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# 285-287 Northolt Road
# South Harrow

**Noise Impact Assessment Report**
**Report 25867.NIA.01**

**AVIM Consultancy Ltd**
**227 Preston Road**
**Wembley HA9 8NF**

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## Contents



**List of Attachments**

## SUMMARY

KP Acoustics Ltd has been commissioned to assess the suitability of the site at 285-287 Northolt Road, HA2 8HX for a commercial community hall development in accordance with the provisions of the National Planning Policy Framework and the Noise Policy Statement for England (NPSE).

An environmental noise survey has been undertaken on site to establish the current ambient noise levels, as shown in Table 3.1. Noise breakout testing was undertaken to test the performance of building facades and calculations have been undertaken to predict the noise levels at the nearest noise sensitive receptor. These calculations are shown in Appendix B.

# 1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned by AVIM Consultancy Ltd, 227 Preston Road, Wembley, HA9 8NF to assess the suitability of the site at 285-287, Northolt Road, South Harrow, HA2 8JA for a commercial community Hall development in accordance with the provisions of the National Planning Policy Framework, the Noise Policy Statement for England (NPSE) and the London Borough of Harrow.

This report presents the results of the environmental survey undertaken in order to measure prevailing background noise levels and outlines any necessary mitigation measures.

# 2.0 SITE SURVEYS

## 2.1 Site Description

The site is bounded by Eastcote Road to the north, Beechwood Gardens to the west, Scarsdale Road to the south, and Wargrave Road to the east. Entrance to the site is located at the front entrance on Northolt Road. The site is made up of a Ground Floor Community Hall with an office and kitchen area located directly above. At the time of the survey, the background noise climate was dominated by road traffic noise from the surrounding roads. The nearest noise sensitive receptor is a flat situated adjacent to the site, at first floor level.

## 2.2 Environmental Noise Survey Procedure

A noise survey was undertaken on the proposed site as shown in Figure 2.1. The location was chosen in order to collect data representative of the worst-case levels expected on the site due to all nearby sources.

Continuous automated monitoring was undertaken for the duration of the survey between 12:30 on 06/01/2023 and 11:00 on 09/01/2023.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

## 2.3 Measurement Positions

Measurement positions are as described within Table 2.1 and shown within Figure 2.2.

| Icon | Descriptor | Location Description |
|---|---|---|
| | Noise Measurement Position 1 | The microphone was installed on a window on the first floor of the front façade, as shown in Figure 2.2. The microphone was located within 1.5 metres of the nearest surface and therefore includes local reflections. |
| | Manual Noise Measurement Position A | The microphone was installed on a tripod at the rear of the property, as shown in Figure 2.2. The microphone was positioned within free-field conditions at approximately 1.5 metres from the nearest surface. |
| | Manual Noise Measurement Position 2 | The microphone was installed on a tripod at the front of the site, as shown in Figure 2.2. The microphone was positioned within free-field conditions at approximately 1.5 metres from the nearest surface. |
| | Closest Noise Sensitive Receiver | Window of neighbouring First Floor apartment located adjacent to the site. |

**Table 2.1 Measurement positions and descriptions**

**Figure 2.2 Site measurement positions (Image Source: Google Maps)**

## 2.4 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.4.

<table>
<tr><th colspan="2">Measurement instrumentation</th><th>Serial no.</th><th>Date</th><th>Cert no.</th></tr>
<tr><td rowspan="4">Noise Kit 30</td><td>NTI Audio XL2 Class 1 Sound Level Meter</td><td>A2A-21149-E0</td><td rowspan="3">04/08/2022</td><td rowspan="3">UK-22-079</td></tr>
<tr><td>Free-field microphone NTI Acoustics MC230A</td><td>A23572</td></tr>
<tr><td>Preamp NTI Acoustics MA220</td><td>10997</td></tr>
<tr><td>NTI Audio External Weatherproof Shroud</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Larson Davis CAL200 Class 1 Calibrator</td><td>17148</td><td>18/03/2022</td><td>UCRT22/1397</td></tr>
</table>

**Table 2.4 Measurement instrumentation**

# 3.0 SOUND INSULATION INVESTIGATION

To assess direct noise transfer from the Community Hall to the nearby residential units, as well as noise breakout from the building, a sound insulation investigation was undertaken as described below.

## 3.1 Procedure

High volume pink noise was generated from one loudspeaker within the Coomunity Hall, positioned to obtain a diffuse sound field. A spatial average of the resulting one-third octave band noise levels between 100 Hz and 3150 Hz was obtained by using a moving microphone technique over a minimum period of 30 seconds.

The same measurement procedure was used at several noise breakout positions at 1m from the façade of the Community Hall.

The results of the tests were rated in accordance with BS EN ISO 717-1: 1997 '*Rating of sound insulation in buildings and of building elements. Part 1 Airborne sound insulation*'.

### 3.2 Equipment

The instrumentation used during the sound insulation investigation is shown in Table 3.2 below.

| Instrument | Manufacturer and Type | Serial Number |
|---|---|---|
| SLM4<br>Precision integrating sound level meter & analyser | NTi Audio, XL2-TA<br>Calibration No: UCRT21/2324, UCRT21/2333 & UCRT21/2328<br>Calibration Dates: 26th and 27th October 2021<br>Calibration Due: 25/10/2023 | A2A-09207-E0 |
| LS8 Active Loudspeaker | RCF ART 310A | VCCG00253 |
| GEN 5 Pink Noise Source | NTi Audio Minirator MR-PRO | G2L-RACDG-G0 |
| CAL1<br>Calibrator 1 | Larson Davis CAL200<br>Calibration No: UCRT22/1397<br>Calibration Date: 18/03/2022<br>Calibration Due: 17/03/2023 | 17148 |

**Table 3.2 Instrumentation used during testing**

## 4.0 RESULTS

### 4.1 Noise Survey

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as a time history in Figure 25867.TH1.

Measured noise levels are representative of noise exposure levels expected to be experienced by all facades of the proposed development, and are shown in Table 4.1.

| Time Period | Noise Measurement Position 1 (Measured Noise level – dBA) |
|---|---|
| Daytime $L_{Aeq,16hour}$ | 68 |
| Night-time $L_{Aeq,8hour}$ | 67 |
| Daytime - Min $L_{A90,16hour}$ | 47 |
| Night-time - Min $L_{A90, 8hour}$ | 38 |
| Min $L_{A90}$ During Opening Hours (07:00 – 02:00) | 41 |

**Table 4.1 Site average noise levels for daytime and night time**

Please note that measurements at Noise Measurement Position 1 are located at a distance less than 1.5 meters from the nearest reflective surface and therefore a 3dB correction has been applied to the results in Table 4.1 to obtain a free-field measurement as per ISO1996 Part 2.

Further manual measurements have been undertaken to derive the expected noise levels for the individual facades of the proposed development. The results of these measurements are as follows:

| Manned Measurement Location | Measurement Period | Manned Noise Level Measurement (dBA) | |
|---|---|---|---|
| | | $L_{Aeq,T}$ | $L_{A90}$ |
| Front | 13:01-13:16 | 70 | 59 |
| Rear | 12:31-12:41 | 50 | 41 |

**Table 4.2 Manned noise measurements**

### 4.2 Sound Insulation Investigation

The main parameter used throughout this document to express airborne sound insulation of separating constructions is $D_w$. All specifications in this report will therefore be given with respect to this descriptor. Summarised results of the airborne tests are shown in Table 4.3.

| Test Element | Source | Receiver | $D_w$ Performance, dB |
|---|---|---|---|
| Window and Doorset | Ground Floor Function Room | 1m from front façade outside | $D_w$ 22dB |
| Floor | Ground Floor Function Room | First Floor Office | $D_w$ 46dB |
| Wall | Ground Floor Function Room | 1m from rear façade outside | $D_w$ 45dB |

**Table 4.3 Airborne test results**

## 5.0 NOISE ASSESSMENT GUIDANCE

### 5.1 Noise Policy Statement for England 2021

The National Planning Policy Framework (NPPF) has superseded and replaces Planning Policy Guidance Note 24 (PPG24), which previously covered issues relating to noise and planning in England. Paragraph 174 of NPPF 2021 states that planning policies and decisions should aim to:

- preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans

In addition, Paragraph 185 of the NPPF states that '*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 Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010 with the aim to 'Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.'

Noise Policy Statement England (NPSE) noise policy aims are as follows:

*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.*

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life*

The Noise Policy Statement England (NPSE) outlines observed effect levels relating to the above, as follows:

- NOEL – No Observed Effect Level
    - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL – Lowest Observed Adverse Effect Level

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

- SOAEL – Significant Observed Adverse Effect Level
    - This is the level above which significant adverse effects on health and quality of life occur.

As stated in The Noise Policy Statement England (NPSE), it is not currently possible to have a single objective-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Specific noise levels are not stated within the guidance for this reason and allow flexibility in the policy until further guidance is available.

### 5.2 BS8233:2014

BS8233:2014 *'Sound insulation and noise reduction for buildings'* describes recommended internal noise levels for residential spaces. These levels are shown in Table 5.2.

| Activity | Location | 07:00 to 23:00 | 23:00 to 07:00 |
|---|---|---|---|
| Resting | Living Rooms | 35 dB(A) | - |
| Dining | Dining Room/area | 40 dB(A) | - |
| Sleeping (daytime resting) | Bedrooms | 35 dB(A) | 30 dB(A) |

**Table 5.2 BS8233 recommended internal background noise levels**

## 6.0 NOISE TRANSFER AND BREAKOUT PREDICTIONS

### 6.1 Direct Noise Transfer to First Floor Bedroom from Community Hall

Using a typical source level of 80dB(A) to represent a worst case source noise levels within the Community Hall, and taking into account the measured $D_w$ rating of the separating floor between the Community Hall and First Floor Office situated directly above, Table 6.1 shows predicted sound pressure levels within the bedroom receiver. Due to a lack of access to the neighboring first floor bedroom to carry out noise breakout measurements, a nominal 6dB correction has been applied to the predicted levels in the office.

| Receiver | BS8233:2014 Requirement | Predicted Noise Levels Within Adjacent Bedroom Receiver |
|---|---|---|
| 1st Floor Bedroom of 289 Northolt Road | 35 dB(A) (07:00-23:00)<br>30 dB(A) (23:00-07:00) | 24dB(A) |

**Table 6.1 Predicted noise levels in bedroom receiver**

As shown in Table 6.1 and Appendix B1, the direct noise transfer through the separating structure with the existing construction would be 6dB below the worst-case criterion stipulated in BS8233. Therefore, any direct sound transfer should not cause noise nuisance to the nearby residential occupiers.

However, a noise management plan is outlined in Section 7.0 to ensure the best practicable means to control noise is consistently implemented.

## 6.2 Noise Breakout to First Floor Windows from Community Hall Front Façade

Using a typical source level of 80dB(A) to represent a worst case in the Community Hall, and taking into account the measured $D_w$ rating of the front façade, Table 6.2 shows the predicted sound pressure level at 1m from the neighboring first floor residential bedroom windows. This has been compared with the measured minimum background noise level during the Community Hall's licensed operating hours of between 07:00 hours and 02:00 hours. Detailed calculations are shown in Appendix B.2.

| Receiver | Minimum Background Noise $L_{A90}$ | Noise Level at Receiver (1m from window) |
|---|---|---|
| Nearest Noise Sensitive Window | 41dB(A) | 40dB(A) |

**Table 6.2 Predicted noise level at 1m from the closest noise sensitive bedroom window**

As shown in Table 6.2, noise breakout from the front façade of the Community Hall is 1dB below the measured minimum background noise level. Therefore, the buildings in its current state would be sufficient in controlling noise breakout to the neighboring residential windows above.

Furthermore, the value of 40dB(A) is to be considered outside of the building. Windows may be closed or partially closed leading to further attenuation, as follows.

Further calculations have been undertaken to assess whether noise breakout from the Community Hall would be expected to meet the recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233:2014 'Guidance on sound insulation and noise reduction for buildings – Code of Practice', gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:2014 recommends 35dB(A) as recommended internal resting/sleeping conditions during daytime hours, and 30dB(A) during nighttime hours.

With a calculated external level of 40dB(A), the residential window itself would need to provide an additional 10 dB attenuation in order for the recommended internal levels to be achieved. According to BS8233:2014, even a partially open window offers 10-15dB attenuation, thus leading to a further reduced interior noise level.

Predicted levels are shown in Table 6.3. It can therefore be stated that noise breakout from the Ground Floor bar would be expected to fail to meet the most stringent recommendations of the relevant British Standard.

| Receiver | Design Range – *For resting/sleeping conditions in a bedroom, in BS8233:2014* | Noise Level at Receiver (due to breakout noise) |
|---|---|---|
| Inside Nearest Residential Space | 35 dB(A) (07:00-23:00)<br>30 dB(A) (23:00-07:00) | 25-30 dB(A) |

**Table 6.3 Noise levels and criteria inside nearest residential space due to breakout noise**

## 6.3 Noise Breakout to First Floor Windows from Community Hall Rear Façade

Using a typical source level of 80dB(A) to represent a worst case in the Community Hall, and taking into account the measured $D_w$ rating of the front façade, Table 6.4 shows the predicted sound pressure level at 1m from the neighboring first floor residential bedroom windows. This has been compared with the measured minimum background noise level during the operating hours. Detailed calculations are shown in Appendix B2.

| Receiver | Minimum Background Noise $L_{A90}$ | Noise Level at Receiver (1m from window) |
|---|---|---|
| Nearest Noise Sensitive Window | 41 dB(A) | 19 dB(A) |

**Table 6.4 Predicted noise level at 1m from the closest noise sensitive bedroom window**

As shown in Table 6.4, noise breakout from the rear façade of the Community Hall is 22dB below the measured minimum background noise level. Therefore, the buildings in its current state would be sufficient in controlling noise breakout to the neighboring residential windows above.

Furthermore, the value of 19dB(A) is to be considered outside of the building. Windows may be closed or partially closed leading to further attenuation, as follows.

Further calculations have been undertaken to assess whether noise breakout from the Community Hall would be expected to meet the recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233:2014 ‘Guidance on sound insulation and noise reduction for buildings – Code of Practice’, gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:2014 recommends 35dB(A) as recommended internal resting/sleeping conditions during daytime hours, and 30 dB(a) during nighttime hours.

With a calculated external level of 19dB(A), the residential window itself would need to provide no additional attenuation in order for the recommended internal levels to be achieved. According to BS8233:2014, even a partially open window offers 10-15dB attenuation, thus leading to a further reduced interior noise level.

Predicted levels are shown in Table 6.5. It can therefore be stated that noise breakout from the Ground Floor bar would be expected to meet the most stringent recommendations of the relevant British Standard.

| Receiver | Design Range – *For resting/sleeping conditions in a bedroom, in BS8233:2014* | Noise Level at Receiver (due to breakout noise) |
|---|---|---|
| Inside Nearest Residential Space | 35 dB(A) (07:00-23:00)<br>30 dB(A) (23:00-07:00) | 4-9 dB(A) |

**Table 6.5 Noise levels and criteria inside nearest residential space due to breakout noise**

Predicted levels are shown in Table 6.5. It can therefore be stated that noise breakout from the Community Hall would be expected to meet the most stringent recommendations of the relevant British Standard.

## 7.0 MITIGATION MEASURES FOR THE COMMUNITY HALL

**Façade Upgrade**

It was subjectively noted during the site visit that the front doorset was the weakest link in the performance of the façade. To mitigate the effects of noise breakout to the nearest receiver via the front façade, we would recommend the installation of an internal lobby at the front entrance. This would provide insulation between the Party Hall space and the main doorset, thus improving the acoustic performance of the front façade. Some general points that should be followed regarding the acoustic performance of doors are as follows.

- Doors should be gasketed around the entire perimeter to be airtight when closed
- Seals should be adjustable to compensate for wear, thermal movement, settlement of building structure and other factors that cause misalignment of the doors

- Good quality hydraulic closers should be fitted on all doors likely to be subjected to heavy use

We also recommend the installation of secondary glazing at the front façade to further reduce noise breakout to the nearest receiver. This should consist of a minimum of a 6mm single pane spaced at least 100-150mm from the existing front windows.

The implementation of these upgrades to the front façade would be expected to provide a nominal 8-10dB overall improvement at this façade, enabling an increase in noise levels within the Community Hall, whilst protecting the amenity of the nearby residents.

**Installation of a Sound Limiter**

In order to ensure that the source noise levels are controlled within the Community Hall, we would recommend that a sound limiter is installed by the occupier. The system designer should be able to advise on the type and standard of sound limiter suitable for the proposed installation.

The limiter should enable the separate control of the different zones and incorporate all elements of the sound system, including any additional filters or amplifiers. Programmable limiters are preferred as these permit a more sophisticated control of frequency content and volume and are fully tamper-proof. Programmed limits should match those shown in Table 7.1, for both the existing front façade (if left with no upgrades), and the upgraded front façade following the guidance in section 7.0.

| Noise Limiter | Octave band centre frequency SRI, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
| Maximum permissible levels within the party hall to meet the requirements of BS8233 – Existing front façade | 75 | 76 | 76 | 76 | 76 | 76 | 76 | 76 |
| Maximum permissible levels within the party hall to meet the requirements of BS8233 – Upgraded front façade | 75 | 85 | 85 | 85 | 80 | 80 | 80 | 76 |

**Table 7.1 Maximum permissible noise levels within the bar**

On-going attention will need to be given by the Community Hall to transmitted noise levels to ensure that the final operational conditions do not undermine the settings of the limiter.

Different types of music and activities can result in varied subjective effects. It is strongly recommended that the management remain aware as the operation becomes established and reset the limiter, if necessary.

**Distributed Sound System**

A loudspeaker system employing relatively few speakers requires each unit to generate high noise levels to maintain a given noise level in the space.

A distributed system with numerous speakers allows each speaker to operate at a lower volume. This ensures that localised noise levels are lower, which reduces the noise directly incident on the structure.

The specifications of the speakers will be dependent on the use of each zone or focus area but should allow sufficient capacity for them to operate at optimum efficiency.

**Loudspeaker Mounting**

Rigid mounting systems are entirely inadequate for the control of transmitted sound from the speakers. To ensure efficient control of noise it is recommended that a proprietary frame support is used for each speaker.

This must incorporate suitable anti-vibration mounting between support and speaker enclosure, with no rigid connections permitted to short-circuit the isolation

The use of neoprene mounts or hangers is recommended. These are expected to provide a static deflection of approximately 3-5mm (i.e. under the load of the speaker). High stiffness neoprene / rubber and metal springs should be avoided in general. The use of neoprene mounts or hangers in fully enclosed metal casings is not advisable as if these are angled the casings can short circuit. Any mount / hanger must be capable of maintaining a 30-degree offset without any rigid components short-circuiting the mount. It must be noted, however, that vertical alignment is more effective.

Generally available speaker vibration mountings are not typically effective for isolation of this standard. Use of heavy duty, proprietary supports coupled with hangers / mounts will be far more effective.

Should the suspended installation of bass cabinets not be possible, we would recommend the use of a proprietary resilient pad on which the cabinets can rest. We would therefore recommend a product such as Regupol 6010BA which would isolate the speakers from generating any vibro-acoustic excitation of the structure.

**Noise Management Plan**

Whilst the findings of the report conclude that the bar would have no negative impact upon the closest noise sensitive receivers, we would recommend that the bar management implement a noise management plan to ensure that best practicable means are used to control noise:

- Clear signage should be displayed at the entrance requesting customers to respect residents and leave the premises in a quiet and respectful manner
- During night-time hours (23:00-07:00), staff should remind customers when leaving to be as quiet and respectful to neighbours as possible
- Staff should ensure that customers do not congregate outside of the premises, especially during night-time hours (23:00-07:00)
- The main entrance doors should be kept closed, except for entrance and egress of customers.

## 8.0 CONCLUSION

An environmental noise survey has been undertaken at 285-287 Northolt Road, Harrow, Harrow, HA2 8JA allowing the assessment of daytime and night-time levels likely to be experienced by the proposed development.

No further mitigation measures should be required in order to protect the nearby residential units from external noise intrusion and internal noise intrusion from the Community Hall.

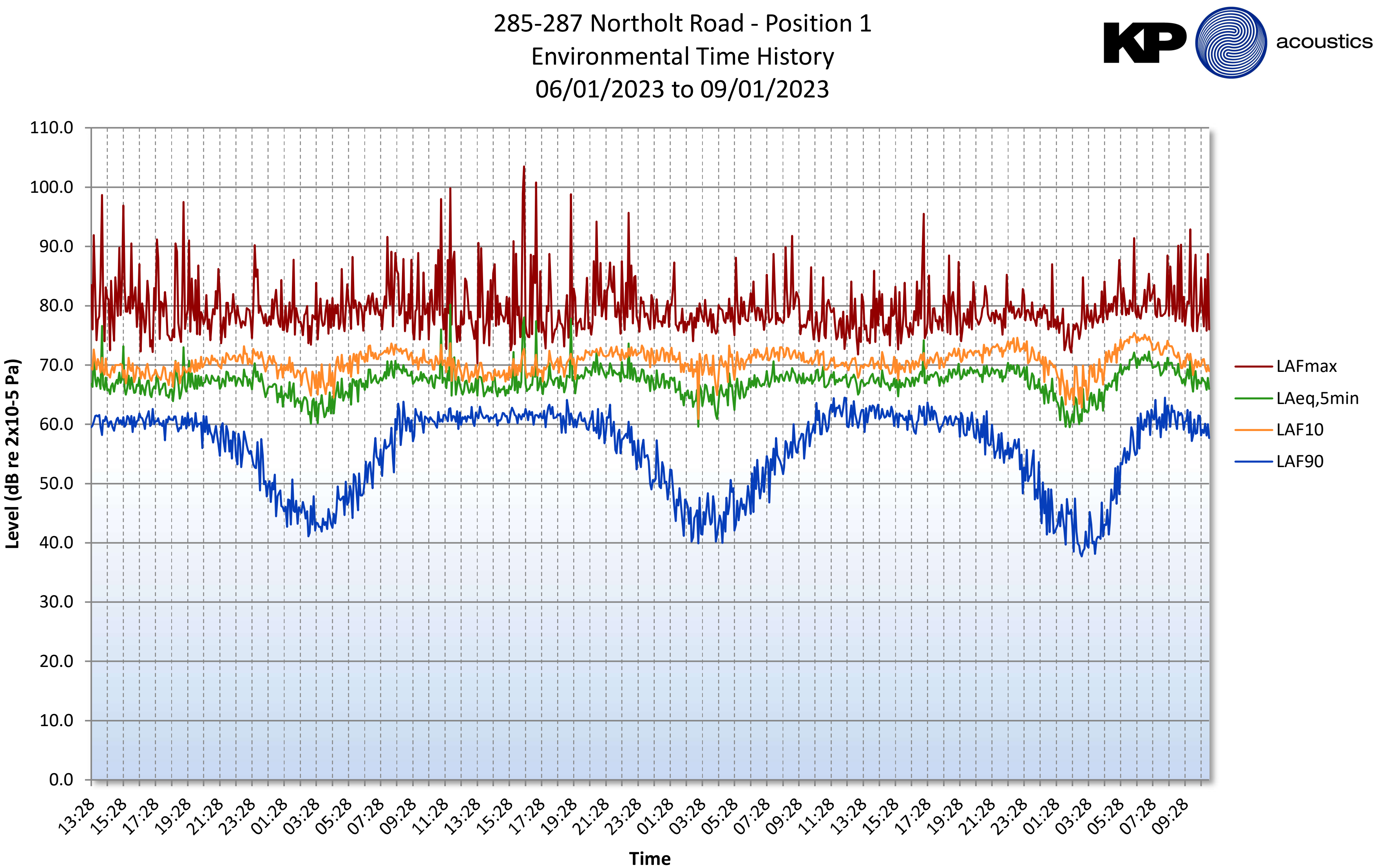


Figure 25867.TH1

# APPENDIX A

## GENERAL ACOUSTIC TERMINOLOGY

### Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of $10^{13}$ units, that only a logarithmic scale is the sensible solution for displaying such a range.

### Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

**$L_{eq}$**

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level $L_{eq}$. The $L_{eq}$ is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

**$L_{10}$**

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

**$L_{90}$**

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

**$L_{max}$**

This is the maximum sound pressure level that has been measured over a period.

### Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

# APPENDIX A

## APPLIED ACOUSTIC TERMINOLOGY

### Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

### Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

### Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

| Change in sound level (dB) | Change in perceived loudness |
|---|---|
| 1 | Imperceptible |
| 3 | Just barely perceptible |
| 6 | Clearly noticeable |
| 10 | About twice as loud |

### Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

### Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

### Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

# APPENDIX B1

# 285-287 Northolt Road, Harrow

## DIRECT NOISE TRANSFER CALCULATIONS

| **Source: Worst Case Noise Levels in Party Hall**<br>**Receiver: First Floor Office** | ***Frequency, Hz***<br>***63*** | ***125*** | ***250*** | ***500*** | ***1k*** | ***2k*** | ***4k*** | ***8k*** | ***dB(A)*** |
|---|---|---|---|---|---|---|---|---|---|
| **Sound Pressure level of worst case activity within main bar space*** | 60 | 70 | 75 | 75 | 75 | 75 | 70 | 67 | **80** |
| **On site level difference, D, of separating floor, dB** | **-28** | **-33** | **-41** | **-47** | **-65** | **-69** | **-69** | **-71** | |
| Approximate area (S) of the separating wall ($50m^2$) | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | |
| **Correction for area (S), dB** | **17** | **17** | **17** | **17** | **17** | **17** | **17** | **17** | |
| Volume of receiving room ($150m^3$) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | |
| Expected reverberation time of receiver space (0.5s) | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| **Correction for absorption in receiver space, dB** | **-24** | **-24** | **-24** | **-24** | **-24** | **-24** | **-24** | **-24** | |
| **Predicted Sound Pressure Level within Receiver Space** | **25** | **30** | **27** | **21** | **3** | **-1** | **-6** | **-11** | **22** |

| | |
|---|---|
| **Direct Transfer Noise Criterion** | **30** |

* noise levels for a Busy Restaurant, as per The Little Red Book of Acoustics – A Practical Guide (Second Edition) by R. Watson and O. Downey

| **Source: First Floor Office**<br>**Receiver: First Floor Bedroom of 289 Northolt Road** | ***Frequency, Hz***<br>***63*** | ***125*** | ***250*** | ***500*** | ***1k*** | ***2k*** | ***4k*** | ***8k*** | ***dB(A)*** |
|---|---|---|---|---|---|---|---|---|---|
| **Predicted Sound Pressure Level in First Floor Office** | 25 | 30 | 27 | 21 | 3 | -1 | -6 | -11 | **22** |
| Approximate area (S) of the separating wall ($12m^2$) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | |
| **Correction for area (S), dB** | **11** | **11** | **11** | **11** | **11** | **11** | **11** | **11** | |
| Volume of receiving room ($30m^3$) | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | |
| Expected reverberation time of receiver space (0.5s) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | |
| **Correction for absorption in receiver space, dB** | **-10** | **-10** | **-10** | **-10** | **-10** | **-10** | **-10** | **-10** | |
| **Correction for transfer through partition wall, 6dB** | **-6** | **-6** | **-6** | **-6** | **-6** | **-6** | **-6** | **-6** | |
| **Predicted Sound Pressure Level within Receiver Space** | **20** | **25** | **22** | **16** | **-2** | **-6** | **-11** | **-16** | **17** |

| | |
|---|---|
| **Direct Transfer Noise Criterion** | **30** |

# APPENDIX B2

# 285-287 Northolt Road, Harrow

## NOISE BREAKOUT CALCULATIONS

| Source: Ground Floor Party Hall Front Façade<br>Receiver: First Floor Front Receiver Window | *Frequency, Hz*<br>*63* | *125* | *250* | *500* | *1k* | *2k* | *4k* | *8k* | *dB(A)* |
|---|---|---|---|---|---|---|---|---|---|
| **Sound Pressure level of worst case activity within main bar space*** | 60 | 70 | 75 | 75 | 75 | 75 | 70 | 67 | **80** |
| Approximate area (S) of the façade overlooking receiver location (30m²) | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | |
| **Correction for area (S), dB** | **15** | **15** | **15** | **15** | **15** | **15** | **15** | **15** | |
| **On site composite level difference, D, dB** | **-27** | **-30** | **-23** | **-28** | **-30** | **-36** | **-34** | **-37** | |
| **Correction for distance (11m), dB** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | |
| **Correction due to no reverberant field externally + propagation effect of the wall surface, dB** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | |
| **Sound Pressure Level at 1m from Receiving Façade** | **23** | **30** | **42** | **37** | **35** | **29** | **26** | **19** | **40** |
| | | | | | | | **Breakout Noise Criterion** | | **41** |

| Source: Ground Floor Party Hall Rear Façade<br>Receiver: First Floor Rear Receiver Window | *Frequency, Hz*<br>*63* | *125* | *250* | *500* | *1k* | *2k* | *4k* | *8k* | *dB(A)* |
|---|---|---|---|---|---|---|---|---|---|
| **Sound Pressure level of worst case activity within main bar space*** | 60 | 70 | 75 | 75 | 75 | 75 | 70 | 67 | **80** |
| Approximate area (S) of the façade overlooking receiver location (m²) | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | |
| **Correction for area (S), dB** | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |
| **On site composite level difference, D, dB** | **-42** | **-47** | **-50** | **-47** | **-53** | **-52** | **-56** | **-58** | |
| **Correction for distance (11m), dB** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | |
| **Correction due to no reverberant field externally + propagation effect of the wall surface, dB** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | |
| **Sound Pressure Level at 1m from Receiving Façade** | **8** | **13** | **15** | **18** | **12** | **13** | **4** | **-1** | **19** |
| | | | | | | | **Breakout Noise Criterion** | | **41** |

* noise levels for a Busy Restaurant, as per The Little Red Book of Acoustics – A Practical Guide (Second Edition) by R. Watson and O. Downey

The main model was designed around the following formula:
SPL2 = SPL1 - SRI + 10log(S) + 10log(r) - 14

where:
SPL2 is the sound pressure level at the receiver's facade
SPL1 is the sound pressure level within the source room
S is the area of the main wall
r is the distance correction
SRI is the sound reduction index of the break-out facade
The 14dB term occurs due to no reverberant sound field in the open (6dB) plus the propagation effect of the wall ($10\log(2/4\pi 1^2)$=8dB)

# APPENDIX B3

## 285-287 Northolt Road, Harrow

### NOISE BREAKOUT CALCULATIONS WITH FRONT FAÇADE UPGRADE AND LIMITER IN PLACE

| Source: Ground Floor Party Hall Front Façade<br>Receiver: First Floor Front Receiver Window | *Frequency, Hz*<br>*63* | *125* | *250* | *500* | *1k* | *2k* | *4k* | *8k* | *dB(A)* |
|---|---|---|---|---|---|---|---|---|---|
| **Sound Pressure level of worst case activity within main bar space*** | 75 | 85 | 85 | 85 | 80 | 80 | 80 | 75 | **88** |
| Approximate area (S) of the façade overlooking receiver location (30m²) | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | |
| **Correction for area (S), dB** | **15** | **15** | **15** | **15** | **15** | **15** | **15** | **15** | |
| **On site composite level difference, D, dB** | **-27** | **-30** | **-23** | **-28** | **-30** | **-36** | **-34** | **-37** | |
| **Nominal improvement with secondary glazing and lobby door set, dB** | **-6** | **-8** | **-10** | **-10** | **-10** | **-10** | **-10** | **-10** | |
| **Correction for distance (11m), dB** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | |
| **Correction due to no reverberant field externally + propagation effect of the wall surface, dB** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | |
| **Sound Pressure Level at 1m from Receiving Façade** | **32** | **37** | **42** | **37** | **30** | **24** | **26** | **17** | **38** |

| Breakout Noise Criterion | 41 |
|---|---|

| Source: Ground Floor Party Hall Rear Façade<br>Receiver: First Floor Rear Receiver Window | *Frequency, Hz*<br>*63* | *125* | *250* | *500* | *1k* | *2k* | *4k* | *8k* | *dB(A)* |
|---|---|---|---|---|---|---|---|---|---|
| **Sound Pressure level of worst case activity within main bar space*** | 75 | 85 | 85 | 85 | 80 | 80 | 80 | 75 | **88** |
| Approximate area (S) of the façade overlooking receiver location (m²) | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | |
| **Correction for area (S), dB** | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |
| **On site composite level difference, D, dB** | **-42** | **-47** | **-50** | **-47** | **-53** | **-52** | **-56** | **-58** | |
| **Correction for distance (11m), dB** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | **-11** | |
| **Correction due to no reverberant field externally + propagation effect of the wall surface, dB** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | **-14** | |
| **Sound Pressure Level at 1m from Receiving Façade** | **23** | **28** | **25** | **28** | **17** | **18** | **14** | **7** | **27** |

| Breakout Noise Criterion | 41 |
|---|---|

* noise levels for a Busy Restaurant, as per The Little Red Book of Acoustics – A Practical Guide (Second Edition) by R. Watson and O. Downey

The main model was designed around the following formula:
SPL2 = SPL1 - SRI + 10log(S) + 10log(r) - 14

where:
SPL2 is the sound pressure level at the receiver's facade
SPL1 is the sound pressure level within the source room
S is the area of the main wall
r is the distance correction
SRI is the sound reduction index of the break-out facade
The 14dB term occurs due to no reverberant sound field in the open (6dB) plus the propagation effect of the wall ($10\log(2/4\pi 1^2)$=8dB)