

NOISE IMPACT ASSESSMENT

KIRKLEE HOUSE, MARKET STREET, HUDDERSFIELD

REPORT REFERENCE NO. J004669-7414-DH-01

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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.



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1.0 SUMMARY

PDA Ltd was commissioned by C49 Architecture to carry out a noise impact assessment for the proposed development at Kirklee House, Market Street, Huddersfield. The proposed development consists of the conversion of an existing 9 storey office block into student accommodation. It is understood that there is to be 99 no. studio apartments across floors 1 to 9 and 8 no. penthouses across newly formed floors 10 and 11. There is to be a ground floor commercial unit with a study space, gym and students lounge to the basement.

A noise level survey has been undertaken at the site representative of daytime and night-time hours. The local noise climate to the north and east of site is dominated by road traffic from Market Street during day and night-time hours. To the west and south of site the noise climate is dominated by road traffic noise from Market Street and distant traffic noise from the A62. During the evening and night-time periods the noise climate is dominated by entertainment noise from the adjacent entertainment premises.

Based upon the measured and predicted noise levels, calculations have been undertaken for the studio apartments and penthouses to evaluate the internal noise levels. Recommendations are given for glazing, ventilation and building façade elements to meet the internal noise level requirements of good practice guidance given in BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings. Calculations suggest that the noise level criteria of BS8233:2014 can be achieved within the proposed accommodation. Further to this, guidance has been followed from Section 5 of the Kirklees Council – Noise Design Advice which considers internal noise ratings in order to protect future occupants from entertainment noise.

2.0 SITE DESCRIPTION

The proposed development consists of the conversion of an existing 9 storey office block into student accommodation. It is understood that there is to be 99 no. studio apartments across floors 1 to 9 and 8 no. penthouses across newly formed floors 10 and 11. There is to be a ground floor commercial unit with a study space, gym and students lounge to the basement.

The site is located within the centre of Huddersfield inside of the A62 ring road. Market Street runs directly to the east of site with Threadneedle Street to the north boundary. There are a number of commercial premises surrounding the development, with Class A4 use premises (Plumbers Arms, Florences Cocktail Bar) bordering directly to the south west.

An aerial image is presented below which outlines the location of the site.

Figure 1. Location of Kirklee House and adjacent entertainment premises.



3.0 NOISE ASSESSMENT CRITERIA

3.1 Kirklees Council – Noise Design Advice

As there are understood to be a number of Class A4 (drinking establishment premises) in close proximity of site, we would highlight the guidance given within Kirklees Council 'Noise Design Advice' document published in May 2007.

3.1.1 New noise sensitive premises near to places of entertainment

Where a development proposes to introduce new noise sensitive dwellings within the vicinity of places of entertainment, it is stipulated within the Kirklees Council document under Section 5 that:

'Developers should assess the likely impact of the entertainment premises on the noise environment. The residential premises must be designed to ensure that music and associated noise is inaudible inside any residential premises in the vicinity.'

The minimum acceptable standard is-

5.1.1 NR 20 in bedrooms (23:00 to 07:00)

5.1.2 NR 25 in all habitable rooms (07:00 to 23:00)

5.1.3 All indoor levels shall be taken with windows open or closed (which ever makes the music appear louder) or with alternatively provided acoustic ventilation over and above "background" ventilation.

5.1.4 Noise Rating curves should be measured as a 15 minute linear L_{eq} at the octave band centre frequencies of 31.5 Hz to 8 kHz.

5.1.5 Other noise sources from the places of entertainment, such as air conditioning plant and kitchen odour extraction systems shall all be treated as industrial development and scenario 3 is acceptable.'

We would suggest that as the Plumbers Arms and Florences Cocktail Bar are understood to have live and pre-recorded music during their opening hours, they may be considered as places of entertainment and as such the above criteria should apply.

3.2 National Planning Policy Framework

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in September 2023. With regard to Noise the Framework states the following;

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

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

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:

- *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;*



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

The terms 'significant adverse' and 'adverse' impacts are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE)' which states;

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

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.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

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

The notes also offer an explanation of the term 'adverse impacts' as follows;

... refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

Although no specific noise limits for LOAEL and SOAEL have been defined, in 2014 the UK Government published a planning practice guidance document for noise which indicates where these limits fall with relation to the perception of noise, updated in July 2019. A summary is reproduced in Section 4.2 below, and the full document is published at <https://www.gov.uk/guidance/noise--2>. It is considered that guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

3.3 Planning Practice Guidance – Noise

The UK Planning Practice Guidance on noise offers further guidance on the typical levels which constitute the NOEL, LOAEL and SOAEL, reproduced in the table below.

Table 1. Planning Practice noise level guidance

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

3.4 BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

Dwelling houses, flats and rooms in residential use

British Standard 8233:2014, *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within dwellings, flats and rooms in residential use when unoccupied. The following criteria are for Living and Dining Rooms for daytime use and Bedrooms for night time.

Table 2. BS8233 recommended indoor ambient noise levels

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

It should however be stressed that the above criterion relates to steady noise, in this case from road traffic etc., excluding unusual noise events departing from the typical noise character of the area.

In addition BS 8233 suggests, '*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*'.

With regard to external areas of residential developments BS8233:2014 states the following;

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

3.5 WHO Guidelines for Community Noise

In 1999, the WHO (World Health Organisation) published Guidelines for Community Noise, stating the following internal noise levels are applicable within dwellings.

Table 3. WHO Guidelines for Community Noise criteria

| Specific Environment | Critical Health Effect(s) | L_{Aeq} dB | Time Base (hours)* |
|----------------------|--|--------------|--------------------|
| Dwelling, indoors | Speech intelligibility & moderate annoyance, daytime & evening | 35 | 16 |
| Inside bedrooms | Sleep disturbance, night time | 30 | 8 |

* Typically taken to be daytime/evening - 07:00 – 23:00 hours and night time 23:00 – 07:00 hours.

It should be noted that while WHO guidelines stipulate an L_{Amax} criteria of 45 dB which should not be exceeded for 10 – 15 times per night-time period, Kirklees Council design advice states that the criteria should not exceed L_{Amax} 55 dB.

4.0 SURVEY DETAILS AND RESULTS

4.1 Environmental Noise Survey

A noise level survey was undertaken at the site between 11:46 hours on Friday 10th November and 10:48 hours on Monday 13th November 2023. The periods measured were deemed to be representative of day and night-time hours while including for typical weekend activity from the surrounding noise sources.

Long-term noise measurement were taken at the east façade facing onto Market Street (Position 1), west façade facing into the courtyard area of the Plumbers Arms and Florences (Position 2) and at the south façade facing onto Market Street and the front beer garden areas of Plumbers Arms and Florences (Position 3). In addition, a short-term measurement was carried out on the east façade facing onto Market Street (Position 4).

The measurement locations are shown in the figure below:

Figure 2. Noise survey locations



The measurement positions are detailed as follows:

- Measurement Position 1 – microphone located on a mast out of first floor window facing onto Market Street to the east.
- Measurement Position 2 – microphone located on a mast out of first floor window facing into rear courtyard of Plumbers Arms and Florences to the west.



- Measurement Position 3 – microphone located on a mast out of first floor window facing onto Market Street and beer gardens of Plumbers Arms and Florences to the south.
- Measurement Position 4 – microphone located on a mast out of sixth floor window facing onto Market Street to the east.

All measurements were made and partly attended by Mr David Hible and Mr Sam Iles of PDA Ltd. Measurements were of continuous 5 minute samples. The survey was conducted using 3 no. NTi XL2 sound level meters. Calibration certificates for the sound level meters are held.

The NTi meters are Class 1 frequency response as per BS EN 61672-1:2003. The sound level meters were field calibrated both before and after the measurement period, during which time no significant deviation from the calibrated level was observed. The sound level meters were fitted with a microphone windshield at all times.

All measurements were undertaken with a fast time-weighting and broadband statistics were measured throughout. In addition, octave band frequency spectra were recorded along with 16 bit/ 24kHz audio.

Weather

10/11/2023

- Temperature: 3 - 8°C
- Wind Speed: 1-5m/s E-N-E
- Mostly clear and no precipitation

11/11/2023

- Temperature: 3-9°C
- Wind Speed: 1-4m/s E-N-E
- Clear skies no precipitation

12/11/2023

- Temperature: 3-7°C
- Wind Speed: 1-3m/s East
- Overcast and scattered showers

13/11/2023

- Temperature: 7-11°C
- Wind Speed: 2-6m/s E-N-E
- Overcast and scattered showers

Noise Sources

The local noise climate to the north and east of site is dominated by road traffic from Market Street during day and night-time hours. To the west and south of site the noise climate is dominated by road traffic noise from Market Street and distant traffic noise from the A62. During the evening and night-time periods the noise climate is dominated by entertainment noise from the adjacent entertainment premises

4.2 Measurement Results

4.2.1 Environmental Noise

Measurement positions on site are shown on Figure 2 Section 4.1 of this report. A summary of the results is given below:

Table 4. Summary of long-term environmental noise measurements

| Date | Position | Time Period (hh:mm) | L _{Aeq,T} (dB) | Range of Night-Time L _{Amax,5mins} (dB) ¹ |
|------------|----------|------------------------|-------------------------|---|
| 10/11/2023 | 1 | Day 11:46 – 23:00 | 63 | - |
| | | Night 23:00 – 07:00 | 57 | 51 – 93 ¹ |
| | 2 | Day 12:56 – 23:00 | 62 | - |
| | | Night 23:00 – 07:00 | 63 | 49 - 100 ¹ |
| | 3 | Day 12:04 – 23:00 | 61 | - |
| | | Night 23:00 – 07:00 | 59 | 55 - 90 ¹ |
| 11/11/2023 | 1 | Day 07:00 – 23:00 | 62 | - |
| | | Night 23:00 – 07:00 | 55 | 52 - 83 |
| | 2 | Day 07:00 – 23:00 | 62 | - |
| | | Night 23:00 – 07:00 | 61 | 50 - 91 |
| | 3 | Day 07:00 – 23:00 | 60 | - |
| | | Night 23:00 – 07:00 | 58 | 55 - 78 |
| 12/11/2023 | 1 | Day 07:00 – 23:00 | 63 | - |
| | | Night 23:00 – 07:00 | 57 | 51 - 92 |
| | 2 | Day 07:00 – 23:00 | 63 | - |
| | | Night 23:00 – 07:00 | 62 | 62 - 94 |
| | 3 | Day 07:00 – 23:00 | 63 | - |
| | | Night 23:00 – 07:00 | 59 | 59 - 87 |
| 13/11/2023 | 1 | Day 07:00 – 10:48 | 65* | - |
| | 2 | Day 07:00 – 10:46 | 65* | - |
| | 3 | Day 07:00 – 10:45 | 64* | - |

*Measurements influenced by wind speeds exceeding 5m/s

¹L_{Amax} results affected by fireworks

Table 5. Summary of short-term environmental noise measurements

| Date | Position | Time Period (hh:mm) | L _{Aeq,T} (dB) | Range of Night-time L _{Amax,5mins} (dB) |
|------------|----------|----------------------|-------------------------|--|
| 10/11/2023 | 4 | Day 11:45 – 12:45 | 61 | - |

5.0 EXTERNAL COMMERCIAL SPACE – BEER GARDENS

We would note that to the south of the adjacent commercial premises (Plumbers Arms, Florences) there is a large area of outdoor seating understood to be beer gardens associated with the premises'. As the survey has been undertaken during a period of the year where these spaces would be expected to be utilised a lot less than summer months, we have carried out a noise modelling exercise to predict the impact on the proposed residential receivers.

In order to assess noise levels associated with the proposed beer garden area we have considered using data given within the 'Average Speech Levels and Spectra in Various Speaking/Listening Conditions: A Summary of the Pearson, Bennett, & Fidell (1977)' report. On-site observations and aerial images suggest that there are approximately 44 no. tables in total. Based upon this for each table we have assumed 2 no. persons to be speaking simultaneously, both with raised voices using data for a male and female. It is assumed the beer garden areas will be open during the existing opening hours of the premises understood to be between 11:00 hours and 24:00 hours Monday to Sunday.

Details of the following external sound power level used within our calculations are summarised within the following table:

Table 6. External Noise Break-out - Patrons in Beer Garden Areas with Raised Voices

| Activity | A-Weighted Sound Power SWL (dB) | Sound Power Level Octave Band Centre Frequencies (Hz) dB(A) | | | | | | |
|---|---------------------------------|---|-----|-----|----|----|----|----|
| | | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Predicted noise level of male patron with raised voices | 73 | 61 | 67 | 72 | 66 | 62 | 57 | 51 |
| Predicted noise level of female patron with raised voices | 71 | 43 | 63 | 68 | 66 | 62 | 57 | 51 |

5.1 Noise Propagation Calculations

A 3-dimensional noise model has been created using SoundPLAN noise modelling software. The software uses the method of ISO 9613 'Acoustics – attenuation of sound during propagation outdoors – general method of calculation' and takes into account geometric spreading, ground effects, air attenuation, barrier attenuation and reflections.

The model is based upon aerial photographs and the supplied proposed site layout plan provided by the Client. A ground absorption coefficient of 0 has been used to correspond with the intervening ground from the site through to the receivers which is predominately hard surfaces (i.e. hard standing, roads, buildings etc).

It should be noted that within the model, the noise source of the patrons are modelled as point sources. For the tables and seating areas we have inserted 88 no. point sources evenly split between male and female sound power levels, based on Section 5.1, and have assumed a height of 1m above the floor level within the model.

For the proposed residential receivers noise levels are calculated at a 4m first floor level and an additional 2.8m for each storey.

The SoundPLAN model would suggest the following noise levels calculated at the closest noise sensitive receivers. Only the highest calculated noise level has been reported in the table below.

Figure 4. Calculated noise levels at residential receivers from the neighbouring Beer Gardens.

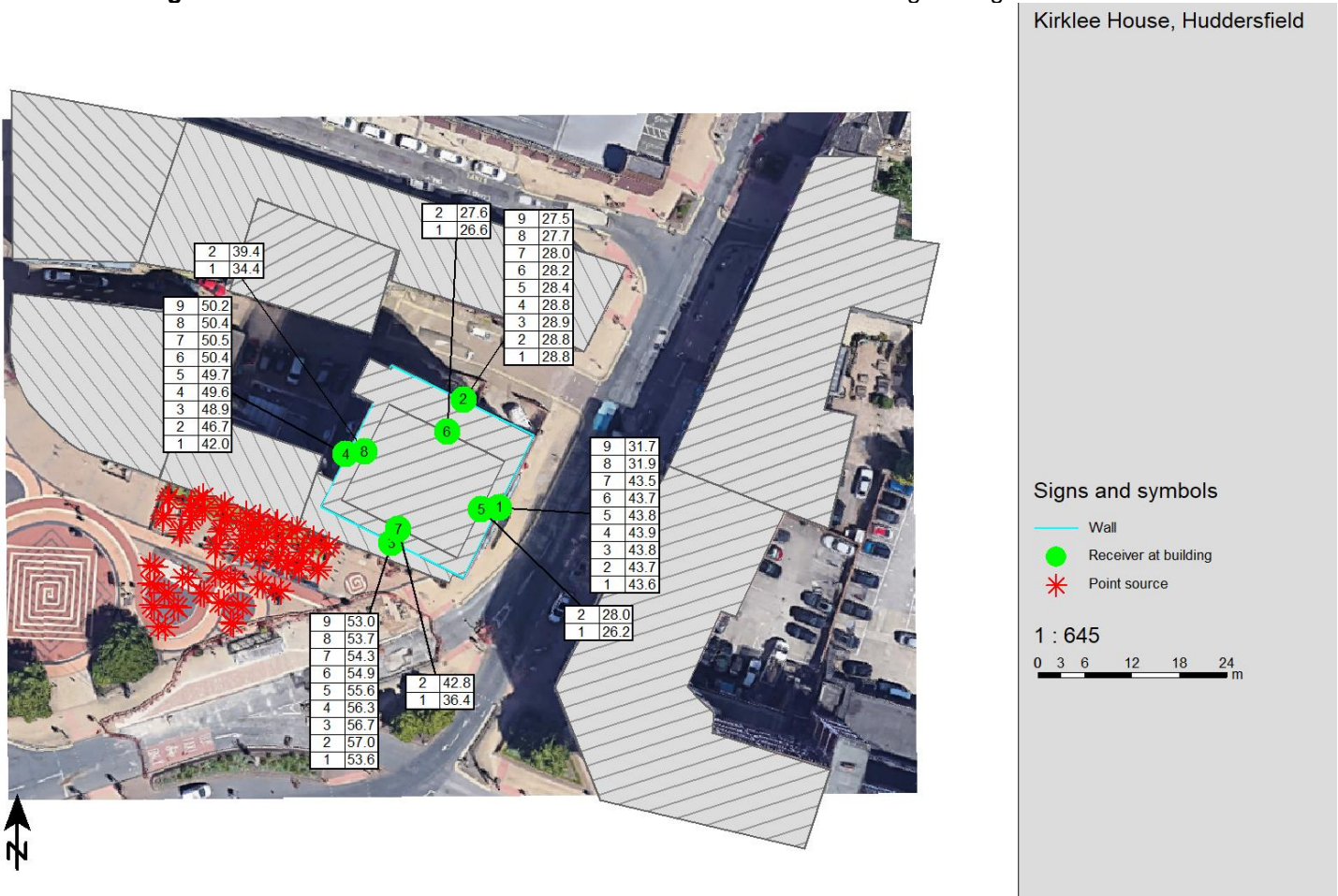


Table 7. Calculated noise levels at the closest receivers

| Operational Period (hh:mm) | Calculated noise level at Eastern facade, dBA | Calculated noise level at Southern facade, dBA | Calculated noise level at Western facade, dBA | Calculated noise level at Northern facade, dBA |
|---------------------------------------|---|--|---|--|
| Daytime opening hours (11:00 – 24:00) | 44 | 57 | 51 | 29 |

6.0 INTERNAL NOISE LEVEL PREDICTIONS

Based upon the measured noise levels given in Section 4 and predicted noise levels given in Section 5, calculations have been undertaken to determine internal noise levels for the conversion project. The proposed elevations and internal layouts are derived from the received C49 Architecture drawing package ref: 'NTL-PL-005' to 'NTL-PL-011'.

It is important to note that for the northern façade of the development, measurements taken at Position 1 (east) and Position 2 (west) have been utilised for the assessment. Furthermore, the comparative



synchronous measurements carried out between measurement Position 1 and 4 showed a reduction of 1 dB between first and sixth floor. We would consider this to be a negligible difference and have therefore, as a worst-case, used the measurement results from first floors across all floors. We would note that this is likely due to reflection from the surrounding buildings.

6.1 Glazing and Ventilation Attenuation Requirements

The dominant paths for noise transfer to the interior of buildings are generally the glazing and ventilation elements of the façade constructions. It is understood that the intention is to provide natural ventilation across all floors of the development. However, upon our initial assessment the measured noise climate across site indicates that an alternative means of ventilation will be required to the west and south facades for studio apartments. This is due to the criteria discussed within Section 3, focussing upon the Kirklees Council guidance for entertainment noise.

Thus, we have carried out our internal calculations based upon each studio apartment on the west and south facades being served by a Mechanically Ventilated Heat Recovery (MVHR) unit. Due to loss through the louvre opening, duct system and heating system, we consider the external noise ingress via this path negligible in comparison to the rest of the façade. However, it should be ensured that noise generated by the mechanical system itself does not give rise to exceedances of the internal noise criteria detailed in Section 3.0.

For studio apartments on the north and east facades and all of the penthouse facades the noise climate implies that natural ventilation may be achieved. Based on this premise, to achieve the required internal noise levels the development would require the following glazing and ventilator specifications.

The calculation of noise break-in to the residential rooms has been undertaken in accordance with the calculation methods of BS EN 12354-3:2000 *Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements. Part 3: Airborne sound insulation against outdoor sound*, in octave bands. Reverberation time is taken as 0.5 seconds as per the BS EN 12354-3 reference time for dwellings.

Figure 3. First to Ninth Floor Glazing and Ventilation Schedule

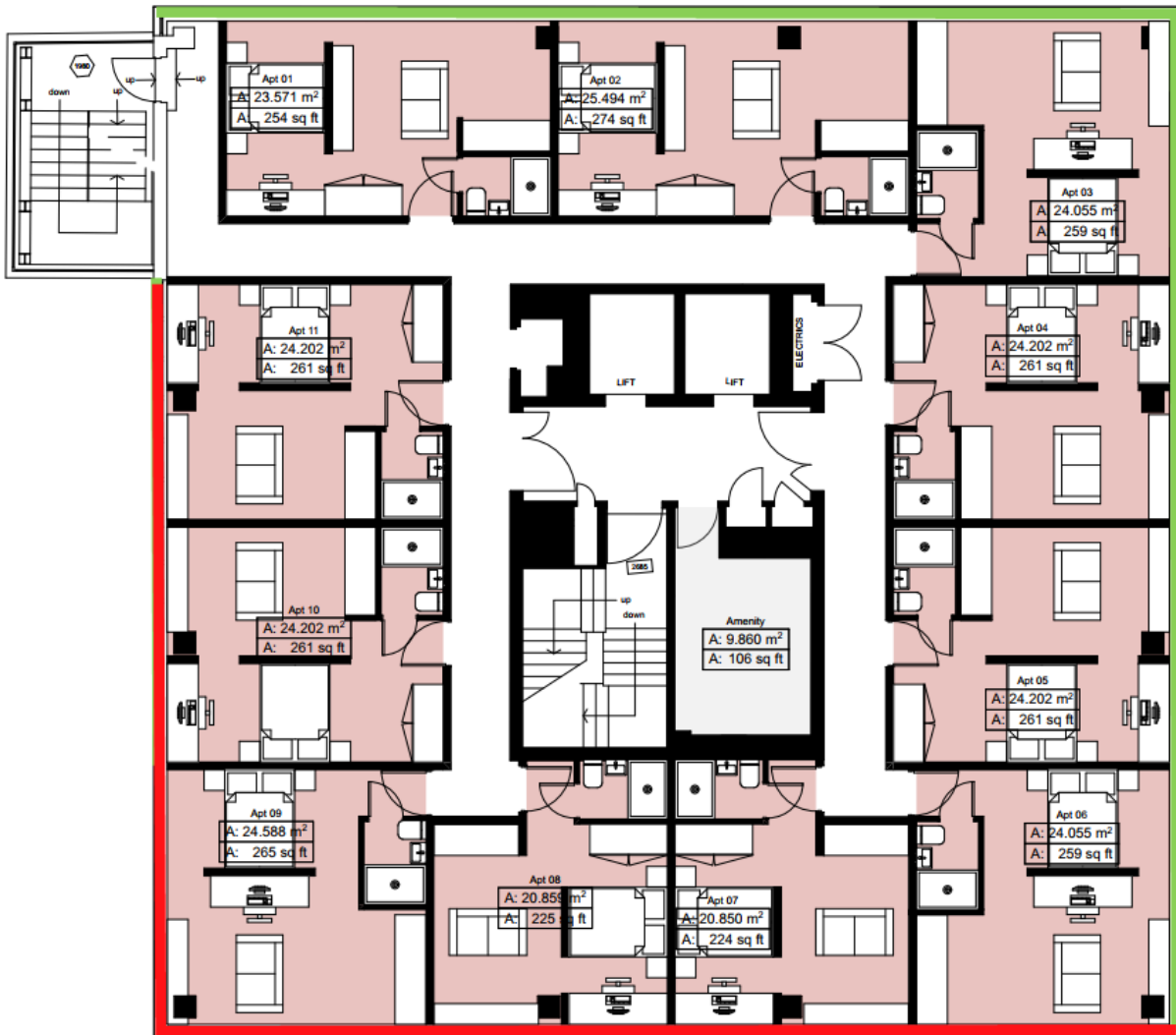


Figure 4. Tenth to Eleventh Floor Glazing and Ventilation Schedule

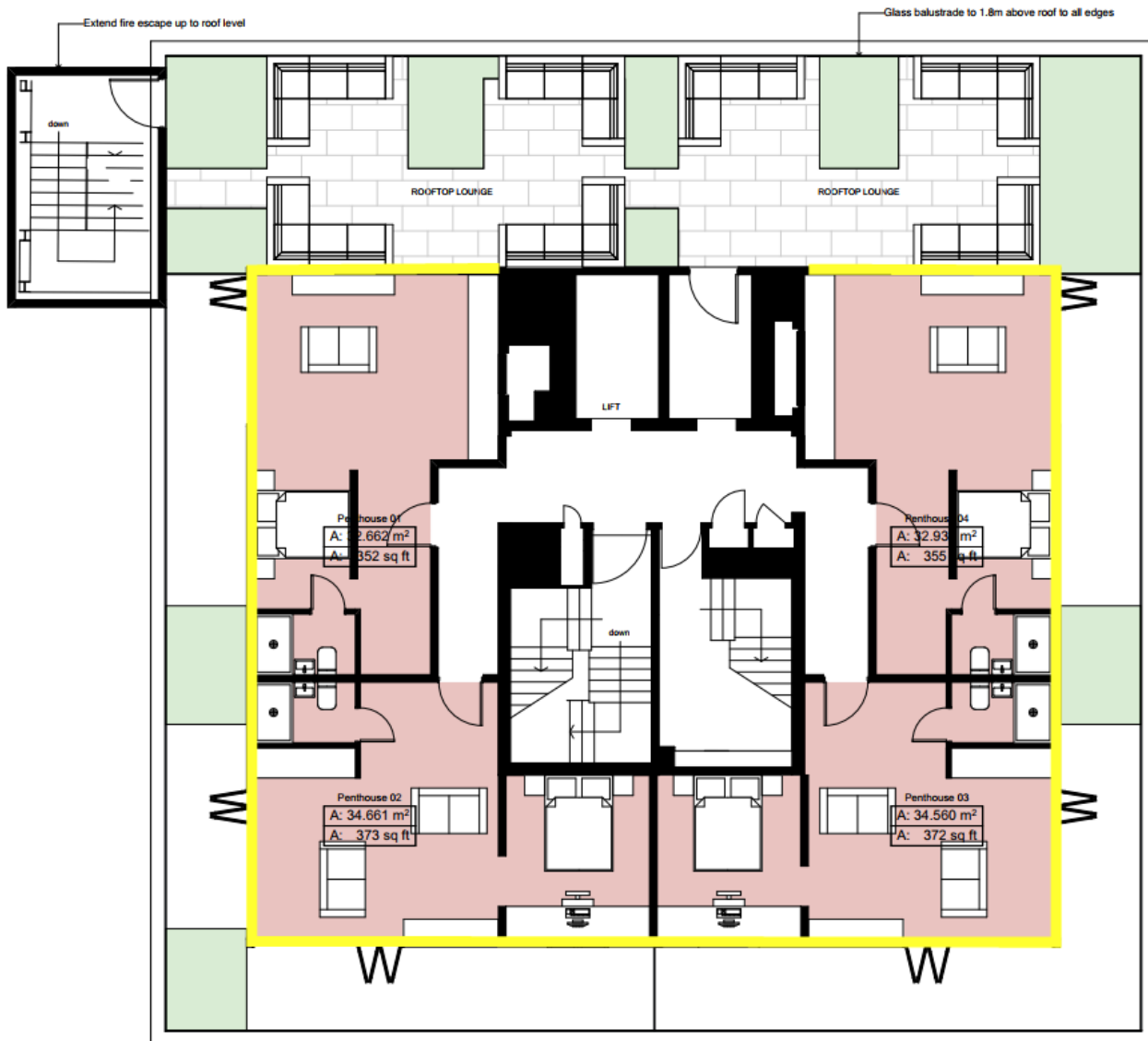


Table 8. Glazing and Ventilation Schedule

| Colour | Floor | Room | Minimum Glazing Rating R_w dB | Minimum combined Ventilator Rating $D_{n,e,w}$ dB | Internal Noise Level Target | | Calculated Internal Noise Level | |
|--------|---------|------------------|---------------------------------|---|-----------------------------|----------------------|---------------------------------|------------------|
| | | | | | $L_{Aeq,T}$ dB Day/Night | L_{Amax} dB Night* | $L_{Aeq,T}$ dB Day/Night | L_{Amax} Night |
| Green | 1 - 9 | Studio Apartment | 37 | 33 | 35/30 | 55 | 33/27 | 48 |
| Red | 1 - 9 | Studio Apartment | | MVHR | 35/30 | 55 | 27/25 | 38 |
| Yellow | 10 - 11 | Penthouse | | 33 | 35/30 | 55 | 34/28 | 50 |

*Criteria derived from Kirklees Council – Noise Design Advice – See Section 3.5

With the glazing and ventilation specifications proposed in Table 5 above, calculations suggest that the internal Day and Night time BS8233:2014/WHO noise level requirements can be achieved. Calculated internal noise levels are given on the worst-case internal receivers. Calculations have been undertaken to determine L_{Amax} noise levels within the bedrooms at night time. Using the full night time L_{Amax} noise

levels measured across site with the glazing and ventilation specifications above, the calculated L_{Amax} values will not normally exceed 55 dB L_{Amax} in accordance with the guidance of Kirklees Council.

6.1.1 Entertainment Venue Noise

In addition to the above noise break-in calculations, an assessment has been made of the noise emissions from the adjacent entertainment venues Plumbers Arms and Florences Cocktail Bar.

The assessment has been carried out by utilising the measured audio files alongside the noise data to establish a ‘worst-case’ one hour period where we would consider the entertainment noise to be most prominent. This has resulted in assessing the internal noise levels against the noise levels measured between 18:30 – 19:30 hours during the Saturday day-time period and 23:00 – 24:00 hours during the Friday night-time period.

A summary of the calculated internal ambient noise ratings (NR) for the ‘worst-case’ receivers are presented in the Table below with comparison to the NR criteria given by Kirklees Council:

Table 9. Calculated internal noise levels within eastern elevation rooms.

| Façade | Specification | Room | Internal Noise Rating Target | | Calculated Internal Target | |
|--------------|---------------|--------------|------------------------------|--------------------|----------------------------|--------------------|
| | | | Day-time (NR) dB | Night-time (NR) dB | Day-time (NR) dB | Night-time (NR) dB |
| West Façade | Red | Apartment 10 | 25 | 20 | 18 | 15 |
| South Façade | | Apartment 9 | | | 22 | 18 |
| North Façade | Green | Apartment 1 | | | 21 | 19 |

NOTE: East façade rooms have not been calculated due to the screening provided by the building itself. We would expect the internal levels due to entertainment noise to be less than that predicted at the north façade.

In regards to Section 5 of *Kirklees Council – Noise Design Advice* it can be seen how the calculated internal NR of the ‘worst-case’ receivers fall below the guidance of NR 25 and NR 20 for day and night-time respectively. Thus, we would consider this to meet the criteria of being understood to be ‘inaudible’/‘virtually inaudible’.

6.1.2 Glazing Specification and Installation Notes

Notes on Glazing Installation

For the glazing specifications in Table 10, all sound insulation values quoted must be achieved by the overall combination of frame and glazing, and not just by the glazing alone. The frame should not reduce the performance of the system overall. Glazing framing systems must be fully sealed with any small gaps (<10mm nominal) around the perimeter to be stuffed with dense mineral wool to full frame depth and sealed both sides with acoustic non-setting mastic, with additional weathering protection to be applied additionally externally to this. No gaps should be left unsealed.

Minimum performance requirements for the combination of glazing and framing recommended in the above tables are as follows:

Table 10. Required Minimum Sound insulation of Combined Glazing and Framing

| Typical Product (glass/cavity/glass) | Minimum Sound Reduction Index R (dB) at Octave Band Centre Frequency (Hz) | | | | | | | | R _w dB |
|--------------------------------------|---|-----|-----|-----|----|----|----|----|-------------------|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| 10/20/6 | 27 | 25 | 30 | 36 | 39 | 35 | 44 | 44 | 37 |

Figures stated in the table above are based on Saint Gobain manufacturer quoted data. Acoustic ratings should be checked with the manufacturer and supported by laboratory test reports where necessary.



Point to note

It should be highlighted that it is crucial that the selected glazing product performance is equal to or greater than the performance values stated in **each** octave band in Table 10 above. Failure to do so may result in the Kirklees Council criteria being exceeded, notably in low frequencies.

6.1.3 Ventilator Requirements

Where natural ventilation is intended for the north, east and penthouse facades BS8233:2014 would suggest, *‘the Building Regulations’ supporting documents on ventilation recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant’s choice.’*

BS8233:2014 Annex G.1 further states, *if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB, resulting in the target levels being exceeded. However, windows may still be openable for rapid or purge ventilation, or occupant’s choice.*

The ventilator inlets described in the following table are calculated to provide adequate sound insulation to maintain internal noise levels compliant with the guidance criteria when used in conjunction with the selected glazing. Example ventilator products are noted below.

The acoustic specification relates to the combined performance of all ventilation elements. Where two or more ventilators are required to meet the ventilation requirement, the acoustic performance for a single ventilator must be selected so that the combined performance is as stated in the table below, e.g. for 2 no. ventilators, the acoustic performance of each will need to be $D_{n,e,w}$ 36 dB to meet a combined specification of $D_{n,e,w}$ 33 dB. Requirements should be checked with the manufacturer. Please note that the treatment is generally not considered necessary for non-habitable rooms such as bathrooms etc.

Table 11 below gives the acoustic performance of the ventilator used in the calculations. Any alternative vent should achieve the same performance or greater in each octave band.

Table 11. Required ventilator performance

| Typical Product | Minimum Sound Reduction Index R (dB) at Octave Band Centre Frequency (Hz) | | | | | | | | $D_{n,e,w}$ dB |
|-----------------------------|---|-----|-----|-----|----|----|----|----|----------------|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| Simon Acoustic TTF Slimline | 38 | 38 | 35 | 35 | 31 | 32 | 35 | 40 | 33 |

Please note that the specification of vents is in terms of acoustic performance only. Ventilation strategy needs to be checked with Local Authority and other standards and regulations for compliance. It should be noted that inclusion of ventilators alone does not ensure compliance with Building Regulations or other regulatory requirements for ventilation. The ventilation strategy should be checked by others.

6.2 External Walls

It is assumed that the external wall is a brick cavity construction. Within our calculations it has been determined that the sound insulation performance of the external wall should be no less than 54 dB R_w .

6.3 Roof

It has been assumed that the roof to the penthouses on floor 11 will be of a lightweight construction. For the purposes of our assessment we have assumed the construction to be a Kingspan roof panel with a suspended ceiling below consisting of insulation and 1 no. 15mm plasterboard. From manufacturers data the sound insulation performance of the penthouse roofs should be no less than 58 dB R_w .



6.4 Rooftop Amenity Spaces

In order to assess the rooftop amenity spaces we have utilised the spot measurement data from Position 4 and reduced this by 10 dB due to the screening provided by the proposed 1.8m glass balustrade to all edges of floor 10 level. Therefore, we would predict a noise level that would fall below the lower guideline value of WHO with the addition of distance attenuation.



7.0 CONCLUSIONS

PDA Ltd was commissioned by C49 Architecture to carry out a noise impact assessment for the proposed development at Kirklees House, Market Street, Huddersfield. The proposed development consists of the conversion of an existing 9 storey office block into student accommodation. It is understood that there is to be 99 no. studio apartments across floors 1 to 9 and 8 no. penthouses across newly formed floors 10 and 11. There is to be a ground floor commercial unit with a study space, gym and students lounge to the basement.

A noise level survey has been undertaken at the site representative of daytime and night-time hours. The local noise climate to the north and east of site is dominated by road traffic from market street during day and night-time hours. To the west and south of site the noise climate is dominated by road traffic noise from Market Street and distant traffic noise from the A62. During the evening and night-time periods the noise climate is dominated by entertainment noise from the adjacent entertainment premises.

Based upon the measured and predicted noise levels, calculations have been undertaken for the studio apartments and penthouses to evaluate the internal noise levels. Recommendations are given for glazing, ventilation and building façade elements to meet the internal noise level requirements of good practice guidance given in BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings. Calculations suggest that the noise level criteria of BS8233:2014 can be achieved within the proposed accommodation. Further to this, guidance has been followed from Section 5 of the Kirklees Council – Noise Design Advice which considers internal noise ratings in order to protect future occupants from entertainment noise.



APPENDIX A – SURVEY DATA

Figure 6. Ambient Noise Level Survey – Measurement Position 1

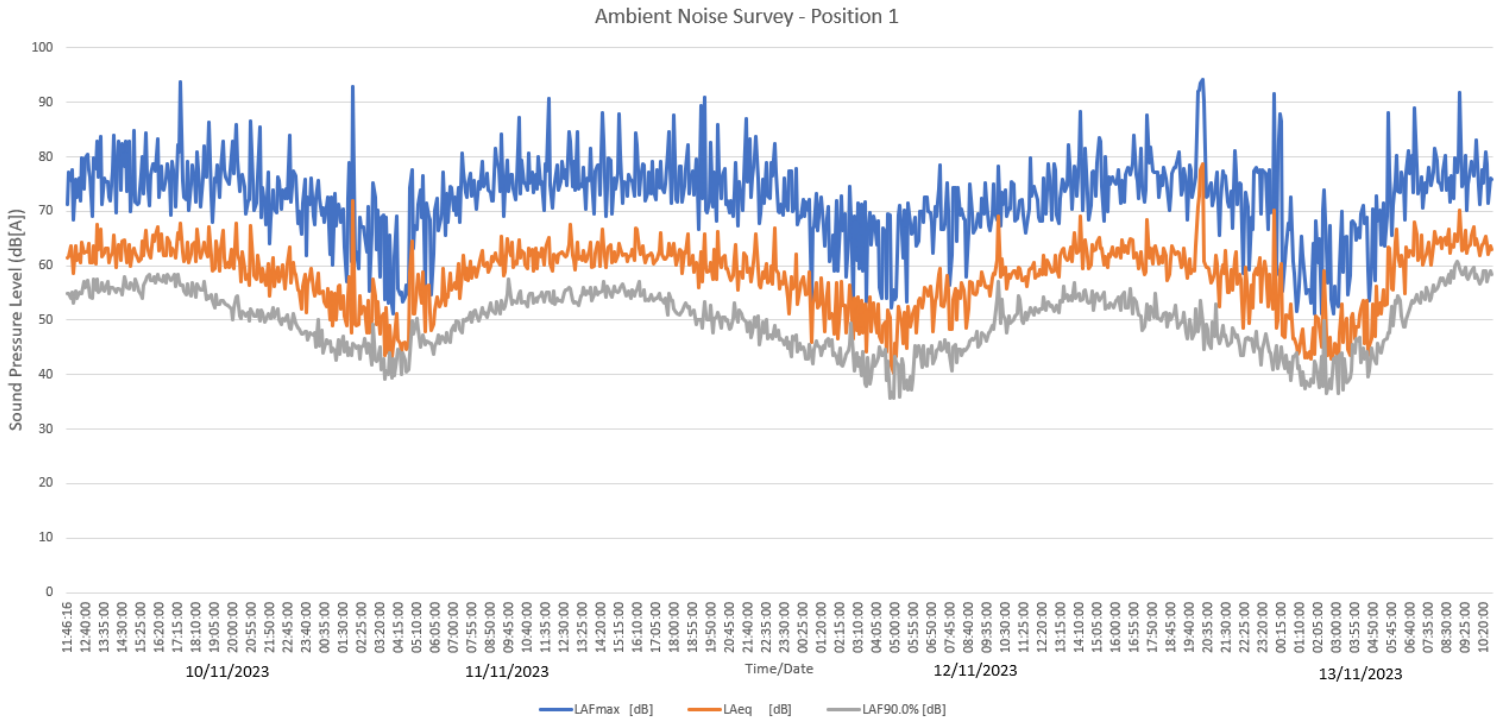




Figure 7. Ambient Noise Level Survey – Measurement Position 2

Ambient Noise Survey - Position 2

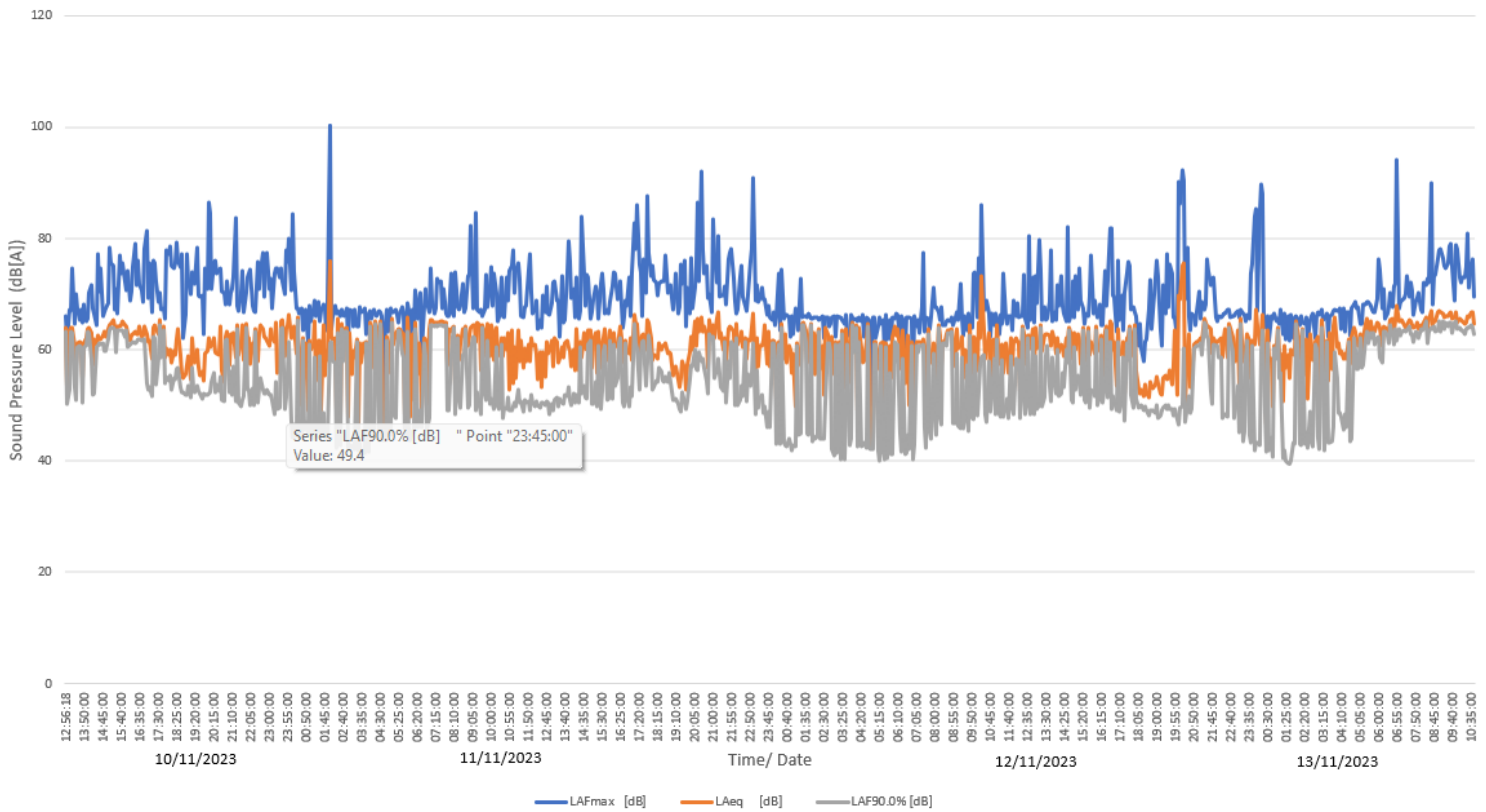


Figure 7. Ambient Noise Level Survey – Measurement Position 3

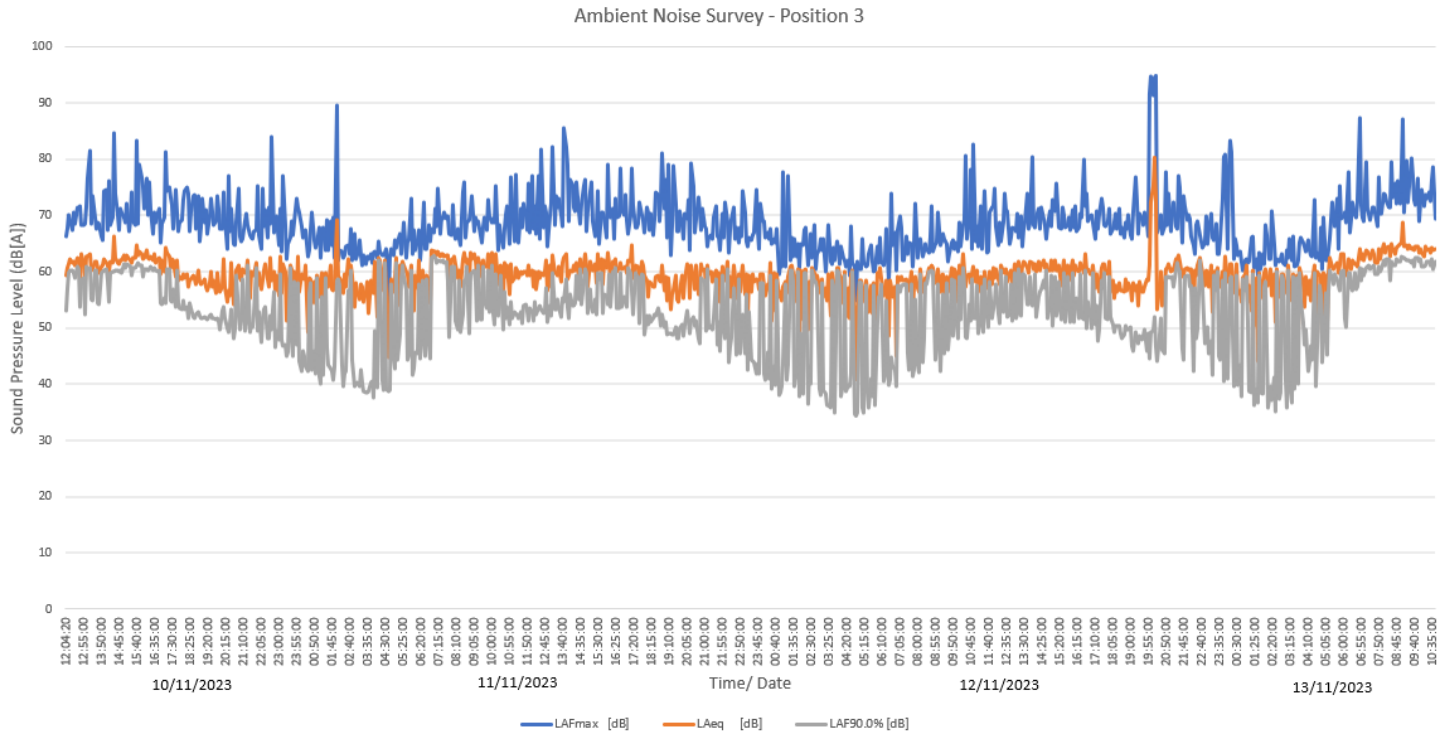


Table 12. Ambient Noise Level Survey – Measurement Position 4

| Time | LAFMAX | LAEQ | LAF90.0% |
|----------|--------|------|----------|
| 11:45:00 | 73 | 60.5 | 54.6 |
| 11:50:00 | 70.4 | 60.2 | 54.6 |
| 11:55:00 | 78 | 62.8 | 54.2 |
| 12:00:00 | 69 | 59 | 54.2 |
| 12:05:00 | 68 | 57.8 | 52.8 |
| 12:10:00 | 73 | 62.1 | 54.9 |
| 12:15:00 | 73.5 | 61.4 | 53.7 |
| 12:20:00 | 73.7 | 60.2 | 53.8 |
| 12:25:00 | 75.7 | 61.2 | 54.4 |
| 12:30:00 | 74.6 | 61.8 | 54.5 |
| 12:35:00 | 73.4 | 61.9 | 56.6 |
| 12:40:00 | 76.6 | 60.6 | 55 |



APPENDIX B – NOTES FOR QUALITY CONTROL

1. Blockwork

All blockwork is to be mortared to an almost fair faced standard both horizontally and vertically. Only perfect blocks may be used with no pitting or cracks. The blockwork must seal effectively to the underside of the soffit.

Where blockwork walls form a cavity wall, care should be taken to avoid rubble and snots from bridging the cavity. This is especially important where one or more of the leaves is floating.

2. Plasterboard

All plasterboard joints are to be butted tight. The rule of thumb is that the joint should be tight enough over its entire length to prevent a normal business card from being inserted. Multiple layers should be fitted with staggered joints.

Base details and deflection heads are to be as per the British Gypsum White Book unless otherwise stated, and copious amounts of mastic to be used when fitting to the walls, floor and ceiling respectively.

3. Mineral Fibre

Mineral fibre slabs are to be butted tightly together and to boundary structures, to form a homogeneous layer.

4. Windows

All window frames are to be a good tight fit into the building structure with any gaps to be filled both internally and externally with a non-setting mastic in addition to the usual weather proofing seal to the exterior. Any gaps between the frame and building that are greater than 5 mm are to be packed with a dense mineral fibre prior to mastic sealing.

5. Electrical Sockets

Electrical sockets must not be fitted back to back and removed areas of blockwork and plasterboard should be kept to an absolute minimum.

6. Water Pipes

All water pipes (and any other pipework) are to be resiliently mounted to avoid “water hammer”. This is particularly important for plasterboard walls.

7. Penetrations

Penetrations are to be dealt with as described in this report. Details for specific services penetrations may be supplied upon request.

8. Approved Samples and Inspections

Samples of each individual acoustic element should be provided for inspection at the beginning of its installation. Once approved, the Clerk of Works must ensure that the same level of quality continues throughout construction.

APPENDIX C – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq} . Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq} . It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An} . It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max} , dB L_{Amax} , etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq} , L_{90} , L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.