Informer House, 2 High Street, Teddington

Noise and Vibration Impact Assessment

On behalf of **Richmond Housing Partnership Limited**

Project Ref: 37375/3003 | Rev: 00 | Date: 26 July 2016

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Document Control Sheet

Project Name: **Informer House, 2 High Street, Teddington**
Project Ref: **37375/3003**
Report Title: **Noise and Vibration Impact Assessment**
Doc Ref: **00**
Date: **26 July 2016**

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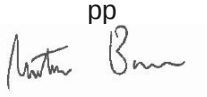
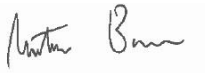
Prepared by:	Zoe Richardson	Trainee Acoustic Engineer	pp 	July 2016
Reviewed by:	Matt Barlow	Principle Acoustician		July 2016
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For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved

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1 Introduction

1.1 Background

1.1.1 Peter Brett Associates LLP (PBA) has been commissioned to provide a noise and vibration impact assessment in order to support a detailed planning application for a proposed commercial and residential development at Informer House, 2 High Street, Teddington.

1.1.2 The proposed development will consist of both commercial and residential use. The existing two storey structure will be replaced with a new structure with a maximum of 7 storeys, five of which will consist of residential dwellings.

1.1.3 The purpose of this report is to describe the existing noise climate at the proposed development site in order to provide advice on internal sound insulation requirements and external building fabric sound insulation requirements with regards to local planning policy and national and international guidance documents relating to environmental noise.

1.2 Scope of Assessment

1.2.1 The objectives of this report are:

- Establish the existing noise climate across the site at two secure and accessible locations by means of automated noise monitoring over a minimum period of 24 hours;
- Establish the existing vibration levels across the site at one secure and accessible location by means of automated vibration monitoring over a minimum period of 24 hours;
- Provide advice on internal sound insulation requirements and propose appropriate internal criteria in line with the requirements of the local authority;
- Consider external building fabric sound insulation requirements in relation to relevant standards and provide outline advice;
- Assess the suitability of the site for the proposed development; and
- To present the results of our assessment in a detailed report suitable for submission to the Local Authority.

1.3 Acoustic Terminology

1.3.1 Whilst every effort has been made to ensure that this report is easy to understand, it is by nature a technical document. To assist the read, an explanation of the terminology used in this report is contained in **Appendix A**.

2 Site Description

2.1 Location

2.1.1 The proposed site is known as 'Informer House', 2 High Street, Teddington and falls within the jurisdiction of the London Borough of Richmond Upon Thames. **Figure 2.1** below shows the location and boundary of the proposed development.

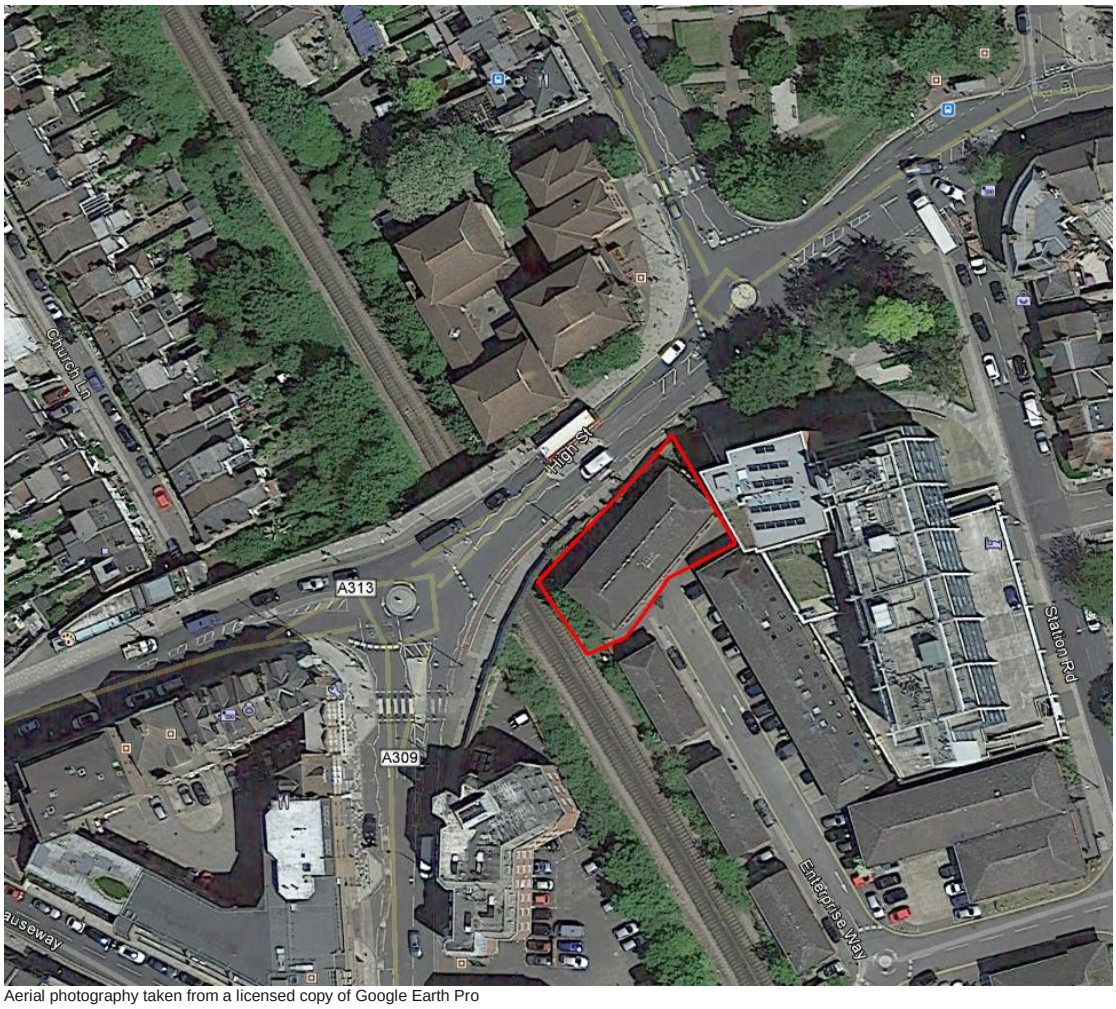

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Figure 2.1: Site Boundary and Location

2.2 Site Description

2.2.1 The site is bordered to the North by the High Street, to the west by the Kingston Loop Railway Line, the south by Enterprise Way and the east by existing commercial premises.

2.3 Proposed Layout

2.3.1 The existing 2 storey building will be replaced with new structure ranging from five storeys to seven. The ground floor will consist of commercial office premises whilst the remaining floors will be residential. There will also be a basement level for car parking. **Figure 2.2** below shows the proposed development footprint and proposed High Street and Enterprise Way façades.

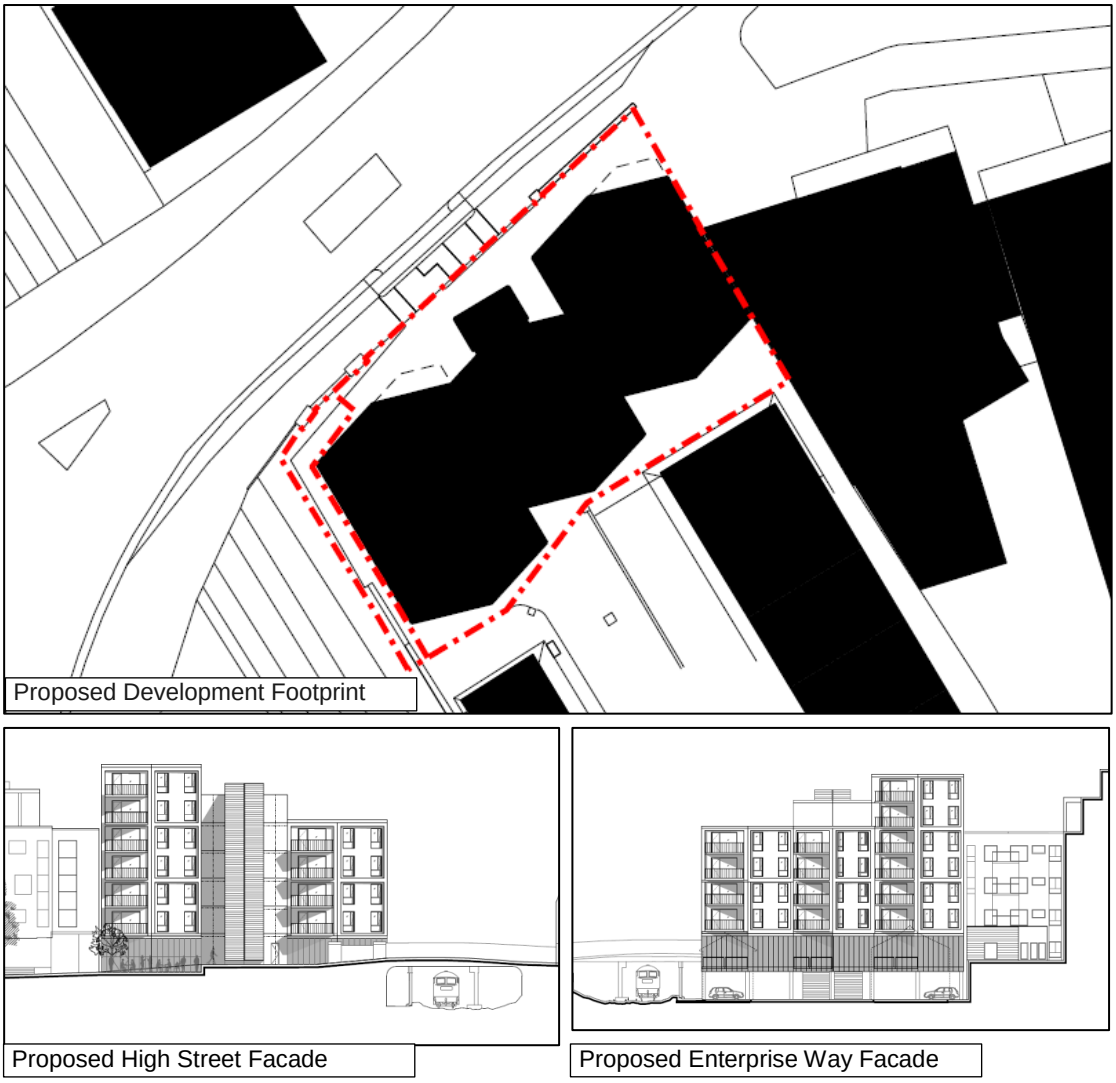

Figure 2.2: Proposed Development

2.3.2 The first floor residential layout (indicative of the proposed residential floors) is shown in **Figure 2.3**.

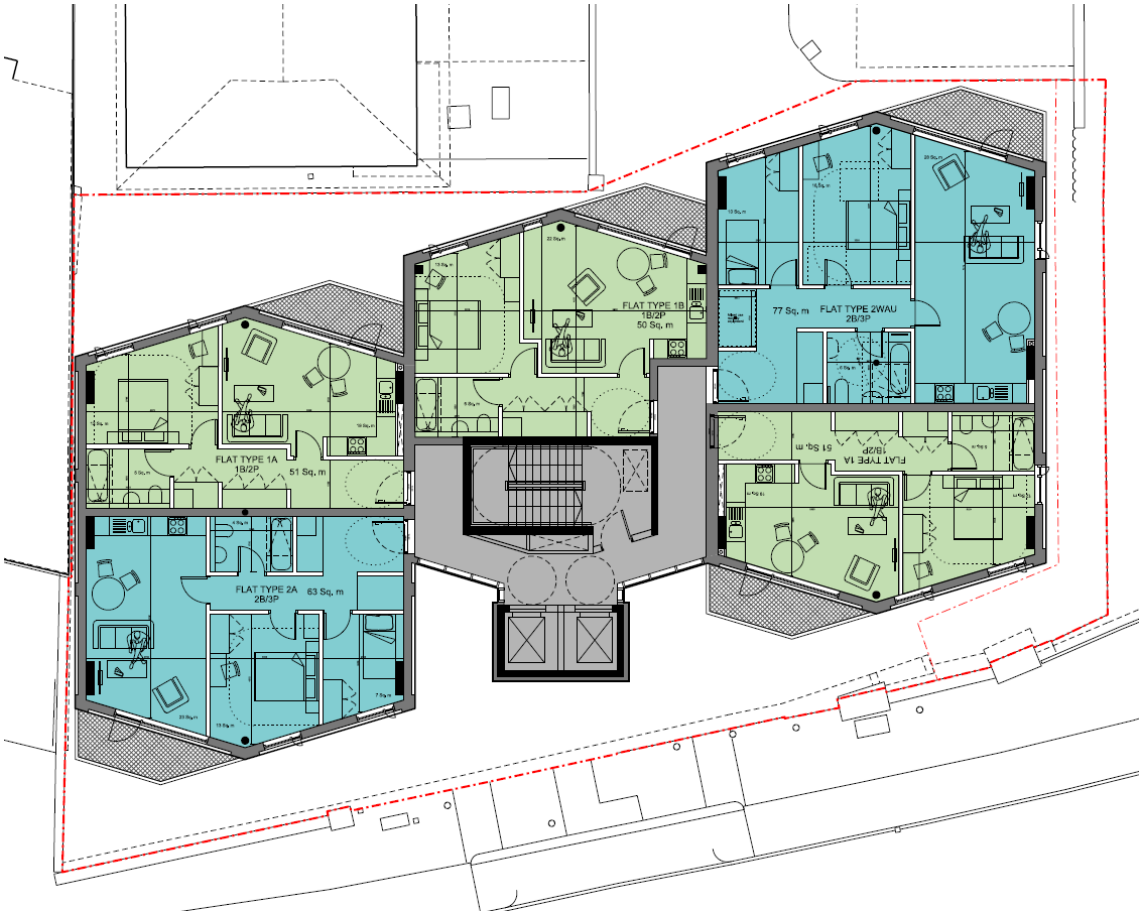

Figure 2.3: First Floor Residential Layout

2.3.3 Whilst the proposed development does not include any outdoor amenity space or gardens the development does include small balconies.

3 National and Local Planning Guidance

3.1 Local Policy

3.1.1 The London Borough of Richmond Upon Thames Core Strategy (adopted 2009) sets out the policies and guidance for development in the area. Policy CP1 Sustainable Development states:

"*Local environmental impacts of development with respect to factors such as noise, air quality and contamination should be minimised."*

3.1.2 The Core Strategy refers to Planning Policy Guidance 24 (PPG 24) for advice on assessing noise. As this policy has now been superseded, the Environmental Health Department at the London Borough of Richmond Upon Thames was contacted to discuss and agree an assessment methodology with regards to the proposed survey and assessment methodology. At the time of writing of this report, no response has been received.

3.1.3 In the absence of specific guidance from the local authority with respect to the assessment of the site we have undertaken a review of applicable national policies and guidance documents to formulate appropriate assessment criteria.

3.1.4 The assessment methodology is subject to the approval of the local authority.

3.2 National Policy

The National Planning Policy Framework (NPPF)

3.2.1 The NPPF was published in March 2012. In respect of noise, Section 11.109 states that:

"*The planning system should contribute to and enhance the natural and local environment by … preventing both new and existing development from contributing to or being put at unacceptable risk from or being adversely affected by unacceptable levels of … noise pollution*."

3.2.2 The NPPF goes on to advise that:

"Planning policies and decisions should aim to:

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

3.2.3 The NPPF indicates that the Noise Policy Statement for England (NPSE) should be used to define the *"significant adverse impacts".*

Noise Policy Statement for England (NPSE)

3.2.4 The Noise Policy Statement for England was published in March 2010. The document seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. It also sets out the long term vision for Government noise policy:

"To promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

3.2.5 The NPSE clarifies that noise should not be considered in isolation of the wider benefits of a scheme or development, and that the intention is to minimise noise and noise effects as far as is reasonably practicable having regard to the underlying principles of sustainable development.

3.2.6 The first two aims of the NPSE follow established concepts from toxicology that are applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level - 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; and

LOAEL – Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.

3.2.7 The NPSE extends these to the concept of a significant observed adverse effect level:

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

3.2.8 The NPSE notes *"…it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times".*

Planning Practice Guidance - Noise (2014)

3.2.9 Government's Planning Practice Guidance (PPG) on noise provides guidance on the effects of noise exposure, relating these to people's perception of noise, and linking them to the NOEL and, as exposure increases, the LOAEL and SOAEL.

3.2.10 As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.

3.1.11 The LOAEL is described in PPG Paragraph 005 as the level above which *"…noise starts to cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life".*

3.1.12 The PPG identifies the SOAEL as the level above which *"…noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area".*

3.3 Guidance

British Standard 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

3.3.1 BS 8233, in relation to this planning application, sets out desirable guideline values in habitable rooms, such as living rooms and bedrooms.

3.3.2 The guideline values relate to steady external noise without a specific character, previously termed 'anonymous noise'. According to the standard, noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate. Examples of noise with a character may include tonal/intermittent plant noise emissions, music playback, and workshop noise. Examples of external steady noise sources may include environmental noise sources such as busy road traffic.

3.3.3 The desirable internal ambient noise levels for dwellings are presented in **Table 3.1**.

Table 3.1: BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

Activity	Location	Daytime (07:00 to 23:00 hours)	Night-time (23:00 to 07:00 hours)
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

3.3.4 The standard also provides advice in relation to design criteria for external noise. Section 7.7.3.2 states that:

"*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable.*

In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate.

Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation.

In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space".

British Standard 6472-1:2008 'Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting'

3.3.5 BS6742-1 contains guidance with respect to the evaluation of the human response to vibration.

3.3.6 The standard assesses impact in terms of vibration dose values (VDV). The VDV defines a relationship that produces consistent assessment of continuous, intermittent, occasional and impulsive vibration and the subsequent human response.

3.3.7 The VDV is expressed as a single value over a stated time period. For assessment purposes these periods are typically taken to be a 16 hour daytime period (07:00 to 23:00 hours) and an 8 hour night-time period (23:00 to 07:00 hours).

3.3.8 The standard explains that the prevalence of adverse comment depends on specific circumstances, including parallel effects such as re-radiated noise or rattling of windows and furniture.

Guidelines for Community Noise, 1999 World Health Organisation, (WHO)

3.3.9 The (WHO) 1999 Guidelines for Community Noise also sets out guidance on suitable internal and external noise levels in and around residential properties. The following internal noise levels are recommended by the WHO in Table 4.1 of the above guidelines:

- 35 dB $L_{Aeq,T}$ in living rooms over a 16 hour day; and
- 30 dB $L_{Aeq,T}$ in bedrooms during the 8 hour night.

3.3.10 With respect to the night-time maximum noise levels, the WHO guidelines in Section 3.4 state:

"*For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night*".

3.3.11 In section 4.2.1. the guidelines state that:

"*For speaker-to-listener distance of about 1 m:*

- *Speech in relaxed conversation is 100% intelligible in background noise levels of about 35 dBA, and can be understood fairly well in background levels of 45 dBA.*
- *Speech with more vocal effort can be understood when the background sound pressure level is about 65 dBA.*"

3.4 Proposed Assessment Criteria

LOAEL and SOAEL for Indoor Ambient Noise Levels in New Residential Dwellings - Transportation Noise

3.4.1 Incident façade levels should not be considered in isolation of the sound reduction provided by the external building fabric. The guidance within Planning Policy Guidance states that *"consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations."*

3.4.2 Based on the advice within BS 8233:2014 an indoor noise level of 35 dB $L_{Aeq,16\ h}$ during the daytime and 30 dB $L_{Aeq,8\ h}$ during the night-time may be considered as the LOAEL for transportation noise.

3.4.3 Similarly an indoor noise level 50 dB $L_{Aeq,16\ h}$ and 45 dB $L_{Aeq,8\ h}$ during the night-time may be considered as the SOAEL for transportation noise. The proposed LOAEL and SOAEL levels for internal areas within dwellings are shown in **Table 3.2**.

Table 3.2: Proposed LOAEL and SOAEL Noise Levels (Internal Ambient Noise Levels)

Level	Daytime (07:00 hours to 23:00 hours)	Night-time (23:00 hours to 07:00 hours)
LOAEL	35 $L_{Aeq,16h}$ (dB)	30 $L_{Aeq,8h}$ (dB) 45 dB L_{Amax} if more than 10-15 events
SOAEL	50 $L_{Aeq,16h}$ (dB)	45 $L_{Aeq,8h}$ (dB) 65 dB L_{Amax} if more than 10-15 events

LOAEL and SOAEL for Outdoor Ambient Noise Levels in New Residential Dwelling Amenity Areas - Transportation Noise

3.4.4 It should be recognised that a compromise should be made between external noise levels on balconies and the convenience of living in a city centre location.

3.4.5 In addition, BS8233 states that

"Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses."

3.4.6 Therefore, based on the guidance detailed within BS8233 it is considered that the use of fixed assessment limits with respect to balconies is not appropriate.

LOAEL and SOAEL for Vibration Levels in Residential and Commercial Properties

3.4.7 **Table 3.3** presents the proposed Vibration Dose Value's in terms of adverse effect levels for residential dwellings and commercial premises. These levels have been derived from the guidance in BS6742-1.

Table 3.3: Proposed LOAEL and SOEAL for Vibration Levels (VDV)

Adverse Effect Level	Vibration Dose Value $ms^{-1.75}$	
	Daytime	Night-time

	(07:00 – 23:00 hours)	(23:00 – 07:00 hours)
SOAEL	0.4 to 0.8	0.2 to 0.4
LOAEL	0.2 to 0.4	0.1 to 0.2

*Note the above values can be increased by a factor of 2 for commercial office developments.

4 Environmental Sound and Vibration Survey

4.1 Procedure

4.1.1 Fully automated environmental sound monitoring was undertaken from approximately 13:15 hours on Wednesday 22 June 2016 to 22:15 hours on Saturday 25 June 2016.

4.1.2 Due to the nature of the survey, i.e. unattended, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However at the beginning and end of the survey period the wind conditions were calm and the sky was overcast. It is known that there was some precipitation over the course of the survey measurements; this has been taken into account when examining the results.

4.2 Measurement Positions

4.2.1 The sound pressure level and vibration measurements were undertaken at two positions at the development site. The measurement positions are described in **Table 4.1** and detailed on **Figure 4.1** below.

4.2.2 The measurement positions were selected in order to establish the existing sound levels at locations considered representative of the location of the proposed dwellings. The $L_{eq,T}$, $L_{90,T,}$ and L_{Fmax} sound levels and Vibration Dose Values (VDV) were measured and recorded at the measurement positions as appropriate.

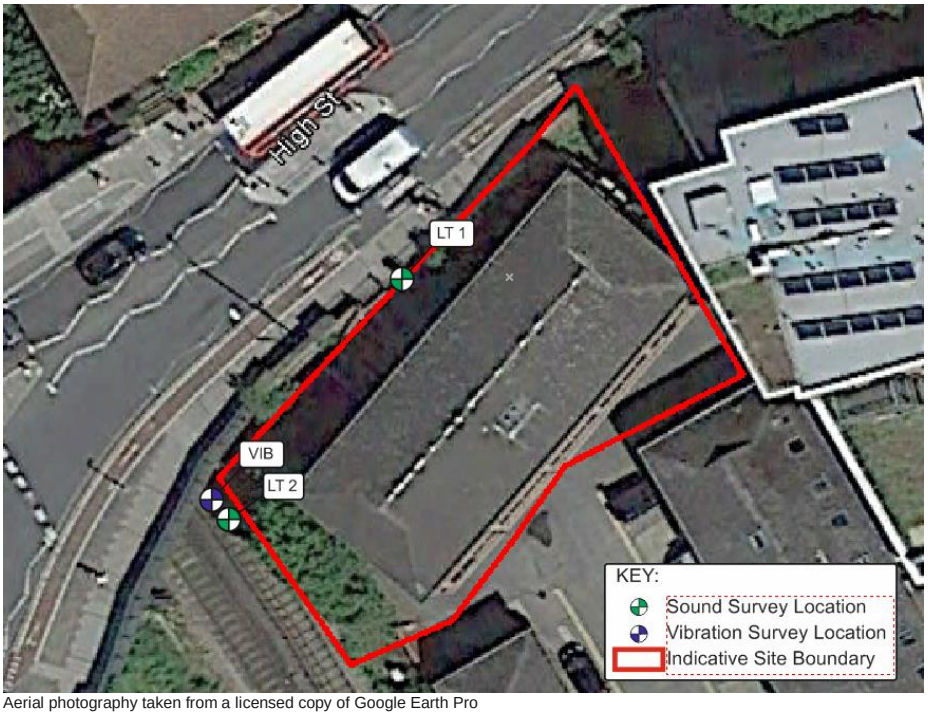

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Figure 4.1: Sound and Vibration Survey Locations

Table 4.1: Environmental Sound Survey Locations

Position	Description
LT 1	The microphone was located to the north of the site boundary, along the High Street and approximately 4 metres back from the edge of the carriageway. It was elevated to approximately 2 metres above ground level.
T 2	The microphone was located to the west of the site boundary, approximately 4 metres back from the railway tracks and to the edge of the small tunnel that runs under the High Street. It was elevated to approximately 1.5 metres above ground level.
VIB	The accelerometer was located at ground level to the west of the site boundary, approximately 4 metres back from the railway tracks and to the edge of the small tunnel that runs under the High Street.

4.3 Instrumentation

4.3.1 The instrumentation used during the surveys is presented in **Table 4.2** below:

Table 4.2: Instrumentation

Item	Type	Manufacturer	Serial Number	Laboratory Calibration Date
Sound Calibrator	4231	Brüel & Kjær	2619374	14.03.2016
Sound Level Meter	NL-52	Rion	00320636	03.06.2015
Microphone	UC-59	Rion	03385	03.06.2015
Pre-Amplifier	NH-25	Rion	10644	03.06.2015
Sound Level Meter	NL-52	Rion	1043457	23.02.2015
Microphone	UC-59	Rion	07232	23.02.2015
Pre-Amplifier	NH-25	Rion	43486	23.02.2015
Vibration Monitor	VM-54	Rion	01150117	27.06.2016

4.3.2 The sound level meters and vibration meter were in environmental cases with the microphones and vibration plate connected via extension cables. The microphones were fitted with Rion WS-15 windshields.

4.3.3 The sound level meters, including extension cables, were calibrated prior to and on completion of the survey with no significant fluctuations recorded (<0.5 dB). Calibration certificates are available upon request.

4.4 Environmental Sound Survey Results

4.4.1 The results of the sound survey have been plotted on Time History Graphs enclosed in **Appendix B**, presenting the 15 minute A-weighted (dBA) L_{10}, L_{90}, L_{eq}, and L_{max} levels at each

measurement position throughout the duration of the survey. The results of the survey are summarised in **Table 4.3** below.

Table 4.3: Sound Survey Results (Free Field Conditions)

Position	Date	Period	$L_{Aeq,T}$ dB	L_{AFmax} dB*	Typical $L_{A10,T}$ dB	Typical $L_{A90,15mins}$ dB
LT 1	22.06.2016	Daytime (13:15 – 23:00)	65	-	66	58
		Night-time (23:00 – 07:00)	62	81	64	49
	23.06.2016	Daytime (07:00 – 23:00)	67	-	69	61
		Night-time (23:00 – 07:00)	60	80	61	38
	24.06.2016	Daytime (07:00 – 23:00)	68	-	68	61
		Night-time (23:00 – 07:00)	61	80	58	36
	25.06.2016	Daytime (07:00 – 22:15)	66	-	67	59
LT 2	22.06.2016	Daytime (13:15 – 23:00)	65	-	58	48
		Night-time (23:00 – 07:00)	63	84	57	47
	23.06.2016	Daytime (07:00 – 23:00)	62	-	58	52
		Night-time (23:00 – 07:00)	60	82	52	36
	24.06.2016	Daytime (07:00 – 23:00)	65	-	58	50
		Night-time (23:00 – 07:00)	61	83	50	36
	25.06.2016	Daytime (07:00 – 22:15)	64	-	56	48

*L_{AFmax} based on the 10-15th highest L_{Fmax} levels measured during the survey

4.4.2 Due to the nature of the surveys, i.e. unattended, it is not possible to accurately describe the dominant noise sources, or specific sound events, throughout the entire survey period. However, at the beginning and end of the survey period the dominant noise sources were noted for each location and are described in **Table 4.4** below.

Table 4.4: Dominant Noise Source at each Location

Position	Dominant Noise Source
LT 1	Road traffic noise along High Street, occasional train pass-by.
LT 2	Train pass by from railway track (Kingston Loop Line).

4.5 Calculation of Daytime and Night-time Incident Noise Levels

4.5.1 Based on the measured environmental noise levels the 'worst case' typical incident noise levels have been calculated for each façade.

4.5.2 **Table 4.5** details the calculated incident noise levels (all sources – road and rail) used in our assessment.

4.5.3 In this instance, environmental sound measurements undertaken between 07:00 hours and 13:00 hours are considered to be representative of the 07:00 to 23:00 hour day-time period.

4.5.4 In this instance, environmental sound measurements undertaken between 03:20 hours and 07:00 hours are considered to be representative of the 23:00 to 07:00 hour night-time period.

Table 4.5: Calculated Incident Noise Levels

Facade	Period	Parameter	Sound Pressure Level, dB at Octave Band Centre Frequencies (Hz)						dBA
			125	250	500	1k	2k	4k	
High Street & Railway	Daytime (07:00 – 23:00)	$L_{eq,T}$ dB	68	66	62	64	61	42	68
	Night-time (23:00 – 07:00)	$L_{eq,T}$ dB	63	62	58	57	53	40	61
		Typical L_{Fmax}	81	81	74	74	72	71	80
Enterprise Way	Daytime (07:00 – 23:00)	$L_{eq,T}$ dB	67	64	60	60	58	58	65
	Night-time (23:00 – 07:00)	$L_{eq,T}$ dB	61	60	56	56	51	37	58
		Typical L_{Fmax}	79	79	72	72	70	69	78

4.6 Vibration Survey Results

4.6.1 A summary of the vibration survey results is presented in **Table 4.6** below.

Table 4.6: Vibration Survey Results

Axis	VDV ($ms^{1.75}$)		
	24 Hours	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
X	0.092	0.075	0.080
Y	0.059	0.037	0.057
Z	0.118	0.108	0.088

5 Suitability of Site for Residential Development

5.1 Internal Sound Levels

5.1.1 The background noise survey results established the noise climate of the site at the specific time and location of the survey. The baseline external noise survey results have been used to determine the likely internal noise levels in the proposed dwellings due to environmental noise ingress.

5.1.2 An analysis of the proposed external building fabric has been undertaken in order to ascertain the required acoustic performance of the glazing and ventilation elements to achieve the criteria detailed in **Section 3.4.** Compliance with the acoustic performance specifications detailed herein should ensure that acceptable internal noise levels are achieved and that internal noise levels fall below the applicable LOAEL.

5.1.3 Our external building fabric analysis has assumed the following:

Façade/Room Dimensions

Worst case room and façade dimensions have been taken from the proposed drawings detailed in **Table 5.1**. Calculations consider the finished floor to ceiling heights within the dwellings to be approximately 2.8 m.

Table 5.1: Drawings

Author	Title
Wimhurst Pelleriti	WP-0410-GA–P–L1
	WP-0410-GA-E-WEST
	WP-0410-GA-E-NORTH
	WP-0410-GA-E-SOUTH

Room Absorption

We have assumed the bedrooms and living rooms to be acoustically ‘soft’ with carpets, curtains and other soft furnishings. For the purposes of our analyses we have assumed the average absorption coefficients detailed in **Table 5.2.**

Table 5.2: Average Absorption Coefficients

Room Type	Average Absorption Coefficient (α) at Octave Band Frequency (Hz)				
	125	250	500	1000	2000
Bedrooms / Living Rooms	0.18	0.25	0.27	0.31	0.32

Proposed External Building Fabric

Table 5.3 details typical sound reduction indices associated with the proposed external building fabric constructions.

Table 5.3: Typical Sound Reductions of Proposed Building Fabric Constructions

Construction	125	250	500	1000	2000
107mm Brick/100mm block cavity wall	41	45	45	54	58
150mm thick concrete roof	37	43	45	50	50

Ventilation

We understand that the proposed houses will be equipped with intermittent extract fans and background ventilators, as per System 1 in Approved Document F.

5.2 Specification and Guidance on Constructions

5.2.1 As detailed in **Section 4.5** incident sound levels vary across the development. In our experience it is not usually appropriate to provide an exhaustive list of differing specifications for each and every façade for both economic and aesthetic reasons. **Appendix C** details the sound reduction performance specification for the glazed elements of the external building fabric.

5.2.2 The glazing performance specifications apply to the glazing package as a whole inclusive of glazing, louvres, spandrel panels, framing, opening lights, doors, seal etc. The performance of the glazing system will depend on many factors such as the glazing configuration, size of windows panels, quality of framing, quality of sealing etc.

5.2.3 The proposed windows should be tested in accordance with BS EN ISO 10140-2:2010 and that the quoted minimum sound reduction specifications are met by the system as a whole, including frames, trickle ventilators etc. as appropriate, and not just the glass.

5.2.4 If the trickle ventilators do not form an integral part of the glazed element they should comply with the specification outlined in **Appendix C** which details the recommended minimum octave band element normalised level differences.

5.2.5 The trickle ventilators (in their open state) shall be tested to BS EN ISO 10140-2:2010. This will involve testing in 1/3 octave frequency bands from at least 100 Hz to 2500 Hz inclusive. These results, together with suitably converted octave frequency band results from 125 Hz to 2000 Hz inclusive, shall be provided for a ventilator unit which is representative of the proposed ventilator for the relevant façade.

5.2.6 It should be noted that the acoustic specification for trickle ventilators is based on a single ventilator. If the number of ventilators in a habitable space is greater than one then the specification should be adjusted using equation (1).

$$(1)\quad Specification + 10\log\left(\frac{V_{new}}{1}\right)$$

where V_{new} is the total number of ventilators in each habitable room (mm^2).

5.2.7 For guidance purposes, the typical conventional double glazing and ventilation performance specifications are detailed in **Table 5.4.** These should prove commensurate with achieving the sound insulation performance specifications detailed within **Appendix E.**

Table 5.4: Glazing Configuration and Ventilation Types

Facade	Glazing Configuration	Ventilation Type
Type A	10 mm glass / 16 mm cavity / 6.4 mm glass	Acoustic Wall Ventilator
Type B	10 mm glass / 16 mm cavity / 6 mm glass	Acoustic Wall Ventilator

5.2.8 It should be noted that due to the necessity for security laminated glass on the ground (and lower / accessible) floors, the specifications may exceed those stated above in some locations.

5.2.9 The guidance construction detailed above is provided for costing purposes only. Selected glazing and ventilation systems should be capable of meeting the performance specifications shown in **Appendix C**, with laboratory test certificates being made available in support of the quoted performance. Glazing proposals which simply reflect the guidance constructions indicated in this report will not, in isolation, be sufficient evidence that a glazing configuration will meet the performance specification.

5.2.10 **Figure 5.1** below identifies the facades glazing and ventilation requirements.

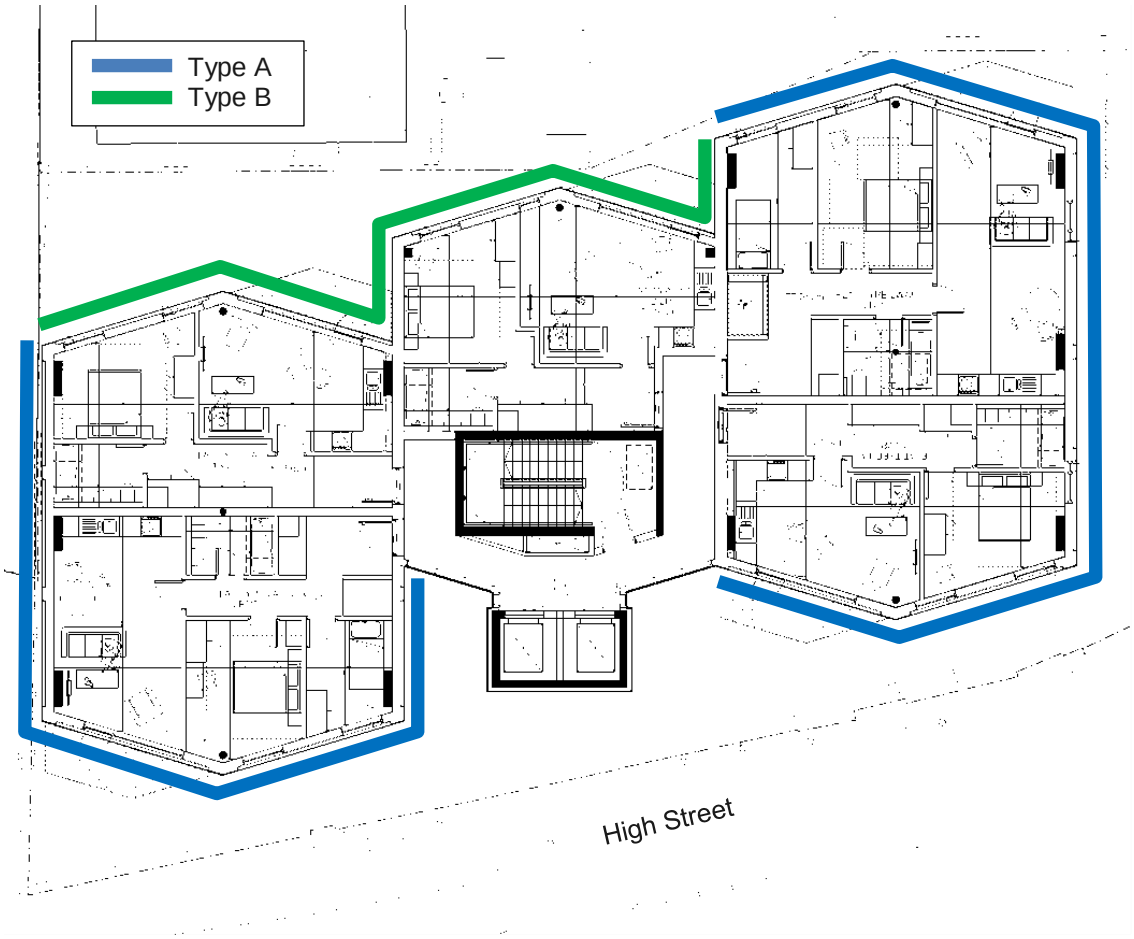


Figure 5.1: Building Facades

5.3 Train Induced Vibration Levels

5.3.1 The results of the vibration survey indicate that vibration levels are likely to fall just below the proposed LOAEL.

5.3.2 Depending on the method of construction it is possible for the structure to alter the vibration levels within the building.

5.3.3 We would therefore suggest that that measures are taken to minimise amplification of vibration levels by the use of heavy, stiff constructions. We would advise against the use of lightweight wide span constructions as these are inherently prone to vibration amplification.

6 Conclusion

6.1.1 Peter Brett Associates has been commissioned to provide a site noise assessment for a full planning application in relation to a proposed commercial and residential development at the Informer House, 2 High Street, Teddington.

6.1.2 A baseline sound and vibration survey was conducted between 22nd June and 25th June 2016 to determine the current conditions around the site. The assessment has been based on guidance detailed within BS 8233: 2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' and British Standard 6472-1:2008 'Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting'.

6.1.3 Based on the measured results from the baseline sound survey and the requirements of the local authority, an acoustic specification for windows and ventilation has been provided.

6.1.4 Based on the results of the vibration survey the levels calculated fall below the proposed LOAEL. Nevertheless due to the proximity of the railway we would suggest that that measures are taken to minimise amplification of vibration levels by the use of heavy, stiff constructions. We would advise against the use of lightweight wide span constructions as these are inherently prone to vibration amplification.

Appendix A Acoustic Terminology

Background Noise	In BS 4142 this is defined as the A weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T ($L_{A90,T}$)
Daytime	For assessment of internal and external noise levels to the development, the daytime is extrapolated from BS 8233 as the period from 07:00 to 23:00 hours (as night-time is from 23:00 to 07:00 hours).
Decibel (dB)	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure levels the reference quantity is 20 uPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Evening	Defined in BS 5228-1 as the period from 19:00 to 23:00 hours.
$L_{A10,T}$	The A weighted noise level exceeded for 10% of the measurement period, T. It gives an indication of the upper limit of fluctuating noise such as that from road traffic. $L_{A10,18h}$ is the arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00 to 24:00 hours.
$L_{A90,T}$	The A weighted noise level exceeded for 90% of the measurement period, T. This is defined in BS 4142 as the 'background noise level'.
$L_{Aeq,T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many noises and can be measured directly with an integrating sound level meter.
$L_{Amax,}$	The highest A weighted noise level recorded during a noise event. The time weighting (slow or fast) should be stated.
Night-time	Defined in BS 8233 and BS 5228-1 as the period from 23:00 to 07:00 hours.

Vibration

The vibratory motion of a surface can be described by either:

(a) displacement (m),

(b) velocity (m/s), or

(c) acceleration (m/s^2).

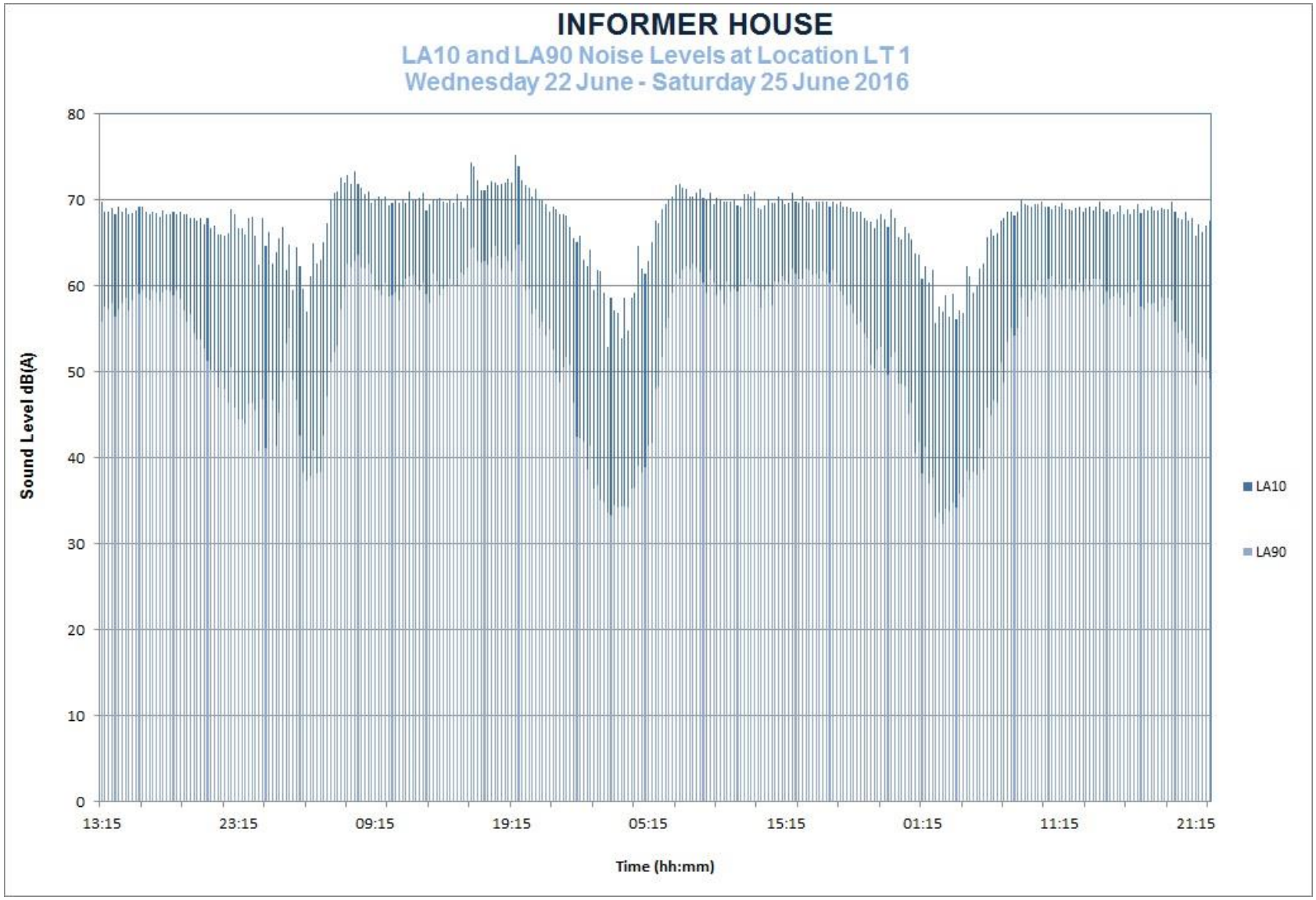
Furthermore the vibration magnitude can be quantified in several ways:

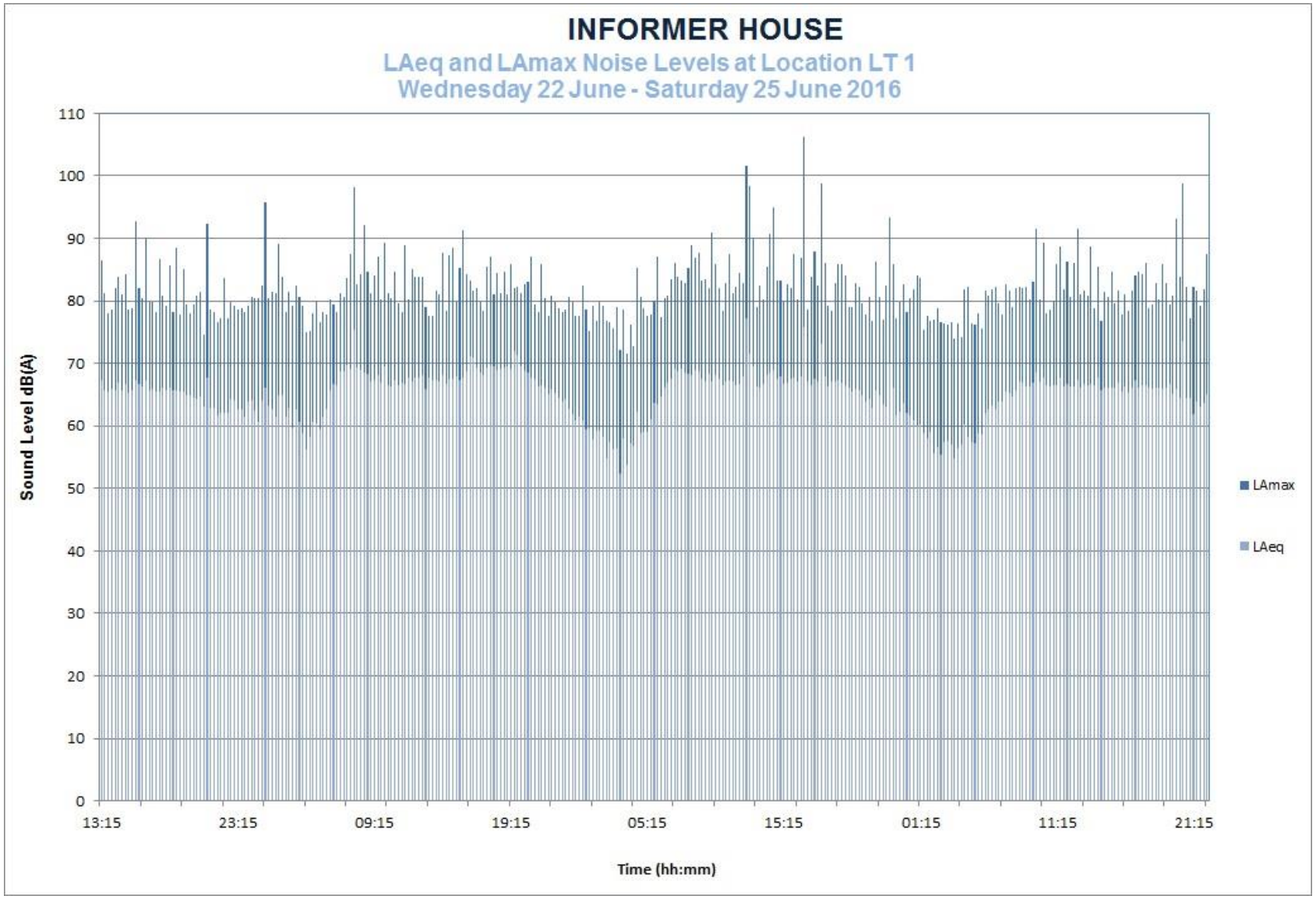
peak to peak	:	This value gives the total excursion of the oscillation about the zero datum. The unit is often used where the vibratory displacement of a component is critical for maximum stress or mechanical clearance calculations.
peak	:	This value gives the maximum excursion of the oscillation above or below the zero datum. This value is useful for indicating the level of short duration shocks.
r.m.s	:	This value gives the root mean square of the time history over a specific time interval (time constant). This value is useful for indicating the energy content of the vibration.
dB	:	Decibel quantities are often encountered. A reference level of 10^{-6} m/s^2 r.m.s is typically used for acceleration.

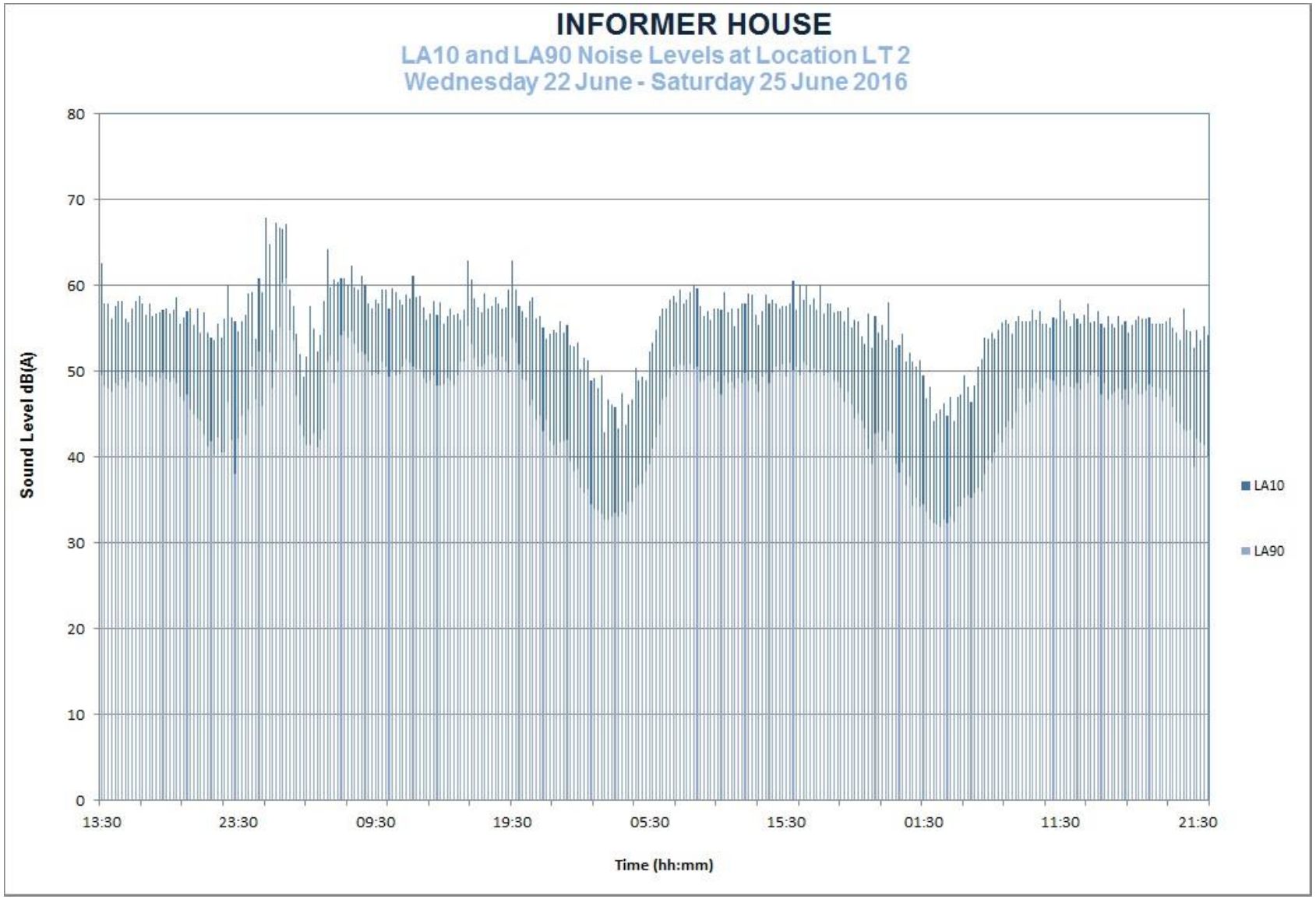
Vibration Dose Value (V.D.V) ($m/s^{1.75}$)

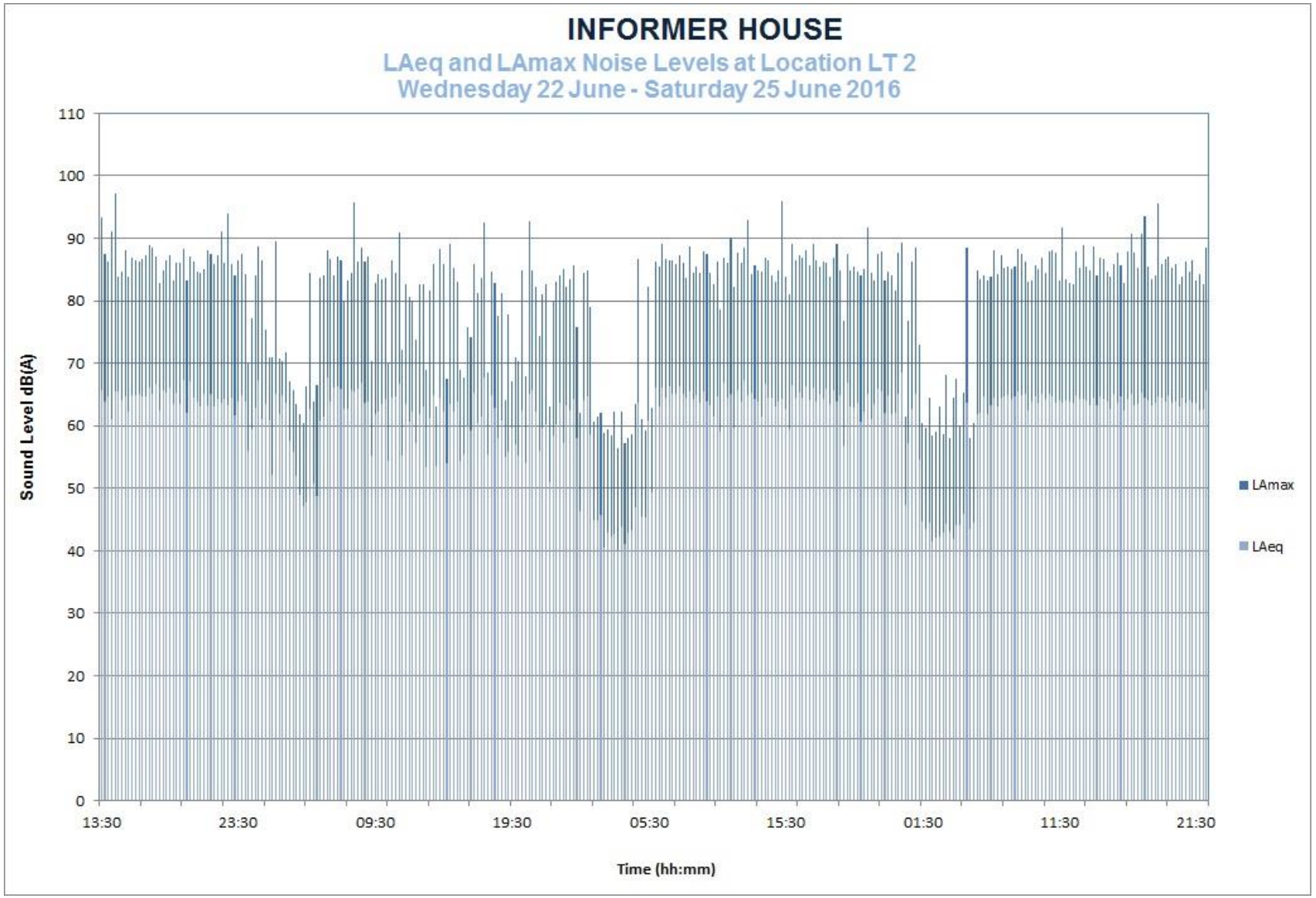
This value assesses both the magnitude of vibration and its duration. Where possible the vibration dose value should be determined over the full exposure to vibration. It is often estimated from the frequency weighted r.m.s value of the acceleration and its duration and is then referred to as e.V.D.V.

Appendix B Noise Survey Data

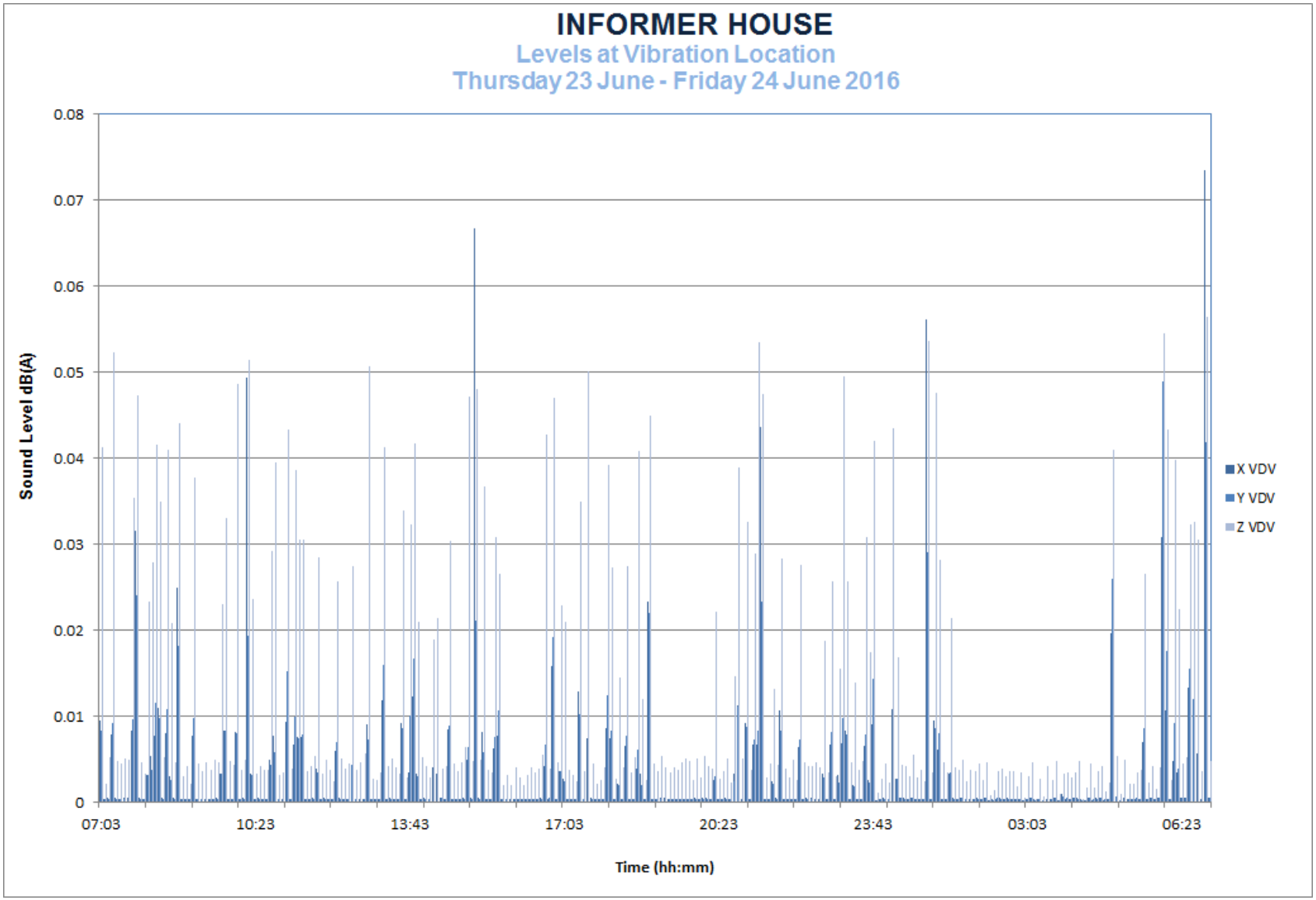

INFORMER HOUSE
LA10 and LA90 Noise Levels at Location LT 1
Wednesday 22 June - Saturday 25 June 2016
Sound Level dB(A)
80
70
60
50
40
30
20
10
0
13:15
23:15
09:15
19:15
05:15
15:15
01:15
11:15
21:15
Time (hh:mm)
LA10
LA90


INFORMER HOUSE
LAeq and LAmax Noise Levels at Location LT 1
Wednesday 22 June - Saturday 25 June 2016
Sound Level dB(A)
110
100
90
80
70
60
50
40
30
20
10
0
13:15
23:15
09:15
19:15
05:15
15:15
01:15
11:15
21:15
Time (hh:mm)
LAmax
LAeq


INFORMER HOUSE
LA10 and LA90 Noise Levels at Location LT 2
Wednesday 22 June - Saturday 25 June 2016
Sound Level dB(A)
80
70
60
50
40
30
20
10
0
13:30
23:30
09:30
19:30
05:30
15:30
01:30
11:30
21:30
Time (hh:mm)
LA10
LA90


INFORMER HOUSE
LAeq and LAmax Noise Levels at Location LT 2
Wednesday 22 June - Saturday 25 June 2016
Sound Level dB(A)
110
100
90
80
70
60
50
40
30
20
10
0
13:30
23:30
09:30
19:30
05:30
15:30
01:30
11:30
21:30
Time (hh:mm)
LAmax
LAeq

Appendix C Vibration Survey Data


INFORMER HOUSE
Levels at Vibration Location
Thursday 23 June - Friday 24 June 2016
Sound Level dB(A)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
07:03
10:23
13:43
17:03
20:23
23:43
03:03
06:23
Time (hh:mm)
X VDV
Y VDV
Z VDV

Appendix D External Building Fabric Acoustic Specification

D.1 Glazing Sound Insulation Performance

D.1.1 The complete cladding system shall achieve the following minimum sound reduction indices when tested in accordance with BS EN ISO 10140-2:2010.

Façade Type	Minimum Recommended Sound Reduction Indices (dB) at Octave Band Frequency (Hz)				
	125	250	500	1k	2k
A	28	31	40	44	45
B	27	28	35	41	40

D.1.2 Fully detailed test reports from independent acoustic test authorities shall be supplies. All test reports shall be in English or, a full English translation.

D.1.3 Test data should include the 1/3 octave band results from 100 Hz to 3150 Hz inclusive, together with the corresponding octave band results from 125 Hz to 4000 Hz inclusive.

D.1.4 The test report shall be provided for test samples which are representative of the complete system for the relevant facades – including frames, joints, seals, spandrel panels and opening lights and trickle vents (as appropriate). The samples proposed should be approved by Peter Brett Associates.

D.2 Trickle Ventilation Sound Insulation Performance

D.2.1 Ventilators shall be tested in accordance with BS EN 10140-2:2010. This will involve testing in 1/3 octaves from at least 100Hz to 2500Hz inclusive. These results, together with suitably converted octave band results from 125Hz to 2000Hz shall be provided for a ventilator unit which is representative of the proposed ventilator for the relevant façade. The samples proposed should be approved by Peter Brett Associates. The following element normalised level differences shall be achieved:

Façade Type	$D_{n,e}$ Values (dB) at Octave Band Centre Frequency (Hz) for Single Ventilator				
	125	250	500	1k	2k
A	37	40	42	48	53
B	37	40	42	48	53

D.2.2 If the number of ventilators in a habitable space is greater than one then the specification of each ventilator should be adjusted using equation (1).

$$(1)\quad Specification + 10\log\left(\frac{V_{new}}{1}\right)$$

where V_{new} is the total number of ventilators in each habitable room.