 (no markup)	All Rooms	31	21	20	26	38	37	39
Type 2	Living Room	31	21	20	26	38	37	39
	Bedroom	35	24	24	32	37	42	43

Table 6-2: Required Minimum Attenuation Values for Glazing

External Building Fabric - Ventilation

6.6. Table 6-3 sets out the required ventilation performance types:

Ventilation Type	Room Type	Element Normalised level difference, D_{new}	Octave band centre frequency SRI, dB					
			125	250	500	1k	2k	4k
Type 1 (no markup)	All Rooms	35	36	34	31	34	38	38
Type 2	Living Room	35	36	34	31	34	38	38
	Bedroom	43	41	39	38	47	43	46

Table 6-3: Required Minimum Attenuation Values for Ventilation

6.7. Tables 6-2 and 6-3 should be viewed in conjunction with Figure 6-1, which indicates the location of glazing and ventilation types:

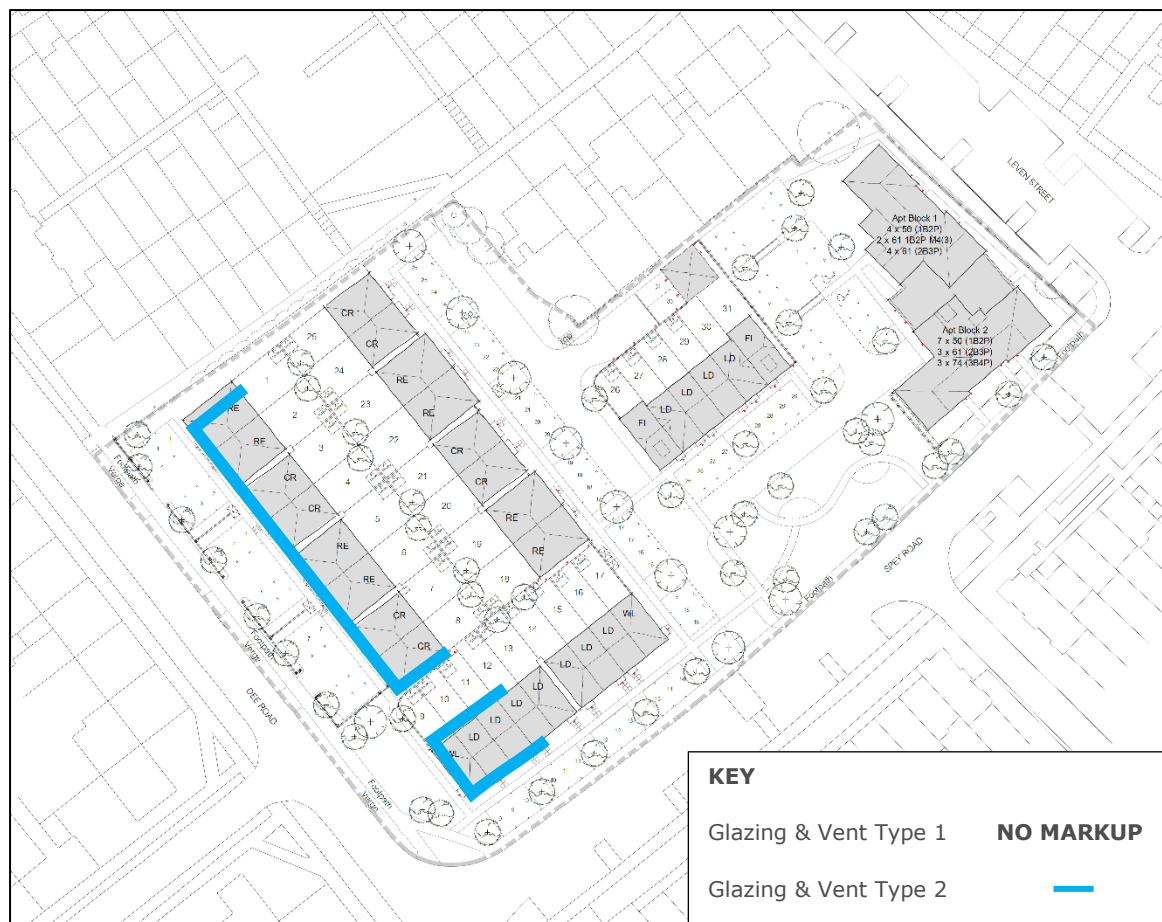


Figure 6-1: Glazing and Ventilation Layout

- 6.8. Where non-sensitive rooms and sensitive rooms form part of an open plan area, for example a dining and kitchen area, the glazing and ventilation specification for the more sensitive room should be used across the combined area.
- 6.9. All major building elements should be tested in accordance with BS EN ISO 10140-2:2010. Sole glass performance data would not necessarily demonstrate compliance with this specification.
- 6.10. 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.

Overheating

- 6.11. Consideration has been given to the potential for adverse noise impact during overheating conditions; where residents may open windows to control temperature. Based on the measured sound levels at the site, façades in close proximity to Dee Road are considered to be 'medium risk' during the daytime and night time. The rest

of the site is considered to be considered 'negligible to low risk' during the daytime and night time under overheating condition according to AVO guidance, as set out in Appendix F.

6.12. In these circumstances a Level 2 Overheating assessment is recommended for parts of the site which fall within medium risk categories as per the Level 1 site risk assessment. The overheating risk categories for the site as described above are shown in Appendix C of this report.

External Amenity Areas

6.13. Gardens and balconies are proposed to all dwellings on site. Based on the measurements taken at the site, nearly all of these areas will meet the guidance criteria of BS8233:2014.

6.14. Where gardens directly overlook Dee Road, a 2m high close boarded timber fence is recommended, as shown in Figure 6-2. This is expected to provide a reduction in noise levels of approximately 5-10dB and would reduce noise levels so that all gardens on site meet the guideline values set out in the standards.

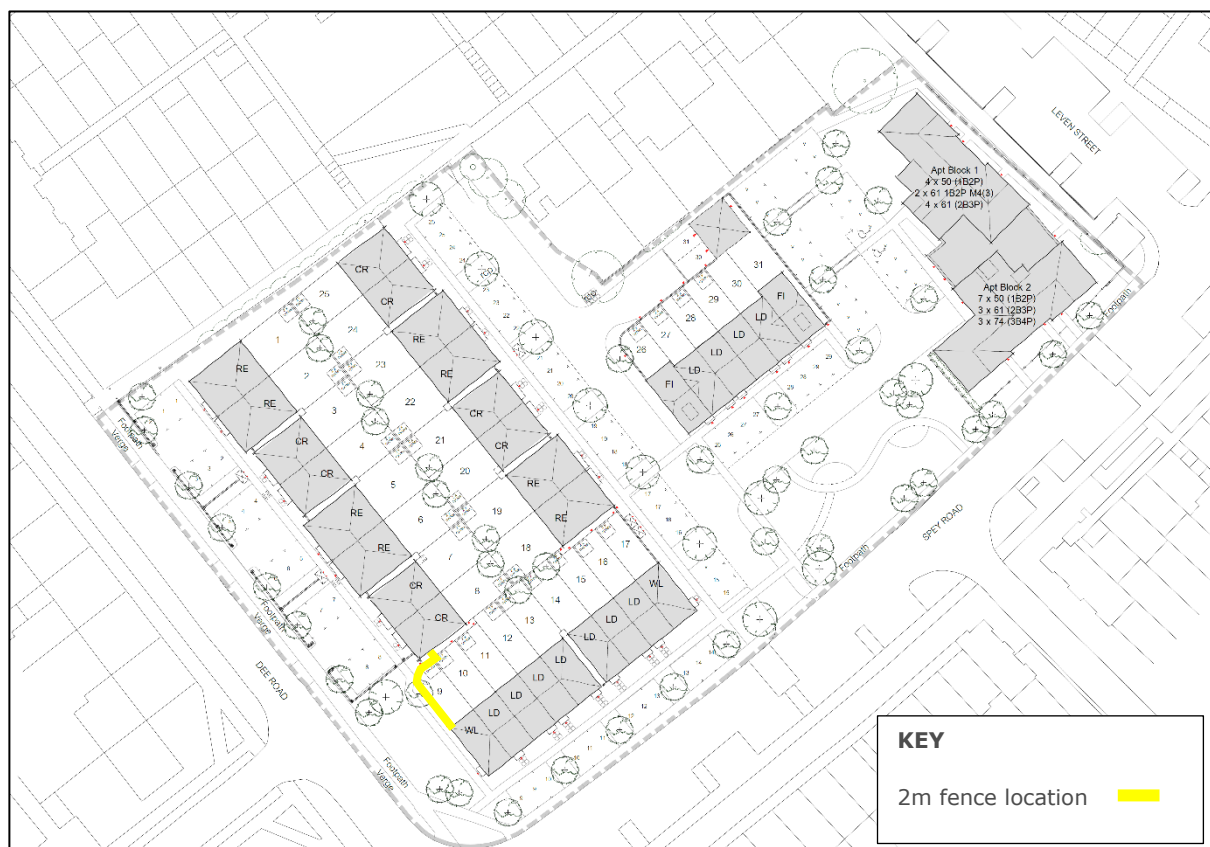


Figure 6-2: 2m Fence Location

Construction Phase

- 6.15. Construction activities should only take place between the hours of 07:00 and 19:00 on weekdays and between 07:00 – 13:00 on Saturdays. 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 LPA.
- 6.16. During construction, the contractor will employ best practicable means to control noise from construction operations.
- 6.17. Temporary screening in the form of solid timber hoarding can be used where operations are adjacent to sensitive receptors. Consideration will be given to neighbouring residential properties when locating the temporary site compounds and material stockpiles.
- 6.18. Stationary equipment and plant such as generators will be placed as far as practicable from noise sensitive properties, and preferably in areas benefiting from existing or purpose-built attenuation such as bunding or behind non-sensitive buildings.
- 6.19. Delivery of materials and removal of waste from the site will be planned to minimise disturbance to neighbouring properties. Idling of plant, machinery and delivery vehicles should be prohibited when not in use.
- 6.20. If required noise levels can be monitored regularly in accordance with BS5228 to ensure the above set limits are not exceeded. In addition to the above all other guidance within BS5228-1 will be followed at all times.

7. CONCLUSIONS

- 7.1. A noise survey has been undertaken and measured levels have been used to calculate and assess suitable glazing and ventilation specifications.
- 7.2. Areas of the site in close proximity to Dee Road are considered to be 'medium risk' and all other areas would be considered 'negligible to low risk' in accordance with guidance in ProPG. Expert Acoustics advice has been sought and good acoustic design processes have been followed to reduce sound levels across the site whilst considering wider design constraints.
- 7.3. To achieve suitable internal amenity sound levels, windows must remain closed, but not sealed, and an alternative means (e.g. trickle ventilation) of ventilation provided during normal conditions for dwellings in close proximity to Dee Road. Residents will have the option to open windows, whilst noting sound levels will be elevated. Where dwellings are sufficiently screened from or set back from Dee Road, open windows will be suitable.
- 7.4. The risk of noise impact under overheating conditions within properties has been considered in accordance with AVO Guidance. Façades in close proximity to Dee Road are considered to be 'medium risk' during the daytime and night time. The rest of the site is considered to be considered 'negligible to low risk' during the daytime and night time. In these circumstances a Level 2 Overheating assessment is recommended for parts of the site which fall within medium risk category as per the Level 1 site risk assessment.
- 7.5. The majority of external amenity areas will meet the guidance criteria set out in the standards. Where gardens directly overlook Dee Road, mitigation measures have been recommended so that all external amenity areas on site meet the guideline values and where there is an excess it is marginal.
- 7.6. Control measures will be implemented to manage potential impacts from construction noise.
- 7.7. The impact of the change in noise levels due to operational site traffic is negligible when compared to the future baseline traffic flows.
- 7.8. This assessment demonstrates that the site is suitable for residential development subject to the recommendations included in this report.

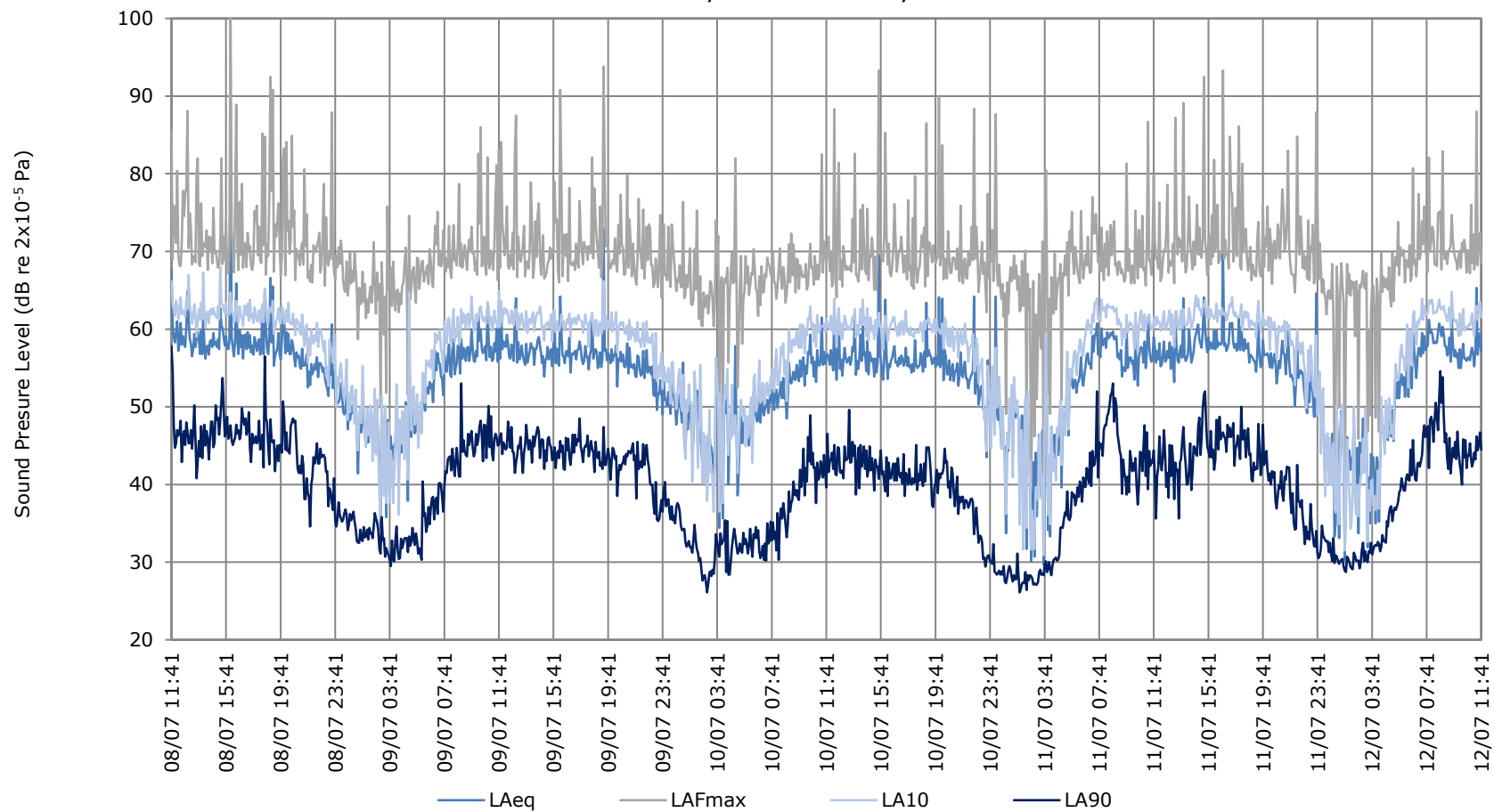
APPENDIX A

Dee Road Fire Station, Reading

Position 1

Environmental Noise Time History

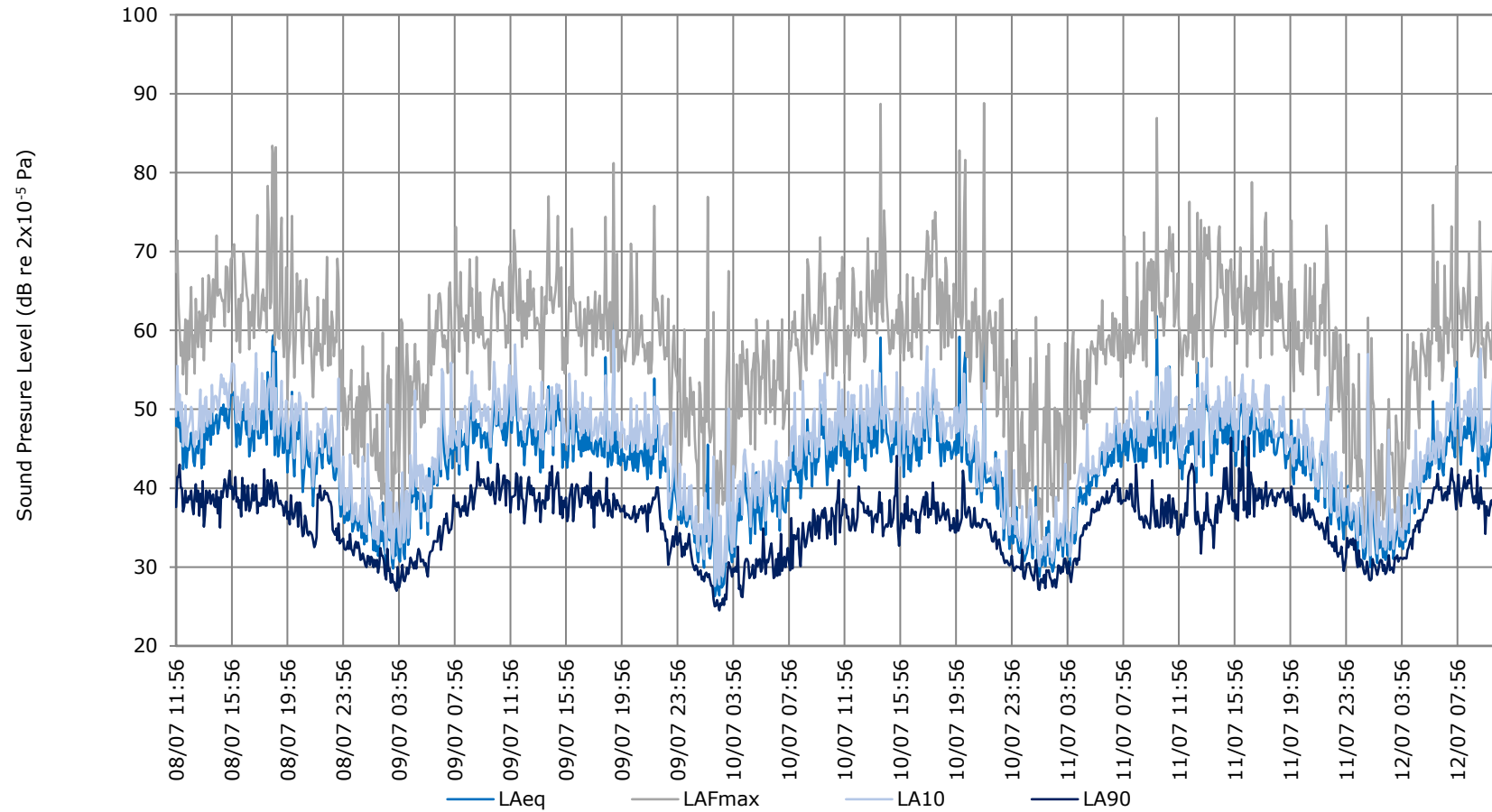
08 July 2022 to 12 July 2022



Dee Road Fire Station, Reading

Position 2

Environmental Noise Time History
08 July 2022 to 12 July 2022



APPENDIX B

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 1 (Closer to Dee Road)

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Living Room
Parameter	L _{Aeq} , 16h

Room Dimensions and Areas	
Room volume	60.00
Total Surface area	98.00
Wall façade area	10.00
Roof façade area	0.00
Glazing area	4.80
Dne Ref Area, A0	10.00
Total façade area	14.80

- Based on typical size

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	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Total Absorption	19.32	19.32	19.32	19.32	19.32	19.32	19.32	19.32	
10Log S/A	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	64	57	55	53	56	53	45	36	59
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	3	3	3	3	3	3	3	3	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	67	60	58	56	59	56	48	39	62

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	18	28	38	34	38	48	31
Transmission Coefficient	0.015849	0.010000	0.015849	0.001585	0.000158	0.000398	0.000158	0.000016	
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	0.006381	0.003682	0.005443	0.001053	0.000321	0.000236	0.000158	0.000112	
Average SRI	22	24	23	30	35	36	38	39	33

Pilkington 6/16/6

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	45.1	35.9	34.9	26.3	23.4	19.9	9.7	-0.7	31
Lp (Direct)	45.3	36.0	35.0	26.5	23.6	20.1	9.8	-0.6	31
Lp (Rev & Direct)	48	39	38	29	27	23	13	2	34
BS8233	47	38	37	28	25	22	12	1	33

Criteria

≤ 35

≤ 35

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 1 (Closer to Dee Road)

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Bedroom
Parameter	LAeq, 8h

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00
Total façade area	13.60

- Based on typical size

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	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	56	50	46	46	48	44	36	28	51
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	3	3	3	3	3	3	3	3	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	59	53	49	49	51	47	39	31	54

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	19	24	24	32	37	42	43	48	35
Transmission Coefficient	0.012589	0.003981	0.003981	0.000631	0.000200	0.000063	0.000050	0.000016	
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	32	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.004962	0.001405	0.001183	0.000286	0.000068	0.000054	0.000032	0.000023	
Average SRI	23	29	29	35	42	43	45	46	39

Pilkington 10/16/6

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

Airvac 5000 EAW - AC2

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	38.2	25.8	21.9	15.1	10.7	5.9	-4.1	-13.8	19
Lp (Direct)	36.4	24.0	20.1	13.3	8.9	4.1	-5.9	-15.6	17
Lp (Rev & Direct)	40	28	24	17	13	8	-2	-12	21
BS8233	40	28	24	17	13	8	-2	-12	21

Criteria

≤ 30

≤ 30

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 1 (Closer to Dee Road)

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Bedroom
Parameter	L _{Amax}

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00
Total façade area	13.60

- Based on typical size

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	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	79	71	66	66	69	63	56	47	71
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	6	6	6	6	6	6	6	6	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (L _{max})	85	77	72	72	75	69	62	53	77

Composite SRI	63	125	250	500	1000	2000	4000	8000	R _w
Glazing SRI	19	24	24	32	37	42	43	48	35
Transmission Coefficient	0.012589	0.003981	0.003981	0.000631	0.000200	0.000063	0.000050	0.000016	
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	32	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.004962	0.001405	0.001183	0.000286	0.000068	0.000054	0.000032	0.000023	
Average SRI	23	29	29	35	42	43	45	46	39

Pilkington 10/16/6

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

Airvac 5000 EAW - AC2

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
L _p (Reverberant), line source	63.4	50.5	44.2	38.3	34.7	28.1	18.6	8.0	43
L _p (Direct)	61.5	48.7	42.4	36.5	32.8	26.3	16.7	6.2	41
L _p (Rev & Direct)	66	53	46	41	37	30	21	10	45
BS8233	65	53	46	40	37	30	21	10	45

Criteria

≤ 45

≤ 45

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Living Room
Parameter	L _{Aeq} , 16h

Room Dimensions and Areas	
Room volume	60.00
Total Surface area	98.00
Wall façade area	10.00
Roof façade area	0.00
Glazing area	4.80
Dne Ref Area, A0	10.00
Total façade area	14.80

- Based on typical size

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	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Total Absorption	19.32	19.32	19.32	19.32	19.32	19.32	19.32	19.32	
10Log S/A	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	64	57	55	53	56	53	45	36	59
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)	64	57	55	53	56	53	45	36	59

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	18	28	38	34	38	48	31
Transmission Coefficient	0.015849	0.010000	0.015849	0.001585	0.000158	0.000398	0.000158	0.000016	
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	0.006381	0.003682	0.005443	0.001053	0.000321	0.000236	0.000158	0.000112	
Average SRI	22	24	23	30	35	36	38	39	33

Pilkington 6/16/6

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	42.1	32.9	31.9	23.3	20.4	16.9	6.7	-3.7	28
Lp (Direct)	42.3	33.0	32.0	23.5	20.6	17.1	6.8	-3.6	28
Lp (Rev & Direct)	45	36	35	26	24	20	10	-1	31
BS8233	44	35	34	25	22	19	9	-2	30

Criteria

≤ 35

≤ 35

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Bedroom
Parameter	LAeq, 8h

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00
Total façade area	13.60

- Based on typical size

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	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	56	50	46	46	48	44	36	28	51
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)	56	50	46	46	48	44	36	28	51

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	18	28	38	34	38	48	31
Transmission Coefficient	0.015849	0.010000	0.015849	0.001585	0.000158	0.000398	0.000158	0.000016	
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	0.005545	0.003124	0.004525	0.001006	0.000335	0.000222	0.000158	0.000121	
Average SRI	23	25	23	30	35	37	38	39	33

Pilkington 6/16/6

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	35.7	26.3	24.7	17.6	14.7	9.1	-0.1	-9.6	21
Lp (Direct)	33.8	24.5	22.9	15.8	12.8	7.2	-1.9	-11.4	19
Lp (Rev & Direct)	38	29	27	20	17	11	2	-7	23
BS8233	38	28	27	20	17	11	2	-8	23

Criteria
≤ 30
≤ 30

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Bedroom
Parameter	L _{Amax}

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00
Total façade area	13.60

- Based on typical size

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	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	79	71	66	66	69	63	56	47	71
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 (L _{max})	79	71	66	66	69	63	56	47	71

Composite SRI	63	125	250	500	1000	2000	4000	8000	R _w
Glazing SRI	18	20	18	28	38	34	38	48	31
Transmission Coefficient	0.015849	0.010000	0.015849	0.001585	0.000158	0.000398	0.000158	0.000016	
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	0.005545	0.003124	0.004525	0.001006	0.000335	0.000222	0.000158	0.000121	
Average SRI	23	25	23	30	35	37	38	39	33

Pilkington 6/16/6

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

Standard Trickle Vent

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
L _p (Reverberant), line source	57.8	48.0	44.1	37.8	35.6	28.3	19.5	9.2	42
L _p (Direct)	56.0	46.2	42.3	36.0	33.8	26.5	17.7	7.4	40
L _p (Rev & Direct)	60	50	46	40	38	31	22	11	44
BS8233	60	50	46	40	38	30	22	11	44

Criteria

≤ 45

≤ 45

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Living Room
Parameter	L _{Aeq} , 16h

Room Dimensions and Areas	
Room volume	60.00
Total Surface area	98.00
Wall façade area	10.00
Roof façade area	0.00
Glazing area	4.80
Dne Ref Area, A0	10.00
Total façade area	14.80

- Based on typical size

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	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Total Absorption	19.32	19.32	19.32	19.32	19.32	19.32	19.32	19.32	
10Log S/A	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	-1.16	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	56	52	48	44	43	40	36	29	48
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)	56	52	48	44	43	40	36	29	48

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	18	28	38	34	38	48	31
Transmission Coefficient	0.015849	0.010000	0.015849	0.001585	0.000158	0.000398	0.000158	0.000016	
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	0.006381	0.003682	0.005443	0.001053	0.000321	0.000236	0.000158	0.000112	
Average SRI	22	24	23	30	35	36	38	39	33

Pilkington 6/16/6

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	33.5	27.1	25.2	14.1	7.9	4.0	-2.0	-11.1	19
Lp (Direct)	33.7	27.2	25.4	14.3	8.0	4.2	-1.8	-11.0	20
Lp (Rev & Direct)	37	30	28	17	11	7	1	-8	23
BS8233	36	29	27	16	10	6	0	-9	21

Criteria

≤ 35

≤ 35

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Bedroom
Parameter	LAeq, 8h

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00

- Based on typical size

Total façade area	13.60
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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	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	48	43	40	37	34	30	25	17	39
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)	48	43	40	37	34	30	25	17	39

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	20	18	28	38	34	38	48	31
Transmission Coefficient	0.015849	0.010000	0.015849	0.001585	0.000158	0.000398	0.000158	0.000016	
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	0.005545	0.003124	0.004525	0.001006	0.000335	0.000222	0.000158	0.000121	
Average SRI	23	25	23	30	35	37	38	39	33

Pilkington 6/16/6

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	27.1	20.0	18.4	8.5	1.4	-4.8	-11.5	-20.0	13
Lp (Direct)	25.3	18.2	16.6	6.7	-0.5	-6.6	-13.3	-21.8	11
Lp (Rev & Direct)	29	22	21	11	4	-3	-9	-18	15
BS8233	29	22	20	11	3	-3	-9	-18	15

Criteria

≤ 30

≤ 30

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	2107330
Property Address	Dee Road Fire Station
Room Type	Bedroom
Parameter	L _{Amax}

Room Dimensions and Areas	
Room volume	35.00
Total Surface area	65.50
Wall façade area	10.00
Roof façade area	0.00
Glazing area	3.60
Dne Ref Area, A0	10.00
Total façade area	13.60

- Based on typical size

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	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	67	61	57	57	58	51	44	38	61
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 (L _{max})	67	61	57	57	58	51	44	38	61

Composite SRI	63	125	250	500	1000	2000	4000	8000	R _w
Glazing SRI	18	20	18	28	38	34	38	48	31
Transmission Coefficient	0.015849	0.010000	0.015849	0.001585	0.000158	0.000398	0.000158	0.000016	
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	0.005545	0.003124	0.004525	0.001006	0.000335	0.000222	0.000158	0.000121	
Average SRI	23	25	23	30	35	37	38	39	33

Pilkington 6/16/6
Typical masonry cavity wall (300mm - 380kg/m2)
Standard Trickle Vent

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
L _p (Reverberant), line source	45.8	38.1	35.6	28.5	24.6	16.7	8.1	0.2	32
L _p (Direct)	44.0	36.2	33.8	26.7	22.8	14.9	6.3	-1.6	30
L _p (Rev & Direct)	48	40	38	31	27	19	10	2	34
BS8233	48	40	38	31	27	19	10	2	34

Criteria
≤ 45
≤ 45

APPENDIX C

Noise Impact During Overheating Risk Categories – Day & Night



APPENDIX D

2022 Baseline

	Site	Direction	5-day Average (AAWT)			5-day Average (AAWT)		
			8H, 23-7			16H, 7-23		
			Total Traffic	HGV	HGV (%)	Total Traffic	HGV	HGV (%)
A	Dee Road (West of Spey Road)	EB	177	0	0.0%	2664	12	0.5%
		WB	187	0	0.0%	2820	0	0.0%
		Two-way	364	0	0.0%	5484	12	0.2%
B	Dee Road (East of Spey Road)	EB	177	0	0.0%	2664	12	0.5%
		WB	187	0	0.0%	2820	0	0.0%
		Two-way	364	0	0.0%	5484	12	0.2%

Operational Site Traffic

	Site	Direction	5-day Average (AAWT)			5-day Average (AAWT)		
			8H, 23-7			16H, 7-23		
			Total Traffic	HGV	HGV (%)	Total Traffic	HGV	HGV (%)
A	Dee Road (West of Spey Road)	EB	2	0	0.0%	39	0	0.0%
		WB	2	0	0.0%	42	0	0.0%
		Two-way	3	0	0.0%	81	0	0.0%
B	Dee Road (East of Spey Road)	EB	4	0	0.0%	86	0	0.0%
		WB	3	0	0.0%	76	0	0.0%
		Two-way	7	0	0.0%	161	0	0.0%

APPENDIX E

Daytime				
	Current Baseline	Operational Site Traffic	Baseline + Operational Site Traffic	Change in Noise Level, dB
Dee Road (West of Spey Road)	5484	81	5565	0.1
Dee Road (East of Spey Road)	5484	161	5645	0.1

Night-time				
	Current Baseline	Operational Site Traffic	Baseline + Operational Site Traffic	Change in Noise Level, dB
Dee Road (West of Spey Road)	364	3	367	0.0
Dee Road (East of Spey Road)	364	7	371	0.1

APPENDIX F

RELEVANT POLICY & GUIDANCE

National Planning Policy Framework (NPPF) – July 2021

Under the NPPF: paragraph 185 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

Whilst the above criteria is for dwellings, BS8233 states that these recommendations are similar for hotel guestrooms and therefore these have been adopted as the criteria for assessment.

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. ProPG states that the guidance can be used for other types of residential institution and therefore it is considered applicable to the site.

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."

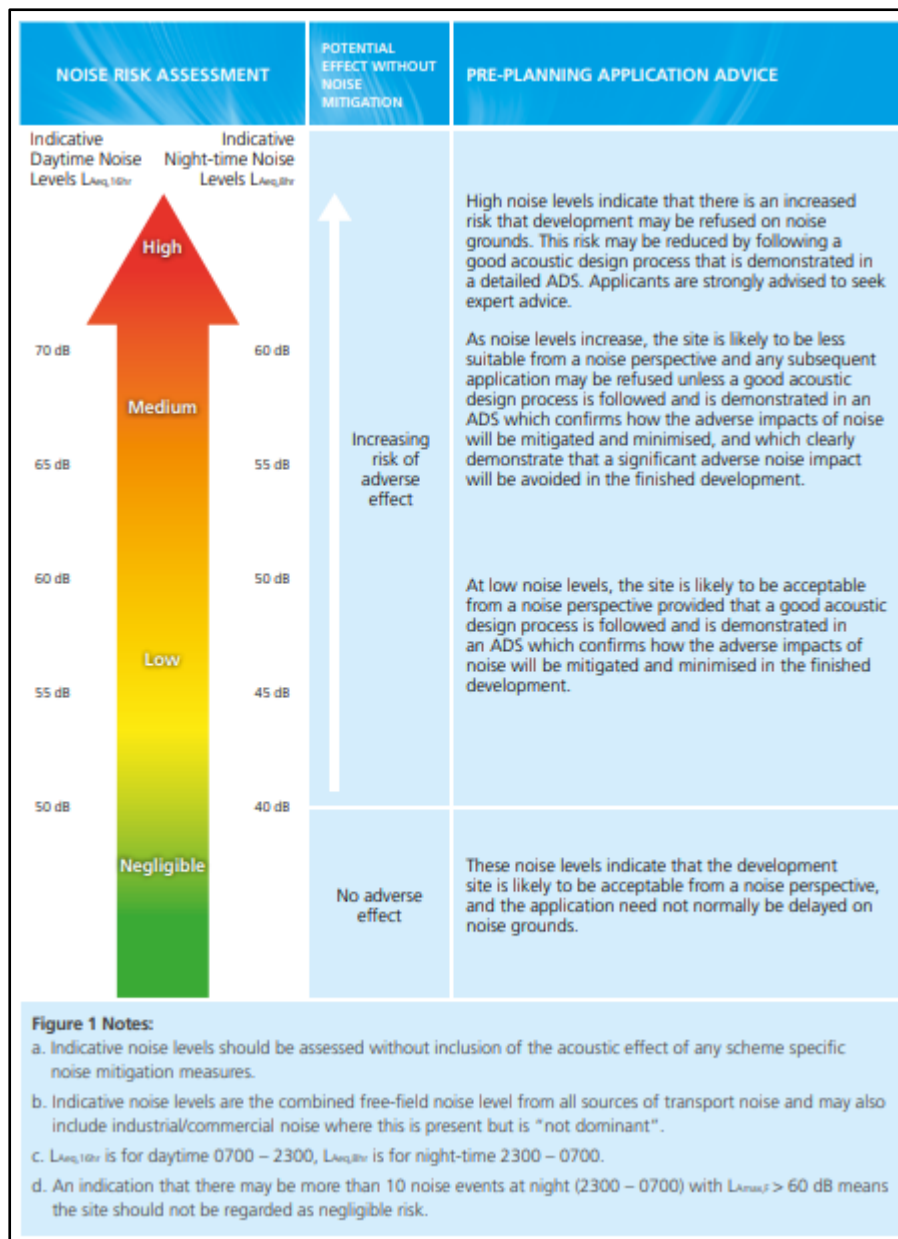


Figure 1: Extract from Figure 1 in ProPG – Initial Site Noise Risk Assessment

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. AVO states that the guidance can be used for other types of residential institution and therefore it is considered applicable to the site.

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.

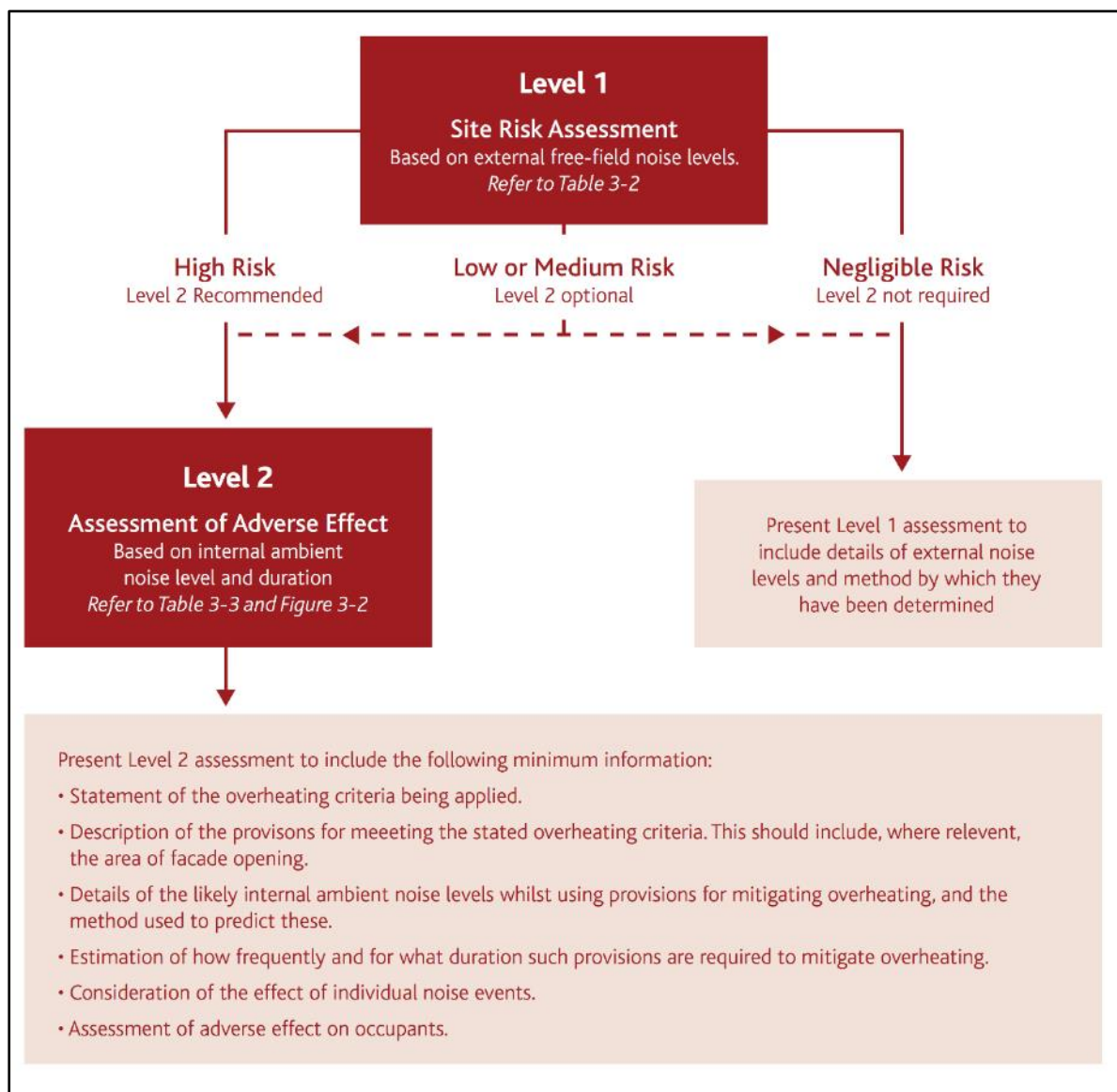


Figure 2: Two-level Assessment Procedure (Figure 3.1 of AVO Guidance)

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

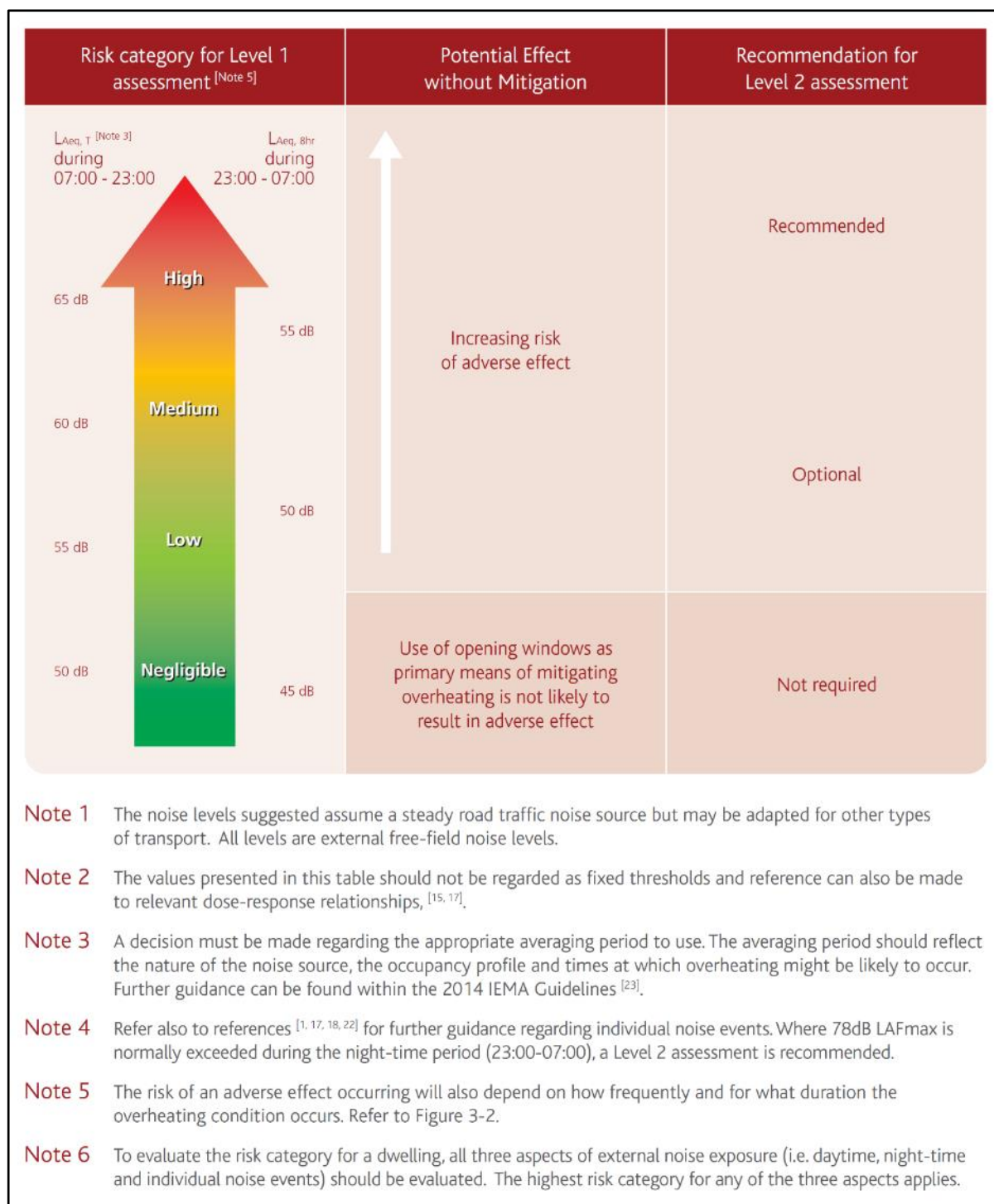


Figure 3: Level 1 Risk Assessment (Figure 3.2 of AVO guidance)

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

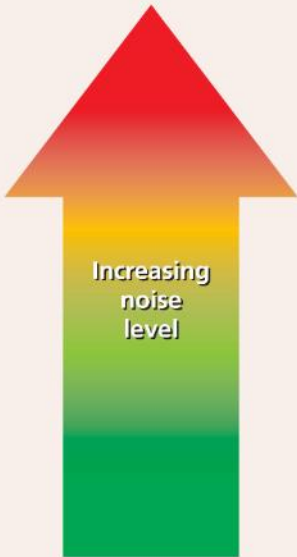
Internal ambient noise level ^[Note 2]			Examples of Outcomes ^[Note 5]	
$L_{Aeq,T}$ ^[Note 3] during 07:00 – 23:00 ^[Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 ^[Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{AF,max}$	Noise causes a material change in 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 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.				

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.

Reading Borough Local Plan (Adopted 2019)

The reading borough local plan sets out the local policies for development in the area which up to 2036, which is the year the local plan will end. There are a number of policies which relate to noise, the relevant policies to the development are CC8 and EN16.

Policy CC8 is reproduced below:

"...CC8: SAFEGUARDING AMENITY

Development will not cause a detrimental impact on the living environment of existing residential properties or unacceptable living conditions for new residential properties, in terms of:

- *Privacy and overlooking;*
- *Access to sunlight and daylight;*
- *Visual dominance and overbearing effects of a development;*
- *Harm to outlook;*
- *Noise and disturbance;*
- *Artificial lighting;*
- *Vibration;*
- *Dust and fumes;*
- *Smell;*
- *Crime and safety; or*
- *Wind, where the proposals involve new development of more than 8 storeys.*

The position of habitable rooms, windows and outdoor living spaces will be particularly important. A back-to-back distance of 20 metres between dwellings is usually appropriate, although the circumstances on individual sites may enable dwellings to be closer without a detrimental effect on privacy.

As well as immediate impacts, other aspects to which this policy applies will include matters such as hours of operation of businesses, and effects of traffic movements, particularly of heavy goods vehicles (HGVs). Proposals which would generate regular movements of HGVs on residential roads will not be acceptable.

Where an otherwise acceptable development could change its character to a use that

would have a greater impact on amenity without needing planning permission, conditions will be applied to restrict such changes. ...”

Policy EN16 is reproduced below:

“...EN16: POLLUTION AND WATER RESOURCES

Development will only be permitted where it would not be damaging to the environment and sensitive receptors through land, noise or light pollution; where it would result in no deterioration in, or ideally enhance, ground and surface water quality; and where adequate water resources, sewerage and wastewater treatment infrastructure will be in place to support the proposed development prior to occupation.

Proposals for development that are sensitive to the effects of noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution unless adequate mitigation measures are provided to minimise the impact of such pollution.

Development will only be permitted on land affected by contamination where it is demonstrated that the contamination and land gas can be satisfactorily managed or remediated so that it is suitable for the proposed end use and will not impact on the groundwater environment, human health, buildings and the wider environment, during demolition and construction phases as well as during the future use of the site...”

APPENDIX G

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:

LAeq,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. The unit is used for assessing traffic and industrial noise for planning purposes and in particular for PPG24.

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.

L_{Amax} : 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_{nTw} :

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