Report VA2594.190214.NIA

35 Pilgrim's Lane, London

Construction/Demolition Noise Assessment

15 February 2019

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Contents

Attachments

VA2594/SP1	Indicative Site Plan
VA2594/TH1 - TH3	Environmental Noise Time Histories
Appendix A	Acoustic Terminology
Appendix B	Acoustic Calculations

1. Introduction

It is proposed to demolish the majority of the existing building at 35 Pilgrim's Lane, London, whilst retaining the front façade, excavate to extend the basement, and construct a new building integrating the retained façade.

Venta Acoustics has been commissioned by Mr N Bali to undertake an environmental noise survey to determine the pre-existing noise climate in the locality and predict the noise impact of the proposed works. This is to accompany the Construction Management Plan, as required by Camden Council.

2. Site Description

As illustrated on attached site plan VA2594/SP1, the site is situated on the corner of Pilgrim's Lane and Denning Road at the end of a terrace of houses on Pilgrim's Lane. The rear of the property backs onto the gardens of the adjacent dwellings on Pilgrim's Lane and Denning Road.

3. Environmental Noise Survey

3.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Friday 8th and Monday 11th February 2019 in the rear garden of the property at the location shown in site plan VA2199/SP1. This location was chosen to be representative of the existing acoustic environment at the surrounding noise sensitive receivers.

Continuous 5-minute samples of the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were undertaken at the measurement location.

The weather during the survey period was generally dry with light winds. The measured noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-11586-E0	UCRT18/1582	7/6/18
Larson Davis calibrator	CAL200	13049	UCRT18/1431	20/4/18

Table 3.1 – Equipment used for the tests

The calibration of the sound level meter was verified before and after use with no significant calibration drift observed.

3.2 Results

The measured sound levels are shown as time-history plots on the attached charts VA2594/TH1-3.

Noise levels are generally determined by traffic in the surrounding roads.

Brief periods of extraneous noise were noted on the survey data, especially on the Monday morning. These have been omitted from the analysis.

The typical noise levels measured were:

Monitoring Period	Typical $L_{A90,5min}$	Average L_{Aeq}
Camden Weekday Construction hours Weekdays – 08:00 – 18:00 hours Saturdays – 08:00 – 13:00 hours	43 dB	50 dB

Table 3.2 – Typical background and average ambient noise levels

The L_{Amax} levels are generally between 65dB and 75dB with occasional events exceeding 80dB.

4. BS5228:2009 – Construction Noise

Annex E of BS5228-1:2009 + A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* provide information and advice on reducing impact of construction works on neighbouring properties.

Criteria for construction noise are recommended in the Department of the Environment Advisory Leaflet (AL) 72.

Department of the Environment Advisory Leaflet (AL) 72 states that construction noise levels at residential locations in rural, suburban and urban areas away from main road traffic and industrial noise should not exceed 70dB(A) during the daytime (defined as 7am – 7pm). The advice also recommends that noise levels during evening periods are at least 10dB lower. It is usually accepted that these limits apply to the average noise level over the working day. The numerical limits can therefore be exceeded for short periods, provided that these are balanced by periods of relative calm.

A further example, based on the likely change in ambient noise levels, is also provided. The ABC method places potential receptors in assessment categories based on the pre-existing ambient noise level. Where ambient noise levels are below L_{Aeq} 65dB during the day, this level should be considered a threshold value above which a potential significant effect is indicated.

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq, T}$)		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A potential significant effect is indicated if the $L_{Aeq, T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.
NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq, T}$ noise level for the period increases by more than 3 dB due to site noise.
NOTE 3 Applied to residential receptors only.

[A)] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.
[B)] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.
[C)] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.
[D)] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Table 4.1 – ABC Method

Using the ABC method from Annex E of BS5228-1:2009 + A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*, the threshold at nearby receivers would be Category A.

Camden allows for a limit of ABC +5dB, equating to a working limit of 70dB(A) at the nearest receivers.

5. Predicted Noise Impact

5.1 Proposed works

The works are split into multiple sub-parts but broadly can be broken into three main phases:

- Demolition
- Excavation, underpinning and construction of new basement
- Construction of new building

It is proposed that all demolition, excavation and construction works will occur during Camden Council's standard hours of construction (08:00-18:00 hours, Monday – Friday and 08:00 – 13:00 hours Saturday) as per the requirements of the consent for the scheme.

5.1.1 Demolition

The demolition stage of the works is understood to include the following processes which have been provided by the contractor.

- Set up site including signage, welfare, temporary fencing and gates (by client)
- Asbestos removal (as required within the R&D survey)
- Removal of all loose debris
- Remove brush and scrub
- Soft strip to remove non-inert material prior to demolition, material removed from site for recycling

- Set up exclusion zones, dust suppression units and waste storage areas.
- Underpinning to party wall
- Erection of access/protection scaffold to side and rear elevations
- Design and installation of façade retention
- Demolition of building structures to top of ground floor slab
- Design and installation of temporary works to exposed party wall as required
- Reclaim and salvage materials where possible.
- Remove all debris from site to a recycling facility
- Clean site of all remaining debris and complete hand over information

The method statement for the underpinning has the following processes.

- Using hand tools and/or pneumatic breakers to break out existing flooring as necessary (compressor to be sited externally to avoid fumes in the work area). In the sequence detailed on the drawings, excavate by hand working space to the front of the underpin legs, battered to allow access and to alleviate the possibility of collapse, Excavate the underpin legs; stockpile the arisings tidily in each room to be finally removed by excavator on completion of demolition works.
- Install timber shutters to face of underpins leaving a 100mm gap through which to pour the concrete.
- Concrete to be placed by hand after delivery by mixer.
- After 48 hrs remove shutters, hand ram dry pack mix into the void and backfill working space with suitable arisings

It is understood that for some elements of the demolition a single 5 tonne excavator will be used on site, with other auxiliary plant such as a dumper, bobcat and MEWP (cherry picker).

Scaffolding will be used throughout the demolition as the building is taken down from the top working downwards, with waste and recyclable items being removed, likely using skips for both elements. It has been assumed for the purposes of the assessment that the scaffolding will be covered to stop dust and help mitigate noise from the area.

The structure is to be deconstructed in a piecemeal fashion with materials stockpiled in the garden prior to removal. The method statement for the works are as below:

- Roof removal. Roof coverings and timber will be removed using hand held tools. The resultant materials will be lowered to ground level using ropes, pulleys or chutes. Materials will be stockpiled for later removal
- Hand demolition of the walls working from the scaffold. The walls will be demolished piecemeal brick by brick with the materials lowered to ground floor via the chutes. Separate tower access positioned internally on the floor may be required to remove the high level gable ends/chimney breasts
- As each level of brickwork is removed front and rear, the timber floors will be removed using hand held tools with the materials lowered to ground floor via ropes, pulleys or chutes.

- Works will progress evenly along each floor level to ensure stability of the structure at all times
- Install temporary party wall supports as designed by the engineer either prior to the main demolition or as the works proceed downward
- Upon completion of the superstructure demolition the floor slabs and foundations will be removed by the excavator fitted with either bucket, breaker or pulveriser whichever is the most appropriate
- All stockpiled debris from the demolition will loaded by hand into skips or tippers positioned in the parking bay, for disposal at a recycling centre

5.1.2 Basement Excavation

Following the completion of the demolition works and underpinning, the basement excavation will be undertaken. This is understood to be undertaken by hand using hand tools and where required drills, grinders and saws. Waste material is to be removed from basement level to outside in an enclosed skip via an electric conveyor belt.

The process is understood to proceed in stages following the process below:

- Excavate an area
- Built 18mm timber formwork for a 350mm concrete based
- Built retaining walls
- Ready mix concrete poured in and vibro-pokered to remove air

This will be repeated in stages until the basement is completed, at which stage the steelwork to support the ground floor slab will be constructed prior to the ground floor slab being poured.

5.1.3 Construction of new building

Following the completion of the basement excavation, the new building will be constructed using traditional methods, with the envelope and roof completed prior to starting works on the inside. At the end of the works, the new terrace garden to the rear will be landscaped prior to handover.

5.2 On-Site Mitigation Measures

Methods will be employed to mitigate against the impact of noise on neighbouring properties and complete the works in as little time as possible. The proposed methods used are described as follows:

- Sections of the existing concrete oversite will be removed using concrete breakers

- The underlying material will be removed by hand digging

- Material will be moved to a skip located outside the front of the building by means of an electric conveyor

- All external plant, tools, conveyor will be housed within the site hoarding area
- If hard material such as rock or concrete is encountered then concrete breakers are used for a limited time
- At all other times hand digging is used. After the excavation phase, a concrete mixer will be located inside the building and concrete poured to stabilise that section of the works
- Prior to the building being re-constructed, an area should be constructed that is enclosed in weatherproof ply or similar for the cutting of materials, mixing of concrete and other obviously noisier works.

5.3 Predicted noise levels

Calculations have been undertaken to determine the likely worst case noise emissions at the most affected neighbours, 37 Pilgrim's Lane and 47 Denning Road. As all works are to be undertaken during daytime hours, the assessment has been undertaken to ground floor rooms, which will benefit from screening from site hoarding and screening provided by the garden wall to the rear of the garden to 47 Denning Road. It is acknowledged that first and second floor windows will have a line of site to the works and hence noise levels will be higher.

These calculations are summarised in Appendix B of this report.

The 'on time' for activities has been assessed as between one hour and ten hours of continuous unbroken operation of plant at their noisiest condition depending on the typical plant usage. Calculations have been undertaken assuming the works will be carried out in the middle of the site, whilst acknowledging that at times they will be nearer and at other farther from the receivers and so the noise levels will vary to a degree.

Source noise levels have been taken from manufacturers' data for indicative plant or listings in BS5228-Part 1: 2009 *Code of practice for noise and vibration control on construction and open sites: Noise*.

The following table summarises the predicted noise levels.

Works	Activity $L_{Aeq(10h)}$
Erection of scaffolding	76 dB
Breaking out brickwork in building	65 dB
Excavator breaking out slab	74 dB
Basement excavations	68 dB
Concrete pumping for slabs	75 dB
Concrete and steel works	63 dB
Envelope works	67 dB
Internal fitout	62 dB
Landscaping/external works	70 dB

Table 5.1 – Predicted sound pressure levels at most affected receptors

There are some activities that have the potential to cause noise levels that are higher than desirable, namely:

- Erection of scaffolding
- Excavator breaking out slab
- Concrete pumping
- Landscaping

Many of these works are likely to be short in duration, and hence would have a potentially lower impact than if they were running over a longer period.

To mitigate noise, it is recommended that breaking out of the slab is undertaken as quickly as possible, at a time agreed with the immediate neighbours prior to the works. Consideration should be made of limiting these works to ‘high noise hours’ between 09:00 - 12:00 hours and 13:00 - 16:00 hours, although these can be amended through liaison with the neighbours to fit best with their lifestyles and schedules.

For other activities, the greatest noise levels are expected to be generated by moving tools and materials around the site, hammering, carrying suppliers and waste through into and out of the building.

Excavation works will be by hand and will generate limited noise. Loading broken concrete into a completely empty skip should be avoided by providing a cushioning layer (sub-soil) before loading concrete. The use of radios outside the building will not be permitted.

Grinding of steel and drilling into the structure are expected to be audible during the internal fitout, with instantaneous noises being in the mid-70dBs but average noise levels being in the mid to low 60dBs. No grinding or cutting of steel should take place outside of the building and these works should be limited to the high impact noise hours.

It is assumed that concrete pumps will be used for the pouring of the foundations and slab, but again this will be a relatively short term activity. If possible, the pump should be enclosed with Heras acoustic barriers, or similar during the pumping to help mitigate noise from the unit.

During landscaping, the majority of noise would be from the cutting of wood or paving. These activities should be undertaken within the cutting enclosure to help reduce noise from these activities.

In addition to the airborne noise levels calculated above, reradiated noise can be expected to be heard in the dwellings with a shared party wall to 35 Pilgrim’s Lane. This is expected to be significant for the short duration of breaking out of existing concrete and short durations during fixing of new fittings to the building structure.

5.3.2 Traffic/delivery noise

Deliveries and waste removal will be by skip lorry, and a delivery lorry on the public road to the front of the site. These will be arranged and controlled to limit waiting time to no more than a 30 minutes.

While the arrival and loading / off-loading of material on lorries is likely to be slightly higher than the typical traffic on Pilgrim's Lane and Denning Road, the infrequent and short duration nature of this is not expected to have a significant noise impact, although noise levels during deliveries would be above 70dB(A) for short periods at the fronts of the properties.

Drivers will be asked to turn off their engines where possible while loading / off-loading. Care will be taken during loading and off-loading to minimise dropping of material or other unnecessary noises.

It is recommended that site deliveries are controlled to be between 9.30am and 3.00pm from Monday to Friday during term time and between 9.30am and 4.30pm from Monday to Friday during school holidays.

Liaison with all nearby construction sites will be undertaken to avoid traffic congestion.

6. Vibration

Vibration levels are expected to be at their highest during the breaking-out of existing concrete. Based on past experience of vibration measurements from demolition works, heavy breakers typically generate vibration levels of 3mm/s to 5mm/s P.P.V. in structures situated within several metres of the working area. Handheld breakers are expected to generate lower levels. Although the vibration is likely to be perceptible in some areas of the neighbouring properties, the anticipated levels of ground-borne vibration are considered highly unlikely to cause cosmetic damage of structures. It is likely that the levels may give rise to re-radiated noise within the neighbouring residential premises during breaking out works and drilling into the structure. These works are expected to be relatively brief. Liaison with the neighbours prior to breaking out works is recommended to inform them of the possibility of tactile vibration.

The ground floor concrete slab should be cut and separated around the perimeter prior to breaking out the central portion of the slab to minimise noise and vibration transmission into adjacent dwellings.

7. Noise and Vibration Monitoring

Due to the small scale of the site and works, it is unlikely that long-term monitoring will be necessary for these works. Due to the close proximity of the site to neighbours and the limited space available, it is unlikely that a suitable position for semi-permanent monitoring will be available and a large number of false positive events will be logged.

As an alternative, and in the first instance, it is recommended that the site manager will be provided with a shop-bought digital sound level meter and given instruction on correct operation. The site manager will take noise measurements prior to and during noisy works, with records kept. This will provide opportunities to optimise mitigation for works and minimise noise break-out from site, thereby reducing noise levels as far as practicable.

Should measured noise levels be significantly higher than predicted, it may be necessary to employ an acoustician to attend site to undertake detailed measurements and provide practical advice on options to reduce noise levels.

Where any complaint is received, the contractor will incorporate 2hr on/off respite periods subject to the agreement of the receptor party. In addition, the proximate receptors/neighbours will be advised at each stage of construction if any particular action is likely to incur noise, dust or vibration nuisance of any kind.

8. General Mitigation and Management

The following key factors have been identified as determining the degree and type of mitigation required.

8.1 Liaison with Residents

The importance of maintaining good relations and communication channels between the Client, contractor and neighbours is considered to be a critical issue. In conjunction with effective communication of site activities and scheduling, liaison with local residents is essential in cultivating a positive attitude in the surrounding community.

Prior to, and throughout, the works, liaison with nearby residents will be one of the key elements for minimising potential impacts.

It is recommended that the Client/Contractor engages with representatives of occupants of the nearby properties at the planning stage to discuss the upcoming works and identify any mutually agreeable periods for ‘noisy works’, should the proposed working hours generally recommended by Camden be not suitable for their requirements.

The periods when high impact works are scheduled should have consideration for the neighbours’ use of their properties, such as days when occupants work from home and scheduled special events such as parties, wakes, etc.

At the early stage, contact details should be provided, along with details of the works, likely durations of each stage of the works, and prior warning for any particularly noisy works anticipated.

During works, a dedicated telephone number and designated staff contact should be made available to respond to any complaints or queries, with a messaging service for ‘out of hours’ enquiries. Information on current and forthcoming activities should be made as freely available as possible.

8.2 Duration of Works

It is essential to cultivate an appropriate environment in which exposure to noise and/or vibration arising from the works can be best tolerated from the outset, minimising adverse community reaction.

Communication of information regarding the overall project duration is significant in controlling adverse community reaction.

8.3 Hours of Works

It is understood that the permitted hours for 'noisy works' are restricted to 8am to 6pm Monday to Friday and 8am to 1pm on Saturdays. In addition to the above permitted hours, it is proposed that further restrictions are placed on works deemed to be of 'high impact' in terms of the level of disturbance caused to neighbouring residents and businesses. This is to ensure that nearby occupiers have sufficient breaks from activities that have the potential to be particularly disruptive. The potential 'high impact' works have been identified in the attached calculations summary and are limited to the breakout of the ground floor slab. The permitted hours for 'high impact' works are 9am to 12pm and 2pm to 5:30pm Monday to Friday, although these could be amended with consent from the neighbours and the Council.

These hours should be rigorously observed for any operations which are likely to generate noise levels noticeable by neighbouring residents. In addition, it may be necessary to undertake noisy works on an on/off basis, thereby providing neighbouring residents with some additional respite. Any exceptions deemed essential to the works which need to be authorised by Camden and must also be communicated with the residents.

It should be noted, however, that it is sometimes preferable to extend working hours for a limited period in order to quickly complete essential noisy operations rather than increase their duration, which might cause more annoyance. If this is to be the case, this would be agreed with the neighbours and the Council should be notified in advance.

8.4 Noise Characteristics

Some noisy activities are particularly intrusive due to tonal or impulsive characteristics which tend to draw more attention to their operation. A typical example of this is heavy duty percussive breakers. Awareness of these issues is important in liaison with local residents.

Keeping door and windows closed during the use of breakers would reduce the impact on the neighbours.

9. BS5228:2009

BS 5228: Part 1: 2009 *Code of practice for noise and vibration control on construction and open sites - Part 1: Noise* and BS 5228: Part 2: 2009 *Code of practice for noise and vibration control on* *construction and open sites - Part 2: Vibration* provide information and advice on reducing impact of construction works on neighbouring properties.

Operatives on site should be trained to employ appropriate techniques to keep site noise to a minimum and should be effectively supervised to ensure that best working practice in respect of noise reduction is followed. This is not only to minimise the impact on neighbouring properties but also to safeguard the hearing of site operatives.

All site personnel should:

- Be mindful of neighbours and the impact of noise on their amenity. A good relationship with neighbours from the beginning of a project often reduces the likelihood of complaints;
- Strictly comply with agreed working hours. This includes minimising noise when arriving at site and preparing for the day;
- Ensure the proper use and maintenance of tools and equipment;
- Always select the lowest noise tools available for the job;
- Turn off machinery when not in use;
- Position machinery and activities on site to reduce the emission of noise to the neighbourhood and to site personnel. Generally, tools should be positioned far from neighbours and in areas where they are hidden from neighbouring windows by walls or site hoarding;
- Avoid unnecessary noise when carrying out manual operations and when operating plant and equipment;
- Understand that sound with characters such as whining, clanging or screeching as well as sudden sounds such as from hammering have a greater impact on neighbours than continuous, un-identifiable sounds;
- Where equipment is likely to cause disturbance to neighbours, this should only be used during agreed “noisy working hours” and / or a temporary structure should be erected around the machine;
- Use hearing protection when working in noisy environments.

9.1 Contractor’s Obligations

In addition to the above, the following general conduct should be adopted by the contractor, where practical, in order to minimise and manage noise and vibration impacts at neighbouring properties;

- Erect good quality imperforate hoarding or temporary mass barrier sheeting, such as Echo Barrier (or similar), fixed to Heras fencing, or similar, around any openings made in the facades to the maximum practicable height, allowing for stability, wind loading, etc.;

- At all times and subject to availability, select and use the quietest plant, machinery and vehicles appropriate for the task being undertaken. All vehicles and mechanical plant used for the purpose of the works will be fitted with effective exhaust silencers, maintained in good and efficient working order and operated in such a manner as to minimise noise emissions;

- Employ at all times the Best Practicable Means (BPM), as defined in Section 72 of the Control of Pollution Act 1974, to reduce noise (including vibration) to a minimum, with reference to the general principles contained in British Standard BS5228 (see above);

- Facilitate an early community involvement exercise with neighbours to establish and agree protected areas of their properties and then to continually update progress and forewarn of forthcoming scheduled noisy works. A member of onsite staff should be designated as community relations manager to maintain good communications with neighbours;

- Adopt and adhere to agreed 'on' and 'off' times for noisy works and/or vibration sources, if required to do so by the Council;

- If deemed necessary, undertake or employ an independent third party to undertake noise, vibration and dust monitoring at locations to be agreed with the Local Authority, with pre-set 'amber' and 'red' trigger levels and text message alerts to notify when and where they are exceeded. The Contractor should commit to stop work immediately if a 'red' alert is received and to investigate. Working procedures may then need to be reviewed and modified to prevent re-occurrence. Records of monitor data should be compiled and reported weekly to all relevant parties. The extent of monitoring required can be continually assessed and amended as found necessary or desirable;

- It may be appropriate to undertake some test works prior to the commencement of the project to demonstrate the likely levels of vibration in the neighbouring properties. Depending on the outcome of the exercise, alternative plant or adjustments to the working programme may need to be considered;

- Operate a 'considerate builder' type scheme in which a commitment is made, amongst others, to undertake proper maintenance of equipment and control use of radios on site, with due consideration to proximity of neighbours, and ensure that equipment is turned off when not in use.

10. Conclusion

Small scale demolition, excavation and construction works are proposed at 35 Pilgrim's Lane, Camden.

A baseline noise survey has been undertaken by Venta Acoustics to establish the pre-existing noise climate in the locality.

The proposed works have been reviewed and predicted noise emissions calculated. These indicate that noise levels will generally be below $L_{Aeq,10hr}$ 70dB except for short durations of the demolition works, concrete pumping and deliveries.

Outline mitigation and Best Practical Means measures have been provided for the site as well as an overview of the recommendations of BS5228:2009 to assist in the training of site personnel.

Jamie Duncan MIOA

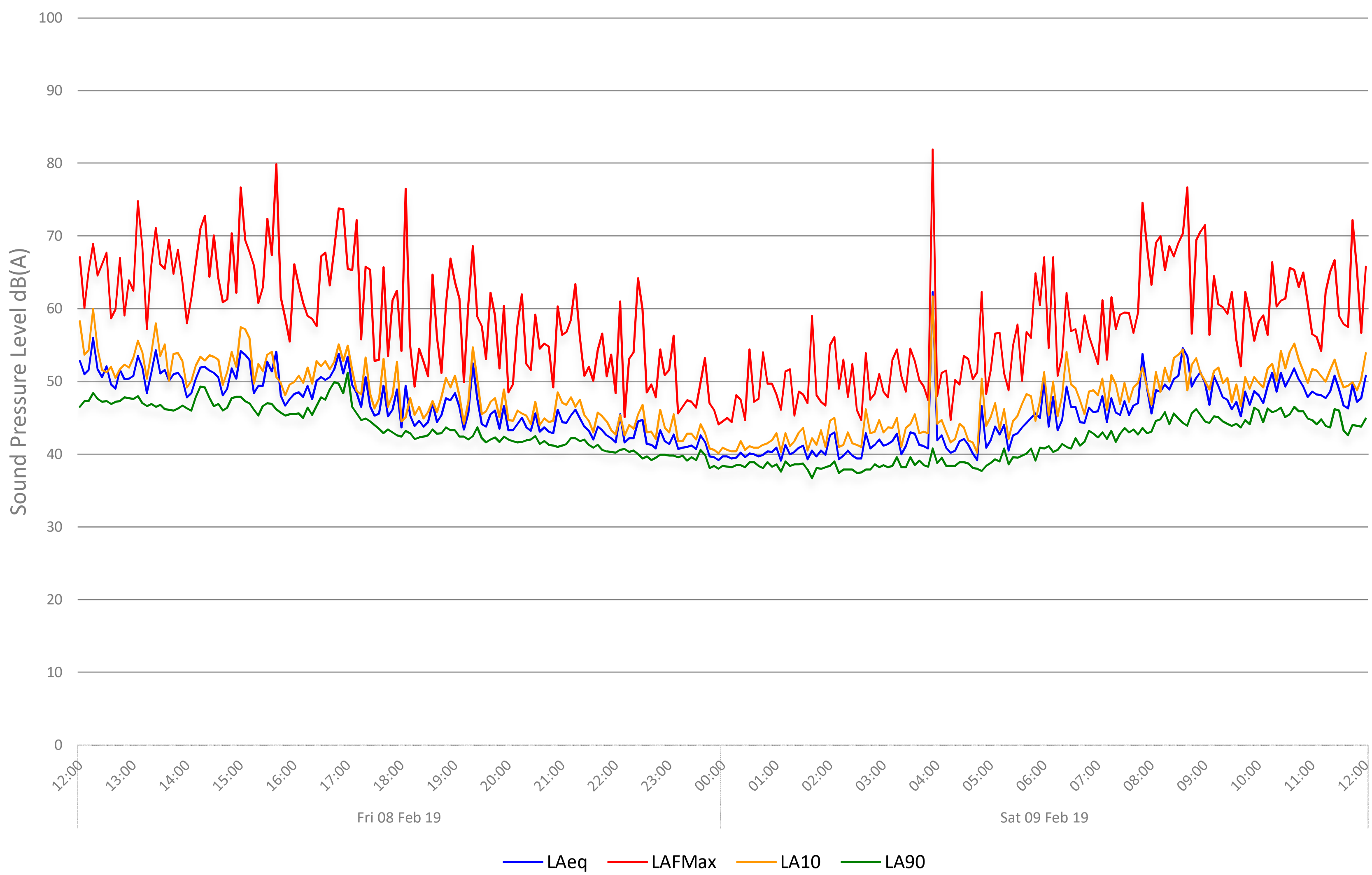

Noise monitoring location
Most Affected Receivers
© 2018 Google
Google Earth

35 Pilgrim's Lane, London

Environmental Noise Time History: 1

Venta Acoustics

Figure VA2594/TH1

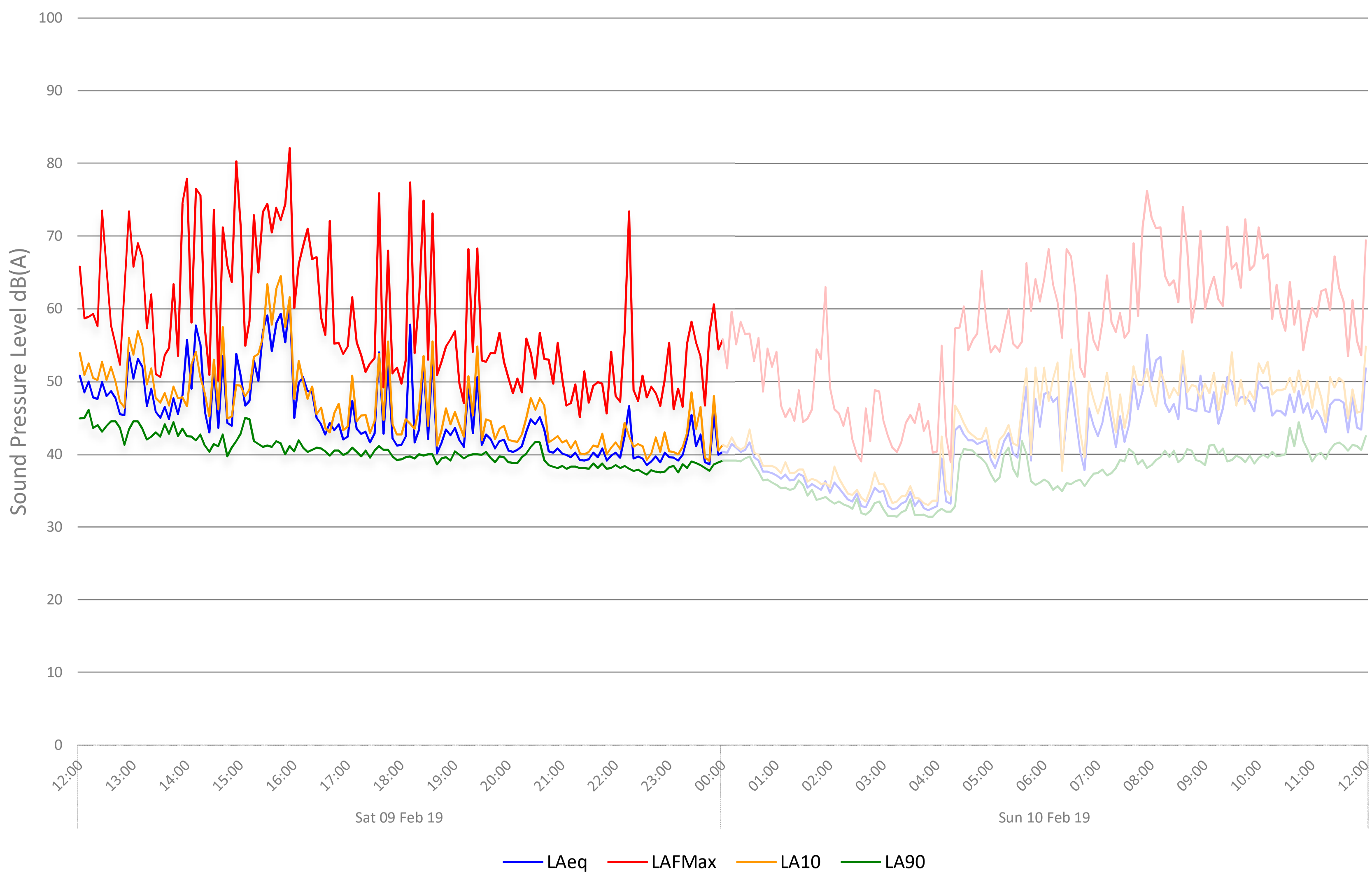


35 Pilgrim's Lane, London

Environmental Noise Time History: 2

Venta Acoustics

Figure VA2594/TH2

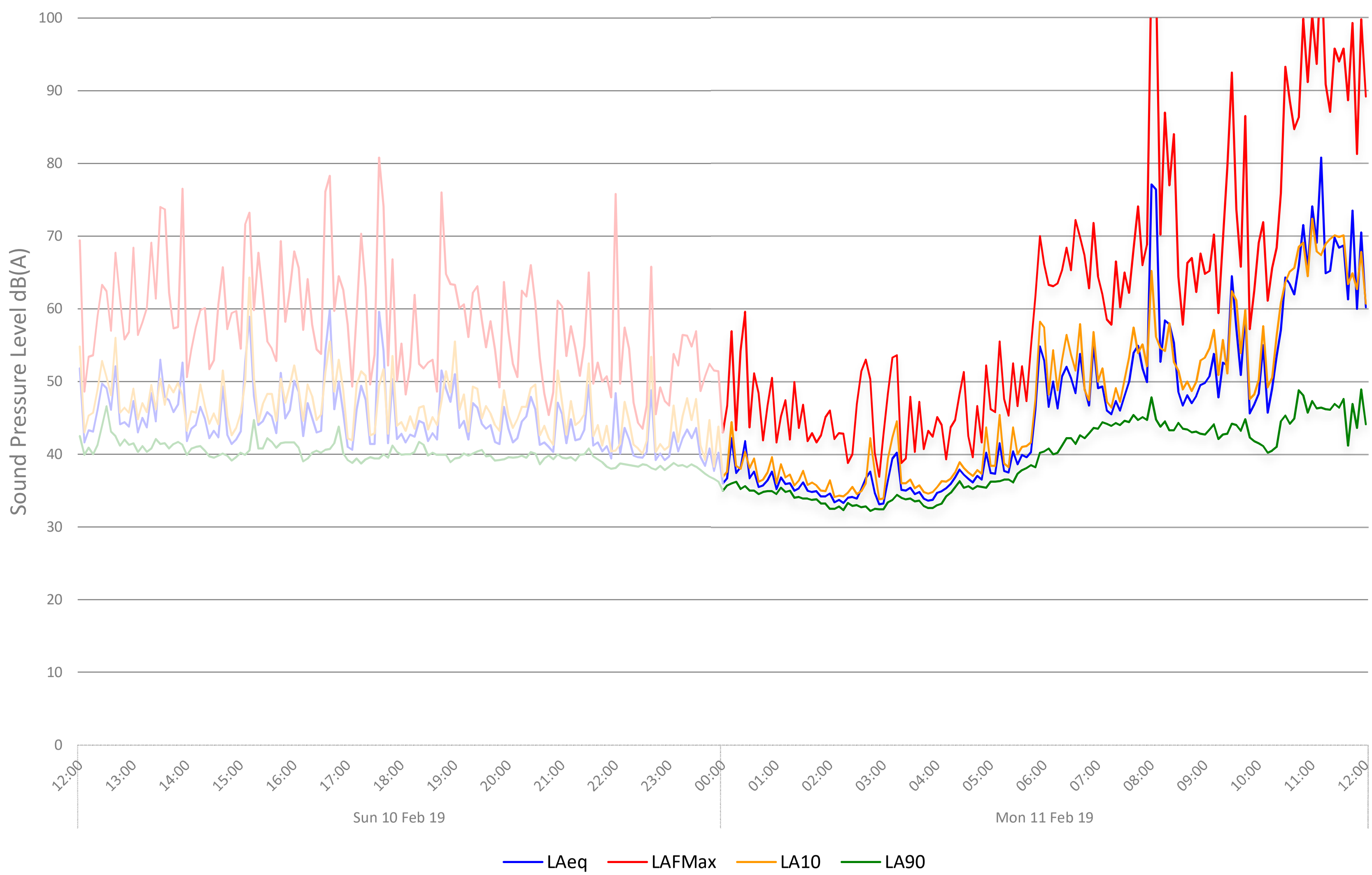


35 Pilgrim's Lane, London

Environmental Noise Time History: 3

Venta Acoustics

Figure VA2594/TH3



1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

APPENDIX B

VA2594 - 35 Pilgrim's Lane, London

Assessment to neighbouring properties

Plant type	Sound Pressure Level $L_{Aeq,T}$ dB	Adjustments: Distance to Receptor m	Adjustments: Screening dB	Adjustments: Reflection dB	Adjustments: % on time (Ref 10h) %	Adjustments: Number of plant	Noise Level at Receptor $L_{Aeq,T}$ dB	Activity $L_{Aeq(10h)}$ dB	High Impact?
Demolition									
Erection of Scaffolding	80dB @10m	5	0	0	10	1	86	76	YES
							Cumulative $L_{Aeq(10h)}$ Level	**76**	YES
Makita HM 1213C SDS Max Demolition Hammer	67dB @10m	10	-10	0	25	2	60	54	
Loading dumper	85dB @10m	10	-10	0	5	1	75	62	
AVT Breaker Makita HM 1810	76dB @10m	10	-10	0	25	1	66	60	
							Cumulative $L_{Aeq(10h)}$ Level	**65**	
Excavator Breaker - floor slab/foundations	83dB @10m	10	-5	0	40	1	78	74	YES
							Cumulative $L_{Aeq(10h)}$ Level	**74**	YES
Excavations/Underpinning/In Ground Concrete Works									
Cordless Drill/Screwdriver	67dB @10m	10	-10	0	10	2	60	50	
Makita HM 1213C SDS Max Demolition Hammer	67dB @10m	10	-10	0	25	2	60	54	
Electric wood saw (cutting formwork)	81dB @10m	10	-10	0	10	1	71	61	
Hammering	79dB @10m	10	-10	0	5	2	72	59	
Concrete Mixer	76dB @10m	10	-10	0	50	1	66	63	
Grinder	87dB @10m	10	-10	0	5	1	77	64	
							Cumulative $L_{Aeq(10h)}$ Level	**68**	
Concrete pump	78dB @10m	10	0	0	50	1	78	75	YES
							Cumulative $L_{Aeq(10h)}$ Level	**75**	YES

Plant type	Sound Pressure Level $L_{Aeq,T}$ dB	Adjustments: Distance to Receptor m	Screening dB	Reflection dB	% on time (Ref 10h) %	Number of plant	Noise Level at Receptor $L_{Aeq,T}$ dB	Activity $L_{Aeq(10h)}$ dB	High Impact?
Concrete and Steel Works									
Cordless Drill/Screwdriver	67dB @10m	10	-10	0	10	2	60	50	
Electric wood saw (cutting formwork)	81dB @10m	10	-10	0	10	1	71	61	
Hammering	79dB @10m	10	-10	0	5	2	72	59	
Concrete Mixer	76dB @10m	10	-10	0	50	1	66	63	
Grinder	87dB @10m	10	-10	0	5	1	77	64	
							Cumulative $L_{Aeq(10h)}$ Level	**63**	
Concrete pump	78dB @10m	10	0	0	50	1	78	75	YES
							Cumulative $L_{Aeq(10h)}$ Level	**75**	YES
Envelope Works									
Paslode Nail Gun	73dB @10m	10	-10	0	2	2	66	49	
Hammering	79dB @10m	10	-10	0	5	2	72	59	
Electric wood saw	81dB @10m	10	-10	0	10	1	71	61	
Cordless Drill/Screwdriver	67dB @10m	10	-10	0	10	2	60	50	
Concrete Mixer	76dB @10m	10	-10	0	50	1	66	63	
Hammer Drill	70dB @10m	10	-10	0	20	1	60	53	
							Cumulative $L_{Aeq(10h)}$ Level	**67**	
Internal Fitout									
Paslode Nail Gun	73dB @10m	10	-15	0	10	2	61	51	
Hammering	79dB @10m	10	-15	0	20	2	67	60	
Electric wood saw	81dB @10m	10	-15	0	10	1	66	56	
Hilti Cordless Drill/Screwdriver	67dB @10m	10	-15	0	20	3	57	50	
Electric Saw	78dB @10m	10	-15	0	5	1	63	50	
							Cumulative $L_{Aeq(10h)}$ Level	**62**	
Landscaping and External Works									
Hand held petrol circular saw cutting paving	91dB @10m	10	-15	0	25	1	76	70	
Electric wood saw	81dB @10m	10	-15	0	25	1	66	60	
							Cumulative $L_{Aeq(10h)}$ Level	**70**	YES