ARDENT
CONSULTING ENGINEERS
AN EMPLOYEE OWNED COMPANY

Bellway Homes Limited

Former Southern Gas Network Belvedere Holders Stations, Yarnton Way

Acoustic Assessment (Draft)

REPORT REF.
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1. Introduction

1.1. Ardent Consulting Engineers were instructed by Bellway Homes Limited to undertake an Acoustic Assessment to support the residential development at the former Southern Gas Network Belvedere Holders Stations, Yarnton Way, London (hereafter referred to as the site).

Site Location

1.2. The site is set in a mixed commercial and residential area. Yarnton Way lies to the north and a railway line to the south. To the east of the site are residential dwellings and to the west a number of small commercial units. There is a frozen foods manufacturer (Ferndale Foods) beyond Yarnton Way to the north of the site.

1.3. The surrounding area and approximate site boundary are shown in Figure 1-1.

Figure 1-1: Site Boundary and Surrounding Area

Site Proposals

1.4. The proposals are for the *'redevelopment of the site to provide residential units including affordable housing (Use Class C3) and commercial floorspace (Class E) in new buildings ranging between 3 to 5 storeys in height, together with associated car parking and cycle storage, landscaping including new areas of public open space and a reptile retention zone, associated infrastructure including new junctions off Yarnton Way, drainage and land raising.'*

1.5. An extract of the site proposals is shown in Figure 1-2.

Figure 1-2: Site Proposals – Ground Floor (Extract)

2. Local Authority Liaison

2.1. Contact was made with London Borough of Bexley to discuss the proposals and approach to the assessment, no response has been received to date. The following assessment criteria was set out and will be used for assessment:

- The suitability of the site for residential development would be assessed in accordance with ProPG guidance and BS8233;
- Assessment of noise from Ferndale Foods and the small commercial units will be conducted in accordance with BS4142 or if appropriate ProPG Guidance;
- Assessment of the fixed mechanical plant and commercial activities associated with the site will be conducted in accordance with BS4142, cumulative rating levels will be set for fixed mechanical plant and target rating levels will be set for commercial activities to achieve a low impact.
- Assessment of vibration from the railway will be conducted in accordance with BS6472;
- Assessment of the change in noise levels due to operational development traffic will be conducted in accordance with DMRB LA111;

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

3. Environmental Noise & Vibration Survey

3.1. An environmental noise survey was undertaken at the site between 14th and 21st October 2021 and a vibration survey was undertaken between 14th and 21st June 2023. measurement positions are shown in Figure 3-1. Measurement positions were selected to obtain representative baseline noise and vibration levels due to the main observed sources around the site whilst also considering security of the measurement equipment.

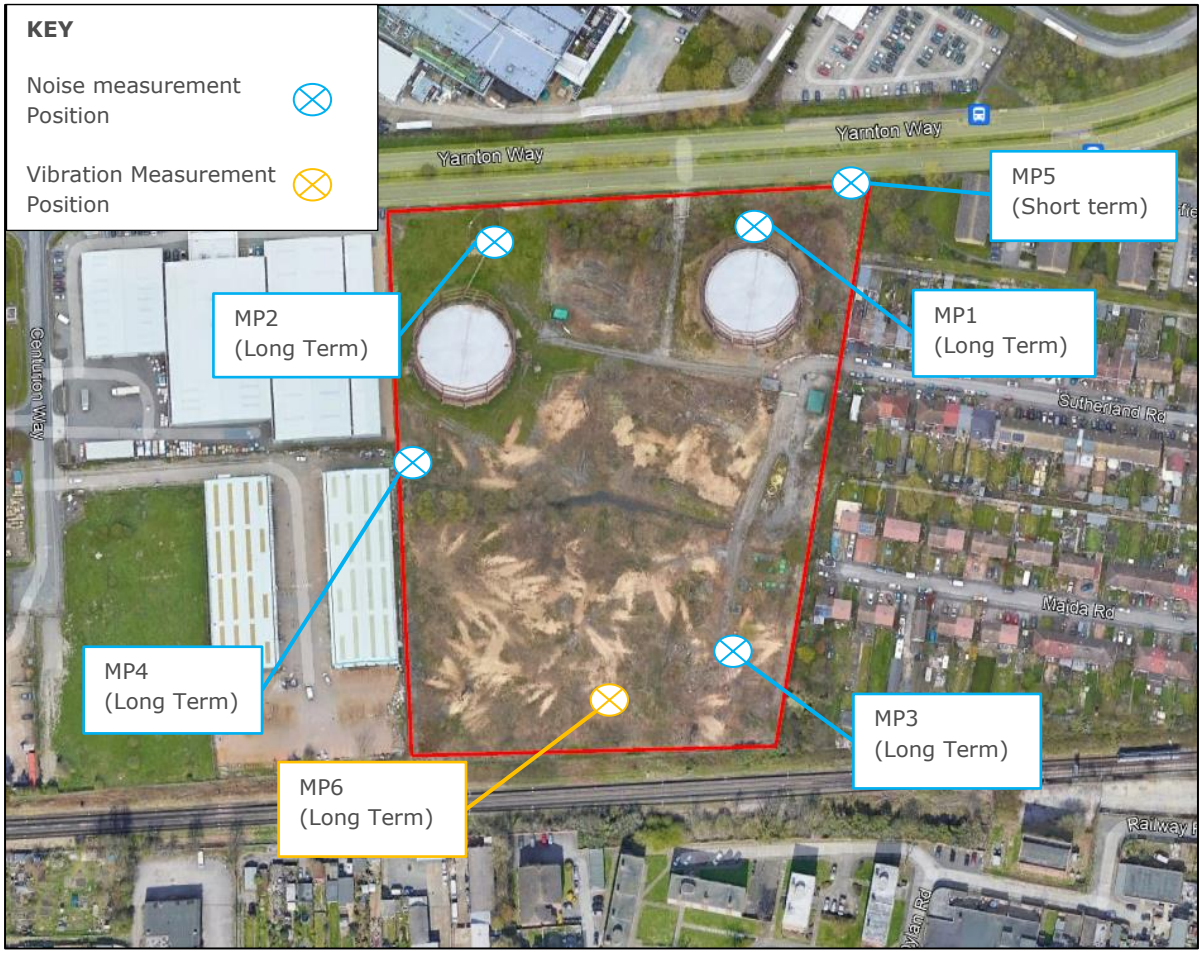


Figure 3-1: Measurement Positions

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

- **Measurement Position MP1** – The microphone was mounted at height of 1.5m overlooking with an unobstructed path to Yarnton Way.
- **Measurement Position MP2** - The microphone was mounted at a height of 1.5m with an unobstructed path to Yarnton Way and in close proximity to the Ferndale Foods factory across the road.
- **Measurement Position MP3– T**he microphone was mounted at a height of 2.5m with an unobstructed path to the railway line.

- **Measurement Position MP4 –** The microphone was mounted at a height of 1.5m above ground level with an unobstructed path to the commercial units to the west of the site.
- **Measurement Position MP5 –** The microphone was mounted at a height of 1.5m above ground level with an unobstructed path to the Yarnton Way.
- **Measurement Position MP6 –** The transducer was positioned on suitable ground and was set back from the railway line approximately the same distance as the nearest proposed building facades.

3.3. The equipment used was as follows:

- Svantek 977 Sound Level Meter (serial number: 34132);
- Svantek 957 Sound Level Meter (serial number: 15385);
- Svantek 957 Sound Level Meter (serial number: 15381);
- Svantek 957 Sound Level Meter (serial number: 28003);
- Rion NC74 Calibrator (serial number: 34172694);
- Rion VM54 Vibration Monitor (serial number: 00680037).

3.4. All equipment used has been professionally calibrated. Field calibration of the sound level meter (and complete measurement signal chain) was undertaken before and after measurement to ensure no drift of the calibration signal.

3.5. Weather conditions considered suitable for environmental noise measurements apart from 19th, 20th and 21st October 2021, when periods of high wind speeds occurred, data from these periods has been excluded from assessment.

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

Monitoring Position	Ambient Noise Level dB $L_{Aeq, T}$ Range (Average)		Background Sound Level, dB $L_{A90,T}$ Range (Representative)		Night-time Maximum Noise Level, dB L_{AFmax} Range (Representative)
	Day	Night	Day	Night	
MP1	50-81 **(58)**	49-62 **(53)**	49-65 **(51)**	48-60 **(50)**	51-80 **(72)**
MP2	53-77 **(60)**	53-64 **(57)**	52-63 **(56)**	59-52 **(53)**	55-80 **(73)**
MP3	41-69**(55)**	37-70 **(51)**	41-61 **(44)**	37-56 **(39)**	41-81 **(78)**
MP4	45-65 **(52)**	44-62 **(49)**	45-53 **(48)**	44-53 **(45)**	47-78**(68)**
MP5*	59-73 **(65)**	-	51-60 **(55)**	-	-
*Daytime measurements only					

Table 3-1: Summary of Measured Noise Levels

3.7. The representative L_{AFmax} level is the value which has been exceeded fewer than 10 times in the 8-hour night-time period, i.e. one which can be considered to be 'not normally exceeded' as per the WHO guidelines.

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

		Octave Band Centre Frequency, dB							
		63	125	250	500	1k	2k	4k	8k
MP1	$L_{Aeq,T}$ (day)	65	58	55	54	55	49	40	35
	$L_{Aeq,T}$ (night)	62	55	51	51	50	43	33	23
	$L_{AFmax,T}$ (night)	73	71	75	69	68	59	50	40
MP2	$L_{Aeq,T}$ (day)	67	63	55	56	57	51	42	34
	$L_{Aeq,T}$ (night)	64	61	53	54	53	47	38	28
	$L_{AFmax,T}$ (night)	78	76	68	69	70	63	52	39
MP3	$L_{Aeq,T}$ (day)	51	50	51	51	47	39	33	54
	$L_{Aeq,T}$ (night)	56	48	46	47	46	44	37	29
	$L_{AFmax,T}$ (night)	82	74	67	69	71	73	69	63
MP4	$L_{Aeq,T}$ (day)	59	53	49	49	48	41	37	35
	$L_{Aeq,T}$ (night)	58	51	47	47	45	37	29	27
	$L_{AFmax,T}$ (night)	69	65	67	68	63	53	40	28
MP5	$L_{Aeq,T}$ (day)	67	62	60	60	63	57	47	37

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

3.9. Based on the measurements taken on site, traffic flows for the surrounding road network and the proposals for the site, a 3D computer based environmental noise model have been created using the 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 up to first order reflected noise from solid structures;
- The existing land topography of the site 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 traffic flows for the surrounding road network where appropriate.

3.10. Noise contours are as shown in Appendix B.

3.11. Based on the measured sound levels at the site, façades in close proximity to Yarnton Way and the railway line are considered to be 'medium to high risk', all other façades would be considered 'low to medium risk' in accordance with ProPG guidance.

3.12. This would not prohibit the development as good acoustic design processes will be followed to reduce sound levels to as low as practical across the site. An acoustic design statement has been produced as shown in Appendix C.

Vibration Survey

3.13. The VDV X, Y and Z vibration axis parameters were measured throughout the duration of the survey. Measured levels during the day and night are summarised below in Table 3-3.

	VDV (X)	VDV (Y)	VDV (Z)	BS6472 (low probability of adverse comment)
Daytime 07:00-23:00)	0.02	0.02	0.1	0.2 – 0.4
Night Time (23:00-07:00)	0.06	0.03	0.2	0.1 – 0.2

Table 3-3: Measured Vibration Dose Values

3.14. The measured vibration levels are significantly below the lowest category in BS6472 (low probability of adverse comment) during the day. At night vibration levels are within the range of low probability of adverse comment in the z axis, for the x and y axes, the levels are significantly below this range.

3.15. Careful consideration will need to be given to the structural design of buildings closest to the railway line at the detailed design stage of the site to reduce vibration transfer.

4. Demolition & Construction Phase

4.1. The demolition and construction phase of the development proposals for the site will include various noise generating processes and plant. The most significant processes in terms of noise generation would be site clearance/ excavation operations, piling and concreting operations.

4.2. A detailed demolition and construction programme, specific plant data and operations are not available at this stage of the project therefore a detailed assessment cannot be undertaken at this time. It is understood that construction operations will be carried out during weekdays (08:00 – 18:00) and on Saturdays (08:00 – 13:00) only.

4.3. To assess the limits for reasonable construction noise experienced at the nearest residential properties, Example Method 1 (the ABC Method) of BS 5228, within section E.3.2, will be used. Table E.1 from the standard is reproduced at Table 4-1.

Table E.1 **Example threshold of significant effect at dwellings**

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

[D] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Table 4-1: Table E.1 – BS5228 Part 1

4.4. Measurements taken in the area indicate that the ambient level is within Category A of Table E.1. Therefore, the following ambient noise levels set out in Table 4-2 resulting from construction activities will be deemed to have a significant effect.

Time Period	Noise Levels Likely to have a significant effect dB L_{Aeq}
Monday to Friday (08:00 – 18:00) & Saturday (08:00 – 13:00)	>65

Table 4-2: Target Construction Noise Levels

4.5. Piling operations have the potential to generate ground borne vibration in the immediate surroundings. Methods and techniques will be employed during these and other vibration generating activities to minimise any potential impacts from the operations. This can include (but is not limited to) use of drilled (CFA) piles rather than impact driven piles.

4.6. When undertaking vibration monitoring during construction works, a limit of around 1mm/s PPV can be set as an action level. In this way, the effects at nearby residential receptors due to vibration would be controlled.

4.7. This limit is derived from Table D.1 of BS5228 2009-02 (vibration); boring to a depth of 12m on made ground/gravel – (Continuous Flight Auger (CFA) piling method). This identifies that at a plan distance of 3.7m, predicted vibration levels (PPV) would be 1.1mm/s. Should piling operations be required within 4m of existing sensitive receptors additional monitoring can be undertaken.

Best Practice Recommendations

4.8. Construction activities should only take place between 08:00 to 18:00 on weekdays and 08:00 to 13:00 on Saturdays. No construction activity should be carried out during the night, on Sundays or on bank holidays without additional consideration to controlling noise, it is expected that a construction management scheme could be secured as a planning condition for the site.

4.9. During construction, the contractor will employ best practicable means to control noise from construction operations.

4.10. Temporary screening in the form of solid timber hoarding can be used where operations are adjacent to sensitive receptors. Consideration will be given to neighbouring residential properties when locating the temporary site compounds and material stockpiles.

4.11. 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.

4.12. Delivery of materials and removal of waste from the site will be planned to minimise disturbance to neighbouring properties. Idling of plant, machinery and delivery vehicles should be prohibited when not in use.

4.13. If required noise and vibration levels can be monitored regularly in accordance with BS 5228 to ensure the above set limits are not exceeded. In addition to the above, all other relevant guidance within BS 5228 will be followed at all times.

5. Fixed Mechanical Plant & Commercial Noise

5.1. The proposals will introduce commercial units, the details of which are not yet known. The commercial units proposed at the site are located directly adjacent to Yarnton Way.

5.2. Noise from plant and activities associated with the commercial units should be designed to achieve a low impact in accordance when assessed in accordance with BS4142, i.e. the cumulative rating level from fixed mechanical plant will be no greater than the representative background sound level.

5.3. The more sensitive periods of the day and night, when noise levels from Yarnton Way were lowest, have been used for assessment. These periods are 20:00 – 23:00 and 02:00 – 05:00 during the day and night respectively.

5.4. The nearest sensitive receptors to the proposed commercial units will be dwellings on site and dwellings to the east of the site adjacent to Yarnton Way, therefore measurement data from position MP1 has been used for assessment. Based on the data taken at measurement positions MP1, the representative background sound levels are 51dB $L_{A90,T}$ and 49dB $L_{A90,T}$ during the day and night respectively.

5.5. Therefore the cumulative rating levels from fixed mechanical plant and from commercial activities should be no greater than 51dB $L_{Ar,Tr}$ and 49dB $L_{Ar,Tr}$ during the day and night respectively.

5.6. Where required plant associated with the site should be selected, located, oriented and attenuated to achieve the criteria. The above criteria need to be considered on the basis of the configuration of plant and the operational conditions.

5.7. Commercial activities should be mitigated and managed using best practice techniques, where necessary, to also achieve the above criteria.

6. Road Traffic Noise

6.1. Traffic flow volumes have been provided by Ardent Transport Consultants, which have been used to calculate the change in noise levels arising from operational road traffic, i.e. during occupation. The data is presented as 18-hour AAWT (06:00-00:00) flows. The traffic flows and the change in noise levels presented in Appendix D.

6.2. Tables 6-1 show the traffic flows and predicted changes in noise levels for the change in traffic flow between the future baseline and operational traffic flows.

Road	Future Baseline 2028 Flow	Future Baseline + Operational Traffic	Change in Noise Level, dB
Yarnton Way, East of the Site (Eastbound)	3678	3888	0.2
Yarnton Way, East of the Site (Westbound)	5558	5740	0.1
Yarnton Way, West of the Site (Eastbound)	3678	3838	0.2
Yarnton Way, West of the Site (Westbound)	5558	5741	0.1
A2041, North of Yarnton Way (Northbound)	11390	11468	0.0
A2041, North of Yarnton Way (Southbound)	11949	12017	0.0
A2041 South of Yarnton Way (Northbound)	9999	10063	0.0
A2041 South of Yarnton Way (Southbound)	9950	10023	0.0
Eynsham Drive (Two-Way)	11559	11619	0.0

Table 6-1: Change in Noise Levels Due to Operational Traffic

6.3. The changes in noise levels are negligible in all cases when compared to Table 3.54b of DMRB, LA 111.

7. Noise From Adjacent Commercial Units

7.1. There are small commercial units located to the west of the site and to the north is Ferndale Foods, a frozen food manufacturer. The location of these operations is shown in Figure 7-1.

Figure 7-1: Location of Commercial Operations

Small Commercial Units

7.2. During the survey, observations were taken regarding activities and any sources of noise at the small commercial units to the west of the site. Additionally, based on the measurements taken at position MP4, noise from these commercial units is not readily distinguishable against the residual acoustic environment, which is dominated by road and rail traffic.

7.3. 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)…"

7.4. The assessment of the risk categories for the site includes noise from these sources. Mitigation measures for the site, shown in in Section 8, will be suitable to control noise from road traffic on Yarnton Way and noise from railway line. Because these are the dominant noise source in the area, these measures will also control noise from the small commercial units.

7.5. This means that whilst these noise sources are not specifically covered as part of the scope of BS8233, the assessment of mitigation requirements to provide suitable internal amenity sound levels includes noise from the small commercial units.

Ferndale Foods

7.6. The impact of noise from Ferndale Foods has been assessed in accordance with BS4142. It is understood that Ferndale Foods operates during the day and night. Observations regarding noise from Ferndale Foods were taken during the survey, plant was audible but was not dominant against traffic on Yarnton Way.

7.7. The representative background sound levels and residual sound levels have been derived from the data at measurement position MP1, this measurement position was far away enough so that it was not influenced by noise from Ferndale Foods. The more sensitive periods of the day and night, when noise levels from Yarnton Way were lowest, have been used for assessment, these are 20:00 – 23:00 and 02:00 – 05:00 during the day and night respectively.

7.8. The representative background sound levels are 51dB $L_{A90,T}$ and 49dB $L_{A90,T}$ the day and night respectively. The residual sound levels are 55dB $L_{Aeq,T}$ and 52dB $L_{Aeq,T}$ during the day and night respectively.

7.9. The specific sound level from Ferndale Foods has been obtained through analysis of the data at positions MP1 and MP2. By logarithmically subtracting the ambient sound levels measurement at position MP1 from those at position MP2, the specific sound level has been derived which is 55dB $L_{Aeq,T}$ and 53dB $L_{Aeq,T}$ during the day and night respectively.

7.10. BS4142 allows for an acoustic feature correction dependant on the characteristics of sound from a source, i.e. impulsivity, tonality, intermittency and other sound characteristics (where the specific features of a sound are readily distinctive against the residual environment, but are not tonal, impulsive or intermittent).

7.11. Based on the observations during the survey and the nature of the activities into account and considering the context of the assessment, i.e. the specific sound level is higher than the background sound level and marginally higher than the residual sound level, an acoustic feature correction of +2dB for tonality is considered appropriate. Table 7-1 below shows the initial assessment of the impact of noise form the commercial units directly adjacent to the site.

Development Site	Day	Night
Specific Sound Level, dB $L_{Aeq,T}$	55	53
Acoustic Screening, dB	0	0
Acoustic Feature Correction, dB	+2	+2
Rating Level, dB $L_{Ar,\ 60min}$	57	55
Background Sound level, dB $L_{A90,T}$	51	49
Excess over background, dB	+6	+6
Assessment	Adverse Impact	Adverse Impact

Table 7-1: BS4142 Initial Assessment

7.12. As can be seen from the above table, the initial assessment of the impact of the Ferndale Foods at the site in accordance with BS4142 indicates an adverse impact during the day and night.

7.13. In terms of the context of the site, the residual sound level is equal to and 1dB higher than the rating level during the day and night, respectively. The rating level is 6dB above the background sound level during the day and night. Subjective assessment of the acoustic environment at the site indicates that the dominant source of noise is road traffic noise from Yarnton Way.

7.14. Whilst BS4142 is designed to use external sound levels that might be present at a residential receptor and to assess the likely effects of sound on people who might be inside or outside a dwelling. BS4142 states the following regarding consideration of internal sound levels:

"…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…"

7.15. Consideration should therefore be given to the proposed façade treatments to dwellings at the site. The proposed glazing and ventilation strategy is outlined in Section 8 of this report will be sufficient to reduce noise levels from Ferndale Foods so that suitable internal amenity is achieved.

7.16. When the acoustic environment and proposed mitigation measures for the site are considered, it is expected that Ferndale Foods will have a low impact on the new residential receptors at the site.

8. Mitigation Recommendations

8.1. The aim of this section is to identify mitigation measures capable of providing suitable levels of attenuation to achieve the required internal sound levels based on the predicted noise levels, therefore demonstrating the suitability of the site for residential development.

8.2. The results of the noise survey and the noise modelling for the site have been used to undertake calculations for suitable façade treatments. The calculations are presented in Appendix E.

8.3. The design of dwellings will enable residents to keep windows closed and an alternative means of ventilation will be provided. It is important to note that windows would not be sealed shut and residents will have the choice of opening them, whilst noting noise levels will slightly increase.

External Building Fabric - Non-Glazed Elements

8.4. 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 8-1 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 8-1: Non-glazed Elements Assumed Sound Reduction Performance

External Building Fabric – Glazing (Residential)

8.5. Table 8-2 sets out the required glazing performance types for residential areas, these specifications take into account the glass, frame, seals and associated fittings.

Glazing Type	Sound Reduction Index, dB R_W	Octave band centre frequency SRI, dB					
		125	250	500	1k	2k	4k
Type 1	44	29	36	42	44	47	59
Type 2	44	29	36	42	44	47	59
Type 2 (no markup)	35	24	24	32	37	42	43

Table 8-2: Required Minimum Attenuation Values for Glazing (Residential)

External Building Fabric – Ventilation (Residential)

8.6. Table 8-3 sets out the required ventilation performance types for residential areas:

Ventilation Type	Element Normalised level difference, dB $D_{n,e,w}$	Octave band centre frequency SRI, dB					
		125	250	500	1k	2k	4k
Type 1	45	42	40	36	48	53	56
Type 2	43	41	39	38	47	43	46
Type 2 (no markup)	35	36	34	31	34	38	38

Table 8-3: Required Minimum Attenuation Values for Ventilation (Residential)

8.7. The above tables should be viewed in conjunction with Figure 8-1, which indicates the location of glazing and ventilation specifications for residential areas. It should be noted that for the Type 1 and Type 2 performance specifications, the glazing is the same, however, a higher sound reduction is required from the ventilation for Type 1.

Figure 8-1: Glazing and Ventilation Layout (Residential)

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

8.9. 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.

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

Overheating

8.11. Consideration has been given to the potential for adverse noise impact during overheating conditions; where residents may open windows to control temperature. The expected noise levels place façades in close proximity to Yarnton Way and the railway line in the medium to high risk categories, all other façades would be considered low risk category under overheating condition according to the AVO guidance.

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

8.13. The strategy to provide thermal comfort and suitable internal noise levels will be developed further at the detailed design stage of the site.

External Amenity Areas

8.14. Private garden and private balconies are proposed at the site across the site. Based on the results of the noise modelling, external sound level at a limited number of amenity areas in close proximity to Yarnton Way and the railway line will slightly exceed the guidance criteria. All other private amenity areas will meet the criteria. It is understood that due to other design considerations, solid balustrades cannot be installed to balconies.

8.15. The proposals for the site also include a communal amenity area, which is shown in Figure 8-2.

Figure 8-2: Amenity Areas

8.16. The results of the noise model demonstrate that the communal amenity area at the west of the site has external sound levels which would be lower than the criteria for private amenity areas. Therefore, residents would have the choice of accepting higher external sound levels on balcony areas or use of alternative communal amenity areas where sound levels would be considered suitable.

8.17. Additionally, BS8233 states the following in terms of the external amenity areas and the context of the site location:

"…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…"

8.18. The design of the site places private amenity spaces on the sheltered side of buildings as much as possible and maximises the separation distance between private amenity area and noise sources whilst taking other design considerations into account.

8.19. The site is located in an urban environment and there are numerous transport links in the immediate vicinity of the site, noise levels have also been reduced by as much as practicably possible. It is therefore considered that the development should not be prohibited due to external sound levels at private amenity areas slightly exceeding the guidance criteria.

9. Conclusions

9.1. Noise and vibration surveys have been undertaken and the measured noise levels have been used to calculate and assess suitable glazing and ventilation specifications.

9.2. Based on the measured sound levels at the site, façades in close proximity to Yarnton Way and the railway line are considered to be medium to high risk, all other façades would be considered low to medium risk in accordance with ProPG guidance. Good acoustic design processes have been followed to reduce sound levels across the site whilst considering wider design constraints and an acoustic design statement has been produced.

9.3. The measured vibration levels are significantly below a low probability of adverse comment during the day. At night vibration levels are within the range of low probability of adverse comment in the z axis, for the x and y axes, the levels are significantly below this range. Careful consideration will need to be given to the structural design of buildings closest to the railway line at the detailed design stage of the site to reduce vibration transfer.

9.4. The change in noise levels due to traffic generated during the operational stage of the proposed development have been compared to the future baseline traffic flows. The change in noise level is negligible in all cases.

9.5. Criteria for the cumulative rating level of noise from fixed mechanical plant and noise from commercial activities at the nearest receptors has been proposed to achieve a low impact in accordance with BS4142.

9.6. An assessment of the small commercial units to the west and Ferndale Foods to the north of the site has been undertaken. Observations during the survey indicated that no significant noise generating activity was noted the small commercial units to the east of the site. The mitigation to control noise from the railway line and the surrounding road network, which are the dominant sources of noise at the site will also be suitable to control noise from the small commercial units to the east of the site.

9.7. The assessment of the impact of noise from Ferndale Foods at the nearest dwellings on site. The assessment shows that when the context of the development, including the mitigation measures which are designed to control noise from road traffic noise

on Yarnton Way, is taken into account Ferndale Foods will not have an adverse effect on new receptors at the site.

9.8. Closed windows and alternative will be provided to allows residents the choice to close windows, whilst achieving suitable background ventilation and internal noise levels. Windows are not sealed shut and residents will have a choice to open windows for ventilation whilst noting slightly elevated internal sound levels.

9.9. The risk of noise impact under overheating conditions within properties has been considered in accordance with AVO Guidance. Areas of the site in close proximity to Yarnton Way and the railway line are considered to be medium to high risk, all other areas of the site would be considered low risk. The strategy to provide thermal comfort and suitable internal noise levels will be developed further as part of the detailed design of the proposed development.

9.10. External sound levels within private balconies and gardens in close proximity to Yarnton Way and railway line will marginally exceed the guidance criteria of BS8233. External sound all other private balconies and gardens will meet the guidance criteria.

9.11. The communal amenity area at the west of the site has external sound levels which would be lower than the criteria for private amenity areas. Therefore, residents would have the choice of accepting higher external sound levels on balcony areas or use of alternative communal amenity areas where sound levels would be considered suitable. Control measures will be implemented to manage potential impacts from construction noise.

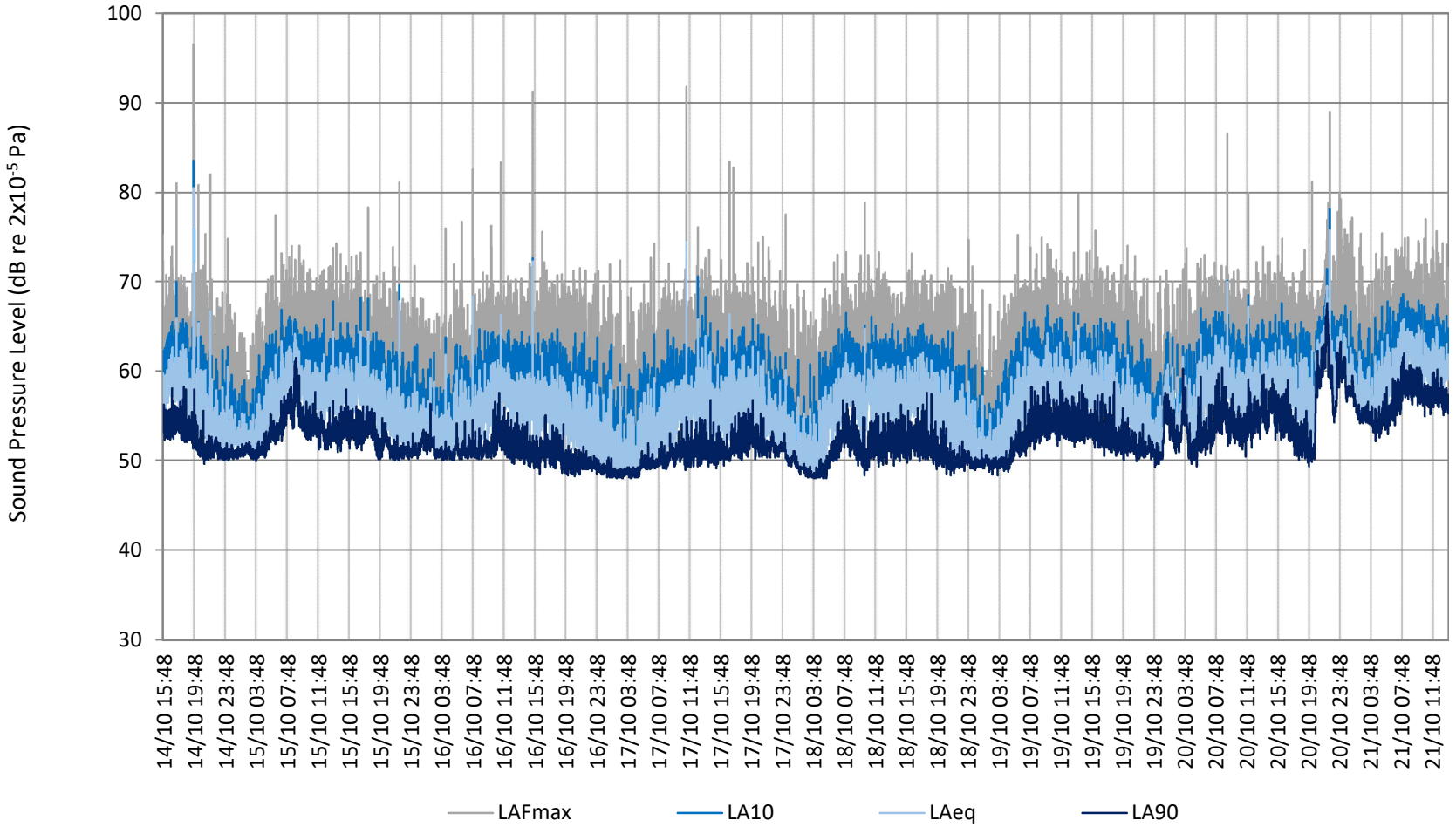
9.12. This assessment demonstrates that the site is suitable for residential development subject to the recommendations included in this report.

APPENDIX A

Yarnton Way, Belvedere - Position 1

Environmental Noise Time History

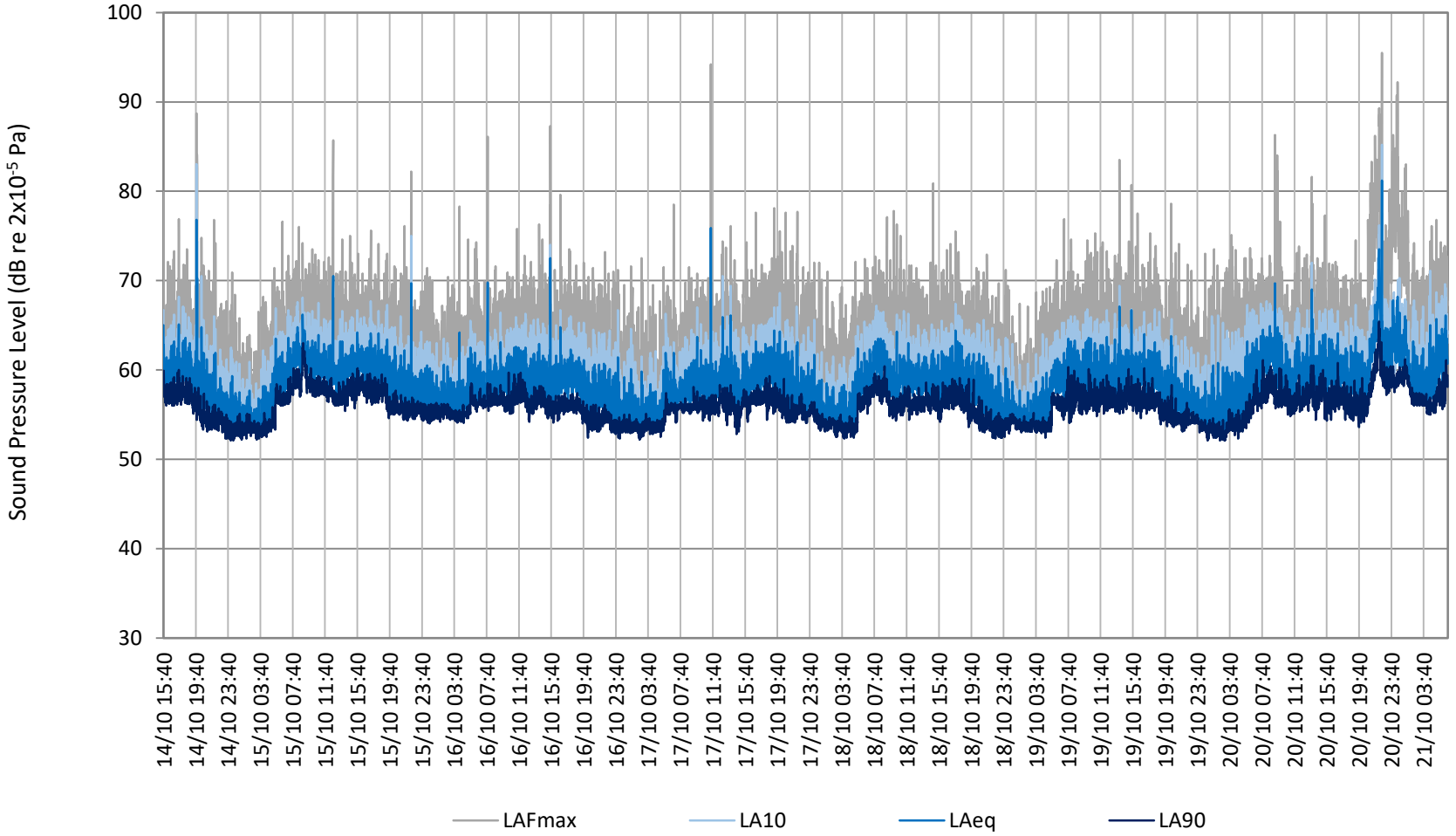
14 October 2021 to 21 October 2021



Yarnton Way, Belvedere - Position 2

Environmental Noise Time History

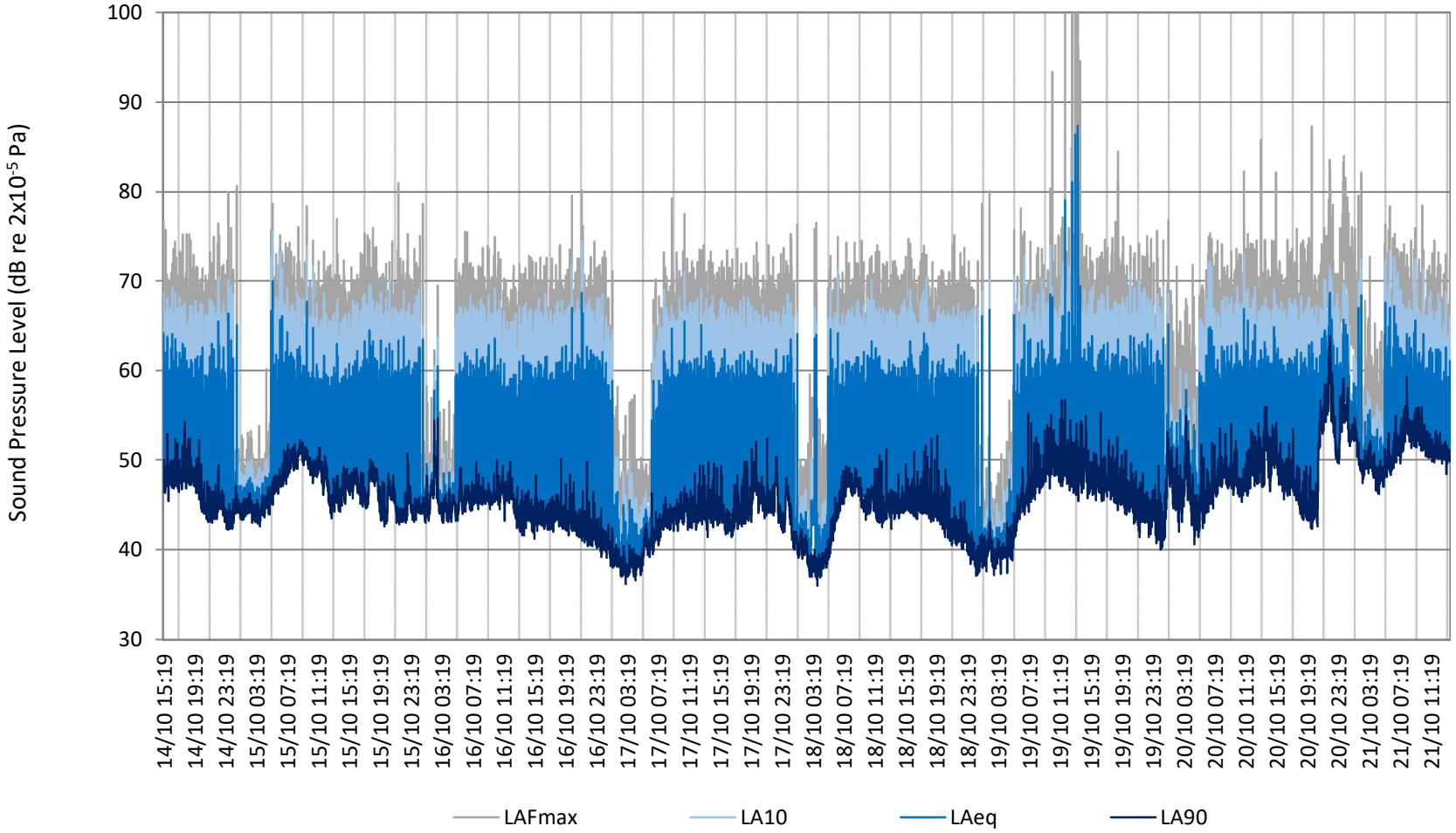
14 October 2021 to 21 October 2021



Yarnton Way, Belvedere - Position 3

Environmental Noise Time History

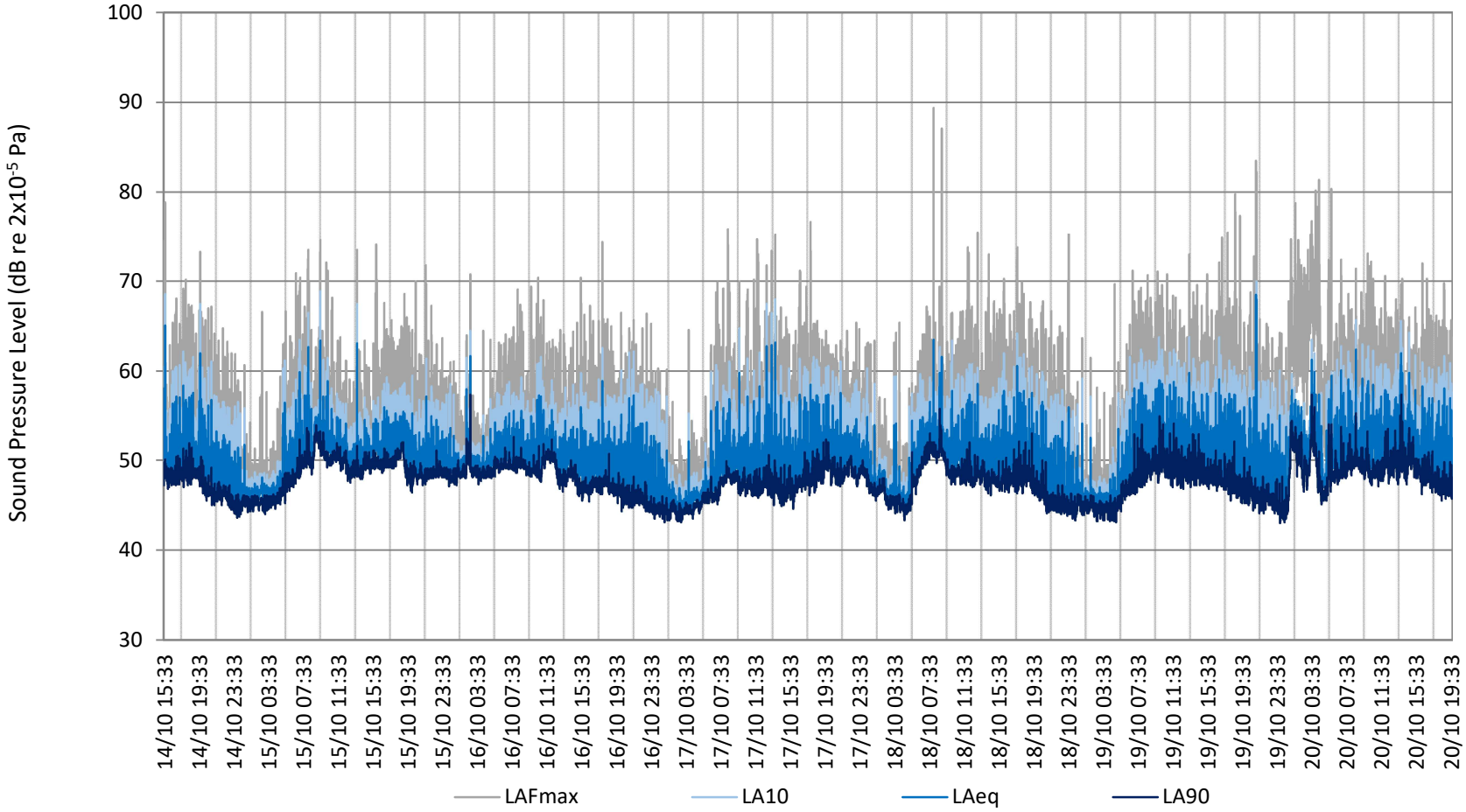
14 October 2021 to 21 October 2021



Yarnton Way, Belvedere - Position 4

Environmental Noise Time History

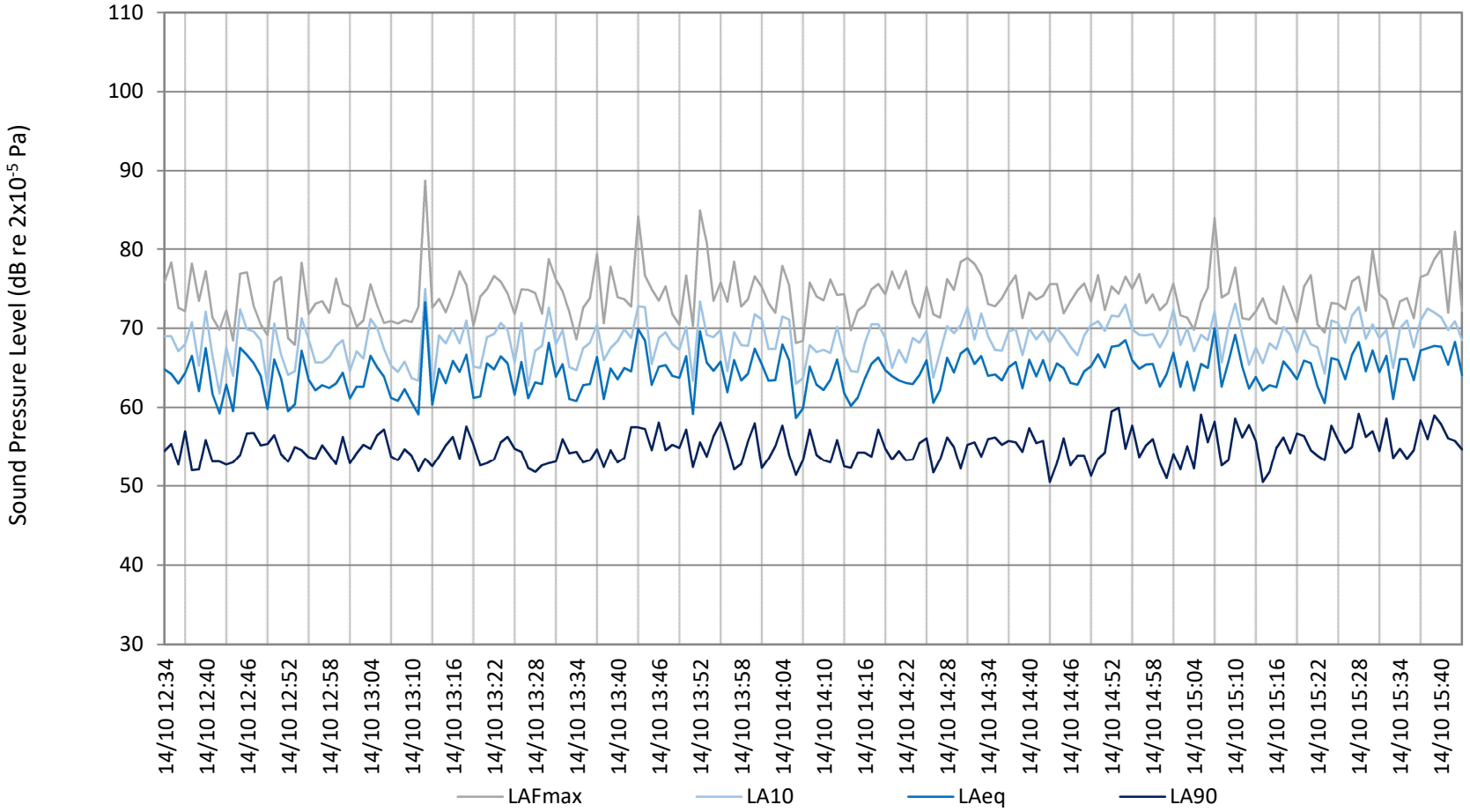
14 October 2021 to 20 October 2021



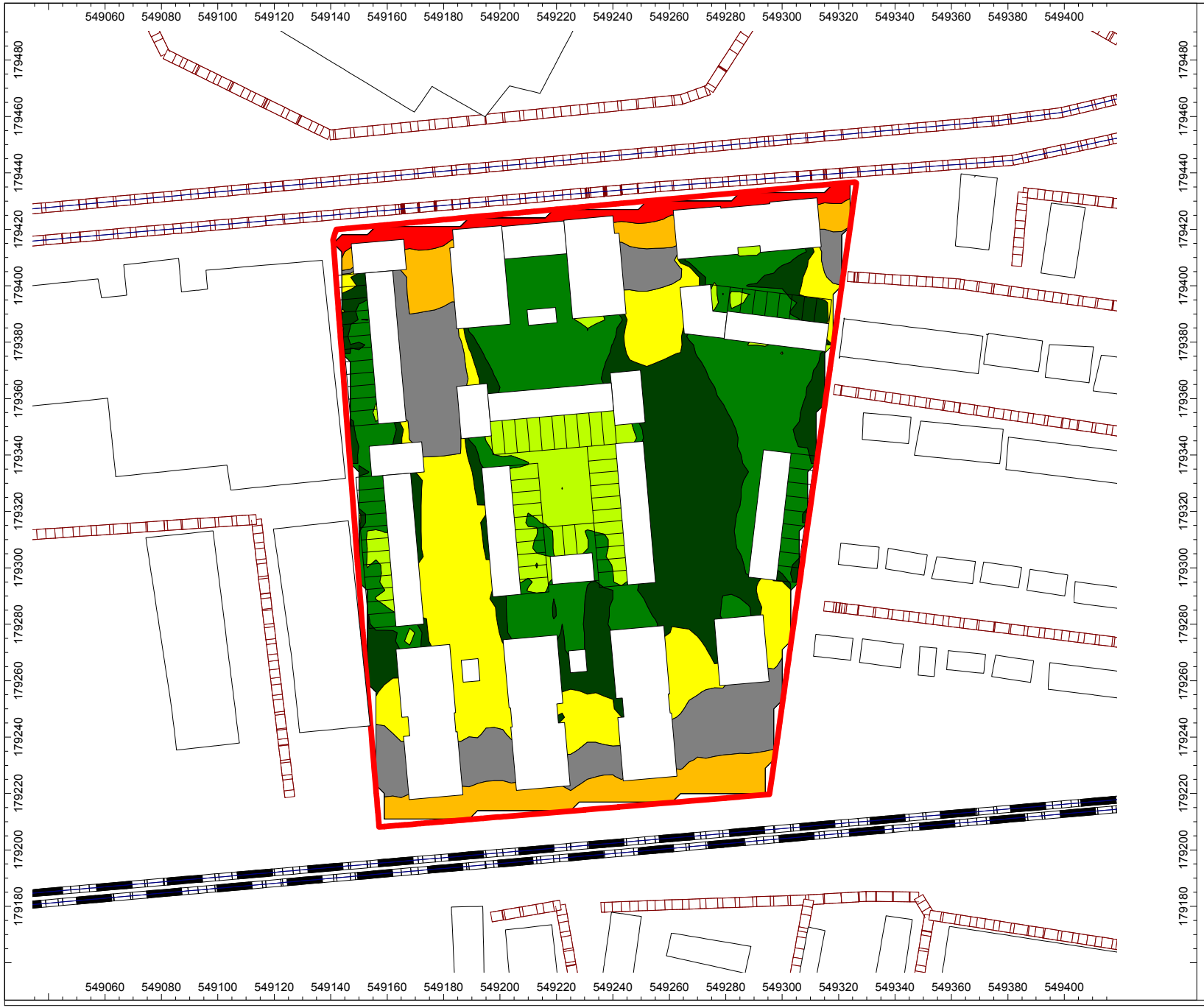
Yarnton Way, Belvedere - Position 5

Environmental Noise Time History

14 October 2021



APPENDIX B



Client:
Bellway Homes
(London Partnerships) Ltd

Project:
Yarnton Way, Belvedere

Date:
11/08/2023

Scenario:
Daytime dB LAeq, 16 hour
1.5m Grid Height

- > 35.0 dB
- > 40.0 dB
- > 45.0 dB
- > 50.0 dB
- > 55.0 dB
- > 60.0 dB
- > 65.0 dB
- > 70.0 dB
- > 75.0 dB
- > 80.0 dB
- > 85.0 dB

Red Line Boundary

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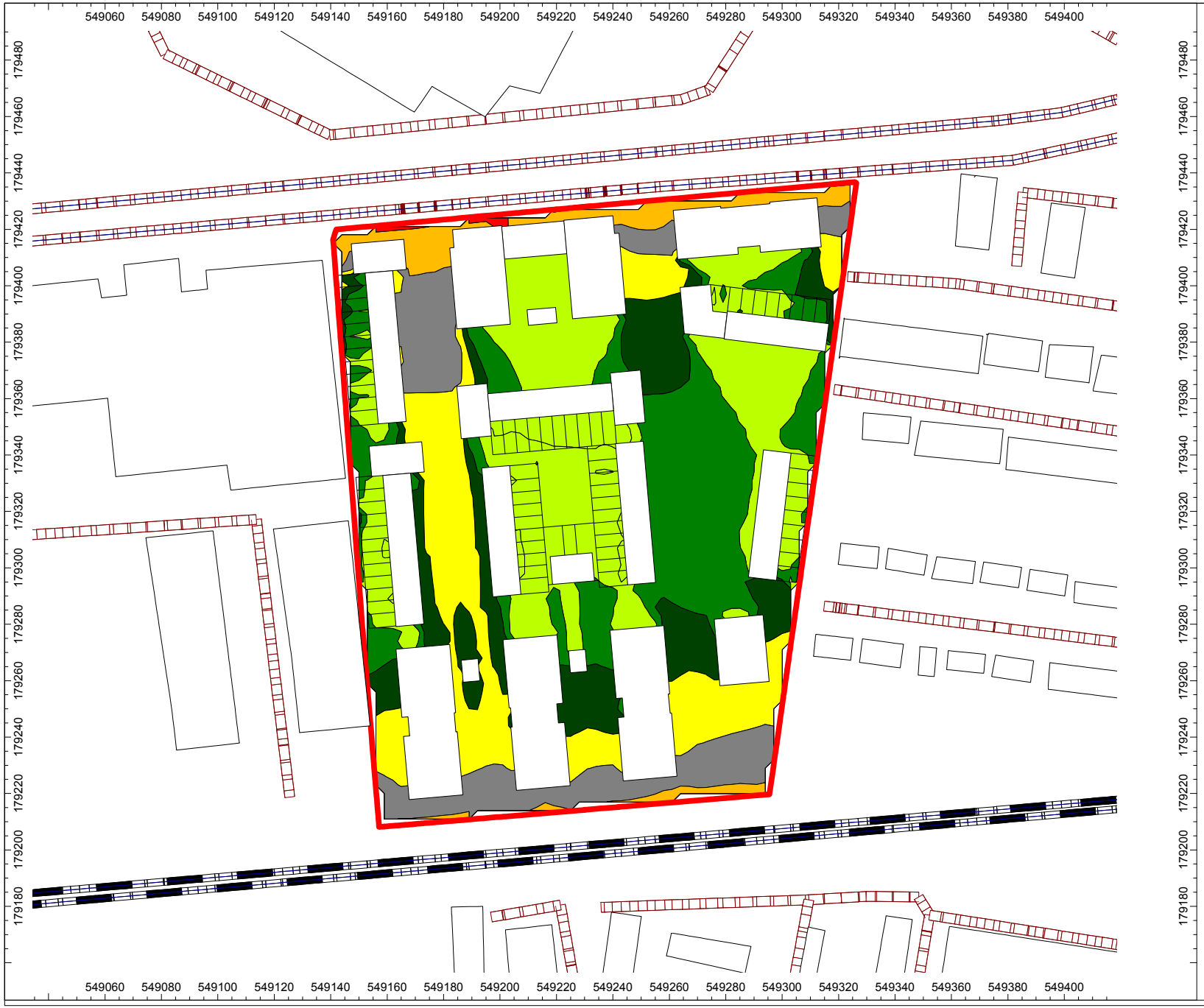

Client:
Bellway Homes
(London Partnerships) Ltd

Project:
Yarnton Way, Belvedere

Date:
11/08/2023

Scenario:
Night-time dB LAeq, 8 hour
4m Grid Height

- > 35.0 dB
- > 40.0 dB
- > 45.0 dB
- > 50.0 dB
- > 55.0 dB
- > 60.0 dB
- > 65.0 dB
- > 70.0 dB
- > 75.0 dB
- > 80.0 dB
- > 85.0 dB

Red Line Boundary

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APPENDIX C

Appendix C

Acoustic Design Statement – Yarnton Way, Belvedere

This Acoustic Design Statement (ADS) accompanies the Noise and Vibration Assessment for the development at Yarnton Way, Belvedere. 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 road traffic noise on Yarnton Way and by noise from the railway line. Noise levels are therefore highest at the northern and southern boundaries of the site and reduce towards the centre of the site. The majority of the site is therefore considered to be *medium* to *high* risk of adverse noise impact, with areas of the site set back from the surrounding road network tending towards a *low* to *medium* risk of adverse noise impact.

The design of the site will incorporate measures to ensure there is no 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.

Where new residential receptors are introduced, any change in the predominant noise source is expected to be due to changes in the volume of road traffic; however the number of expected movements is low in comparison to the baseline traffic conditions and therefore it is not expected that new residential receptors will significantly increase noise levels.

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 north of the site where ambient noise levels are higher due to road traffic noise from Yarnton Way as commercial use areas are less sensitive to noise. This is shown in Figure C1.

Figure C1 – Layout

Mechanical plant will be selected, located and if necessary attenuated to avoid adverse impact at the nearest receptors. As much as possible at the site commercial uses do not share separating walls with residential uses and are not located above residential uses anywhere at the site.

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

Where possible the design places balconies either on the sheltered side of buildings or set back from Yarnton Way and the railway line.

All residents will have access to a private balcony and in the majority of cases noise levels 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 a communal shared amenity space where the guidance noise levels in ProPG: Noise are met. Therefore, residents have a choice between their private balcony 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 low risk at the centre of the site medium to high risk at the northern and southern boundaries. However, principles of good acoustic design have been followed to minimise the potential impact of noise though; careful layout and orientation of buildings; zoning; use of dual aspect and buffer zones; self-screening and where appropriate façade mitigation. It is considered that the site is suitable on noise grounds and therefore planning may be granted subject to the inclusion of suitable noise conditions.

APPENDIX D

Traffic Flow Data

Road Name	2022 18h AAWT			Baseline 2023 18h AAWT			Future Baseline 2028 AAWT (06:00-00:00)			Future Baseline + Development 2028 AAWT (06:00-00:00)		
	Lights	HDV	HDV%	Lights	HDV	HDV%	Lights	HDV	HDV%	Lights	HDV	HDV%
Yarnton Way E (EB)	2905	576	17%	2934	582	17%	3069	609	17%	3278	610	16%
Yarnton Way E (WB)	4397	864	16%	4441	873	16%	4645	913	16%	4826	914	16%
Yarnton Way W (EB)	2905	576	17%	2934	582	17%	3069	609	17%	3228	610	16%
Yarnton Way W (WB)	4397	864	16%	4441	873	16%	4645	913	16%	4827	914	16%
A2041 N (NB)	10041	742	7%	10141	749	7%	10607	783	7%	10684	784	7%
A2041 N (SB)	10466	845	7%	10571	853	7%	11057	892	7%	11124	893	7%
A2041 S (NB)	8846	619	7%	8934	625	7%	9345	654	7%	9409	654	6%
A2041 S (SB)	8816	602	6%	8904	608	6%	9314	636	6%	9387	636	6%
Eynsham Drive (Two-Way)	10342	600	5%	10445	606	5%	10925	634	5%	10985	634	5%
Site Access (Two-Way)	-	-	-	-	-	-	-	-	-	734	4	1%

Change in Noise Levels

Road Name	Future Baseline 2028 AAWT (06:00-00:00)	Future Baseline + Development 2028 AAWT (06:00-00:00)	Change in Noise Level, dB
Yarnton Way E (EB)	3678	3888	0.2
Yarnton Way E (WB)	5558	5740	0.1
Yarnton Way W (EB)	3678	3838	0.2
Yarnton Way W (WB)	5558	5741	0.1
A2041 N (NB)	11390	11468	0.0
A2041 N (SB)	11949	12017	0.0
A2041 S (NB)	9999	10063	0.0
A2041 S (SB)	9950	10023	0.0
Eynsham Drive (Two-Way)	11559	11619	0.0

APPENDIX E

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Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAeq, 16h**

Room Dimensions and Areas		
Room volume	35.00	**- Based on typical size**
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

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A	
Measured Noise Level	65	58	55	54	55	49	40	35	58	
Façade to free field	0	0	0	0	0	0	0	0		
Angle of view	0	0	0	0	0	0	0	0		
Screening (Maekewa)	0	0	0	0	0	0	0	0		
Distance correction	0	0	0	0	0	0	0	0		
Other	4	4	4	4	4	4	4	4		**Correction based on noise model**
Noise level at façade (Leq)	69	62	59	58	59	53	44	39	62	

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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	46	32	24	21	15	11	-1	-6	24	
Lp (Direct)	44	30	22	19	13	9	-3	-8	23	**Criteria**
Lp (Rev & Direct)	48	34	26	23	17	13	1	-4	27	**≤ 35**
BS8233	48	34	26	23	17	13	1	-4	26	**≤ 35**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAeq, 8h**

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

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	62	55	51	51	50	43	33	23	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	
Other	5	5	5	5	5	5	5	5	
Noise level at façade (Leq)	67	60	56	56	55	48	38	28	58

Correction based on noise model

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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	44	30	21	19	11	6	-7	-17	22	
Lp (Direct)	42	28	19	17	9	4	-9	-19	20	**Criteria**
Lp (Rev & Direct)	46	32	23	21	13	8	-5	-15	24	**≤ 30**
BS8233	46	32	23	21	13	8	-5	-15	24	**≤ 30**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 1

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAmax**

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

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	73	71	75	69	68	59	50	40	72
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	6	6	6	6	6	6	6	6	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	79	77	81	75	74	65	56	46	78

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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	56	47	46	38	30	23	11	1	41	
Lp (Direct)	54	45	44	36	28	21	9	-1	39	**Criteria**
Lp (Rev & Direct)	58	49	48	40	32	25	13	3	43	**≤ 45**
BS8233	58	49	48	40	32	25	13	3	43	**≤ 45**

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Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAeq, 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

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	67	63	55	56	57	51	42	34	60
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	3	3	3	3	3	3	3	3	
Noise level at façade (Leq)	70	66	58	59	60	54	45	37	63

Correction based on noise model

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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	47	36	23	22	16	12	0	-8	26	
Lp (Direct)	45	34	21	20	14	10	-2	-10	24	**Criteria**
Lp (Rev & Direct)	49	38	25	24	18	14	2	-6	28	**≤ 35**
BS8233	49	38	25	24	18	14	2	-6	28	**≤ 35**

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Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAeq, 8h**

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

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A	
Measured Noise Level	64	61	53	54	53	47	38	28	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		
Other	3	3	3	3	3	3	3	3		**Correction based on noise model**
Noise level at façade (Leq)	67	64	56	57	56	50	41	31	60	

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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	44	34	21	20	12	8	-4	-14	23	
Lp (Direct)	42	32	19	18	10	6	-6	-16	21	**Criteria**
Lp (Rev & Direct)	46	36	23	22	14	10	-2	-12	25	**≤ 30**
BS8233	46	36	23	22	14	10	-2	-12	25	**≤ 30**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 2

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAmax**

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

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	78	76	68	69	70	63	52	39	73
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	6	6	6	6	6	6	6	6	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	84	82	74	75	76	69	58	45	79

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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	61	52	39	38	32	27	13	0	41	
Lp (Direct)	59	50	37	36	30	25	11	-2	39	**Criteria**
Lp (Rev & Direct)	63	54	41	40	34	29	15	2	43	**≤ 45**
BS8233	63	54	41	40	34	29	15	2	43	**≤ 45**

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Noise Break-in Calculation - Position 3

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAeq, 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

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A	
Measured Noise Level	51	50	51	51	47	39	33	54	55	
Façade to free field	0	0	0	0	0	0	0	0		
Angle of view	0	0	0	0	0	0	0	0		
Screening (Maekewa)	0	0	0	0	0	0	0	0		
Distance correction	0	0	0	0	0	0	0	0		
Other	3	3	3	3	3	3	3	3		**Correction based on noise model**
Noise level at façade (Leq)	54	53	54	54	50	42	36	57	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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	31	23	19	17	6	0	-9	12	18	
Lp (Direct)	29	21	17	15	4	-2	-11	10	16	**Criteria**
Lp (Rev & Direct)	33	25	21	19	8	2	-7	14	20	**≤ 35**
BS8233	33	25	21	19	8	2	-7	14	20	**≤ 35**

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Noise Break-in Calculation - Position 3

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAeq, 8h**

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

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	56	48	46	47	46	44	37	29	51
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	4	4	4	4	4	4	4	4	
Noise level at façade (Leq)	60	52	50	51	50	48	41	33	55

Correction based on noise model

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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	37	22	15	14	6	6	-4	-12	16	
Lp (Direct)	35	20	13	12	4	4	-6	-14	14	**Criteria**
Lp (Rev & Direct)	39	24	17	16	8	8	-2	-10	18	**≤ 30**
BS8233	39	24	17	16	8	8	-2	-10	18	**≤ 30**

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Noise Break-in Calculation - Position 3

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAmax**

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

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	82	74	67	69	71	73	69	63	78
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	6	6	6	6	6	6	6	6	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	88	80	73	75	77	79	75	69	84

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	41	39	38	47	43	46	46	43
Transmission Coefficient	0.000631	0.000079	0.000126	0.000158	0.000020	0.000050	0.000025	0.000025	
Average Transmission Coeff	0.002956	0.000684	0.000196	0.000136	0.000025	0.000042	0.000019	0.000019	
Average SRI	25	32	37	39	46	44	47	47	43

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	65	50	38	38	33	37	30	24	44	
Lp (Direct)	63	48	36	36	31	35	28	22	42	**Criteria**
Lp (Rev & Direct)	67	52	40	40	35	39	32	26	46	**≤ 45**
BS8233	67	52	40	40	35	39	32	26	46	**≤ 45**

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Noise Break-in Calculation - Position 4

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAeq, 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

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	59	53	49	49	48	41	37	35	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	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	59	53	49	49	48	41	37	35	52

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	19	24	24	32	37	42	43	48	35
Transmission Coefficient	0.012589	0.003981	0.003981	0.000631	0.000200	0.000063	0.000050	0.000016	
Wall SRI	28	34	43	55	66	77	85	85	55
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000	
Roof SRI	23	26	43	52	60	65	65	65	51
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000	
Ventilation, Dne	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	0.004683	0.001531	0.001383	0.000753	0.000346	0.000133	0.000130	0.000121	
Average SRI	23	28	29	31	35	39	39	39	35

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	38	27	22	20	15	4	0	-2	21	
Lp (Direct)	36	25	20	18	13	2	-2	-4	19	**Criteria**
Lp (Rev & Direct)	40	29	24	22	17	6	2	0	23	**≤ 35**
BS8233	40	29	24	22	17	6	2	0	23	**≤ 35**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 4

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAeq, 8h**

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

- Based on typical size

Total façade area	13.60

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	58	51	47	47	45	37	29	27	49
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	58	51	47	47	45	37	29	27	49

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	19	24	24	32	37	42	43	48	35
Transmission Coefficient	0.012589	0.003981	0.003981	0.000631	0.000200	0.000063	0.000050	0.000016	
Wall SRI	28	34	43	55	66	77	85	85	55
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000	
Roof SRI	23	26	43	52	60	65	65	65	51
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000	
Ventilation, Dne	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	0.004683	0.001531	0.001383	0.000753	0.000346	0.000133	0.000130	0.000121	
Average SRI	23	28	29	31	35	39	39	39	35

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	37	25	20	18	12	0	-8	-10	19	
Lp (Direct)	35	23	18	16	10	-2	-10	-12	17	**Criteria**
Lp (Rev & Direct)	39	27	22	20	14	2	-6	-8	21	**≤ 30**
BS8233	39	27	22	20	14	2	-6	-8	21	**≤ 30**

ARDENT CONSULTING ENGINEERS

Noise Break-in Calculation - Position 4

Description	
Ardent CE Project No.	**194180**
Property Address	**Yarnton Way, Belvedere**
Room Type	**Bedroom**
Parameter	**LAmax**

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

Room Absorption Calcuation	63	125	250	500	1000	2000	4000	8000	
Estimated Reverberation time	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Alpha bar	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Total Absorption	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27	
10Log S/A	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Façade level	63	125	250	500	1000	2000	4000	8000	A
Measured Noise Level	69	65	67	68	63	53	40	28	68
Façade to free field	0	0	0	0	0	0	0	0	
Angle of view	0	0	0	0	0	0	0	0	
Screening (Maekewa)	0	0	0	0	0	0	0	0	
Distance correction	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	
Noise level at façade (Leq)	69	65	67	68	63	53	40	28	68

Composite SRI	63	125	250	500	1000	2000	4000	8000	Rw
Glazing SRI	19	24	24	32	37	42	43	48	35
Transmission Coefficient	0.012589	0.003981	0.003981	0.000631	0.000200	0.000063	0.000050	0.000016	
Wall SRI	28	34	43	55	66	77	85	85	55
Transmission Coefficient	0.001585	0.000398	0.000050	0.000003	0.000000	0.000000	0.000000	0.000000	
Roof SRI	23	26	43	52	60	65	65	65	51
Transmission Coefficient	0.005012	0.002512	0.000050	0.000006	0.000001	0.000000	0.000000	0.000000	
Ventilation, Dne	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	0.004683	0.001531	0.001383	0.000753	0.000346	0.000133	0.000130	0.000121	
Average SRI	23	28	29	31	35	39	39	39	35

Calculated Internal Noise Level, dB	63	125	250	500	1000	2000	4000	8000	A	
Lp (Reverberant), line source	48	39	40	39	30	16	2	-10	38	
Lp (Direct)	46	37	39	37	28	14	1	-12	36	**Criteria**
Lp (Rev & Direct)	50	41	43	41	32	18	5	-8	40	**≤ 45**
BS8233	50	41	42	41	32	18	4	-8	40	**≤ 45**

APPENDIX F

Noise Impact During Overheating Risk Categories – Day & Night

Risk Category for Level 1 Assessment according to Table 3-2 Acoustics, Ventilation and Overheating: Residential Design Guide	
	High
	Medium
No markup	Low
	Negligible

APPENDIX G

RELEVANT POLICY & GUIDANCE

National Planning Policy Framework (NPPF) – July 2021

Under the NPPF: paragraph 185 of Section 15, with regard to environmental noise; Planning policies and decisions should aim to: -

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

Noise Policy Statement for England (NPSE)

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

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

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

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

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

National Planning Practice Guidance (2014)

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

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

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

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

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

Calculation of Road Traffic Noise – 1988

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

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

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

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

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

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

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

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

Control of Pollution Act 1974

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

The Environmental Protection Act 1990

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

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

The Building Regulations 2010

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

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

World Health Organisation

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

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

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

WHO also states the following paragraph with regard to the effects of LAmax 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 L_{Aeq}, 16hour	23:00 to 07:00 L_{Aeq}, 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 $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ 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."

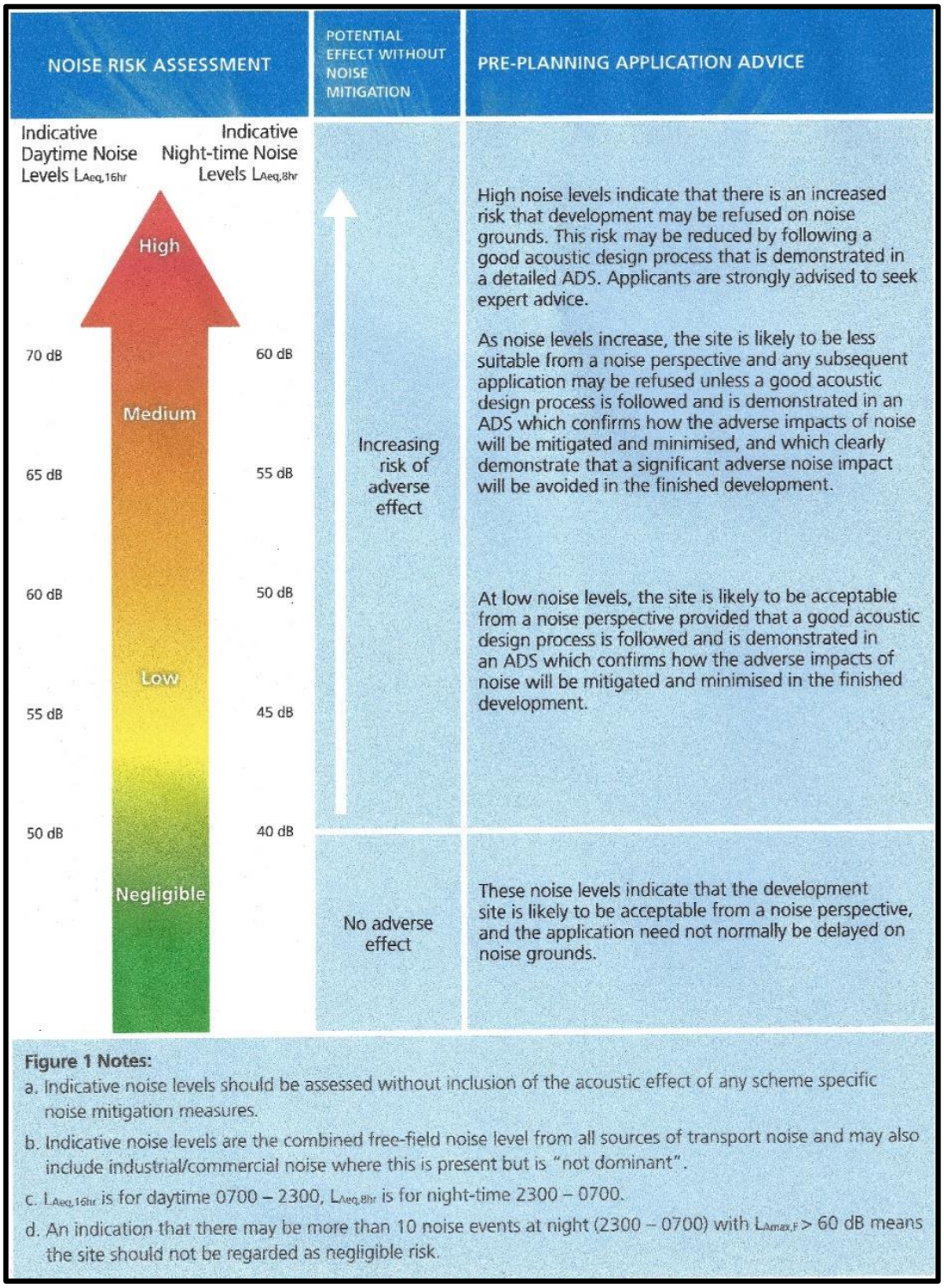

Figure 1: Extract from Figure 1 in ProPG – Initial Site Noise Risk Assessment

Acoustics Ventilation and Overheating - Residential Design Guide, January 2020

Acoustics Ventilation and Overheating (AVO) recommends an approach to acoustic assessments for new residential development taking consideration for acoustics, ventilation, and overheating. AVO states that the guidance can be used for other types of residential institution and therefore it is considered applicable to the site.

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

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

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

The Level 2 assessment suggests that assessment of the adverse effect from noise exposure should include an estimate of how frequently and for what duration the overheating condition occurs (Table 3-3 of the guidance)

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

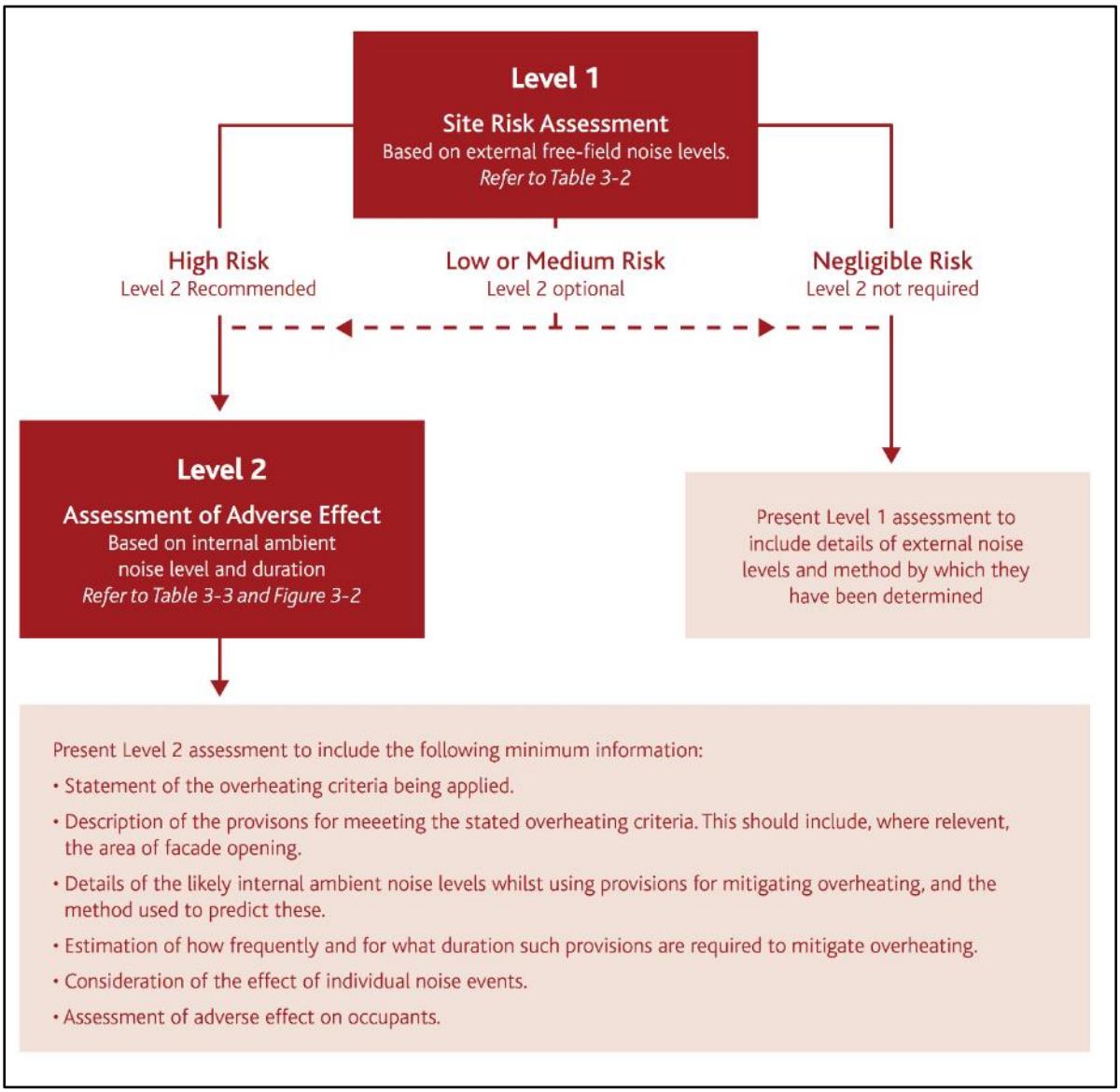

Figure 2: Two-level Assessment Procedure (Figure 3.1 of AVO Guidance)

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

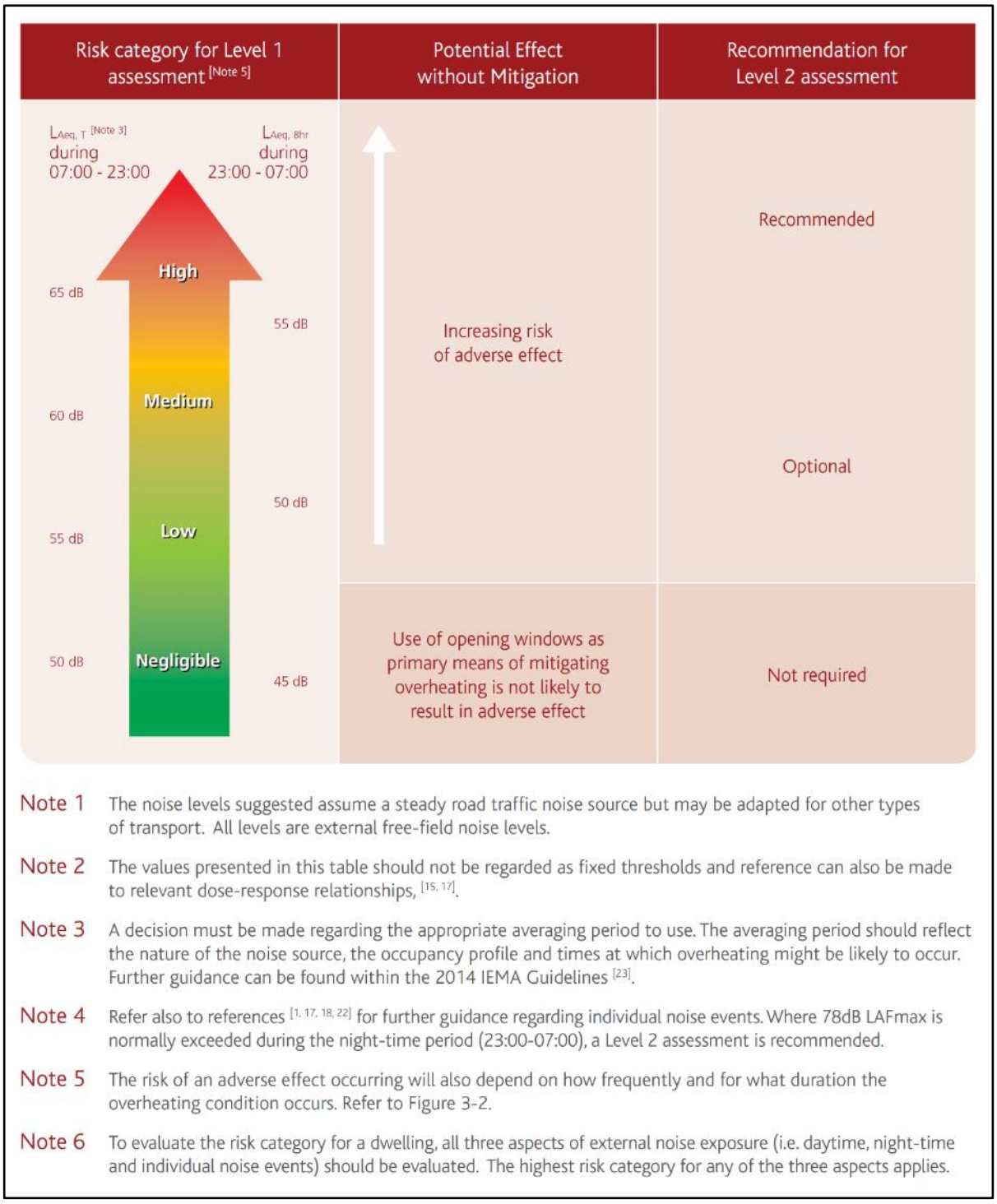

Figure 3: Level 1 Risk Assessment (Figure 3.2 of AVO guidance)

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

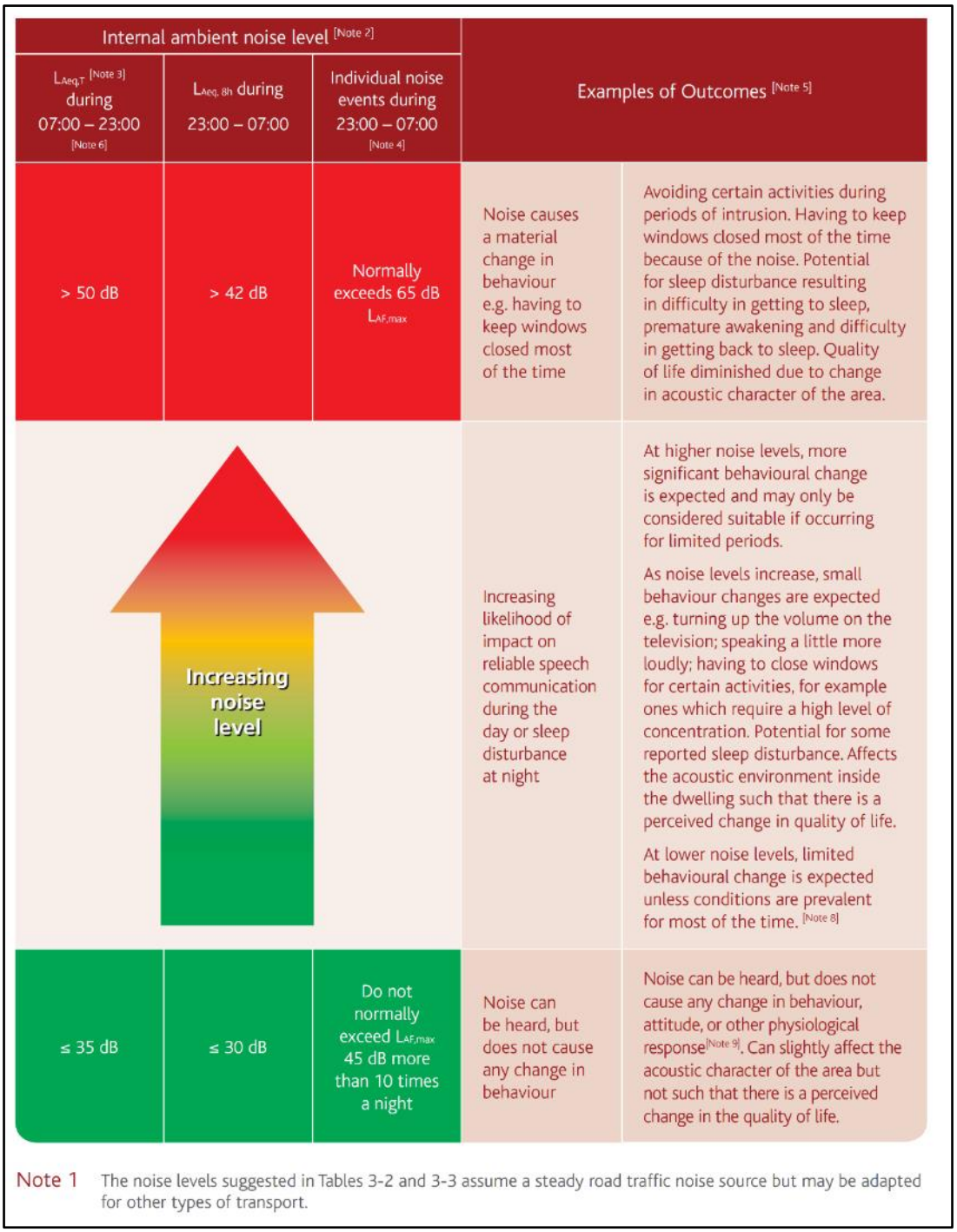

Figure 4: Level 2 Risk Assessment (Figure 3.3 of AVO guidance)

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.

BS6472-1:2008 – Guide to Evaluation of Human Exposure to Vibration in Buildings - Part 1: Vibration sources other than blasting

This document offers guidance on how people inside buildings respond to vibration: the judgement criteria are more stringent at higher frequencies than in the superseded standard due to changes in the vertical frequency weighting.

Assessment of building vibration with respect to human response: When the appropriately-weighted vibration measurements or predictions have been used to derive the VDV (Vibration Dose Value) for either 16hr (daytime) or 8h (night-time) at the relevant places of interest, their significance in terms of human response can be derived from Table 6, shown below:

Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings

Place and time	Low probability of adverse comment $m \cdot s^{-1.75}$ 1)	Adverse comment possible $m \cdot s^{-1.75}$	Adverse comment probable $m \cdot s^{-1.75}$ 2)
Residential buildings 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

NOTE For offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the above vibration dose value ranges for a 16 h day.

Table 6: Vibration Dose Values from BS6472-1:2008

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.

The London Plan 2021

The latest version of the London Plan, as published in March 2021, provides an overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years. The 'Publication London Plan' brings together the geographic and locational aspects of the Mayor's other strategies, including a range of environmental issues such as climate change (adaptation and mitigation), air quality, noise and waste.

The most relevant guidance in terms of the impact and assessment of noise is found within Policy D14: Noise, which states:

"…Policy D14 Noise

A *In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:*

1) *avoiding significant adverse noise impacts on health and quality of life*

2) *reflecting the Agent of Change principle as set out in Policy D13 Agent of Change*

3) *mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses*

4) *improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity)*

5) *separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation*

6) *where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles*

7) *promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

B *Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations…"*

Policy D14: Noise refers to Policy D13: Agent of Change, which states:

"…***Policy D13 Agent of Change***

A *The Agent of Change principle places the responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development. Boroughs should ensure that Development Plans and planning decisions reflect the Agent of Change principle and take account of existing noise and other nuisance generating uses in a sensitive manner when new development is proposed nearby.*

B *Developments should be designed to ensure that established noise and other nuisance-generating uses remain viable and can continue or grow without unreasonable restrictions being placed on them.*

C *New noise and other nuisance-generating development proposed close to residential and other noise-sensitive uses should put in place measures to mitigate and manage any noise impacts for neighbouring residents and businesses.*

D *Development proposals should manage noise and other potential nuisances by:*

1) ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area

2) exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations

3) separating new noise-sensitive development where possible from existing noise-generating business and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures.

E *Boroughs should not normally permit development proposals that have not clearly demonstrated how noise and other nuisances will be mitigated and managed…"*

London Borough of Bexley Local Plan

The London Borough of Bexley Local Plan provide policies which form a framework for development in the borough. Policy DP11:Achieving High Quality Design relates to noise and the design of the site and the relevant sections are reproduced below:

"POLICY DP11 Achieving high-quality design

1. Development proposals within a Primarily Residential Area, as defined on the Policies Map, must

seek to protect or enhance the area's character and its amenities. Proposals for uses other than those residential in nature, will only be acceptable where they provide community, social or leisure facilities, or employment uses compatible with a residential area.

2. Irrespective of location, all development proposals for new buildings, extensions and alterations, conversions, changes of use and public and private spaces will be expected to follow the principles and requirements set out in this document and to…

… ***Privacy, outlook and adverse impacts***

c. ensure that appropriate levels of privacy, outlook, natural daylight and other forms of amenity are provided

d. ensure existing properties' amenity is appropriately protected

e. ensure that all proposed development and uses do not unacceptably affect residents or occupiers of either the proposed development or of existing neighbouring residents, businesses and community facilities by means of noise, odour, vibration and light spill or other disturbances…"

APPENDIX H

ACOUSTIC TERMINOLOGY

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

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

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

LAeq,T : the equivalent A-weighted continuous sound level.

This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hours for daytime noise. It contains all the sound energy of the varying sound levels over the same time period and expresses it as a continuous sound level over that period. The unit is used for assessing traffic and industrial noise for planning purposes and in particular for PPG24.

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

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

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

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

LAmax : the maximum A-weighted level of sound over a period of measurement.

LAr,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.

Rw : weighted sound reduction index.

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

DnTw :

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