Noise Impact Assessment for Planning Purposes

Job No:	*2305028*
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Prepared for:	*Kavod Property Ltd* *13 (Vincent House) Lowlands Road* *Pontnewydd* *NP44 1RF*
Site address:	*West of England Tavern* *2 Brunel Street* *Newport* *NP20 2JT*

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BRIEF FOR CONSULTANCY:

This report has been prepared by Acoustics & Noise Limited, Newport, South Wales, for Kavod Property Ltd, 13 (Vincent House) Lowlands Road, Pontnewydd, NP44 1RF under the instruction of Femi David.

Purchase Order No:

OBJECTIVES:

To investigate the noise impact on the proposed mixed commercial/residential development at West of England Tavern, 2 Brunel Street, Newport, NP20 2JT.

Where applicable recommend mitigation to meet the anticipated impact criteria.

NON-TECHNICAL SUMMARY:

The development proposal seeks planning permission for the redevelopment of the ground floor at West of England Tavern, 2 Brunel Street, Newport, NP20 2JT as a public house with residential accommodation on the upper floors. The residential accommodation comprises ten self-contained flats.

The significant source of environmental noise at the site is associated with road traffic on the A48, 25m to the south of the development building. In addition to the road traffic noise assessment, Environmental Health provided the following comment:

"*We would require robust assessment of the potential noise impact of the Licensed Premises activities affecting the residential properties, sound insulation specifications, ceiling / floor acoustic insulation specifications, glazing & ventilation, alongside the RTN assessment, to consider the suitability of the scheme for residential occupation*".

As this report is intended to accompany a full planning application, noise criteria are not yet available from Newport City Council. However, given our past experience with similar developments in Newport, we anticipate that any conditions issued by Newport City Council will be based upon those issued for similar, recent City Centre residential development.

There are no external amenity spaces associated with the proposed residential units and the sensitive receptors will be located within the habitable rooms. This report considers the minimum sound reduction performance for the proposed building envelope to ensure that

desirable internal noise levels are achievable. The overall sound insulation of the building envelope is typically determined by the weakest acoustic element which would normally be the windows.

The calculated external road traffic noise levels at the site indicate that an open window ventilation strategy would not be suitable for any of the habitable rooms within the development. A scheme of sound insulation is required to control the noise ingress. The recommended scheme requires that the glazing is in the closed position to control noise ingress.

This report assesses the whole site and provides recommendations for the minimum sound reduction performance required from any specified glazing units to ensure that the anticipated day and night time internal ambient noise criteria are achievable. Manufacturers' data should be used to confirm the minimum sound reduction performance requirements recommended in this report are achievable from any specified glazing units, including any provision for background ventilation if applicable.

To realize the full sound insulation potential of the glazing, the glazed unit should be installed into a frame with good seals. It is assumed that the glazing solutions are in the closed position to control the noise ingress. The decision on whether the glazing 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.

With regard to the proposed public house on the ground floor, there will be no provision for music entertainment. The primary noise source will be associated with the '*crowd noise*' from up to a maximum capacity of 80 people.

Noise transmission through the existing separating floor could potentially have an adverse effect on the amenity and health and wellbeing of the occupants of the proposed residential dwellings on the upper floors. This report details an assessment carried out to determine the noise levels that are likely to be experienced within the proposed first floor residential dwellings.

The results of this assessment indicate that the existing separating floor construction between the proposed public house and the residential accommodation above will be insufficient for controlling the noise emissions from the commercial activities. A scheme of mitigation is recommended for the separating floor to ensure that acceptable internal noise levels are achievable within the residential accommodation.

It is important that an independent assessment of the structural requirements for the recommended upgrade to the separating floor should be undertaken by a suitably qualified person to ensure the structural integrity of the proposed modifications.

The above recommended construction is based on the assumption that no music entertainment is proposed within the ground floor commercial unit. If music entertainment were to be provided within the public house, the above recommended construction may not be suitable.

The recommended mitigation detailed in this report will ensure that acceptable internal ambient noise levels are achievable within the proposed residential accommodation.

1.0 DESCRIPTION OF SITE

1.1 The site is located at the West of England Tavern, 2 Brunel Street, Newport, NP20 2JT and is currently a vacant three-storey, city centre, detached property formerly utilised as a public house.

1.2 The site is bounded by the A48 dual carriageway to the south.

1.3 A 2.4m high timber acoustic barrier is located alongside the A48 as it passes the development site.

1.4 The site is in an urban location and the acoustic climate is characterised by road traffic noise.

1.5 At the time of this assessment, significant construction work was ongoing at the nearby visitor centre for the Transporter Bridge.

1.6 A satellite view of the site is presented in Appendix 1.

2.0 DISCUSSION

2.1 At the time of this assessment, there was significant ongoing construction work associated with the new visitors' centre at the Transporter Bridge located opposite the development site. Noise from the construction works would significantly compromise the results of any noise survey that would normally be required for the assessment.

2.2 Following discussions with Newport City Council, it was agreed with the Environmental Health officer that, under the circumstances, a more pragmatic approach to assessing the road traffic noise impact would be to use acoustic modelling techniques with traffic flow data from the A48 used to calculate the noise propagation across the development site.

2.3 In addition to the road traffic noise assessment, Environmental Health provided the following comment:

"We would require robust assessment of the potential noise impact of the Licensed Premises activities affecting the residential properties, sound insulation specifications, ceiling / floor acoustic insulation specifications, glazing & ventilation, alongside the RTN assessment, to consider the suitability of the scheme for residential occupation."

2.4 Acoustics and Noise Ltd were engaged by Kavod Property Ltd to undertake a noise impact assessment for the above proposal to satisfy the requirements of Newport City Council, as detailed above.

2.5 **DESCRIPTION OF PROPOSED DEVELOPMENT**

2.5.1 The development proposal seeks planning permission for the redevelopment of the ground floor at West of England Tavern, 2 Brunel Street, Newport, NP20 2JT as a public house with residential accommodation on the upper floors. The residential accommodation comprises ten self-contained flats.

2.5.2 The proposed development layout is presented in Appendix 3.

2.6 **NOISE SENSITIVE RECEPTOR LOCATIONS**

2.6.1 The nearest sound sensitive receptors are the residential flats proposed for the upper floors of the development.

2.6.2 All information regarding noise sources and proposed activities included in this report were provided by the applicant's planning agent.

2.7 DESCRIPTION OF PRIMARY NOISE SOURCES

Road Traffic

2.7.1 The A48 is a busy main dual carriageway located 25m to the south of the development site.

Public House

2.7.2 Noise from the public house will be associated with patron activity with the proposed use catering for up to 80 people. The proposed operation of the ground floor as a public house has the potential to adversely impact the occupants of the residential accommodation on the upper floors via noise transference through the separating floors.

2.8 ASSESSMENT CRITERIA

Road Traffic

2.8.1 There are no objective criteria detailed in the comments from Newport City Council.

2.8.2 Suitable guidance on acceptable internal noise levels can be found in BS 8233:2014 [7]. This document suggests that "*in general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values*".

2.8.3 For the purposes of this report, the calculated road traffic noise levels within the proposed dwellings are assessed against the guideline criteria detailed in Table 1 below.

Table 1 – Assessment Criteria for Internal Road Traffic Noise Levels

Assessment Period	Maximum Internal Ambient Noise Level*
Daytime (07:00 – 23:00)	35 dB $L_{Aeq,16hr}$
Night Time (23:00 – 07:00)	30 dB $L_{Aeq,8hr}$

** within habitable rooms*

Public House

2.8.4 For a given level of noise, the effect in terms of annoyance or disturbance will differ depending on the time of day that the noise occurs, and the individual activity being undertaken at that time.

2.8.5 Planning guidelines typically distinguish between daytime (07:00 – 23:00) and night time (23:00 – 07:00) when setting criteria for residential premises to reflect the differing '*time of day*' sensitivity to noise. For example, it is generally accepted that the night time becomes more sensitive because people are trying to sleep.

2.8.6 At the time of this assessment, the proposed opening hours are not known, however, it is likely that it will be open until at least 23:00 hours in keeping with traditional licenced premises. During this late evening period, the occupants of the proposed flats would reasonably be expected to be trying to get to sleep.

2.8.7 To ensure that the activities within the proposed Public House would not result in an adverse impact to the occupants of the proposed dwellings during the late evening, this assessment considers that an appropriate night time noise criteria should be designed to.

2.8.8 To inform this assessment and ensure that any disturbance from the potential noise within the public house is minimised, the calculated noise transmission through the separating elements is compared with the night time design limits detailed by CIBSE [1].

2.8.9 The CIBSE design limits are expressed in terms of a Nose Rating (NR), which can be used to specify the maximum acceptable level in each octave band of a frequency spectrum, or to assess the acceptability of a noise spectrum for a particular situation.

2.8.10 NR is a graphical method for assigning a single number rating to a noise spectrum. To obtain a rating, the noise spectrum is superimposed on a family of NR contours. The NR of the spectrum corresponds to the value of the first NR contour that is entirely above the spectrum.

2.8.11 For residential accommodation during the night time, CIBSE recommends the design noise limits summarised in Table 2 below.

Table 2 – Summary of Crowd Noise Assessment Criteria

Description	NR Noise Criteria	dBA Noise Criteria*
Residential Accommodation	NR25	30

** Maximum permissible noise levels*

3.0 DETERMINATION OF NOISE LEVELS

3.1 ROAD TRAFFIC NOISE

3.1.1 When assessing road traffic noise levels, the conclusions are normally based on the results of an extensive noise survey. However, in this case, due to the ongoing and significant nearby construction work and time constraints for the submission of the planning application it was not practicable to carry out a noise survey. It was agreed with the local authority, that for the purposes of this application, the road traffic noise levels at the site could be assessed using available traffic count data and 3D modelling techniques to predict the road traffic noise levels across the site.

3.1.2 Traffic count data provides street level traffic data for every junction-to-junction link on the 'A' road and motorway network in Great Britain. Details of the traffic flow data used in this assessment are presented in Appendix 5.

3.1.3 The model was used to calculate the external free-field noise levels at each of the proposed dwellings. Details of the modelling are presented in Appendix 5 with the results presented in Appendix 6 which are used to inform the impact assessment discussed later in this report.

3.2 PUBLIC HOUSE ACTIVITY NOISE

3.2.1 The proposed ground floor public house will cater for up to 80 people with no musical entertainment.

3.2.2 In the absence of any standard prediction methodologies for predicting the noise emissions from activities involving crowds of people, this assessment refers to published research presented at Acoustics 2011 [2], which presents a series of formula suitable for predicting the noise emissions from small to medium sized crowds, of up to 100 people.

3.2.3 The results of the calculations are presented in Appendix 4.

4.0 IMPACT ASSESSMENT

4.1 RELEVANT GUIDANCE

4.1.1 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 9.

4.2 ROAD TRAFFIC IMPACT ASSESSMENT FOR PROPOSED RESIDENTIAL UNITS

4.2.1 There are no external amenity spaces associated with the proposed residential units and therefore, the sensitive receptors will be located within the habitable rooms.

4.2.2 The internal noise level in a room is calculated by subtracting the sound reduction performance of the external façade from the calculated noise level outside the room. This is described as the outdoor to indoor noise level difference.

4.2.3 3D modelling techniques were used to calculate the external free-field noise levels at each of the proposed dwellings.

4.2.4 The results of the modelling are presented as easily understood, colour coded, noise contour maps in Appendix 6.

4.2.5 Internal Ambient Noise Levels

4.2.5.1 As stated above, 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, the sound insulation performance of the external façade is assumed to be equivalent to the weakest acoustic element which will be the glazing units.

4.2.5.2 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.

4.2.5.3 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".

4.2.5.4 The relevant outdoor sound spectrum is defined in BS EN ISO 717-1 [11] as a correction term, C or C_{tr}, to be applied to the level difference.

4.2.5.5 When considering road traffic travelling at low speeds (<80 km/h), as is this case for traffic travelling along the A48, the appropriate correction term is C_{tr}.

4.2.5.6 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).

4.2.6 **Open Window Ventilation Strategy**

4.2.6.1 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 [7].

4.2.6.2 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 $L_{Aeq,8hrs}$.

4.2.6.3 To aid the identification of any habitable rooms where an open window ventilation strategy would be suitable, reference is made to the colour coded noise contour maps presented in Appendix 6.

4.2.6.4 Maps are generated to visually depict the road traffic noise propagation across the development site. Green areas indicate where the noise levels are low enough such that an open window would be suitable for providing background ventilation for any habitable room located within the area. Red areas indicate that the noise levels are such that internal ambient noise levels within any habitable room located within these areas will exceed the criteria detailed in Table 1.

4.2.6.5 Following analysis of the contour maps presented in Appendix 6, it is clear that all proposed habitable rooms are located within the red areas during either or both

the daytime and night time periods and therefore and an open window ventilation strategy is not suitable for the proposed development.

4.2.7 **Minimum Façade Sound Insulation Performance**

4.2.7.1 To ensure that the required internal noise levels are achievable for all habitable rooms, this assessment uses the model to calculate the external road traffic noise levels at all rooms to enable the calculation of the minimum sound reduction performance of the glazing units. This will ensure that an effective mitigation strategy can be determined for any room where an open window ventilation strategy is not appropriate.

4.2.7.2 The results of the modelling exercise to determine the external road traffic noise levels at each habitable room are presented in Appendix 6 with the minimum sound reduction calculations for the glazing units detailed in Appendix 8.

4.2.7.3 The results indicate a wide variety in the minimum sound reduction specification requirements depending on location. Therefore, it may be more practical from an on-site logistics perspective, to specify the same performance for all glazing units. This will ensure that appropriate glazing is installed to all rooms, avoiding on-site confusion leading to mistakenly installing glazing to a room that was intended for another location.

4.2.7.4 The results indicate that a minimum sound reduction performance of 25 dB $R_w + C_{tr}$ would provide the required internal ambient noise levels to all habitable rooms during both the daytime and night time periods.

4.2.7.5 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.

4.2.7.6 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.

4.2.7.7 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.

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

4.3 ASSESSMENT OF SEPARATING PARTITION BETWEEN COMMERCIAL AND RESIDENTIAL UNITS

4.3.1 Noise transmission through the separating floor between the ground floor commercial unit and the first-floor residential accommodation could potentially have an adverse effect on the amenity and health and wellbeing of residential receptors.

4.3.2 The calculated noise emissions associated with the primary noise sources are detailed in Appendix 4 and used to calculate the noise transference through the separating floor, as detailed in Appendix 7. The resultant noise level within the residential accommodation is compared with the criteria detailed in Table 2 to determine the effectiveness of the existing or recommended constructions in controlling the noise transference to acceptable levels.

EXISTING CONSTRUCTION

4.3.3 The efficacy of the existing construction for the separating floor is assessed as to its suitability in controlling the noise transference to acceptable levels as described in Table 2.

4.3.4 The sound reduction performance of the existing floor construction was calculated using industry leading INSUL software. The noise transmission calculations are carried out using octave band data with the results presented in Appendix 7.

4.3.5 The results indicate that within the first-floor residential accommodation, the calculated internal sound pressure level arising from the activities within the

ground floor public house achieves a noise rating (NR) of NR47 with an equivalent maximum A-weighted sound pressure level of 50 dB L_{pA}.

4.3.6 This significantly exceeds the assessment criteria detailed in Table 2 and mitigation to the existing separating floor is recommended to ensure acceptable internal noise levels within the flat above are achievable during the use of the ground floor unit.

4.4 RECOMMENDED SEPARATING FLOOR MITIGATION

4.4.1 A scheme of mitigation is required for the separating floor between the proposed ground floor commercial unit and the residential accommodation located above.

4.4.2 The recommended mitigation is provided in Appendix 2 and summarised below:

- *Existing floor/ceiling*
- *Independent Ceiling of 2x15mm acoustic plasterboard with 100mm Mineral wool infill to the void (min 48kg/m^3)*
- *Minimum cavity depth 300mm with new ceiling installed below the existing structure with no contact with the existing ceiling.*

4.4.3 The sound reduction performance for the floor construction recommended above is presented in Appendix 2.

4.4.4 The results of the noise transference calculations detailed in Appendix 7, for the upgraded floor/ceiling, indicate that within the first floor residential accommodation, the mitigated internal sound pressure level arising from the activities within the proposed public house achieves a noise rating (NR) of NR21 with an equivalent maximum A-weighted sound pressure level of 25 dB L_{pA}.

4.4.5 This comfortably satisfies the assessment criteria detailed in Table 2 and demonstrates that the proposed modifications are effective in ensuring acceptable internal noise levels within the flat above are achievable during the use of the ground floor unit.

4.4.6 An independent assessment of the structural requirements should be undertaken by a suitably qualified person to ensure the structural integrity of the proposed modifications.

4.4.6.1 Note that if music entertainment were to be provided within the public house, the above recommended construction may not be suitable.

5.0 CONCLUSIONS

5.1 Road Traffic Noise

5.1.1 An assessment of the impact from road traffic noise was carried out to determine the extent of mitigation measures required to achieve acceptable internal ambient noise levels within the proposed residential accommodation.

5.1.2 The conclusions of this report apply to the proposed development design and are based on anticipated planning conditions from Newport City Council which in turn are based on the conditions for similar developments within the City Centre.

5.1.3 The results of this assessment indicate that an open window ventilation strategy is not suitable for any of the proposed habitable rooms within the development.

5.1.4 This report has further assessed the development proposal and provides recommendations for the minimum sound reduction performance requirements for any specified glazing units to ensure desirable internal ambient noise levels at all times.

5.2 Commercial Noise

5.2.1 The results of this assessment indicate that the existing separating floor construction between the proposed public house and the residential accommodation above is insufficient for controlling the noise emissions from the commercial activities.

5.2.2 An effective scheme of mitigation is recommended for the separating floor between the proposed ground floor commercial unit and the residential accommodation located above.

6.0 RECOMMENDATIONS

6.1 All glazing units to habitable rooms should be specified with a minimum sound reduction performance of 25 dB $R_w + C_{tr}$ to ensure desirable internal noise levels during both the daytime and night time.

6.2 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.

6.3 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.

6.4 All habitable 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.

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

6.6 The following mitigation to the separating elements between the proposed ground floor commercial unit and residential accommodation will provide acceptable noise levels within the residential accommodation during the use of the commercial unit:

RECOMMENDED SEPARATING FLOOR UPGRADE

- *Existing floor/ceiling*
- *Independent Ceiling of 2x15mm acoustic plasterboard with 100mm Mineral wool infill to the void (min 48kg/m^3)*

- *Minimum cavity depth 300mm with new ceiling installed below the existing structure with no contact with the existing ceiling.*

6.7 An independent assessment of the structural requirements should be undertaken by a suitably qualified person to ensure the structural integrity of the proposed modifications.

6.8 The above recommended construction is based on the assumption that no music entertainment is proposed within the ground floor commercial unit. If music entertainment were to be provided within the public house, the above recommended construction may not be suitable.

P.A.T. 22/08/23
M.Sc., I.Eng., M.I.O.A., M.Inst.SCE., M.A.E.S.

Appendix 1
View of Assessment Area

A1.0 VIEW OF ASSESSMENT AREA

Figure 1 – View of Assessment Area

Appendix 2
Sound Reduction Performance for Separating Floor

A2.0 SOUND REDUCTION PERFORMANCE FOR SEPARATING FLOOR

Figure 2 – Sound Reduction Performance for Existing Floor Construction

Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within Rw ±3 dB
Acoustics and Noise Ltd, 55 Malpas Road, Newport,NP20 5PJ. - Key No. 1563
Job Name:West of England Tavern
Job No.:2305028 Initials:PaulTrew
Date:14/08/2023
File Name: ceiling calcs.ixl

Notes:

Rw 43 dB
C -2 dB
Ctr -7 dB

Mass-air-mass resonant frequency = =41 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 28.5 kg/m²

System description

Panel 1 : 1 x 19 mm Siberian Larch (ρ:720 kg/m3,E:14GPa,η:0.04, ρs:13.7 kg/m², fc:780 Hz)

Frame: Timber stud (2.3E2 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 225 mm , 1 x Fibreglass (10kg/m3) Thickness 60 mm
Panel 2 : 2 x 10 mm Plasterboard (ρ:710 kg/m3,E:2GPa,η:0.01, ρs:14.2 kg/m², fc:5465 Hz)

freq.(Hz)	R(dB)	R(dB)
50	12	
63	8	10
80	10	
100	19	
125	26	23
160	31	
200	35	
250	37	37
315	40	
400	41	
500	43	42
630	43	
800	39	
1000	40	40
1250	43	
1600	45	
2000	48	47
2500	50	
3150	51	
4000	51	53
5000	62	

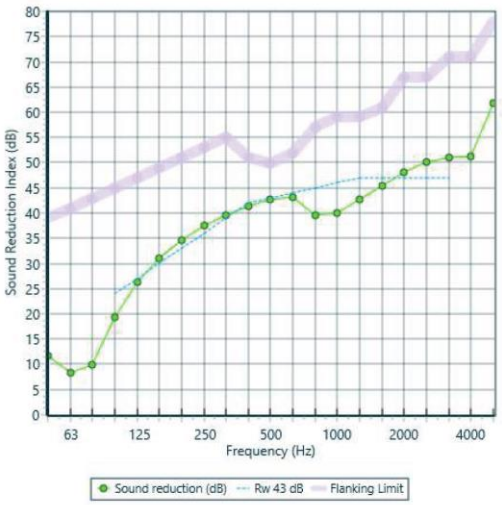
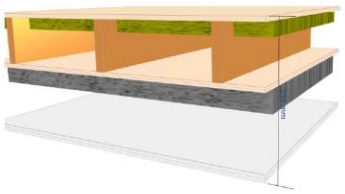


Figure 3 – Sound Reduction Performance for Recommended Floor Construction

Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within Rw ±3 dB
Acoustics and Noise Ltd, 55 Malpas Road, Newport,NP20 5PJ. - Key No. 1563
Job Name: West of England Tavern
Job No.: 2305028 Initials:PaulTrew
Date:14/08/2023
File Name:insul

Notes:Independant ceiling minimum cavity depth 300mm. No connections between independant ceiling and existing ceiling



Rw 86 dB
C -4 dB
Ctr -12 dB

Mass-air-mass resonant frequency = =27 Hz , 54 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 57.7 kg/m²

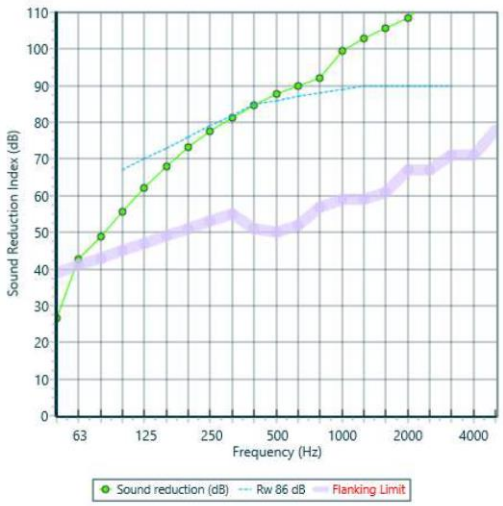
System description

Panel 1 : 1 x 19 mm Siberian Larch (ρ:720 kg/m3,E:14GPa,η:0.04, ρs:13.7 kg/m², fc:780 Hz)

Frame: Timber stud (2.3E2 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 225 mm , 1 x Fibreglass (10kg/m3) Thickness 60 mm
Panel 2 : 2 x 10 mm Plasterboard (ρ:710 kg/m3,E:2GPa,η:0.01, ρs:14.2 kg/m², fc:5465 Hz)

Frame: None (no connections) (3E2 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 300 mm , 1 x Rockwool (40kg/m3) Thickness 100 mm
Panel 3 : 2 x 15 mm Gyproc SoundBloc 15mm (ρ:840 kg/m3,E:3.1GPa,η:0.01, ρs:25.2 kg/m², fc:3176 Hz)

freq.(Hz)	R(dB)	R(dB)
50	26	
63	43	31
80	49	
100	55	
125	62	59
160	68	
200	73	
250	78	76
315	81	
400	85	
500	88	87
630	90	
800	92	
1000	99	96
1250	103	
1600	106	
2000	108	108
2500	114	
3150	119	
4000	120	121
5000	128	



Appendix 3
Proposed Development Drawings

A3.0 PROPOSED DEVELOPMENT DRAWINGS

Figure 4 – Proposed Ground Floor Layout

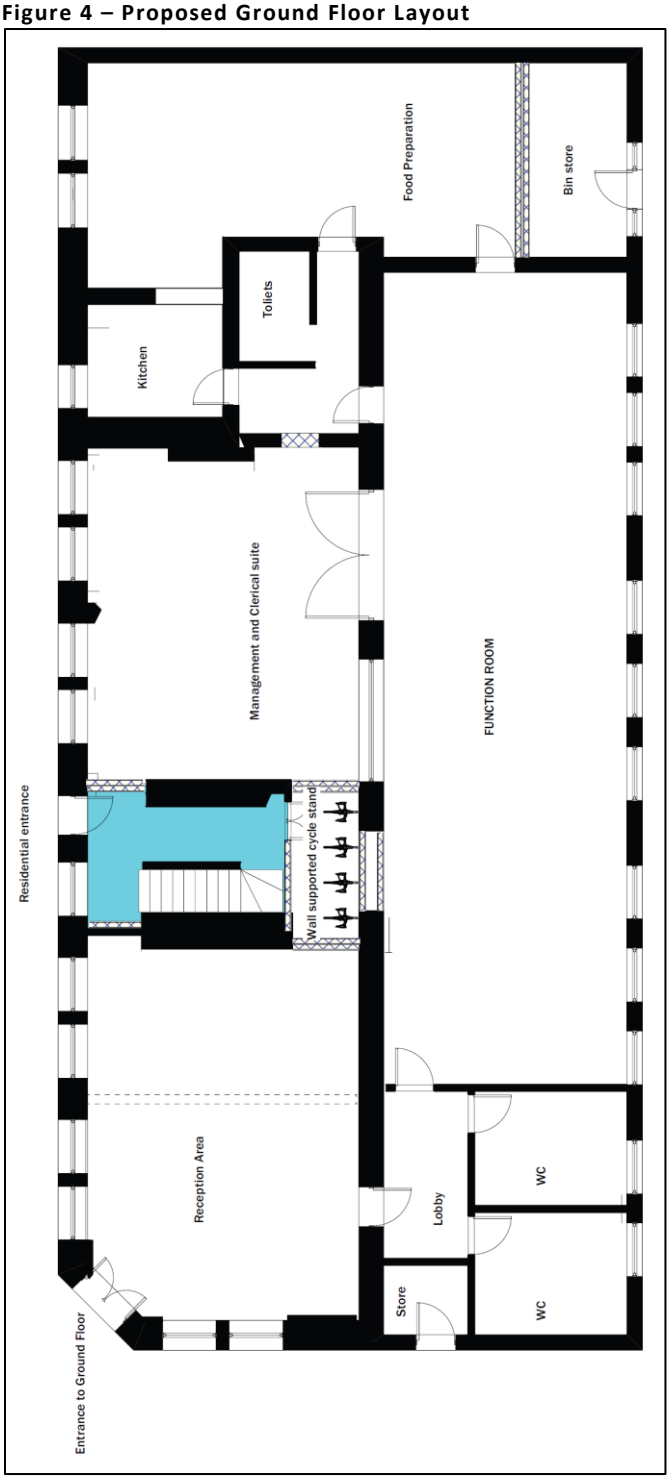


Figure 5 – Proposed First Floor Layout

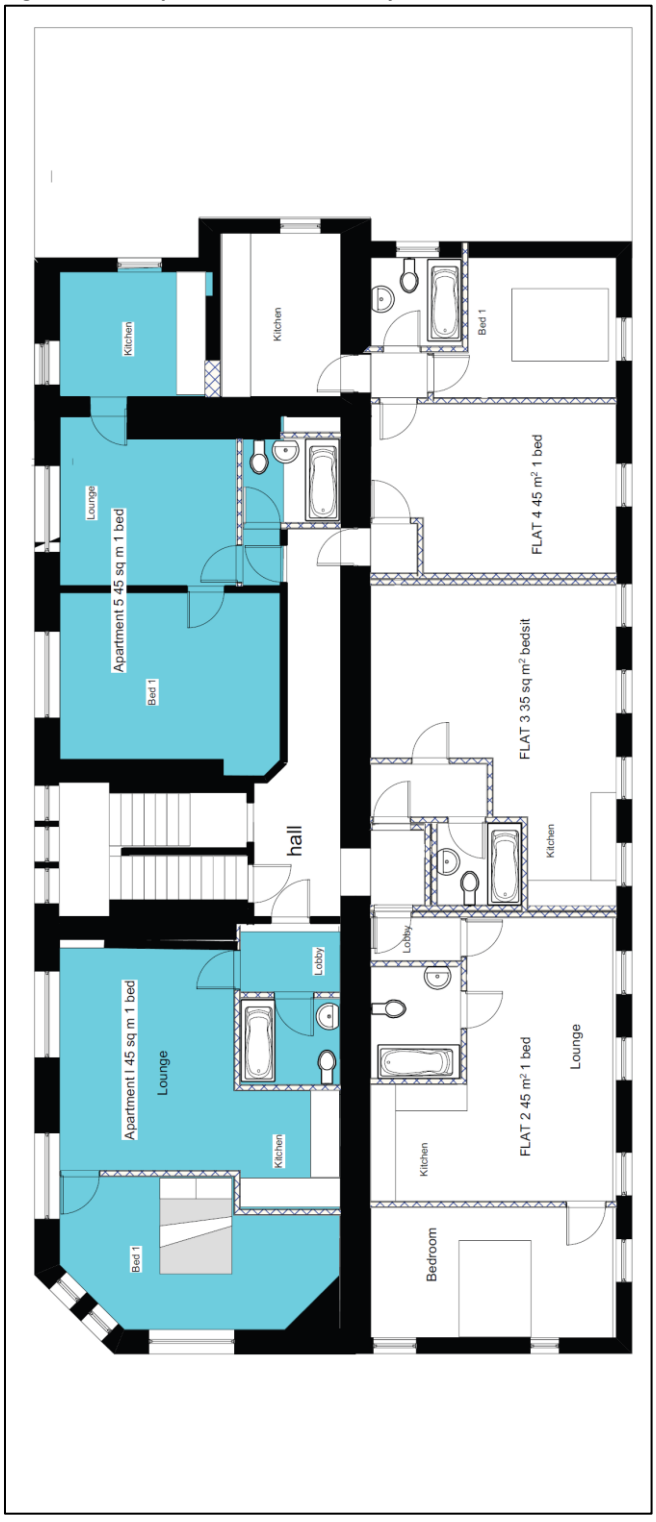
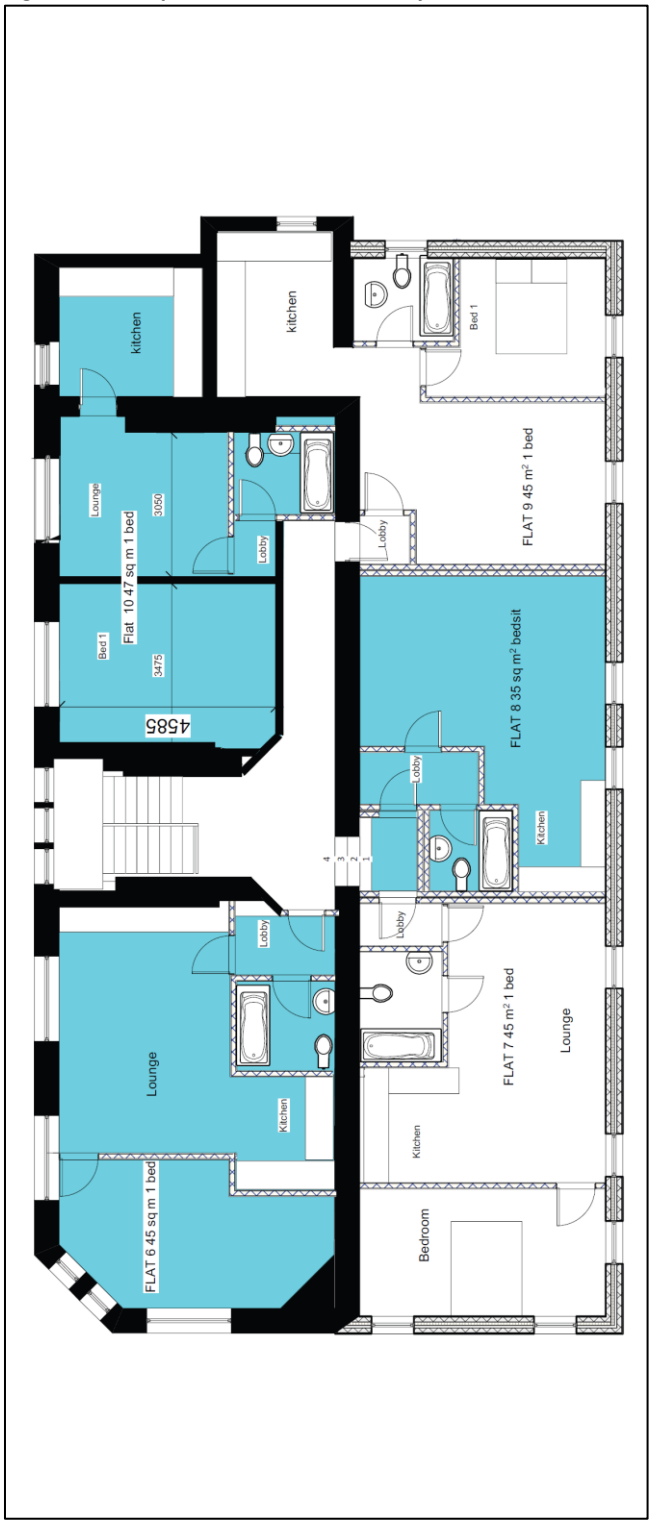


Figure 6 – Proposed Second Floor Layout



Appendix 4
Commercial Unit Activity Noise Levels

A4.0 COMMERCIAL UNIT ACTIVITY NOISE LEVELS

A4.1 The primary noise sources within the proposed public house are associated with the '*crowd*' noise from up to 80 patrons visiting the facility.

A4.2 In the absence of any standard prediction methodologies for predicting the noise emissions from activities involving crowds of people, this assessment refers to published research presented at Acoustics 2011 [2], which presents a series of formula suitable for predicting the noise emissions from small to medium sized crowds, of up to 100 people.

A4.3 The research [2] states that the A-weighted sound power levels for a crowd size, N, can be approximated by:

$$L_{WAeq} = 15 \log(N) + 64 \text{ dB(A)}$$

where L_{WAeq} represents the sound power level derived from measurements of crowd noise using the L_{Aeq} descriptor.

A4.4 For a maximum crowd of 80 people, L_{WAeq} = 93 dB.

A4.5 As the crowd is located indoors, the sound pressure level at a location within the space is comprised of the reverberant sound level plus the direct sound pressure level.

A4.6 The reverberant sound level can be estimated using the formula:

$$L_p = L_w + 10 \lg \left(\frac{4}{Rc}\right) \text{ dB}$$

where R_c is the room constant.

A4.7 The room constant is a function of the acoustic absorption within the room and can be estimated using the formula:

$$R_c = \frac{0.16.V}{T} \text{ m}^2$$

where V is the room volume (m^3) and T is the reverberation time of the room.

A4.8 The volume of the commercial space is estimated as 264 m^3, and the reverberation time is assumed to be 1.5 seconds, which is reasonable for a '*lively bar*' setting.

A4.9 The room constant is calculated as R_c = 28.3 m^2.

A4.10 The reverberant sound pressure level within the commercial area is calculated as L_{pA} = 85 dB.

A4.11 If we assume that the separating floor elements are 1m from the crowd (worst-case), then the direct sound pressure level at the separating element is calculated using the formula $L_{pA} = L_{wA} – 20Log(r) – 8$ where r = 1m.

A4.12 In this case, the direct sound pressure level at the separating element is L_{pA} = 85 dB.

A4.13 Combining the reverberant sound pressure level and the direct sound pressure level at the separating element, the total crowd noise is calculated as L_{pA} = 85 + 85 = 88 dB.

A4.14 When determining the minimum sound reduction performance requirements, it is important to consider any particular acoustic characteristics of the noise source. The frequency spectrum for the above noise sources is estimated using the appropriate sound spectra detailed in BS EN ISO 717-1 [11] for a range of typical noise sources.

A4.15 To represent the patron noise, Spectrum No 1 is appropriate for assessing noise sources such as people talking and children playing.

A4.16 The relevant noise spectra and the calculated cumulative noise level within the proposed public house are presented in Table 3 below.

Table 3 – Calculated Noise Source Octave Band Spectrum

		63	125	250	500	1000	2000	4000	
Spectrum No 1	$C_{50\text{-}5000}$	-32	-22	-15	-9	-6	-5	-5	
Crowd Noise Spectra, L_{pA} (dB)		56	66	73	79	82	83	83	88

Appendix 5
3D Acoustic Model Details

A5.0 3D ACOUSTIC MODEL DETAILS

A5.1 TRAFFIC COUNT DATA (AADT)

Figure 7 – Location of Traffic Count Points 664 and 84012

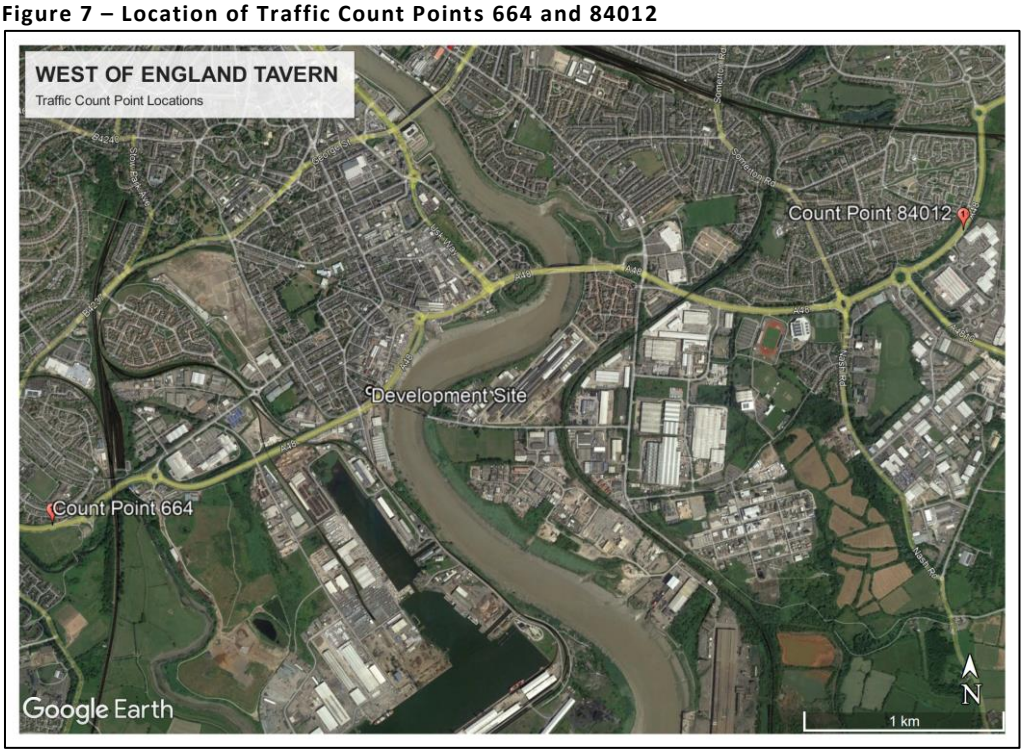


Table 4 – Traffic Count Data for Years 2014 – 2021, Count Point 84012

AADF Year	CP	Road	All HGVs	All Motor Vehicles	18 hr Flows*	%HGV
2021	84012	A48	1208	26296	24797	4.6
2020	84012	A48	1139	23951	22586	4.8
2019	84012	A48	1391	24403	23012	5.7
2018	84012	A48	1391	24363	22974	5.7
2017	84012	A48	1371	24299	22914	5.6
2016	84012	A48	1341	24131	22756	5.6
2015	84012	A48	1377	23629	22282	5.8
2014	84012	A48	1110	15596	14707	7.1

** A COBA factor (0.943) is used convert the flows from 24 hour to 18 hour*

Table 5 – Traffic Count Data for Years 2014 – 2021, Count Point 664

AADF Year	CP	Road	All HGVs	All Motor Vehicles	18 hr Flows*	%HGV
2021	664	A48	1898	26871	25339	7.1
2020	664	A48	1772	22246	20978	8.0
2019	**664**	**A48**	**1978**	**29287**	**27618**	**6.8**
2018	664	A48	1965	29222	27556	6.7
2017	664	A48	1927	29110	27451	6.6
2016	664	A48	1632	27948	26355	5.8
2015	664	A48	1645	27284	25729	6.0
2014	664	A48	1648	27501	25933	6.0

** A COBA factor (0.943) is used convert the flows from 24 hour to 18 hour*

A5.2 Traffic count data provides street level traffic data for every junction-to-junction link on the 'A' road and motorway network in Great Britain. The data is presented as 24-hour Annual Average Daily Traffic Flows (AADF). AADF figures give the number of vehicles that will drive on that stretch of the road on an average day of the year and are presented as vehicles per day broken down by vehicle type.

A5.3 The use of long-term averages provides a more representative description of the road traffic noise levels at the site when compared with a more typical short-term 24-hour '*snapshot*' of the sound levels.

A5.4 The proposed development site overlooks the A48 from a location between two identified count points, CP664, which is located on the A48, 1700m to the west of the development site, and CP84012 located 3000m to the east. The publicly available data was obtained from www.dft.gov.uk.

A5.5 Between count point 84012 and the development site, there are several major junctions where a significant number of vehicles may join or leave the A48. Between count point 664 and the development site there are only two minor junctions with a less significant change in vehicle composition would be expected.

A5.6 When using traffic flow data is it usual to utilise the latest available data set for any noise emission calculations. However, following inspection of the available

data from 2014 – 2021, it can be seen that there is an identifiable reduction in vehicle numbers using the road during the year 2020 and that the vehicles numbers during 2021 have still not recovered to the pre 2020 numbers. This reduction is attributable to the government travel restrictions put in place during the Covid-19 pandemic.

A5.7 To ensure that the sound emission calculations are representative of the typical vehicle numbers travelling past the development site, this assessment refers to the data provided for the year 2019.

A5.8 As discussed above, count point 664 provides the most robust estimate of the traffic flow past the development site owing to the minimal number of junctions between the count point and the site.

A5.9 It should also be noted that a 25% change in road traffic flows results in a change of 1 dB to the noise emissions which is imperceptible.

A5.10 It is not anticipated that there would be a 25% change in the traffic flows as a result of traffic leaving or entering the A48 and therefore, the traffic flow figures for count point 664 during 2019 provides a reliable estimate of the traffic passing by the development site at the time of this assessment.

A5.11 **ASSUMPTIONS MADE IN MODEL**

A5.11.1 The ground attenuation was modelled as hard with a ground factor value of 0.0. The road surface was modelled as '*Macadam*'.

A5.11.2 Acoustic barriers were modelled as reflective.

A5.11.3 Atmospheric conditions were modelled as

- *Temperature: 293.15 K*
- *Pressure: 101.33*
- *Air Humidity: 60%*

A5.12 **PREDICTION OF NOISE LEVELS ACROSS PROPOSED DEVELOPMENT SITE**

A5.12.1 As the site is relatively complex and comprises multiple dwellings, a 3D acoustic CAD model of the proposed development is constructed to aid in the identification

of potential areas or plots that may not meet the stated criteria. This process minimises unnecessary schemes of mitigation.

A5.12.2 EMS B&K Predictor V2019 Software was utilised to model the road traffic noise levels across the whole of site. This noise prediction software allows for the investigation of noise emissions in complex or large outdoor environments. The software can be used to analyse industrial noise sources and traffic measurements to the latest European and U.K. Standards.

A5.12.3 A major advantage of using this method is the ability to remodel changes and alterations to the site and/or sources.

A5.13 **CAD MODEL CONSTRUCTION**

A5.13.1 Topographical information for the site was obtained from the online site '*DataMapWales*' in the form of Digital Terrain Model data (1m resolution). The '*DataMapWales*' platform has been developed as a partnership between Welsh Government and Natural Resources Wales. It serves as a hub for data and information covering a wide spectrum of topics, but primarily around the environment.

A5.13.2 The topographical data was imported into the CAD software and used to construct the 3D terrain for the site.

A5.13.3 '*OS Open Zoomstack*' was used as a background image for the model. '*OS Open Zoomstack*' provides a single, customisable basemap of Great Britain made freely available in partnership with the UK government. The data was obtained from '*www.osdatahub.os.uk.co.uk*' under the Open Government Licence (OGL) v3.0 and contains OS data © Crown copyright and database right 2023.

A5.13.4 A proposed site layout drawing, '*SD724 01*', was provided by Skerryvore Designs Ltd to be used as a background for the model to locate the proposed development and noise sensitive receptors accurately.

A5.13.5 A '*road item*' was positioned centrally along the A48 using the basemap as a guide.

A5.13.6 The modelling software defines a '*road item*' as '*a line source used for modelling the sound level emissions of vehicles on a road*'.

A5.13.7 Using the data from the traffic count point 664, the total traffic flow (both directions) over 18 hours, Q18, the average vehicle speed, V, and the percentage of heavy vehicles, pHV are entered into the model to define the '*road item*'.

A5.13.8 In this case, Q18 = 27618, pHV = 7% and the average vehicle speed is estimated to be 60 km/hr as described in paragraph 14.2 in CRTN [8].

A5.13.9 This data represents the average, two way, daily 18-hour vehicle flow on the A48 for the most reliable year for which data is available (as discussed above), which in this case was 2019 (see Table 5).

A5.13.10 The software calculations for noise propagation follow the procedures set out in CRTN [8] and TRL Method 3 for non-motorway roads [9].

A5.13.11 The proposed development will have habitable rooms located on both the first and second floor levels (see Appendix 3). The height of the first-floor receptor is modelled at 4.5m and the height of the second-floor receptor is modelled at 7.5m.

A5.13.12 Individual model receivers are placed 0.1m in front of each habitable room within the development and set to calculate the external free-field noise levels at each receiver.

A5.13.13 A noise contour grid covering the whole site is constructed to visually display the external free field noise levels around the development site at each floor level. Each grid is a collection of receivers set 1m apart at heights of 4.5m and 7.5m representing the first floor and second floor receptors respectively.

A5.14 CAD MODEL PREDICTION

A5.14.1 Using EMS B&K Predictor V2019 software, calculations were made for each receiver and contour grid using the road noise source emissions as described above.

A5.14.2 Calculations are made for both the daytime and night time periods for all receivers with separate contour maps generated at each storey for each assessment period.

A5.14.3 The results of the assessment are presented in the form of easily understood noise contour maps with individual external free-field noise levels calculated at each habitable room and are presented in Appendix 6.

A5.14.4 These contour maps indicate the free field noise levels across the whole of the proposed development with each contour colour boundary assigned a noise level so that areas of the proposed development that comply with each of the criteria can be easily identified.

A5.15 **NOISE CONTOUR MAPS**

A5.15.1 Colour coded noise contour maps are generated by the acoustic model to aid identification of the following:

- *Plots where the internal noise criteria will be exceeded if using an open window ventilation strategy. Noise levels within habitable rooms on any façade located within the red areas will exceed the internal noise criteria with a window partially open for ventilation purposes. Separate contour maps are generated to represent rooms at first floor and second floor for both the daytime and night time periods.*

Appendix 6
Modelling Results

A6.0 MODELLING RESULTS

Figure 8 – Road Traffic Noise Emissions, First Floor, Daytime

Figure 9 – Road Traffic Noise Emissions, First Floor, Night Time

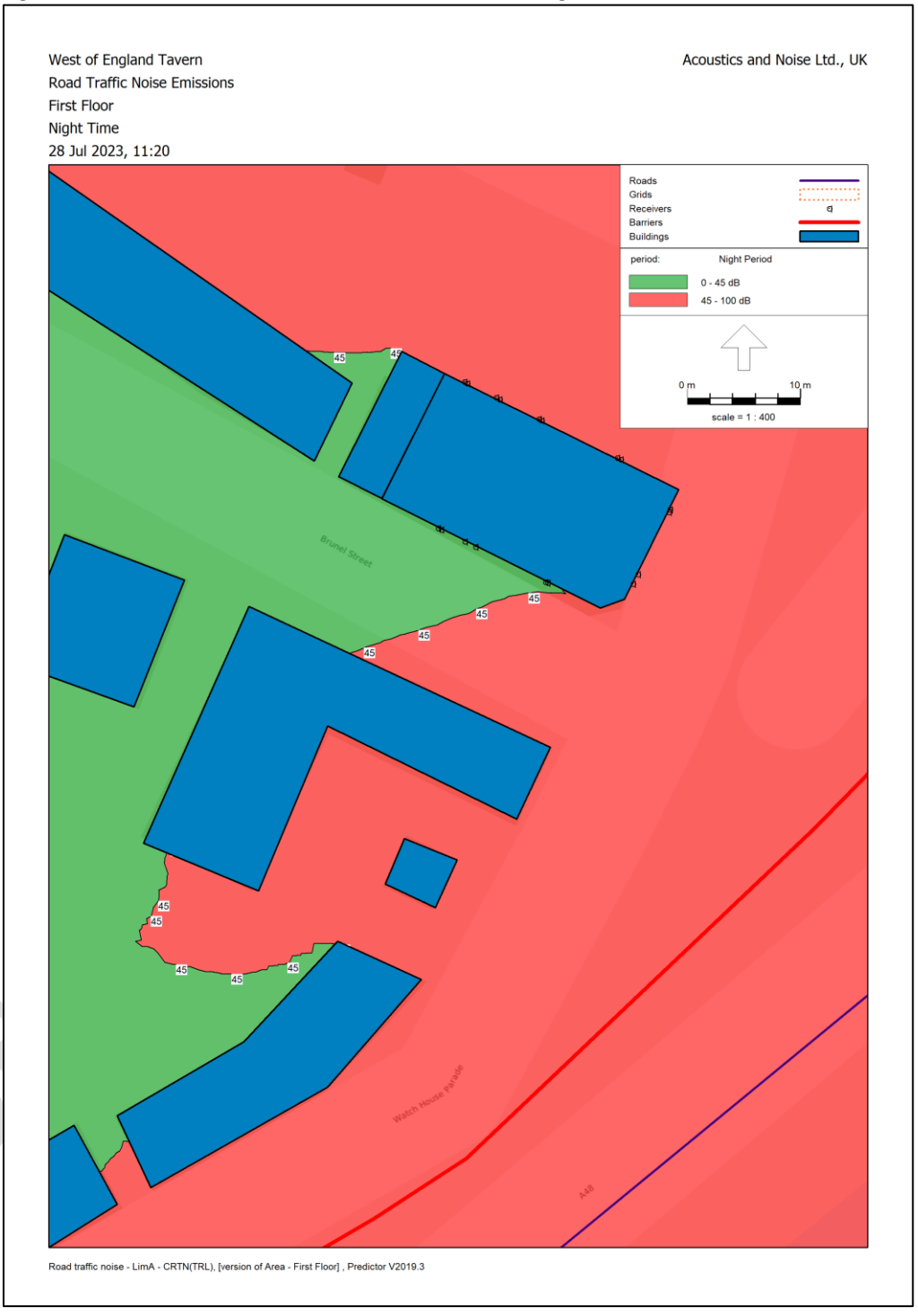


Figure 10 – Road Traffic Noise Emissions, Second Floor, Daytime

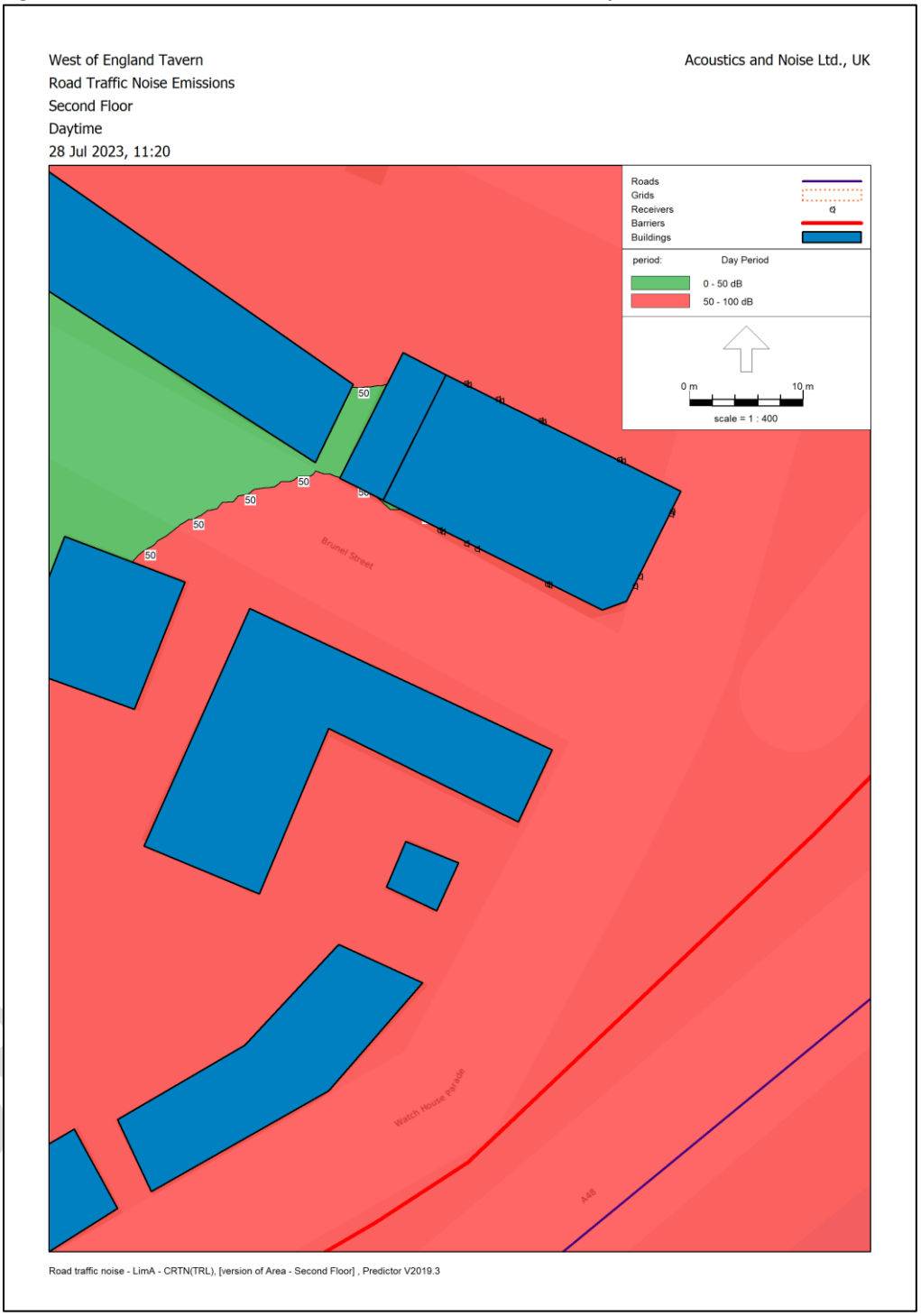


Figure 11 – Road Traffic Noise Emissions, Second Floor, Night Time

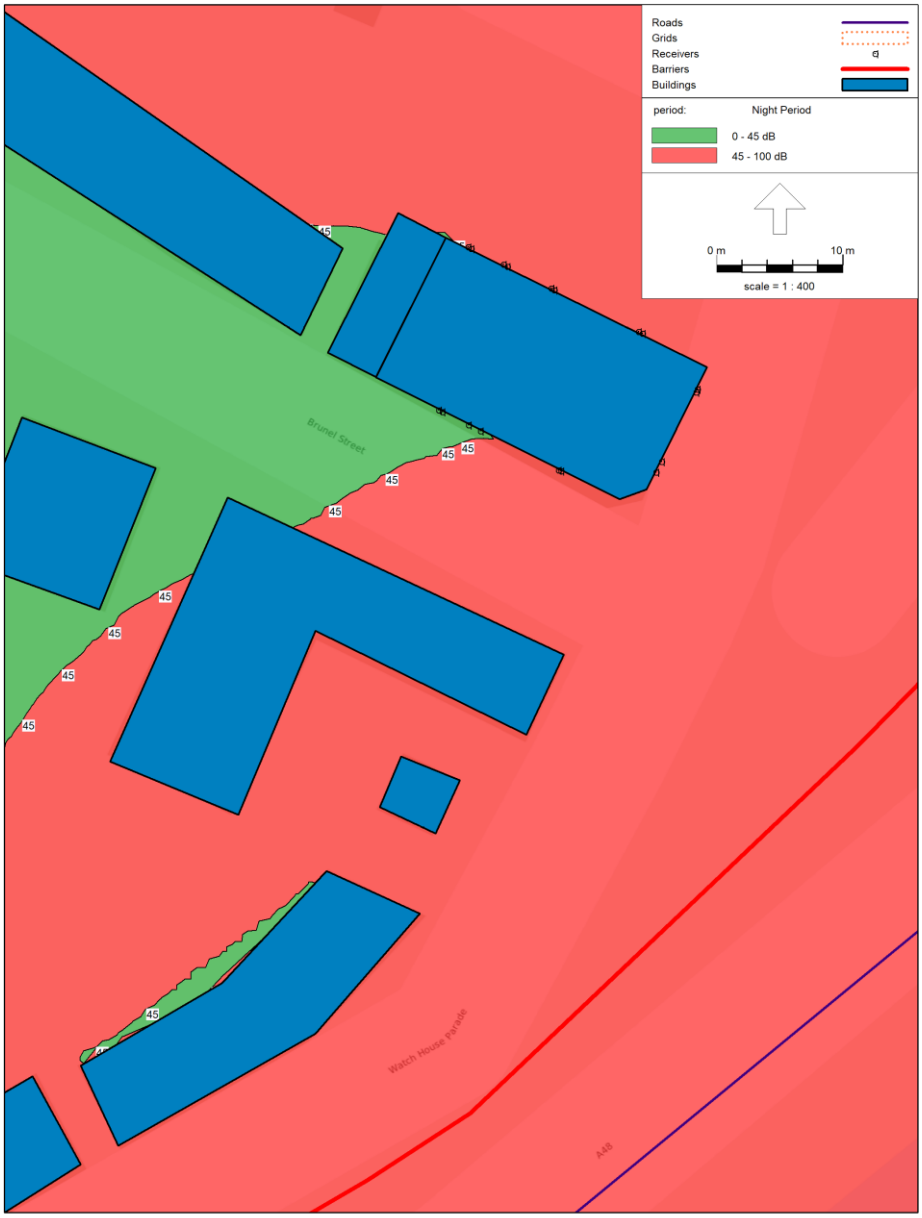


Table 6 – Free-field Road Traffic Noise Emissions at Sensitive Receptors

Description	Storey	Daytime (07:00 – 23:00) $L_{Aeq,16hrs}$ (dB)	Night Time (23:00 – 07:00) $L_{Aeq,8hrs}$ (dB)
Plot 10 Bedroom	Second Floor	52.1	44.5
Plot 10 Lounge	Second Floor	51.7	44.1
Plot 1 Bedroom	First Floor	59.0	51.0
Plot 1 Lounge	First Floor	52.1	44.4
Plot 2 Bedroom	First Floor	59.3	51.2
Plot 2 Lounge	First Floor	57.8	49.7
Plot 3 Bedsit	First Floor	57.0	49.0
Plot 4 Bedroom	First Floor	56.3	48.4
Plot 4 Lounge	First Floor	56.6	48.6
Plot 5 Bedroom	First Floor	50.7	43.1
Plot 5 Lounge	First Floor	50.1	42.5
Plot 6 Bedroom	Second Floor	60.2	52.1
Plot 6 Lounge	Second Floor	54.3	46.5
Plot 7 Bedroom	Second Floor	60.2	52.1
Plot 7 Lounge	Second Floor	57.9	49.9
Plot 8 Bedsit	Second Floor	57.1	49.1
Plot 9 Bedroom	Second Floor	56.4	48.4
Plot 9 Lounge	Second Floor	56.7	48.7

Appendix 7
Acoustic Assessment of Commercial Ceiling

A7.0 ACOUSTIC ASSESSMENT OF COMMERCIAL CEILING

A7.1 EXISTING FLOOR CONSTRUCTION

A7.1.1 The construction details for the existing separating floor between the ground floor commercial unit and the first-floor residential accommodation were provided by Skerryvore Designs as follows:

- *Timber floor.*
- *225mm timber joists.*
- *2x10mm plasterboard.*
- *Mineral fibre infill.*

A7.1.2 The calculations for the sound reduction performance of the above construction were carried out using industry standard INSUL software to calculate the sound resistance with an error margin of ±3dB (see Appendix 2).

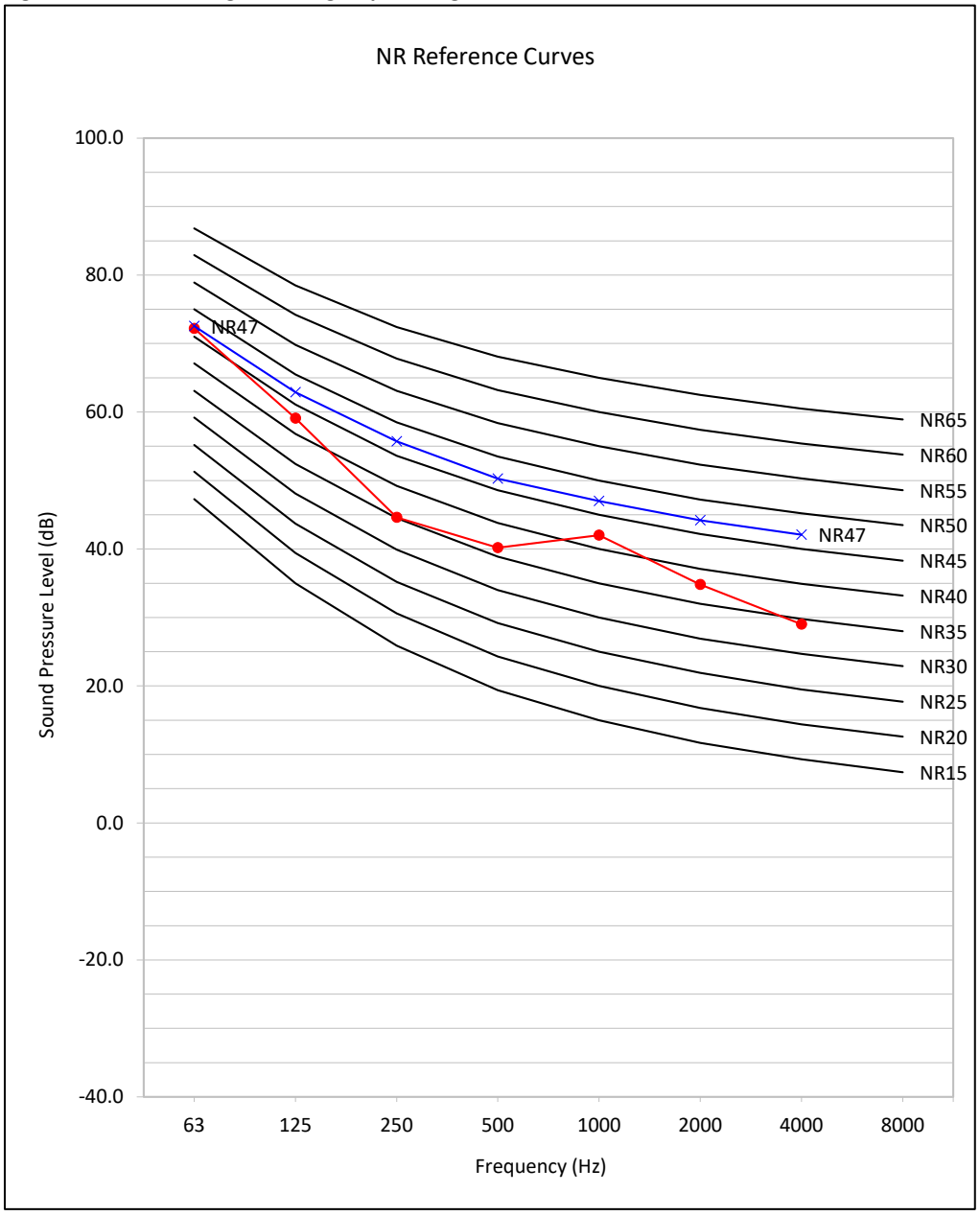
A7.1.3 The calculations for the sound transference through the existing separating floor are presented in Table 7 below with the equivalent NR rating presented in Figure 12.

Table 7 – Sound Transference through Existing Separating Floor

Description	63	125	250	500	1000	2000	4000	Total
Crowd Noise [80 people] L_{pA} (dB)	56	66	73	79	82	83	83	88
Sound Reduction Existing Floor, R (dB)	10	23	37	42	40	47	53	
Sound Transmission (dBA)*	46	43	36	37	42	36	30	50

** Within first floor residential accommodation*

Figure 12 – NR Rating, Existing Separating Floor



A7.2 RECOMMENDED FLOOR CONSTRUCTION

A7.2.1 It has been demonstrated above that the existing floor construction between the ground floor commercial unit and the first-floor residential accommodation does not provide sufficient sound reduction to protect the occupants of the residential units.

A7.2.2 Without significant modifications to the construction of the separating floor, an adverse noise impact would likely occur.

A7.2.3 An effective option for the upgrade to the separating floor construction is presented in Appendix 2. The upgraded construction details are as follows:

- *Timber floor.*
- *225mm timber joists.*
- *2x10mm plasterboard.*
- *Mineral fibre infill.*
- *Minimum 300mm Cavity depth.*
- *Independent ceiling comprising 2x15mm Acoustic plasterboard off suitable timber joists.*
- *100mm mineral fibre (minimum 40kg/m^3) infill to cavity.*

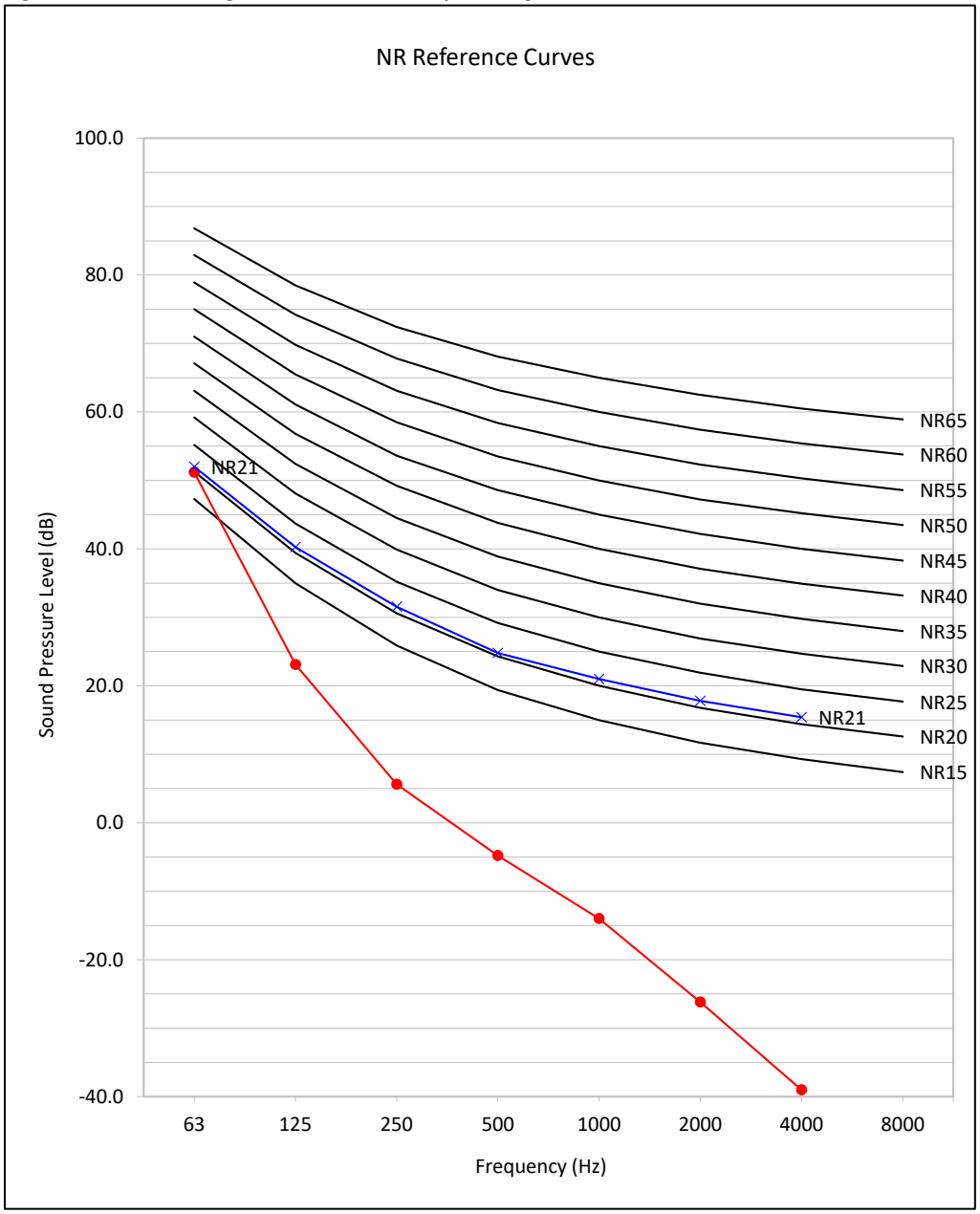
A7.2.4 The calculations for the sound transference through the recommended separating floor construction are presented in Table 8 below with the equivalent NR rating presented in Figure 13.

Table 8 – Sound Transference through Recommended Separating Floor

Description	63	125	250	500	1000	2000	4000	Total
Crowd Noise [80 people] L_{pA} (dB)	56	66	73	79	82	83	83	88
Sound Reduction Recommended Floor, R (dB)	31	59	76	87	96	108	121	
Sound Transmission (dBA)*	25	7	-3	-8	-14	-25	-38	25

** Within first floor residential accommodation*

Figure 13 – NR Rating, Recommended Separating Floor



Appendix 8
Sound Reduction Calculations for Glazing Units

A8.0 SOUND REDUCTION CALCULATIONS FOR GLAZING UNITS

Table 9 – Minimum Sound Reduction Performance for Glazing, Daytime (07:00 – 23:00 hrs)

Receptor	Calculated External Free-field Noise Level $L_{Aeq,16hrs}$ (dB)	Internal Ambient Noise Level Criteria (07:00 – 23:00 hrs) $L_{Aeq,16hrs}$ (dB)	Minimum Sound Reduction Performance for Glazing $R_w + C_{tr}$ (dB)
Plot 10 Bedroom	52	35	17
Plot 10 Lounge	52	35	17
Plot 1 Bedroom	59	35	24
Plot 1 Lounge	52	35	17
Plot 2 Bedroom	59	35	24
Plot 2 Lounge	58	35	23
Plot 3 Bedsit	57	35	22
Plot 4 Bedroom	56	35	21
Plot 4 Lounge	57	35	22
Plot 5 Bedroom	51	35	16
Plot 5 Lounge	50	35	15
Plot 6 Bedroom	60	35	25
Plot 6 Lounge	54	35	19
Plot 7 Bedroom	60	35	25
Plot 7 Lounge	58	35	23
Plot 8 Bedsit	57	35	22
Plot 9 Bedroom	56	35	21
Plot 9 Lounge	57	35	22

Table 10 – Minimum Sound Reduction Performance for Glazing, Night Time (23:00 – 07:00 hrs)

Receptor	Calculated External Free-field Noise Level $L_{Aeq,8hrs}$ (dB)	Internal Ambient Noise Level Criteria (23:00 – 07:00 hrs) $L_{Aeq,8hrs}$ (dB)	Minimum Sound Reduction Performance for Glazing $R_w + C_{tr}$ (dB)
Plot 10 Bedroom	45	30	15
Plot 10 Lounge	44	30	14
Plot 1 Bedroom	51	30	21
Plot 1 Lounge	44	30	14
Plot 2 Bedroom	51	30	21
Plot 2 Lounge	50	30	20
Plot 3 Bedsit	49	30	19
Plot 4 Bedroom	48	30	18
Plot 4 Lounge	49	30	19
Plot 5 Bedroom	43	30	13
Plot 5 Lounge	43	30	13
Plot 6 Bedroom	52	30	22
Plot 6 Lounge	47	30	17
Plot 7 Bedroom	52	30	22
Plot 7 Lounge	50	30	20
Plot 8 Bedsit	49	30	19
Plot 9 Bedroom	48	30	18
Plot 9 Lounge	49	30	19

Appendix 9
Relevant Guidance

A9.0 RELEVANT GUIDANCE

A9.1 **Technical Advice Note 11 (TAN11) [3]**

A9.1.1 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).

A9.2 **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 11.

Table 11 – Planning Advice as per TAN11

NEC	Planning Advice
A	*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.*
B	*Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.*
C	*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.*
D	*Planning permission should normally be refused.*

A9.2.1 The noise exposure category for the site is the measured noise level compared with the range of noise levels as shown in Table 12.

Table 12 – 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

A9.2.2 Maximum noise event values L_{ASmax} of 82dB were analysed as per Note 2 [3].

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

A9.2.3 Mixed sources refer to any combination of road, rail, air and industrial noise sources. The '*mixed source*' values detailed in Table 12 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.

A9.3 **Planning Policy Wales [4]**

A9.3.1 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*'.

A9.3.2 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.

A9.3.3 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.

A9.3.4 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.

A9.3.5 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)*'.

A9.3.6 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.

A9.3.7 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.

A9.3.8 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.

A9.3.9 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.

A9.3.10 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.

A9.4 **Noise and Soundscape Action Plan [5]**

A9.4.1 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.

A9.5 **ProPG: Planning & Noise [6]**

A9.5.1 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.

A9.5.2 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).

A9.5.3 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.

A9.5.4 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.*

A9.5.5 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.

A9.5.6 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.

A9.5.7 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.

A9.5.8 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.

A9.6 **BS 8233 - Guidance on Sound Insulation and Noise Reduction for Buildings [7]**

A9.6.1 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.

A9.6.2 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.*".

A9.6.3 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.

A9.6.4 These guideline values range from 35 - 40 dB LAeq,16hrs during the daytime period and 30 dB LAeq,8hrs during the night time period as detailed in Table 13 below.

Table 13 – BS 8233 Internal Noise Level Guidelines

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

A9.6.5 The guidelines also provide scope for relaxing these values by up to 5 dB and still achieve reasonable internal conditions.

A9.6.6 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.

A9.6.7 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).

A9.6.8 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 $L_{Aeq,16hrs}$ with an upper guideline value of 55 dB $L_{Aeq,16hrs}$ which would be acceptable in noisier environments.

A9.6.9 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.

A9.6.10 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.

A9.6.11 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 [10].

A9.6.12 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.

A9.6.13 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.

A9.7 **Calculation of Road Traffic Noise (CRTN) [8]**

A9.7.1 This memorandum describes the procedures for calculating noise from road traffic. These procedures are necessary to enable entitlement under the Noise Insulation Regulations to be determined but they also provide guidance appropriate to the calculation of traffic noise for more general applications e.g. environmental appraisal of road schemes, highway design and land use planning.

A9.7.2 Road traffic noise levels are expressed in terms of the index, $L_{A10,t}$ dB. The value of $L_{A10,t}$ is the noise level exceed for just 10% of the time over the time period t. For the purposes of CTRN, the time period, t, is 18 hours (06:00 – 00:00 hrs).

A9.7.3 The procedures for calculating traffic noise, as described in the memorandum, comprise five main stages:

- *Division of road into a number of segments;*
- *Calculation of the Basic Noise Level (BNL), at a reference distance of 10m from the nearside carriageway edge, for each road segment using traffic flow data (number of vehicles, speed, %HGV);*
- *For each segment, calculate the noise level at the reception point (1m from exposed façade) by considering the distance to the reception point, ground attenuation and any screening from barriers and or buildings.*
- *Correction to the calculated noise level to account for site layout features including reflections from nearby buildings and facades and the source segment size;*

- *Calculate the total noise level at the reception point by combining the contributions from all road segments.*

A9.7.4 The aim of this memorandum is to enable prediction in as many situations as possible, covering both free and non-free flowing traffic. Prediction is the preferred calculation technique and in complex situations is best carried out using appropriate computer software.

A9.7.5 In addition, CRTN describes a shortened measurement procedure for determining the noise level from the road, $L_{A10,18h}$ dB, based on measurements made over three consecutive hours between 10:00 and 17:00 hours.

A9.7.6 Using $L_{A10,3h}$ as the arithmetic mean of the three consecutive vales of the hourly $L_{A10,1h}$, the value of $L_{A10,18hr}$ can be calculated from the relation:

$$L_{A10,18h} = L_{A10,3h} - 1 \text{ dB}$$

A9.8 **Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping [9]**

A9.8.1 The UK national method for calculating road traffic noise is described in the document '*Calculation of Road Traffic Noise*' (CRTN) [8]. The noise index derived using these procedures, L_{A10} is however, different from the more commonly used descriptor for environmental noise, $L_{Aeq,T}$.

A9.8.2 Defra therefore commissioned TRL Limited to develop an interim computational method to convert $L_{A10,18hr}$ to $L_{Aeq,t}$ to be used in the UK.

A9.8.3 For UK conditions, TRL recommends that the best interim approach is to adapt CRTN be applying an '*end correction*' to obtain the relevant EU indices from calculated values of L_{A10}.

A9.8.4 Three methods are described dependant on the detail of traffic data available:

- *Method 1: Where the user has available hourly traffic data;*
- *Method 2: Where detailed hourly traffic data is not available, but the user has, or can estimate, traffic data for the relevant day, evening and night time periods;*

- *Method 3: Where detailed hourly or period traffic data is not available, but the user has, or can estimate, traffic data for the full 18hr time period.*

A9.8.5 Each method allows CRTN to calculate the $L_{A10,18hr}$ using the available data and then convert to the relevant period $L_{Aeq,T}$ using defined relationships.

A9.9 **BS EN 12354 Part 3, Airborne Sound Insulation against Outdoor Sound [10]**

A9.9.1 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.

A9.9.2 The results of the calculation can be used to determine the indoor sound pressure level due to external sound sources such as road traffic.

A9.9.3 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*'.

A9.9.4 The indoor A-weighted sound pressure level can be determined from calculation in frequency bands for the appropriate frequency range, applying the A-weighting.

A9.9.5 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 [11], 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.

A9.10 **ISO 9613 [12]**

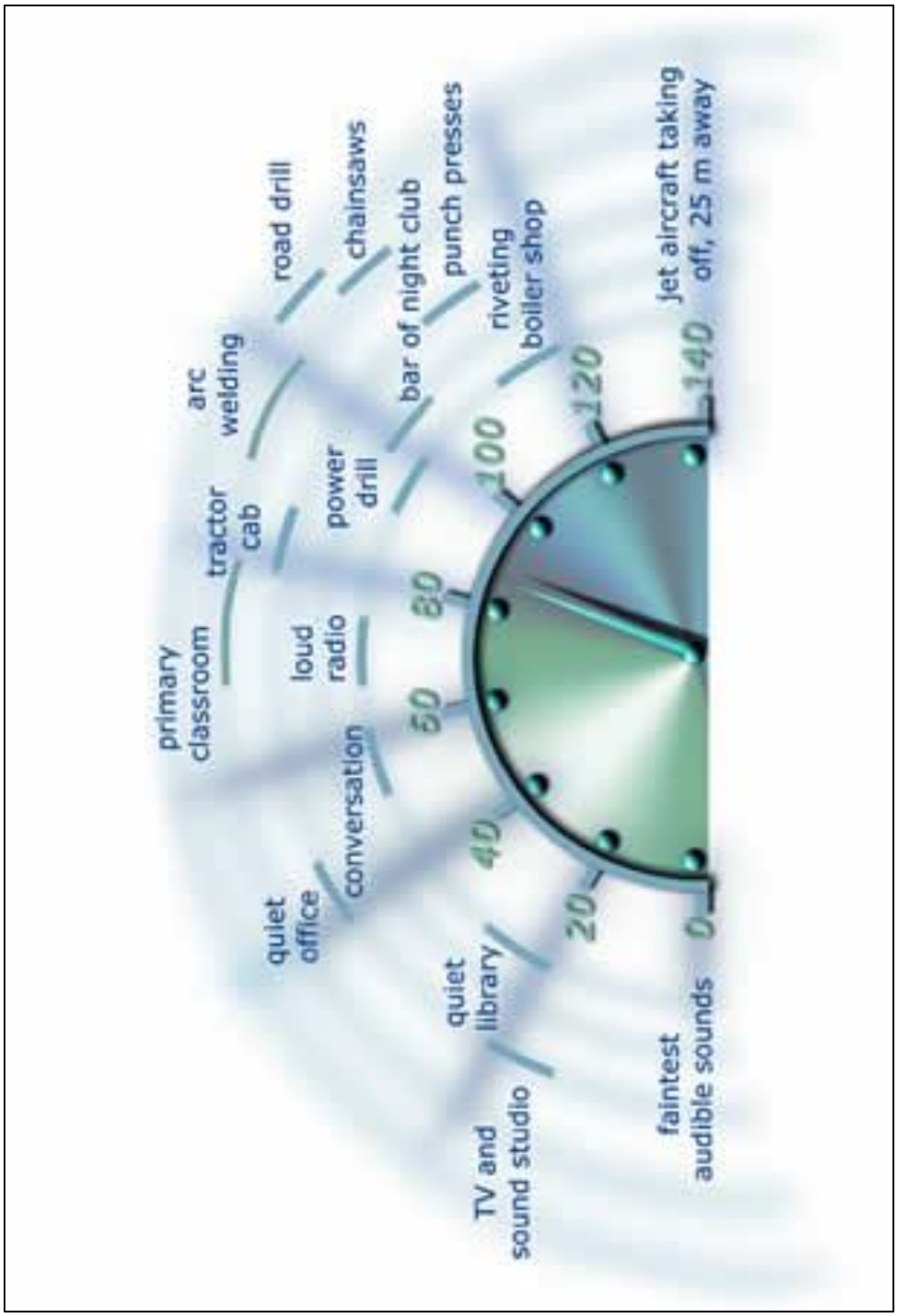
A9.10.1 Part 1 of this standard specifies an analytical method of calculating the attenuation of sound as a result of atmospheric absorption for a variety of meteorological conditions

A9.10.2 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 10
Range of Typical Sound Levels

A10.0 RANGE OF TYPICAL SOUND LEVELS

Figure 14 – Range of Typical Sound Levels



Appendix 11
Glossary of Acoustic Terms

A11.0 GLOSSARY OF ACOUSTIC TERMS

A11.1 **Acoustic environment:**

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

A11.2 **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.

A11.3 **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.

A11.4 **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

A11.5 **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:

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

where:

p_0 *is the reference sound pressure (20 µPa); and*

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

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

A11.6 **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.

A11.7 **Rating level, $L_{Ar,Tr}$:**

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

A11.8 **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.

A11.9 **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

A11.10 **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

A11.11 **Specific sound level, $L_s = L_{Aeq,Tr}$:**

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

A11.12 **Specific sound source:**

Sound source being assessed

A11.13 **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.

A11.14 **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 detectible only under laboratory conditions.

A11.15 **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.

A11.16 **Free Field:**

A sound field in which no significant sound reflections occur.

A11.17 **L_{Amax}:**

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

A11.18 **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.

A11.19 **Frequency:**

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

A11.20 **Hertz:**

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

Appendix 12
References

A12.0 REFERENCES:

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