

Hayes McKenzie — Consultants in Acoustics

Ropley, Botley Road

Environmental Noise Impact Assessment

Report HM: 3734_R01_EXT3

17 October 2024

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Prepared for: Chris Pitter
Pitter Properties Ltd
Botley Road
West End
Southampton
SO30 3HA

Report prepared by: Rich Burrows BSc, AMIOA
Consultant

Checked by: Seth Roberts BEng, MIOA
Principal Consultant

Approved by: Rob Shepherd MEng, MIOA
Associate Director

Document Control

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EXT1	10/05/2024	Draft report issued to client
EXT2	11/10/2024	Revised report issued addressing consultee response
EXT3	17/10/2024	Figure 1 amended to show revised North building plot location

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Unit 3, Oakridge Office Park, Whaddon, Salisbury SP5 3HT, UK
+44 (0)1722 710091, salisbury@hayesmckenzie.co.uk

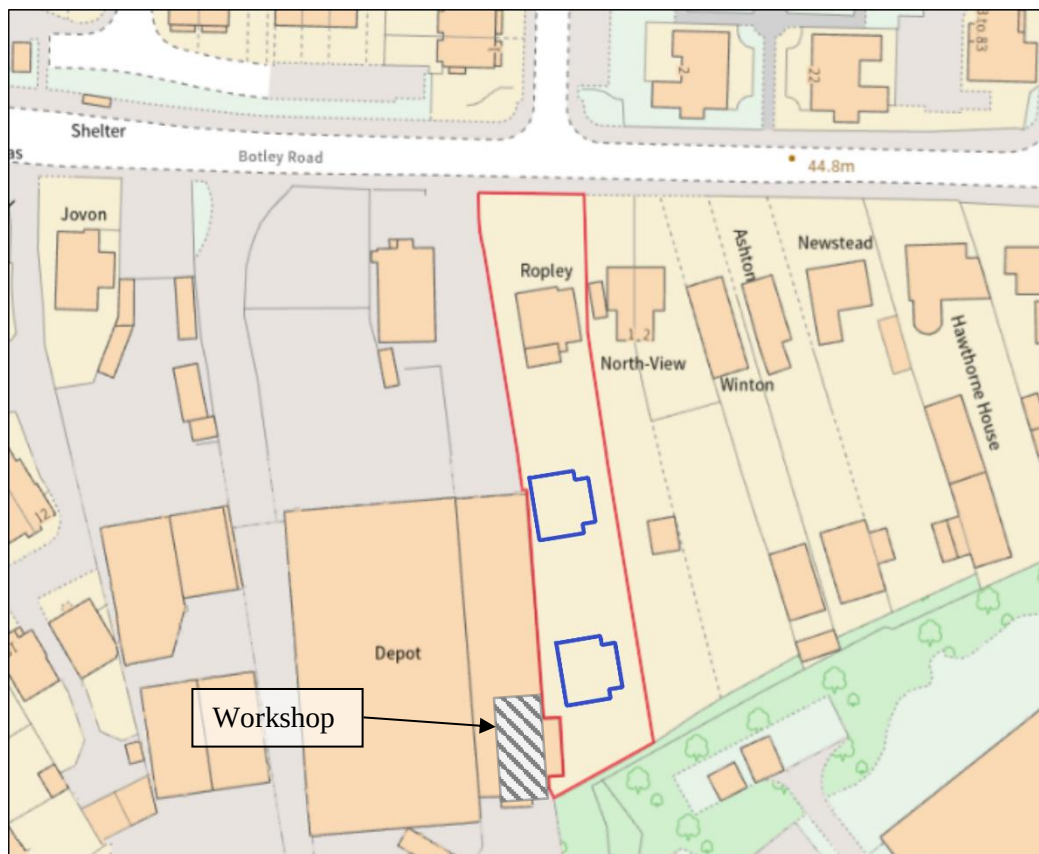
1. INTRODUCTION

- 1.1 Following the submission of an initial noise impact assessment report in support of a planning application for a new residential development at Ropley, Botley Road, West End, Southampton (Eastleigh Borough Council Ref. F/24/97943), consultee comments have been received requesting additional information relating to noise. Hayes McKenzie have been commissioned to revise the initial report and provide amendments covering the requested additional information. Section 3 provides details on the consultee comments and the associated updates that are included in this version of the report.
- 1.2 It is understood that two previous planning applications for residential development at the site have gone to appeal and noise has been a material consideration for determining the appeal decisions, which both resulted in refusal. As such, relevant comments from previous appeal decisions and inspectors' reports have been taken into account when considering the methodology for the noise assessment presented in this report.
- 1.3 It is important to note that the client is the owner of Pitter Commercials Ltd (part of Botley Road Garage) which is a business that specialises in heavy goods vehicle (HGV) sales, parts and servicing. Botley Road Garage is adjacent to FeryTrans Ltd, which is immediately adjacent to the proposed development. The nature of business associated with FeryTrans Ltd is logistics and the company uses this site for the maintenance and storage of HGVs.
- 1.4 The main focus of this report is the assessment of noise emitted from the adjacent commercial premises (currently occupied and run by FeryTrans Ltd), upon the proposed residential development. Commercial noise and the associated impact is assessed in accordance with British Standard 4142:2014 '*Methods for rating and assessing industrial and commercial sounds*' (BS 4142).
- 1.5 In addition to commercial noise at the proposed development, it should be noted that the background sound environment is dominated by road traffic. This report assesses transportation noise associated with road traffic noise levels in accordance with Professional Practice Guidance on Planning and Noise 2017 (ProPG).

2. PROPOSED DEVELOPMENT AND PLANNING HISTORY

- 2.1 The site is located at a property named Ropley on Botley Road, West End, SO30 3HA. The application site boundary is highlighted in red on the location plan shown at Figure 1 below.
- 2.2 The proposed development includes removal of the garage on the eastern side of the existing house to allow vehicular access to the rear and construction of two 3-bedroom dwellings. The footprints of the two proposed dwellings are highlighted in blue on the location plan shown at Figure 1.

Figure 1 – Site Location Plan



- 2.3 There have been two previous applications for residential development on the site, one in 2008 and one in 2013. The 2008 application (Application no. F/08/62528) was refused permission on 29 May 2008 and the decision notice states that:

'The application has failed to demonstrate that adequate mitigation measures can be put in place to protect the amenity of future residents from noise disturbance generated by the neighbouring commercial uses.'

- 2.4 The 2008 decision was appealed and in an appeal decision dated 30 September 2008 (Appeal Ref: APP/W1715/A/08/2079069) the appeal was dismissed, and the decision was upheld. The appeal decision cites noise as a reason, again specifically highlighting the adjacent commercial uses:

'Immediately to the west of the site is a large garage occupied by a coach hire business and beyond that are other motor trade uses including a vehicle repair workshop. I have not been advised of any time restrictions on these operations and, whilst excessive nuisance may be curtailed by legislation other than the planning acts, it is clear that there is considerable potential for noise to be generated.'

- 2.5 The 2013 application (Application no. F/13/73364) was refused permission on 6 February 2014 and the decision notice provided exactly the same reason relating to noise from the adjacent commercial uses as was provided in the 2008 decision. The decision was appealed and in an appeal decision dated 13 November 2014 (Appeal Ref: APP/W1715/A/14/2223373) the inspector notes specifically that:

'Intermittent noise, albeit brief, which take place in the early hours or late at night, or on weekends, are likely to be unacceptably disturbing to the occupiers of the proposed dwellings, especially in summer, when bedroom windows are likely to be open. The ambient noise from road traffic and the nearby M27 would, in the daytime mask this effect to a degree, but less so at night. This noise is likely to be both noticeable and intrusive. No mitigation strategy has been suggested by the appellant'

- 2.6 It is therefore clear that providing suitable mitigation against the potential noise impact of the adjacent commercial uses, would be paramount to any successful application for residential development at this site.
- 2.7 The adjacent commercial site immediately to the west of the proposed development is currently operated by a logistics company (FeryTrans Ltd). In March 2023, planning consent was granted to FeryTrans for an application to: *'Demolish existing rear single storey projection and erect new cladding wall with door entrance for workshop servicing and alter existing roof (retrospective)'*. This recent application (Application No. F/22/92626) for the adjacent site details the location of a workshop for HGV maintenance to the rear of the site as highlighted with grey and white hatching at Figure 1. It should be noted that no restrictions on operating times are included within the decision notice.

- 2.8 It is understood that FeryTrans primarily use the adjoining site for HGV storage and that maintenance is carried out in the workshop during normal working hours whilst HGV movements associated with storage could occur at any time of the day or night. At the time of the previous 2008 and 2013 applications, the adjoining site was operated by a coach company with a very similar storage and maintenance use.

3. CONSULTEE COMMENTS AND UPDATES TO ASSESSMENT

- 3.1 The Eastleigh Borough Council Environmental Health consultee response is detailed in an email from Paul Bieda (Pollution Control Specialist) to Gary Osmond (Senior Planning Officer) dated 18th September 2024. Within the response it specifically discusses the previous Hayes McKenzie report (3734_R01_EXT1 dated 10th May 2024) and notes that:

'The report demonstrated there would be a significant adverse impact from commercial noise to the proposed development and recommended a 4m high acoustic barrier with FerryTrans, the specification proposed will reduce the noise levels lower than required in amenity spaces as detailed in BS 8233:2014.'

The response goes on to state:

'...regarding transportation noise, since there is a risk associated with maximum noise levels at night, the report should demonstrate compliance with internal noise levels to living and bedrooms both day and night in line with BS 8233'

- 3.2 Both of the points raised above note requirements relating to BS8233 so a subsection on this standard has been added to section 4 below. The first point highlights that the proposed mitigation reduces levels lower than would be required for BS8233, implying that a smaller acoustic barrier may suffice. To reduce the visual impact, the acoustic barrier could be lowered and section 10 has been revised to consider a 2.5 m high acoustic barrier rather than a 4 m high acoustic barrier.
- 3.3 In relation to both commercial noise and transportation noise, the requirements of BS8233 have been considered within the revised assessment (presented within this report) and set out clearly within section 10 to address the points raised in the consultee response.

4. STANDARDS AND RELEVANT GUIDANCE

BS 4142:2014 + A1:2019

- 4.1 BS 4142¹ provides an assessment methodology for rating noise immission levels from industrial and commercial sound at residential properties and is appropriate for assessing commercial sound that has potential to impact the proposed development. The standard details a method for determining the noise impact based on the difference between the existing background sound level (without the noise source) measured using the L_{A90} measurement index² and the noise immission level of the source at a receiver location (known as the specific sound level) measured or predicted using the L_{Aeq} index³. The standard subjects the specific sound level to character corrections where acoustic features are audible. These character corrections are added to the specific sound level resulting in a rating level, which is then compared to the background level to assess the level of impact.
- 4.2 The character corrections pertain to three specific acoustic features, tonality, impulsivity, and intermittency. Character corrections may only be applicable if the acoustic features are audible at the receptor and not the source or a location closer to the source. The corrections can be applied up to and including 9 dB for tonality, 6 dB for impulsivity and 3 dB for intermittency. It should be noted that the standard also allows for a correction not covered by these three specific features stating:
- 'Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied'*
- 4.3 The difference between the background sound level and rating level (rating minus background) is then used to provide an initial assessment of the noise impact, according

¹ BS 4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound, BSI 2019

² The L_{A90} is the A-weighted instantaneous noise level measured in dBA, which is exceeded for 90% of the measurement period.

³ L_{Aeq} is the A-weighted, equivalent continuous sound level over the duration of the measurement interval measured in dBA. This metric is an energy average of the fluctuating sound level over the measurement interval.

to Table 1 below. BS 4142:2014 states that '*the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact*'.

Table 1 – BS 4142 Guidance on Noise Impact

Difference	Assessment
Around +10 dB or more	Indication of a significant adverse impact, depending on the context
Around +5 dB	Indication of an adverse impact, depending on the context
<0 dB	Indication of a low impact

4.4 Whilst BS 4142 gives an indicative assessment of the impact on residential amenity, there are no specific guidelines on what may be acceptable in each situation and, in this respect, the standard is left open to interpretation. BS 4142 is not intended to be applied to the assessment of indoor sound levels but is based around determining the likelihood of adverse or significant adverse impact at external measurement locations.

4.5 Section 11 of BS 4142 refers to the assessment process and states:

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

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

4.6 It is therefore important to bear in mind that the difference between rating level and background sound is only an initial estimate of impact and that the standard allows for professional judgement when considering the context of predicted or measured noise levels.

4.7 Section 7 of the standard provides guidance on determination of the specific sound level. It is noted that, where measurement of specific sound level is not possible, then this can be determined by calculation. It also describes how the specific sound level is quantified as an L_{Aeq} over the 'reference time interval' which means that, where it is not continuous, it is necessary to correct the measured noise level, taken during periods when the source is operating, for the percentage 'on-time' within the relevant reference time interval. The standard details different reference time intervals for the day-time and night-time of 1 hour and 15 minutes respectively. In this case, some of the adjacent commercial operations could be operating at any time of the day or night so the day and night reference time intervals are both relevant for this assessment.

- 4.8 When assessing the background sound levels, BS 4142 does not specify the averaging period of the background sound measurements only stating that *'the duration should be adequate to represent the situation but not normally less than 15 minutes'*. BS 4142 goes on to state in section 8.3 regarding existing specific sound source(s) not operating continuously that *'existing legitimate industrial or commercial sources of sound that are present when the specific source is not operating may be considered as part of the background sound climate'*. It is noted that there is no 'single' background sound level as this is a fluctuating parameter. As a result, it is recommended that a series of sequential or disaggregated measurements, are carried out to determine a 'representative' level which is then used as the basis of the assessment. It is noted that the data should suitably represent the particular circumstances and periods of relevance to the assessment and that weekday and weekend periods may need to be considered separately. Levels are to be reported as integer values to reflect the variability of such measurements.

BS 8233, Guidance on sound insulation and noise reduction for buildings

- 4.9 BS 8233:2014⁴ provides guidance on suitable internal noise levels for different types of buildings, including various home and office spaces with different uses. Section 7.7.1 of the standard incorporates World Health Organisation (WHO) guidance⁵ on acceptable noise levels for residential dwellings which is stated to be based on annual average noise levels, assuming typical diurnal variation. The provided levels contribute to design criteria for living rooms and bedrooms which are specified in a table (Table 4 in the standard). An extract of this table is given below in Table 2:

Table 2 – Extract from BS8233, Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living room	35 dB LAeq,16hour	-
Dining	Dining room/area	40 dB LAeq,16hour	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq,16hour	30 dB LAeq,8hour

Footnote 4 to this table states that:

'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 LAmax,f, depending on the character and number of events per night. Sporadic noise events could require separate values'.

- 4.10 It should be noted that, in relation to sleep disturbance, the previous version of the standard

4 British Standards, 2014, BS 8233 "Guidance on sound insulation and noise reduction for buildings"

5 World Health Organization, 1999, "Guidelines for Community Noise"

(BS8233:1999) provided a guideline limit of 45 dB L_{Amax} within bedrooms at night and this was supported by the WHO guidelines for community noise (also published in 1999). Whilst there is no specific guidance within the current version of the standard on a suitable $L_{Amax,f}$ threshold or numbers of events, the previous guideline of 45 dB $L_{Amax,f}$ is considered to be a conservative threshold suitable for frequent car pass-bys on a busy road. This assertion is further supported by values in Table H.3 within Annex H of the standard which specifies a typical design range for hotel bedrooms of 45 – 55 dB L_{Amax} during the night hours.

- 4.11 The standard also provides guideline values for external noise levels (i.e. in gardens and patios) stating that 50 dB $L_{Aeq,T}$ is desirable and that 55 dB $L_{Aeq,T}$ should be regarded as an upper limit in noisier external environments. However, the standard goes on to state that:

'...it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure that 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 spaces, but should not be prohibited.'

World Health Organisation Night Noise Guidelines for Europe 2009

- 4.12 The 2009 WHO Night Noise Guidelines provide guidance on both longer-term average noise metrics (L_{Aeq})³ and instantaneous maximum noise levels (L_{Amax})⁶ in terms of the health effects and in particular, effects on health related to sleep disturbance. In relation to noise disturbances at the proposed development, the guidance relating to instantaneous noise levels and health effects is most relevant. Table 1 of the document defines various thresholds for the onset of different health effects; under 'sleep quality' a threshold of 42 dB $L_{Amax,inside}$ is listed for 'Waking up in the night and/or too early in the morning'. Table 1 of the document also lists lower thresholds of 32, 35 and 35 dB $L_{Amax,inside}$ for the following biological sleep effects: 'onset of motility', 'EEG awakening' and 'Changes in duration of various stages of sleep, in sleep structure and fragmentation of sleep' respectively.
- 4.13 It should be noted that although these recommendations refer to studies relating to transportation noise, they can equally be applied to commercial noise. In relation to the number or frequency of events above the thresholds described above, the document states

⁶ L_{Amax} is the maximum A-weighted noise level during a measurement interval measured in dBA. L_{Amax} levels should also include a descriptor, either 's' or 'f' to denote either 'slow' or 'fast' sound level meter time weighting which are 1 second and 125 milliseconds respectively.

at paragraph 1.3.2:

'There is no generally accepted way to count the number of (relevant) noise events. Proposals range from the number of measured L_{Amax} , the number of units (vehicles, aeroplanes, trains) passing by, to the number exceeding a certain L_{Amax} level (commonly indicated by NA_{xx} ; NA_{70} is the number of events higher than 70 dB).'

- 4.14 There is no further guidance within the WHO document about what an acceptable number of events per night might be. However, the NA_{70} (mentioned above) along with the NA_{60} and NA_{65} are commonly used as supplementary metrics in aircraft noise assessment and there is some discussion about research in this area at page 50 of the document. The document refers to a research paper by Passchier-Vermeer⁷ which is discussed under section 3.1.7 and, within this section, a dose-effect relationship for internal levels of commercial aircraft noise is given at equation [4]. It is stated that the derived formula [4] is only valid over: *'the intervals $54 < SEL < 90$ ($37 < L_{Amax} < 82$) and the number of events per night $1 < N < 10$ '*. The following paragraphs build on this stated dose-effect relationship and derive another formula [5] for determining the maximum number of awakenings per year for a given yearly average level outside (L_{night}), based on some worst-case assumptions about the conversion between internal peak noise levels and average external noise levels. Working backwards with the stated assumptions for conversion between L_{night} and internal L_{Amax} levels, it is possible to calculate that for fewer than 10 commercial aircraft noise events per night, with a range of 50 - 60 dB L_{Amax} , there could be roughly expected to be a range of 10 - 100 awakenings per year. Although this result is specifically based on research relating to aircraft noise, it does provide some kind of benchmark and it is implicit that for 10 or more events per night the expected awakenings would be higher.

Planning policy and guidance

- 4.15 General guidance on noise is contained within the Government's overarching Noise Policy Statement for England (NPSE), the National Planning Policy Framework (NPPF), and Planning Practice Guidance (which includes PPG-Noise).
- 4.16 The NPSE sets out the Government's long-term vision on 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'. The NPSE sets out its noise policy aims as follows:

Through the effective management and control of environmental, neighbour and

⁷

Passchier-Vermeer W (2003). Night-time noise events and awakening. TNO Inro report 2003-32, TNO Institute for Traffic and Transport, Delft.

neighbourhood noise within the context of Government policy of 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.*

4.17 The NPPF states that the planning system should contribute to and enhance the natural and local environment by 'preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution'. It goes on to state (at paragraph 123) that planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

Professional Practice Guidance on Planning & Noise 2017

4.18 There are no specific limits set within the NPSE and NPPF for residential development, but a noise risk assessment is recommended by ProPG⁸ which is relevant to the proposed development. The guidance set out in ProPG pertains to transportation noise and, where industrial/commercial noise is present on a site, ProPG states that the guidance is still applicable provided that the industrial or commercial noise is '*not dominant*'. At paragraph 2.41 of ProPG it clarifies what is meant by 'not dominant' giving the following definition:

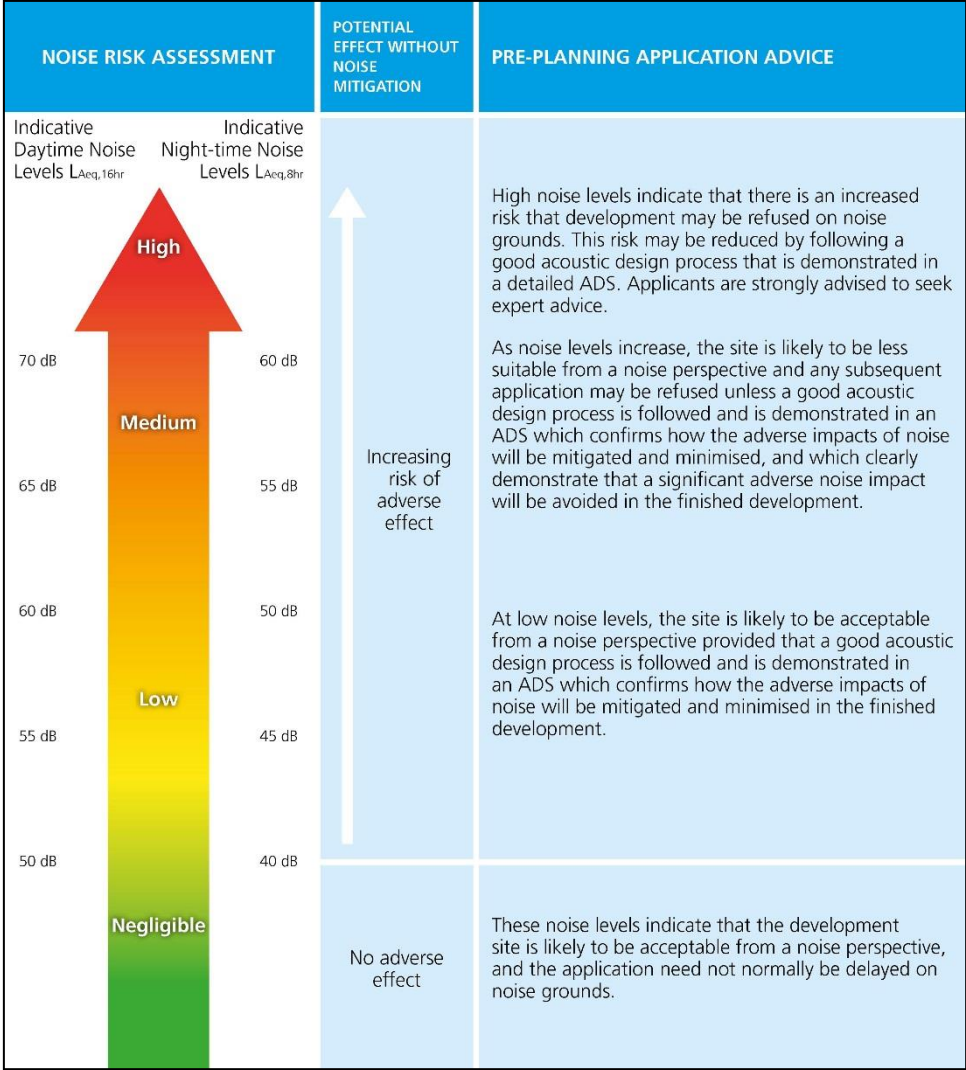
'where the impact would be rated as lower than adverse (subject to context) if a BS4142:2014 assessment was to be carried out'

4.19 ProPG sets out indicative noise levels related to the transportation noise risk assessment

⁸ ProPG: *Planning and Noise, Professional Practice Guidance on Planning & Noise*, overseen by the Association of Noise Consultants (ANC), Institute of Acoustics (IOA), and the Chartered Institute of Environmental Health (CIEH). IOA, May 2017

which are shown below at Figure 2. The indicative noise levels set out the level of risk associated with the noise environment at the proposed development site, with increasing noise levels indicating increasing risk, whereby noise mitigation should be incorporated into the design of the site to ensure that noise levels at the development site are acceptable.

Figure 2 – ProPG – Initial Site Noise Risk Assessment



4.20 In addition to the indicative night and daytime noise levels, it is stated that if there is an indication that there may be more than 10 $L_{A\max,F}$ events over 60 dB at night, then the site should not be regarded as negligible risk despite low measured levels of $L_{Aeq,8hr}$.

5. METHODOLOGY AND SOURCES OF NOISE

- 5.1 The proposed development site is subject to two main types of noise, transportation noise related to road traffic on nearby roads and commercial noise related to the operation of nearby commercial premises. The two types of noise are considered separately and assessed in different ways as discussed in the sub-sections below.

Transportation Methodology

- 5.2 The proposed development site is adjacent to Botley Road and approximately 575 m away from the M27 motorway. The expected level of road traffic noise is governed by distance to carriageways, traffic quantity and type of vehicles (i.e. HGVs generate higher levels than cars). Although the existing house on the site is within 20 m of Botley Road, the proposed dwellings are more than 50 m away and screened by the existing house such that road traffic noise relating to the M27 is likely to be more significant than that from Botley Road. The level of road traffic noise at the existing house will be unchanged by the proposed development and road traffic noise levels at the proposed dwellings can be quantified through measurements to the rear of the site at locations representative of the proposed dwellings.
- 5.3 The methodology used in this assessment involves the installation of two sound level meters in conjunction with a weather station to facilitate the accurate derivation of typical road traffic noise levels during both daytime and night-time periods. The equipment was setup to automatically collect measurements over four days including a weekend period. Collecting weather data allows for periods of abnormal weather conditions (such as rainfall, high wind speeds and unusual wind directions) to be evaluated and excluded from the analysis if necessary. The derived transportation noise levels are then assessed against the ProPG criteria presented above at Figure 2.

Commercial Methodology

- 5.4 The adjacent commercial premises to the site all have similar uses involving the storage and maintenance of vehicles including HGVs. The closest of these businesses and therefore the main contributor of commercial noise at the site, is FeryTrans Ltd, located adjacent to the site on the western boundary. The assessment presented here follows the methodology set out in BS 4142 to assess the significance of the noise impact from

FeryTrans upon the proposed development.

- 5.5 To derive the necessary sound levels, the two sound level meters and weather station installed in relation to transportation noise were also used to determine the background sound, ambient sound and residual sound in accordance with BS4142 methodology. To supplement these measurements, additional measurements were carried out to quantify specific sound levels of equipment representative of HGV maintenance operations, considered to be typical of those associated with FeryTrans Ltd. The equipment was installed over a typical weekday and weekend period (Friday to Monday). It is important to note that FeryTrans list on their website 'working hours' as 7am to 5pm on Monday to Friday, 7am to 12pm on Saturday and 8am to 10am on Sunday and holidays. However, FeryTrans also describe on their website under 'opening time' that they operate 24hrs a day and it should be noted that, as a logistics company, it would not be unreasonable to expect that HGVs could be operated out of hours and may come and go from the premises at any time of the day or night. It is considered likely that maintenance work would only ever be carried out during the 'working hours' when the site is fully staffed and that maintenance work outside of these hours would not be representative of typical operations.
- 5.6 The maintenance work carried out on the FeryTrans premises is contained within the workshop to the rear of the business premises (see Figure 1). It was noted whilst on site that the workshop is housed within an open garage with the entrance and exit along the northern and southern facades (no doors at either end). It was also noted whilst onsite that the forecourt (north) in front of the building was occupied by vehicles using the space to manoeuvre and prepare HGVs.
- 5.7 Prior to undertaking the measurements, HMPL were informed that there would be no cooperation from FeryTrans Ltd to measure noise from any of their equipment. As an alternative to this, the client provided access to Botley Road Garage, which houses equipment used for HGV maintenance and would provide a representative measurement of equipment housed in FeryTrans Ltd. The items that were selected for individual measurements are as follows: two battery powered impact wrenches, which are used for unbolting the wheels from a HGV, an Air Compressor Gun, which is used for pressurising HGV tyres and an Air Compressor, which generates the pressurised air delivered by the Air Compressor Gun. All other tools used for HGV maintenance are considered to generate significantly less noise and would therefore not contribute significantly to overall noise levels generated by HGV maintenance operations.
- 5.8 The BS 4142 reference time interval during the daytime is 1-hour and 15-minutes during the night, both of which are relevant for this site. The daytime assessment has been carried out by comparing the rating level generated by maintenance operations over a 1-hour

averaging period, with the representative background sound level for the daytime hours. The night-time assessment has been carried out by comparing the rating level generated by HGV movements over a 15-minute averaging period, with the representative background sound level for the night-time hours.

- 5.9 There is no set amount of time that any of the individual noise sources contained within FeryTrans Ltd may be operational. The operational time of the items of equipment selected for measurement is dependent on the work that is being carried out. It is very difficult to estimate any kind of 'on time' for the noise sources considered in this assessment, but typically none of them would be likely to continue for more than two minutes at a time and the total operating time would be considerably less than one hour. To assess a worst-case scenario, the equipment considered in this assessment has been assumed to be operating constantly.

6. SOUND LEVEL MEASUREMENTS

- 6.1 As described in the methodology section above, a 4-day noise survey was conducted to determine existing levels of road traffic noise along with background sound, ambient sound and residual sound. In addition, 'source noise measurements' were also carried out close to equipment used for HGV maintenance. Details of the noise survey and source noise measurements are provided in the sub-sections below

Noise Survey

- 6.2 The noise monitoring locations were installed on Friday 8th March 2024 and the sound level meters were collected on Tuesday 12th March 2024. The sound level meters (SLMs) were placed in locations representative of the proposed development, as shown at Figure 3.
- 6.3 One sound level meter (s/n 420658) was installed to the north of the site to quantify noise levels from road traffic and vehicles manoeuvring at FeryTrans. This location is labelled as SLM1 at Figure 3 and a photograph of the installed equipment is provided at Figure 4. The other sound level meter (s/n 821098) was installed to the south of the site, nearest to the workshop and operations to the south of FeryTrans Ltd. This location is labelled as SLM2 at Figure 3 and a photograph of the installed equipment is provided at Figure 5.
- 6.4 Measurements at both locations were carried out using Rion NL52 Sound Level Meters,

each fitted with a ½" microphone complying with the Class 1 standard in IEC 61672-1. The microphones were each mounted on a tripod at a height of between 1.2 – 1.5 m and each were fitted with a 45 mm diameter foam ball windshield surrounded by a 125 mm radius secondary windshield of 40 mm thickness. The equipment at both locations was set up to measure the L_{Aeq} and L_{A90} noise level in 15-minute intervals, together with 100 ms ⅓ octave L_{eq} noise data and audio recordings to allow identification of measured noise.

- 6.5 In accordance with the requirements of BS 4142, a weather station was installed adjacent to one of the microphones to log rainfall and wind speeds in 15-minute intervals, as seen in Figure 5. The weather station measures periods of rainfall and high wind speeds that can be excluded from the derivation of the background sound level, as these factors could increase the measured levels.
- 6.6 Calibration was carried out using a B&K type 4231 Acoustic Calibrator (s/n 3009009) set at a level of 94.21 dB at the start of the survey and checked at the end. A drift in the calibration of -0.1 dB was observed for the sound level meter to the north of the site, nearest the existing property at the site (s/n 420658). No drift in calibration was observed for the sound level meter to the south of the site, which faces the forecourt of the FeryTrans Ltd (s/n 821098). Both calibrations are within normal tolerances, and no correction has been made to the measured levels. All equipment was within the relevant laboratory calibration period.

Figure 3 – Sound Level Meter locations SLM1 (s/n 420658) and SLM2 (s/n 821098).

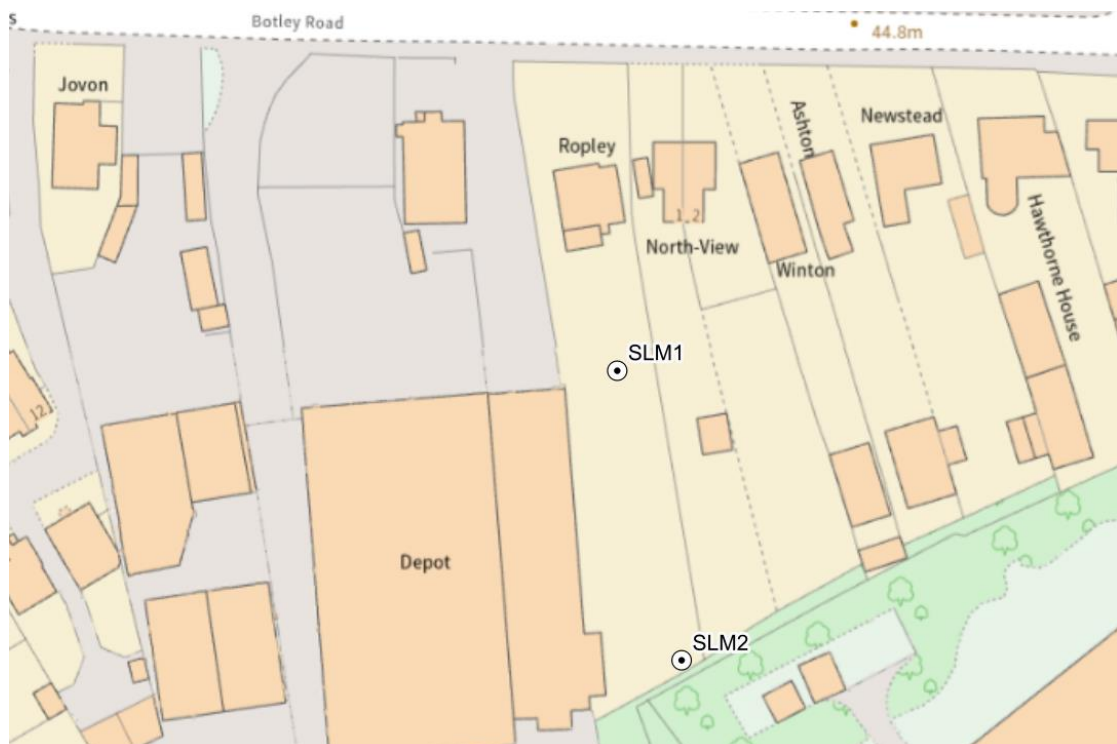


Figure 4 – Sound Level Meter 1 (s/n 420658).



Figure 5 – Sound Level Meter 2 (s/n 821098) and Weather Station.



- 6.7 It is important to note prior to attending site, the client informed HMPL that if personnel at FeryTrans Ltd identified the sound level meter and equipment that the staff would be likely to engage in noisy activities that are not typical. Additionally, the barrier between the site and FeryTrans Ltd consisted of a damaged wall/fence that provided very limited noise and/or visual protection from the operations at FeryTrans Ltd. The workshop towards the south of the site provided the greatest visual protection and as such was used as the location to install the weather station, as shown in Figure 5. This is not an ideal location for a weather station but was selected to provide greater visual screening.
- 6.8 A time history of background sound levels during the measurement survey along with weather data and other noise indices, including 12-hour daytime, 4-hour evening and 8-hour night-time L_{Aeq} values, are shown below in Figure 6 and Figure 7 for the two locations respectively. It should be noted that, any periods of rainfall and higher wind speeds have been excluded from the calculation of average noise levels shown on the charts and the tabular results (shown at Table 3 and Table 4). Periods of rainfall and wind speeds are recorded in mm and m/s respectively as indicated on the secondary axis at the right-hand side of the charts.

Table 3: Average Noise Levels for Sound Level Meter 1.

Period 24hrs (from 0700- 0700)	Day-time 0700-1900 Average Noise Level		Evening-time 1900- 2300 Average Noise Level		Night-time 2300-0700 Average Noise Level	
	dB $L_{Aeq, 12hr}$	dB L_{A90}	dB $L_{Aeq, 4hr}$	dB L_{A90}	dB $L_{Aeq, 8hr}$	dB L_{A90}
Friday 8 th – Saturday 9 th March			49	46	45	39
Saturday 9 th – Sunday 10 th March	55	52	49	46	44	36
Sunday 10 th – Monday 11 th March	49	43	47	43	47	42
Monday 11 th – Tuesday 12 th	57	50	48	41	38	33
Tuesday 12 th – Wednesday 13 th	51	48				
Overall	54	48	48	44	45	38

Table 4: Average Noise Levels for Sound Level Meter 2.

Period 24hrs (from 0700-0700)	Day-time 0700-1900 Average Noise Level		Evening-time 1900-2300 Average Noise Level		Night-time 2300-0700 Average Noise Level	
	dB L _{Aeq} , 16hr	dB L _{A90}	dB L _{Aeq} , 4hr	dB L _{A90}	dB L _{Aeq} , 8hr	dB L _{A90}
Friday 8 th – Saturday 9 th March			51	49	46	40
Saturday 9 th – Sunday 10 th March	54	53	49	47	43	36
Sunday 10 th – Monday 11 th March	48	42	43	39	46	36
Monday 11 th – Tuesday 12 th	52	48	44	39	37	33
Tuesday 12 th – Wednesday 13 th	54	48				
Overall	52	48	48	43	44	37

Figure 6 – Time History of Background Sound Measurements for SLM1 (s/n 420658).

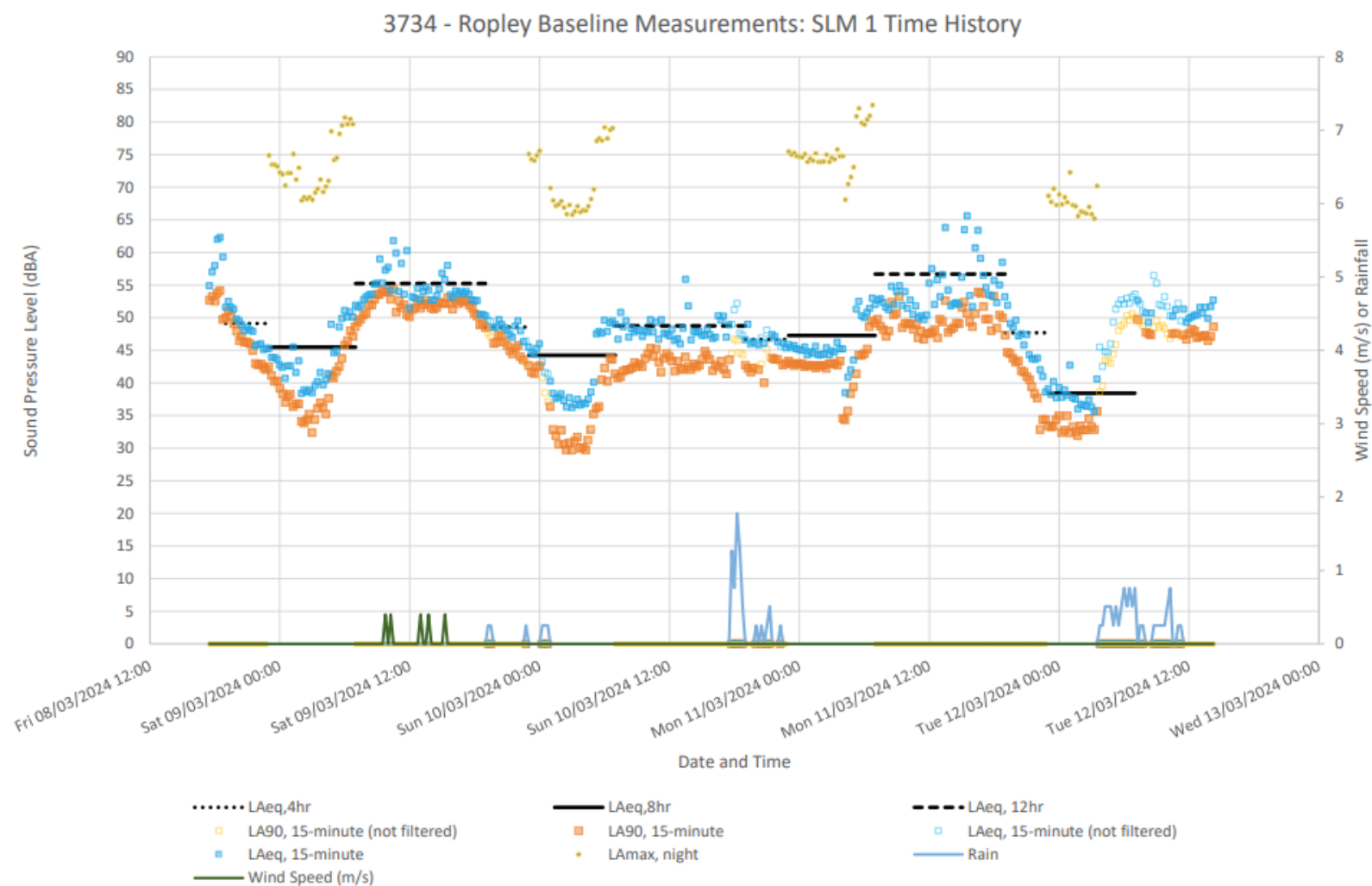
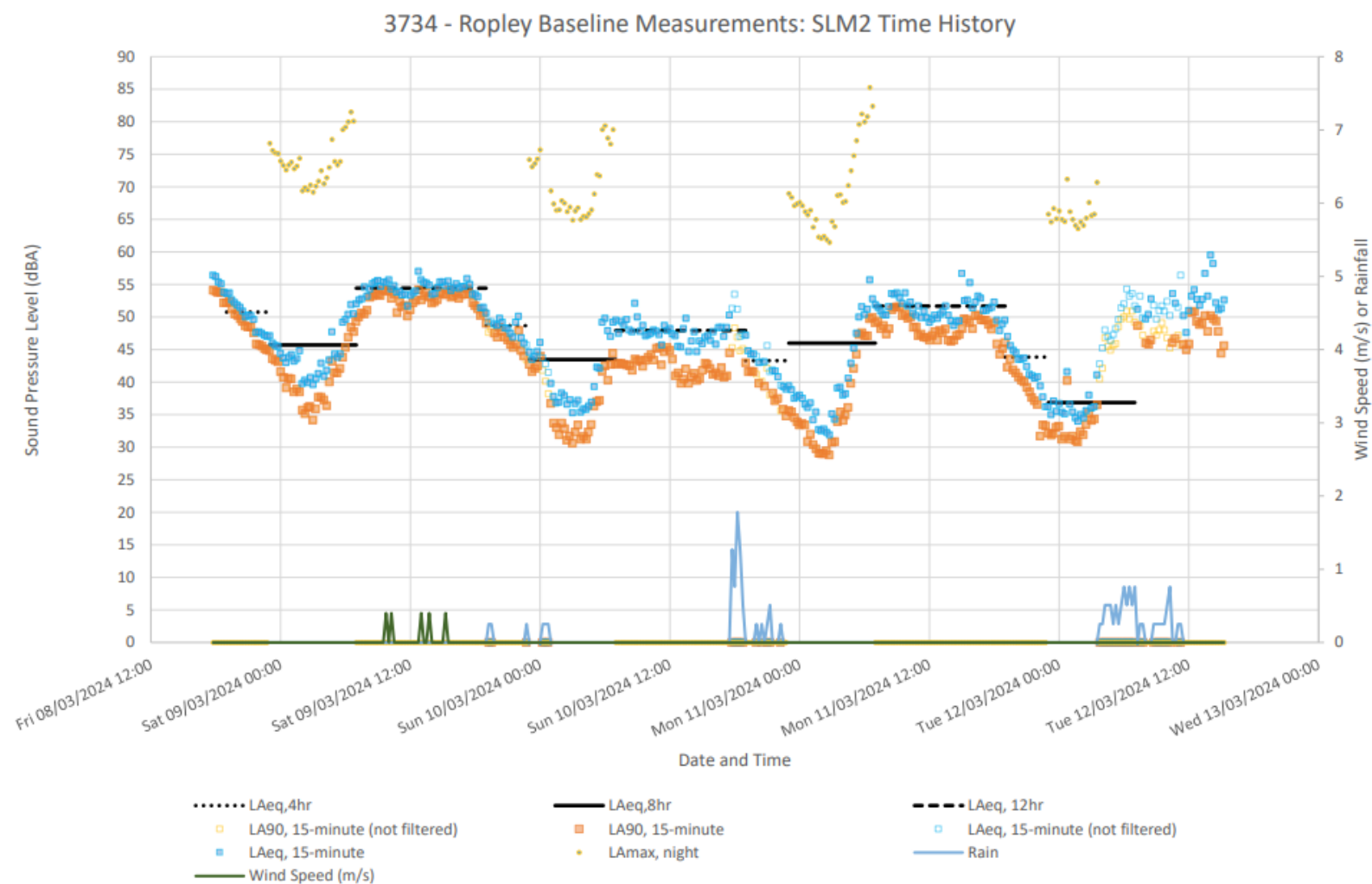


Figure 7 – Time History of Background Sound Measurements for SLM2 (s/n 821098).



- 6.9 It can be seen at Figure 6 that the night hours from Sunday evening through to the early hours of Monday morning were higher than other nights at the SLM1 location and the noise environment appears to be characterised by a continuous ambient sound level of 45 dB L_{Aeq} . After reviewing the audio files and confirming with the client, the elevated noise levels have been identified as being associated with a refrigerated HGV trailer. An HGV with a refrigerated trailer typically powers the refrigeration unit with either a separate diesel generator or the engine of the HGV itself (which must be kept running constantly to provide sufficient power to maintain temperature). The audio files indicate that the trailer was likely powered by an idling HGV engine and that the HGV with the refrigeration unit was parked up sometime on Sunday with the engine idling (or generator running) until sometime around 04:00 on Monday morning. The measured noise levels are consistent with what would be expected for an idling HGV approximately 15 m away from SLM1, on the forecourt on the other side of the boundary fence. The same elevated noise levels are not seen at SLM2 during the same period and this is consistent with the increased distance from the likely location of the HGV. It is considered that these elevated noise levels at SLM1 on Sunday night are representative of worst-case noise levels from HGV movements that could occur outside of normal working hours.
- 6.10 The loudest 15-minute period of ambient noise is measured as 66 dB L_{Aeq} at 15:30 on Monday 11th March 2024 at SLM1 (see Figure 6). It is clear that there are a number of periods with elevated noise levels and after reviewing the audio for the Monday daytime period, it is clear that the noise can be attributed to an angle grinder which was operated between 12:20 and 17:00. It has been confirmed with the client that the angle grinder was in use on Monday afternoon to remove an old refrigeration unit from a trailer which was parked on the forecourt close to the SLM1 location. Whilst this is not a typical HGV maintenance activity, an angle grinder cutting through metal does represent a worst-case for the highest noise levels that might reasonably be expected during working hours.
- 6.11 Figure 8 to Figure 11 show statistical frequency analysis of the daytime and night time background sound levels (L_{A90}) at SLM1 and SLM2. On Monday 11th March the most frequently occurring background sound level is 50 dB L_{A90} at both SLM1 and SLM2 (see Figure 8 and Figure 10) and this is considered to be a suitably representative background sound level for both locations during a weekday. It is noted that the most commonly occurring L_{A90} values on Tuesday 12th March are lower but this is likely due to the fact that there is a significantly reduced dataset as there was a lot of data excluded due to rain on Tuesday morning. Looking at Figure 6 and Figure 7 it is clear that the noise levels on Friday afternoon (8th March) into Friday evening follow a very similar pattern to that seen on Monday afternoon to evening at both locations.
- 6.12 During the nights on weekdays, it can be seen at Figure 9 that the most commonly occurring

values are split between 33 dB L_{A90} and 37 dB L_{A90} for Monday and Friday respectively at SLM1. At SLM2 there is an even wider split between 32 dB and 44 dB L_{A90} on Monday and Friday night as can be seen at Figure 11. Referring back to Table 3 and Table 4, it can be seen that the average levels on Friday night are generally higher than Monday night and it seems likely that unusual activity on Friday night may have increased the background sound levels. On Monday night, the average background sound level is **33 dB L_{A90}** at both locations and this is considered to be a suitably representative background sound level for both locations during weekday night periods.

- 6.13 At the weekend there is a large split between the most commonly occurring background sound levels with a range of 43 to 53 dB L_{A90} at SLM1 and 43 to 54 dB L_{A90} at SLM2. This is not unusual since there is often more road traffic noise on a Saturday compared to weekdays and Sunday is often significantly quieter. The most commonly occurring background sound level on Sunday is 43 dB L_{A90} at both locations and it has been confirmed through listen to audio recordings that this is controlled by distant road traffic noise from the M27. Therefore, **43 dB L_{A90}** is considered to be representative of typical background sound levels on a Sunday and this will be used to assess the weekend daytime periods.
- 6.14 During the night periods at the weekend, Figure 6 and Figure 7 confirm that the refrigerated HGV trailer operating during the night-time period on Sunday 10th to Monday 11th March has significantly affected the background sound levels. The most frequent noise level over this period (Sunday night) can be seen to be 43 dB L_{A90} at Figure 9 which is considered to be representative of the HGV discussed above at paragraph 6.9. It has been confirmed through listening to audio, and it can also be seen at Figure 6, that the refrigeration plant was switched off at around 03:50 on 11th March. During the next two 15 minute periods (starting at 04:00 and 04:15 on 11th March), the background sound level drops to 34 dB L_{A90} and this correlates well with the most frequently occurring background sound level on Sunday night for SLM2 which can be seen to be 34 dB L_{A90} at Figure 11. Saturday night is more variable with a split between 32 to 43 dB L_{A90} at SLM2 but referring to Table 3 and Table 4, it can be seen that average background sound levels are 36 dB at both locations on Saturday night. Sunday night is typically slightly quieter and therefore, it is considered that **34 dB L_{A90}** is an appropriate representative value to assume for the background sound level during the weekend night periods.

Figure 8 – Daytime Background Sound Measurement Results ($L_{A90, 15min}$) at SLM 1 (s/n 420658).

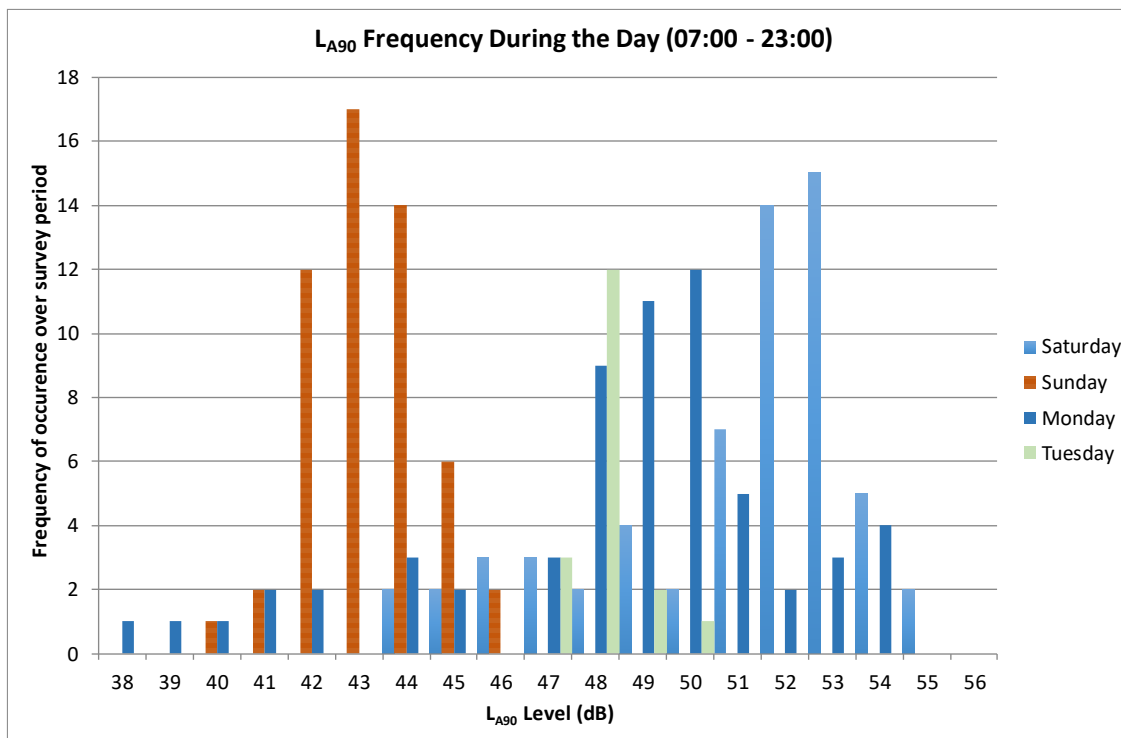


Figure 9 – Night-time Background Sound Measurement Results ($L_{A90, 15min}$) at SLM 1 (s/n 420658).

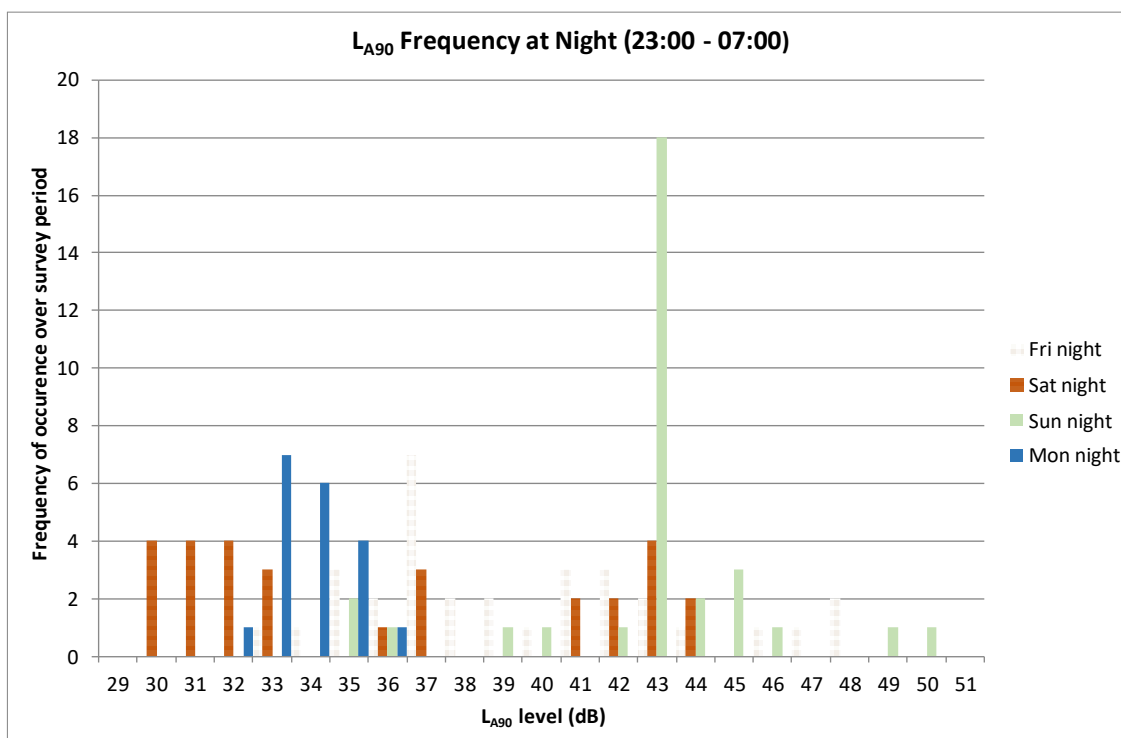


Figure 10 – Daytime Background Sound Measurement Results ($L_{A90, 15min}$) at SLM2 (s/n 821098).

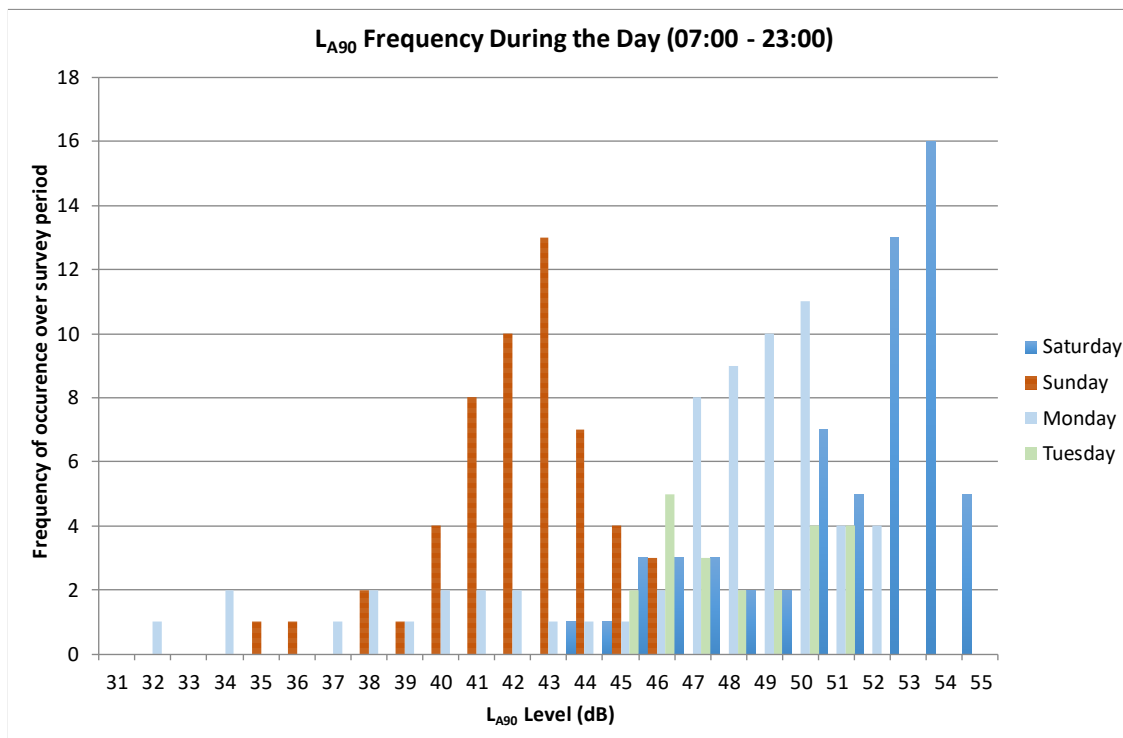
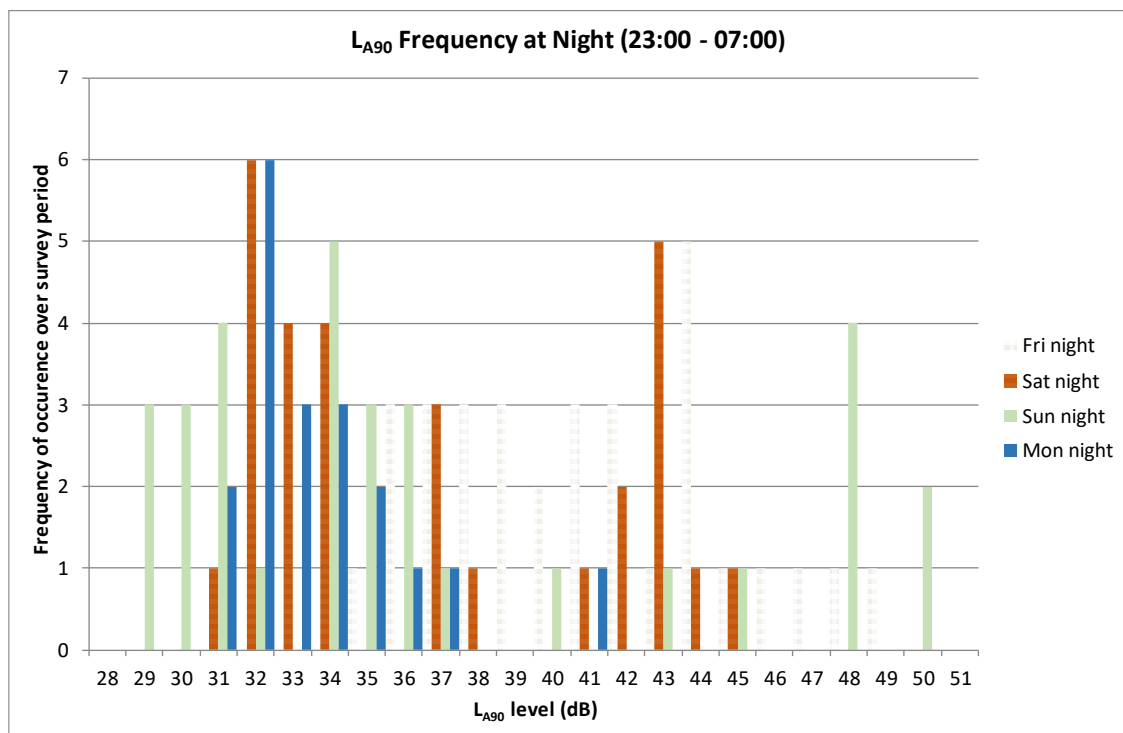


Figure 11 – Night-time Background Sound Measurement Results ($L_{A90, 15min}$) at SLM2 (s/n 821098).



- 6.15 The derived weekend background noise levels for the purposes of the BS 4142 assessment are 43 dB L_{A90} for the daytime period and 34 dB L_{A90} for the night-time period. The derived weekday period background sound levels for the purposes of the BS 4142 assessment is 50 dB L_{A90} for the daytime and 33 dB L_{A90} for the night-time period.

Source Noise Measurements

- 6.16 In order to predict typical noise levels associated with HGV maintenance activities it is necessary to quantify the sound power of the items of equipment considered to be the main noise sources that are discussed at paragraph 5.7 above. Measurements of these noise sources were carried out on Tuesday 12th March 2024 using an SLM (s/n 420658) with the microphone positioned at 1 m away from each individual noise source in turn. The SLM was mounted on a camera tripod set at a height between 1.2 m to 1.5 m high and a 45 mm foam ball windshield was fitted over the microphone. The SLM was calibrated before and after undertaking source measurements, noting no observed shift in calibration. The SLM measured and recorded consecutive $L_{Aeq, 10s}$ for the duration of one minute, per individual item, whilst the equipment was operational.
- 6.17 As referred to in paragraph 5.7, the source noise measurements were carried out on four items of equipment. The two high-torque, battery powered, brushless impact wrenches one DeWalt DCF879 and one MAC BWP151, one Air Compressor gun and one Atlas Copco oil-injected rotary screw Air Compressor GX5 unit, are shown at Figure 12.
- 6.18 The results of the measurements have been analysed to identify representative L_{Aeq} levels at 1 m. For each item of equipment, the measured octave band spectra have been logarithmically averaged over the 1-minute measurement period and then normalised to the highest measured $L_{Aeq, 10s}$ and these representative levels are shown at Table 5. Assuming hemispherical propagation from a point source, the expected sound power for each of the items of equipment have been calculated and are shown at Table 6.

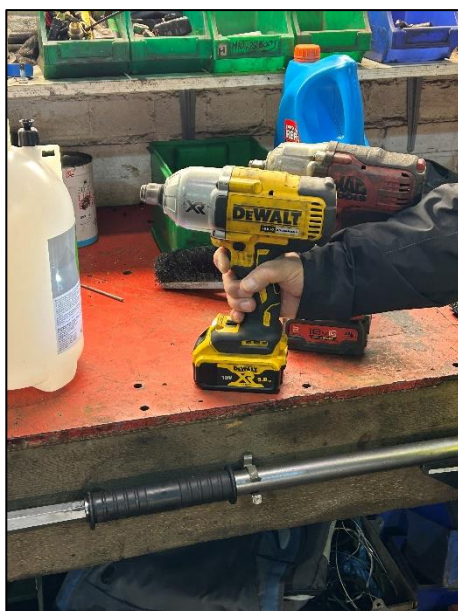
Table 5: Representative L_{Aeq} at 1m for the Noise Sources.

Item of Equipment	Overall L_{Aeq} at 1 m	L_{Aeq} at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
DeWalt DCF879	77.0	27.4	39.0	63.7	56.6	66.7	68.4	72.8	72.3
MAC BWP151	76.9	31.1	40.6	51.9	53.3	67.2	71.1	73.4	69.4
Air Compressor gun	89.4	37.4	43.0	59.7	72.3	87.8	80.8	80.3	74.6
Atlas Copco oil-injected rotary screw Air Compressor GX5 unit	67.8	34.8	43.5	52.8	58.6	63.9	62.6	58.6	50.5
Total	89.9	40.2	47.9	65.6	72.6	87.8	81.5	81.7	77.4

Table 6: Sound Power Levels of the items of equipment.

Item of Equipment	Overall SWL	L _{WA} at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
DeWalt DCF879	85.0	35.4	47.0	71.7	64.6	74.7	76.4	80.8	80.3
MAC BWP151	84.9	39.1	48.6	59.9	61.3	75.2	79.1	81.4	77.4
Air Compressor gun	97.4	45.4	51.0	67.7	80.3	95.8	88.8	88.3	82.6
Atlas Copco oil-injected rotary screw Air Compressor GX5 unit	75.8	42.8	51.5	60.8	66.6	71.9	70.6	66.6	58.5
Total	97.9	48.2	55.9	73.6	80.6	95.8	89.5	89.7	85.4

Figure 12: Photographs of Each Item of Equipment.



7. PREDICTIONS

- 7.1 In order to assess commercial noise levels related to typical HGV maintenance operations, conservative predictions have been carried out based on the total sound power levels (L_w) provided at Table 6. Predicted noise levels have been calculated using the International Standard ISO 9613-2⁹ which sets out a method based around the following formula.

$$\text{Predicted Octave Band Noise Level} = L_w + D - A_{\text{geo}} - A_{\text{atm}} - A_{\text{gr}} - A_{\text{bar}} - A_{\text{misc}}$$

- 7.2 The factors in this formula are discussed in detail below.

D - Directivity Factor

- 7.3 The directivity factor allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. The source noise levels used here correspond to the maximum noise levels associated with the plant considered and no further adjustment has been made in this respect.

A_{geo} - Geometrical Divergence

- 7.4 The geometrical divergence accounts for spherical spreading in the free-field from a point sound source resulting in an attenuation depending on distance according to:

$$A_{\text{geo}} = 20 \times \log(d) + 11$$

where, d = distance from the source

- 7.5 Predicted operational noise has been calculated at a distance of 15 m which is considered representative of the amenity areas within the gardens of the proposed dwellings.

A_{atm} - Atmospheric Absorption

- 7.6 The atmospheric absorption accounts for the frequency dependant linear attenuation with distance of sound power over the frequency spectrum according to:

⁹ ISO 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation, International Organization for Standardization, 2024

$$A_{atm} = d \times \alpha$$

where, α = the atmospheric absorption coefficient of the relevant frequency band

- 7.7 Published values of ' α ' from ISO9613 Part 15 have been used, corresponding to a temperature of 10°C and a relative humidity of 70%, which give relatively low levels of atmospheric attenuation, and subsequently conservative noise predictions. The actual absorption coefficient values used in the predictions are shown at Table 7 below.

Table 7: Atmospheric Absorption Coefficients

Octave Band Centre Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Atmospheric Absorption Coefficient (dB/m)	0.0001	0.0004	0.0010	0.0019	0.0037	0.0097	0.0328	0.1170

A_{gr} - Ground Effect

- 7.8 Ground effect is the interference of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects are inherently complex and depend on the source height, receiver height, propagation height between the source and receiver and the ground conditions. The ground conditions are described according to a variable G which varies between 0 for 'hard' ground (includes paving, water, ice, concrete and any sites with low porosity) and 1 for 'soft' ground (includes ground covered by grass, trees or other vegetation). To provide a worst-case, predictions in this report are based on G = 0 for all areas, with a receiver height of 1.5 m.

A_{bar} - Barrier Attenuation

- 7.9 The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise.
- 7.10 As the existing boundary fence between FeryTrans and the site is damaged and provides little to no visual or acoustic screening between the plots, it has been assumed that there is no barrier attenuation.

A_{misc} - Miscellaneous Other Effects

- 7.11 ISO 9613 allows for inclusion of additional attenuation effects such as those seen for sound propagation through foliage and plants. No additional attenuation due to foliage or anything else has not been included here and any such effects are unlikely to significantly reduce

noise levels below those predicted.

Predicted Results

7.12 The results of the predictions are shown below which are considered to be suitably worst-case predicted specific sound levels for HGV maintenance operations.

Table 8: Predicted Specific Sound level L_{Aeq} for HGV Maintenance.

Item of Equipment	Overall L_{Aeq}	L_{Aeq} at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
All Items	66.1	16.7	24.4	42.1	49.0	64.2	57.8	57.7	52.1

7.13 As shown in Table 8, the predicted specific sound level of all the measured equipment operating continuously is 66 dB L_{Aeq} which is considered to be worst case as equipment would be unlikely to be in continuous use over a 1-hour period. Comparatively, the highest measured operational noise level due to an angle grinder (discussed at paragraph 6.9) is also 66 dB L_{Aeq} over a 15-minute period. The measured spectrum from the angle grinder is similar to the predicted octave band spectrum shown at Table 8 but it is not clear how much effect residual sound levels may have contributed to the 15-minute measurement of the angle grinder. As such, it is considered appropriate to use the predicted operational noise for the purposes of the BS 4142 assessment to account for worst-case specific sound levels during the day.

8. TRANSPORTATION NOISE ASSESSMENT

8.1 Transportation sound levels have been derived from data collated during the measurement period of Friday 8th to Tuesday 12th March (as summarised section 6). As stated in transportation methodology section, the transportation noise levels will be assessed against ProPG guidance to derive appropriate pre-planning application advice. Since the results have been presented at Table 3 and Table 4 as 12hr day and 4hr evening levels, it is necessary to combine the results to determine 16 hour daytime levels for comparison with ProPG guidance. The derived daytime (and night-time) noise levels for SLM1 and SLM2 are presented at Table 9 and Table 10 respectively.

Table 9: Transportation Noise Levels for Daytime and Night-time at SLM 1.

Weekday	Period	Noise Level
Friday	Daytime	-
	Night-time	46 dB LAeq, 8hr
Saturday	Daytime	54 dB LAeq,16hr
	Night-time	44 dB LAeq, 8hr
Sunday	Daytime	48 dB LAeq,16hr
	Night-time	47 dB LAeq, 8hr
Monday	Daytime	56 dB LAeq,16hr
	Night-time	38 dB LAeq, 8hr
Overall	Daytime	54 dB LAeq,16hr
	Night-time	45 dB LAeq, 8hr

Table 10: Transportation Noise Levels for Daytime and Night-time at SLM 2.

Weekday	Period	Noise Level
Friday	Daytime	-
	Night-time	46 dB LAeq, 8hr
Saturday	Daytime	54 dB LAeq,16hr
	Night-time	44 dB LAeq, 8hr
Sunday	Daytime	47 dB LAeq,16hr
	Night-time	46 dB LAeq, 8hr
Monday	Daytime	51dB LAeq,16hr
	Night-time	37 dB LAeq, 8hr
Overall	Daytime	51 dB LAeq,16hr
	Night-time	44 dB LAeq, 8hr

8.2 The data in Table 9 and Table 10 indicate that SLM 1 has the highest overall sound levels for both daytime and night-time. Although it is considered possible that measured levels have been influenced by commercial noise activity during Monday, audio recordings indicate that for the majority of the time the noise environment is dominated by road traffic noise and the overall average levels are not considered to be significantly affected by commercial noise. As such, the highest overall noise levels (from SLM1) have been used to form the basis of this transportation noise assessment.

8.3 The overall daytime noise level is 54 dB LAeq,16hr and the night-time noise level is 45 dB LAeq,8hr, which indicate a negligible to low level of risk and is generally acceptable from a

noise perspective. However, maximum noise levels during the night are all consistently above 60 dB L_{Amax} (as shown at Figure 6 and Figure 7) and as such, the site should not be considered a negligible risk (see paragraph 4.20). Due to the high maximum noise levels at night, it is considered that some form of mitigation would be appropriate to reduce potential effects on future occupants.

- 8.4 The results of the measurements shown at Figure 6 and Figure 7 indicate that maximum noise levels at night are typically in the range of 70 – 80 dB L_{Amax} and the WHO guidance on sleep disturbance recommends that noise levels should not exceed 42 dB L_{Amax} within bedrooms (see paragraph 4.12). Therefore, a good acoustic design would recommend a minimum sound reduction of 38 dB from outside to inside in order to ensure that the sleep disturbance criterion is not exceeded.

9. COMMERCIAL NOISE ASSESSMENT

- 9.1 The initial BS 4142 assessment is based on identifying the excess of the rating level over the representative background sound level to determine the significance of commercial noise impact. The rating level is derived from the specific sound level with the addition of character corrections depending on context.

Specific Sound Levels

- 9.2 It has been identified that the likely commercial activity at FeryTrans during the day can include HGV maintenance whilst at night, the noise would be limited to HGV movements and engine idling noise.
- 9.3 The specific sound level generated through HGV maintenance activities has been identified as 66 dB L_{Aeq} at paragraph 7.13 above.
- 9.4 The specific sound level relating to HGV movements is considered to be well represented by the measurements of HGV engine idling in the early hours of Monday morning (see paragraph 6.9). The measured ambient level of 45 dB L_{Aeq} is well above background sound and in the early hours of the morning there would be unlikely to be any significant

contribution from other residual sound. Therefore, 45 dB L_{Aeq} is assumed to be a suitable specific sound level, representative of either continuous engine idling or HGV movements over a 15-minute period during the night.

Weekend Assessment

- 9.5 For the purposes of this assessment the background sound levels have been identified as 43 dB L_{A90} for the daytime weekend period and 34 dB L_{A90} for the night-time period (see paragraph 6.15).
- 9.6 The daytime assessment for the weekend period, is shown at Table 11. For the daytime assessment, character corrections have been applied to the specific sound level, as the activity associated with HGV maintenance is likely to be perceptible at the noise receptor location as either tonal or impulsive. It is considered appropriate to add a 4 dB correction to the specific sound level to allow for either tonality (compressor noise) or impulsivity (impact wrenches), resulting in a rating level of 70 dB $L_{Ar,Tr}$. To provide a worst-case, no on-time corrections have been applied.

Table 11: Daytime Weekend Assessment

Daytime weekend assessment for measured sound levels		
Results		Description
Background sound level	43 dB L_{A90}	The representative background sound level for daytime periods at the weekend.
Rating Level	70 dB $L_{Ar,Tr}$	Specific sound level plus an adjustment for the tonal or impulsive characteristic features of the sound.
Excess of rating level over background sound level	27 dB	Excess of rating level over background sound level is likely to be an indication of a significant adverse impact, depending on the context.

- 9.7 The night-time assessment for the weekend period, is shown at Table 12. For this assessment, character corrections have been applied to the specific sound level, as the activity associated with HGV maintenance could be just perceptible at the noise receptor location as tonal. It is considered appropriate to add a 2 dB correction to the specific sound level to allow for either tonality, resulting in a rating level of 47 dB $L_{Ar,Tr}$. To provide a worst-case, no on-time corrections have been applied.

Table 12: Night-time Weekend Assessment.

Night-time weekend assessment for measured equipment		
Results		Description
Background sound level	34 dB L_{A90}	The representative background sound level for night-time periods at the weekend
Rating Level	47 dB $L_{A,r,Tr}$	Specific sound level plus an adjustment for the tonal characteristic features of the sound.
Excess of rating level over background sound level	13 dB	Excess of rating level over background sound level is likely to be an indication of a significant adverse impact, depending on the context.

Weekday Assessment

- 9.8 For the purposes of this assessment the background sound levels have been identified as 50 dB L_{A90} for the weekday daytime period and 33 dB L_{A90} for the night-time period (see paragraph 6.15). The same assumptions are used to derive the rating levels as presented for the weekend assessment and the resulting assessments are presented at Table 13 and Table 14 for daytime and night-time respectively.

Table 13: Weekday Daytime Assessment.

Daytime weekday assessment for measured equipment		
Results		Description
Background sound level	50 dB L_{A90}	The representative background sound level for weekday daytime periods
Rating Level	70 dB $L_{A,r,Tr}$	Specific sound level plus an adjustment for the tonal or impulsive characteristic features of the sound.
Excess of rating level over background sound level	20 dB	Excess of rating level over background sound level is likely to be an indication of a significant adverse impact, depending on the context.

Table 14: Weekday Night-time Assessment

Night-time weekday assessment for measured equipment		
Results		Description
Background sound level	33 dB L_{A90}	The representative background sound level for weekday night-time periods
Rating Level	47 dB $L_{A,r,Tr}$	Specific sound level plus an adjustment for the tonal characteristic features of the sound.

Night-time weekday assessment for measured equipment		
Results		Description
Excess of rating level over background sound level	14 dB	Excess of rating level over background sound level is likely to be an indication of a significant adverse impact, depending on the context..

Rating Levels and Context

- 9.9 The noise from the HGV maintenance at FeryTrans is likely to be distinguishable from the residual sound but it should be noted that noise from this type of activity would be sporadic and commercial noise is not considered to dominate the ambient sound at this site. However, the excess of the rating levels above background sound levels during the day are significantly higher than 10 dB and it is considered that mitigation would be required to bring these down to an acceptable level.
- 9.10 The noise from HGV movements is not distinctively different against the residual sound at the site as transportation noise is dominant from Botley Road and the M27. As such, the night-time commercial noise is unlikely to generate an adverse impact. It should also be noted that maximum noise levels due to transportation noise are consistently above 60 dB L_{Amax} during the night hours (at both measurement locations) and this is more likely to generate a noise impact at night than the commercial noise.

10. MITIGATION

Commercial noise mitigation

- 10.1 The BS 4142 assessment has indicated the potential for a significant adverse impact from commercial during the weekday and weekend daytime periods. In order to reduce the impact in the amenity areas within the gardens of the proposed dwellings, an acoustic barrier can be installed long the western boundary of the development site.
- 10.2 The acoustic barrier attenuation necessary to mitigate the HGV maintenance noise can be

derived using empirical equations derived in a paper by Maekawa¹⁰. The paper details a method for calculating the shielding effect of barriers constructed for the purposes of noise reduction. The following equation is used to derive the level difference from shadow zone barrier attenuation, which can derive the barrier attenuation dependent on the heights and distances of the source, receiver, and barrier.

$$\Delta L = 5 + 20 \cdot \log \left[\frac{\sqrt{2 \cdot \pi \cdot N}}{\tanh(\sqrt{2 \cdot \pi \cdot N})} \right]$$

Where the Fresnel number $N = \frac{2\delta}{\lambda}$

(Where λ is the wavelength and δ is the difference between the diffracted and direct path in m)

Acoustic Barrier on Western Boundary

10.3 For the purposes of the barrier calculation, the receiver height is 1.2 m and source height is 2 m, as the workshop sits slightly higher than the ground level at the proposed development towards the north of the site. As such, a 2.5 m high barrier has been assumed to ensure sufficient protection between the northern entrance of the FeryTrans workshop and the adjacent proposed development. The receiver has been assumed to be 15 m from HGV maintenance activities on the centre of the forecourt at FeryTrans. The source to barrier distance has been assumed to be 5 m, as a worst-case scenario, where HGV maintenance is propagating in free-field space from the middle of the forecourt. The proposed barrier reduces specific sound levels by 10 dB shown in Table 15.

Table 15: Western Barrier Attenuation Calculation

Description		dBA at Octave Band Centre Frequency (Hz)						
		63	125	250	500	1k	2k	4k
HGV Maintenance		16.7	24.4	42.1	49	64.2	57.8	57.7
Barrier attenuation		5.7	6.3	7.4	9.0	11.3	14.1	17.0
L _{Aeq} at receiver	54 dB	11.0	18.1	34.7	40.0	52.8	43.7	40.7

10.4 The specific sound level with the barrier attenuation is reduced to 55 dBA. The proposed barrier therefore reduces the specific sound level for HGV maintenance to a level 5 dB above the background sound level for the weekday daytime period. Allowing for the 4 dB character correction (which may no longer be required allowing for the barrier), the rating

¹⁰ Noise reduction by screens, Z.Maekawa, Kobe University, Japan, 1968

level is 9 dB above the background sound level for weekday daytime. At the weekend, assumed representative background sound levels during the day are 7 dB lower so rating levels could be up to 16 dB above the background sound.

Weekday and Weekend Daytime Context

- 10.5 Whilst, the calculations above indicate the potential for a rating level associated with HGV maintenance activities to exceed the daytime background sound level by up to 16 dB at the weekend, it must be born in mind that the assessment is very conservative in nature. The rating level includes no on-time correction and the barrier calculation is based on a receiver positioned at 10 m from the boundary which is very much worst-case. In practice a person using the proposed amenity areas may well be closer to the barrier and could expect more attenuation of the specific sound level. Furthermore, the weekend daytime assessment is based on reduced background sound levels on a Sunday and Feri Trans specify significantly reduced working hours over the weekend, particularly on Sunday. In reality, it is likely that staff carrying out maintenance would typically be carrying this out during weekdays and would be unlikely to undertake these activities at the weekend. In any event, the working hours are limited to between 08:00 and 10:00 on Sunday so even if HGV maintenance activities did occur this would only be for a small part of the day.
- 10.6 Also, in the context of a noise environment which is dominated by transportation noise, continually punctuated by maximum noise levels in the region of 70 – 80 dB L_{Amax} due to vehicle pass-bys, it is not considered that the mitigated specific sound levels are particularly high. It can be seen at Figure 6 and Figure 7 that on a Saturday, typical 15-minute average noise levels are in the region of 55 dB L_{Aeq} due to road traffic noise. Even averaged over a 16-hour day, the road traffic noise does not drop below 51 dB L_{Aeq} at either of the measurement locations (see Table 9 and Table 10). In this context, an L_{Aeq} of 54 dB would be unlikely to be particularly noticeable and certainly not out of character for the area. It is therefore considered that in practice, noise related to HGV maintenance is unlikely to generate an adverse impact.

Transportation Noise Mitigation

- 10.7 For all bedroom and living room windows in the existing and proposed dwellings, the following specifications within Table 16 are recommended in order to avoid sleep disturbance.

Table 16: Specification for Residential Windows

Location	Minimum weighted sound reduction index	Example Glazing & Ventilation Requirements
Bedroom and living room windows in all façades of existing and proposed dwellings	38 dB R_w	Double glazing with 6mm glass, a 16 mm air gap and 6.8 mm acoustic laminate glass on the other side. Acoustic Trickle Ventilation with open area of no more than 2500 mm ² and D_{new} of at least 39 dB

10.8 Assuming that typical external noise levels are no higher than 80 dB L_{Amax} (see paragraph 8.4), the above specifications result in internal noise levels of just over 41 dB L_{Amax} which meets the 42 dB L_{Amax} criteria set out at paragraph 4.12.

10.9 An example of ventilation which meets the requirement of an open area of no more than 2500 mm² and D_{new} of at least 39 dB is the [Greenwood AWV39 acoustic wall ventilator](#). It should be noted that selection of appropriate acoustic trickle ventilation is critical to meeting the sound insulation requirements set out at Table 16.

BS 8233 Assessment

10.10 As indicated at Table 9 and Table 10, road traffic noise is up to 56 dB $L_{Aeq,16hr}$ and 47 dB $L_{Aeq, 8hr}$ during the day and night hours respectively. Assuming the glazing and ventilation specification given in Table 16, this results in internal levels of 17 dB $L_{Aeq,16hr}$ and 8 dB $L_{Aeq, 8hr}$ with windows closed. These levels easily meet the design criteria from BS8233 reproduced at Table 2 above.

10.11 Internal maximum noise levels of 41 dB with the windows closed (see paragraph 10.8 above) meet the adopted BS 8233 criterion of 45 dB L_{Amax} discussed at paragraph 4.10 above.

10.12 During the daytime in external amenity areas, typical 15-minute average transportation noise is in the region of 55 dB L_{Aeq} and commercial noise is up to 54 dB L_{Aeq} (as noted at paragraph 10.6 above). These levels meet the suggested BS 8233 upper limit for amenity spaces of 55 dB $L_{Aeq,T}$ discussed at paragraph 4.11 above.

11. UNCERTAINTY

- 11.1 Uncertainty in the outcome of the assessment is associated with the uncertainty of the background sound levels, the uncertainty of the calculation of the specific sound level, and the uncertainty of any characteristic penalties included in the rating level.
- 11.2 The uncertainty associated with the average measured background sound levels is estimated to be about ± 2 dB. It is considered that this level of uncertainty is not significant and would not affect the perceived outcome of this assessment when taken in isolation.
- 11.3 The specific sound levels are likely to be lower than predicted due to the conservative nature of the worst-case predictions. The HGV maintenance equipment would be unlikely to be operating constantly during a 1-hour daytime period, and would typically occur inside the workshop rather than out on the forecourt as has been assumed. This uncertainty could be significant and may affect the outcome of this assessment since, for the majority of the time, rating levels would be lower than calculated here. Furthermore, the assumed character corrections are estimated and may well not be applicable with the proposed mitigation in place. This level of uncertainty associated with the calculated rating levels is considered to be sufficient to, at least, cancel out the level of uncertainty introduced by the selected representative background sound levels.

12. CONCLUSIONS

- 12.1 Hayes McKenzie have carried out a commercial noise assessment in accordance with BS 4142, a transportation noise assessment following guidance in ProPG and have also provided additional information in relation to criteria within BS 8233.
- 12.2 The transportation noise assessment indicates that although, overall average levels of road traffic noise are low, there is a risk associated with maximum noise levels at night, which requires mitigation. Hayes McKenzie have recommended suitable glazing and ventilation to achieve a level of sound insulation which will ensure that maximum noise levels do not cause sleep disturbance.

- 12.3 The commercial noise assessment indicates that noise associated with HGV maintenance operations is likely to generate a significant adverse impact during the daytime. Hayes McKenzie have recommended a 2.5 m high acoustic barrier to ensure that the proposed development is adequately protected against commercial noise.
- 12.4 Following the implementation of the recommended mitigation measures, internal and external noise levels meet design criteria within BS 8233 and Hayes McKenzie consider that the noise impact is reduced to an acceptable level.