

Bellway Homes Ltd (South London)

Durrington Gasworks (Elizabeth Square Phase 2)

Noise and Vibration Assessment

**REPORT REF.
2505550_B-ACE-XX-XX-RP-C-0601B**

April 2026

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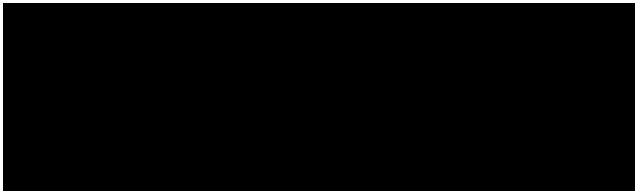
Appendix E: Acoustic Terminology

Annex A: Relevant Policy & Guidance

Document Control Sheet

Rev	Issue Purpose	Author	Checked	Approved	Date
-	Draft	JR	AS	Draft Only	04/12/25
-	Final	JR	AS	LD	18/12/25
A	Commercial Updates	JR	AS	LD	23/02/25
B	Updated Layout	JR	AS	LD	27/04/26

Distribution



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1. Introduction

- 1.1. Ardent Consulting Engineers have been instructed by Bellway Homes Ltd (South London) to undertake a Noise and Vibration Assessment at Durrington Gasworks (Elizabeth Square Phase 2) (hereafter referred to as the site).

Site Description

- 1.2. The site is situated to the west of Worthing town centre in predominantly residential area of Durrington-on-Sea. The site is bounded to the north by the railway line with residential properties beyond. Durrington Railway Station is located to the east of the site. Residential properties are located to the direct south on Barrington Road, to the west by Goring Business Park which includes various commercial units, with Temple Spa Rhythm and Blues Holdings and World of Books the closest units to the site boundary to the north and west of the site. To the immediate east, construction works are currently ongoing for an approved application of 287 residential units.
- 1.3. The site and surrounding area is shown in Figure 1-1.



Figure 1-1: Site, surrounding area and approximate red line boundary.

1.4. The development proposals are for a full planning application as follows:

"Full Planning Application for mixed-use development comprising 123 dwellings and commercial units with associated parking, landscaping, open space and drainage."

1.5. The site layout is shown in Figure 1-2 overleaf.



Figure 1-2: Site Layout (Extract)

2. Local Authority Liaison

2.1. Contact¹ was made with Officers at Adur and Worthing Councils (AWC), the following was agreed in relation to the assessment criteria and methodology:

- The noise survey methodology would cover 3 positions for 5 days and include a weekend, during school term time;
- Vibration monitoring at one position on the northern boundary for the railway line serving Durrington-on-Sea;
- Assessment of the suitability for the site would be in accordance with BS 8233 and ProPG;
- Potential impact of overheating would be considered in accordance with AVO Guidelines;
- An assessment of traffic noise impact will be undertaken in accordance with DMRB LA111.
- Assessment of existing and proposed operational noise in accordance with BS 4142; and
- Assessment of proposed fixed plant in accordance with BS 4142;

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

¹ Email contact with Michael Lavender on 02/12/2025, response on 03/12/2025

3. Environmental Noise Levels

- 3.1. An environmental noise survey was undertaken between 15th and 20th October 2025. Observations of operations at the nearby commercial uses (MP2) were undertaken on the 15th October 2025.
- 3.2. The measurement positions are shown in Figure 3-1. Measurement positions were selected to obtain representative baseline noise levels due to the main observed sources.



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 2m above local ground level in freefield conditions with a direct path to the railway line.
 - **Measurement Position 2** – The microphone was mounted at a height of 2m above local ground level in freefield conditions located to the north-

west corner of the site. This was also on the southern boundary fence of the external service yard for Temple Spa Rhythm and Blues Holdings.

- **Measurement Position 3** – The microphone was mounted at a height of 2m above local ground level in freefield conditions in close proximity to the gas substation.
- **Vibration Measurement Position 1 (V1)** - The transducer was positioned on solid, compacted soil in close proximity to the railway line at the north of the site approximately 10m from the railway track.

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

- SVAN Svantek 977 Sound Level Meter (serial number: 34133)
- SVAN Svantek 977 Sound Level Meter (serial number: 45355)
- 01dB Solo Sound Level Meter (serial number: 60587)
- Rion NC-74 Sound Calibrator (serial number: 34172694)
- Rion VM-56 Tri-Axial Vibration Meter (serial number: 00680037)

3.5. All equipment used has been professionally calibrated. Field calibration of the sound level meters (and complete measurement signal chain) was undertaken before and after measurements to ensure no significant drift of the calibration signal. Calibration certificates are available upon request.

3.6. The weather conditions were noted during the setup and collection. The conditions for the noise survey were considered to be suitable and the details can be found in Table 3-1 below.

Date	Position	Wind Direction	Wind Speed (m/s)	Temperature (°C)	Cloud Cover (%)	Conditions
15/10/25	MP 1/2 (Setup)	North-east	2	13	50	Dry
20/10/25	MP 1/2 (Collection)	South	3	14	100	Dry

Table 3-1: Weather conditions

3.7. Observations of the prevailing weather conditions were taken during the survey, which noted some adverse weather conditions during the survey on Sunday 19th October during the night. This night has been excluded from the data set following analysis of the data.

3.8. Analysis of the measured data at MP2 showed an increase in noise levels between 05:00-07:00 during the survey. Following analysis of the measured data, there was a clear spike between 4 kHz – 8 kHz which is consistent with birdsong at dawn. Therefore, data between this period has been removed.

3.9. A summary of the measurements is in Table 3-2 and time histories of measured noise levels are shown in Appendix A.

Monitoring Position	Ambient Sound Level dB L _{Aeq, T} Range (Average)		Background Sound Level dB L _{A90, T} Range (Average)		Night dB L _{AFmax} Range (generally exceeded fewer than 10 times per night)
	Day	Night	Day	Night	
MP1	35-71 (62)	28-63 (54)	37-59 (43)	29-52 (27)	28-86 (80)
MP2	34-62 (53)	28-42 (36)	31-53 (43)	24-38 (28)	27-67 (53)
MP3	34-59 (52)	24-54 (39)	28-53 (45)	21-44 (26)	24-83 (57)

Table 3-2: Summary of Measured Noise Levels

3.10. Representative octave band levels are provided in Table 3-3. 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_{eq, T} (day)	61	57	55	58	58	55	49	44
	L_{eq, T} (night)	50	50	48	51	51	47	40	32
	L_{max, T} (night)	72	80	76	77	77	73	65	55
MP2	L_{eq, T} (day)	62	54	50	49	48	45	41	38
	L_{eq, T} (night)	47	38	34	32	31	27	27	26
	L_{max, T} (night)	73	57	49	46	43	43	46	45
MP3	L_{eq, T} (day)	61	54	48	47	48	44	40	33
	L_{eq, T} (night)	45	38	34	32	36	32	24	22
	L_{max, T} (night)	72	58	53	52	52	51	45	43

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

3.11. The dominant noise source was railway noise located to the north of the site. Other sources of noise included distant road traffic noise and some aircraft noise travelling from east to west. Road traffic associated with Goring Business park was also noted alongside some customer noise from a food truck also at the business park. Some distant school playground noise was noted at the south of the site from West Park CE Primary School. Some construction activity was noted during the weekdays at MP3.

3.12. Observations were taken at the commercial units to the west of the site. An electric forklift was noted to be operational outside the external yard at the World of Books to the north-west of the site during the day. The western units appeared to belong to World of Books with Temple Spa Rhythm and Blues Holdings within the eastern units, both operating as a storage facility.

3.13. Based on the measurements, a 3D computer based environmental noise model has been created using DataKustik 'CadnaA' Noise Mapping software. The following has been taken in account in the generation of the noise model:

- The noise model was set up to apply the noise prediction methodology set out in ISO 9613-2: Acoustics – Attenuation of Sound propagation outdoors – Part 2: General Method of Calculation;
- The model has been set to include second order reflected noise from solid structures;
- The topography of the site and surrounding area has been taken into consideration in the assessment;
- Acoustic screening and reflections afforded by nearby buildings, solid structures and fences/barriers;
- The model has been calibrated and verified using the noise survey data and the current baseline traffic flows for the surrounding road network.

3.14. Noise contours are shown in Appendix B.

3.15. Based on the noise survey results, baseline model and in accordance with Figure 1 of the ProPG guidance, the site would be considered a low risk during the day and negligible to low risk during the night.

3.16. This would not prohibit the development as good acoustic design processes can be followed to reduce sound levels to as low as practical across the proposed

development. An acoustic design statement has been produced, which is shown in Appendix D.

3.17. A histogram of day and night background sound levels for MP2 is shown in Figure 3-2. This position was selected to represent the closest proposed dwellings for an operational noise assessment from operations of Temple Spa Rhythm and Blues Holdings and World of Books located to the west of the site.

Vibration Survey

3.18. The VDV X, Y and Z vibration axis parameters were measured throughout the duration of the survey. Measured vibration dose values (VDV) levels are summarised below in Table 3-4 the day and night periods.

	VDV [m/s^{1.75}] (X)	VDV [m/s^{1.75}] (Y)	VDV [m/s^{1.75}] (Z)	BS6472 (low probability of adverse comment)
Day (07:00-23:00)	0.01	0.01	0.05	0.2 – 0.4
Night (23:00-07:00)	0.01	0.01	0.03	0.1 – 0.2

Table 3-4: Measured Vibration Dose Values

3.19. The measured vibration levels are below a low probability of adverse comment in accordance with BS 6472 during the day and night, therefore vibration does not require any further consideration.

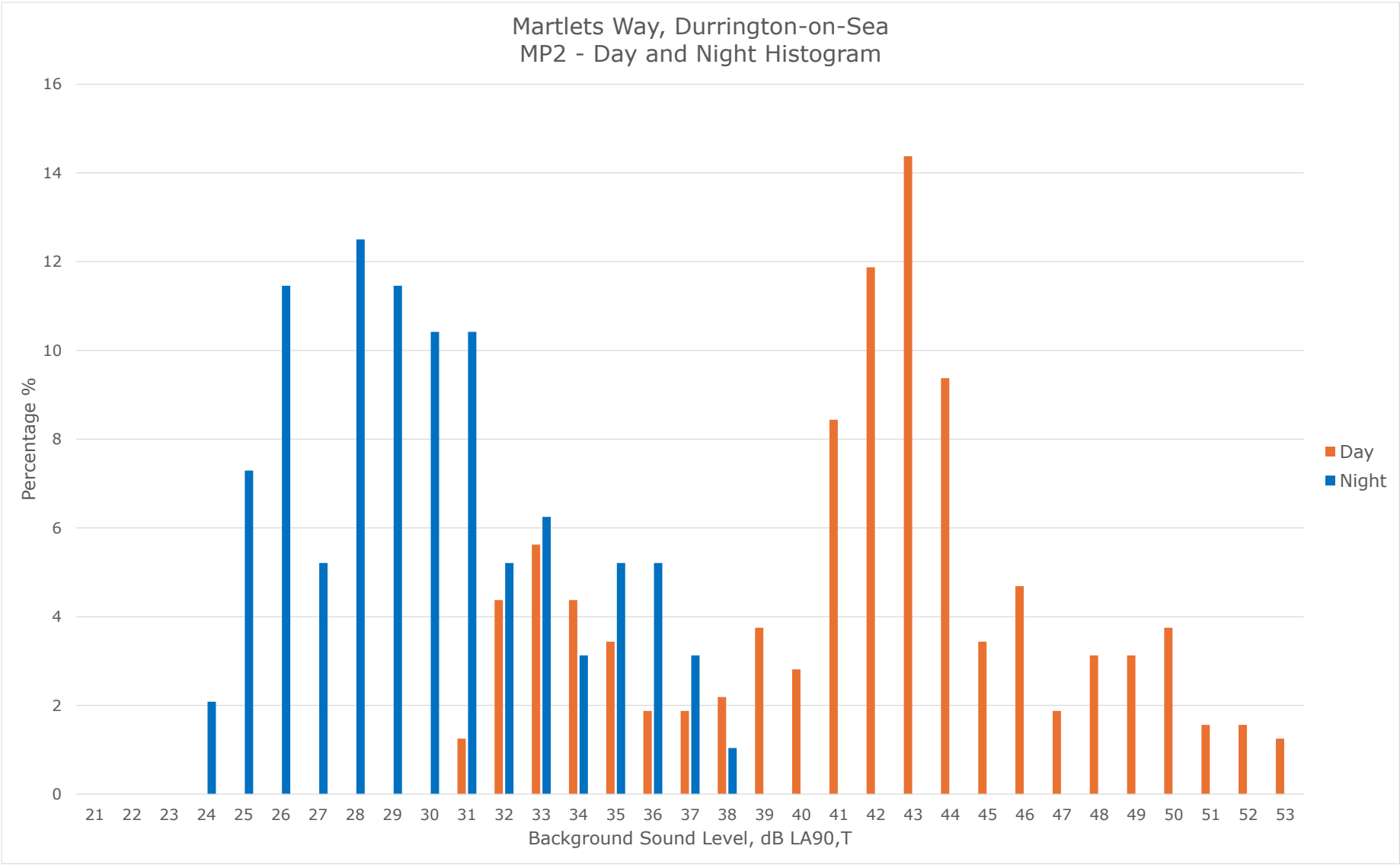


Figure 3-2: Day and Night Histogram MP2

3.20. Representative background sound levels of **43 dB $L_{A90,T}$** during the day and **28 dB $L_{A90,T}$** at night for MP2 have been used to inform the assessment.

4. Construction Phase

- 4.1. The construction phase of the proposed development will include various noise generating processes and plant. The most significant processes in terms of noise generation would be site clearance/excavation operations, piling (if required) and concreting operations.
- 4.2. To assess reasonable noise thresholds for construction noise experienced at the nearest residential properties, Example Method 1 (the ABC Method) of BS 5228, within section E.3.2 is 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 – BS 5228 Part 1

- 4.3. Ambient noise levels place the site within Category A and B of Table E.1. Therefore, the following noise levels set out in Table 4-2 from construction activities are considered to be a reasonable noise threshold to avoid significant adverse impact at the nearest receptors.

Time Period	Construction Target Noise Level dB L_{Aeq}
Monday to Friday (07:00 – 19:00) & Saturday (07:00 – 13:00)	≤65

Table 4-2: Construction Target Noise Level

Best Practice Recommendations

- 4.4. Construction and mobile plant operations are likely to generate high noise levels that have the potential to adversely affect neighbouring noise sensitive properties.
- 4.5. During construction, the contractor will employ best practicable means to control noise from construction operations. This will form part of the construction environmental management plan (CEMP) for the site.
- 4.6. Operations will be reasonably transient, and it is expected that noisy operations will take place for relatively short periods throughout the demolition and construction.
- 4.7. 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 compounds and material stockpiles.
- 4.8. 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.
- 4.9. Delivery of materials and removal of waste from the Development will be planned to minimise disturbance to neighbouring properties. Idling of plant, machinery and delivery vehicles should be prohibited when not in use.
- 4.10. If required noise levels can be monitored regularly in accordance with BS 5228-1 to ensure the above set limits are not exceeded. In addition to the above all other guidance within BS 5228-1 will be followed at all times.

5. Existing Commercial Operations

- 5.1. An assessment of operations at World of Books and Temple Spa Rhythm and Blue Holdings has been undertaken, which are located approximately 20m to the north of the closest proposed dwelling. MP2 was chosen to capture operations of these units, on the boundary of the external yard.
- 5.2. As noted in Section 3, analysis of the measured data at MP2 showed an increase in noise levels between 05:00-07:00, which appeared to be influenced by birdsong at dawn. It is understood from the noise assessment undertaken for world of books (*planning ref AWDM/0791/15*) that operations may occur from 06:00. However, there did not appear to be any activity between these hours.
- 5.3. Therefore, an assessment during the day has been considered, with contextual discussion around the design of the development and potential early morning noise sources included within this assessment.
- 5.4. Observations of operations for World of Books and Temple Spa Rhythm and Blue Holdings was mainly from deliveries, which included the use of an electric forklift truck, and general disposal of goods into external skips.
- 5.5. Noise from deliveries at the external yard has been included within the noise model, calibrated to the MP2. To calibrate the model, the residual sound level, which was taken at MP2 at a time where minimal operational noise was measured, has been subtracted from the ambient sound level during the loudest period which included a delivery and external yard activity, to derive a source noise level. A source noise level of 53 dB $L_{Aeq,1h}$ from the external yard has been used in the noise model during the day, as shown in the noise contour plot in Appendix B.
- 5.6. A BS 4142 assessment for noise from World of Books and Temple Spa Rhythm and Blue Holdings has been included in Table 5-1 overleaf which shows a summary of the assessment results and initial estimate of likely significance at the propose closest receptor.
- 5.7. An acoustic barrier at a height of 3m is included along the south of the existing service yard to mitigate noise at the proposed dwellings. The location is shown in below in Figure 5-1.

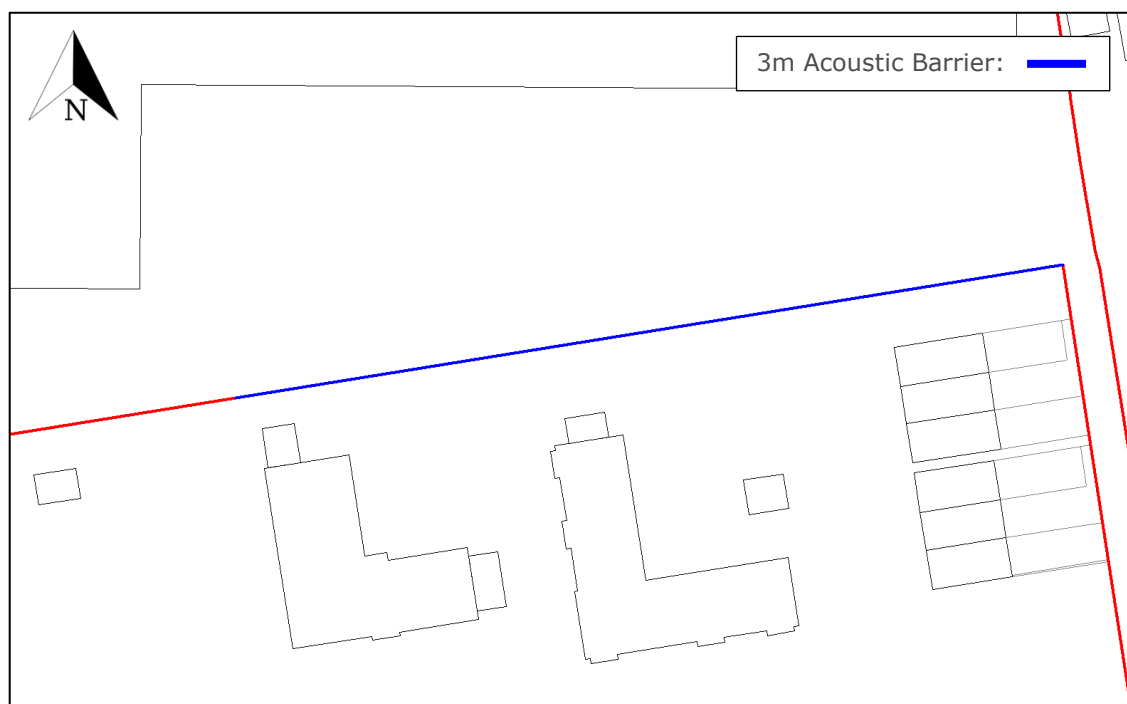


Figure 5-1: 3m Acoustic Barrier Location

- 5.8. It is recommended that solid balustrades are included in the design for all apartment balconies overlooking World of Books and Temple Spa Rhythm and Blue Holdings service yard, to reduce noise levels by approximately 5 dB.
- 5.9. An acoustic feature correction has not been applied, as the specific sound level at the closest proposed balcony is predicted to be below the residual and background sound level.

Closest Proposed Receptor	BS 4142 Assessment
Residual Level, dB $L_{Aeq,T}$	50
Specific Level, dB $L_{Aeq,T}$	42
Acoustic Feature Correction, dB	0
Rating Level, dB $L_{Ar,Tr}$	42
Background sound level, dB $L_{A90,T}$	43
Excess over background, dB	-1
Initial Assessment	Low Impact

Table 5-1: BS4142 Initial Estimate at Closest Proposed Receptor

- 5.10. The initial estimate of likely significance indicates a low impact at the closest proposed receptor location.

5.11. It should be noted that the guidance presented within BS 4142 promotes a flexible assessment methodology that can be modified depending on the context in which a sound source occurs.

5.12. Noise from the commercial units is not readily distinguishable against the residual acoustic environment, which is dominated by the surrounding road network and rail serving Durrington-on-Sea station.

5.13. Clause 11, Note 3 of BS 4142 discusses factors that can affect the estimate of impact. Note 3 is duplicated below:

"...Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following...

...3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

- i) facade insulation treatment;*
- ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
- iii) acoustic screening..."*

5.14. ProPG notes the following regarding sources such as this:

"...In the special case where industrial or commercial noise is present on the site but is "not dominant" (i.e. where the impact would be rated as lower than adverse (subject to context) if a BS4142:2014 assessment was to be carried out), its contribution may be included in the noise level used to establish the degree of risk (and if included, this should be clearly stated)..."

5.15. The proposals have been designed to mitigate the noise impacts from rail, which will also mitigate potential noise from commercial sources during the early morning. The design of the scheme is to allow residents to keep windows closed and provide suitable alternative ventilation so that façade insulation can aid in reducing the impacts of operational noise. Details of the mitigation, including façade insulation treatment, is provided in section 7.

6. Proposed Operational Noise

Fixed Plant

- 6.1. Design criteria has been proposed for any fixed mechanical plant serving the proposed development.
- 6.2. The representative background sound levels from MP2 have been used to provide indicative plant noise limits for assessment. MP2 is in close proximity to the proposed commercial unit and is representative of the acoustic environment where fixed plant is to be introduced. A plant enclosure for Air Source Heat Pumps (ASHPs) is located to the north of the commercial building facing the existing nearby commercial units, which demonstrates the principles of good acoustic design positioning the source away from the closest sensitive receptors.
- 6.3. The representative background sound level at MP2 are 43 dB $L_{A90,T}$ and 28 dB $L_{A90,T}$ during the day and night respectively.
- 6.4. Therefore, to achieve a low impact, cumulative noise from fixed mechanical plant should not exceed a rating level at the nearest receptors of 43 dB $L_{Ar,Tr}$ and 28 dB $L_{Ar,Tr}$ during the day and night periods respectively which is equal to the existing background sound level.
- 6.5. All plant associated with the development should be selected, located, oriented and where required attenuated to achieve the criteria. Plant should also be designed and selected so that it does not produce distinguishable acoustic characteristics, such as tonal and impulsive characteristics. The above criteria need to be considered on the basis of the configuration of plant and the operational conditions.

Proposed Commercial Unit

- 6.6. Initial conversations have been held with a potential end user of the commercial unit. Whilst the user cannot be confirmed at this time they have provided a basis of proposed operations from the commercial unit for this assessment.
- 6.7. Operations at the site will include some internal manufacturing of small scale items with a 50-50 split between office space and manufacturing space. No processing of raw materials such as metal cutting, woodworking or similar activities are expected at the unit.

- 6.8. The building has been designed to reduce the impacts of noise from deliveries as the roller shutter door has been recessed to increase distance separation from the closest proposed residential garden on Juno Close. The location of the delivery space to the southern façade of the building is due to requirements for a turning space.
- 6.9. The roller shutter door will only remain open during delivery events and otherwise will remain shut.
- 6.10. Deliveries will take place between 07:30-17:30, with peak movements at the site between 08:00-17:00. Deliveries are typically from transit vans and hand loaded, although there is an occasional HGV delivery at the site, which will use an electric forklift truck externally.
- 6.11. To assess a worst case assessment, HGV movements and an electric forklift truck has been included within the noise model. A noise contour of proposed operational noise is shown in Appendix B.
- 6.12. The assessment considers the use of electric forklift trucks in the external service yard for the unloading of the HGV deliveries. Based on measurements taken from a similar scheme, the electric forklift truck is expected to have a sound power level of 75 dB L_{WA} .
- 6.13. The noise generated by the movement of vehicles accessing the service yard will be similar to that on the local road network and existing commercial units and will be masked by local activity.
- 6.14. Delivery vehicles will enter the Site from the west, manoeuvre and reverse to the roller shutter door of the warehouse on the southern elevation of the building. Goods from the HGV will be unloaded externally using the electric forklift truck.
- 6.15. Delivery events have been modelled under the assumption of 1 HGV delivery during the day with a reference periods of 1 hour. The assessment considers both the entrance and exit movement.
- 6.16. Based on measurements at schemes of a similar size, HGV movements/manoeuvring can typically generate noise levels of around 75 dB L_{Aeq} at 10m which has been modelled and used to inform the assessment.

6.17. A Sound Exposure Level (SEL) calculation has been to derive the sound power level of the line sources in the model, representing the HGV movements/manoeuvring.

6.18. An acoustic feature correction has not been applied, as the specific sound level from at the closest proposed residential garden is predicted to be significantly below the residual and the background sound level.

6.19. Table 6-1 below shows a summary of the assessment results and initial estimate of likely significance.

Closest Receptor (Juno Close)	BS 4142 Assessment Day (07:00-23:00)
Residual Level, dB $L_{Aeq,T}$	50
Specific Level, dB $L_{Aeq,T}$	37
Acoustic Feature Correction, dB	0
Rating Level, dB $L_{Ar,Tr}$	37
Background sound level, dB $L_{A90,T}$	43
Excess over background, dB	-6
Initial Estimate	Low Impact

Table 6-1: BS 4142 Assessment

6.20. The results show that the initial estimate of likely significance from operational noise equates to a low impact in accordance with BS 4142 at the closest sensitive residential receptors during the day.

6.21. BS 4142 promotes a flexible assessment methodology that can be modified depending on the context in which a sound source occurs.

6.22. As noted, the noise generated by the movement of vehicles accessing the service yard will be similar to that on the local road network and will be masked by local activity.

6.23. The Site is located in an established mixed-use area where HGV movements and unloading events and character of noise are not uncommon.

6.24. The majority of deliveries to and from the site are from smaller sized vans, where loading takes place by hand. The noise associated with these events is considered negligible, with the vehicles similar to typical vans delivering daily parcels to residential properties near the site.

6.25. Therefore, it is considered that noise associated with HGV movements and forklift unloading events at the proposed commercial unit will result in a low impact, and the amenity of existing receptors will be protected.

6.26. Noise from the commercial unit could be controlled with a suitably worded condition with further assessment undertaken once more detailed information is known.

7. Mitigation Recommendations

- 7.1. The aim of this section is to identify mitigation measures to achieve the guidance sound levels.
- 7.2. To achieve suitable internal amenity sound levels during the day and night, properties will be designed to enable residents to keep the windows closed and an alternative means of ventilation will be provided. Windows would not be sealed shut and can be opened whilst noting that noise levels would be slightly elevated.
- 7.3. Calculations to determine the glazing and ventilation requirements for the site have been conducted based on the measured noise levels and the noise model. The calculations are presented in Appendix C.

External Building Fabric - Non-Glazed Elements

- 7.4. 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 7-1 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 7-1: Non-glazed Elements Assumed Sound Reduction Performance

External Building Fabric - Glazing

- 7.5. Table 7-2 sets out the required glazing performance, these specifications take into account the glass, frame, seals and associated fittings.

Glazing Type	Sound Reduction Index, R_w	Octave band centre frequency SRI, dB					
		125	250	500	1k	2k	4k
Type A (No Markup)	31	21	20	26	38	37	39
Type B	44	29	36	42	44	47	59

Table 7-2: Required Minimum Sound Reduction for Glazing

External Building Fabric - Ventilation

7.6. Table 7-3 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
Ventilation Type A	35	36	34	31	34	38	38
Ventilation Type B	45	42	40	36	48	53	56

Table 7-3: Required Minimum Sound Reduction for Ventilation

7.7. Tables 7-2 and 7-3 are to be used in conjunction with Figure 7-1 which provides locations of uprated glazing and ventilation specifications.



Figure 7-1: Glazing and Ventilation Specifications

7.8. 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.

7.9. 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.

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

Overheating

7.11. Noise levels place facades in the negligible to low risk category of noise impact for periods of overheating where residents might open windows during the day and night.

7.12. Good acoustic design has been demonstrated within the proposals to maximise distance from the railway line as much as practical, such as parking bays near to the northern boundary for the north-western apartments, to minimise any potential noise impact during overheating conditions.

7.13. The accompanying energy statement provided by Daedalus Environmental indicate that mechanical extract ventilation may be necessary at some properties.

7.14. Further consideration will be given to the noise impact during overheating conditions at the detailed design stage of the Development and as part of demonstrating compliance with Approved Document O of the Building Regulations.

External Amenity Areas

7.15. It is assumed close boarded garden fences are included for all private gardens at a height of 1.8m.

7.16. On the northern boundary for plots 13-29, an increased fence height of 3m is included along the northern gardens to reduce external noise levels. This is also extended towards the east on the northern boundary. This is shown in Figure 7-2 below.

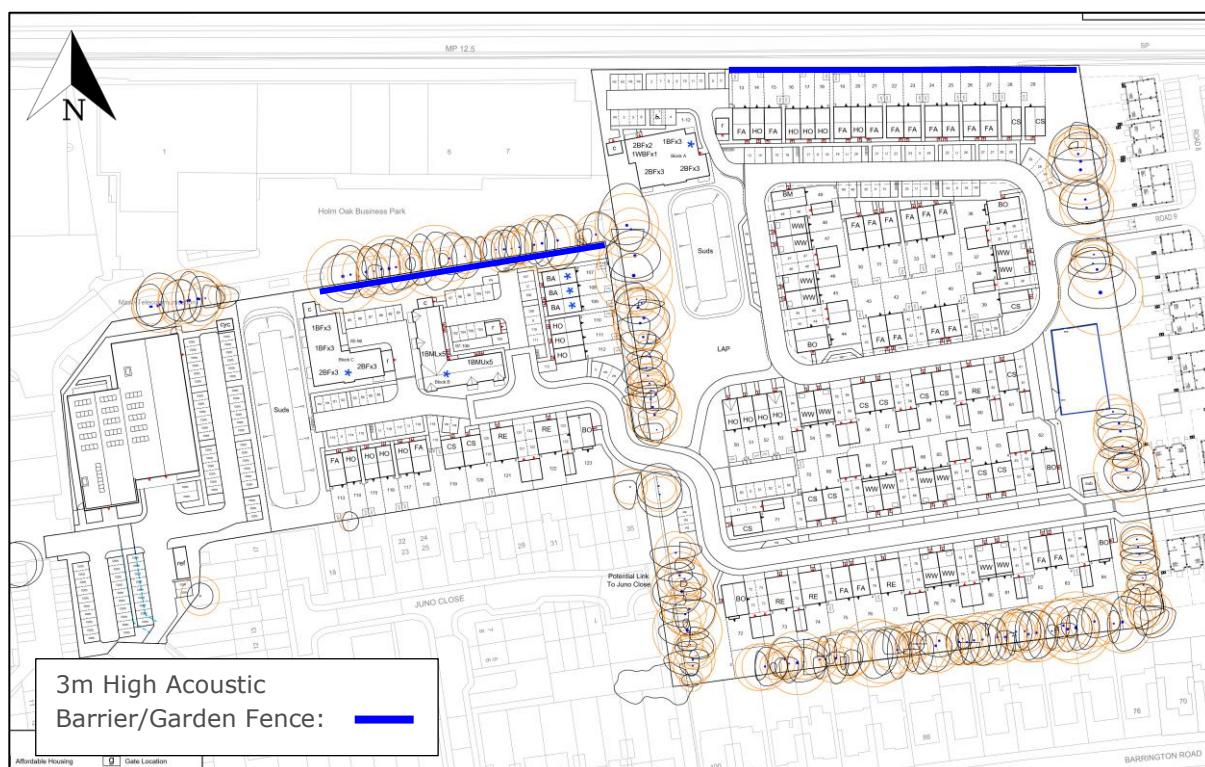


Figure 7-2: Increased Garden Fence Height Locations

7.17. External sound levels across all gardens except for plots 13-29 will achieve below the guidance value of 50 dB L_{Aeq} . For these plots all gardens will meet the 55 dB L_{Aeq} upper guidance value.

7.18. It is expected that the all balconies will achieve below the upper guidance criteria of 55 dB L_{Aeq} . It is recommended that solid balustrades be introduced to reduce noise levels by approximately 5 dB for the western apartment balconies that overlook the service yard for World of Books and as discussed in section 5.

7.19. Additionally, a Local Area for Play (LAP) is being introduced within the scheme to the central area which will be subject to external noise levels below 50 dB L_{Aeq} guidance criteria providing all residents with suitable external amenity.

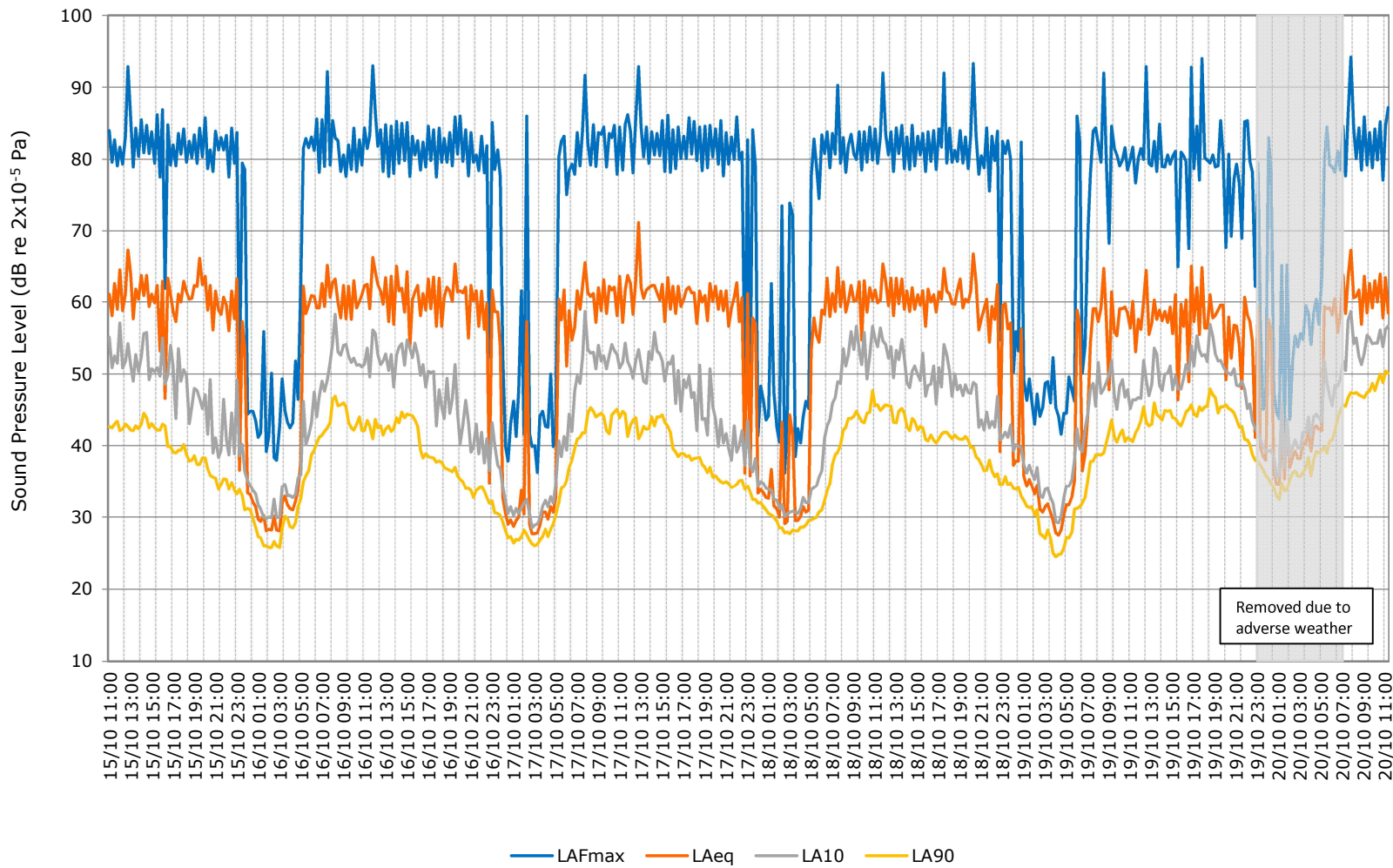
8. Conclusions

- 8.1. A noise survey has been undertaken on site, the measured noise levels and results of the noise model have been used to inform the acoustic design and assessments.
- 8.2. The site would be considered low risk in accordance with ProPG Guidance during the day and negligible to low risk during the night. This would not prohibit the development as recommendations to reduce internal sound levels in habitable rooms and amenity areas are included.
- 8.3. Private balconies should include solid balustrades on the apartment buildings overlooking World of Books and Temple Spa Rhythm and Blue Holdings service yard.
- 8.4. Assessment of commercial operations from World of Books and Temple Spa Rhythm and Blue Holdings has been included. A low impact is predicted in accordance with BS 4142.
- 8.5. Design criteria has been included for fixed plant for the proposed commercial units to the west of the site that achieves a low impact at the closest existing and proposed sensitive receptors in accordance with BS 4142.
- 8.6. Assessment of proposed commercial operations has been included based on the currently available information. A low impact is predicted in accordance with BS 4142.
- 8.7. Mitigation proposals to protect amenity from the dominant source of rail noise will also mitigate against any commercial operations and the development has been designed so that residents can keep windows closed which will aid in reduction of operational noise levels internally. This will also protect against potentially early morning operational noise.
- 8.8. To achieve suitable internal amenity sound levels during the day and night, properties will be designed to enable residents to keep the windows closed and alternative means of ventilation will be provided. Windows would not be sealed shut and can be opened whilst noting that noise levels would be slightly elevated.
- 8.9. The risk of noise impact during overheating conditions within properties has been considered in accordance with Acoustics Ventilation and Overheating (AVO) Guidance. Noise levels place facades in the negligible to medium category of noise impact during overheating conditions during the day and night.

- 8.10. The strategy to provide thermal comfort and suitable internal noise levels will be developed as part of the detailed design of the site. Therefore, the impact of noise during overheating conditions will be mitigated so that suitable internal amenity can be achieved for all dwellings on site.
- 8.11. External sound levels across all gardens at the site will meet the 55 dB L_{Aeq} upper guidance criteria. The majority of gardens will achieve below 50 dB criteria.
- 8.12. All residents will have access to a proposed LAP, which achieve suitable external amenity below 50 dB L_{Aeq} in accordance with BS 8233.
- 8.13. This assessment demonstrates that the site is suitable for development subject to the recommendations included in this report.

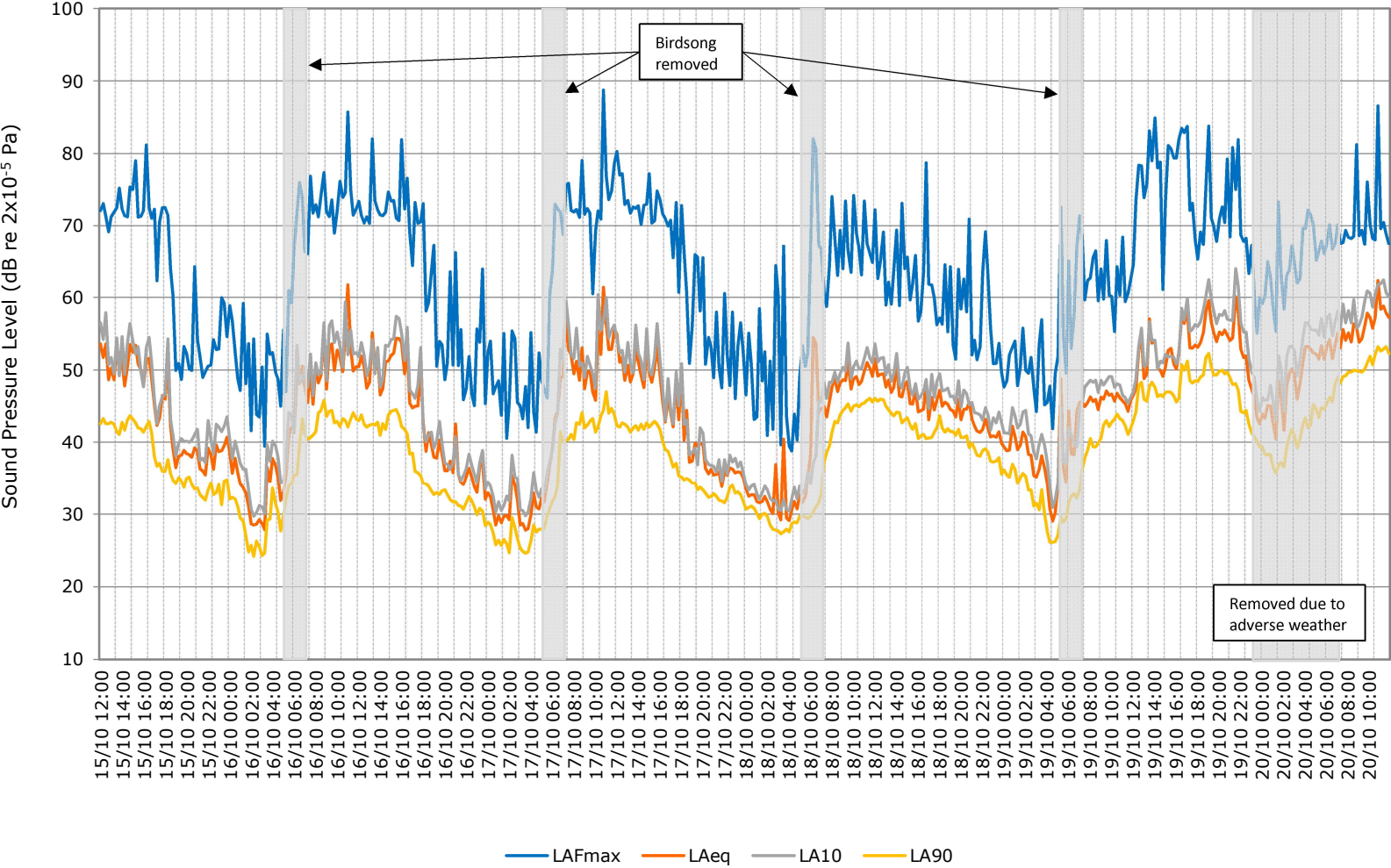
APPENDIX A

Position 1 - Martlets Way, Durrington-on-Sea
Environmental Noise Time History
15th to 20th October 2025



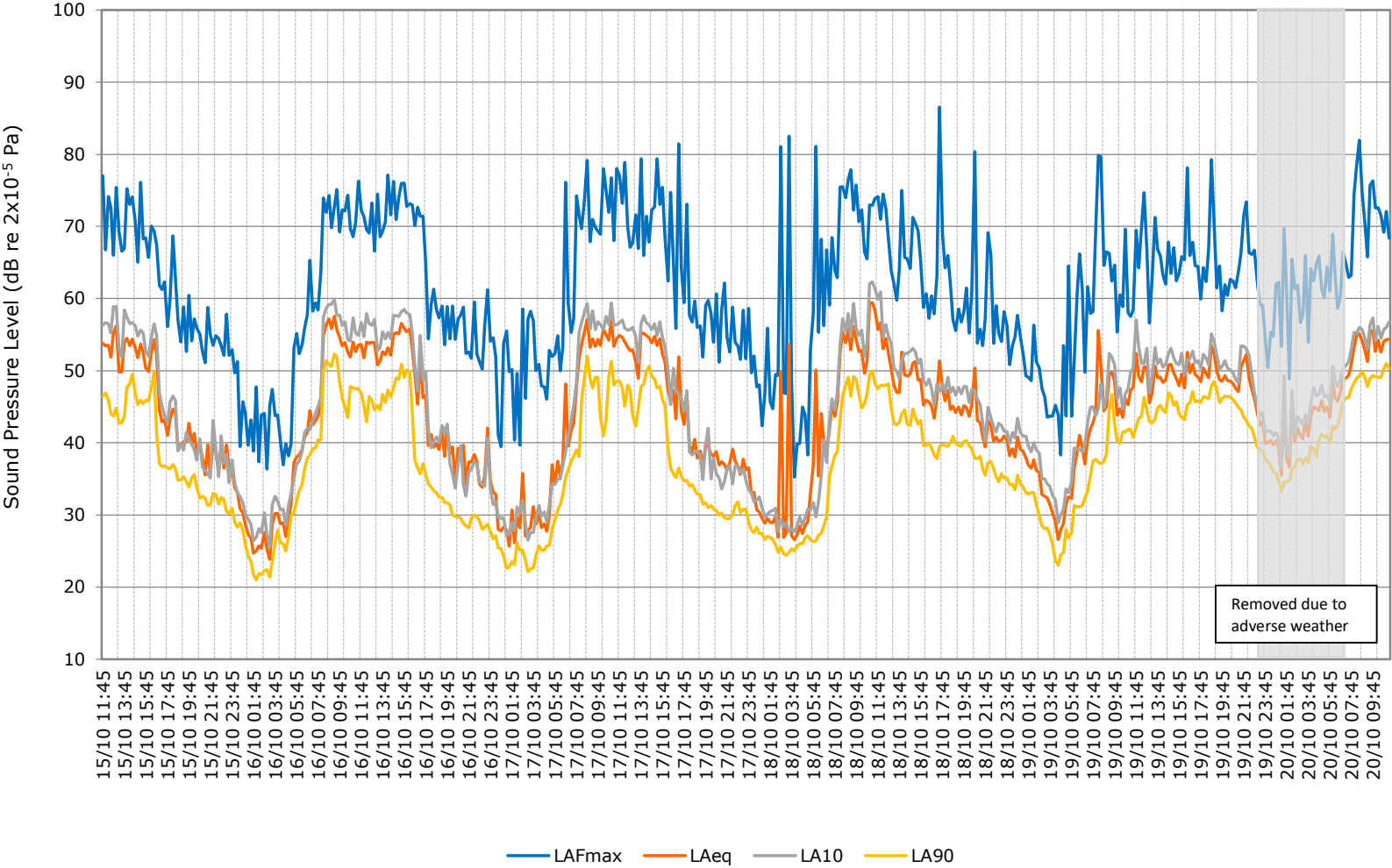
Position 2 - Martlets Way, Durrington-on-Sea

Environmental Noise Time History
15th to 20th October 2025



Position 3 - Martlets Way, Durrington-on-Sea

Environmental Noise Time History
15th to 20th October 2025



APPENDIX B



Client:

Bellway Homes Ltd
(South London)

Project:

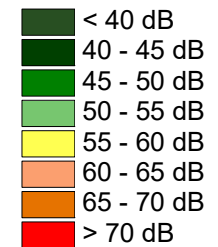
Durrington Gasworks,
Elizabeth Square Phase 2

Date:

23/04/26

Scenario:

Day LAeq, 16h
1.5m Grid Height

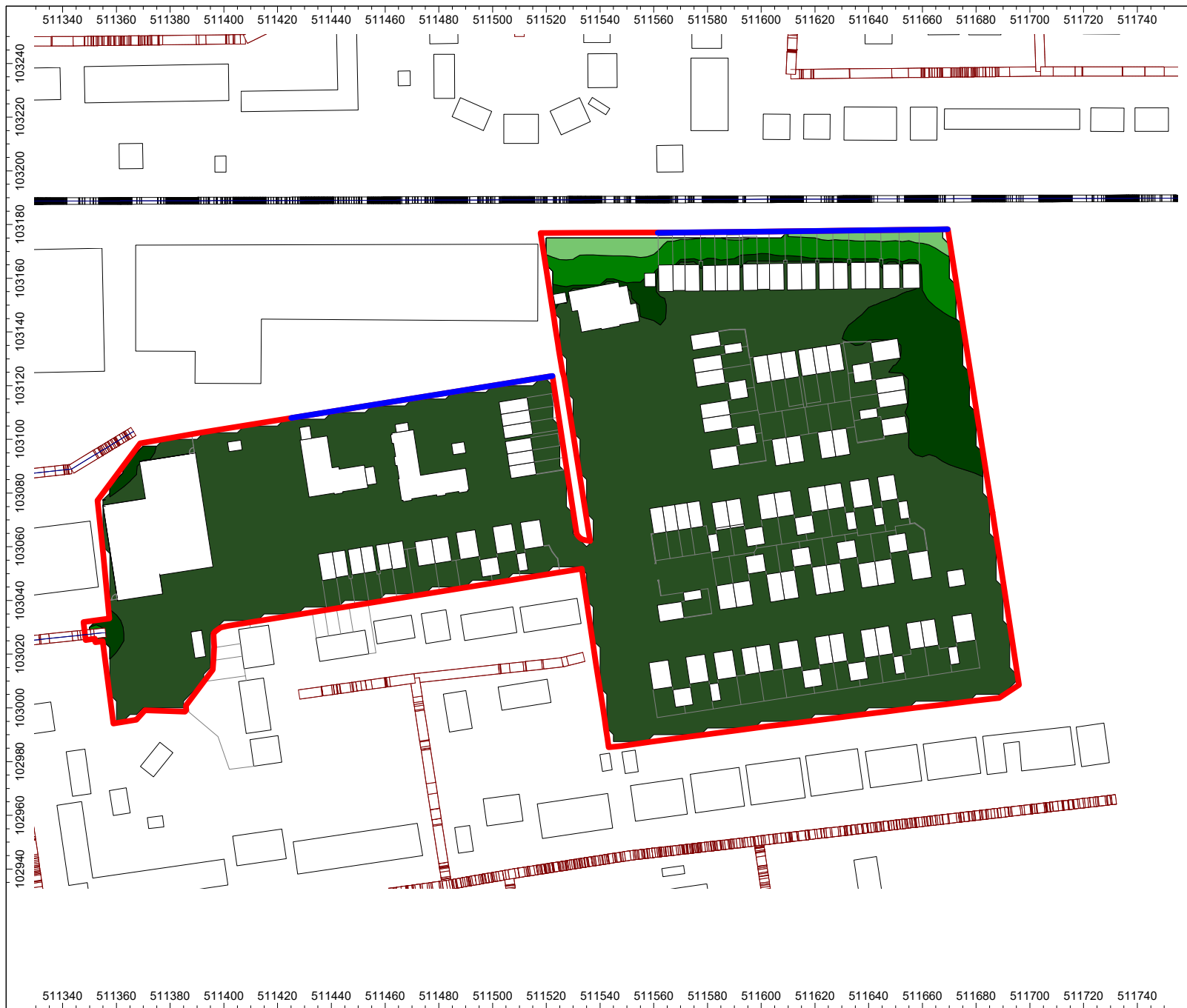


Red Line Boundary

3m Acoustic Barriers/
Garden Fence

ARDENT
CONSULTING ENGINEERS

AN EMPLOYEE OWNED COMPANY



Client:

Bellway Homes Ltd
(South London)

Project:

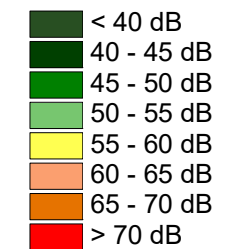
Durrington Gasworks,
Elizabeth Square Phase 2

Date:

23/04/26

Scenario:

Night LAeq, 8h
4.0m Grid Height

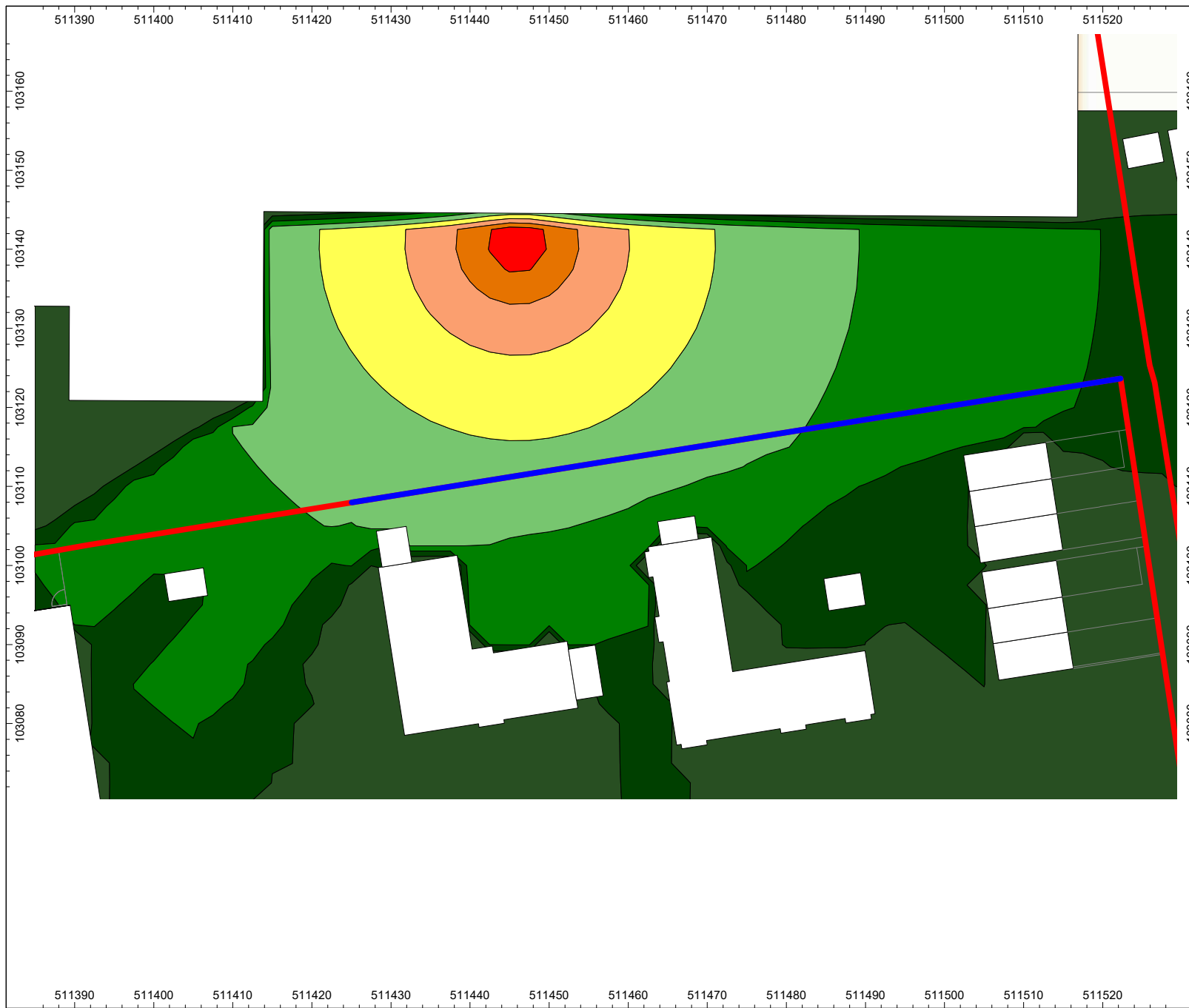


Red Line Boundary

3m Acoustic Barriers/
Garden Fence

ARDENT
CONSULTING ENGINEERS

AN EMPLOYEE OWNED COMPANY



Client:

Bellway Homes Ltd
(South London)

Project:

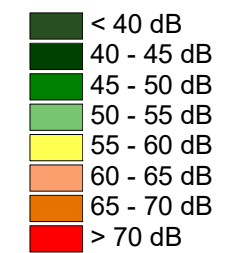
Durrington Gasworks,
Elizabeth Square Phase 2

Date:

23/04/26

Scenario:

Existing Operational Noise
Day LAeq, 1h
4.0m Grid Height
(Balconies)

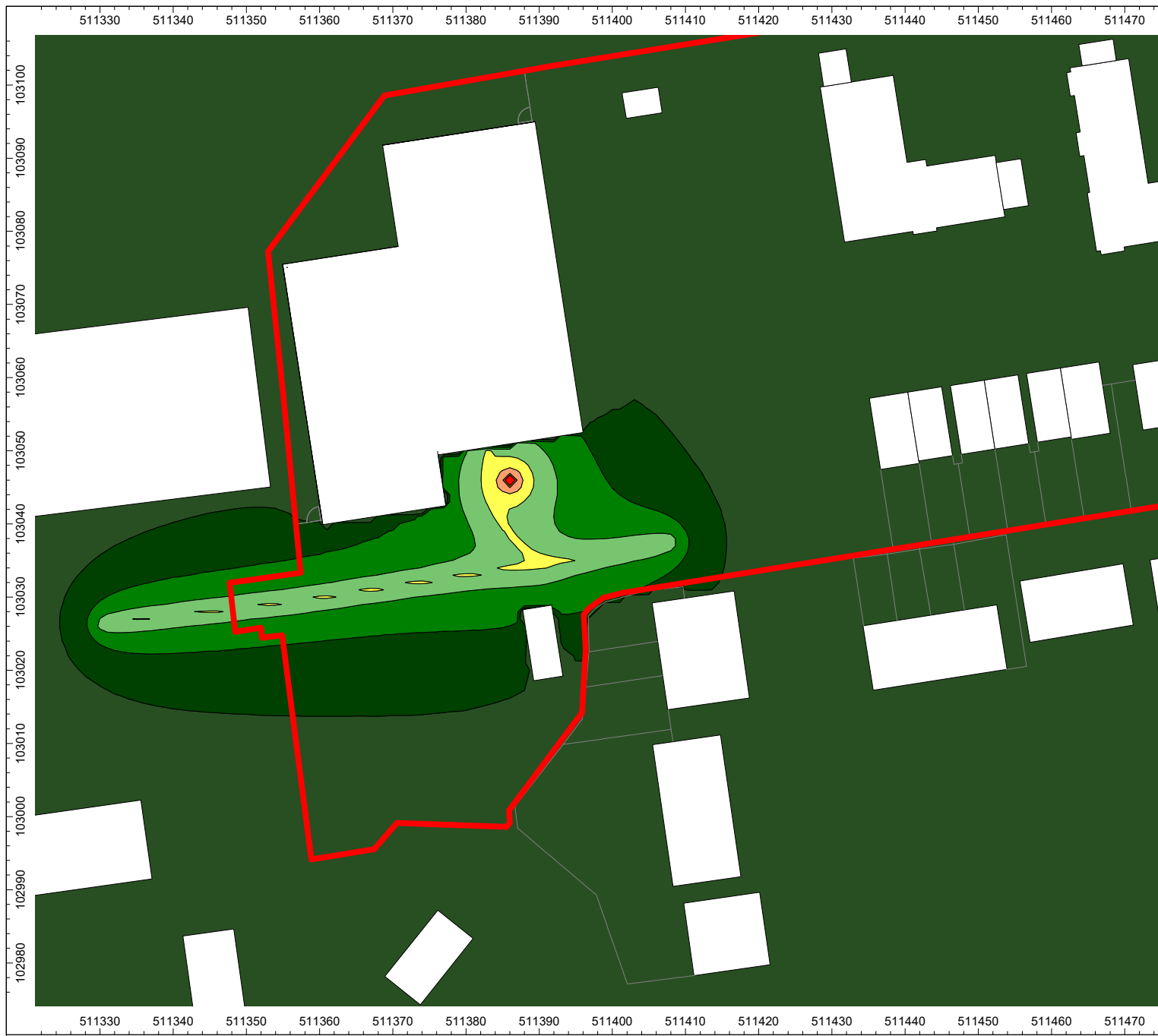


Red Line Boundary

3m Acoustic Barriers/
Garden Fence

ARDENT
CONSULTING ENGINEERS

AN EMPLOYEE OWNED COMPANY



Client:

Bellway Homes Ltd
(South London)

Project:

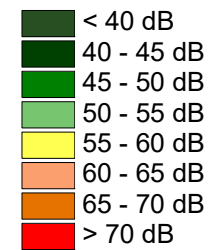
Durrington Gasworks,
Elizabeth Square Phase 2

Date:

23/04/26

Scenario:

Proposed Operational Noise
Day LAeq, 1h
1.5m Grid Height



Red Line Boundary

ARDENT
CONSULTING ENGINEERS

AN EMPLOYEE OWNED COMPANY

APPENDIX C

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 1 North

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Living Room
Parameter	Leq, 16h

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	61	57	55	58	58	55	49	44	62
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	
Model correction	-4	-4	-4	-4	-4	-4	-4	-4	
Noise level at façade (Leq)	57	53	51	54	54	51	45	40	58

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	23	29	36	42	44	47	59	60	44
Transmission Coefficient	0.005012	0.001259	0.000251	0.000063	0.000040	0.000020	0.000001	0.000001	
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	42	40	36	48	53	56	56	45
Transmission Coefficient	0.000631	0.000063	0.000100	0.000251	0.000016	0.000005	0.000003	0.000003	
Average Transmission Coeff	0.002956	0.000672	0.000177	0.000204	0.000022	0.000009	0.000002	0.000002	
Average SRI	25	32	38	37	47	50	57	57	44

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	33.5	23.1	15.3	18.9	9.3	2.3	-9.8	-14.9	18
Lp (Direct)	31.7	21.3	13.5	17.1	7.5	0.5	-11.6	-16.7	16
Lp (Rev & Direct)	36	25	18	21	12	5	-8	-13	20
BS8233	36	25	17	21	11	4	-8	-13	20

Criteria

≤ 35

≤ 35

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 1 North

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Bedroom
Parameter	Leq, 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	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	50	50	48	51	51	47	40	32	54
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	
Model correction	-4	-4	-4	-4	-4	-4	-4	-4	
Noise level at façade (Leq)	46	46	44	47	47	43	36	28	50

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	23	29	36	42	44	47	59	60	44
Transmission Coefficient	0.005012	0.001259	0.000251	0.000063	0.000040	0.000020	0.000001	0.000001	
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	42	40	36	48	53	56	56	45
Transmission Coefficient	0.000631	0.000063	0.000100	0.000251	0.000016	0.000005	0.000003	0.000003	
Average Transmission Coeff	0.002956	0.000672	0.000177	0.000204	0.000022	0.000009	0.000002	0.000002	
Average SRI	25	32	38	37	47	50	57	57	44

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	22.9	16.2	8.4	11.6	2.2	-5.7	-18.5	-27.1	11
Lp (Direct)	21.1	14.4	6.6	9.8	0.4	-7.5	-20.3	-28.9	9
Lp (Rev & Direct)	25	18	11	14	4	-4	-16	-25	13
BS8233	25	18	10	14	4	-4	-16	-25	13

Criteria

≤ 30

≤ 30

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 1 North

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Bedroom
Parameter	Lmax

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	72	80	76	77	77	73	65	55	81
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	
Model correction	-6	-6	-6	-6	-6	-6	-6	-6	
Noise level at façade (Lmax)	66	74	70	71	71	67	59	49	75

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	23	29	36	42	44	47	59	60	44
Transmission Coefficient	0.005012	0.001259	0.000251	0.000063	0.000040	0.000020	0.000001	0.000001	
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	42	40	36	48	53	56	56	45
Transmission Coefficient	0.000631	0.000063	0.000100	0.000251	0.000016	0.000005	0.000003	0.000003	
Average Transmission Coeff	0.002956	0.000672	0.000177	0.000204	0.000022	0.000009	0.000002	0.000002	
Average SRI	25	32	38	37	47	50	57	57	44

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	42.5	44.1	34.3	35.9	26.3	18.3	4.2	-5.9	35
Lp (Direct)	40.7	42.3	32.5	34.1	24.5	16.5	2.4	-7.7	34
Lp (Rev & Direct)	45	46	37	38	29	21	6	-4	38
BS8233	45	46	36	38	28	20	6	-4	37

Criteria

≤ 45

≤ 45

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2 West

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Living Room
Parameter	Leq, 16h

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	62	54	50	49	48	45	41	38	53
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	
Model correction	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	62	54	50	49	48	45	41	38	53

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	21	20	26	38	37	39	44	31
Transmission Coefficient	0.015849	0.007943	0.010000	0.002512	0.000158	0.000200	0.000126	0.000040	
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	0.002580	0.002977	0.001251	0.000335	0.000169	0.000150	0.000127	
Average SRI	23	26	25	29	35	38	38	39	34

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	41.3	29.9	26.6	21.8	15.1	9.1	4.6	0.9	24
Lp (Direct)	39.4	28.1	24.7	20.0	13.2	7.3	2.8	-1.0	22
Lp (Rev & Direct)	44	32	29	24	17	11	7	3	26
BS8233	43	32	29	24	17	11	7	3	26

Criteria

≤ 35

≤ 35

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2 West

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Bedroom
Parameter	Leq, 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	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	47	38	34	32	31	27	27	26	36
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	
Model correction	1	1	1	1	1	1	1	1	
Noise level at façade (Leq)	48	39	35	33	32	28	28	27	37

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	21	20	26	38	37	39	44	31
Transmission Coefficient	0.015849	0.007943	0.010000	0.002512	0.000158	0.000200	0.000126	0.000040	
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	0.002580	0.002977	0.001251	0.000335	0.000169	0.000150	0.000127	
Average SRI	23	26	25	29	35	38	38	39	34

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	27.3	14.9	11.6	5.8	-0.9	-7.9	-8.4	-10.1	9
Lp (Direct)	25.4	13.1	9.7	4.0	-2.8	-9.7	-10.2	-12.0	7
Lp (Rev & Direct)	30	17	14	8	1	-6	-6	-8	11
BS8233	29	17	14	8	1	-6	-6	-8	11

Criteria

≤ 30

≤ 30

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 2 West

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Bedroom
Parameter	Lmax

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	73	57	49	46	43	43	46	45	53
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	
Model correction	0	0	0	0	0	0	0	0	
Noise level at façade (Lmax)	73	57	49	46	43	43	46	45	53

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	21	20	26	38	37	39	44	31
Transmission Coefficient	0.015849	0.007943	0.010000	0.002512	0.000158	0.000200	0.000126	0.000040	
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	0.002580	0.002977	0.001251	0.000335	0.000169	0.000150	0.000127	
Average SRI	23	26	25	29	35	38	38	39	34

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	52.3	32.9	25.6	18.8	10.1	7.1	9.6	7.9	28
Lp (Direct)	50.4	31.1	23.7	17.0	8.2	5.3	7.8	6.0	26
Lp (Rev & Direct)	55	35	28	21	12	9	12	10	30
BS8233	54	35	28	21	12	9	12	10	30

Criteria

≤ 45

≤ 45

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 3 South-east

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Living Room
Parameter	Leq, 16h

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	61	54	48	47	48	44	40	33	52
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	
Model correction	-2	-2	-2	-2	-2	-2	-2	-2	
Noise level at façade (Leq)	59	52	46	45	46	42	38	31	50

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	21	20	26	38	37	39	44	31
Transmission Coefficient	0.015849	0.007943	0.010000	0.002512	0.000158	0.000200	0.000126	0.000040	
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	0.002580	0.002977	0.001251	0.000335	0.000169	0.000150	0.000127	
Average SRI	23	26	25	29	35	38	38	39	34

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	38.3	27.9	22.6	17.8	13.1	6.1	1.6	-6.1	21
Lp (Direct)	36.4	26.1	20.7	16.0	11.2	4.3	-0.2	-8.0	19
Lp (Rev & Direct)	41	30	25	20	15	8	4	-4	23
BS8233	40	30	25	20	15	8	4	-4	23

Criteria

≤ 35

≤ 35

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 3 South-east

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Bedroom
Parameter	Leq, 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	

- Typical Bedroom RT

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	45	38	34	32	36	32	24	22	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	
Model correction	1	1	1	1	1	1	1	1	
Noise level at façade (Leq)	46	39	35	33	37	33	25	23	40

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	21	20	26	38	37	39	44	31
Transmission Coefficient	0.015849	0.007943	0.010000	0.002512	0.000158	0.000200	0.000126	0.000040	
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	0.002580	0.002977	0.001251	0.000335	0.000169	0.000150	0.000127	
Average SRI	23	26	25	29	35	38	38	39	34

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	25.3	14.9	11.6	5.8	4.1	-2.9	-11.4	-14.1	9
Lp (Direct)	23.4	13.1	9.7	4.0	2.2	-4.7	-13.2	-16.0	8
Lp (Rev & Direct)	28	17	14	8	6	-1	-9	-12	12
BS8233	27	17	14	8	6	-1	-9	-12	11

Criteria

≤ 30

≤ 30

ARDENT CONSULTING ENGINEERS
Noise Break-in Calculation - Position 3 South-east

Description	
Ardent CE Project No.	2505550_B
Property Address	Durrington Phase 2
Room Type	Bedroom
Parameter	Lmax

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	72	58	53	52	52	51	45	43	57
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	
Model correction	4	4	4	4	4	4	4	4	
Noise level at façade (Lmax)	76	62	57	56	56	55	49	47	61

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	18	21	20	26	38	37	39	44	31
Transmission Coefficient	0.015849	0.007943	0.010000	0.002512	0.000158	0.000200	0.000126	0.000040	
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	0.002580	0.002977	0.001251	0.000335	0.000169	0.000150	0.000127	
Average SRI	23	26	25	29	35	38	38	39	34

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A
Lp (Reverberant), line source	55.3	37.9	33.6	28.8	23.1	19.1	12.6	9.9	33
Lp (Direct)	53.4	36.1	31.7	27.0	21.2	17.3	10.8	8.0	31
Lp (Rev & Direct)	58	40	36	31	25	21	15	12	35
BS8233	57	40	36	31	25	21	15	12	35

Criteria

≤ 45

≤ 45

APPENDIX D

Appendix D

Acoustic Design Statement – Durrington Gasworks (Elizabeth Square Phase 2)

This Acoustic Design Statement (ADS) accompanies the Noise and Vibration Assessment and Environmental Statement for the development at Durrington Gasworks, Durrington-on-Sea. The approach to the ADS is in line with that set out in ProPG: Planning & Noise, May 2017.

Stage 1 Assessment

The ambient noise environment is controlled by railway noise located on the northern boundary of the site and serving Durrington-on-Sea. Noise levels are therefore highest at the northern boundaries of the site and reduce towards the southern boundaries. The majority of the site is therefore considered to be a *low* risk of adverse noise impact, with areas of the site set back from the surrounding road network tending towards a *negligible* risk of adverse noise impact.

The proposals are not expected to significantly alter the composition of the acoustic environment as there are existing commercial uses to the immediate west of the site. It is not expected that the future commercial operations will increase noise levels at existing sensitive receptors based on the design criteria proposed. The design of the site will incorporate measures to ensure there is adverse noise impact as a result of the co-located commercial and residential uses, including measures to ensure that there are no onerous restrictions on the commercial operators.

Stage 2 Assessment

Element 1 – Good Acoustic Design

With a co-located commercial and residential scheme the principles of good acoustic design are key to a successful development and to ensure there is no significant adverse noise impact from, or on respective users of the site.

The design team have sought to follow the best practice principles including the hierarchy of noise control wherever practicable in developing the layout of the site. This is broadly set out as follows:

1. Noise control at source – through the careful positioning of potentially noisy activities away from sensitive receptors;

2. Noise control in the transmission path – by maximising acoustic screening with sensible layout by positioning higher sensitivity (internal and external) areas on the more sheltered sides of buildings;
3. Noise control at receptors – through appropriate building envelope mitigation to include glazing, ventilation and separating walls and floors.

The layout concentrates the commercial use areas towards the west of the site, towards existing commercial units. The building has been designed to reduce the impacts of noise from deliveries as the roller shutter door has been recessed to increase distance separation from the closest proposed residential garden on Juno Close. The location of the delivery space to the southern façade of the building is due to requirements for a turning space.

An Air Source Heat Pump (ASHP) enclosure has been positioned to the north of the commercial building. This is towards the locations of the existing commercial on Goring Business Park and positions plant away both existing and proposed residential properties considering noise control at the source.

The location of the commercial unit and ASHP enclosure is shown in Figure H1 below.



Figure D1 – Layout Showing Commercial Use (Scale: NTS)

Existing residential properties on Juno Close are in relatively close proximity to the commercial use areas. Mechanical plant is positioned on the northern façade and well

screened to minimise the likelihood of noise impacts to these existing properties. Mechanical plant will be selected, located and if necessary attenuated to avoid adverse impact at the nearest receptors.

Element 2 – Internal Noise Levels

Based on the measured and calculated noise levels the internal noise levels in residential units can be determined. Appropriate façade attenuation will be provided to ensure compliance with Figure 2 ProPG which incorporates the guidance in BS8233:2014. In doing so Element 2 requirements of Stage 2 are met.

Glazing and ventilation specification is detailed in noise assessment.

Element 3 – External Amenity Area Noise Levels

Increased garden fence height of 3m is proposed for the northern boundary of the site which is adjacent to the railway line.

Inclusive of the above mitigation, all properties will have a private garden which has been assessed to have external amenity sound levels below the upper guidance value of 55 dB L_{Aeq} . Properties excluding Plots 13-29 will achieve below 50 dB L_{Aeq} .

It is expected that balconies will achieve below the upper guidance criteria of 55 dB L_{Aeq} . It is recommended that solid balustrades be introduced for the apartment blocks near World of Books and Temple Spa Rhythm and Blue Holdings to reduce noise levels by approximately 5 dB to reduce operational noise from the service yard.

Additionally, a Local Area for Play (LAP) is being introduced within the scheme to the central area which will be subject to external noise levels below 50 dB L_{Aeq} guidance criteria providing all residents with suitable external amenity.

All residents will have access to a private amenity spaces which meet the guidance levels in ProPG and good acoustic design principles have been incorporated to reduce potential impact as much as practicably possible.

In addition, all residents have access to shared amenity spaces where the guidance noise levels in ProPG: Noise are met. Therefore, residents have a choice between their private space or the shared amenity areas across the site.

Further detail on external amenity areas is included in noise assessment.

Element 4 – Assessment of Other Relevant Issues

The good acoustic design principles which have been followed mean that the proposed development is in general compliance with the principles of the ProPG.

The development is designed as a high quality vibrant co-located living and working environment that balances the needs of the occupiers of the spaces through high quality sustainable design.

The proposed facade sound insulation performances mean that internal residential noise levels when windows are closed will be in line with the ProPG guidance levels.

Noise levels in private amenity areas are generally compliant with some slight exceedances. The design of the site has reduced noise levels in private amenity spaces as far as practicable and the residual exceedances are minimal. Alternative, high quality shared amenity areas are provided within the site and comply with the ProPG guidance levels.

Recommendation for the Decision Maker

In the context of the existing acoustic environment at the site there is a varying risk of adverse noise impact, ranging from negligible risk at the south of the site to low risk at the northern boundaries. However, principles of good acoustic design have been followed to minimise the potential impact of noise through; careful layout and orientation of buildings; self-screening and where appropriate façade mitigation. It is considered that the site is suitable on noise grounds.

APPENDIX E

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.

$L_{A10,T}$: 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'.

$L_{A90,T}$: 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

APPENDIX F

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.

$L_{A10,T}$: 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'.

$L_{A90,T}$: 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

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 (2019)

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.

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but no such that there is a change in the quality of life.	No Observed Adverse Effect Level	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. 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 small actual or perceived change in the quality of life.	Observed Adverse Effect Level	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and Disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. 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 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 Level	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. 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."

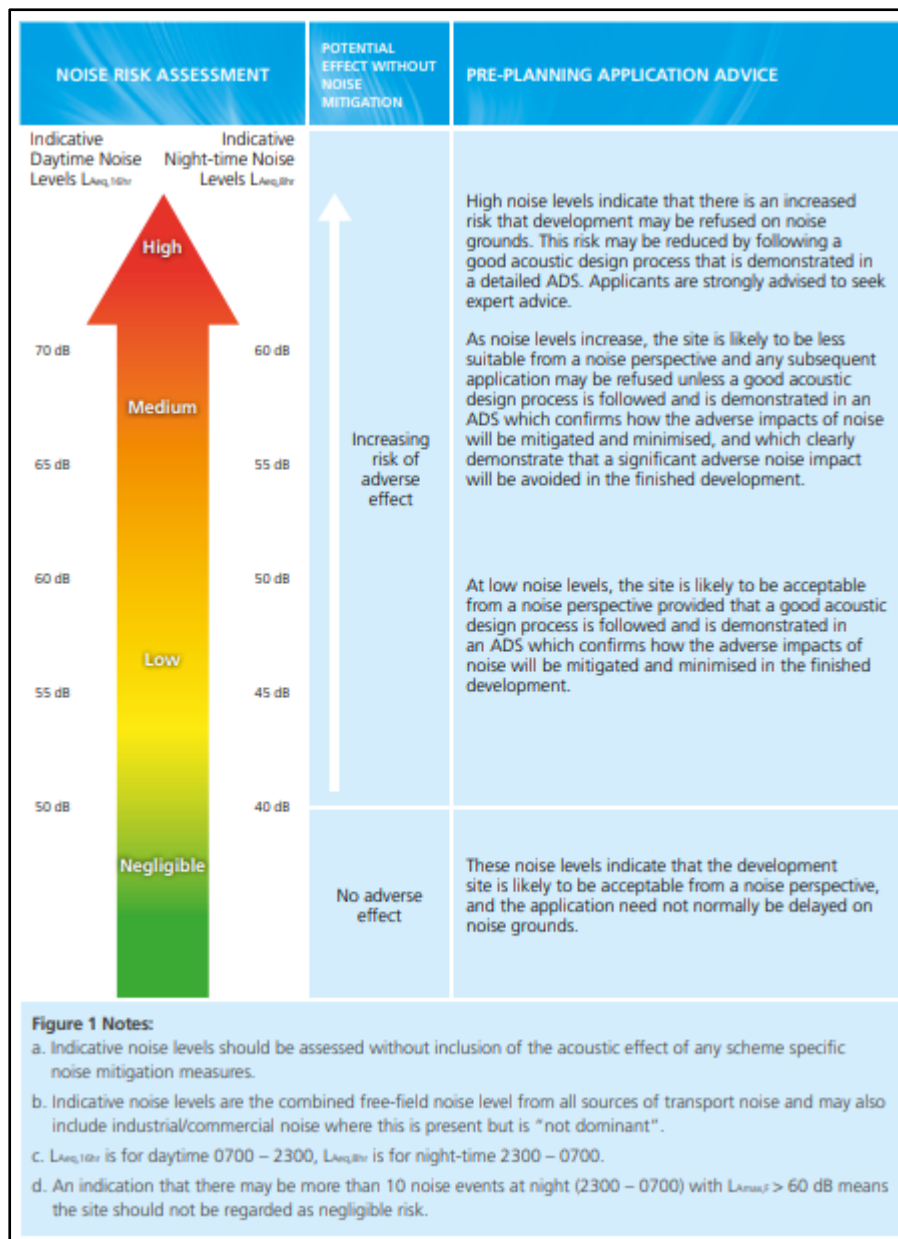


Figure 1: Extract from Figure 1 in ProPG – Initial Site Noise Risk Assessment

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.

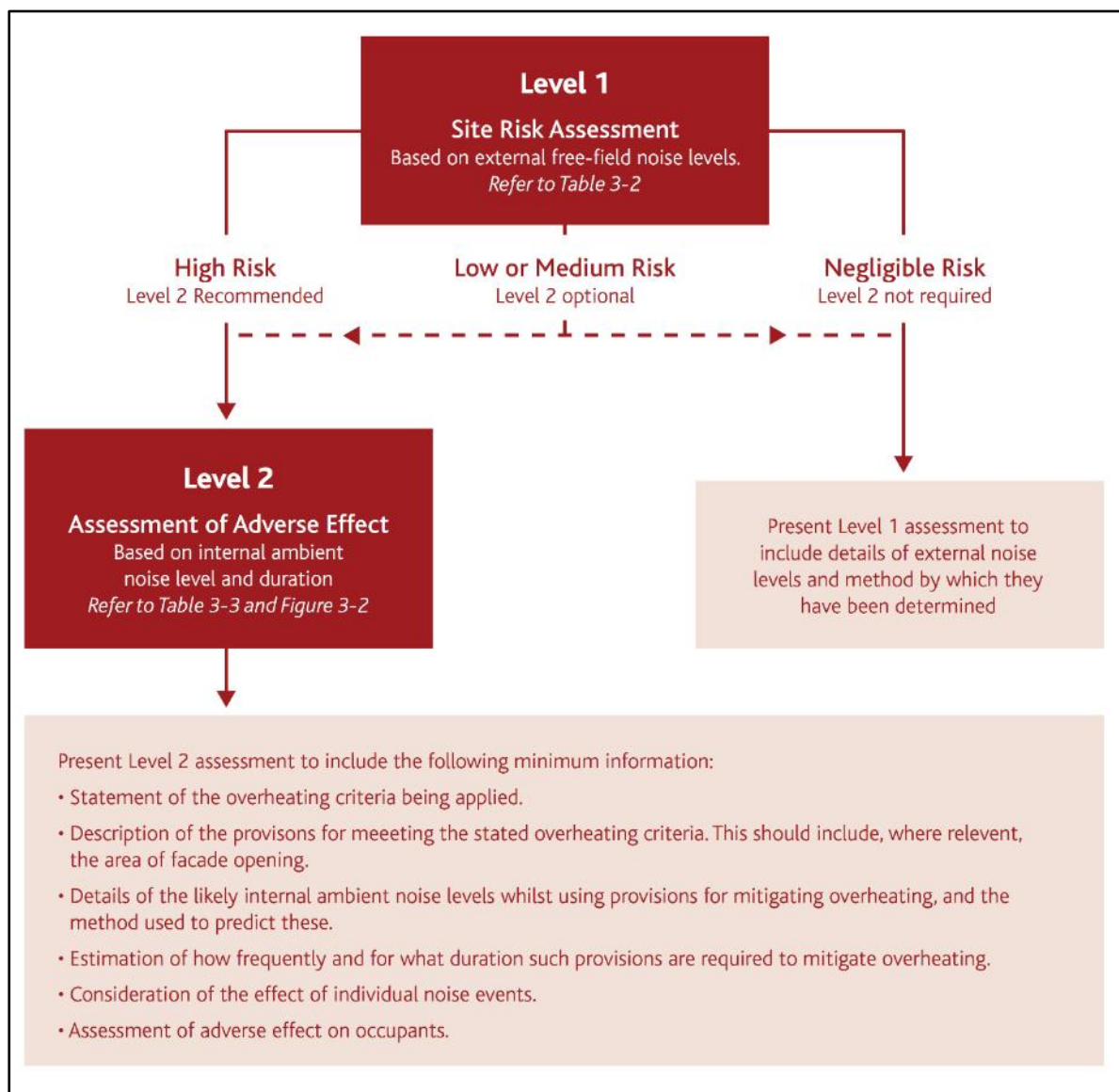


Figure 2: Two-level Assessment Procedure (Figure 3.1 of AVO Guidance)

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

Risk category for Level 1 assessment [Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
L_{Aeq,T} [Note 3] during 07:00 - 23:00 L_{Aeq,8hr} during 23:00 - 07:00 High 65 dB 55 dB Medium 60 dB 50 dB Low 55 dB 45 dB Negligible 50 dB 45 dB	Increasing risk of adverse effect	Recommended Optional
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

Note 1 The noise levels suggested assume a steady road traffic noise source but may be adapted for other types of transport. All levels are external free-field noise levels.

Note 2 The values presented in this table should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships, [15, 17].

Note 3 A decision must be made regarding the appropriate averaging period to use. The averaging period should reflect the nature of the noise source, the occupancy profile and times at which overheating might be likely to occur. Further guidance can be found within the 2014 IEMA Guidelines [23].

Note 4 Refer also to references [1, 17, 18, 22] for further guidance regarding individual noise events. Where 78dB LAFmax is normally exceeded during the night-time period (23:00-07:00), a Level 2 assessment is recommended.

Note 5 The risk of an adverse effect occurring will also depend on how frequently and for what duration the overheating condition occurs. Refer to Figure 3-2.

Note 6 To evaluate the risk category for a dwelling, all three aspects of external noise exposure (i.e. daytime, night-time and individual noise events) should be evaluated. The highest risk category for any of the three aspects applies.

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.

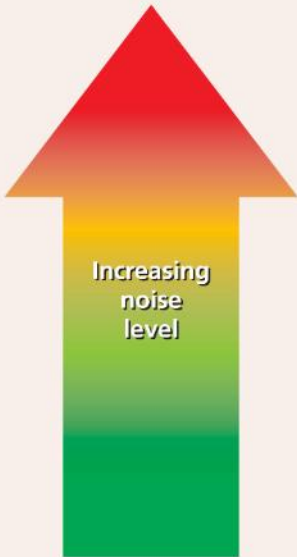
Internal ambient noise level ^[Note 2]			Examples of Outcomes ^[Note 5]	
$L_{Aeq,T}$ ^[Note 3] during 07:00 – 23:00 ^[Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 ^[Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{AF,max}$	Noise causes a material change in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

BS4142:2014 Methods for rating industrial and commercial sound

BS4142:2014 uses a comparison between the rating and background sound levels to establish an initial estimate of the likely significance of impact. The standard notes:

- a) *Typically, the greater this difference, the greater the magnitude of the impact.*
- b) *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- c) *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- d) *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*

The context of the assessment must then be considered, which can significantly alter the outcome of the assessment. Factors that might alter the outcome of the assessment include the absolute level of sound compared to the residual sound level, the character of the sound compared to the residual, the sensitivity of the receptor etc.