



**THE CROWN & THISTLE PUBLIC HOUSE
NO. 44 THE TERRACE, GRAVESEND,
KENT DA12 2BJ**

PROPOSED RESIDENTIAL DEVELOPMENT

NOISE IMPACT ASSESSMENT

Report No. MRL/100/2038.1v1
October 2023

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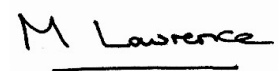
NOISE IMPACT ASSESSMENT

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1.0 INTRODUCTION

- 1.1 MRL Acoustics Limited was commissioned by Kite Holdings Ltd to assess the impact of noise on a proposed residential development scheme at The Crown & Thistle PH, No. 44 The Terrace, Gravesend, Kent DA12 2BJ.
- 1.2 The scheme comprises the conversion of the former 3-storey Crown & Thistle PH building into a 5-bedroom House of Multiple Occupation (HMO), with part demolition of the single storey rear extension, erection of a bin store in the rear garden, replacement of the UPVC window in the rear elevation at second floor level with a timber sash window and associated internal and external alterations.
- 1.3 We understand that a previous planning application has recently been refused by the Local Authority on the grounds of noise. These concerns related to insufficient information being provided in terms of any noise impact assessment, noise mitigation and acoustic ventilation measures, and a lack of details submitted demonstrating that future occupiers would not be impacted on from noise and disturbance from road traffic, river traffic and general environmental noise.
- 1.4 In addition, concerns were also raised relating to the level of sound insulation that could be achieved by the proposed party floors between the bedrooms due to any building restrictions arising from the historic nature of the building.
- 1.5 The assessment has therefore included:-
- Measurements of the existing ambient noise climate at the site over a full 24-hour period for road traffic noise, commercial noise from passing boats on the river, and any other sources of industrial noise;
 - Assessment of the noise impact on the development in accordance with the National Planning Policy Framework; the Noise Policy Statement For England; the WHO Guidelines; BS 8233 : 2014; and ProPG : Planning & Noise – May 2017;

- Recommendation of an appropriate noise mitigation scheme for the new dwellings, if necessary,
- Recommendation of a suitable scheme of sound insulation upgrading measures to the party floors in order to demonstrate compliance with the airborne and impact sound insulation requirements of Part E of the Building Regulations 2003.

1.6 This report outlines our findings and our recommendations.

1.7 All recommendations are given for acoustic reasons only and compliance with other requirements (e.g. fire protection/structural integrity, etc.) must be checked by other specialist members of the design team.

1.8 The noise survey and report were carried out and prepared by Matthew Lawrence who has over 29 years' experience in the acoustic industry and an MSc and Diploma in Acoustics & Noise Control, and who is a Member of the Institute of Acoustics (IOA).

1.9 MRL Acoustics Ltd is also a member of the Association of Noise Consultants (ANC).

1.10 Noise levels referred to in the text have been rounded to the nearest whole decibel (dB), as fractions of decibels are imperceptible.

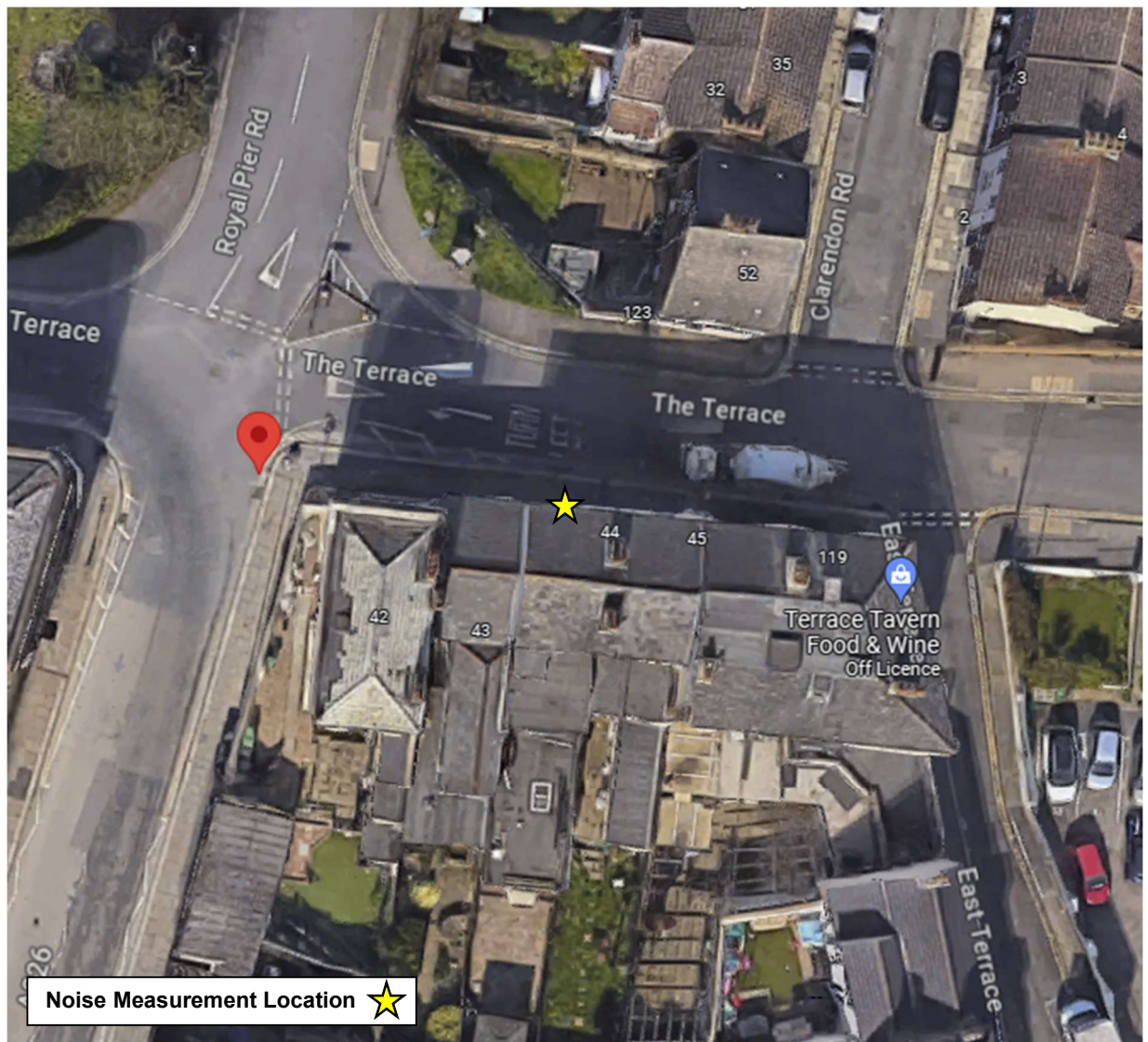
1.11 An explanation of the various noise units, indices and acoustical terms used in this report is provided in Appendix I.

2.0 DESCRIPTION OF THE SITE

- 2.1 The development site is situated at No. 44 The Terrace, Gravesend, approximately 16m distance to the east of the junction with Royal Pier Road. The existing 3-storey building was formerly The Crown & Thistle PH and is historic Grade II listed. The building is currently used for a flat on the 1st and 2nd floor levels, with the ground floor still fitted out as a pub, albeit in a poor state of repair.
- 2.2 At the eastern end of the terrace of buildings there is the former Terrace Tavern PH, which is now closed and is a local food store and off-license. At the western end of the terrace (No. 42) there is a 3-storey residential building. There are existing residential properties located opposite the site on the other side of the road.
- 2.3 This part of The Terrace is a one-way, fairly quiet low-trafficked road, whereas Royal Pier Road is a busy main road leading into Gravesend town centre with a steady flow of road traffic during the daytime period. The dominant noise source affecting the front of the site was from intermittent passing road traffic.
- 2.4 The Port of London Authority offices and the River Thames are located approximately 100m distance to the north of the site with a large number of intervening buildings in between. It was noted whilst setting up the noise equipment at the site that large boats sailing past on the river are visible from the 1st floor level but were not audible at all.
- 2.5 It was also noted on site that there are no commercial noise or industrial noise sources impacting on the site, either at the front or at the rear of the site.
- 2.6 The site location and development layout plans are shown at the end of this report.

3.0 NOISE LEVEL SURVEY

- 3.1 A noise level survey was carried out at the site over a full 24-hour period from 11:15 hours on Monday 16th October until 11:30 hours on Tuesday 17th October 2023 in order to establish the general daytime and night-time ambient noise climate of the area in terms of road traffic noise, any commercial noise from the river and general street noise.
- 3.2 The noise measurements were taken at 1st floor level on the front elevation of the existing building overlooking The Terrace and facing towards the Port of London Authority offices and the River Thames to represent the residential windows of the proposed dwellings that will be exposed to the highest levels of environmental noise.
- 3.3 The noise monitoring location is shown in the site plan below:-



- 3.4 The noise survey was carried out using a Rion NA-28 'Class 1' Sound Level Meter (serial no. 01291241) fitted within an environmental weather-proof case.
- 3.5 The calibration level of the meter was checked before and after the survey to a level of 94.0 dB with a Rion NC-74 sound calibrator (serial no. 35094450) with no variation in the levels observed.
- 3.6 The microphone was mounted on a tripod and metal boom out of a 1st floor level window, approximately 1m away from the building façade. The microphone was fitted with a Rion WS-15 weather-proof windshield at all times.
- 3.7 The noise measurements consisted of consecutive 15-minute samples of noise over a continuous 24-hour period.
- 3.8 Details of the equipment used during the noise level survey are shown in Table 1. Current calibration certificates for the equipment can be provided if required.

Table 1: Details of Equipment Used During Noise Survey

Equipment Description	Manufacturer	Type/Number	Serial Number	Date of Expiration of Calibration	Calibration Certification Number
Sound Level Meter	Rion	Type NA-28	01291241	12/06/2024	TCRT20/1224
Microphone	Rion	UC-59	01683	12/06/2024	TCRT20/1224
Pre-Amplifier	Rion	NH-23	81273	12/06/2024	TCRT20/1224
Calibrator	Rion	Type NC-74	35094450	12/06/2024	TCRT20/1223

- 3.9 The weather conditions for the survey were generally warm and dry with a light breeze throughout and are shown in Table 2 overleaf:-

Table 2: Weather Conditions During Noise Survey

Date	Temperature (°C)		Wind Speed (m/s)	Wind Direction	Rainfall (mm)	Cloud Cover (%)	Acceptable Conditions
	Day	Night					
16/10/2023	16	11	0.9	SW	0	15	Yes
17/10/2023	15	-	1.1	SW	0	20	Yes

- 3.10 The weather conditions were measured on-site using a Kestrel 2000 hand-held weather meter and supported by weather data from the Meteorological Office weather app relating to local weather conditions for this area.
- 3.11 The noise survey was carried out in general accordance with the requirements outlined in BS 7455 – 1 : 2003 for environmental noise surveys.
- 3.12 The measured results are ‘facade’ levels as the microphone was within 3.5m of a reflective surface (other than the ground) and therefore a -2.5 dB façade correction is applicable to the measured results to convert them to ‘free-field’ levels in order to assess the noise impact in accordance with BS 8233 : 2014.

Results

- 3.13 The measured ‘facade’ levels are detailed in Appendix II at the end of this report and the corrected ‘free-field’ levels are summarised in Table 3 below:-

Table 3: Measured ‘Free-Field’ Noise Levels

Location	Time Period	Noise Levels (dB)		
		L _{Aeq}		L _{Amax} (Average)
		Day (07:00 – 23:00)	Night (23:00 – 07:00)	Night (23:00 – 07:00)
1 st Floor Window Level	24-Hours	47	42	53

4.0 ASSESSMENT OF NOISE IMPACT

National Planning Policy Framework (NPPF)

4.1 National Government Guidance is available in the form of the National Planning Policy Framework (NPPF) – July 2021. The NPPF sets out the Government's planning policies for England and how these are expected to be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

4.2 Paragraph 174 of Section 15 of the NPPF, 'Conserving and enhancing the natural environment' provides general guidance regarding planning and noise. It states:-

"Planning policies and decisions should contribute to and enhance the natural and local environment by:-

- a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);
- b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;
- c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate;
- d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;
- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever

possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

- f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.”

4.3 Paragraph 185 of Section 15 of the NPPF, ‘Conserving and enhancing the natural environment’ goes on to state:-

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

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”

The Noise Policy Statement for England 2010 (NPSE)

4.4 The NPSE sets out the long term vision for government noise policy which is to:-

“Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.”

4.5 This is supported by the following aims:-

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:-

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.”

4.6 The first aim of the NPSE should be read in the context of Government policy on sustainable development indicating that significant adverse effects on health and quality of life should be avoided while accommodating the principles of sustainable development.

4.7 The second aim of the NPSE is applicable where the impact falls between LOAEL and SOAEL (see Section 4.9 below) requiring that all reasonable measures to mitigate and minimise adverse impacts on health and quality of life be implemented while accommodating the principles of sustainable development. This does not imply that any adverse effects cannot occur.

4.8 The third aim of the NPSE is to actively improve health and quality of life through effective management of noise within the context of Government policy on sustainable development wherever it is possible and reasonable to do so.

4.9 The NPSE applies the following concepts adapted from toxicology:-

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

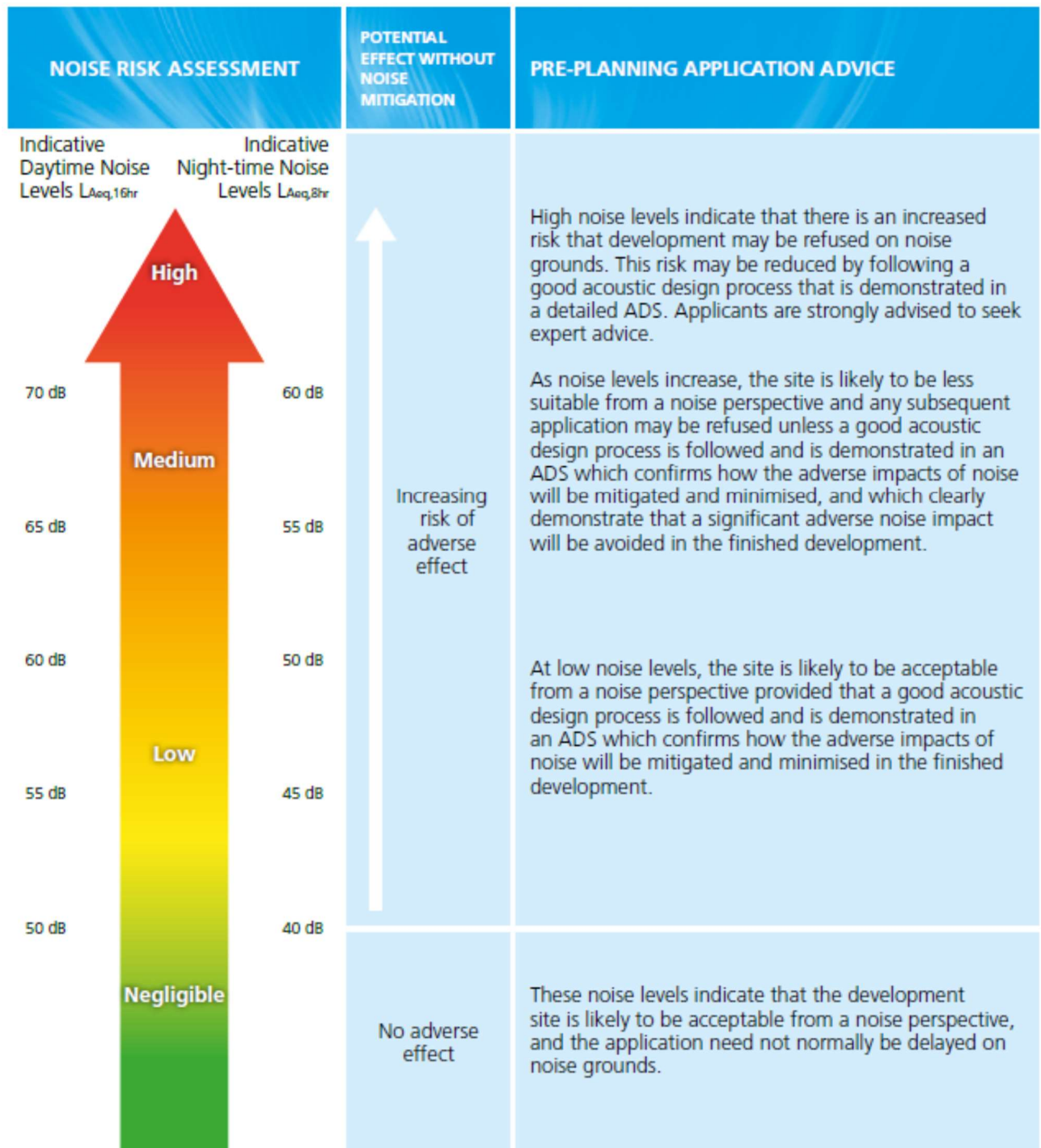
This is the level above which significant adverse effects on health and quality of life occur.

- 4.10 It should be noted that there are no numerical values for these concepts defined in the NPSE. There is also no single objective noise-based measure that defines Observed Effect Levels that is applicable to all sources of noise in all situations and consequently, the levels are likely to be different for different noise sources, for different receptors and at different times.

Professional Practice Guidance On Planning & Noise (ProPG)

- 4.11 The Professional Practice Guidance on Planning and Noise (ProPG) has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. The National Planning Policy Framework (NPPF) encourages improved standards of design. The CIEH, IOA and the ANC have worked together to produce this guidance which encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.
- 4.12 This ProPG provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers. It aims to complement Government planning and noise policy and guidance. In particular, it strives to:
- advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
 - encourage the process of **good acoustic design** in and around new residential developments;
 - outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
 - improve understanding of how to determine the extent of potential noise impact and effect; and assist the delivery of sustainable development.

- 4.13 Based on the measured free-field indicative daytime noise level of 47 dB L_{Aeq} (16-Hour) and the free-field indicative night-time noise level of 42 dB L_{Aeq} (8-Hour), the site can be classified as being of 'Low' Risk according to Figure 1 of the ProPG document.
- 4.14 Figure 1 of the ProPG document and also Figure 2 of the ProPG document indicating the internal noise level guidelines are reproduced on the following pages.

**Figure 1 Notes:**

- Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.
- Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is "not dominant".
- $L_{Aeq,16hr}$ is for daytime 0700 – 2300, $L_{Aeq,8hr}$ is for night-time 2300 – 0700.
- An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F} > 60$ dB means the site should not be regarded as negligible risk.

Figure 1. Stage 1– Initial Site Noise Risk Assessment

ACTIVITY	LOCATION	07:00 – 23:00 HRS	23:00 – 07:00 HRS
Resting	Living room	35 dB $L_{Aeq,16\text{ hr}}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16\text{ hr}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\text{ hr}}$	30 dB $L_{Aeq,8\text{ hr}}$ 45 dB $L_{Amax,F}$ (Note 4)

NOTE 1 The Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the internal L_{Aeq} target levels recommended in the Table.

NOTE 3 These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

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

Figure 2. ProPG Internal Noise Level Guidelines (additions to BS8233:2014 shown in blue)

British Standard 8233 : 2014

- 4.15 Guidance on acoustic design goals for new residential developments is set out in British Standard 8233 : 2014 '*Guidance on sound insulation and noise reduction for buildings*'. The World Health Organisation '*Guidelines for Community Noise*' and the ProPG guidance generally concurs with the recommendations of BS 8233 : 2014. The criteria are summarised in Table 4 below:-

Table 4: BS 8233 Recommended Acoustic Design Criteria

Location	Internal Noise Levels	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Living Room	35 dB L _{Aeq}	-
Dining Room	40 dB L _{Aeq}	-
Bedroom	35 dB L _{Aeq}	30 dB L _{Aeq}
Garden	Desired Limit Not Exceeding 50 dB L _{Aeq} Upper limit of 55 dB L _{Aeq}	

Assessment of Noise Impact

- 4.16 The results of the noise level survey indicate that at the noise monitoring position at the 1st floor level on the northern facing elevation of the building, the site is exposed to a daytime external noise level of 47 dB L_{Aeq}.
- 4.17 For the night-time period, the site is exposed to an external noise level of 42 dB L_{Aeq} and an average maximum noise level of 53 dB L_{Amax}.
- 4.18 Allowing -13 dB attenuation for an open window, based on the measured daytime noise level of 47 dB L_{Aeq}, the resultant internal noise level within habitable rooms during the daytime will be 34 dB L_{Aeq} (47 dB – 13 dB).

- 4.19 For the night-time period, allowing -13 dB attenuation for an open window, based on the measured night-time noise level of 42 dB L_{Aeq} , the resultant internal noise level within bedrooms will be 29 dB L_{Aeq} (42 dB – 13 dB).
- 4.20 Therefore, with windows open, the internal noise limits outlined within BS 8233 : 2014 of 35 dB L_{Aeq} within living rooms and bedrooms and 40 dB L_{Aeq} within dining rooms during the daytime will be achieved.
- 4.21 At night-time with the windows open the 30 dB L_{Aeq} criteria in bedrooms will also be achieved.
- 4.22 Therefore, due to the compliance with the recommended internal noise limits, it is considered that only a minor scheme of noise mitigation measures is required in order to fully protect the amenity of the future residents in order to achieve both the daytime and night-time internal noise levels.
- 4.23 Our recommendations are set out in Section 5.0.

5.0 RECOMMENDED SCHEME OF NOISE MITIGATION MEASURES

5.1 Table 5 below provides information on the typical sound insulation performance of various glazing specifications:-

Table 5: Sound Insulation of Typical Windows

Description	Weighted Sound Reduction Index, R_w
Any type of window in a facade when partially open	15
Single glazed windows (4mm glass)	29
Single glazed windows (6mm glass)	31
Double glazed units (4-16-4)	33
Double glazed units (4-16-6)	35
Double glazed units (6-16-6)	36
Double glazed units (4-16-6.4mm laminated glass)	39
Secondary glazed windows (4-100-4)	35 - 40
Secondary glazed windows (6-200-6)	40 - 45

5.2 As the internal noise limits can be achieved with the windows open, there is no specific acoustic performance requirement for the glazing configuration to any habitable rooms.

Night-time Maximum Noise Levels

5.3 With regard to individual event maximum noise levels BS 8233 states:-

“Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.”

- 5.4 The WHO Guidelines for Community Noise give a specific maximum internal noise level of 45 dB L_{Amax} that should not normally be exceeded more than 10 -15 times per night.
- 5.5 The ProPG guidance states that in noise-sensitive rooms at night, e.g. bedrooms, individual noise events (from all sources) should not normally exceed 45 dB L_{Amax} more than 10 times per night as this represents a threshold below which the effects of individual noise events on sleep can be regarded as negligible.
- 5.6 If we therefore remove the 10 no. highest measured L_{Amax} noise levels obtained between 23:00 – 07:00 hours from the results table shown in Appendix II, the 11th highest recorded night-time level is 54 dB L_{Amax} (allowing for a -2.5 dB(A) façade correction).
- 5.7 External maximum noise levels of 54 dB(A) would result in internal maximum levels of around 41 dB(A) with the bedroom windows open (based on -13 dB attenuation for an open window).
- 5.8 The detailed noise survey results in Appendix II indicate that for the rest of the night-time period, the maximum levels did not exceed the 11th highest recorded level of 54 dB(A).
- 5.9 Therefore, for this particular development scheme, the WHO criteria and ProPG guidance limits for L_{Amax} levels at night should be achieved, even with the bedroom windows open.

Ventilation

- 5.10 Since opening the windows in the proposed habitable rooms does not result in an exceedance of the internal noise criteria, it is considered that an acoustically treated alternative method of ventilation for these rooms is not required for this particular development site.
- 5.11 Standard slot-frame trickle-vents fitted to the windows is considered to be acceptable in this case and they do not need to be acoustically rated units.

External Areas

- 5.12 The measured average outdoor daytime noise level at the site was 47 dB L_{Aeq} .
- 5.13 This level is 8 dB(A) lower than the recommended upper limit general daytime outdoor noise level of 55 dB L_{Aeq} and 3 dB(A) lower than the desired level of 50 dB L_{Aeq} outlined within BS 8233 and the WHO Guidelines.
- 5.14 Therefore, it is considered that the provision of good quality 1.8m high close-boarded timber fencing (or 1.8m high brick walls) around any private amenity areas (if provided) will be sufficient to ensure that the general outdoor daytime noise climate for any amenity spaces is achieved.

6.0 INTERNAL SOUND INSULATION

- 6.1 The acoustic performance requirements for party walls and party floors in dwellings formed by material change of use and also for purpose-built dwellings are stated within Requirement E1 of Approved Document E (2003 Edition) of the Building Regulations.

Party Walls

- 6.2 For *airborne* sound insulation of party walls (i.e. resistance to the transmission of speech, music noise, television noise etc) the minimum acceptable level of sound insulation performance in terms of the Weighted Standardised Level Difference plus spectrum adaptation term ($D_{nT,w} + C_{tr}$) is **43 dB $D_{nT,w} + C_{tr}$ for dwellings formed by material change of use** and **45 dB $D_{nT,w} + C_{tr}$ for purpose-built dwellings**. Higher values of $D_{nT,w} + C_{tr}$ indicate better airborne sound insulation performance.

Party Floors

- 6.3 The required minimum acceptable level of *airborne* sound insulation for party floors in buildings is the same as for party walls, i.e. **43 dB ($D_{nT,w} + C_{tr}$) for dwellings formed by material change of use** and **45 dB ($D_{nT,w} + C_{tr}$) for purpose-built dwellings**.
- 6.4 Higher values of $D_{nT,w} + C_{tr}$ indicate better airborne sound insulation performance.
- 6.5 The required level of *impact* sound insulation performance for party floors in terms of the Weighted Standardised Impact Sound Pressure Level ($L'_{nT,w}$) is a value of no higher than **64 dB $L'_{nT,w}$ for dwellings formed by material change of use** and **62 dB $L'_{nT,w}$ for purpose-built dwellings**.
- 6.6 Lower values of $L'_{nT,w}$ indicate better impact sound insulation performance.
- 6.7 For situations where there are residential units above commercial premises, there is no requirement for impact sound insulation under Part E of the Building Regulations – it is only airborne sound that needs to be considered in these cases.

6.8 Based on our site visit on Monday 16th October 2023 to set up the noise monitoring equipment, we understand that the existing separating floors in the building consist of the following construction:-

- Standard 20mm thick timber floorboards;
- Assumed 220mm deep timber joists with no insulation in-between;
- Lath & plaster or standard 12.5mm thick plasterboard ceilings below.

6.9 We understand that as the building is historic Grade II listed, it is preferred that the majority of the sound insulation upgrading measures are applied to the underside of the separating floors in order to avoid substantial alterations to doors, skirting boards, etc.

6.10 We would therefore recommend the following scheme of upgrading measures:-

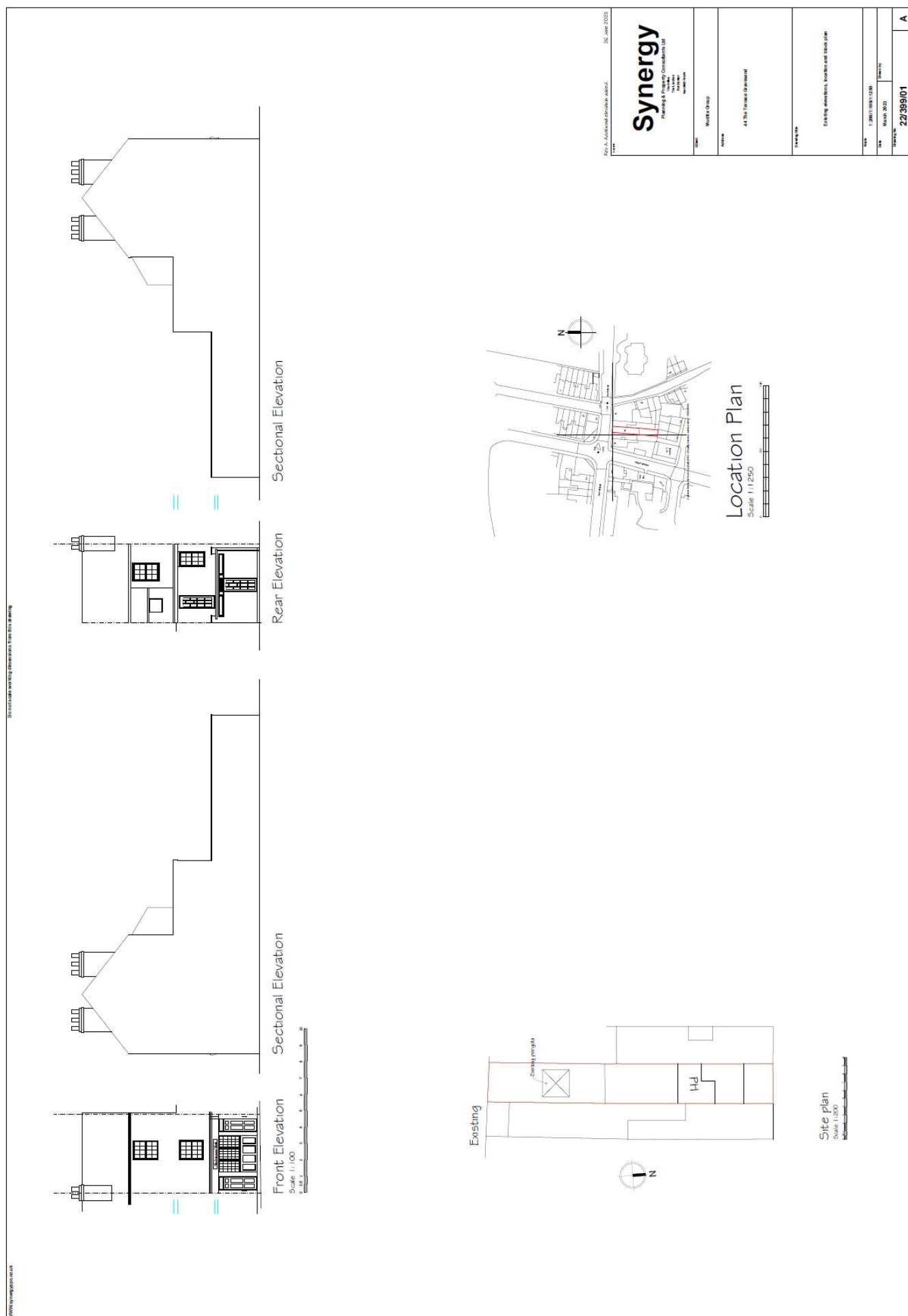
- Lift the existing floorboards and fit 150mm thick (minimum) dense mineral wool insulation with a minimum density of at least 40 kg/m³ between the floor joists;
- Re-lay the existing floorboards and make good any damaged areas, holes, gaps, etc.
- Overlay the separating floors with minimum 4mm thick hardboard;
- Bond 4.5mm thick Isomass Isocheck Re-Mat 5 onto the new hardboard or;
- Bond 5mm thick Regupol Sonus Core 5 rubber mat onto the new hardboard or;
- Install any other similar performing minimum 4 – 5mm thick rubber or foam resilient layer over the new hardboard flooring;
- On the ceilings below, inspect and repair any holes and damaged areas with suitable dense plaster and then provide a suspended ceiling below comprising minimum 50mm deep timber battens lined with 2 x 15mm thick SoundBloc plasterboard fitted on 16mm deep British Gypsum resilient bars;

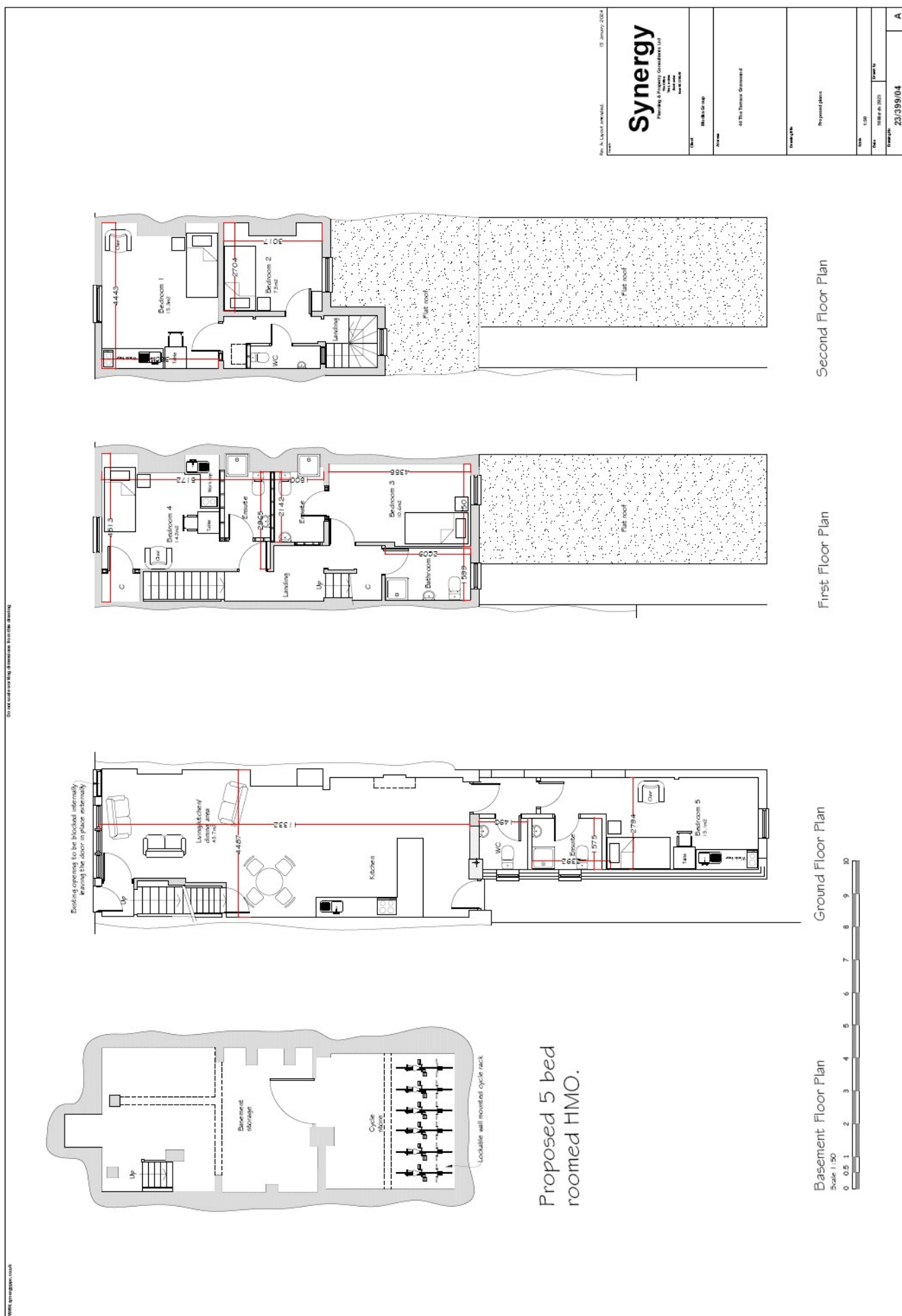
- The plasterboard ceiling linings must have the joints staggered and the edges taped and sealed.

- 6.11 Using our INSUL software, we have predicted that the party floor construction outlined above, if constructed properly with a high level of workmanship and attention to detail, should provide an airborne sound reduction level of approximately $54 \text{ dB } R_w - 4 \text{ dB } C_{tr}$.
- 6.12 This would equate to an airborne sound insulation level of $50 \text{ dB } R_w$ which in turn can be approximated to $45 \text{ dB } D_{nT,w} + C_{tr}$. This approximate level of airborne sound insulation demonstrates compliance with the minimum level of $43 \text{ dB } D_{nT,w} + C_{tr}$ required under Part E for dwellings formed by material change of use.
- 6.13 The INSUL calculation is show at the end of this report.
- 6.14 In terms of impact sound insulation, with the bonded resilient layer and the suspended ceilings below, it is considered that the proposed party floor upgrading measures should also comfortably achieve the maximum permitted level of $64 \text{ dB } L'_{nT,w}$ required under Part E for dwellings formed by material change of use.

7.0 SUMMARY AND CONCLUSIONS

- 7.1 The impact of noise has been assessed for the proposed residential development scheme at The Crown & Thistle PH, No. 44 The Terrace, Gravesend, Kent DA12 2BJ.
- 7.2 The results of the noise level survey and assessment indicate that the development site is exposed to modest levels of external environmental noise during both the daytime and the night-time periods due to noise from intermittent local road traffic.
- 7.3 Noise from commercial sources, i.e. noise from passing boats on the River Thames or any building services plant serving nearby buildings, was not audible at the site and is not significant in terms of adversely affecting the proposed dwellings.
- 7.4 An appropriate noise mitigation scheme has been recommended for the new dwellings which should provide sufficient noise attenuation to meet the required internal acoustic criteria and fully protect the amenity of future residents in accordance with the standards outlined in the WHO Guidance, BS 8233 : 2014 and the ProPG guidance document.
- 7.5 A design scheme for the party floors between the proposed bedrooms has been provided that is capable of achieving the standards for both airborne sound insulation and impact sound insulation outlined under Requirement E1 of Approved Document E of the Building Regulations for dwellings formed by material change of use.





Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within $R_w \pm 3$ dB

MRL Acoustics Ltd - Key No. 1561

Job Name:

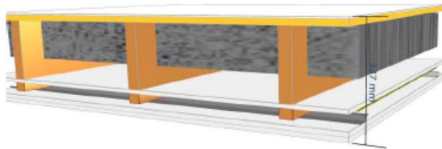
Initials:mattl

Date:23/10/2023

File Name:Crown & Thistle PH, Gravesend - Party Floor.ixl



Notes:



R_w 54 dB

C -1 dB

Ctr -4 dB

Mass-air-mass resonant frequency = 35 Hz, 116 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 57.2 kg/m²

System description

Panel 1 : 1 x 4 mm Rubber

+ 1 x 20 mm Flooring Particle Board

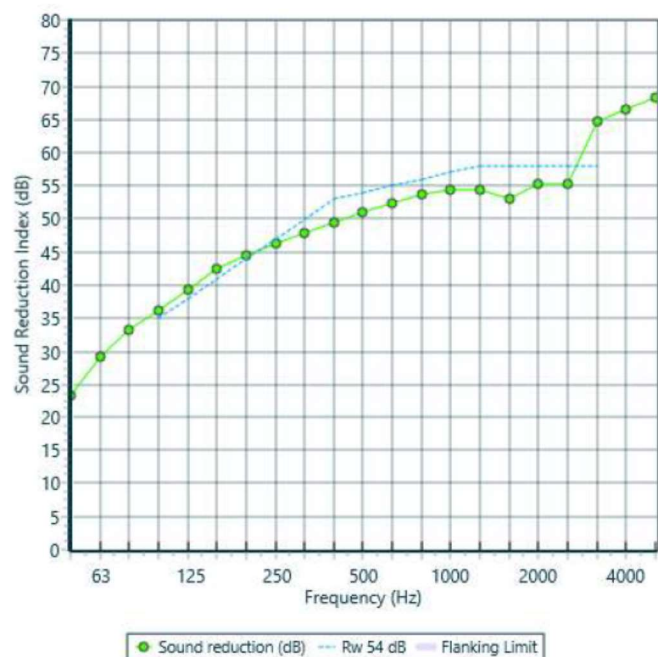
Frame: Timber stud (2.2E2 mm x 45 mm), Stud spacing 600 mm; Cavity Width 220 mm, 1 x Rockwool (40kg/m³) Thickness 150 mm

Panel 2 : 1 x 12.5 mm Gyproc Wallboard 12.5mm (p:640 kg/m³, E:1.6GPa, η :0.01, ps:8 kg/m², fc:3263 Hz)

Frame: Solid Joist with resilient rail (32 mm x 45 mm), Stud spacing 600 mm; Cavity Width 50 mm, 1 x Fibreglass (10kg/m³) Thickness 10 mm

Panel 3 : 2 x 15 mm Gyproc SoundBloc 15mm (p:840 kg/m³, E:3.1GPa, η :0.01, ps:25.2 kg/m², fc:3176 Hz)

freq.(Hz)	R(dB)	R(dB)
50	23	
63	29	27
80	33	
100	36	
125	39	39
160	42	
200	45	
250	46	46
315	48	
400	50	
500	51	51
630	52	
800	54	
1000	54	54
1250	54	
1600	53	
2000	55	54
2500	55	
3150	65	
4000	67	66
5000	68	



APPENDIX I – NOISE UNITS AND INDICES

a) Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

b) Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20,000 Hz. However, the upper frequency limit gradually reduces as a person gets older.

c) A-weighting

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters and is denoted dB(A) or dBLA.

d) Glossary of Terms

When a noise level is constant and does not fluctuate over time, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below:-

L_{Aeq} The A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period.

L_{Amax} The maximum A-weighted noise level recorded during the monitoring period.

L_{A10} The A-weighted noise level exceeded for 10% of the specified time period. L_{A10} is most often used as a measure of traffic noise.

L_{A90} The A-weighted noise level exceeded for 90% of the specified time period. L_{A90} is used as a measure of 'background noise'.

SEL The 'sound exposure level' of a single event (such as a passing train) and is the L_{Aeq} value of the whole event normalised to a 1 second period level of a sound.

- RT Measured reverberation time in receiver room in seconds.
- RT_0 Standard reverberation time of 0.5 seconds.
- D Level difference, effectively $D = \text{source level} - (\text{receiver level corrected for background level})$.
- D_{nT} Standardised level difference, standardised to a receiver room reverberation time of 0.5 seconds, $D_{nT} = D + 10 \log (RT/RT_0)$.
- $D_{nT,w}$ Weighted standardised level difference, a single figure generated by comparing the D_{nT} with a reference curve. The reference curve is shifted in 1 dB steps until the sum of adverse deviation of the test curve, compared to the reference curve, is as large as possible, but no more than 32.0 dB. The value of the shifted reference curve at 500 Hz is taken as the $D_{nT,w}$. N.B. As $D_{nT,w}$ for airborne transmission represents a level difference, an improvement generates a larger figure.
- C_{tr} A 'spectrum adaptation term' used to correct the $D_{nT,w}$ in order to reflect low frequency performance of the wall or floor tested.
- L Level, effectively $L = \text{receiver level corrected for background level}$.
- L'_{nT} Standardised level, standardised to a receiver room reverberation time of 0.5 seconds, $L'_{nT} = L - 10 \log (RT/RT_0)$.
- $L'_{nT,w}$ Weighted standardised level, a single figure generated by comparing the L'_{nT} with a reference curve. The reference curve is shifted in 1 dB steps until the sum of adverse deviation of the test curve, compared to the reference curve, is as large as possible, but no more than 32.0 dB. The value of the shifted reference curve at 500 Hz is taken as the $L'_{nT,w}$. N.B. As $L'_{nT,w}$ for impact transmission represents an absolute level, an improvement generates a smaller figure.

APPENDIX II – RESULTS OF NOISE LEVEL SURVEY

Date: Monday 16th October – Tuesday 17th October 2023

Equipment: Rion NA-28 'Class 1' sound level meter, Rion NC-74 acoustic calibrator, environmental weather case, Rion WS-15 windshield, microphone, tripod

Weather: Generally warm and dry with a light breeze throughout

Results: All values in dB(A)

Table A1: Results of 24-Hour Ambient Noise Level Survey

Date	Time	Run Time	Leq	Lmax	L10	L90	SPL Time Weighting	Frequency Weighting
16/10/2023	11:15	00:15:00	48.9	63.0	51.9	43.7	Fast	A
16/10/2023	11:30	00:15:00	49.0	58.6	52.1	43.5	Fast	A
16/10/2023	11:45	00:15:00	49.0	57.5	51.8	44.2	Fast	A
16/10/2023	12:00	00:15:00	48.8	61.2	51.8	43.2	Fast	A
16/10/2023	12:15	00:15:00	48.7	59.2	51.8	43.3	Fast	A
16/10/2023	12:30	00:15:00	48.9	59.0	51.4	43.5	Fast	A
16/10/2023	12:45	00:15:00	49.5	60.4	52.4	43.7	Fast	A
16/10/2023	13:00	00:15:00	49.7	63.8	52.4	44.3	Fast	A
16/10/2023	13:15	00:15:00	49.5	54.4	52.3	44.1	Fast	A
16/10/2023	13:30	00:15:00	49.1	58.9	52.2	43.8	Fast	A
16/10/2023	13:45	00:15:00	48.3	54.1	51.8	43.4	Fast	A
16/10/2023	14:00	00:15:00	49.4	58.8	52.4	43.5	Fast	A
16/10/2023	14:15	00:15:00	48.4	61.8	51.4	43.3	Fast	A
16/10/2023	14:30	00:15:00	48.4	60.5	51.8	43.2	Fast	A
16/10/2023	14:45	00:15:00	49.1	56.4	51.6	43.0	Fast	A
16/10/2023	15:00	00:15:00	50.2	63.0	52.5	42.1	Fast	A
16/10/2023	15:15	00:15:00	48.2	56.1	51.2	42.8	Fast	A
16/10/2023	15:30	00:15:00	49.4	55.4	52.6	43.9	Fast	A
16/10/2023	15:45	00:15:00	50.4	66.9	52.9	44.5	Fast	A
16/10/2023	16:00	00:15:00	48.9	62.5	52.6	44.0	Fast	A
16/10/2023	16:15	00:15:00	50.0	57.9	52.9	44.3	Fast	A
16/10/2023	16:30	00:15:00	49.1	62.6	51.6	44.5	Fast	A
16/10/2023	16:45	00:15:00	50.4	65.4	52.6	45.1	Fast	A
16/10/2023	17:00	00:15:00	49.8	67.3	51.6	46.0	Fast	A
16/10/2023	17:15	00:15:00	49.6	60.7	51.9	45.0	Fast	A
16/10/2023	17:30	00:15:00	49.7	64.5	52.3	45.6	Fast	A
16/10/2023	17:45	00:15:00	51.4	64.3	53.3	45.9	Fast	A
16/10/2023	18:00	00:15:00	51.1	61.6	53.1	45.1	Fast	A
16/10/2023	18:15	00:15:00	50.2	62.1	53.4	45.0	Fast	A
16/10/2023	18:30	00:15:00	51.4	61.2	53.4	44.6	Fast	A
16/10/2023	18:45	00:15:00	49.2	61.9	53.8	44.3	Fast	A
16/10/2023	19:00	00:15:00	50.6	59.1	54.1	43.8	Fast	A
16/10/2023	19:15	00:15:00	49.0	65.5	51.5	44.1	Fast	A

Date	Time	Run Time	Leq	Lmax	L10	L90	SPL Time Weighting	Frequency Weighting
16/10/2023	19:30	00:15:00	50.2	61.6	54.0	43.3	Fast	A
16/10/2023	19:45	00:15:00	48.1	56.1	51.7	42.8	Fast	A
16/10/2023	20:00	00:15:00	48.0	56.0	51.5	42.0	Fast	A
16/10/2023	20:15	00:15:00	47.5	54.2	51.0	40.7	Fast	A
16/10/2023	20:30	00:15:00	47.5	56.7	51.4	39.8	Fast	A
16/10/2023	20:45	00:15:00	46.9	52.2	50.9	39.5	Fast	A
16/10/2023	21:00	00:15:00	47.0	58.9	50.0	38.8	Fast	A
16/10/2023	21:15	00:15:00	47.4	56.5	51.4	40.7	Fast	A
16/10/2023	21:30	00:15:00	47.2	60.0	50.4	39.4	Fast	A
16/10/2023	21:45	00:15:00	47.1	57.1	50.6	39.8	Fast	A
16/10/2023	22:00	00:15:00	47.6	58.0	51.3	39.3	Fast	A
16/10/2023	22:15	00:15:00	46.3	56.0	50.1	37.9	Fast	A
16/10/2023	22:30	00:15:00	44.9	53.9	49.4	35.9	Fast	A
16/10/2023	22:45	00:15:00	44.9	55.4	49.7	34.7	Fast	A
16/10/2023	23:00	00:15:00	45.6	56.4	50.7	36.3	Fast	A
16/10/2023	23:15	00:15:00	44.5	60.2	48.6	36.0	Fast	A
16/10/2023	23:30	00:15:00	44.1	56.3	49.3	34.8	Fast	A
16/10/2023	23:45	00:15:00	45.2	63.2	48.9	34.6	Fast	A
17/10/2023	00:00	00:15:00	44.3	55.5	49.9	35.3	Fast	A
17/10/2023	00:15	00:15:00	43.2	55.8	47.6	32.8	Fast	A
17/10/2023	00:30	00:15:00	44.4	55.4	48.7	31.5	Fast	A
17/10/2023	00:45	00:15:00	41.4	56.5	45.3	31.7	Fast	A
17/10/2023	01:00	00:15:00	42.3	59.0	46.7	31.9	Fast	A
17/10/2023	01:15	00:15:00	41.7	51.6	45.6	30.2	Fast	A
17/10/2023	01:30	00:15:00	41.8	54.8	45.3	31.9	Fast	A
17/10/2023	01:45	00:15:00	42.7	56.7	45.8	31.9	Fast	A
17/10/2023	02:00	00:15:00	40.9	58.0	43.4	30.5	Fast	A
17/10/2023	02:15	00:15:00	41.9	53.7	45.4	30.1	Fast	A
17/10/2023	02:30	00:15:00	40.5	57.5	44.2	29.3	Fast	A
17/10/2023	02:45	00:15:00	42.1	52.8	45.6	31.5	Fast	A
17/10/2023	03:00	00:15:00	40.2	51.6	43.7	30.7	Fast	A
17/10/2023	03:15	00:15:00	41.8	54.0	44.8	32.3	Fast	A
17/10/2023	03:30	00:15:00	43.0	52.1	47.2	33.8	Fast	A
17/10/2023	03:45	00:15:00	42.5	49.8	46.6	32.1	Fast	A
17/10/2023	04:00	00:15:00	43.0	51.5	49.1	33.8	Fast	A
17/10/2023	04:15	00:15:00	42.5	55.1	49.1	35.3	Fast	A
17/10/2023	04:30	00:15:00	44.0	52.3	49.6	38.8	Fast	A
17/10/2023	04:45	00:15:00	44.4	55.9	51.5	41.2	Fast	A
17/10/2023	05:00	00:15:00	45.9	55.5	52.5	41.2	Fast	A
17/10/2023	05:15	00:15:00	46.2	56.8	52.7	42.7	Fast	A
17/10/2023	05:30	00:15:00	47.4	58.2	53.4	43.2	Fast	A
17/10/2023	05:45	00:15:00	47.8	56.5	54.5	43.3	Fast	A
17/10/2023	06:00	00:15:00	48.3	62.1	54.2	44.5	Fast	A
17/10/2023	06:15	00:15:00	48.6	58.3	54.7	44.5	Fast	A
17/10/2023	06:30	00:15:00	49.2	57.6	53.9	44.8	Fast	A
17/10/2023	06:45	00:15:00	49.4	57.9	54.1	45.7	Fast	A
17/10/2023	07:00	00:15:00	49.6	63.1	54.0	45.7	Fast	A
17/10/2023	07:15	00:15:00	51.0	55.2	54.1	46.5	Fast	A
17/10/2023	07:30	00:15:00	50.8	57.0	53.6	45.9	Fast	A

Date	Time	Run Time	Leq	Lmax	L10	L90	SPL Time Weighting	Frequency Weighting
17/10/2023	07:45	00:15:00	49.5	57.7	53.4	45.1	Fast	A
17/10/2023	08:00	00:15:00	49.9	58.7	53.0	44.3	Fast	A
17/10/2023	08:15	00:15:00	49.5	59.0	52.3	43.9	Fast	A
17/10/2023	08:30	00:15:00	50.3	64.5	53.1	45.3	Fast	A
17/10/2023	08:45	00:15:00	49.9	54.1	51.9	45.1	Fast	A
17/10/2023	09:00	00:15:00	49.7	58.5	52.8	44.7	Fast	A
17/10/2023	09:15	00:15:00	49.5	57.8	55.3	45.6	Fast	A
17/10/2023	09:30	00:15:00	48.5	60.3	53.9	44.4	Fast	A
17/10/2023	09:45	00:15:00	49.1	62.6	52.3	43.7	Fast	A
17/10/2023	10:00	00:15:00	48.1	57.7	52.4	45.0	Fast	A
17/10/2023	10:15	00:15:00	48.6	59.4	53.8	45.0	Fast	A
17/10/2023	10:30	00:15:00	49.2	61.6	51.6	45.1	Fast	A
17/10/2023	10:45	00:15:00	48.9	66.4	51.8	45.1	Fast	A
17/10/2023	11:00	00:15:00	49.1	55.5	51.1	44.6	Fast	A
17/10/2023	11:15	00:15:00	48.0	60.0	52.1	44.8	Fast	A