Cole Jarman

Station Yard, Twickenham

Planning Assessment

Report 19/0151/R1

Station Yard, Twickenham

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Report 19/0151/R1

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Table of Contents

Attachments

Glossary of Acoustic Terms

19/0151/SP1
Site plan showing attended noise and vibration measurement positions.

19/0151/SCH1
Schedule of attended noise measurement results.

19/0151/F1
Proposed layout showing locations of acoustic specifications.

19/0151/SPC1
Specification of acoustically rated building elements.

Appendix A
Planning and noise guidance.

End of Section

Planning Assessment

1 Introduction

1.1 It is proposed to construct a new residential development of 46 apartments across five to six storeys as part of the redevelopment of the existing Station Yard area within Twickenham town centre.

1.2 Cole Jarman have been appointed to undertake noise and vibration surveys and assessments for the proposed site in order to inform the design and planning processes.

1.3 This report sets out details of the aforementioned surveys undertaken at the site in order to quantify the existing noise climate and impact of vibration from the adjacent rail line, along with a noise intrusion assessment for the dwellings within the proposed development.

2 Site Layout

2.1 Existing Site Layout

2.1.1 The site, located on the corner of Station Yard and Railway Approach, Twickenham is currently functioning as a car park, and is shown on attached site plan 19/0151/SP1.

2.1.2 The site is bounded to the north by the rail lines serving Twickenham Station some 90m from the site's eastern boundary, which sees frequent train activity due to its location on the main line between Reading and London Waterloo Stations. Beyond this is Brewery Lane, the Twickenham Wharf residential apartment blocks and Exchange Theatre.

2.1.3 The site shares its southern boundary with Station Yard, which serves as a through road between the local residences and the A310 London Road via its connection on Railway Approach. Beyond the road to the south are a combination of residential flats and terraces that extend in a southerly direction along Grosvenor Road.

2.1.4 The A310, London Road overlooks the site due to its bridge over the nearby rail lines to the east. Bridge House, a large five storey office premises partially screens the site from London Road. The area beyond London Road to the northeast is occupied by Twickenham Station, which was undergoing major redevelopment works at the time of our noise survey, with up to five storeys of residential apartments being constructed over the station's footprint.

2.1.5 The area to the west of the site across Station Road is occupied by a public house and further residential premises running adjacent to the rail line.

2.1.6 The site is within the jurisdiction of The London Borough of Richmond.

2.2 Proposed Development

2.2.1 The proposed development is to feature 46 residential flats across five levels, with each flat having access to a private balcony.

3 Noise Survey

3.1 Methodology

3.1.1 In order to establish the existing noise climate on site, two attended noise surveys were undertaken at the site on Wednesday 28th August the hours of hours 0530 – 1300 and 2200 – 0200 on Thursday 29th August 2019.

3.1.2 Measurements of noise levels were taken from positions on the northern and southern site boundaries. These have been illustrated in attached site plan 19/0151/SP1, and are described below:

- MP1: Free-field position roughly 3m above local ground level along the site's northern boundary;
- MP2: Free-field position roughly 1.8m above local ground level along the site's southern boundary on Station Yard.

3.1.3 These positions were selected to quantify existing noise levels from the adjacent rail lines on the proposed site's northern facade, as well as representative noise levels from Station Road along the site's southern boundary.

3.1.4 Measurements of the L_{Aeq}, L_{Amax} and L_{A90} indices were recorded over consecutive 15-minute periods for the duration of the survey using the equipment listed within table T1 (see attached Glossary of Acoustic Terms for an explanation of the noise units used). The sound level analyser was also set to log noise levels at 1-minute intervals, to facilitate post processing of results.

Item	Manufacturer	Type
Sound Level Analyser	Rion	NL-52
Acoustic Calibrator	Rion	NC-74
Weatherproof windshield	Rion	WS-15

T1 Equipment used during attended noise survey.

3.1.5 In both instances, the microphone was fitted within a weatherproof enclosure, and the sound level meter calibrated before and after both surveys in order to confirm an acceptable level of accuracy. No significant drift was noted to have occurred across either survey period.

3.1.6 The weather conditions during the day time noise monitoring period were cloudy and cool with some breeze and damp roads. The weather conditions during the night time attended survey were cloudy, dry and cool with some breeze. These conditions are deemed acceptable and are not considered to have affected measurement results.

3.2 Results

3.2.1 The background noise climate on-site is controlled primarily by traffic noise emanating from London Road, with elevated noise levels during periods of vehicular activity along Station Yard/Railway Approach. Significantly elevated noise levels are noted during train activity along the site's northern boundary, with some trains sounding their horns during the daytime upon their arrival/departure into Twickenham Station. High aircraft flyovers and pedestrian activity as a result of footfall from the nearby Twickenham Station on Station Yard also had a minor effect on the noise levels on the site.

3.2.2 A summary of noise levels recorded at the measurement positions are presented in tables T2 and T3 below. More detailed results are set out within the attached schedule 19/0151/SCH1.

MP1: Site's northern boundary

Period	L_{Aeq}	L_{Amax}	L_{A90}
0530-0600	66	91^{+}	40
0600-0700	66	88	45
0700-0800	68	88	48
0800-0900	70	90	54
0900-1000	71	107*	53
1000-1100	77	114*	52
1100-1200	70	93	56
1200-1300	67	95	54

T2 Attended measurement results at position MP1.
$^{+}$birdsong close to microphone
*train horn

MP2: Site's southern boundary

Period	L_{Aeq}	L_{Amax}	L_{A90}
2200-2300	56	76	43
2300-2400	56	78	42
0000-0100	52	72	38
0100-0200	49	70	39

T3 Attended measurement results at position MP2.

4 Noise Assessment

4.1 Planning Guidance and Criteria

Planning Guidance

4.1.1 Guidance is available from various sources to aid our assessment and establish the criteria with which the development should strive towards. Full details of relevant national planning guidance, local planning policy and design criteria are included in Appendix A.

4.1.2 Richmond's Noise SPD contains guidance with respect to indoor ambient noise levels within its Table 1, which in turn is based on Table 4 of British Standard BS 8233:2014. This has been replicated below:

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

(iii) Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. *In noise sensitive rooms at night (e.g. bedrooms) individual noise events should not normally exceed 45dB L_{AFmax} more than 10 times a night*. This guideline is supported by advice contained in the WHO Community Noise Guidelines (2000).

T4 Table 1 of Richmond SPD Development Control for Noise Generating and Noise Sensitive Development.

4.1.3 With regard to noise levels in external amenity areas, paragraph 7.7.3.2 of BS 8233:2014 and section 5.3 of the Richmond Noise SPD state the following:

'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 50dB $L_{Aeq,T}$, with an upper guidance value of 55dB $L_{Aeq,T}$ 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.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying, washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces., which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.

4.1.4 It can be seen that external noise levels, in particular on small balconies to apartment blocks, are not proposed to be a controlling index by which suitability of a residential site is defined.

4.1.5 Under the topic of further considerations relating to the impact of noise on residential developments, the PPG states:

'The noise impact may be partially off-set if the residents of those dwellings have access to:

a relatively quiet façade (containing windows to habitable rooms) as part of their dwelling and/or;

a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or;

a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or;

a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance).'

4.1.6 This is not to say that access to the above items is mandatory, rather that it can help to offset any noise impacts.

Summary of Proposed Criteria

- Daytime internal noise levels within all habitable rooms no greater than 35dB $L_{Aeq,16h}$;
- Night time internal noise levels within all bedrooms no greater than 30dB $L_{Aeq,8h}$;
- Night time maximum noise levels within all bedrooms no greater than 45dB L_{Amax} for typical events occurring no more than 10 times during the night;
- Aspirational daytime noise levels in outdoor amenity areas ideally no greater than 55dB $L_{Aeq,16h}$ with noise levels above acceptable, providing that reasonable steps have been taken to mitigate as far as is practicable.

Summary of Proposed Criteria: Overheating Scenario

- Where openable windows are required (to prevent overheating etc.) an internal noise level of 45dB $L_{Aeq,16h}$ or 40dB $L_{Aeq,8h}$ should be achieved (i.e. 10dB above target levels with windows closed). This approximates to an external free field level of 57dB $L_{Aeq,16h}$ or 52dB $L_{Aeq,8h}$.
- Where these criteria are not met, appropriate means of cooling (e.g. enhanced ventilation rates or air conditioning) should be considered, as necessary to allow for sufficient overheating control to be provided with windows closed.

4.1.7 It should be noted that a draft version of an industry guidance document, *Acoustics, Ventilation and Overheating Residential Design Guide*, suggests that levels up to 5dB higher than specified above would be acceptable while using openable windows to prevent overheating. However, as this guidance has not been formally adopted, we have opted to apply the more stringent criteria of the ProPG guidance.

4.2 Assessment and Mitigation

4.2.1 Based on the results of the noise surveys, day and night time noise levels have been derived for each proposed façade of the building for the purposes of the assessment.

North façade

4.2.2 At measurement position MP1 trains are the most significant noise source. The daytime noise survey period (07:00-13:00h) included the morning rush hour where trains are more regular than during off-peak times. Taking the measured 72dB $L_{Aeq,6h}$ to be representative of the full 16-hour daytime period for the purposes of the assessment is therefore considered a robust approach.

4.2.3 During the night time survey period at MP1 (05:30 – 07:00h) trains were passing regularly throughout. Through inspection of train timetables, it can be seen for the majority of the night time period trains would be less frequent. Taking the measured 66dB $L_{Aeq,90min}$ to be representative of the full 8-hour night time period for the purposes of the assessment is therefore considered a robust approach.

4.2.4 These levels have been used as the basis for our assessment of noise incident on the northern façade, which runs adjacent to the rail line and therefore has a full view of all train movements.

East and West façades

4.2.5 Angle-of-view and distance corrections have been applied to these MP1 noise levels to derive appropriate levels for the assessment of noise break-in to the scheme's east and west (side) façades.

South façade

4.2.6 The southern façade of the proposed building will be significantly screened from rail noise. To calculate the future noise levels at this location it is therefore necessary to separate trains from

other sources in the survey results. All instances of train pass-bys have been removed from the measured survey data through cross-reference of the measured 1-minute profile noise levels and on-site notes as summarised in tables below:

Time	L_{Aeq} all noise sources (dB)	L_{Aeq} from all noise sources excluding trains (dB)
0530-0600	66.4	52.7
0600-0700	65.5	59.2
0700-0800	68.2	62.0
0800-0900	69.5	59.1
0900-1000	71.4*	59.9
1000-1100	77.2*	57.7
1100-1200	69.7	59.1
1200-1300	67.5	58.1

T5 MP1 noise levels including and excluding effects of passing trains
*affected by train horn

Time	L_{Aeq} all noise sources (dB)	L_{Aeq} from all noise sources excluding trains (dB)
2200-2300	56.1	52.4
2300-0000	56.2	54.3
0000-0100	51.7	49.3
0100-0200	50.0	48.9

T6 MP2 noise levels including and excluding effects of passing trains

4.2.7 The road traffic noise across the site is relatively consistent, the MP1 measurement results from all sources excluding trains is therefore taken to be representative of the south façade. This gives noise levels during the daytime of 59dB $L_{Aeq,7h}$ (07:00-13:00h and 22:00-23:00h) and during the night time of 55dB $L_{Aeq,4.5h}$ (05:30-07:00h and 23:00-02:00h). An estimate of train noise reflected to the south façade has been made by applying relevant corrections to the MP1 measurement results, this has been added to the stated day and night levels.

L_{Amax} noise levels

4.2.8 As a full night time period was not measured at MP1, the highest recorded L_{Amax} value caused by a train passby during the night time period of 88dB has been used to ensure a robust assessment.

4.2.9 Appropriate corrections have been applied to calculate the typical L_{Amax} levels at other locations.

Incident noise levels

4.2.10 The resultant L_{Aeq} and L_{Amax} noise levels used in our assessment for each façade are set out within table T7.

Position	Daytime $L_{Aeq,16h}$, dB	Night time $L_{Aeq,8h}$, dB	Night L_{Amax}, dB (typical)
North (rear) façade	72	66	88
East & West (side) façades	67	61	85
South (front) façades	61	56	67

T7 Derived noise levels at various façades.

Internal Noise Levels

4.2.11 In order to adequately control noise break-in to habitable rooms and bedrooms throughout the development, it will be necessary for the various elements of the external building fabric to provide certain minimum levels of sound insulation performance. An assessment of noise intrusion has therefore been undertaken based on the results of the noise survey.

4.2.12 Room dimensions have been based upon plans produced by *Wilmshurst Pelleriti*, issued September 2019. If the room or glazing dimensions are to vary significantly from what is shown in the plans and elevations provided, a review of the scheme of mitigation will be required.

4.2.13 The assessment has been based on the following scheme drawings:

- WP-0689-A-0100-P-L0;
- WP-0689-A-0101-P-L1; and
- WP-0689-A-0105-P-L5.

4.2.14 Following discussions with the project team, it has been established that the façade construction will feature a masonry outer leaf with plasterboard inner face. The plasterboard lining within apartments on the north, west and east façades should comprise two layers of dense plasterboard mounted on studs independent of the masonry. This distance between the masonry and the inner face of the plasterboard should be ≥150mm. The cavity should contain ≥100mm un-faced mineral wool/fibreglass insulation. It may be acceptable acoustically to use alternative heavy or lightweight façade options, subject to review at detailed design stage. It is assumed a concrete roof is to be used. Lightweight roof options would require specific attention if under consideration.

4.2.15 In order to control external noise intrusion to rooms throughout this development such that the internal noise criteria set out within section 4.1 can be met, glazing with a sound insulation performance greater than that which is achievable using basic thermal glazing will be required for all windows and balcony doors across the development. The specification of these are dependent on the façade's view on the adjacent train line due to the varying noise levels across the site as per table T7.

4.2.16 Minimum sound reduction specifications have been calculated for each façade location and these are presented in the attachment 19/0151/SPC1. The specification should be read in conjunction with figure 19/0151/F1.

4.2.17 The assessment indicates that is possible to provide a suitable internal noise environment to protect the amenity of future residents with windows closed. However, ventilation will need to be considered, as detailed in section 4.3 below.

Balcony Noise Levels

4.2.18 As can be seen looking at the derived noise levels in table T7, the aspirational noise targets for external amenity areas defined within BS 8233 are exceeded at all façades.

4.2.19 Noise levels on all façades (most notably those on the rear and sides) should be reduced as far as possible through the use of solid parapets/balustrades to balcony fronts.

4.2.20 It should be noted as per the guidance in BS 8233:2014, the aspirational noise targets are not applied to small balconies. As such the recommendations set out in section 4.2.19 above are taken as a recommendation of best-practice.

4.2.21 With regard to the PPG commentary in paragraphs 4.1.5 and 4.1.6, the site is 400m from Moormead and Band Recreation Ground, 460m from Diamond Jubilee Gardens and 570m from York House Gardens to the south. This gives residents of the scheme access to three large public amenity spaces within a 9-minute walking distance, which should be considered in the context of the scheme location.

4.3 **Ventilation**

4.3.1 To maintain suitable internal noise levels across the development, background ventilation rates will need to be provided when the windows are closed.

4.3.2 Windows should not be sealed, but openable for times when purge ventilation is required (examples given in Approved Document F include purging of fumes from burnt food when cooking or removal of fumes when painting).

4.3.3 MVHR units are proposed to provide background noise ventilation to flats on the north, west and east façades. Noise from such systems must be taking into account, both to the inhabitants of the dwelling that the system is serving and to any nearby external noise-sensitive receivers.

4.3.4 We recommend that the following noise criteria are applied to operating in background ventilation mode, with a 5dB tolerance for boost mode under the user's control:

- Bedrooms NR25;
- Living Rooms NR30;
- Bathrooms NR35;
- Corridors NR40.

4.3.5 Typically to achieve these criteria would be locating the unit carefully (e.g. within a store cupboard), room-side in-duct attenuators to control fan noise, suitable anti-vibration mounts to minimise structureborne noise.

4.3.6 With the above noted ventilation options introduced together with the recommended glazing performances, the internal noise criteria will be protected to provide suitable levels of amenity in line with the criteria set out in section 4.1.

Control of Overheating

4.3.7 The following commentary on overheating and noise is provided in paragraph 2.34 of ProPG, published in 2017:

'Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to the transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment.'

4.3.8 A consultation draft of an industry guidance document, *Acoustics, Ventilation and Overheating Residential Design Guide* (AVO) was published in February 2018 by the Association of Noise Consultants (ANC).

4.3.9 Table B-4 of AVO provides guidance on acceptable means of providing overheating control (i.e. addressing the thermal comfort requirement above); other technologies are available but their suitability should be confirmed by the appropriate consultancies.

- Passive Ventilative Cooling (openable windows or large format ventilators) – Rooms are ventilated by cross-ventilation by significant openings in the façade;

- Mechanical Ventilative Cooling – Ventilation is mechanically driven by using fans; either as an independent system or a boost mode of an MVHR system. The use of such a system may remove the need for passive trickle ventilators;

- Mechanically Cooled Air – Ventilation is provided by air conditioning (or comfort cooling) system.

4.3.10 As previously noted, to utilise openable windows to provide overheating control, internal noise levels should be no greater than 45dB $L_{Aeq,16h}$ during the day and 40dB $L_{Aeq,8h}$ during the night

time. As an external level, this is 57dB $L_{Aeq,16h}$ and 52dB $L_{Aeq,8h}$, with a 12dB sound reduction being taken for a partially open window. Where noise levels are above these criteria, such as in the case for all façades of the Station Yard development, an alternative overheating control strategy will be necessary, which allows windows to remain closed.

4.3.11 On this basis, it is recommended the ventilation systems utilised on all façades have a user operated 'boost' setting to increase ventilation rates to provide Mechanical Ventilative Cooling.

5 Vibration Survey & Assessment

5.1 Criteria

5.1.1 Advice on acceptable levels of vibration can be found in BS 6472:2008-1. This standard uses the concept of Vibration Dose Values (VDVs) to consider the likely impact of vibration upon people. The measured vibration levels are first weighted, using curves described in BS 6841:1987 to give an overall weighted acceleration level, before a calculation procedure is applied to derive the VDV.

5.1.2 Two different constant vibration sources with different frequency characteristics, but with the same overall weighted acceleration levels could be considered to be equally annoying or not, as the case may be. The VDV is derived by totalling the time exposure to the particular weighted acceleration levels over a particular period. The totalling procedure is however heavily weighted towards the higher vibration levels, rather than the time exposure, as for example, a high level of vibration exposure for 30 seconds is more intrusive than a level half of that for an exposure of 1 minute.

5.1.3 BS 6472:2008's guidance on VDVs is set out within table T8 below. The London Borough of Richmond's VDV requirements per their Noise SPD correspond to the table's '*Low probability of adverse comment*' column.

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

(1) Below these ranges adverse comment is not expected
(2) Above these ranges adverse comment is very likely

T8 BS 6472:2008 Table 1. Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings.

5.2 Survey Methodology & Instrumentation

5.2.1 Tri-axial vibration measurements were conducted at a single location alongside the morning attended noise survey on Wednesday 28th August 2019 between the hours of 0530-1300.

5.2.2 The measurement position is marked on the attached site plan 19/0151/SP1 as position VB1 and is described below:

- VB1: Local ground level on existing asphalt surface approximately 3m from closest railhead, similar to the site's proposed northern façade.

5.2.3 Measurements were made using a real-time analyser continuously logging the 1/3 octave band (0.5Hz – 80Hz) RMS values and calculating the corresponding VDV values in accordance with the methodology set out within BS6472. The passing of trains was manually compared to the expected station schedule and noted when present at the time of survey.

5.2.4 During the measurements, numerous passenger trains passed the site, as well as two freight trains. Vibration measurements were made using the information as detailed in table T9 below.

Item	Manufacturer	Type
Laptop with integral 4-channel analyser interface, running Samurai real time analyser software	Sinus	Soundbook MK1 Samurai Version 2.8
Accelerometer	Svantek	SA207B

T9 Equipment used during attended vibration survey.

5.2.5 Measurements at position VB1 were made in the horizontal and vertical axes, however the vertical axis was found to be dominant, as is typically the case for railway-generated vibration.

5.3 Results and Discussion

5.3.1 VDV values were measured between 0518 and 1304 hours on Wednesday 28th August 2019. By comparing the measured vibration data with notes taken on site and historical arrival departure information for Twickenham Station from Network Rail's open data feed platform, courtesy of *realtimetrains.co.uk*, representative VDVs have been derived for trains travelling across each line in to Twickenham Station in order to calculated representative 16-hour daytime and 8-hour night time VDVs.

5.3.2 Freight activities were observed along both the east and westbound lines through Twickenham Station while on site. To ensure a pessimistic assessment of the impact of freight movement on residences, the largest number of freight forecast over a week (7 in both a day and night time period) period through Twickenham Station has been factored in to our calculation of the 16 and 8-hour day and night time VDV values.

5.3.3 The 16h daytime and 8h night time VDVs derived on this basis are set out within table T10.

Time Period	Axis	Vibration Dose Value $ms^{-1.75}$
16-hour daytime $VDV_{b,day}$	Z-axis vertical	0.06
8-hour night time $VDV_{b,night}$	Z-axis vertical	0.05
16-hour daytime $VDV_{d,day}$	X-axis parallel with rail lines	0.00
8-hour night time $VDV_{d,night}$	X-axis parallel with rail lines	0.00
16-hour daytime $VDV_{d,day}$	Y-axis perpendicular to rail lines	0.00
8-hour night time $VDV_{d,night}$	Y-axis perpendicular to rail lines	0.00

T10 Calculated Vibration Dose Values.

5.3.4 Measured levels of vibration have been compared with the criteria in BS6472. It can be seen that the worst-case vertical vibration experienced on site would still not be expected to reach even the range of '*low probability of adverse comment*'. Vibration therefore should not be considered as a major obstacle for the development.

5.3.5 It is assumed the upper floors of the building will comprise suspended concrete slabs and that piled foundations will be used.

5.3.6 Some minor amplification in ground borne vibration would be expected due to suspended floor slabs, but this would be countered by the attenuation of vibration levels as it passing from the ground into the foundations of the building.

6 Conclusions

6.1 It is proposed to construct a new residential development of 46 apartments across five to six storeys as part of the redevelopment of the existing Station Yard area within Twickenham town centre.

6.2 Cole Jarman have conducted an unattended noise survey at the site in order to establish the existing noise climate. Details of this survey and subsequent noise intrusion assessment have been provided within this report.

6.3 Acoustic performance requirements have been set out for the various external façade building elements. Taking account of the recommendation set out, the assessment indicates that a suitable internal noise climate can be achieved with windows closed. It should be noted however that it is recommended the ventilation systems utilised on all façades have a user operated 'boost' setting to increase ventilation rates to provide Mechanical Ventilative Cooling.

6.4 A vibration survey has also been undertaken on site. The measured Vibration Dose Values have been compared with the relevant British Standard and London Borough of Richmond requirements. The guidance indicates that vibration levels on site are below the range in which there would be a low probability of adverse comments. BS6472 therefore advises that at this level, *'adverse comment is not expected'*.

6.5 Noise and vibration should not therefore be considered as an obstruction to a decision to grant planning permission, subject to the development incorporating suitable mitigation measures as described.

End of Section

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_{n}.

L_{AX}, L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

End of Section

Cole Jarman

Figure 19/0151/SP1

Title:

Site plan illustrating attended noise and vibration measurement positions

North

Project:

Station Yard, Twickenham

Date:

September 2019

Revision:

-

Scale:

Not to scale

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Attended Noise Survey Results

Measurement Position 1

Period	L_{Aeq}	L_{Amax}	L_{A90}
0530-0545	67.9	90.8+	40
0545-0600	63.8	86.1	43.9
0600-0615	63.9	81.5	45.3
0615-0630	66.8	88.1	47.3
0630-0645	63.8	86.4	47.8
0645-00700	66.5	87.5	51.5
0700-0715	68.5	88.2	48.2
0715-0730	68.4	87.9	48.8
0730-0745	68.4	86.7	51.4
0745-0800	67.4	86.9	53.2
0800-0815	68.4	86.2	54.2
0815-0830	68.2	87.4	53.7
0830-0845	70.6	88.3	55.7
0845-0900	70.3	89.5	56.5
0900-0915	66.4	86.3	55.1
0915-0930	68.1	87.1	54.9
0930-0945	64.9	88.2	52.8
0945-1000	76.1	107.3*	54.2
1000-1015	80.1	113.6*	52.7
1015-1030	79.5	110*	52.6
1030-1045	69.2	91.7	51.9
1045-1100	68.5	90.5	55.5
1100-1115	72.2	92.6	62.3
1115-1130	69	87.3	56.3
1130-1145	67	87.3	56.2
1145-1200	68.4	88.1	56.2
1200-1215	66.2	94.5	55.9
1215-1230	68.5	86.7	55.8
1230-1245	66.5	88.3	54.5
1245-1300	68.1	85.8	53.8

+Bird song
*train horn

Measurement Position 2

Period	L_{Aeq}	L_{Amax}	L_{A90}
2200-2215	53.7	69.2	45
2215-2230	58.3	75.9	45.6
2230-2245	55.3	74.2	43.4
2245-2300	55.8	71.4	43
2300-2315	54.9	75.3	43.5
2315-2330	54.4	73.2	42.2
2330-2345	58.3	77.7	46.1
2345-0000	55.9	76.2	41.9
0000-0015	54.6	70.7	42.5
0015-0030	52.1	72.2	39.2
0030-0045	47.7	65.4	38.2
0045-0100	48.9	64.7	39.9
0100-0115	49.1	69.8	41.3
0115-0130	50	68	40.5
0130-0145	50.8	61.9	39.1
0145-0200	45.5	59.5	39

North

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Figure 19/0151/F1

Title:

Proposed layout showing locations of acoustic specifications

Key

- Facade Type A
- Facade Type B
- Facade Type C

To be read in conjunction with specification 19/0151/SPC1

Project:

Station Yard, Twickenham

Date:

October 2019

Revision:

1

Scale:

Not to scale

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Specification 19/0151/SPC1

Subject:	**External Building Fabric Element Sound Reduction Performance Requirements**		
Project:	**Station Yard, Twickenham**		
Date:	**September 2019**	**Prepared:**	**AS**
Revision:	**0**	**Approved:**	**AE**

This specification covers the acoustic performance requirements for the different elements of the façade construction on the Station Yard Development, in order to control noise intrusion to the residential properties within and meet the specific internal noise criteria. The specific elements of the façade covered by this specification are as follows:

1. Glazing (Windows & Balcony doors)
2. Ventilation

This specification is to be read in conjunction with figures 19/0151/F1, which identify three façade types A, B and C. Each type A-C is assigned an acoustic performance in the following sections of this specification and example construction types provided, which would be expected to meet the performance required.

1 Glazed Elements

1.1 Glazing

The following tables in this section on pages 2 and 3 of this specification set out the sound reduction performance requirements for the glazing on Façade Types A-C on the development.

The indicative R_w values and indicative glazing configurations quoted in the table on page 2 overleaf are for guidance only; alternative configurations may be utilised.

The octave band sound reduction performances quoted in the table on page 2 overleaf must be achieved by the glazing systems taken as a whole in their installed condition. The specification therefore applies to the glazing, the frames and all seals on any openable parts of the systems and any required ventilation or condensation control systems. This list is not exhaustive: no part of the glazing system shall cause the figures within the tables not to be achieved.

The supplier should be expected to prove by means of certified test results that the above sound reduction figures can be achieved by the system being proposed. The tests shall be

conducted in accordance with BS EN ISO 10140:2010 Parts 1 to 5, or BS EN ISO 140:1998 Part 5.

	Sound Reduction Index (SRI, dB) at Octave Band Centre Frequency (Hz)						Indicative R_w
	125	**250**	**500**	**1k**	**2k**	**4k**	
Façade Type A Glazing							
Studios							
Indicative glazing type *14mm glass / 24mm air space / 8mm glass*	34	41	44	43	50	50	**46**
Bedrooms							
Indicative glazing type *14mm glass / 22mm air space / 12mm glass*	33	40	40	43	50	50	**45**
Façade Type B & C Glazing							
Indicative glazing type *11mm laminated glass / 15mm air space / 8mm glass*	26	27	34	37	38	46	**36**

T1 Glazing sound reduction performance requirements for façade types A-C.

It should be noted that the glazing serving any Living Rooms along the façade type C should meet the specification for the façade type C glazed doors as set out within the following table T2.

1.2 Balcony Doors

	Sound Reduction Index (SRI) at Octave Band Centre Frequency (Hz)						Indicative R_w
	125	250	500	1k	2k	4k	
Façade Type A Door							
Indicative triple glazed door type 17mm laminated glass / 12mm air gap / 6mm float glass / 10mm air gap / 12mm laminated glass	34	39	43	42	47	53	**45**
Façade Type B Door							
Indicative double glazed door type 11mm laminated glass / 15mm air space / 8mm glass	26	30	34	37	38	46	**37**
Façade Type C Door							
Living Rooms *Indicative double glazed door type 6mm glass / 15mm air space / 4mm glass*	23	22	33	37	38	38	**35**

T2 Glazed balcony door sound reduction performance requirements for façade types A-C.

2 Ventilation

Table T3 overleaf on page 4 of this specification sets out the octave band and indicative single figure sound reduction performance requirements for the ventilators to the different residential rooms for façade types A-C on the buildings. Specific details of the ventilation requirements for each façade type A-C are as follows:

Façade Types A & B

A mechanical supply and extract ventilation system will be required to remove the need to rely upon openable windows to provide background and rapid/increased ventilation in these locations. The systems supplied should utilise continuously operating fans with a user operated setting to allow an increased ventilation rate when desired. It is anticipated ventilation systems complying with the requirements of Building Regulations Approved Document F 2010 System 4 (MVHR) would be suitable.

Atmospheric air intake and outlet ductwork terminations must not cause the internal criteria to be exceeded due to external noise intrusion. Concealing ductwork above an imperforate plasterboard ceiling (nominal 10kg/m^3) is expected to be sufficient in most locations.

External Building Fabric Element Sound Reduction Performance Requirements

Façade Type C

A partial or full mechanical ventilation system will be required to remove the need to rely upon openable windows to provide background ventilation in these locations. The systems supplied should utilise continuously operating fans – with a user operated setting, where possible, to allow an increased ventilation rate when desired. It is anticipated that systems complying with the requirements of System 1, System 3 or System 4 as defined within Building Regulations Approved Document F 2010 would be suitable.

Atmospheric air intake and outlet ductwork terminations must not cause the internal noise criteria to be exceeded due to external noise intrusion. Concealing ductwork above an imperforate plasterboard ceiling (nominal 10kg/m^2) is expected to be sufficient in all locations.

Trickle Vents

Trickle vents are not permitted on Façade Types A&B. Within other façade types, ventilation systems incorporating passive air intakes (trickle vents) in the façades are acceptable. The vents should have an installed element-normalised level difference ($D_{n,e}$) when tested in accordance with BS EN 10140:2010 Parts 1 to 5 of not less than that indicated in the following table:

	Trickle Vent Installed Element Normalized Level Difference (dB $D_{n,e}$) at Indicative Octave Band Centre Frequency (Hz)						
	125	**250**	**500**	**1k**	**2k**	**4k**	**$D_{n,e,w}$**
Façade Groups A & B	Trickle vents not permitted						
Façade Type C Ventilator							
Indicative ventilator type i.e. Passivent Fresh 90dB	34	41	44	43	50	50	**46**

T3 Ventilator sound reduction performance requirements for façade types A-C.

Typical vents which would achieve the performance requirements are also identified within table T3.

The indicative $D_{n,e,w}$ values and indicative vent types quoted above are for guidance only. Alternatives may be utilised, provided the **octave band** sound reduction performance quoted is achieved.

End of Section

Appendix A

Subject:	**Planning Considerations and Guidance**		
Project:	**Station Yard, Twickenham**		
Date:	**October 2019**	**Prepared:**	**AS**
Revision:	**0**	**Approved:**	**AE**

This document sets out the various standards and national guidance upon which the design advice has been based.

A1 National Planning Policy Framework (NPPF)

A1.1 The National Planning Policy Framework (NPPF), published in March 2012 and updated in February 2019, is currently the relevant document for defining the national policy toward noise sensitive development. It refers to the Noise Policy Statement for England (NPSE), which is discussed in the subsequent section.

A1.2 The current policy on sustainable development influences the emphasis of any noise assessment. The development of a quiet, rural site is by most measures less sustainable than the development of a site located near existing infrastructure and facilities. The rating of development sites based on prevailing noise levels should reflect this.

A1.3 Specifically, on the subject of noise, paragraph 180 of NPPF states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a. *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;*

b. *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;"*

A1.4 Paragraph 180 references the Noise Policy Statement for England and no other particular standards.

A1.5 On the general issue of amenity, paragraph 127 states that planning policies and decisions should ensure that developments:

"create places that […] promote health and well-being, with a high standard of amenity for existing and future users…"

A1.6 Further to this, paragraph 170 states that planning policies and decisions should contribute to and enhance the natural and local environment by:

"preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution"

A1.7 A notable inclusion in the July 2018 edition of NPPF is the 'agent of change' principle in paragraph 182. In terms of noise, this principle requires that those proposing a new noise sensitive development incorporate sufficient mitigation such that the operation of existing premises in the area is not unreasonably restricted in order to control noise impact upon the new development:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

A2 Noise Policy Statement for England (NPSE)

A2.1 This NPSE does not set quantitative guidelines for the suitability of noise sensitive development in an area depending on the prevailing levels of noise. Absent, therefore, is reference to specific noise thresholds which determine whether noise sensitive development is suitable and, if so, whether particular mitigation factors need to be considered.

A2.2 Instead, the NPSE sets out three aims:

The first aim of the Noise Policy Statement for England

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

The second aim of the Noise Policy Statement for England

"Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

The third aim of the Noise Policy Statement for England

"Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

A2.3 Paragraph 2.24 states that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life. It also states that this does not mean that such adverse effects cannot occur.

A2.4 In essence, therefore, each development site must be judged on its ability to deliver on each of the stated aims. Quantifying the prevailing noise levels is therefore an essential first step in assessing a given site.

A2.5 The NPSE refers to SOAEL, the Significant Observed Adverse Effect Level. This is defined as the level above which significant adverse impacts on health and quality of life occur. Given the overall thrust of the NPSE, the SOAEL is therefore an important assessment standard although the document also comments that:

"It is not possible to have a single objective noise based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times."

A2.6 Attention is drawn to the fact that the SOAEL is the level above which significant adverse effects can be observed. Importantly, it should be noted that the overall objective is to avoid or minimise significant adverse impacts; some degree of impact is acceptable and it is not necessary to seek to achieve no impact at all.

A3 Planning Practice Guidance (PPG)

A3.1 The Department for Communities and Local Government 'Planning Practice Guidance' (PPG) was published on 6 March 2014 and updated in July 2019.

A3.2 The PPG on Noise expands upon the NPPF and NPSE and sets out more detailed guidance on noise assessment. Like the NPPF and NPSE, the guidance does not include any specific noise levels but sets out further principles that should underpin an assessment.

A3.3 The PPG includes a section on noise, which states:

"*Plan-making and decision making need to take account of the acoustic environment and in doing so consider:*

whether or not a significant adverse effect is occurring or likely to occur;

whether or not an adverse effect is occurring or likely to occur; and

whether or not a good standard of amenity can be achieved."

A3.4 It then refers to the NPSE and states that the aim is to identify where the overall effect of the noise exposure falls in relation to Significant Observed Adverse Effect Level [1] (SOAEL), the Lowest Observed Adverse Effect Level [2] (LOAEL) and the No Observed Effect Level [3] (NOEL).

A3.5 The guidance then presents a table, which is reproduced as table 0 overleaf. The implication of the final line of the table is that only the 'noticeable and very disruptive' outcomes are unacceptable and should be prevented. All other outcomes (i.e. all other lines in the table) can be acceptable, depending upon the specific circumstances and factors such as the practicalities of mitigation.

[1] The level of noise exposure above which significant adverse effects on health and quality of life occur.
[2] The level of noise exposure above which adverse effects on health and quality of life can be detected.
[3] The level of noise exposure below which no effect at all on health or quality of life can be detected.

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

AT1 Summary of Noise Exposure Hierarchy (from PPG)

A3.6 Under the topic of further considerations relating to mitigating the impact of noise on residential developments, the PPG states:

"Noise impacts may be partially offset if residents have access to one or more of:

a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling;

a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced if this area is exposed to noise levels that result in significant adverse effects;

a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or

a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minute walking distance)."

A4 Internal and External Noise Design Criteria

A4.1 **The World Health Organisation (WHO) Guidelines 1999**

A4.1.1 The Guidelines for Community Noise (World Health Organisation, 1999) included values for community noise in specific environments.

A4.1.2 It is important to note that the WHO Guidelines are aspirational, as illustrated by the National Noise Incidence Study (NNIS, 2000), which indicates that 55% of the population of England and Wales are exposed to external noise levels above 55 dB $L_{Aeq,\ day}$. A National Physical Laboratory (NPL) report (with reference CMAM 16, dated September 1998) reviewing the original 1980 WHO Guidelines and the 1995 draft version of the current Guidelines stated:

"*Exceedances of the WHO guideline values do not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached.*"

"*As such, it would be unwise to use the WHO guidelines as targets for any form of strategic assessment, since, given the prevalence of existing noise exposure at higher noise levels, there might be little opportunity for and little real need for any across the board major improvements. On the other hand, the most constructive use for the WHO guidelines will be to set thresholds above which greater attention should be paid to the various possibilities for noise control action when planning new developments. It is important to make clear at this point that exceedances do not necessarily imply an over-riding need for noise control, merely that the relative advantages and disadvantages of noise control action should be weighed in the balance.*"

A4.1.3 To prevent moderate annoyance in outdoor living areas, such as gardens and balconies of dwellings, the WHO guideline value is 50 dB $L_{Aeq,\ 16h}$. This can be described as an upper limit for the average noise level across the daytime and evening period (07:00h to 23:00h). The corresponding guideline value to prevent serious annoyance is stated as 55 dB $L_{Aeq,\ 16h}$.

However it is again noted that these levels are aspirational in nature, as described in A4.1.2above.

A4.1.4 In terms of the internal noise environment, in order to achieve maximum speech intelligibility and to avoid moderate annoyance, the guideline value for noise levels within dwellings is stated as 35 dB $L_{Aeq,\ 16h}$ (covering the day and evening 07:00h to 23:00h). The corresponding value for the night period (23:00h to 07:00h) to avoid sleep disturbance is 30 dB $L_{Aeq,\ 8h}$.

A4.1.5 Additionally in terms of sleep disturbance, a guideline value of 45 dB L_{Amax} is given. In relation to this value, the Guidelines state:

"When the background noise is low, noise exceeding 45 dB L_{Amax} should be limited, if possible…"

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10–15 times per night…"

A4.2 WHO Environmental Noise Guidelines 2018

A4.2.1 An updated version of the Guidelines was published in October 2018. It constitutes a significant revision of the 1999 Guidelines, rather than comprising minor amendments. In relation to road traffic and railway noise, the guidance states the following:

Road Traffic Noise

For average noise exposure, the GDG strongly recommends reducing noise levels produced by road traffic below **53 decibels (dB)** L_{den}, as road traffic noise above this level is associated with adverse health effects.

For night noise exposure, the GDG strongly recommends reducing noise levels produced by road traffic during night time below **45 dB** L_{night}, as night-time road traffic noise above this level is associated with adverse effects on sleep.

To reduce health effects, the GDG strongly recommends that policy-makers implement suitable measures to reduce noise exposure from road traffic in the population exposed to levels above the guideline values for average and night noise exposure. For specific interventions, the GDG recommends reducing noise both at the source and on the route between the source and the affected population by changes in infrastructure.

Railway Noise

For average noise exposure, the GDG strongly recommends reducing noise levels produced by railway traffic below **54 dB** L_{den}, as railway noise above this level is associated with adverse health effects.

For night noise exposure, the GDG strongly recommends reducing noise levels produced by railway traffic during night time below **44 dB** L_{night}, as night-time railway noise above this level is associated with adverse effects on sleep.

To reduce health effects, the GDG strongly recommends that policy-makers implement suitable measures to reduce noise exposure from railways in the population exposed to levels above the guideline values for average and night noise exposure. There is, however, insufficient evidence to recommend one type of intervention over another.

A4.2.2 The L_{den} is an equivalent sound level that represents the situation over the full 24 hour day, taking account of the L_{day} (0700-1900h), with a penalty of 5dB(A) for evening noise $L_{evening}$ (1900-2300h) and a penalty of 10dB(A) for night time noise L_{night} (2300-0700). The L_{night} index is equivalent to the $L_{Aeq,\ 8h}$ index as used in other standards such as BS 8233 (but not necessarily with the same numerical guidelines).

A4.2.3 The guidance no longer specifies L_{Amax} criteria but states in section 2.2.2:

"In many situations, average noise levels like the L_{den} or L_{night} indicators may not be the best to explain a particular noise effect. Single-event noise indicators – such as the maximum sound pressure level ($L_{A,max}$) and its frequency distribution – are warranted in specific situations, such as in the context of night-time railway or aircraft noise events that can clearly elicit awakenings and other physiological reactions that are mostly determined by $L_{A,max}$. Nevertheless, the assessment of the relationship between different types of single-event noise indicators and long-term health outcomes at the population level remains tentative. The guidelines therefore make no recommendations for single-event noise indicators."

A4.2.4 As with the 1999 WHO document, the guideline values in the 2018 document represent aspirational targets to be achieved in the long term, rather than values that should immediately be adopted into relevant policy.

A4.2.5 This is reflected in the following excerpt from the government's Aviation 2050 consultation document (which relates to aircraft noise but the principle of the statement is relevant to other noise sources):

"The government is considering the recent new environmental noise guidelines for the European region published by the World Health Organisation (WHO). It agrees with the ambition to reduce noise and to minimise adverse health effects, but it wants policy to be underpinned by the most robust evidence on these effects, including the total cost of action and recent UK specific evidence which the WHO report did not assess."

A4.2.6 Therefore, other current standards and guidance, such as BS 8233, still represent the most relevant and appropriate basis for assessment.

A4.3 British Standard BS 8233:2014

A4.3.1 Guideline values for dwellings with respect to internal and external noise levels are included in BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (BSi).

A4.3.2 The standard states 50 dB $L_{Aeq,\,T}$ as being desirable as a steady state noise level not to be exceeded in gardens. It also states 55 dB $L_{Aeq,\,T}$ as an upper guideline value. The time period *T* is usually taken to be the 16 hour day (07:00h to 23:00h).

A4.3.3 Paragraph 7.7.3.2 of the standard goes on to say the following:

"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.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

A4.3.4 It can be seen that external noise levels, especially on small balconies to apartment blocks, are not proposed to be a controlling index by which suitability of a residential site is defined.

A4.3.5 Therefore, when designing noise sensitive developments that incorporate gardens or other external amenity areas, the intent shall be to provide an area for each property in which the noise levels are consistent with these standards. Where these standards cannot be achieved, then reasonable measures shall be employed to provide screening or other forms of mitigation so as to minimise the noise levels in the external amenity areas.

A4.3.6 An important principle here is that sustainable development sites will often be exposed to relatively high levels of environmental noise, and while means are available to insulate internal

spaces, they are not always available to protect external spaces. Strict adherence to the enforcement of such external noise criteria would preclude development in the majority of areas considered for development in semi-urban or urban environments or in areas in the vicinity of transportation noise sources. This is why the external standards shall be viewed as targets or triggers of mitigation measures rather than thresholds not to be exceeded in all circumstances.

A4.3.7 Buildings can be designed to achieve specific levels of insulation against external noise. It is reasonable, therefore, to set specific internal noise standards as the test of whether a development satisfies the requirements of the NPPF and the aims of the NPSE. In essence, these require a high quality design that achieves a good standard of amenity.

A4.3.8 Guidance in respect of indoor ambient noise levels is contained in Table 4 of BS 8233:2014 and tabulated below.

Activity	**Location**	**07:00 to 23:00**	**23:00 to 07:00**
Resting	Living room	35 dB $L_{Aeq,\ 16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,\ 16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,\ 16h}$	30 dB $L_{Aeq,\ 8h}$

Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

AT2 Table 4 of BS 8233:2014

A4.3.9 The previous edition of BS 8233 included quantitative guidance with respect to night-time L_{Amax} noise levels in bedrooms. BS 8233:2014 does not provide such guidance, however in paragraph 7.7.5.1.1 it is noted that the recommendations for ambient noise in hotel bedrooms are similar to those for living accommodation and Table H.3 in Annex H.3 gives example night-time L_{Amax} limits in hotel bedrooms of 45-55 dB.

A4.3.10 The WHO study informing the 1999 Guidelines derived the L_{Amax} night time noise standard on the basis of 10 to 15 occurrences per night.

A4.4 ProPG: Planning and Noise (2017)

A4.4.1 ProPG is a guidance document prepared by a working group consisting of representatives of the Association of Noise Consultant (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH). It provides professional practice guidance on Planning and Noise with regard to new residential development that will be exposed to airborne noise from transport sources. It is also noted that good professional guidance should have regard to any

reasonably foreseeable changes to existing, and/or new sources, as well as sources currently effecting the site.

A4.4.2 ProPG provides two stages of assessment, the first being an initial site risk assessment and the second being a full assessment. The second is only necessary when the initial risk assessment and circumstances dictate.

Stage 1: Initial Site Noise Risk Assessment

A4.4.3 ProPG suggests that a Stage 1 initial site risk assessment should be undertaken on all sites at the earliest possible opportunity in order to gauge the potential effect of noise on future residential premises, without the benefit of any noise mitigation measures.

A4.4.4 It is important to note that the initial 'Stage 1' assessment at a proposed residential development is not the basis for the eventual recommendation to the decision maker. It is intended to highlight the importance of good acoustic design within a scheme. For example, a site with a high risk of adverse effect without noise mitigation may not necessarily be unsuitable for development; however, the importance of good acoustic design provided by experts would be critical at such a site, with a detailed acoustic design statement provided.

A4.4.5 ProPG states that a site which displays a low risk of adverse effect without noise mitigation is more likely to be acceptable from a noise perspective, provided that a good acoustic design process is followed, and sites with no risk of adverse effect need not normally be delayed on noise grounds.

A4.4.6 The criteria provided for Stage 1 assessment of the L_{Aeq} noise levels for day and night within the initial site risk assessment are provided below:

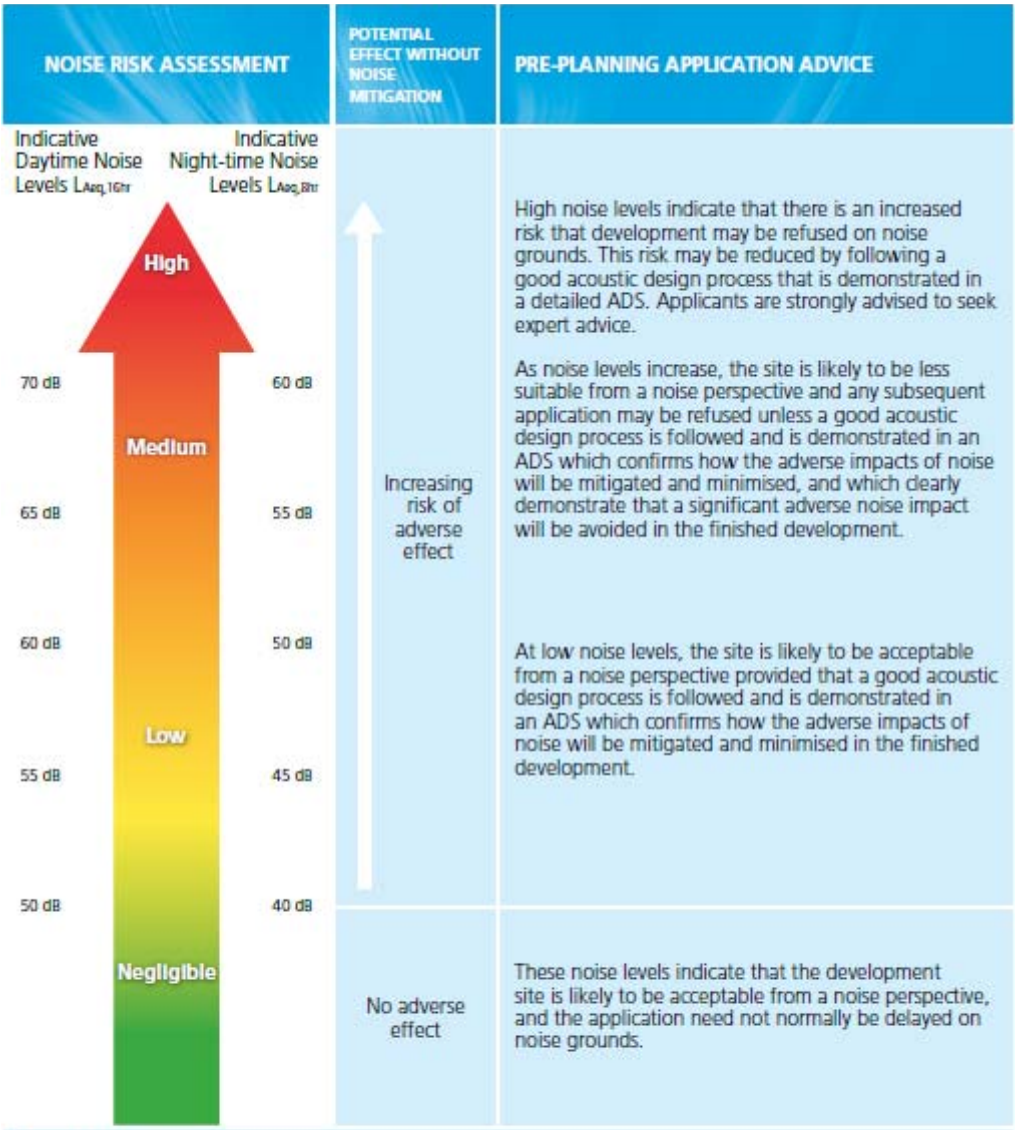


Figure 1 Notes:

a. Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.

b. Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is "not dominant".

c. $L_{Aeq,16hr}$ is for daytime 0700 – 2300, $L_{Aeq,8hr}$ is for night-time 2300 – 0700.

d. An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F}$ > 60 dB means the site should not be regarded as negligible risk.

A4.4.7 The initial noise risk assessment also considers the effect of L_{Amax} maximum noise levels at night (2300-0700h), where the guidance states:

"An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F}$ > 60 dB means the site should not be regarded as a negligible risk."

Stage 2: Overview

A4.4.8 Stage 2 of the ProPG guidance provides a systematic consideration of key elements of acoustic design. The guidance advocates a proportional, risk based approach to the Stage 2 assessment. The Stage 1 risk assessment should inform whether careful consideration is required, with the detailed input of specialist acoustic consultants essential at higher risk sites, or straightforward accelerated decision making potentially possible in relation to lower risk sites.

Stage 2: Element 1 – Good Acoustic Design Process

A4.4.9 ProPG states that a good acoustic design process is an implicit part of achieving the requirements of government noise policy, as set out in the NPSE and NPPF, and outlined in Supplementary Document 1 of the ProPG.

A4.4.10 However, it is also stated that good acoustic design does not simply constitute compliance with recommended internal and external criteria, if the solution adversely affects living conditions within the spaces, and hence the quality of life of the inhabitants. The following example is provided:

"Using fixed unopenable glazing for sound insulation purposes is generally unsatisfactory and should be avoided; occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be considered unsatisfactory when open. Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for the approach, is not regarded as good acoustic design."

A4.4.11 Applicants must therefore consider all possibilities for mitigation including but not limited to:

- Checking the feasibility of relocating, or reducing noise levels from relevant sources;
- Considering options for planning the site or building layout;
- Considering the orientation of proposed building(s);
- Selecting construction types and methods for meeting building performance requirements;
- Assessing the viability of alternative solutions;
- Assessing external amenity area noise;
- Examining the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc.

Stage 2: Element 2 – Internal Noise Level Guidelines

A4.4.12 ProPG considers the guidance provided within BS 8233:2014 to be suitable for the assessment of internal noise levels. However, the ProPG provides additional commentary. The following table reproduces the internal ambient criteria provided within Figure 2 of ProPG. The guidance from BS 8233:2014 is displayed in black, with additional comments and criteria from ProPG in blue:

Activity	Location	0700h to 2300h	2300h to 0700h
Resting	Living room	35 dB $L_{Aeq, 16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16h}$	30 dB $L_{Aeq, 8h}$ 45 dB $L_{AMax,F}$ (Note 4)

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. 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 (see Appendix A [which advocates reference to available dose-response relationships appropriate for the types of noise source being considered]).

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (see Section 3.D [which states that if certain criteria are fulfilled the noise practitioner should recommend refusal on noise grounds alone, regardless of any case for the development]).

AT3 Table 4 of BS 8233:2014 with ProPG annotations in blue

A4.4.13 It should be noted that the guidance above includes criteria for L_{Amax} noise levels, along with further guidance relating to the assessment of maximum levels in Note 4.

A4.4.14 The ProPG also states in Note 5 that where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed. However, any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position.

A4.4.15 At this point, it is also worth noting the typical expectation that noise criteria can be exceeded for limited times when additional natural ventilation may be used to provide a cooling effect. For example, this is reflected in the design of schools, where the current statutory guidance

(BB93 [4]) allows for up to 55 dB L_{Aeq} **internally** under such conditions in the warmest summer months. This represents a clear pragmatic approach to ventilation and cooling in a sustainable manner, without the need for mechanical comfort cooling methods.

A4.4.16 A draft guidance document titled 'Acoustics Ventilation and Overheating RESIDENTIAL DESIGN GUIDE' was issued for consultation purposes in February 2018 by the Association of Noise Consultants. The weight afforded to this document should currently be limited, due to its draft nature. However, it notes that the threshold between medium and high risk scenarios, in terms of internal noise levels, is 50 dB $L_{Aeq, 16h}$ daytime and 43dB $L_{Aeq, 8h}$ night time when considering open windows for overheating control. The threshold between low and medium risk scenarios is represented by values 5 dB greater than those in table AT3 above.

Stage 2: Element 3 – External Amenity Area Noise Assessment

A4.4.17 With regard to external amenity spaces, ProPG references the guidance provided within BS 8322:3014, section 6. ProPG presents a statement summarising BS 8233:2014 section 6 which states:

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq, 16h}$"

A4.4.18 The standard continues:

"These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited."

A4.4.19 ProPG also references guidance within the PPG on noise, which states:

"If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended"

A4.4.20 It is highlighted within ProPG that both BS 8233:2014 and the PPG on noise require a decision to be made as to whether or not external amenity areas are intrinsically important to the required design. However, it is noted that the PPG also states that noise impacts may be partially offset if the residents of affected dwellings are provided, through the design of the development or the planning process, with access to alternative spaces as set out in paragraph A3.6 of this appendix.

A4.4.21 ProPG section 2.51 states that Local Planning Authorities (LPAs) will be best placed to provide guidance in relation to what is 'relatively quiet', as the concept will inherently vary between scenarios.

[4] Building Bulletin 93: Acoustic design of schools - performance standards (2015)

A4.4.22 The advice in section 2.52 of ProPG highlights the increased importance of LPAs protecting publically accessible external amenity spaces in areas that typically exhibit heightened existing noise climates, such as cities, where development is necessary but private external amenity areas below 55 dB $L_{Aeq,16h}$ are not practicable. Publically accessible spaces such as parks and squares in these areas may be providing respite for nearby residents and, therefore, should be protected.

Stage 2: Element 4 – Assessment of Other Relevant Issues

A4.4.23 This section of the guidance relates to all other relevant issues and seeks to build upon relevant national and local planning and noise policies. Examples are provided including, but not limited to, the following:

- Compliance with relevant national and local policy
- Magnitude and extent of compliance with ProPG
- Likely occupants of the development
- Acoustic design v unintended adverse consequences
- Acoustic design v wider planning objectives

A4.4.24 Other issues specific to the site may be added by the LPA, where relevant.

Industrial Noise

A4.4.25 The scope of the ProPG is restricted to sites that are exposed predominantly to noise from transportation sources. However, there is a special case where industrial or commercial noise is present on the site but is "not dominant" i.e. the impact would be rated as lower than adverse (subject to context) if a BS 4142:2014 assessment was to be carried out. In such a case, the contribution of the industrial/commercial noise may be included in the noise level used to establish the degree of risk associated with the site. If included, this should be clearly stated.

A4.4.26 Where industrial or commercial noise is "dominant" i.e. where the impact would be rated as adverse or greater (subject to context) if a BS 4142:2014 assessment was to be carried out, then the risk assessment should *not* be applied to the industrial or commercial noise component. Regard should be had to the guidance in BS 4142:2014.

A4.4.27 The judgement on whether or not to undertake a BS4142 assessment to determine dominance should be proportionate to the level of risk. In low risk cases a subjective judgement of dominance, based on audibility, would normally be sufficient.

A5 BS 4142:2014

A5.1 Regarding noise impact from a commercial or industrial source, BS 4142:2014 provides an assessment methodology and criteria relating to:

a) sound from industrial and manufacturing processes;

b) sound from fixed installations which comprise mechanical and electrical plant and equipment;

c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and

d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

A5.2 The application of the standard is detailed below:

"This standard is applicable to the determination of the following levels at outdoor locations:

a) rating levels for sources of sound of an industrial and/or commercial nature; and
b) ambient, background and residual sound levels,

for the purposes of:

1) investigating complaints;
2) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and
3) assessing sound at proposed new dwellings or premises used for residential purposes."

A5.3 The rating level of noise from the facility is calculated, over a set period, at each of the nearest noise sensitive locations. This rating level is then compared with the existing background sound level.

A5.4 The standard recommends the following reference time period T_r over which the specific sound should be evaluated, for each of the day and night periods:

T_r = 1 hour during the day; and

T_r = 15 minutes during the night.

A5.5 The standard states that daytime is typically between 07:00h and 23:00h. Accordingly, night-time is between 23:00h and 07:00h.

A5.6 The reason for the shorter night time assessment period of 15 minutes is identified in the standard as follows:

"The shorter reference time interval at night means that short duration sounds with an on time of less than 1 h can lead to a greater specific sound level when determined over the reference time interval during the night than when determined during the day."

A5.7 The rating level of noise for the assessment periods, $L_{Ar,\,Tr}$ is the calculated noise level at the nearest receiver location, adjusted depending on the acoustic characteristic of the noise

source. Adjustment factors are based on any tonality, impulsivity, intermittency and other characteristics present in the resultant sound at the receiver position. The level or appropriateness of any penalty will depend both on the type of noise source and the context in which it is perceived. Similarly, in accordance with BS 4142, the period of time for which an individual noise source is active during the relevant reference time period will also be considered in establishing the rating level.

A5.8 It will also be necessary to consider the existing noise climate and what sound sources contribute to it. For example, where a noise generating activity is proposed adjacent to an existing similar noise generating site, the impact of the new noise source would be less than if it were to be planned in a location where its character and type is different to and more noticeable than any existing noise source nearby.

A5.9 With regard to the background sound level against which the rating level is compared, the standard states the following:

"In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."

A5.10 The periods of interest over a 24 hour day are usually related to day time activities (07:00-23:00h) and night time (23:00-07:00h). However the standard makes the following statement:

"Among other considerations, diurnal patterns can have a major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes. Furthermore, in this general context it can also be necessary to separately assess weekends and weekday periods."

A5.11 Therefore, the periods of time which are typically considered 'waking up' and 'falling asleep' stages, for example 06:00h to 07:00h and 23:00h to 24:00h, may need to be considered independently. Alternative periods may also be identified where breakdown beyond the standard day and night time analysis will be necessary, for example where background sound levels are shown to be regularly elevated. Similarly, both weekend and weekday periods may need to be considered separately, with criteria set for both. The requirement to analyse specific time periods should be considered for each site individually.

A5.12 Once the rating level at each receptor has been calculated, reference can be made to the following commentary in BS 4142 in relation to conducting an initial assessment of the impact, based on the difference between the rating level of the noise source and the pre-existing background sound level.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following.

NOTE 1 More than one assessment might be appropriate.

a) Typically, the greater this difference [between industrial site noise rating level and baseline background level], 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.

NOTE 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

A5.13 It can be seen that the likelihood of a significant adverse impact occurs once the rating level is at least 10 dB greater than the representative background sound level (depending on context).

A5.14 In addition to the above, BS 4142 also states:

"For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

A5.15 When assessing whether the existing sound levels are low, it is also relevant to refer to other standards which provide absolute thresholds for suitable noise levels inside buildings, such as BS 8233:2014 as described above. A rating level of 30 dB is typically considered a lower limit for design criteria; background levels below 30 dB and rating levels below 35 dB were considered 'very low' in BS 4142:1997. Where the existing background level is considered low on this basis, the aim would typically be to achieve a rating level of 30 dB, regardless of the comparison with the background level.

A5.16 Following the initial impact assessment described above, it is necessary to modify the initial impact assessment based on context.

A5.17 The standard states the following (with emphasis added) regarding the introduction of a new noise-sensitive receptor in paragraph 8.5:

"Measure the background sound at the intended location of any new noise-sensitive receptor(s) in the absence of any specific sound.

NOTE Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. ***In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.****"*

A5.18 This explicitly states that standards other than BS 4142 can be considered in the context of a scheme, where new noise sensitive development is proposed next to an existing noise source.

A5.19 It goes on to state that where the initial estimate of the impact needs to be modified due to the context, all pertinent factors should be taken into consideration, including the following:

1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

NOTE 3 Consideration ought to be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the "Effects on humans of industrial and commercial sound" portion of the "Further reading" list in the Bibliography.

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.

A5.20 As detailed in point 1 above following the initial impact assessment it is necessary to consider if the assessed impact should be changed due to the absolute level of the noise. When considering absolute noise levels for new dwellings it is appropriate to consider the criteria for dwellings near to industrial noise given within BS 8233. Where the noise rating level is below the criteria set for external amenity areas within BS 8233 the noise impact is considered to not be an adverse impact.

A5.21 Where the impact affects internal noise levels it is appropriate to install mitigation in the form of façade insulation treatment and alternative ventilation. In order to establish the required performance of this mitigation it is necessary to consider the absolute internal noise levels from the industrial source.

A5.22 BS 8233 provides appropriate criteria for absolute noise levels from industrial noise within dwellings. This is based on the following guidance on internal noise within dwellings in BS 8233:

"This subclause applies to external noise as it affects the internal acoustic environment from sources without a specific character, previously termed "anonymous noise". Occupants are usually more tolerant of noise without a specific character than, for example, that from neighbours which can trigger complex emotional reactions. For simplicity, only noise without character is considered in Table 4. For dwellings, the main considerations are:

a) for bedrooms, the acoustic effect on sleep; and

b) for other rooms, the acoustic effect on resting, listening and communicating.

NOTE Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."

A5.23 The guidance above makes it clear that noise which has a specific character may require lower noise criteria than proposed for anonymous steady noise sources. BS 4142 deals with this by applying penalties to certain characteristic. Consequently, the rating level already accounts for noise which has a specific character, such that the L_{Aeq} noise level will be lower than the rating level.

A5.24 Paragraph 6.5.2 of BS 8233 states the following for residential developments in areas affected by industrial noise:

"Where industrial noise affects residential or mixed residential areas, the methods for rating the noise in BS 4142 should be applied. BS 4142 describes methods for determining, at the outside of a building:

a) noise levels from factories, industrial premises or fixed installations, or sources of an industrial nature in commercial premises; and

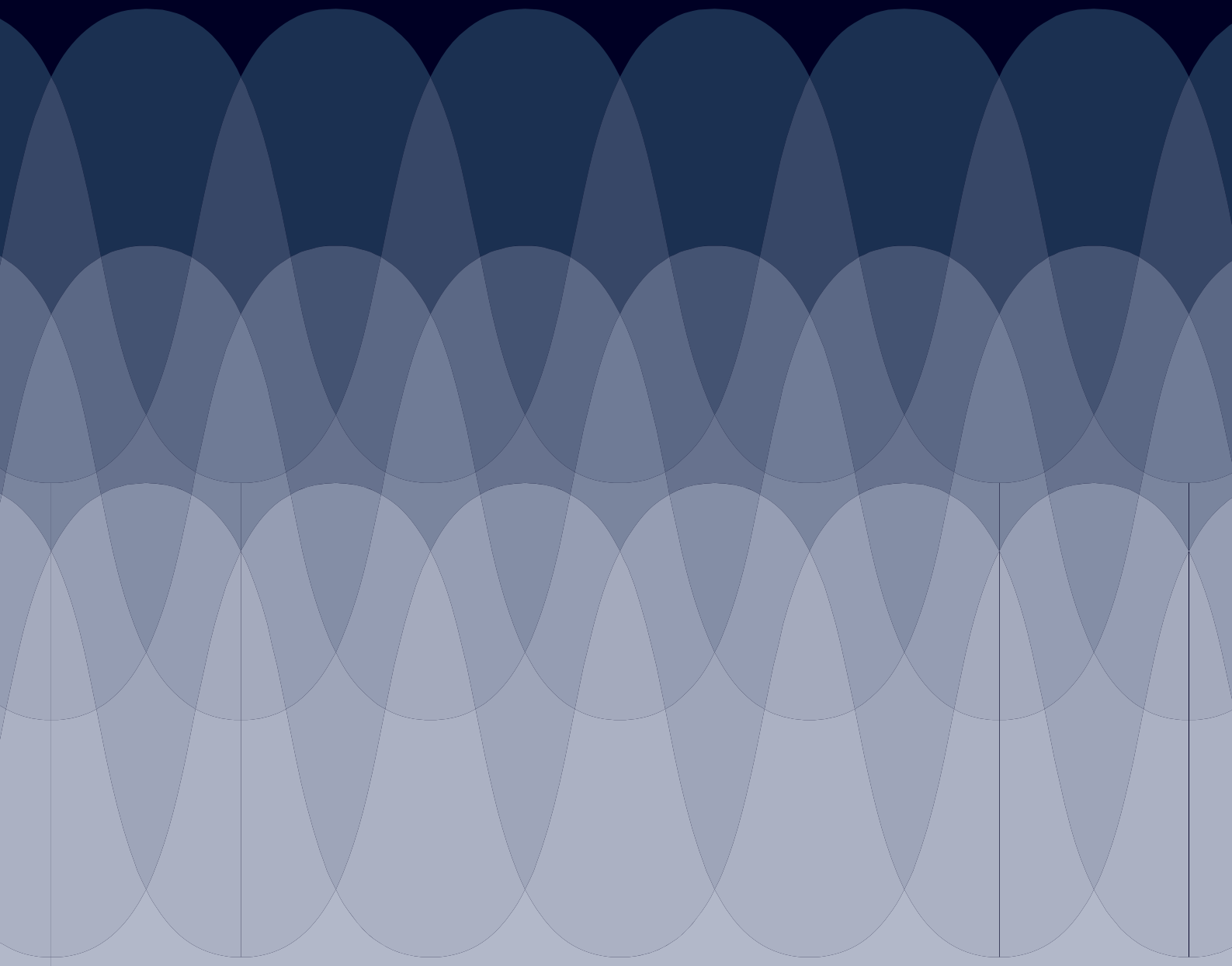
b) background noise level."

A5.25 The quote above is explicit in stating that the methods for **rating** the noise in BS 4142 should be applied i.e. deriving a rating level, L_{Ar}. It does not state that a full BS 4142 'assessment' should be conducted. The reference to the background noise level relates only to a statement of the scope of BS 4142.

A5.26 It is clear that BS 4142 notes the use of façade insulation treatment (and associated appropriate ventilation) as mitigation. This is consistent with PPG guidance as noted in relevant sections of this appendix. In terms of ventilation, it notes that such mechanisms should be provided to reduce the need to have windows open but it does not state that windows must be kept closed. This principle is in line with BS8233 guidance where assessment should be considered with windows closed, but background ventilation provided; it is also in line with PPG where windows can be closed some of the time (i.e. not all of the time) to ensure a SOAEL is not reached.

A5.27 BS 8233 directs BS 4142 to be used in order to establish the noise rating level from the industrial noise source. This allows for the character of the source to be fully taken into account so that the noise criteria from BS 8233 table 4 (Section 7) can be applied to this type of source. It is important to highlight that BS 8233 is explicit when stating that only the noise rating levels from BS 4142 should be applied. It does not state that a full assessment in line with the BS 4142 methodology should be conducted.

End of Section



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