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# 6 SUMATRA ROAD, LONDON

## Noise, Vibration and Dust Management Plan

Report 16558.NVDMP.01

Prepared on 16 October 2017

For

**6 Sumatra Road**

**London**

**NW6 1PU**

# Contents



**List of Attachments**

# 1.0 INTRODUCTION

KP Acoustics has been commissioned by Nick and Suzie Carter, 6 Sumatra Road, London, NW6 1PU, to compile a noise and vibration management plan for the project at 6 Sumatra Road, London, NW6 1PU.

This report presents all information gathered from relevant documentation and the steps which should be adopted regarding noise, vibration and dust, in order to maintain the amenity of all sensitive receivers adjacent to the site.

# 2.0 ENVIRONMENTAL NOISE SURVEY

## 2.1 Procedure

A baseline noise and vibration survey was undertaken on site as shown in in Site Plan 16558.SP1. The choice of the position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receivers relative to the proposed construction site. The duration of the survey was between 12:30 on 13 October and 07:00 on 15 October 2017.

Initial inspection of the site revealed that the background noise profile at the monitoring location was dominated by road traffic noise from the surrounding roads.

The weather during the course of the survey was generally dry with wind speeds within acceptable tolerances and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2007 Acoustics "*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*".

## 2.2 Equipment

The equipment calibration was verified before and after the survey and no calibration irregularities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 958A Class 1 Sound and Vibration Level Meter
- 1 No. Dytran Tri-axial accelerometers, Type 3233A
- B&K Type 4231 Class 1 Calibrator

### 2.3 Noise Results

The results of the background noise monitoring from 13TH October To 15th October, before on-site operations started, are shown in Figure 16558.NTH1. The graph shows the measured $L_{Aeq}$, $L_{Amax}$, $L_{A10}$ and $L_{A90}$ averaged over 5 minute sample periods.

The average daytime ambient noise level ($L_{Aeq}$) during daytime and night-time are shown in Table 2.1.

| | **Average background noise level $L_{Aeq}$ dB(A)** |
|---|---|
| Daytime (07:00-23:00) | 49 |
| Night-time (23:00-07:00) | 41 |

**Table 2.1: Minimum measured background noise levels**

### 2.4 Vibration Results

The maximum daily vibration levels (Peak Particle Velocity) measured over the baseline monitoring period are shown in Figure 16558.VTH1.

## 3.0 NOISE, VIBRATION AND DUST ELEMENTS

### 3.1 Noise

The site is a terraced building and therefore adjoins and is structurally linked to the properties on either side, which are as follows:

- Flat A, 4 Sumatra Road
- Flat B, 4 Sumatra Road
- Flat C, 4 Sumatra Road
- 8 Sumatra Road

The effects of noise on all neighbouring premises can be varied and complicated. In extreme cases they would be likely to include a sensation of loudness, potential interference with speech communication, disturbance of work or leisure, and disturbance of sleep. A complicating factor is that, in any neighbourhood, some individuals will be more sensitive to noise than others.

In order to assess instantaneous noise levels at any time, the instantaneous A-weighted sound pressure level, $L_{pA}$ can be used. This will give an indication of the loudness and degree of speech interference from noise.

The most commonly used descriptor, however, is the equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$. The time period involved should always be stated as the figure is a mathematical average of the all individual contributions of various sources during the reference period T. When assessing noise from individual events that may not always be present during a longer period $L_{Aeq}$, it can be useful to use a short reference period (e.g. 5min). As an alternative descriptor, the maximum sound pressure level, $L_{A(max)}$,or the one percentile level, $L_{A01}$, may be used.

With regards to noise levels, it is proposed that the absolute limit would be determined in accordance with The London Borough of Camden of 75dB $L_{Aeq, 10\ hour}$.

Note that guidance from The London Borough of Camden states the following:

- Noise levels from all sites should aim to be within a daily level of 75 dB ($L_{Aeq, 10hr}$) for airborne noise at the nearest occupied premises/site boundary
- A first Action Level Trigger of 78 dB ($L_{Aeq, 1hr}$) should be used

## 3.2 Vibration

The assessment of sensitivity to vibration at different times of the day is far more complex than sensitivity to noise. The sensitivity of the human frame to vibration varies according to the axis of vibration relative to the human body (e.g. x, y or z axis) and to the frequency of vibration. In general, except at very low frequencies, sensitivity is greater in the z axis (i.e. head to foot). When setting vibration control targets it is reasonable to assume that people will normally be sitting or standing during the day and lying down during the night.

With an impulsive source of vibration, it is usual to measure the peak value attained from the beginning to the end of a drive. It is also usual to measure in terms of peak particle velocity (P.P.V) if the risk of damage to the building is the primary concern and there is also an interest in human reaction. If the concern is purely for human tolerance, then acceleration is the preferred parameter.

Vibrations, even of very low magnitude, may be perceptible to people and can interfere with the satisfactory conduct of certain delicate activities, e.g. operating theatres, use of very sensitive laboratory weighing equipment etc.

Nuisance from vibration is frequently associated with the assumption that, if vibrations can be felt, then damage is consequently inevitable; however, considerably greater levels of vibration are required to cause damage to buildings and structures than to be perceived by the human body.

Vibrations from site activities to the neighbourhood may therefore cause anxiety as well as annoyance and can disturb sleep, work or leisure activities. As with noise, in any neighbourhood, some individuals will be more sensitive to vibration than others.

### 3.3 Dust

Dust from construction and demolition sites can have a negative effect on the amenity of neighbouring residents. As with noise and vibration, dust and other pollutants can have a range of effects, the severity of which can vary depending upon the on the recipient as referenced in the IAQM "*Guidance on the assessment of dust from demolition and construction*".

As such, it is important that a number of mitigation measures are applied in order to minimise dust emissions from the site, in accordance with the Mayor's SPG for Control of Dust and Emissions during Construction and Demolition. Furthermore, regular monitoring may be required in order to ensure that dust levels pose no threat to the amenity of nearby recipients.

## 4.0 CRITERIA FOR NOISE & VIBRATION

The following factors are typically used to assess the likelihood of disturbance caused by noise and vibration generating activities:

*Site location*

The relative location of a site in relation to noise or vibration sensitive receivers will be a determining factor. The closer a site is to sensitive premises, the higher the likelihood of complaints due to noise and vibration emanating from the site.

*Duration of site operations*

In general, the longer the duration of all on-site operations, the more likely it is that noise or vibration from the site will potentially be an issue. In this respect, good public relations are very important. Local residents may be willing to accept a new status of noise and vibration if they know and understand the source and the duration of all operations. It is then important that site operations are carried out according to a stated schedule.

*Hours of work*

For any noise sensitive premises some periods of the day will be more sensitive than others. For example levels of noise that would be intruding within a dwelling during the day would not be an issue during the night. For dwellings, times of site operation outside normal weekday working hours will need special consideration.

Noise control targets for the evening period in such cases will need to be stricter than those for the daytime and, when noise limits are set, the evening limit may have to be as low as 10 dB(A) below the daytime limit. Very strict noise control targets should be applied to any site which is to operate at night.

*Attitude to the site operator*

It is well established that "one's music is somebody else's noise" and vice-versa. People's attitudes to noise are always influenced by their attitudes to the noise source itself.

Noise and vibration generated from a site will tend to be accepted more willingly by local residents if they consider that the site operator is adopting best practicable means to avoid unnecessary noise.

*Noise and vibration characteristics*

In many cases the particular identity of noise and vibration will affect people's judgement and appreciation of the signal itself. For example, the presence of a high-amplitude impulsive noise, accompanied by a vibration sensation would render the overall assessment slightly more onerous as "penalties" would need to be employed. These would comprise weightings to signals (e.g. 5dB(A) to a highly tonal or intermittent noise source).

## 5.0 NOISE, VIBRATION & DUST MANAGEMENT PLAN

Deviation from approved method statements will be permitted only with prior approval from relevant parties. This will be facilitated by formal review before any deviation is undertaken.

**Site Personnel**

All operatives on site will be trained to ensure that noise minimisation and best practicable means (BPM) are implemented at all times. Works will be checked regularly by Site Engineers to ensure that BPM are being undertaken and where necessary corrective actions implemented.

Employees must show consideration to the sensitive receptors, including residential neighbours, and must not generate unnecessary noise when walking to and from the site, or when leaving and arriving at work.

**General Noise and Vibration Control Measures**

The Best Practicable Means (BPM) (as defined in Section 72 of the Control of Pollution Act 1974) will be used to reduce noise and vibration levels at all times. Where practicable the control measures set out in BS 5228:2009 + A1:2014 Part 1, Section 8 will also be implemented.

**Recommended noise and vibration control measures include:**

- Choice of methodology/technique for operations (including site layout) will be considered in order to eliminate or reduce emissions at sensitive locations
- Fixed items of construction plant will be electrically powered in preference to diesel or petrol driven
- If any specialise fabrication is required, this will be undertaken off-site if possible
- Noisy plant will be kept as far away as possible from sensitive areas

- Each item of plant used will comply with the noise limits quoted in the relevant European Commission Directive 2000/14/EC/United Kingdom Statutory Instrument (SI) 2001/1701 [3] where reasonably available
- Equipment will be well-maintained and will be used in the mode of operation that minimises noise and shut down when not in use
- Vehicles shall not wait or queue on the public highway with engines running (unless the engine is required to power the operation of the vehicle e.g. concrete wagon)
- Where possible deliveries will be arranged on a just-in-time basis in order to prevent vehicles queuing outside site.
- All materials will be handled in a manner that minimises noise
- Moveable acoustic screens used for any handheld tools used externally

**Recommended dust control measures include:**

General advice for all construction and demolition sites, as recommended within the Mayor's SPG for Control of Dust and Emissions during Construction and Demolition include the following:

- Dust generated by the construction process will be suppressed via a fine directional spray jet of water aimed at the source, and any material to be transported to be wetted down prior to transit.
- Skips and powder containers to be covered when not in use
- Cutting equipment to be used with water suppressant and/or suitable extract system
- No burning of waste wood or other materials on site
- The stockpiling of dust generating materials on site will be minimised
- Wet brushing techniques will be used for cleaning
- Regular checks for visual observation of dust and soiling within 50m of site
- Screening to be erected surrounding site boundaries where possible

Regular monitoring may be necessary during the construction operations on site, in order to ensure that measured pollutants do not exceed safe levels, in positions agreed with the Local Authority. Furthermore, according to IAQM guidelines, it would be necessary to inspect the area in the local vicinity of the construction works to ensure that surfaces are not soiled by dust emissions from the site, with suitable cleaning offered if necessary. In order to minimise this, it would be recommended that screens are erected around the site boundaries as appropriate.

## 6.0 NOISE ASSESSMENT

Overview of the programme is assumed to be as follows. It should be noted that at this stage a contractor has not yet been appointed to this is subject to change.

1. Site set-up - 1 week
2. Basement construction - 28 weeks
    a. Initial underpins - 12 weeks
    b. Structural steelwork - 1 weeks
    c. Basement ground slab and drainage - 3 weeks
    d. Waterproofing - 4 weeks

Typical noise data has been sourced from the relevant manufacturers where possible, and levels stated in BS5228 have been used where no manufacturer's data is available.

| Activity | Start date | End date | Predicted Daily Airborne Noise Level, dB $L_{Aeq,10h}$ (at the nearest sensitive facade) |
|---|---|---|---|
| Site set up | 2 Nov 2017 | 7 Nov 2017 | 73 |
| Initial Underpinning | 6 Nov 2017 | 16 Feb 2018 | 75 |
| Structural Steelwork | 13 Dec 2017 | 20 Dec 2017 | 70 |
| Basement and ground floor slab drainage | 17 Feb 2018 | 12 Mar 2018 | 72 |
| Internal waterproofing to basement | 17 Mar 2018 | 17 Apr 2018 | 63 |

**Table 5.1: Predicted noise levels of site operations**

Note that all calculations as shown above and in Appendix B have been calculated using the method stipulated in BS5228. All resultant noise levels have been calculated taking into account the operating hours of the activity/operation/machinery in reference to a 10 hour working day.
As shown in Appendix B and Table 5.1, transmission of noise to the nearest residential windows due to the works on site would meet the noise emissions criterion outlined in BS5228.

As a proactive approach to controlling noisy site operations, it would be recommended that noise monitoring is undertaken throughout the piling to alert site staff when noise emissions criteria are being approached in order to reduce operations accordingly.

## 7.0 VIBRATION ASSESSMENT

This section presents an assessment of the potential risk regarding vibration generated by the construction works detailed in this document, and the associated adverse effects on the surrounding area.

**Guidance Vibration Limits**

Estimated vibration levels have been evaluated against guidance presented in relevant British Standards in order to assess the likelihood of both structural damage to neighbouring buildings and the human response of the occupants.

**Building Damage**

According to BS 7385 Part 2 for residential or light commercial buildings, the threshold for the onset of potential cosmetic damage (i.e. formation of hairline cracks on drywall surfaces or the growth of existing cracks in plaster or drywall surfaces) to buildings varies with frequency. This ranges from a PPV of 15 mm/s at 4Hz, rising to 20mm/s at 15 Hz, and to 50 mm/s at and above 40Hz for transient vibration. BS 7385: Part 2 also states that the probability of building damage tends towards zero at 12.5 mm/s peak component particle velocity.

| Line (see Figure 6.1) | Type of Building | Peak component particle velocity in frequency range of predominant pulse | |
|---|---|---|---|
| | | 4Hz to 15Hz | 15Hz and above |
| 1 | Reinforced or framed structures. Industrial and heavy commercial buildings | 50mm/s at 4Hz and above | |
| 2 | Unreinforced or light framed structures. Residential or light commercial type buildings | 15mm/s at 4Hz increasing to 20mm/s at 15Hz | 20mm/s at 15Hz increasing to 50mm/s at 40Hz and above |
| Note 1: Values referred to are at the base of the building | | | |
| Note 2: For Line 2, at frequencies below 4Hz, a maximum displacement of 0.6mm (zero to peak) should not be exceeded | | | |

**Table 6.1: Transient Vibration Guide Values for Cosmetic Damage (from BS 7385: Part 2:1993)**

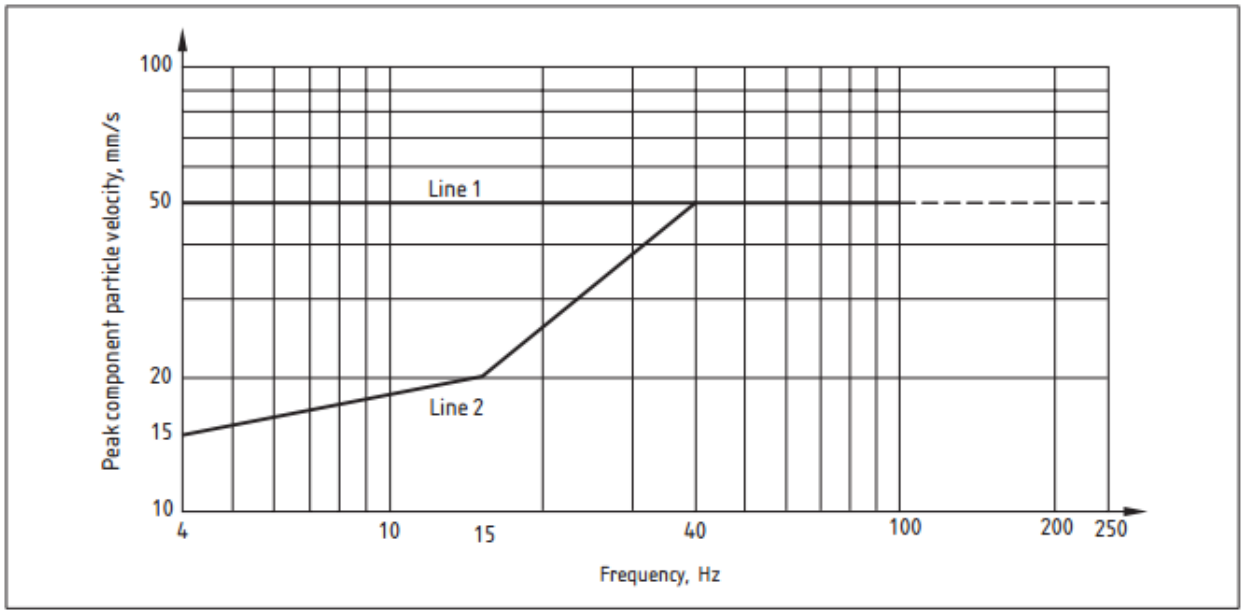


**Figure 6.1: Summary of Damage Thresholds for Transient Vibration on Domestic Structures**

**Subjective Response**

According to guidance provided in BS 5228 Part 2 , the threshold of vibration perceptible to humans lies around 0.14 to 0.3 mm/s. The Standard also indicates that a PPVs of around 1 mm/s in residential environments, as a first estimate, are likely to cause complaints, but can be tolerable provided prior warning and explanation of the works is given to residents; whilst, vibration magnitudes of around 10 mm/s are likely to be intolerable for more than a very brief exposure to this level.

Based on Local Authority requirements, vibration criteria are outlined below:

- 3mm/s p.p.v. Stop and review works and methodology; reduce work periods before recommencement.
- 5mm/s p.p.v. Stop works, review incident, look at work programme, and agree with Noise & Nuisance Team on a revised methodology where available before recommencing work.

## 8.0 CONCLUSION

KP Acoustics has been commissioned to undertake an assessment of noise levels from all site operations at 6 Sumatra Road, London, NW6 1PU, in order to provide initial advice on the control of noise, vibration and dust on site.

Information on good practice steps have been provided, while a realistic approach has been adopted regarding the maximum noise and vibration levels which should be met on site.

Noise predictions of on-site operations have been calculated as the closest noise sensitive receiver. Predictions indicate that noise levels meet the limits set by the London Borough of Camden. Note that due to the nature on construction noise, levels could rise above the

threshold stipulated in BS5228, and therefore continuous noise monitoring will be undertaken to ensure operational periods of site activity are controlled.

Guidelines provided within this report are provided to ensure that any disturbance caused by noise or vibration will be minimised as much as is practically possible.

**Report by**

**Daniel Green AMIOA**

**KP Acoustics Ltd.**

**Checked by**

**Kyriakos Papanagiotou MIOA**

**KP Acoustics Ltd.**

Noise & Vibration Survey Monitoring Position

**Title:**

Indicative site plan showing noise & vibration monitoring position **(Ref: Google Earth)**

**Date:** 16 October 2017

**FIGURE 16558.SP1**

KP acoustics

6 Sumatra Road, London
Environmental Noise Time History
13th October to 15th October 2017

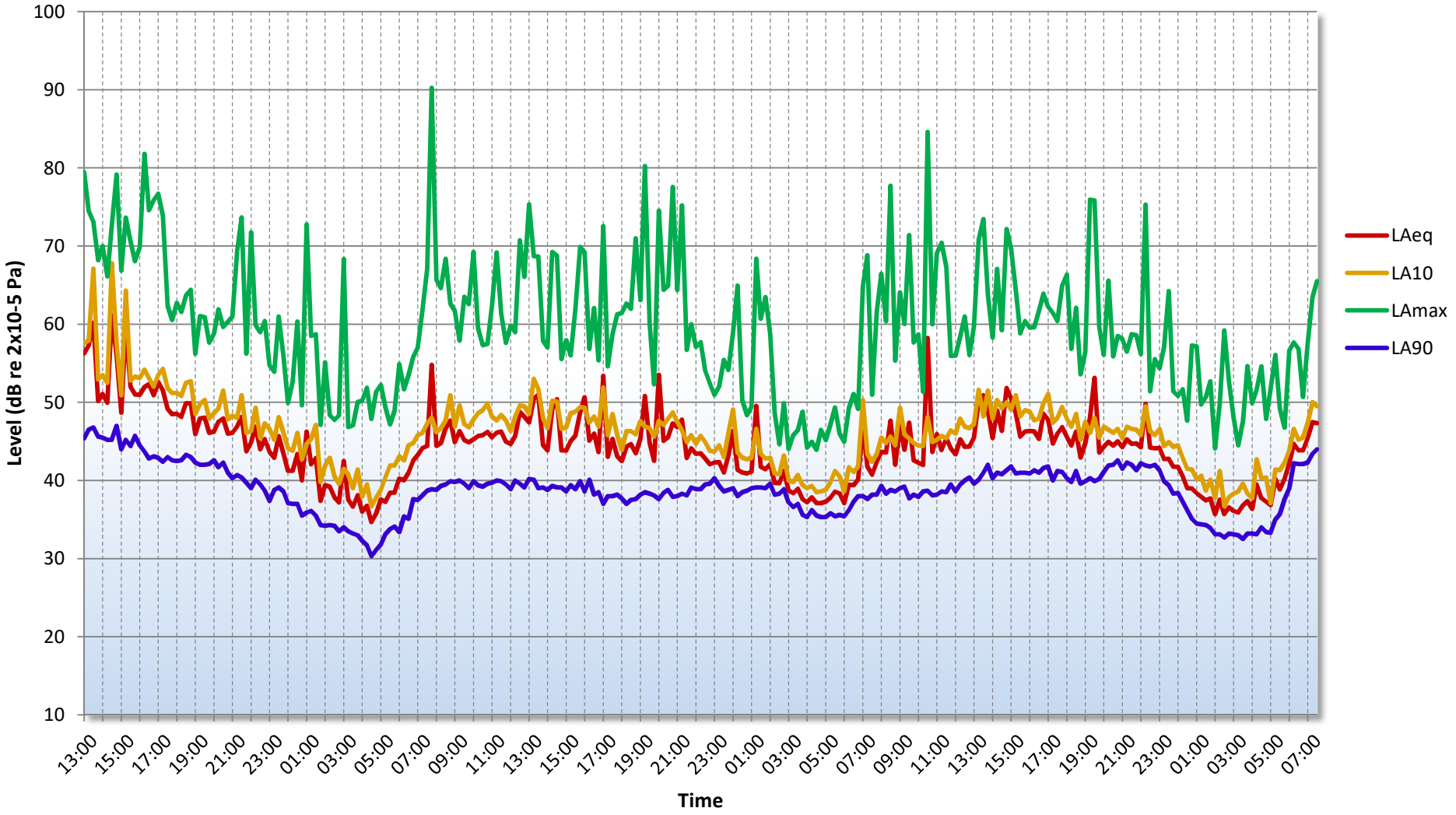


Figure 16558.NTH1

6 Sumatra Road, London
Environmental Noise Time History
13th October to 15th October 2017

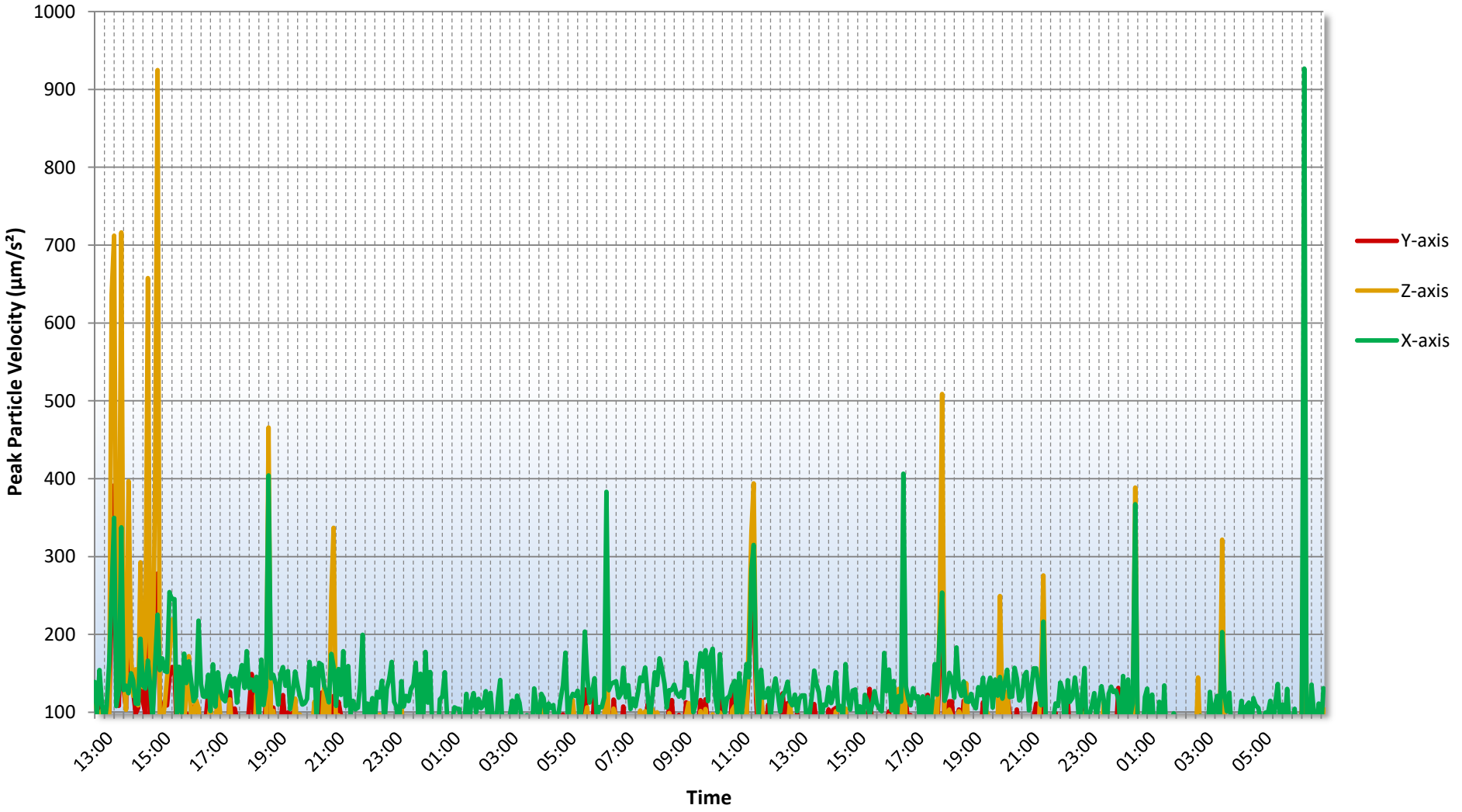


Figure 16558.VTH1

# 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 B

## 6 Sumatra Road, London

### BS5228 CALCULATIONS OF ACTIVITY NOISE

| **Source: Demolition/Construction Site** | *Frequency, Hz* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Receiver: Nearest Noise Sensitive façade | ***63*** | ***125*** | ***250*** | ***500*** | ***1k*** | ***2k*** | ***4k*** | ***8k*** | ***dB(A)*** |
| **Site set-up : Start date 2 Nov 2017, duration 1 week** | | | | | | | | | |
| Cutting timber using circular saw: Makita HS7601J/1 (SPL@10m) | 69 | 75 | 77 | 74 | 71 | 70 | 74 | 69 | |
| Distance correction (min. 3m) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| Correction due to on- time (7hr per day) | -2 | -2 | -2 | -2 | -2 | -2 | -2 | -2 | |
| Attenuation provided by moveable acoustic screen, dB | 0 | -6 | -9 | -10 | -17 | -25 | -28 | -30 | |
| ***Total*** | ***77*** | ***77*** | ***76*** | ***72*** | ***62*** | ***53*** | ***54*** | ***47*** | **72** |
| Delivery vehicle with lifting arm - DAF CF65 FA CF 65.220 Crane Vehicle (SPL@10m) | 83 | 77 | 70 | 70 | 70 | 68 | 64 | 58 | |
| Distance correction (min. 8m) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Correction due to on- time (15 minutes per day) | -16 | -16 | -16 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***69*** | ***63*** | ***56*** | ***56*** | ***56*** | ***54*** | ***50*** | ***44*** | **61** |
| **Predicted Daily Airborne Noise Level, dB $L_{Aeq,10h}$ at the nearest sensitive façade** | **78** | **77** | **76** | **72** | **63** | **57** | **56** | **49** | **73** |
| **Initial Underpinning : Start date 6 Nov 2017, duration 12 weeks** | | | | | | | | | |
| Excavation/breaking ground - Light handheld breaker: Makita HM1203C (SPL@10m) | 83 | 83 | 81 | 74 | 73 | 76 | 78 | 77 | |
| Distance correction (min. 5m) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Correction due to on- time (5hr per day) | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | |
| Attenuation provided by screening from building envelope (interal activity) | -10 | -12 | -14 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***76*** | ***74*** | ***70*** | ***61*** | ***60*** | ***63*** | ***65*** | ***64*** | **71** |
| Breaking out concrete/ brickwork - Medium handheld breaker: Hilti TE1000 (SPL@10m) | 83 | 83 | 81 | 74 | 73 | 76 | 78 | 77 | |
| Distance correction (min. 5m) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Correction due to on- time (7hr per day) | -2 | -2 | -2 | -2 | -2 | -2 | -2 | -2 | |
| Attenuation provided by screening from building envelope (interal activity) | -10 | -12 | -14 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***77*** | ***75*** | ***71*** | ***62*** | ***61*** | ***64*** | ***66*** | ***65*** | **72** |
| Cutting steel reinforcement - 9" grinder, handheld: Makita GA9050/1 (SPL@10m) | 72 | 72 | 69 | 72 | 73 | 72 | 71 | 71 | |
| Distance correction (min. 5m) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Correction due to on- time (30 minutes per day) | -13 | -13 | -13 | -13 | -13 | -13 | -13 | -13 | |
| Attenuation provided by screening from building envelope (interal activity) | -10 | -12 | -14 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***55*** | ***53*** | ***48*** | ***49*** | ***50*** | ***49*** | ***48*** | ***48*** | **56** |
| Cutting timber using circular saw: Makita HS7601J/1 (SPL@10m) | 69 | 75 | 77 | 74 | 71 | 70 | 74 | 69 | |
| Distance correction (min. 5m) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Correction due to on- time (2 hours per day) | -7 | -7 | -7 | -7 | -7 | -7 | -7 | -7 | |
| Attenuation provided by screening from building envelope (interal activity) | -10 | -12 | -14 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***58*** | ***62*** | ***62*** | ***57*** | ***54*** | ***53*** | ***57*** | ***52*** | **63** |
| Conveyor to remove spoil - Easikit Conveyor EK300 (SPL@10m) | 78 | 76 | 62 | 63 | 60 | 59 | 58 | 49 | |
| Distance correction (min. 5m) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Correction due to on- time (6hr per day) | -2 | -2 | -2 | -2 | -2 | -2 | -2 | -2 | |
| Attenuation provided by timber hoarding enclosure | -7 | -8 | -9 | -10 | -11 | -13 | -15 | -16 | |
| ***Total*** | ***75*** | ***72*** | ***57*** | ***57*** | ***53*** | ***50*** | ***47*** | ***37*** | **61** |
| Grab truck to empty skip - DAF CF 410 FAD Grab truck (SPL@10m) | 82 | 84 | 77 | 74 | 70 | 65 | 59 | 55 | |
| Distance correction (min. 8m) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Correction due to on- time (20 minutes per day) | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | |
| ***Total*** | ***69*** | ***71*** | ***64*** | ***61*** | ***57*** | ***52*** | ***46*** | ***42*** | **63** |
| Delivery vehicle with lifting arm - DAF CF65 FA CF 65.220 Crane Vehicle (SPL@10m) | 83 | 77 | 70 | 70 | 70 | 68 | 64 | 58 | |
| Distance correction (min. 8m) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Correction due to on- time (15 minutes per day) | -16 | -16 | -16 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***69*** | ***63*** | ***56*** | ***56*** | ***56*** | ***54*** | ***50*** | ***44*** | **61** |
| **Predicted Daily Airborne Noise Level, dB $L_{Aeq,10h}$ at the nearest sensitive façade** | **81** | **80** | **74** | **68** | **66** | **67** | **69** | **68** | **75** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Structural Steelwork: Start date 13 Dec 2017, duration 1 weel** | | | | | | | | | |
| Breaking out brickwork - Medium handheld breaker: Hilti TE1000 (SPL@10m) | 83 | 83 | 81 | 74 | 73 | 76 | 78 | 77 | |
| Distance correction (min. 5m) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Correction due to on- time (3hr per day) | -5 | -5 | -5 | -5 | -5 | -5 | -5 | -5 | |
| Attenuation provided by moveable acoustic screen, dB | 0 | -6 | -9 | -10 | -17 | -25 | -28 | -30 | |
| ***Total*** | ***84*** | ***78*** | ***73*** | ***65*** | ***57*** | ***52*** | ***51*** | ***48*** | **69** |
| Cutting steel - 9" grinder, handheld: Makita GA9050/1 (SPL@10m) | 72 | 72 | 69 | 72 | 73 | 72 | 71 | 71 | |
| Distance correction (min. 5m) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Correction due to on- time (3hr per day) | -5 | -5 | -5 | -5 | -5 | -5 | -5 | -5 | |
| Attenuation provided by screening from building envelope (interal activity) | -10 | -12 | -14 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***63*** | ***61*** | ***56*** | ***57*** | ***58*** | ***57*** | ***56*** | ***56*** | **64** |
| Delivery vehicle with lifting arm - DAF CF65 FA CF 65.220 Crane Vehicle (SPL@10m) | 83 | 77 | 70 | 70 | 70 | 68 | 64 | 58 | |
| Distance correction (min. 8m) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Correction due to on- time (15 minutes per day) | -16 | -16 | -16 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***69*** | ***63*** | ***56*** | ***56*** | ***56*** | ***54*** | ***50*** | ***44*** | **61** |
| **Predicted Daily Airborne Noise Level, dB $L_{Aeq,10h}$ at the nearest sensitive façade** | **84** | **78** | **73** | **66** | **62** | **60** | **58** | **57** | **70** |
| **Basement Ground Slab and Drainage: Start date 17 Feb 2018, duration 3 weeks** | | | | | | | | | |
| Cutting steel reinforcement - 9" grinder, handheld: Makita GA9050/1 (SPL@10m) | 72 | 72 | 69 | 72 | 73 | 72 | 71 | 71 | |
| Distance correction (min. 10m) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Correction due to on- time (4 hours per day) | -4 | -4 | -4 | -4 | -4 | -4 | -4 | -4 | |
| Attenuation provided by screening from building envelope (interal activity) | -10 | -12 | -14 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***58*** | ***56*** | ***51*** | ***52*** | ***53*** | ***52*** | ***51*** | ***51*** | **59** |
| Drilling into concrete - Handheld concrete drill: Hitachi H45MRY (SPL@10m) | 67 | 80 | 74 | 72 | 72 | 72 | 68 | 61 | |
| Distance correction (min. 10m) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Correction due to on- time (3 hours per day) | -5 | -5 | -5 | -5 | -5 | -5 | -5 | -5 | |
| Attenuation provided by screening from building envelope (interal activity) | -10 | -12 | -14 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***52*** | ***63*** | ***55*** | ***51*** | ***51*** | ***51*** | ***47*** | ***40*** | **57** |
| Concrete delivery - 8 wheel ready mix concrete truck Volvo FMX420 8x4 Concrete Mixer (SPL@10m) | 75 | 76 | 71 | 70 | 71 | 68 | 64 | 60 | |
| Distance correction (min. 8m) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Correction due to on- time (1.75hr per day) | -8 | -8 | -8 | -8 | -8 | -8 | -8 | -8 | |
| ***Total*** | ***69*** | ***70*** | ***65*** | ***64*** | ***65*** | ***62*** | ***58*** | ***54*** | **69** |
| Concrete pumping - Towed concrete pump Schwing BP 550HD-18 (SPL@10m) | 69 | 64 | 64 | 66 | 63 | 59 | 53 | 47 | |
| Distance correction (min. 5m) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Correction due to on- time (1.75hr per day) | -8 | -8 | -8 | -8 | -8 | -8 | -8 | -8 | |
| ***Total*** | ***67*** | ***62*** | ***62*** | ***64*** | ***61*** | ***57*** | ***51*** | ***45*** | **66** |
| Delivery vehicle with lifting arm - DAF CF65 FA CF 65.220 Crane Vehicle (SPL@10m) | 83 | 77 | 70 | 70 | 70 | 68 | 64 | 58 | |
| Distance correction (min. 8m) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Correction due to on- time (15 minutes per day) | -16 | -16 | -16 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***69*** | ***63*** | ***56*** | ***56*** | ***56*** | ***54*** | ***50*** | ***44*** | **61** |
| **Predicted Daily Airborne Noise Level, dB $L_{Aeq,10h}$ at the nearest sensitive façade** | **73** | **72** | **68** | **68** | **67** | **64** | **60** | **57** | **72** |
| **Internal Waterproofing to Basement: Start date 12 Mar 2018, duration 4 weeks** | | | | | | | | | |
| Drilling into concrete - Handheld concrete drill: Hitachi H45MRY (SPL@10m) | 67 | 80 | 74 | 72 | 72 | 72 | 68 | 61 | |
| Distance correction (min. 10m) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Correction due to on- time (5hr per day) | -3 | -3 | -3 | -3 | -3 | -3 | -3 | -3 | |
| Attenuation provided by screening from building envelope (interal activity) | -10 | -12 | -14 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***54*** | ***65*** | ***57*** | ***53*** | ***53*** | ***53*** | ***49*** | ***42*** | **59** |
| Delivery vehicle with lifting arm - DAF CF65 FA CF 65.220 Crane Vehicle (SPL@10m) | 83 | 77 | 70 | 70 | 70 | 68 | 64 | 58 | |
| Distance correction (min. 8m) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Correction due to on- time (15 minutes per day) | -16 | -16 | -16 | -16 | -16 | -16 | -16 | -16 | |
| ***Total*** | ***69*** | ***63*** | ***56*** | ***56*** | ***56*** | ***54*** | ***50*** | ***44*** | **61** |
| **Predicted Daily Airborne Noise Level, dB $L_{Aeq,10h}$ at the nearest sensitive façade** | **69** | **67** | **60** | **58** | **58** | **57** | **53** | **46** | **63** |

**Appendix C**

**Main construction methods to be used in each phase and predicted noise levels**

| Phase | Main Phase | Sub-phase | Construction activity | Anticipated start date based on Project start date of 28 Sep 2017 | Anticipated end date based on Project start date of 28 Sep 2017 | Average hours per day | Equipment used | Our working location | Nearest sensitive receptor | Predicted Daily Airborne Noise Level, dB LAeq,10h (at the nearest sensitive facade) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Site set-up | | | | | | | | | |
| 1 | | | Building hoarding - cutting timber | 2 Nov 2017 | 7 Nov 2017 | 7 | Handheld circular skill saw for cutting timber: BOSH GKS 190 | Outside / front garden (Using portable acoustic screen) | 3 metres | 72 |
| 1 | | | Delivery vehicle with lifting arm | 2 Nov 2017 | 2 Nov 2016 | 0.25 | DAF CF65 FA CF 65.220 Crane Vehicle | On road to front of house | 8 metres / adjoining building | 61 |
| | | | | | | | | | | |
| 2 | Basement construction | | | | | | | | | |
| 2a | | Initial underpinning | Excavation / breaking ground using hand held breakers | 6 Nov 2017 | 16 Feb 2018 | 5 | Light handheld breaker: Makita HM1203C | Inside house at lower ground floor level | 5 metres / adjoining building | 71 |

| Phase | Main Phase | Sub-phase | Construction activity | Anticipated start date based on Project start date of 28 Sep 2017 | Anticipated end date based on Project start date of 28 Sep 2017 | Average hours per day | Equipment used | Our working location | Nearest sensitive receptor | Predicted Daily Airborne Noise Level, dB LAeq,10h (at the nearest sensitive facade) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2a | | Initial underpinning | Breaking out concrete / brickwork | 26 Nov 2017 | 30 Jan 2016 | 7 | Medium handheld breaker: Hilti TE1000 | Inside house at lower ground floor level | 5 metres / adjoining building | 72 |
| 2a | | Initial underpinning | Cutting steel reinforcement using a grinder | 6 Nov 2017 | 16 Feb 2018 | 0.5 | 9" grinder, handheld: Makita GA9050/1 | Inside house at lower ground floor level | 5 metres / adjoining building | 56 |
| 2a | | Initial underpinning | Cutting timber using a circular saw | 6 Nov 2017 | 16 Feb 2018 | 2.5 | Handheld circular skill saw for cutting timber: Makita HS7601J/1 | Inside house at lower ground floor level | 5 metres / adjoining building | 63 |
| 2a | | Initial underpinning | Conveyor to remove spoil | 6 Nov 2017 | 2 Feb 2018 | 6 | Conveyor: Easikit Conveyor EK300 | External, front garden.<br>Conveyor enclosed in timber hoarding. | 5 metres / adjoining building | 61 |
| 2a | | Initial underpinning | Grab truck to empty skip | 7 Nov 2017 | 3 Feb 2018 | 0.33 | DAF CF 410 FAD Grab truck | On road to front of house | 8 metres / adjoining building | 63 |

| Phase | Main Phase | Sub-phase | Construction activity | Anticipated start date based on Project start date of 28 Sep 2017 | Anticipated end date based on Project start date of 28 Sep 2017 | Average hours per day | Equipment used | Our working location | Nearest sensitive receptor | Predicted Daily Airborne Noise Level, dB LAeq,10h (at the nearest sensitive facade) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2a | | Initial underpinning | Delivery vehicle with lifting arm | 13 Dec 2017 | 13 Dec 2017 | 0.25 | DAF CF65 FA CF 65.220 Crane Vehicle | On road to front of house | 8 metres / adjoining building | 61 |
| | | | | | | | | | | |
| 2b | | Structural steelwork | Breaking out brickwork | 13 Dec 2017 | 20 Dec 2017 | 3 | Medium handheld breaker: Hilti TE1000 | External, rear garden (Using portable acoustic screen) | 5 metres / adjoining building | 69 |
| 2b | | Structural steelwork | Cutting steel | 13 Oct 2017 | 20 Dec 2017 | 3 | 9" grinder, handheld: Makita GA9050/1 | Inside house at lower ground floor level | 5 metres / adjoining building | 64 |
| 2b | | Structural steelwork | Delivery vehicle with lifting arm | 13 Dec 2017 | 13 Dec 2017 | 0.25 | DAF CF65 FA CF 65.220 Crane Vehicle | On road to front of house | 8 metres / adjoining building | 61 |
| | | | | | | | | | | |
| 2c | | Basement ground slab and drainage | | 17 Feb 2018 | 1 MAR 2018 | | | | | |

| Phase | Main Phase | Sub-phase | Construction activity | Anticipated start date based on Project start date of 28 Sep 2017 | Anticipated end date based on Project start date of 28 Sep 2017 | Average hours per day | Equipment used | Our working location | Nearest sensitive receptor | Predicted Daily Airborne Noise Level, dB LAeq,10h (at the nearest sensitive facade) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2c | | Basement ground slab and drainage | Cutting steel reinforcement using a grinder | 17 FEB 2018 | 19 Feb 2018 | 4 | 9" grinder, handheld: Makita GA9050/1 | Under house at new basement level. Fully enclosed | 10 metres / adjoining building | 59 |
| 2c | | Basement ground slab and drainage | Drilling into concrete | 17 Feb 2018 | 19 Feb 2018 | 3 | Handheld concrete drill: Hitachi H45MRY | Under house at new basement level. Fully enclosed | 10 metres / adjoining building | 57 |
| 2c | | Basement ground slab and drainage | Concrete delivery | 1 Mar 2018 - 1 day in total | 1 Mar 2018 - 1 day in total | 1.75 | 8 wheel ready mix concrete truck - Volvo FMX420 8x4 Concrete Mixer | On road to front of house | 8 metres / adjoining building | 69 |
| 2c | | Basement ground slab and drainage | Concrete pumping | 1 Mar 2018 - 1 day in total | 1 Mar 2018 - 1 day in total | 1.75 | Towed concrete pump - Schwing BP 550HD-18 | On road to front of house | 5 metres / adjoining building | 66 |
| 2c | | Basement ground slab and drainage | Delivery vehicle with lifting arm | 2 Mar 2018 | 12 Mar 2018 | 0.25 | DAF CF65 FA CF 65.220 Crane Vehicle | On road to front of house | 8 metres / adjoining building | 61 |
| | | | | | | | | | | |

| Phase | Main Phase | Sub-phase | Construction activity | Anticipated start date based on Project start date of 28 Sep 2017 | Anticipated end date based on Project start date of 28 Sep 2017 | Average hours per day | Equipment used | Our working location | Nearest sensitive receptor | Predicted Daily Airborne Noise Level, dB LAeq,10h (at the nearest sensitive facade) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2d | | Internal waterproofing to basement | | 12 Mar 2018 | 16 Mar 2018 | | | | | |
| 2d | | Internal waterproofing to basement | Drilling into concrete | 16 Mar 2018 | 16 Mar 2018 | 5 | Handheld concrete drill: Hitachi H45MRY | Under house at new basement level. Fully enclosed | 10 metres / adjoining building | 59 |
| 2d | | Internal waterproofing to basement | Delivery vehicle with lifting arm | 17 Mar 2018 | 17 Apr 2018 | 0.25 | DAF CF65 FA CF 65.220 Crane Vehicle | On road to front of house | 8 metres / adjoining building | 61 |
| **Total** | | | | | | | | | | |