

Noise Assessment for Planning Purposes

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Prepared for: Interstrand Ltd
Alexandra Gate
3 Ffordd Pengam
Cardiff
CF24 2SA

Site address: Newport Export Packing
Queens Hill
Newport
NP20 5HJ

Acoustics & Noise Limited

55 Malpas Road, Newport, South Wales, NP20 5PJ

TEL: +44(0)1633-850880

FAX: +44(0)1633-850882

www.acousticsandnoise.co.uk

office@acousticsandnoise.co.uk



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Prepared by	Chris McDonagh	Chris McDonagh			Chris McDonagh
Signature					
Checked by	Paul Trew	Paul Trew			Paul Trew
Signature					
Authorised by	Paul Trew	Paul Trew			Paul Trew
Signature					
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BRIEF FOR CONSULTANCY

This report has been prepared by Acoustics & Noise Limited, Newport, South Wales, for Interstrand Ltd, Alexandra Gate, 3 Ffordd Pengam, Cardiff, CF24 2SA under the instructions of Tristan Hobbs.

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OBJECTIVES

To investigate the noise climate on the proposed site.

To establish the suitability for developing the land for residential purposes.

NON-TECHNICAL SUMMARY

It is proposed to develop a site at Newport Export Packing, Queens Hill, Newport, NP20 5HJ for residential purposes comprising 43 units. The acoustic climate at the site is characterised by road traffic noise. The site is considered to be a road noise site as defined in Technical Advice Note 11 (TAN 11) which prescribes the measurement methods and standards to be used for an appropriate noise survey. The results of the survey are separated into day and night periods which are compared with four Noise Exposure Categories (NECs).

This report is to accompany an outline planning application which provides full details of the proposed development.

A 24-hour noise survey of the land was carried out to allow an assessment of the impact of road traffic noise on the site as per the general requirements of TAN 11 and further informed by the standard road traffic noise conditions provided by Newport City council in a pre-app response.

Following consideration of the measured noise levels at the site, during both the daytime and night time, this site is categorised as Noise Exposure Category (NEC) 'B'. For development sites that fall into NEC 'B', the advice in TAN 11 states that:

"Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise".

It is anticipated that 'an adequate level of protection against noise' will be attainable through the application of good acoustic design principles.

The proposed site layout already incorporates many of the good acoustic design principles highlighted in this report and desirable acoustic conditions are achievable for the majority of the site. No additional mitigation is required for any habitable room located on the inward facing elevations of the proposed 'L' shaped building.

However, for the northern and eastern elevations of the proposed building, the only practical mitigation strategy is to consider the sound reduction performance of the building envelope. With reference to the proposed outline development design layout, this report considers the noise levels at the most exposed elevations to determine the minimum sound reduction required from the glazing for potential habitable rooms located on these elevations.

Manufacturers' data should be used to confirm the minimum sound reduction performance requirements, as detailed in this report, are achievable from any specified glazing units, including any provision for background ventilation if applicable.

The windows for these units are required to be in the closed position to effectively control noise ingress. The decision on whether the windows should be permanently closed is outside the scope of this assessment and our technical expertise. However, where windows are exposed to anonymous noise sources such as road traffic, there is normally no requirement for these windows to be permanently sealed.

All habitable rooms subject to sound mitigation measures will require an alternative, effective means of ventilation. Any ventilation scheme should satisfy the requirements of Approved Document F and provide the required ventilation rates. It is important that any scheme is approved by Building Control and does not compromise the internal noise levels. Recommendations for suitable ventilation are outside the scope of this assessment and technical expertise and independent specialist advice should be obtained to ensure that any ventilation scheme is suitable for purpose.

Noise levels within the external communal amenity area located towards the centre of the proposed development site will satisfy the local authority external amenity noise criteria.

The conclusions of this report should be used to inform both the detailed design and any planning conditions applicable to this development.

Following an investigation of the principles of good acoustic design, the following considerations are recommended:

- *Consideration should be given to the sound reduction of the northern and eastern elevations of the development building.*

Once a detailed development design is produced and any planning conditions are known, the proposal can be assessed in detail using 3D modelling techniques to ensure that the final layout satisfies those conditions and *'ensures an adequate level of protection against noise'*.

This will have the advantage of being able to identify only those areas of the site that will require mitigation thus avoiding any unnecessary expense.

1.0 DESCRIPTION OF SITE

- 1.1 The site is located at Newport Export Packing, Queens Hill, Newport, NP20 5HJ and is currently occupied by a vacant factory unit.
- 1.2 The site is in a predominantly urban area and is bounded by a church to the north with a number of commercial units to the east. The A4042 is located 85m east of the site boundary with residential units located to the west and south.
- 1.3 The acoustic climate at the site is characterised by road traffic noise.
- 1.4 A satellite view of the site is presented in Appendix 2.

2.0 DISCUSSION

2.1 It is proposed to develop the site for residential purposes comprising 43 units.

2.2 In response to a pre-application planning enquiry for the above proposal, the Noise and Neighbourhood Team at Newport City Council provided the following comments:

"...A noise assessment should be submitted with any full application:

Since the proposed dwellings are in close proximity to existing noise sources (road traffic noise), the applicant will be required to submitted, a full noise assessment to demonstrate that the site is suitable for residential development. If the noise assessment indicates that noise from the development will impact residents then a detailed scheme of noise mitigation measures shall be submitted to and approved in writing by the local planning authority.

Please find attached our standard noise traffic conditions:

Road Traffic Noise – Internal

No development, other than demolition, shall commence until a scheme has been submitted to and approved in writing by the Local Planning Authority to provide that all habitable rooms exposed to external road traffic noise in excess of 55 dBA Leq 16 hour [free field] during the day [07.00 to 23.00 hours] or 45 dBA Leq 8 hour [free field] at night [23.00 to 07.00 hours] shall be subject to sound insulation measures to ensure that all such rooms achieve an internal noise level of 35 dBA Leq 16 hour during the day and 30 dBA Leq 8 hour at night. The submitted scheme shall ensure that habitable rooms subject to sound insulation measures shall be able to be effectively ventilated without opening windows. No dwelling shall be occupied until the approved sound insulation and ventilation measures have been installed to that property in accordance with the approved details. The approved measures shall be retained thereafter in perpetuity.

Road Traffic Noise – External

No development, other than demolition, shall commence until a scheme has been submitted to and approved in writing by the Local Planning Authority to provide that the maximum day time noise level in outdoor living areas exposed to external road traffic noise shall not exceed 50 dBA Leq 16 hour [free field]. The scheme of noise mitigation as approved shall be constructed in its entirety prior to the first occupation of any dwelling and shall be retained thereafter in perpetuity..."

2.3 Acoustics and Noise Ltd. were engaged by Interstrand Ltd to assess the noise climate at the site and determine the sites' suitability for development with regard to the above comments and standard noise conditions.

2.4 **Description of Proposed Development**

2.4.1 The development proposal seeks planning permission for residential use comprising 43 units.

2.4.2 The proposed residential development will be located in an urban environment and could potentially be exposed to noise that may have an adverse effect on the amenity and health and wellbeing of the future occupants.

2.4.3 The significant source of noise at the site is associated with road sources at the east and west boundaries.

3.0 IMPACT ASSESSMENT

3.1 Relevant Guidance

3.1.1 As a matter of best practice, this assessment has been undertaken with reference to relevant guidance on noise. Summary descriptions of the guidance is presented in Appendix 5.

3.2 TAN 11 Road Traffic Assessment

3.2.1 To determine the acoustic conditions across the proposed development site a 24-hour road traffic noise survey was conducted at both the eastern and western extent of the proposed scheme. These locations enjoyed an uninterrupted view of the road traffic travelling along Queens Hill to the west and Factory Road and A4042 to the east.

3.2.2 The procedures detailed in TAN 11 refer to free-field noise levels. However, for the survey location overlooking Factory Road on the eastern boundary to the site, the survey results represent the façade noise level, 1m from the façade.

3.2.3 Paragraph A9 of TAN 11 [1] states that “Levels of noise from road and rail traffic are often specified at one metre from the façade, and these façade levels should be assumed to be 3dB(A) higher than levels measured away from any buildings...”.

3.2.4 In this case, therefore, the calculated daytime and night time façade noise levels for the Factory Road survey are assumed to be 3dB higher than the required free-field levels and should be reduced accordingly as detailed in Table 1.

Table 1 – Corrected Free-field Road Traffic Noise Levels (Factory Road)

Period	Measured Façade Level (dB)	Façade Correction (dB)	Corrected Free-field Level (dB)
Daytime, $L_{Aeq,16hrs}$	59	-3	56
Night time, $L_{Aeq,8hrs}$	53	-3	50
Night time L_{ASmax}	79	-3	76

- 3.2.5 The Queens Hill survey was carried out in free-field conditions and no façade correction is applicable. A summary of the results for Queens Hill is presented in Table 2 below.

Table 2 – Measured Free-Field Road Traffic Noise Levels (Queens Hill)

Period	Measured Free-Field Level (dB)
Daytime, $L_{Aeq,16hrs}$	56
Night time, $L_{Aeq,8hrs}$	52
Night time L_{ASmax}	71

- 3.2.6 Inspection of the results indicate that there is only a minor difference between the Queens Hill and Factory Road survey data. To enable a robust assessment, the highest values from the two surveys of the daytime and night time periods, are used to represent the external noise levels at each measurement position when assessing the sites' suitability for residential development. The appropriate values are summarised in Table 3 below.

Table 3 – Maximum Free-Field Road Traffic Noise Levels (Both Surveys)

Period	Measured Free-Field Level (dB)
Daytime, $L_{Aeq,16hrs}$	56
Night time, $L_{Aeq,8hrs}$	52
Night time L_{ASmax}	76

- 3.2.7 The maximum free-field road traffic noise levels at the site can now be compared with the NEC detailed in TAN 11 [1], as presented in Appendix 5, to determine the suitability of the site for residential purposes.
- 3.2.8 The free field road traffic noise levels place the most exposed extent of the site within NEC 'B'. During the night time period, there were no instances of L_{ASmax} (free-field) exceeding 82 dB and therefore, there is no requirement to further amend the NEC.

3.2.9 For sites categorised as NEC 'B', TAN11 [1] states:

"Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise".

3.2.10 It is anticipated that an 'adequate level of protection against noise' will be attainable through the consideration of good acoustic design principles where necessary.

3.3 Assessment Criteria

3.3.1 The standard noise assessment criteria are detailed in the pre-app response from the local authority and are representative of the desirable internal and external ambient noise levels detailed in BS 8233 [5] and WHO guidelines [6]. These are interpreted in Table 4 below.

Table 4 – Assessment Criteria

Location	07:00 – 23:00 hrs	23:00 – 07:00 hrs
Within Habitable Rooms	35 dB LAeq,16hrs	30 dB LAeq,8hrs
External Amenity Space	50 dB LAeq,16hrs	--

3.4 Good Acoustic Design

3.4.1 Planning Policy Wales [2] recommends that the good acoustic design principles put forward in ProPG, Supplementary Document 2 [4] may also be adopted in Wales.

3.4.2 The principles of good acoustic design follow a hierarchy of noise management measures that Local Planning Authorities should encourage, including the following, in descending order of preference:

- *Maximising the spatial separation of noise source(s) and receptor(s).*
- *Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.*

- *Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.*
- *Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.*
- *Using the layout of the scheme to reduce noise propagation across the site.*
- *Using the orientation of buildings to reduce the noise exposure of noise-sensitive rooms.*
- *Using the building envelope to mitigate noise to acceptable levels.*

3.4.3 The above measures are considered in the following sections.

3.4.4 **Maximising the spatial separation of noise source(s) and receptor(s).**

3.4.4.1 Due to the relatively small scale of the development site and that there are road traffic noise sources at both the eastern and western extent of the site, there is limited scope to increase the source/receptor distance.

3.4.5 **Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.**

3.4.5.1 As the noise source is out of the control of the developer, reducing existing noise levels or relocating existing noise sources is not feasible.

3.4.6 **Using existing topography and existing structures to screen the proposed development site from significant sources of noise.**

3.4.6.1 With reference to the proposed layout detailed in Appendix 4, the majority of the site will be effectively screened from the road traffic travelling along Queens Hill by the existing terrace of houses along Queens Hill.

3.4.6.2 There are no existing structures or topographical features between the noise sources to the east and the development site that could provide beneficial acoustic screening.

3.4.7 **Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.**

- 3.4.7.1 For any noise barrier to be effective it will need to interrupt the source to receptor propagation path (line of site).
- 3.4.7.2 As discussed above, the existing Queens Hill terrace of houses will act as an effective barrier and screen the majority of the site from the road traffic travelling along Queens Hill.
- 3.4.7.3 For the proposed flats along the eastern extent of the site an acoustic barrier would be impractical due to limited space and would be of limited use to any flats located above first floor level. In addition, any barrier located along the eastern boundary may conflict with other planning requirements, e.g. visual impact, streetscene etc.
- 3.4.8 **Using the layout of the scheme to reduce noise propagation across the site.**
- 3.4.8.1 With reference to the proposed layout, the relatively compact extent of the site means there is limited scope for any alternative layout options that would materially reduce the noise propagation across the site any further.
- 3.4.8.2 The proposed layout provides an 'L' shaped footprint to the building located at the north east extent of the site. The proposed building mass will provide beneficial acoustic screening from road traffic travelling along Factory Road and the raised A4042 at all habitable rooms located on the inner elevations and to the proposed communal amenity space at the centre of the site.
- 3.4.9 **Using the orientation of buildings to reduce the noise exposure of noise-sensitive rooms.**
- 3.4.9.1 Due to the relatively compact extent of the site, there is limited scope for alternative orientation options that would materially affect the noise propagation to the habitable rooms.
- 3.4.9.2 Locating the five-storey apartment block at the north-eastern boundary to the site minimises the noise propagation to the rest of the development from significant road traffic along Factory Road and the raised A4042.
- 3.4.10 **Using the building envelope to mitigate noise to acceptable levels.**
- 3.4.10.1 Following consideration of the above acoustic design principles, the remaining option will be to consider the sound reduction performance of the proposed

building envelope. The overall sound insulation of the building envelope is typically determined by the weakest acoustic element which would normally be the windows.

- 3.4.10.2 With reference to the proposed design, it is likely that mitigation to the building envelope would only be required for the northern and eastern elevations, as the habitable rooms on these elevations do not benefit from any effective screening from the road traffic travelling along the A4042 and Factory Road to the east.

3.5 Mitigation

- 3.5.1 Planning Policy Wales [2] states *"The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution"*.
- 3.5.2 Proposed development should be designed, wherever possible, to prevent adverse effects to amenity, health and the environment. As a minimum, measures should be implemented to limit or constrain any effects that may occur.
- 3.5.3 As discussed above, the proposed site layout already incorporates many of the good acoustic design principles highlighted. However, for the north and east elevations, the only practical mitigation strategy is to consider the sound reduction performance of the building envelope.
- 3.5.4 With reference to the proposed development layout presented in Appendix 4, which may be subject to further amendment following consideration of the principles of good acoustic design, this report considers the minimum sound reduction performance for glazing units to the most exposed rooms along the north and east façades of the proposed development.
- 3.5.5 As detailed above, the maximum free field external noise levels at the measurement positions were determined to be 56 dB $L_{Aeq,16\text{ hrs}}$ during the daytime and 52 dB $L_{Aeq,8\text{ hrs}}$ during the night time.
- 3.5.6 For the purposes of this assessment, it is assumed that all habitable rooms located within the north and east elevations are exposed to the same level of road traffic

noise. This represents worst-case and ensures a robust consideration of the suitable acoustic mitigation.

3.6 Internal Ambient Noise Levels

3.6.1 The internal noise level in a room is calculated by subtracting the sound reduction performance of the external façade from the noise level outside the room. In this case, to represent worst-case, the sound reduction performance of the external façade is assumed to be equivalent to the weakest acoustic element which will be the glazing units.

3.6.2 For housing design purposes, this outdoor to indoor noise level difference can be described in terms of the sound reduction index of appropriate parts of the building envelope calculated from values of R_w .

3.6.3 However, as stated in BS EN 12354-3, *"...the indoor A-weighted sound pressure level can be determined directly from the A-weighted outdoor sound pressure level, provided the level difference is expressed in a single number rating for the relevant outdoor sound spectrum"*.

3.6.4 The relevant outdoor sound spectrum is defined in BS EN ISO 717-1 [8] as a correction term, C or C_{tr} , to be applied to the level difference.

3.6.5 When considering road traffic travelling at low speeds (<80 km/h), as is this case for traffic travelling along the surrounding highways, the appropriate correction term is C_{tr} .

3.6.6 Therefore, in this case, the level difference of the elements for the building envelope can be described as the single number rating value, $R_w + C_{tr}$, where the element is exposed to road traffic travelling at low speed (<80km/h).

3.6.7 Open Window Ventilation Strategy

3.6.7.1 Whenever possible, it is desirable to open the windows to provide background ventilation and when partially open windows are relied upon for background ventilation, the sound reduction of the façade is reduced to 15 dB [5].

3.6.7.2 To achieve the internal noise criteria of 35 dB $L_{Aeq,16hrs}$ with an open window during the daytime time period, the external noise level would be required to be below 35

+ 15 = 50 dB $L_{Aeq,16hrs}$. To achieve the internal noise criteria of 30 dB $L_{Aeq,8hrs}$ with an open window during the night time period, the external noise level would be required to be below 30 + 15 = 45 dB $L_{Aeq,8hrs}$.

- 3.6.7.3 For the habitable rooms located on the inner elevations to the building, if we assume that the building will provide a minimum 10 dB reduction to the noise propagation to these rooms as a result of blocking the line of site to the noise sources, then the external noise levels will be reduced to 56 – 10 = 46 dB $L_{Aeq,16hrs}$ during the daytime period and 52 – 10 = 42 dB $L_{Aeq,8hrs}$ during the night time period.
- 3.6.7.4 For habitable rooms located at the western extent of the building, there is the potential for higher noise levels with the addition of the road traffic noise from Queens Hill.
- 3.6.7.5 Noise levels at the position of habitable rooms closest to Queens Hill will be lower than those measured at western extent to the site due to the increased distance from the road traffic noise source.
- 3.6.7.6 The measured noise levels can be corrected to account for propagation over the increased distance to the noise source compared with the measurement position. The correction factor is defined as $10\log(r_1/r_2)$ where r_1 is the distance from the road to the measurement point and r_2 is the distance at which the noise level is calculated.
- 3.6.7.7 The Queens Hill survey was conducted at a distance of $r_1 = 5$ m from the nearside carriageway. The nearest habitable room to Queens Hill is at a distance of $r_2 = 60$ m from the road.
- 3.6.7.8 The line source propagation correction for distance is calculated as $10\log(5/60) = -11$ dB.
- 3.6.7.9 Therefore, the nearest habitable room to Queens Hill will be exposed to noise levels from Queens Hill of 56 – 11 = 45 dB $L_{Aeq,16hrs}$ during the daytime and 52 – 11 = 41 dB $L_{Aeq,8hrs}$ during the night time.

- 3.6.7.10 The cumulative noise levels from both road traffic noise sources, when determined at the nearest habitable rooms to Queens Hill, are $46 + 45 = 49$ $L_{Aeq,16hrs}$ during the daytime and $42 + 41 = 45$ $L_{Aeq,8hrs}$ during the night time.
- 3.6.7.11 The calculated external road traffic noise levels at any habitable room located on the inner elevations of the proposed development building will be effectively screened from the noise sources by the building itself.
- 3.6.7.12 An open window ventilation strategy is suitable for habitable rooms located on the inner elevations and no further mitigation is recommended.

3.6.8 Minimum Façade Sound Insulation Performance

- 3.6.8.1 For habitable rooms located on the northern and eastern elevations, the external road traffic noise will result in the internal ambient noise criteria being exceeded when using an open window ventilation strategy. Mitigation is required for these rooms.
- 3.6.8.2 Table 5 below details the calculations for the minimum sound reduction for the glazing units on the northern and eastern elevations of the proposed development.

Table 5 – Minimum Glazing Sound Reduction Calculations

	External Level	Local Authority Internal Noise Criteria	Minimum Glazing Sound reduction $R_w + C_{tr}$ (dB)
$L_{Aeq,16hr}$ (dB)	56	35	21
$L_{Aeq,8hr}$ (dB)	50	30	20

- 3.6.8.3 Whilst the above minimum sound reduction performance should be achievable from standard, thermal double-glazing units, manufacturers' data should be used to confirm the performance requirements are achievable from any specified glazing units, including any provision for background ventilation if applicable.
- 3.6.8.4 The windows are required to be in the closed position to effectively control noise ingress. The decision on whether the windows should be permanently closed is outside the scope of this assessment and our technical expertise. However, where

windows are exposed to anonymous noise sources such as road traffic, there is normally no requirement for these windows to be permanently sealed.

3.6.8.5 All rooms subject to sound mitigation measures should be provided with an alternative, effective means of ventilation. Any ventilation scheme should satisfy the requirements of Approved Document F and provide the required ventilation rates. Specialist advice should be obtained to ensure that any ventilation scheme is suitable for purpose. It is important that any scheme is approved by Building Control and does not compromise the internal noise levels.

3.6.8.6 Recommendations for suitable ventilation are outside the scope of this assessment and technical expertise.

3.7 External Amenity Spaces

3.7.1 The local authority external noise criteria detailed in Table 4 requires that the amenity areas should not be exposed to road traffic noise levels in excess of 50 dB $L_{Aeq,16hrs}$ (free-field) during the daytime period. The daytime free-field road traffic noise levels determined from the surveys is 56 dB $L_{Aeq,16hrs}$.

3.7.2 With reference to the proposed development drawings detailed in Appendix 4, a communal amenity area is proposed for the centre of the site. This amenity space is afforded beneficial acoustic screening from the existing houses along Queens Hill to the west and from the proposed development building to the east.

3.7.3 If we assume that the buildings will provide a minimum 10 dB reduction to the noise propagation as a result of blocking the line of site to the noise sources, then the noise levels within the central communal amenity, will be reduced to $56 - 10 = 46$ dB $L_{Aeq,16hrs}$ during the daytime period.

3.7.4 The proposed site layout will provide acceptable daytime noise levels within the proposed communal amenity area.

4.0 CONCLUSIONS:

- 4.1 An assessment of the potential impact from road traffic noise was carried out to determine the extent of any mitigation measures required to achieve acceptable internal and external ambient noise levels at the proposed residential development.
- 4.2 The results of the assessment indicate that the external free-field noise levels place the site into NEC 'B'. During the night time period, there were no instances of $L_{A_{Smax}}$ exceeding 82 dB and therefore, there is no requirement to further amend the NEC.
- 4.3 As per TAN11 this site should be categorised as being in NEC 'B' and :-
"Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise".
- 4.4 It is anticipated that an *'an adequate level of protection against noise'* will be attainable through the consideration of good acoustic design principles.
- 4.5 The proposed site layout already incorporates many of the good acoustic design principles highlighted in this report and desirable acoustic conditions are achievable for the majority of the site.
- 4.6 The results of this assessment indicate that an open window ventilation strategy is suitable for any habitable rooms proposed for the inward facing elevations of the proposed 'L' shaped development building which are effectively screened from the road traffic noise sources.
- 4.7 However, for the northern and eastern elevations of the development building, which enjoy a clear line of sight to the road traffic noise sources, the only practical mitigation strategy is to consider the sound reduction performance of the building envelope.
- 4.8 This report has further assessed the development proposal and provides recommendations for the minimum sound reduction performance requirements for

specified glazing units to northern and eastern elevations to ensure desirable internal ambient noise levels at all times.

- 4.9 Noise levels within the communal external amenity area located at the centre of the site will satisfy the local authority external amenity noise criteria.

5.0 RECOMMENDATIONS:

- 5.1 The conclusions of this report should be used to inform both the detailed design and any planning conditions applicable to this development.
- 5.2 All glazing units to habitable rooms located on the northern and eastern elevations of the proposed development building should be specified with a minimum sound reduction performance of 21 dB $R_w + C_{tr}$ to ensure desirable internal noise levels during both the daytime and night time.
- 5.3 Whilst the above minimum sound reduction performance should be achievable from standard, thermal double-glazing units, manufacturers' data should be used to confirm the performance requirements are achievable from any specified glazing units, including any provision for background ventilation if applicable.
- 5.4 Based on the proposed development design, the windows within the northern and eastern elevations are required to be in the closed position to effectively control noise ingress. The decision on whether the windows should be permanently closed is outside the scope of this assessment and our technical expertise. However, where windows are exposed to anonymous noise sources such as road traffic, there is normally no requirement for these windows to be permanently sealed.
- 5.5 All habitable rooms subject to sound mitigation measures would need to be provided with an alternative, effective means of ventilation. Any ventilation scheme should satisfy the requirements of Approved Document F and provide the required ventilation rates. Specialist advice should be obtained to ensure that any ventilation scheme is suitable for purpose. It is important that any scheme is approved by Building Control and does not compromise the internal noise levels.
- 5.6 Recommendations for suitable ventilation are outside the scope of this assessment and technical expertise.
- 5.7 Following an investigation of the principles of good acoustic design, the following considerations are recommended:
- *Consideration could be given to the sound reduction of the northern and eastern elevations of the proposed building.*

- 5.8 Once any planning conditions are known, the development proposal can be assessed in detail using 3D modelling techniques to confirm that the final layout satisfies those conditions and '*ensures an adequate level of protection against noise*'.
- 5.9 This will have the advantage of being able to identify only those areas of the site that will require mitigation thus avoiding any unnecessary expense.

P.A.T. 16/11/2023

M.Sc., I.Eng., M.I.O.A.,

M.Inst.SCE., M.A.E.S.

Appendix 1 Survey Details

A1.0 SURVEY DETAILS

- A1.1 During an initial site visit, it was subjectively perceived that the noise levels across the site were different at the eastern and western extents of the site.
- A1.2 To enable a robust assessment of the noise levels across the site, two measurement positions were chosen, one on the western boundary of the site adjacent to Queens Hill and another position at the eastern boundary overlooking Factory Road and the A4042.
- A1.3 **Programme of Measurements**
- A1.3.1 The meters were calibrated at the start of the measurement procedure and checked after each set of measurements. No significant deviation i.e. > 0.5 dB was recorded.
- A1.3.2 Measurements were carried out on 10th October 2022 for a minimum duration of 24 hours.
- A1.3.3 The equipment was monitored by a guard who made notes on any extraneous noise events and weather conditions.
- A1.3.4 Measurement periods where any of these events occurred were excluded from the analysis.
- A1.3.5 Weather conditions: Dry, 20% cloud cover, 12°C, no wind.
- A1.4 **Measurement Procedure:**
- A1.4.1 The meters were located in a weather-proof container and powered with heavy duty rechargeable batteries.
- A1.4.2 At the Queens Hill survey location, the microphone was located on a tripod 1.2 m from the ground at the entrance to the proposed site with a clear line of site to traffic travelling along Queens Hill. The microphone was inside an approved weather-proof microphone housing (see Appendix 2).
- A1.4.3 At the Factory Road survey location, the microphone was located on a bracket extending approximately 1m from the façade of an existing industrial building, at a

height of approximately 12m. The microphone was inside an approved weather-proof microphone housing.

- A1.4.4 This location enjoyed an uninterrupted view of the road traffic travelling along Factory Road and the A4042.
- A1.4.5 The meters were adjusted to log and store in 15-minute periods both L_{Aeq} and L_{A90} . The meter was also set to capture L_{Amax} events greater than 82dB L_{Amax} . See set up details in Table 8.
- A1.4.6 On completion of the survey, the data was downloaded to a computer for further analysis.
- A1.4.7 The analysis consisted of dividing the results into the time periods 07:00–23:00 and 23:00–07:00. Using B & K Evaluator Software the relevant $L_{Aeq,T}$ value was calculated. Also, the number, if any, of $L_{Amax} > 82$ dB events during the night period were recorded.
- A1.5 **Subjective Observations**
- A1.5.1 The acoustic climate at the site was characterised by road traffic noise from the surrounding highways.

Table 6 – Subjective Observations from Guard

Time	Subjective Comment
14:02	Lorry pass-by
14:13	Aircraft pass-over
15:34	Motorcycle pass-by
17:29	Motorcycle pass-by. Paused at gate to look at equipment
18:37	Motorcycle pass-by
18:45	Lorry pass-by
05:00	Speeding car pass-by
08:05	Bus stopped. Students shouting.
08:49	Lorry pass-by
09:00	Lorry pass-by

- A1.5.2 The security guard was instructed to keep a log of any unusual noises or activities and to provide subjective comments of the noise climate during the survey. These observations are detailed in Table 6 above.

A1.6 Equipment Used:

Table 7 – Equipment Used

Item	Serial Number	UKAS Calibration Certificate Date (if applicable)
Queens Hill (ANL-M3) B&K 2250 Handheld Analyser	2559188	Certificate: 15913 Date: 25/03/21
Queens Hill (ANPC3) B&K 4231 Calibrator	2162602	Certificate: 15911 Date: 25/03/21
Factory Road (ANL-M4) B&K 2250 Handheld Analyser	2567736	Certificate: 15914 Date: 25/03/21
Factory Road (ANL-C4) B&K 4231 Calibrator	2567363	Certificate: 15912 Date: 25/03/21

Table 8 – Meter Details (Queens Hill)

Instrument:		2250
Application:		BZ7224 Version 4.7.6
Start Time:		10/10/2022 10:12:45
End Time:		10/11/2022 10:31:48
Elapsed Time:		1.00:19:03
Bandwidth:		Broadband
Max Input Level:		140.86
	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		A
Instrument Serial Number:		2559188
Microphone Serial Number:		2556132
Input:		Top Socket
Windscreen Correction:		None

Sound Field Correction:		Free-field
Calibration Time:		10/10/2022 10:06:13
Calibration Type:		External reference
Sensitivity:		50.50 mV/Pa

Table 9 – Meter Details (Factory Road)

Instrument:		2250
Application:		BZ7224 Version 4.7.6
Start Time:		10/10/2022 13:14:17
End Time:		10/11/2022 14:45:03
Elapsed Time:		1.01:30:46
Bandwidth:		1/3-octave
Max Input Level:		142.69
	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		A
Spectrum:	FS	Z
Instrument Serial Number:		2567736
Microphone Serial Number:		2560565
Input:		Top Socket
Windscreen Correction:		None
Sound Field Correction:		Free-field
Calibration Time:		10/10/2022 13:00:32
Calibration Type:		External reference
Sensitivity:		40.91 mV/Pa

Appendix 2 View of Measurement Positions

A2.0 VIEW OF MEASUREMENT POSITIONS

Figure 1 – Measurement Positions

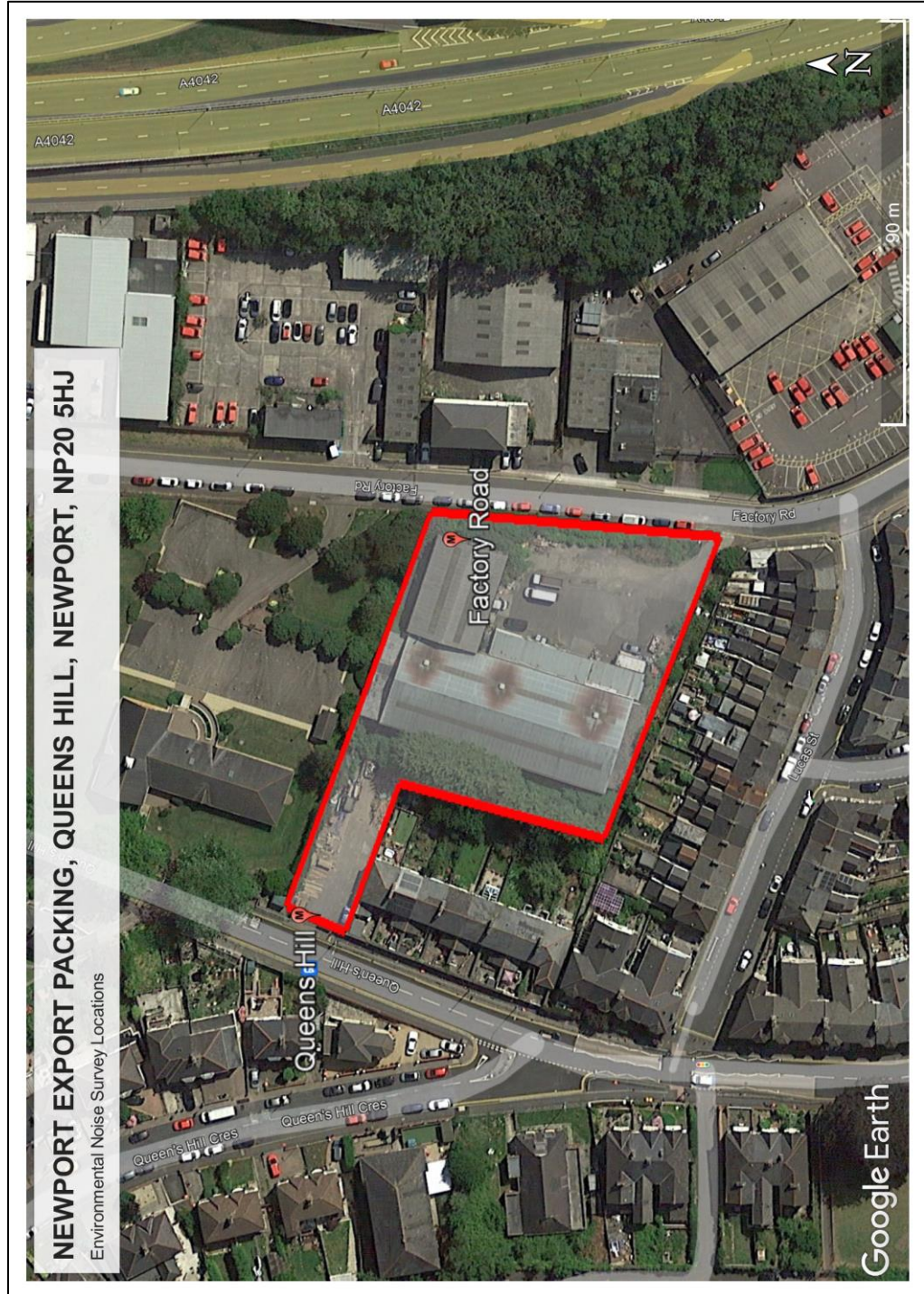


Figure 2 – View of Survey Equipment (Queens Hill)



Figure 3 – View of Survey Equipment (Factory Road)



Appendix 3 Survey Results

A3.0 SURVEY RESULTS

Table 10 – Summary of Queens Hill Survey Results (Free-Field Noise Levels)

Name	Period	Duration, t	L _{Aeq,t} (dB)	L _{AF90,t} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
Daytime	07:00 – 23:00	16:00	56.0	48.0	87.5	84.3
Night Time	23:00 – 07:00	08:00	52.3	41.5	74.7	71.2

Table 11 – Summary of Factory Road Survey Results (Façade Noise Levels)

Name	Period	Duration, t	L _{Aeq,t} (dB)	L _{AF90,t} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
Daytime	07:00 – 23:00	16:00	58.8	51.5	85.8	81.6
Night Time	23:00 – 07:00	08:00	53.2	44.2	82.3	78.8

Table 12 – Queens Hill Daytime Free-Field Noise Levels (07:00 – 23:00)

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
11/10/2022	07:00:00	59.1	54.7	74.9	70.4
11/10/2022	07:15:00	58.6	55.0	73.3	71.2
11/10/2022	07:30:00	57.6	54.4	65.1	63.9
11/10/2022	07:45:00	56.7	53.4	66.2	61.9
11/10/2022	08:00:00	57.0	52.7	70.2	65.6
11/10/2022	08:15:00	56.5	51.9	65.5	62.9
11/10/2022	08:30:00	56.2	50.5	70.9	67.7
11/10/2022	08:45:00	55.3	49.7	66.1	62.9
11/10/2022	09:00:00	56.7	48.4	78.9	74.7
11/10/2022	09:15:00	56.3	48.2	71.2	68.0
11/10/2022	09:30:00	55.5	47.7	68.5	65.8
11/10/2022	09:45:00	56.1	48.7	80.2	72.3
11/10/2022	10:00:00	55.3	48.2	70.3	67.4
10/10/2022	10:15:00	57.9	53.9	72.6	69.8
10/10/2022	10:30:00	56.9	52.4	69.6	67.3
10/10/2022	10:45:00	56.6	52.6	67.2	65.3
10/10/2022	11:00:00	56.1	52.1	66.9	64.2
10/10/2022	11:15:00	56.0	51.7	64.2	63.0
10/10/2022	11:30:00	57.9	52.7	78.3	75.9
10/10/2022	11:45:00	56.2	51.4	68.8	66.8
10/10/2022	12:00:00	56.3	52.4	64.5	62.2
10/10/2022	12:15:00	56.4	51.8	67.7	64.6
10/10/2022	12:30:00	56.0	51.6	63.9	62.0
10/10/2022	12:45:00	56.0	51.3	68.6	67.5
10/10/2022	13:00:00	56.8	51.8	73.6	71.9
10/10/2022	13:15:00	56.0	51.5	70.0	63.9
10/10/2022	13:30:00	55.4	51.0	65.1	63.5

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
10/10/2022	13:45:00	56.6	52.2	71.2	69.2
10/10/2022	14:00:00	56.9	51.3	75.1	71.6
10/10/2022	14:15:00	55.6	51.1	68.3	65.8
10/10/2022	14:30:00	60.1	51.7	87.5	84.3
10/10/2022	14:45:00	56.7	52.5	70.5	68.4
10/10/2022	15:00:00	58.7	51.6	78.4	74.3
10/10/2022	15:15:00	57.0	51.2	74.7	73.0
10/10/2022	15:30:00	56.6	52.1	63.5	62.3
10/10/2022	15:45:00	56.9	53.0	66.8	63.3
10/10/2022	16:00:00	56.4	52.7	65.7	63.6
10/10/2022	16:15:00	56.5	53.4	68.6	64.5
10/10/2022	16:30:00	57.4	53.3	70.0	67.6
10/10/2022	16:45:00	56.8	52.4	66.7	64.4
10/10/2022	17:00:00	57.2	53.0	68.2	65.7
10/10/2022	17:15:00	56.8	52.2	68.3	63.5
10/10/2022	17:30:00	60.7	52.0	86.0	83.2
10/10/2022	17:45:00	54.9	50.9	67.2	62.9
10/10/2022	18:00:00	54.9	50.4	64.5	62.9
10/10/2022	18:15:00	54.6	49.7	69.4	66.4
10/10/2022	18:30:00	54.0	48.3	64.6	62.9
10/10/2022	18:45:00	54.9	48.6	74.1	70.2
10/10/2022	19:00:00	53.5	48.6	72.4	68.5
10/10/2022	19:15:00	53.2	47.6	63.0	60.6
10/10/2022	19:30:00	53.4	47.5	63.2	61.5
10/10/2022	19:45:00	53.2	47.7	67.0	65.1
10/10/2022	20:00:00	52.7	48.2	62.7	60.5
10/10/2022	20:15:00	53.3	48.8	64.3	62.5

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
10/10/2022	20:30:00	53.1	48.8	65.7	62.8
10/10/2022	20:45:00	52.1	46.7	65.4	63.1
10/10/2022	21:00:00	52.3	47.5	64.6	63.0
10/10/2022	21:15:00	51.1	46.1	63.0	60.5
10/10/2022	21:30:00	50.3	44.6	70.0	65.5
10/10/2022	21:45:00	49.4	43.7	62.2	60.0
10/10/2022	22:00:00	50.3	43.5	68.1	64.3
10/10/2022	22:15:00	48.2	42.9	62.0	60.2
10/10/2022	22:30:00	47.9	42.2	62.8	60.4
10/10/2022	22:45:00	47.2	40.4	63.8	62.6

Table 13 – Queens Hill Night Time Free-Field Noise Levels (23:00 – 07:00)

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
10/10/2022	23:00:00	46.2	40.4	59.4	57.9
10/10/2022	23:15:00	45.9	39.5	63.4	61.6
10/10/2022	23:30:00	47.6	40.6	64.5	62.2
10/10/2022	23:45:00	46.1	41.1	61.5	59.5
11/10/2022	00:00:00	46.2	40.7	60.6	58.3
11/10/2022	00:15:00	43.3	38.9	55.4	51.8
11/10/2022	00:30:00	46.2	38.6	66.0	64.4
11/10/2022	00:45:00	47.3	40.3	67.7	62.3
11/10/2022	01:00:00	44.8	40.1	61.0	58.7
11/10/2022	01:15:00	45.8	40.9	62.3	59.9
11/10/2022	01:30:00	46.1	41.4	62.1	59.2
11/10/2022	01:45:00	45.9	42.3	61.1	58.9
11/10/2022	02:00:00	45.2	42.4	56.6	53.1
11/10/2022	02:15:00	45.8	41.5	67.5	64.8
11/10/2022	02:30:00	45.2	40.4	58.8	57.4
11/10/2022	02:45:00	49.2	41.0	71.5	67.2
11/10/2022	03:00:00	48.0	45.6	70.7	66.6
11/10/2022	03:15:00	47.8	45.5	62.8	60.4
11/10/2022	03:30:00	50.1	47.7	63.0	60.6
11/10/2022	03:45:00	51.4	47.9	68.7	66.7
11/10/2022	04:00:00	51.4	47.4	65.6	63.5
11/10/2022	04:15:00	51.1	46.3	68.0	63.5
11/10/2022	04:30:00	52.8	49.4	65.2	62.1
11/10/2022	04:45:00	53.2	49.8	65.4	62.7
11/10/2022	05:00:00	53.8	48.6	72.1	68.2
11/10/2022	05:15:00	53.3	48.1	64.3	61.7
11/10/2022	05:30:00	55.9	51.3	70.5	68.8

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
11/10/2022	05:45:00	56.5	52.5	71.1	65.7
11/10/2022	06:00:00	57.3	53.3	74.7	69.4
11/10/2022	06:15:00	57.4	53.6	64.5	62.7
11/10/2022	06:30:00	58.0	53.6	74.7	71.2
11/10/2022	06:45:00	58.7	54.8	69.9	66.2

Table 14 – Factory Road Daytime Façade Noise Levels (07:00 – 23:00)

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
11/10/2022	07:00:00	59.7	55.5	69.7	68.3
11/10/2022	07:15:00	60.6	55.6	75.9	70.6
11/10/2022	07:30:00	61.4	56.0	75.5	71.9
11/10/2022	07:45:00	61.5	57.1	71.1	69.8
11/10/2022	08:00:00	62.5	57.5	78.6	77.3
11/10/2022	08:15:00	61.9	57.1	74.8	72.6
11/10/2022	08:30:00	60.2	56.0	75.0	73.4
11/10/2022	08:45:00	60.9	55.8	74.7	73.1
11/10/2022	09:00:00	59.1	53.9	73.9	72.4
11/10/2022	09:15:00	59.3	52.7	76.5	70.9
11/10/2022	09:30:00	60.0	51.8	81.6	77.0
11/10/2022	09:45:00	57.8	51.1	72.6	71.0
11/10/2022	10:00:00	56.8	51.4	72.3	70.7
11/10/2022	10:15:00	57.7	51.7	70.9	69.6
11/10/2022	10:30:00	56.6	52.1	69.5	68.2
11/10/2022	10:45:00	58.0	52.0	72.8	71.6
11/10/2022	11:00:00	58.8	52.2	73.0	71.0
11/10/2022	11:15:00	59.6	52.4	83.6	78.2
11/10/2022	11:30:00	57.5	51.6	70.7	68.9
11/10/2022	11:45:00	59.0	51.7	77.3	74.6
11/10/2022	12:00:00	59.5	52.0	78.8	77.4
11/10/2022	12:15:00	57.6	51.8	69.8	68.8
11/10/2022	12:30:00	59.8	51.4	85.8	81.6
11/10/2022	12:45:00	57.2	50.8	76.0	70.0
11/10/2022	13:00:00	57.9	51.2	70.0	68.7
10/10/2022	13:15:00	58.7	53.2	71.0	69.9
10/10/2022	13:30:00	58.2	54.1	70.7	69.6

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
10/10/2022	13:45:00	58.6	53.5	74.4	71.7
10/10/2022	14:00:00	58.7	53.3	76.9	71.0
10/10/2022	14:15:00	59.5	53.4	72.9	71.8
10/10/2022	14:30:00	59.1	53.6	70.3	68.9
10/10/2022	14:45:00	59.8	53.8	76.4	74.6
10/10/2022	15:00:00	61.0	53.9	83.9	79.0
10/10/2022	15:15:00	60.1	53.4	75.8	74.7
10/10/2022	15:30:00	59.9	54.3	74.3	73.4
10/10/2022	15:45:00	59.9	54.3	76.3	74.6
10/10/2022	16:00:00	60.0	54.0	74.1	71.1
10/10/2022	16:15:00	59.7	53.1	73.3	72.5
10/10/2022	16:30:00	60.2	54.3	71.2	69.7
10/10/2022	16:45:00	60.0	54.9	73.2	70.7
10/10/2022	17:00:00	61.2	54.5	79.1	76.7
10/10/2022	17:15:00	60.0	54.8	71.3	69.4
10/10/2022	17:30:00	60.2	54.3	75.1	72.4
10/10/2022	17:45:00	58.9	53.4	68.7	66.4
10/10/2022	18:00:00	58.3	52.2	67.1	65.9
10/10/2022	18:15:00	58.4	53.1	71.6	67.2
10/10/2022	18:30:00	58.2	52.8	73.8	70.9
10/10/2022	18:45:00	57.2	52.5	65.9	64.1
10/10/2022	19:00:00	56.9	51.8	66.4	65.0
10/10/2022	19:15:00	56.6	52.4	65.3	63.8
10/10/2022	19:30:00	57.5	51.2	72.5	70.0
10/10/2022	19:45:00	57.2	51.0	73.6	72.0
10/10/2022	20:00:00	57.2	51.5	72.7	69.2
10/10/2022	20:15:00	56.8	50.3	74.6	73.1

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
10/10/2022	20:30:00	55.8	50.7	65.4	63.2
10/10/2022	20:45:00	54.9	50.2	67.0	64.4
10/10/2022	21:00:00	55.2	50.7	64.7	62.7
10/10/2022	21:15:00	56.6	50.1	76.4	73.5
10/10/2022	21:30:00	55.2	50.3	66.1	64.9
10/10/2022	21:45:00	54.5	49.5	68.1	66.2
10/10/2022	22:00:00	55.3	50.0	66.3	64.6
10/10/2022	22:15:00	53.7	48.7	70.7	67.9
10/10/2022	22:30:00	51.9	46.6	66.1	64.7
10/10/2022	22:45:00	50.7	46.5	61.4	59.6

Table 15 – Factory Road Night Time Façade Noise Levels (23:00 – 07:00)

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
10/10/2022	23:00:00	51.4	46.1	65.3	64.2
10/10/2022	23:15:00	50.2	44.8	64.8	59.5
10/10/2022	23:30:00	50.5	43.9	68.6	67.3
10/10/2022	23:45:00	48.5	43.1	63.0	60.9
11/10/2022	00:00:00	49.7	44.5	63.7	61.8
11/10/2022	00:15:00	47.7	43.8	60.1	57.9
11/10/2022	00:30:00	49.2	43.5	65.5	63.7
11/10/2022	00:45:00	48.6	43.9	61.3	58.9
11/10/2022	01:00:00	48.8	43.7	62.9	61.3
11/10/2022	01:15:00	47.8	42.9	61.7	58.2
11/10/2022	01:30:00	46.7	42.1	58.9	57.6
11/10/2022	01:45:00	47.5	43.7	60.7	58.5
11/10/2022	02:00:00	48.5	44.7	60.5	58.8
11/10/2022	02:15:00	48.1	44.7	62.0	59.8
11/10/2022	02:30:00	47.3	43.9	58.9	56.9
11/10/2022	02:45:00	50.2	45.8	64.7	62.5
11/10/2022	03:00:00	48.9	45.6	61.9	60.1
11/10/2022	03:15:00	48.3	45.0	60.1	58.8
11/10/2022	03:30:00	48.8	44.5	60.1	58.6
11/10/2022	03:45:00	48.7	43.6	62.0	60.6
11/10/2022	04:00:00	49.5	42.4	69.3	67.9
11/10/2022	04:15:00	48.3	43.3	61.3	58.8
11/10/2022	04:30:00	52.8	45.9	70.6	69.1
11/10/2022	04:45:00	52.2	47.3	64.6	62.6
11/10/2022	05:00:00	53.4	48.2	63.5	62.0
11/10/2022	05:15:00	53.6	48.7	70.7	69.3
11/10/2022	05:30:00	56.2	52.7	65.6	64.7

Start date	Start time	L _{Aeq,15mins} (dB)	L _{AF90,15mins} (dB)	L _{AFmax} (dB)	L _{ASmax} (dB)
11/10/2022	05:45:00	56.7	52.0	68.9	67.2
11/10/2022	06:00:00	57.7	51.1	80.0	78.0
11/10/2022	06:15:00	56.5	51.5	71.1	69.4
11/10/2022	06:30:00	60.1	54.2	82.3	78.8
11/10/2022	06:45:00	60.8	55.5	77.4	75.8

Appendix 4 Proposed Development Layout

A4.0 PROPOSED DEVELOPMENT LAYOUT

Figure 4 – Proposed Development Layout



Appendix 5 Relevant Guidance

A5.0 RELEVANT GUIDANCE

A5.1 Technical Advice Note 11 (TAN11) [1]

A5.1.1 The requirements for the assessment of noise impact on a proposed development site are detailed in TAN11 (Noise). This document prescribes the measurement methods and standards to be used for the noise survey. The results of the survey are separated into day and night periods which are compared with four Noise Exposure Categories (NECs).

A5.1.2 Noise Exposure Categories for Dwellings (NECs)

When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC, as shown in Table 16.

Table 16 – Planning Advice as per TAN11

NEC	Planning Advice
A	<i>Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.</i>
B	<i>Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.</i>
C	<i>Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.</i>
D	<i>Planning permission should normally be refused.</i>

A5.1.3 The noise exposure category for the site is the measured noise level compared with the range of noise levels as shown in Table 17.

Table 17 – Free-Field Noise Levels Corresponding to the NECs, $L_{Aeq,T}$ dB

Noise source		Noise Exposure Category			
		A	B	C	D
Road traffic	0700-2300	<55	55-63	63-72	>72
	2300-0700	<45	45-57	57-66	>66
Rail traffic	0700-2300	<55	55-66	66-74	>74
	2300-0700	<45	45-59	59-66	>66
Air traffic	0700-2300	<57	57-66	66-72	>72
	2300-0700	<48	48-57	57-66	>66
Mixed Sources	0700-2300	<55	55-63	63-72	>72
	2300-0700	<45	45-57	57-66	>66

A5.1.4 Maximum noise event values $L_{A\max}$ of 82dB were analysed as per Note 2 [1].

“Note 2: Night-time noise levels 2300-0700): sites where individual noise events regularly exceed 82dBLAmax (5 time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8H}$ (except where the $L_{Aeq,8H}$ already puts the site in NEC D)”.

A5.1.5 Mixed sources refer to any combination of road, rail, air and industrial noise sources. The ‘mixed source’ values detailed in Table 17 are based on the lowest numerical values of the single source limits in the table. The ‘mixed source’ NEC should only be used where no individual noise source is dominant.

A5.2 Planning Policy Wales [2]

A5.2.1 The foreword to the Planning Policy Wales (PPW) document states that ‘PPW will help to ensure that the planning decisions taken in Wales, no matter how big, or how small, are going to improve the lives of both our current and future generations. It will support changing the way we live and work, and the buildings and environment of Wales, today, building a better environment to accommodate current and future needs’.

- A5.2.2 PPW sets out the land use planning policies of the Welsh Government. The primary objective is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales. A well functioning planning system is fundamental for sustainable development and achieving sustainable places.
- A5.2.3 The planning system should create sustainable places (Placemaking) which are attractive, sociable, accessible, active, secure, welcoming, healthy and friendly. Development proposals should create the conditions to bring people together, making them want to live, work and play in areas with a sense of place and well-being, creating prosperity for all.
- A5.2.4 Placemaking in development decisions happens at all levels and involves considerations at a global scale, including climate change, down to the very local level, such as considering the amenity impact on neighbouring properties and people. Negative environmental impacts should be avoided in the wider public interest.
- A5.2.5 The environmental impact relevant to this assessment, will be from noise. PPW refers to the term 'soundscape' which it describes as *'the acoustic environment as perceived or experienced and/or understood by a person or people, in context (ISO definition)'*.
- A5.2.6 An appropriate soundscape contributes to a positive experience of place as well as being necessary for public health, amenity and well-being. Conversely, noise pollution can have negative effects and should be reduced as far as possible.
- A5.2.7 Certain sounds, such as those created by trees, birds or water features, can contribute to a sense of tranquillity whilst others can be reassuring as a consequence of their association with the normality of everyday activities. Problematic forms of sound are generally experienced as noise pollution and can affect amenity and be prejudicial to health or a nuisance. Noise action plans drawn up by public bodies aim to prevent and reduce noise levels where necessary and preserve soundscape quality where it is good. Both high and low levels of noise, depending on context, can be annoying or disruptive and impact on amenity, health

and well-being and as such should be protected through the planning process wherever necessary.

A5.2.8 A key planning policy principle is to consider the effects which proposed developments may have on soundscape quality and the effects which existing soundscape quality may have on proposed developments. Soundscape influences the choice of location and distribution of development and it will be important to consider the relationship of proposed development to existing development and its surrounding area and its potential to exacerbate or create poor or inappropriate soundscapes.

A5.2.9 The agent of change principle says that a business or person responsible for introducing a change is responsible for managing that change. In practice, for example, this means a developer would have to ensure that solutions to address noise from nearby pre-existing infrastructure, businesses or venues can be found and implemented as part of ensuring development is acceptable.

A5.2.10 Proposed development should be designed wherever possible to prevent adverse effects to amenity, health and the environment but as a minimum to limit or constrain any effects that do occur.

A5.3 **Noise and Soundscape Action Plan [3]**

A5.3.1 This document sets out action plans for each of the three agglomerations in Wales. These are identified as the Cardiff and Penarth agglomeration, the Newport agglomeration and the Swansea and Neath agglomeration.

A5.4 **ProPG: Planning & Noise [4]**

A5.4.1 Even though ProPG has been written principally to assist with the planning process in England, PPW recommends that the good acoustic design principles put forward in Supplementary Document 2 may also be adopted in Wales.

A5.4.2 A good acoustic design process takes a multi-faceted and integrated approach to achieve optimal acoustic conditions, both internally (inside noise-sensitive parts of the building(s)) and externally (in spaces to be used for amenity purposes).

- A5.4.3 Good acoustic design should provide the optimum acoustic outcome, without design compromises that will adversely affect living conditions and the quality of life of the inhabitants or other sustainable design objectives and requirements.
- A5.4.4 In requiring good acoustic design, there is a hierarchy of noise management measures that LPAs should encourage, including the following, in descending order of preference:
- *Maximising the spatial separation of noise source(s) and receptor(s).*
 - *Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.*
 - *Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.*
 - *Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.*
 - *Using the layout of the scheme to reduce noise propagation across the site.*
 - *Using the orientation of buildings to reduce the noise exposure of noise-sensitive rooms.*
 - *Using the building envelope to mitigate noise to acceptable levels.*
- A5.4.5 It is acknowledged that the inherent challenge of introducing noise-sensitive development in noisy locations can limit the extent to which good acoustic design can be achieved in harmony with the other factors that influence the overall quality of a scheme and that compromises may need to be made e.g. accepting that it may not always be possible to achieve acoustic standards with windows open or accepting that noise levels in parts of the outdoor amenity areas may not be optimal.
- A5.4.6 Where the scheme relies on windows being closed to achieve good internal noise conditions, details should be provided why this approach has arisen and how the use of layout, orientation, spatial design and non-building envelope mitigation has been considered to minimise the need for reliance upon closed windows.

- A5.4.7 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 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. Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded.
- A5.4.8 A good acoustic design will be one that continues to minimise noise impacts and to avoid significant noise effects for the lifetime of the development or as long as is practicable taking into account other economic, environmental and social impacts. Ideally new development should also help to mitigate any existing adverse impacts elsewhere, for example by acting as a barrier between noisy infrastructure and any existing noise-sensitive uses that do not benefit from incorporated mitigation.
- A5.5 **BS 8233 - Guidance on Sound Insulation and Noise Reduction for Buildings [5]**
- A5.5.1 For many common situations, BS 8233 suggests criteria, such as suitable sleeping/resting conditions, and proposes noise levels that normally satisfy these criteria for most people.
- A5.5.2 The foreword advises that the information detailed in BS 8233 “...takes the form of guidance and recommendations. It should not be quoted as it were a specification or a code of practice and claims of compliance cannot be made to it.”.
- A5.5.3 Section 7.7.2 details the guideline values for desirable internal ambient noise levels within dwelling houses, flats and rooms in residential use (when unoccupied) when such properties are exposed to steady external noise sources.
- A5.5.4 These guideline values range from 35 - 40 dB $L_{Aeq,16hrs}$ during the daytime period and 30 dB $L_{Aeq,8hrs}$ during the night time period as detailed in Table 18 below.

Table 18 – BS 8233 Internal Noise Level Guidelines

Activity	Location	07:00 – 23:00 hrs	23:00 – 07:00 hrs
Resting	Living Room	35 dB LAeq,16hrs	--
Dining	Dining room	40 dB LAeq,16hrs	--
Sleeping (Daytime Resting)	Bedroom	35 dB LAeq,16hrs	30 dB LAeq,8hrs

- A5.5.5 The guidelines also provide scope for relaxing these values by up to 5 dB and still achieve reasonable internal conditions.
- A5.5.6 The internal noise level in a room is calculated by subtracting the sound reduction performance of the external façade from the noise level outside the room.
- A5.5.7 It should be noted that the acoustic performance of the building envelope will be reduced, in the event windows are opened for ventilation or cooling purposes, to no more than 10 to 15 dB(A).
- A5.5.8 For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,16hrs with an upper guideline value of 55 dB LAeq,16hrs which would be acceptable in noisier environments.
- A5.5.9 It is recognised that these guideline values may not be achievable in all circumstances where development might be desirable. In higher noise areas, 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.
- A5.5.10 The guideline values presented in BS8233, applies to external noise as it affects the internal acoustic environment from sources without a specific character such as road traffic noise.

- A5.5.11 BS 8233 provides both simple and detailed calculation methods for determining the internal ambient noise levels attributable to the external noise level. These methods are based on those given in BS EN 12354-3 [7].
- A5.5.12 The indoor sound pressure level is estimated from the measured or calculated outdoor sound pressure level by using the sound level difference of the façade.
- A5.5.13 The more rigorous calculation method described in BS 8233 uses octave band data to determine the internal noise level and is more appropriate where the external noise may exhibit specific characteristics.
- A5.5.14 BS 8233 also states in section 7.7.2 that “*...regular individual noise events can cause sleep disturbance. A guideline value may be set in terms of SEL of $L_{Amax,F}$ depending on the character and number of events per night...*”
- A5.5.15 However, BS 8233 does not quantify what the L_{Amax} guideline value should be and therefore this assessment anticipates that any L_{Amax} criteria will make reference to the value presented in the W.H.O. guidelines [6].
- A5.6 **Guidelines for Community Noise, W.H.O. [6]**
- A5.6.1 Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries, construction and public work, and the neighbourhood.
- A5.6.2 The objective of the World Health Organization (WHO) is ‘*the attainment by all peoples of the highest possible level of health*’.
- A5.6.3 WHO defines ‘health’ as ‘*A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*’. This broad definition of health makes reference to the concept of well-being and thereby includes noise impacts such as annoyance, speech interference, and impaired task performance as ‘health’ issues.
- A5.6.4 The WHO guidelines deal with all aspects of environmental noise impact and provide guideline values for community noise in specific environments. Most of the

noise guidelines are given as period L_{Aeq} values. The relevant values for Dwellings are summarized in Table 19 below.

Table 19 – WHO Guideline Noise Levels for Dwellings

Residential Environment	Critical Health Effect(s)	$L_{Aeq,T}$ (dB)	Time Base, T
Outdoor Living Area	Serious Annoyance, daytime and evening	55	07:00 – 23:00 (16 hours)
	Moderate Annoyance, daytime and evening	50	07:00 – 23:00 (16 hours)
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	07:00 – 23:00 (16 hours)
Inside Bedrooms	Sleep disturbance, night-time	30	23:00 – 07:00 (8 hours)
Outside Bedrooms	Sleep disturbance, window open (outdoor values)	45	23:00 – 07:00 (8 hours)

- A5.6.5 These guideline values consider specific environments and identified health effects. Each value is set at the lowest levels that affect health such as annoyance and were derived from annoyance studies.
- A5.6.6 The guidelines, whilst not having any legal force in the UK, are commonly used by local authorities when setting environmental noise criteria for proposed developments.
- A5.6.7 For a restful sleep, the W.H.O. guidelines further recommend that the indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10 to 15 times per night.
- A5.6.8 In addition, the Guidelines also state that “...at night, sound pressure levels at the outside façades of the living spaces should not exceed 45 dB L_{Aeq} and 60 dB L_{Amax} so that people may sleep with the windows open...the noise reduction from outside to inside with the windows partly open is 15dB”.
- A5.7 **BS EN 12354 Part 3, Airborne Sound Insulation against Outdoor Sound [7]**

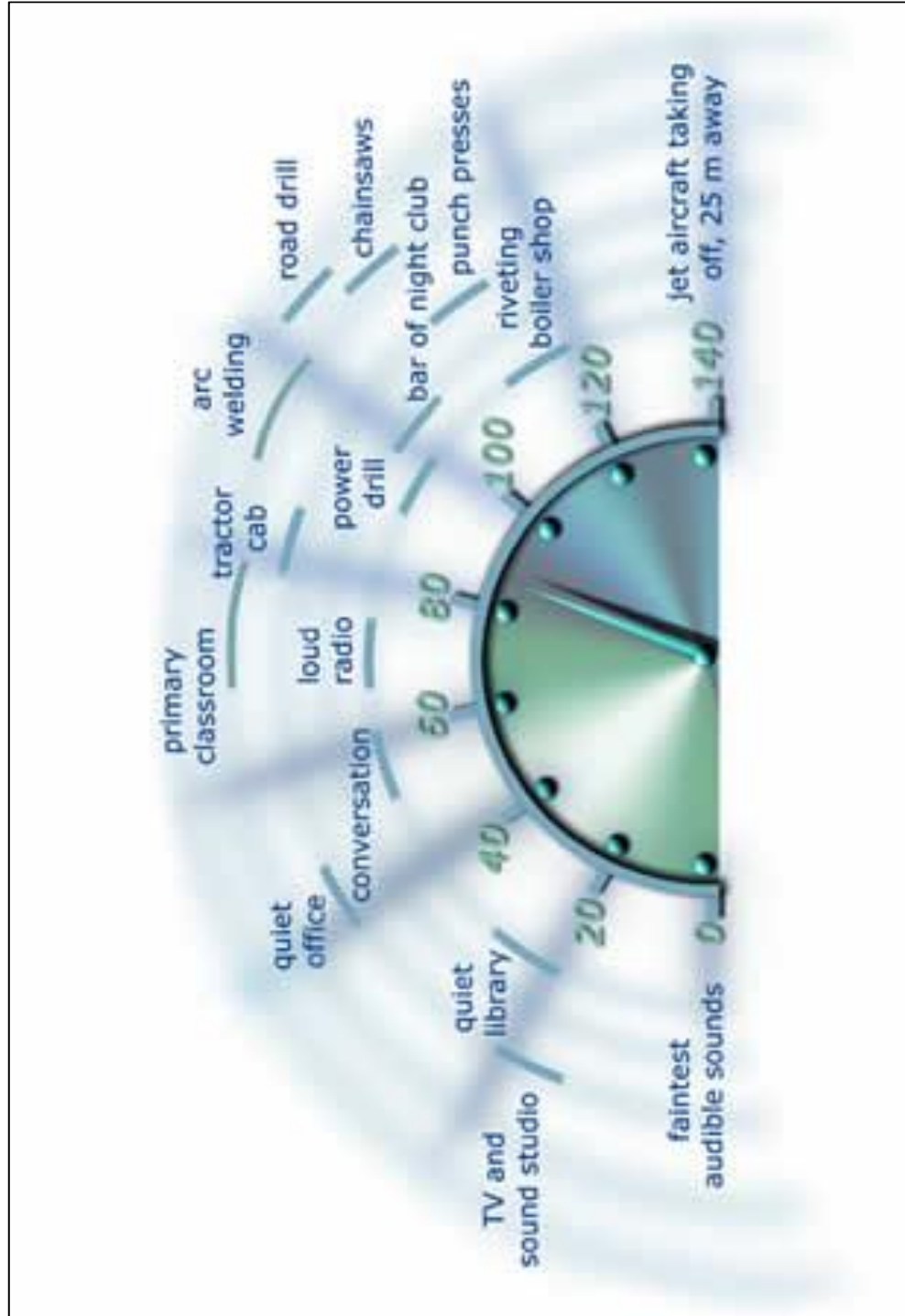
- A5.7.1 This Standard specifies a calculation model to estimate the sound insulation or the sound pressure level difference of a façade or other external surface of a building. The calculation is based on the sound reduction index of the different elements from which the façade is constructed. Calculations can be carried out for frequency bands or single number ratings.
- A5.7.2 The results of the calculation can be used to determine the indoor sound pressure level due to external sound sources such as road traffic.
- A5.7.3 BS EN 12354 states that *'The sound level difference refers to a position 2m in front of the façade. If the calculated or measured outdoor sound pressure level refers to other positions or situations, the level at 2m in front of the façade should be deduced from it. It could, for instance, be deduced from the sound pressure level of the incident sound (without the building) by taking into account the façade reflection. For a plain façade this will result in a 3dB higher level, globally for all frequency bands'*.
- A5.7.4 The indoor A-weighted sound pressure level can be determined from calculation in frequency bands for the appropriate frequency range, applying the A-weighting.
- A5.7.5 Alternatively, the indoor A-weighted sound pressure level can be determined directly from the A-weighted outdoor sound pressure level, provided the level difference is expressed in a single number rating for the relevant outdoor sound spectrum in accordance with BS EN ISO 717-1 [8], i.e. applying the spectrum adaptation terms C_{tr} or C to describe the level difference as, for example, $R_w + C_{tr}$ when the outdoor sound is road traffic.
- A5.8 **ISO 9613 [9]**
- A5.8.1 Part 1 of this standard specifies an analytical method of calculating the attenuation of sound as a result of atmospheric absorption for a variety of meteorological conditions
- A5.8.2 Part 2 describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous

A-weighted sound pressure level (as described in ISO 1996) under meteorological conditions.

Appendix 6 Range of Typical Noise Levels

A6.0 RANGE OF TYPICAL NOISE LEVELS

Figure 5 – Range of Typical Noise Levels



Appendix 7 Glossary of Acoustic Terms

A7.0 GLOSSARY OF ACOUSTIC TERMS

A7.1 Acoustic environment:

Sound from all sound sources as modified by the environment [BS ISO 12913-1:2013]

A7.2 Ambient sound:

Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far

NOTE The ambient sound comprises the residual sound and the specific sound when present.

A7.3 Ambient sound level, $L_A = L_{Aeq,T}$:

The equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T

NOTE the ambient sound level is a measure of the residual sound and the specific sound when present.

A7.4 Background sound level, $L_{A90,T}$:

A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T , measured using time weighting F and quoted to the nearest whole number of decibels

A7.5 Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$:

The value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10 \lg \left\{ (1/T) \int_{t_1}^{t_2} \left[\frac{p_A(t)^2}{p_0^2} \right] dt \right\}$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

A7.6 Measurement time interval, T_m :

Total time over which measurements are taken

NOTE This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.

A7.7 Rating level, L_{A,T_r} :

Specific sound level plus any adjustment for the characteristic features of the sound

A7.8 Reference time interval, T_r :

Specified interval over which the specific sound level is determined

NOTE this is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h.

A7.9 Residual sound:

Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound

A7.10 Residual sound level, $L_r = L_{Aeq,T}$:

Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T

A7.11 Specific sound level, $L_s = L_{Aeq,T_r}$:

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r

A7.12 Specific sound source:

Sound source being assessed

A7.13 A-weighting:

Normal hearing covers the frequency (pitch) range from about 20 Hz to 20,000 Hz but sensitivity is greatest between about 500 Hz and 5,000 Hz. The 'A-weighting' is an electrical circuit built into noise meters to approximate this characteristic of human hearing.

A7.14 Decibel (dB):

The logarithmic measure of sound level. 0dB (A) is the threshold of normal hearing. 140 dB (A) is the level at which instantaneous damage to hearing is caused. A change of 1 dB is detectable only under laboratory conditions.

A7.15 dB(A):

Decibels measured on a sound level meter incorporating a frequency weighting (A-weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with an individual's assessment of loudness. A change of 3 dB (A) is the minimum perceptible under normal conditions and a change of 10 dB(A) corresponds roughly to doubling or halving the loudness of a sound.

A7.16 Free Field:

A sound field in which no significant sound reflections occur.

A7.17 L_{Amax} :

The maximum 'A-weighted' level of sound recorded during a sound event. The time weighting used (fast or Slow) should be stated.

A7.18 Tonality:

The degree to which a sound contains audible pure tones. Broadband sound (across a wider range of frequencies) is generally less annoying than sound with identifiable tones.

A7.19 Frequency:

The number of cycles per second of a vibration usually expressed in units of Hertz, Hz

A7.20

Hertz:

Unit of frequency, equal to one cycle per second. Frequency determines the pitch of a sound.

Appendix 8 References

A8.0 REFERENCES

- 1 Planning Guidance (Wales) TAN (Wales) 11 Noise, Welsh Office
- 2 Planning Policy Wales, Edition 10, Welsh Government, December 2018
- 3 Noise and soundscape action plan 2018 – 2023, Welsh Government, 2018
- 4 ProPG: Planning & Noise, Professional Practice Guidance on Planning & Noise, New Residential Development, ANC, IOA, CIEH, May 2017
- 5 BS 8233:2014. 'Guidance on sound insulation and noise reduction for buildings', British Standards Institution 2014
- 6 "Guidelines for Community Noise", Berglund, Lindvall, Schwela, World Health Organization, 1999
- 7 BS EN 12354-3, "Building acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound", British Standards, 2017
- 8 BS EN ISO 717-1:1997, 'Acoustics - Rating of sound insulation in buildings and of building elements, Part 1: Airborne sound insulation', British Standards
- 9 ISO 9613 Acoustics – Attenuation of sound propagation outdoors Parts 1 & 2