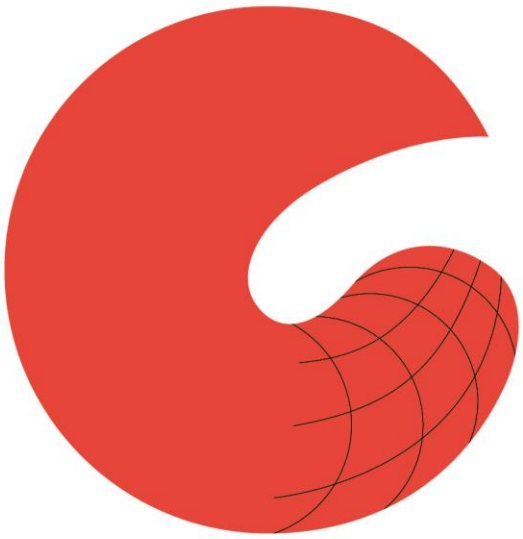

create
CONSULTING
ENGINEERS LTD

11-12 INGESTRE ROAD, LONDON, NW5 1UX

Noise and Vibration Assessment – Revision D

11-12 INGESTRE ROAD, LONDON, NW5 1UX
Noise and Vibration Assessment

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Reference: FV/CS/P17-1282/01 Rev D

Date: June 2018

11-12 INGESTRE ROAD, LONDON, NW5 1UX
Noise and Vibration Assessment – Revision D

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Noise and Vibration Assessment
Revision D

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Appendices

Registration of Amendments

Revision and Date	Amendment Details	Revision Prepared By	Revision Approved By
Rev A 09/07/18	Minor amendments following client feedback	JDB	JDB
Rev B 11/07/18	Updated to amend typographical error	JDB	JDB
Rev C 04/09/18	Calculations re-run following updates to the roof top plant compounds	JDB	CB
Rev D 05/09/18	Updated for latest release of NPPF	JDB	JDB

1.0 INTRODUCTION

Brief

1.1 Create Consulting Engineers Ltd have been commissioned by Four Quarters (Ingestre Road) Ltd to undertake a Noise and Vibration Assessment in support of a planning application for the development of the land at 11-12 Ingestre Road, London, NW5 1UX.

Project Context

1.2 The proposed development comprises the demolition of existing buildings and the erection of a six storey plus single storey basement building accommodating 50 Assisted Living residential apartments with associated communal and support facilities and ancillary cafe, salon and mini gym, together with external amenity spaces, car lift, basement parking, laundry, plant, CCTV, lighting, access, landscaping, infrastructure and other ancillary works.

1.3 Architectural plans have been included at the rear of the report. Drawing No 27463-A-P11-01a (Ground Floor) has been reproduced below as Figure 1.1, which gives a plan view of the proposed development.

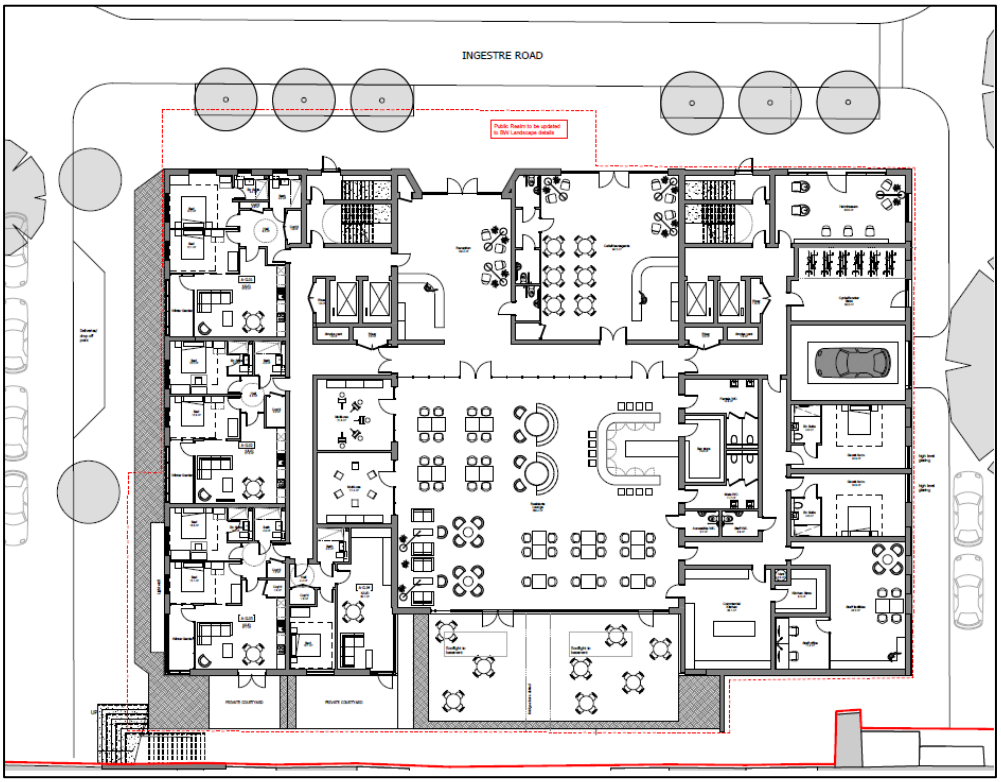


Figure 1.1: Proposed Development Plan (Ground Floor)

2.0 SITE LOCATION AND DESCRIPTION

Site Location

2.1 The site is located in the London Borough of Camden, approximately 375m west of Tufnell Park tube station, approximately 600m northwest of Kentish Town tube station and approximately 50 meters south of the Railway as shown on Figure 2.1 below.

2.2 The site is located on Ingestre Road and accessed from the northeast, via Burghley Road and to the west (pedestrian access only) from Little Green Street, via Highgate Road (B518).

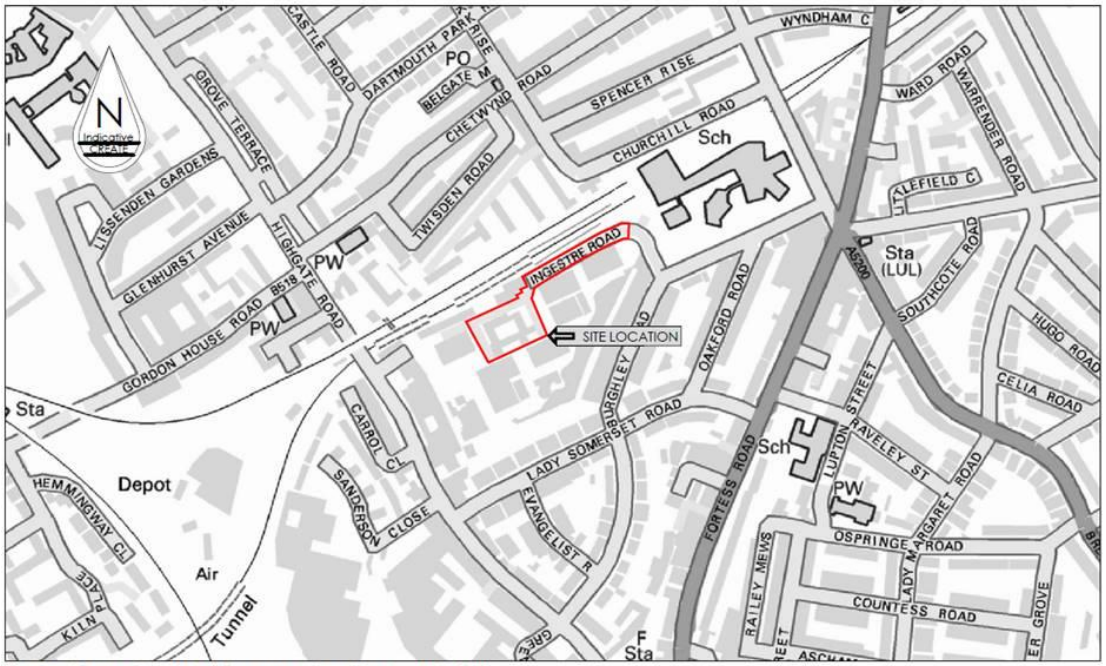


Figure 2.1: Site Location Plan

Site Description

2.3 The site is situated in a predominantly residential area. The site is approximately 0.18 hectares in area and comprises a part two, part three-storey redundant building, originally built as an elderly persons home. The site building comprises four wings arranged around a central courtyard.

2.4 A plan of the existing layout of the development site has been presented in Figure 2.2 overleaf.

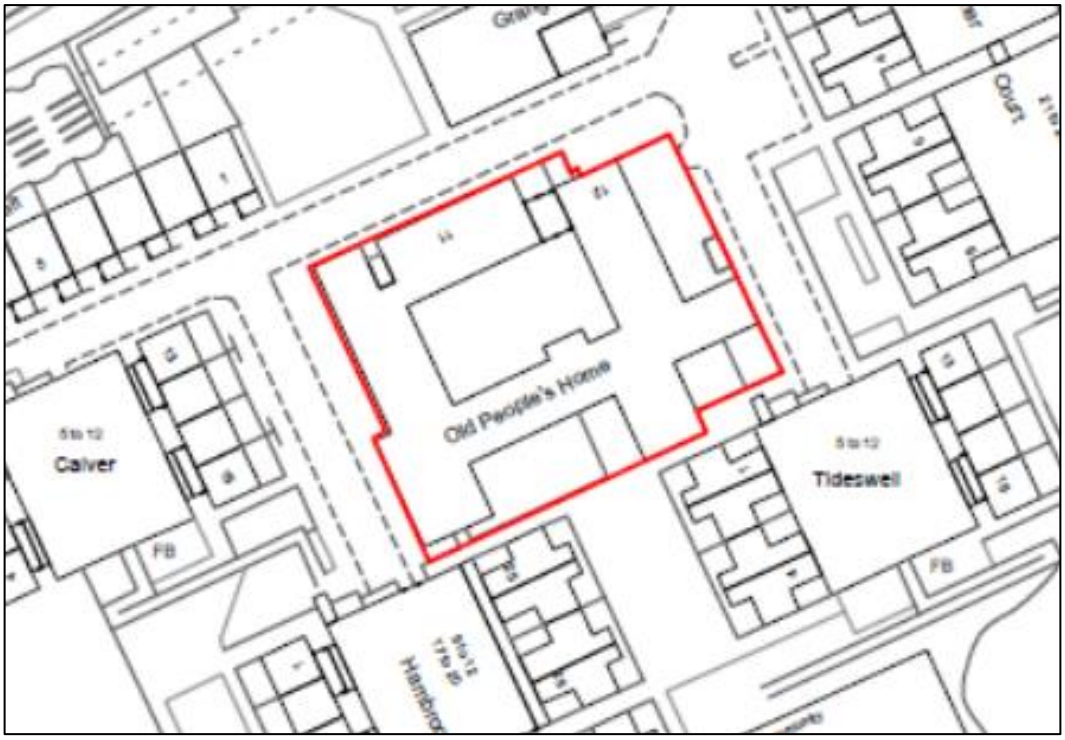


Figure 2.2: Existing Layout of the development site

3.0 LEGISLATION, POLICY AND GUIDANCE

Introduction

3.1 This section presents the planning context of the proposed development with regard to noise quality.

National Planning Policy

National Planning Policy Framework (2018)

3.2 The National Planning Policy Framework (NPPF)[1] replaces the previous version of the NPPF and the Planning Policy Statements (PPS) and Planning Policy Guidance (PPG), including the Department of the Environment's Planning Policy Guidance Note 24: 'Planning and Noise' (PPG 24), which was published in 1994. The main reference to noise within the latest version of the NPPF is at Paragraphs 170 (e) and 180:

3.3 *'Para.170 (e). "Planning policies and decisions should contribute to and enhance the natural and local environment by:*

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

3.4 *'Para.180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

- *(a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[60];*
- *(b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.; and*
- *© limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'*

3.5 The reference number 60 cross references the National Policy Statement for England (NPSE) Explanatory Note.

[1] Department for Communities and Local Government (2018). National Planning Policy Framework. HMSO, London.

3.6 Although some qualitative guidance on noise has been provided in the web based Planning Practice Guidance document, there has been no alternative quantitative guidance proposed by the Government as a direct replacement for PPG24. This was due to the recognition that every site is different and that there is no single acceptable noise level, suitable for all applications.

ProPG: Planning & Noise (2017)

3.7 In May 2017 the Institute of Acoustics (IOA), Association of Noise Consultants (ANC) and the Chartered Institute of Environmental Health (CIEH) released this document which provides professional guidance on planning and noise, specifically relating to residential developments.

3.8 It was produced to provide practitioners with a guidance on a recommended approach to the management of noise within the planning system in England. It encourages good acoustic design, including site layouts, orientation of rooms within dwellings etc. Importantly, this document does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy on which users should take their own advice as appropriate.

3.9 ProPG risk assesses the noise levels in a graduating manner from Negligible Risk through to High Risk in the following manner. It also states that "an indication that there might be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F}$ > 60 dB means the site should not be regarded as negligible risk."

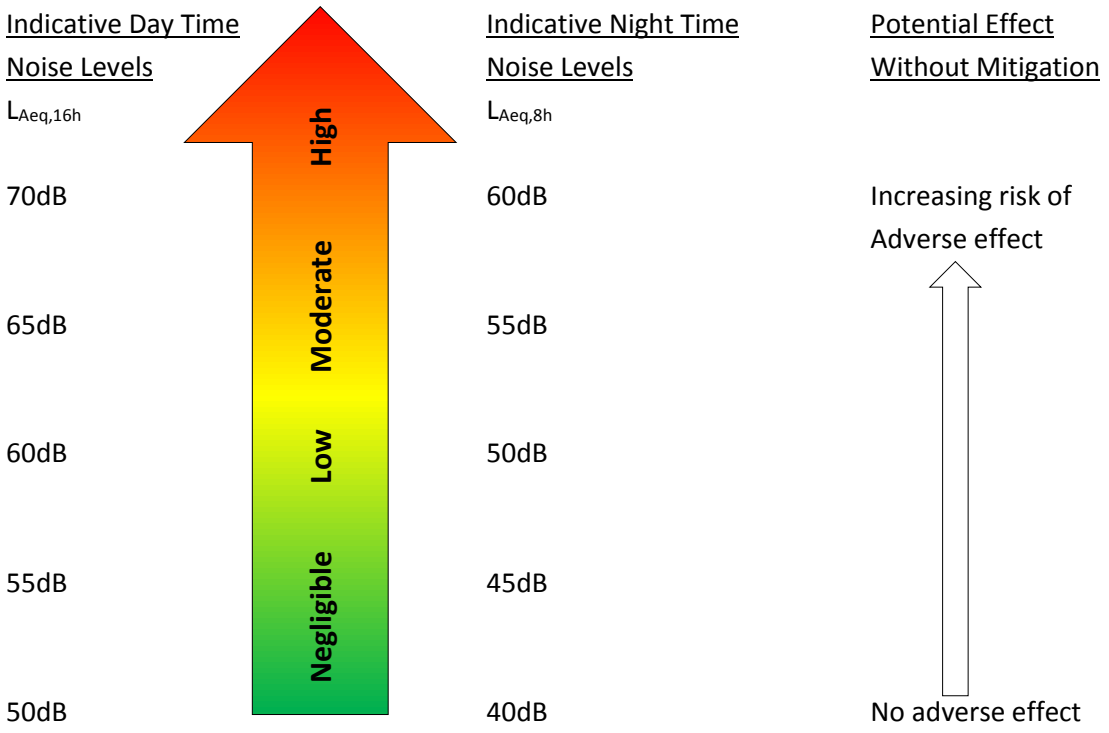


Figure 3.1: Initial Site Risk Assessment Using Fig 1 of ProPG

National Planning Policy Guidance (2014)

3.10 On 6th March 2014, the Department for Communities and Local Government (DCLG) launched the National Planning Practice Guidance (NPPG)[2] web-based resource to supersede previous planning guidance documents including PPG24 and provide clarification over all disciplinary sectors in the delivery of the design quality aspirations of the NPPF.

3.11 The NPPG-Noise provides guidance on the assessment of noise, the needs to be considered when new developments may create additional noise and when developments would be sensitive to the prevailing acoustic environment.

3.12 The acoustic environment should be taken into account in the planning of new development and decision making should take the following into consideration:

- *'whether or not significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.'*

3.13 It then cross references the Noise Policy Statement for England (2010) for further clarification on how to assess the overall effect of noise exposure.

The Noise Policy Statement for England (2010)

3.14 The Noise Policy Statement for England (NPSE)[3] was published in March 2010 and is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is 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.'*

3.15 The vision is supported by the following aims which are reflected in the aims for planning policies and decisions in Paragraph 123 of the NPPF:

> *'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
> - *Avoid significant adverse impacts on health and quality of life;*
> - *Mitigate and minimise adverse impacts on health and quality of life; and*
> - *Where possible, contribute to the improvement of health and quality of life.'*

[2] Department for Communities and Local Government (2014). National Planning Policy Guidance. HMSO, http://planningguidance.planningportal.gov.uk/
[3] Department for Environment, Food and Rural Affairs (DEFRA) (2010). Noise Policy Statement for England. HMSO, London.

3.16 The Explanatory Note to the NPSE introduces three concepts to the assessment of the potential effects of noise:

- 'NOEL – No Observed Effect Level: This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL – Lowest Observed Adverse Effect Level: This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – *Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur.'*

3.17 Unlike the now redundant PPG24, the three levels are not defined numerically in the NPSE, and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent a SOAEL for noise is acknowledged and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

Local Planning Policy and Guidance

Camden Local Planning policy 2017: Policy A4. Noise and Vibration

3.18 Camden Local Planning document details within Appendix 3 the Noise and Vibration thresholds for new developments. This thresholds reflect the observed effect levels outlined in national Planning Practice Guidance and are explained further in the Camden Planning Guidance on amenity supplementary planning document. The thresholds set noise levels for:

- Noise sensitive development in areas of existing noise; and
- Noise generating development in areas sensitive to noise.

3.19 The Camden Local Plan provides a clear vision for the Council's planning policies which has replaced the Core Strategy and Development Policies planning documents. This local plan is valid until 2031.

3.20 Within the Camden Local Plan, Appendix 3: "Noise Thresholds" refers back to the NPPF and Planning Practice Guidance in terms of the NOEL, LOAEL, and the SOAEL. It has attempted to simplify the guidance in terms of three design criteria; **Green**, **Amber** and **Red**, depending on the context of the noise, the severity of the noise, type of noise and sensitivity of the receptor. GREEN would signify that noise would generally be considered to be at an acceptable level; AMBER is equivalent to between the LOAEL and SOAEL where noise would be observed to have an adverse effect level, but may be considered acceptable when assessed; and RED is where noise is observed to have a significant adverse effect.

3.21 Table C of Appendix 3 shows the noise levels applicable to proposed industrial and commercial developments (including plant and machinery). This table has been replicated in Table 3.1 on the following page.

Existing Noise Sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	Rating Level' 10dB* below background	Rating Level' between 9dB below and 5dB above background	Rating Level' greater than 5dB above background
Dwellings**	Outside Bedroom Window (façade)	Night	Rating Level' 10dB* below background and no events exceeding 57dB LAMax	Rating Level' between 9dB below and 5dB above background or noise events between 57dB and 88dB LAMax	Rating Level' greater than 5dB above background and/or events exceeding 88dB LAMax
*10dB should be increased to 15dB if the noise contains audible tonal elements (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, te Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.					
** levels given are fo dwellings, however levels are use specific and different levels will apply dependent on the use of the premises.					

Table 3.1: Excerpt from Camden Local Plan Table C from Appendix 3.

3.22 It also continues to state that there are "certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependent on the room, 1m from the façade of the affected premises, where the noise sensitive premise is located in a quiet background area.

3.23 In terms of the proposed developments likely to be sensitive to noise The Camden Local Plan states that special consideration will need to be given to noise sensitive developments that are in areas which are, or expected to become, subject to levels of noise likely to have an adverse impact. The threshold of acceptability of the noise will depend on the intended use of the noise sensitive development; and the source of the noise experienced, or likely to be experienced. Figure 3.2 shows the levels applicable to noise sensitive receptors.

Dominant Noise Source	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Anonymous noise such as general environmental noise, road traffic and rail traffic ~	Noise at 1 metre from noise sensitive façade/free field	Day	<50dB$L_{Aeq,16hr}$*	50dB to 72dB$L_{Aeq,6hr}$*	>72dB$L_{Aeq,16hr}$*
		Night	<45dB$L_{Aeq,8hr3}$ <40 dB$L_{Aeq,8hr}$**	45dB to 62dB$L_{Aeq,8hr}$* >40dBL_{night}**	>62dB$L_{Aeq,8hrs}$*
	Inside a bedroom	Day	<35dB$L_{Aeq,16hr}$	35dB to 45dB$L_{Aeq,16hr}$	>45dB$L_{Aeq,16hr}$
		Night	<30dB$L_{Aeq,8hr}$ 42dB$L_{Amax,fast}$	30dB to 40dB$L_{Aeq,16hr}$ 40dB to 73dB$L_{Amax,fast}$	>40dB$L_{Aeq,\ 8hr}$ >73dB$L_{Amax,fast}$
	Outdoor living space (free field)	Day	<50dB$L_{Aeq,16hr}$	50dB to 55dB$L_{Aeq,6hr}$	>55dB$L_{Aeq,16hr}$
Non-anonymous noise	See guidance note on non-anonymous noise				

Figure 3.2: Noise levels applicable to Noise Sensitive Residential Development proposed in areas of existing noise

The Draft London Plan – August 2018

3.24 Although this is still in Draft plan, this document is not strictly applicable, however the principle policies have been referenced for this application.

3.25 Policy D12 refers to the "Agent of Change" but in this instance is not particularly relevant as it refers to new developments being placed close to, or adjacent to, noise generating uses, such as music venues. In this instance, the proposed development would be in a relatively quiet location.

3.26 Policy D13 refers to noise and with a view to reducing, managing and mitigating noise with a view to improving health and quality of life through the use of certain measures.

3.27 These include;

- Avoiding significant adverse impacts on health and quality of life;
- Reflecting the agent of change principle as set out in Policy D12;
- Mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses;
- Improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquility);
- Separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening or layout, orientation, uses and materials – in preference to sole reliance on sound insulation;
- Where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles; and
- Promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

3.28 This noise impact assessment has been written to take this policy into account to "future proof" the development on the assumption that this draft plan is fully commissioned.

4.0 ASSESSMENT METHODOLOGY AND CRITERIA

4.1 This section has outlined the assessment methodology and the significant criteria that have been used to assess the noise levels at the proposed development.

4.2 This assessment has considered the existing ambient noise and vibration levels and the likely significant effects on existing and proposed human receptors within the site and surrounding area.

4.3 The nature of the proposed development has been noted to be fully residential. Therefore, an assessment has been undertaken of the suitability of the site for the proposed use and whether any mitigation measures are required in order to provide an adequate environment for future occupants.

Site Suitability - Internal and External Noise Levels

4.4 BS 8233:2014 Guidance on sound insulation and noise reduction for buildings[4] provides criteria for the assessment of noise affecting various uses including residential dwellings.

4.5 WHO 'Guidelines for Community Noise' provides criteria for the assessment of internal and external noise levels affecting various used including residential dwellings.

4.6 BS 8233: 1987 has been withdrawn and replaced firstly by 8233:1999, and more recently BS 8233:2014 Sound insulation and noise reduction for buildings. The current BS 8233:2014 standard has revised the 'good' and 'reasonable' noise level criterion that were set out in BS 8233:1999, and replaces it with a recommendation of a single standard:

Activity	Location	07:00 to 23:00 $L_{Aeq, 16hr}$	23:00 to 07:00 $L_{Aeq, 8hr}$
Resting	Living Room	35 dB	-
Dining	Dining Room/Area	40 dB	-
Sleeping (Daytime Resting)	Bedroom	35 dB	30 dB
Note – Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.			

Table 4.1: BS 8233:2014 Indoor Ambient Noise Levels for Dwellings

4.7 It also suggests 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 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it also recognized that these guideline values are not achievable in all circumstances where development might be desirable".

[4] British Standard Institute (2014). BS 8233:2014 Sound Insulation and Noise Reduction for Buildings. BSI, London.

4.8 The WHO Guidelines for Community Noise state the following guideline values for community noise in specific environments.

Specific Environment	Critical Health Effects	L_{Aeq}	$L_{Amax,fast}$
Dwelling, indoors	Speech intelligibility and moderate annoyance	35 dB	-
Inside Bedrooms	Sleep disturbance, night-time	30 dB	45 dB
Outdoor living area	Serious Annoyance, daytime and evening	55 dB	-
	Moderate annoyance, daytime and evening	50 dB	-

Table 4.2: WHO Guideline Values for Community Noise

4.9 The document also states:

> *'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night, (Vallet & Varnet 1991[5]).'*

4.10 On the basis of the above it would be proposed the following internal noise levels be adopted as a minimum design target for the proposed residential dwellings.

Period	Duration	Noise(1) (2)
Day	07:00 – 23:00	35 dB L_{Aeq}, 16hr
Night	23:00 – 07:00	30 dB L_{Aeq}, 8hr
		45 dB L_{AFmax}

Notes:
(1) From Consultation Response, BS 8233:2014 and WHO guidelines.
(2) The design targets relate to internal noise levels. With respect to outdoor living areas, a target of 55 dB $L_{Aeq,T}$ should avoid serious annoyance during the day and evening.

Table 4.3: Proposed Indoor Criteria

Vibration

4.11 In terms of vibration levels the following table shows the criteria followed in terms of vibration dose values. These values represent the best judgement currently available and may be used for both vertical and horizontal vibration, provided that they are correctly weighted. This table has been obtained from the standard BS 6472-1:2008.

[5] Vallet, M and Vernet, I (1991). Night aircraft noise index and sleep research results. In Lawrence, A (ed.), Inter-Noise 91. The Cost of Noise, Vol. 1, pp. 207-210. Noise Control Foundation, Poughkeepsie, NY, USA.

Place and period	Low probability of adverse comment $m*s^{-1.75}$	Adverse comment possible $m*s^{-1.75}$	Adverse comment probable $m*s^{-1.75}$
Residential buildings 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 4.4: Vibration dose value ranges which might result in probability of adverse comment within residential buildings.

Plant Noise assessment

4.12 The British Standard 4142:2014 (BS4142) describes methods for rating sound of an industrial and/or commercial nature to assess its likely effects on people who might be inside or outside a dwelling or premises used for residential purposes upon which the sound is incident.

4.13 BS 4142 specifies that an initial estimate of the impact of the specific sound can be obtained by subtracting the measured background sound level from the rating level and then considering the following:

- Typically the greater this difference, the greater the magnitude of the impact;
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

4.14 The rating level is defined in BS4142 as the sound level of the source plus any penalties for the characteristic features of the sound, such as tonality and impulsivity among others.

4.15 In the case of this proposal, there are two plant compounds proposed to be located on the roof of the building. Within these compounds, there will be seven Mitsubishi CAHV-P500YA-HPB how water heat pumps. Section 9 of this report has addressed the issue of plant noise and made assessments and recommendations to adhere to BS4142:2014.

4.16 There have also been two personnel lifts and a single car lift proposed within this application. It has been understood however that the lift motors will be housed internally within the various lift motor rooms.

5.0 ACOUSTIC SURVEY PROCEDURE

Manned and Unmanned Acoustic Survey

5.1 An environmental noise and vibration survey has been completed by Mr. J. Blacklock, BEng (Hons), CEng, PG Dip IOA, MIOA, MCIBSE, and Mr. F. Valenzuela, BSc, AMIOA of Create Consulting Engineers Ltd, to monitor the existing levels of noise and vibration that were experienced at the proposed development site at the time of the assessment, using a mixture of manned and unmanned noise monitoring.

5.2 Two locations for unmanned continuous environmental noise monitoring were used between 12:30h Monday 24th through to 12:30h Tuesday 25th July 2017. The unmanned monitoring was performed at the approximate location of MP1 and MP2 as it has been shown on Figure 4.1.

5.3 Whilst assessing the noise on site, the author of this report also walked around the site, but there were not any signs of any potential commercial noise in the close proximity to the proposed site. However, some short-term measurements were made around the proposed development site to assess the noise from potential noise sources which included a community centre, 2 Gas pressure controlling stations and an AHU.

5.4 The short-term measurements were taken at the locations shown on the same Figure 5.1 and designated by SP1 to SP4. This short-term measurements were taken to assess the noise from the additional noise sources in the near vicinity to the main measurement points.

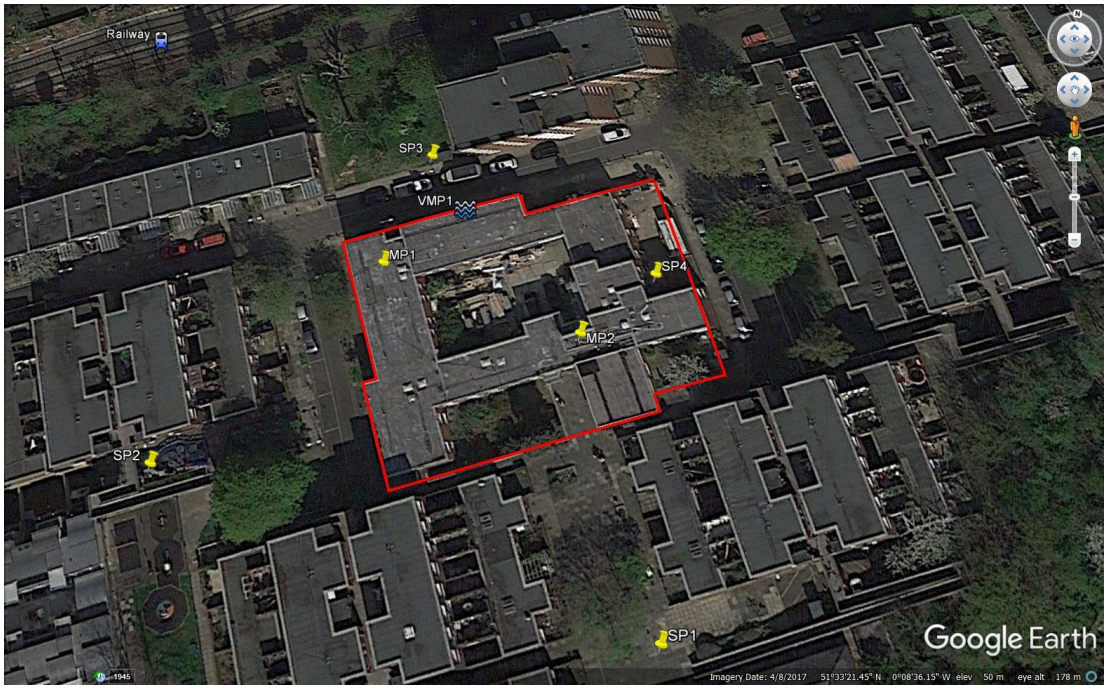


Figure 5.1: Manned and unmanned noise and vibration monitoring

5.5 The following table shows a brief description of the short-term measurements sources considered and their related activity.

Reference	Description	Distance to site (m)	Comments
SP1	Community Centre	30	No activity.
SP2	GPRS1* /Playground	32	Very limited activity
SP3	GPRS2*	9	Very limited activity
SP4	Air Handling Unit	1	Very limited activity
*Gas Pressure Reducing Unit			

Table 5.1: Description of receptors at short term measurement positions.

5.6 The following table shows the equipment used for the unmanned and manned noise and vibration monitoring. The equipment used at position MP2 was also used for short-term measurements around the site once it had measured overnight at MP2.

Noise Equipment	MP1	MP2
Sound Level Meter	Norsonic 140 RTA Serial # 1406932	Norsonic 140 RTA Serial # 1406933
Microphone Protection Kit	Norsonic 1217 Serial # 12175400	Norsonic 1217 Serial # 12175401
Mounting used	Tripod mounted	Tripod mounted
Battery Packs	CA1317 Lithium Batteries	CA1317 Lithium Batteries
Acoustic Calibrator	Norsonic 1251 – Serial # 34963	
Weather Station	ClimeMET CM2000 Professional	
Vibration Equipment	**VMP1**	
Vibration Meter	V901 Vibrock Seismograph Serial # 1001	
Sensor	GOLD-Tri-Axial VDV Transducer	

Table 5.2: Equipment used for the noise and vibration monitoring.

5.7 Once fully assembled, the units were calibrated with a Norsonic 1251 acoustic calibrator, serial number 34963, to a level of 114.1dB at 1kHz and checked for sensitivity both before and after the measurements, no variations greater than 0.1 dB were noted on the meter.

5.8 Sound measurements at location MP1 saw the microphone secured on a boom at a height of approximately 2 meters above roof level in line with BS7445-1:2003[6]. The equipment was set to continuously record the sound levels every second in terms of $L_{Aeq,T}$, $L_{Amax,F}$ and $L_{feq,T}$ (from 6.3 Hz to 20 kHz) and store the data in 15 minutes synchronised files. The Norsonic software NorReview was used to evaluate, post process and calculate the $L_{A90,T}$, $L_{A10,T}$ and $L_{AF(Max),T}$ values.

[6] British Standard Institute (2003) BS 7445-1: Description and measurement of environmental noise. BSI, London.

5.9 The Vibration measurement was carried out with the Vibrock V901 seismograph with PPV and VDV sensors. The V901 was placed at the approximate location of the closest proposed property (approximately 40m from the rail track) and 2m inside the boundary and left to monitor vibration overnight.

5.10 The weather was also measured and noted to be low winds, dry and suitable for the entirety of the monitoring duration. Detailed graphs showing the weather patterns have been included in the appendices section of this report.

6.0 NOISE AND VIBRATION MONITORING RESULTS

Noise Monitoring Results

6.1 The existing acoustic environment at the site was dominated by the railway at approximately 46 meters from MP1 (unobstructed view), occasional airplanes, the occasional local vehicular traffic, pedestrian or bicycle noise. The following table shows the results obtained from the Long Term Noise Monitoring at MP1 and MP2. The $L_{AF(Max),T}$ value was obtained from the top ten highest values calculated for 15 minutes resolution using NorReview.

MP1 Ingestre Road	$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	$L_{AF(Max),T}$
Day Time 07:00-23:00	51	53	42	N/A
Night Time 23:00-07:00	48	47	36	64
MP2 Ingestre Road	$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	$L_{AF(Max),T}$
Day Time 07:00-23:00	51	52	42	N/A
Night Time 23:00-07:00	46	48	36	64

Table 6.1: Results of the Long Term Noise Monitoring

6.2 In line with the ProPG Planning and Noise Guidance, these measured ambient sound levels would risk assess the proposed development site at Ingestre Road as being "*NEGLIGIBLE"* during daytime hours and "*HAVING NO ADVERSE EFFECT"* during the night-time.

6.3 Table 6.2 shows the results of the short-term noise monitoring for each position considered and their related frequency component.

				Ocatve Band Frequency (Linear Values)						
Noise source	Measurement position	L_{feq}/L_{f90}	dB(A)	63HZ	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz
Community hall	SP1	Lfeq	47	54	49	48	46	41	37	33
		Lf90	42	49	44	42	38	33	28	22
GPRS1/Playground	SP2	Lfeq	55	57	53	48	47	52	50	39
		Lf90	42	48	42	39	36	34	29	23
GPRS2	SP3	Lfeq	48	60	52	48	45	42	39	34
		Lf90	39	49	44	39	36	32	28	23
AHU	SP4	Lfeq	46	56	48	47	45	40	34	31
		Lf90	38	43	39	38	34	31	27	22

Table 6.2: Short-term measurement of noise sources around the proposed site.

6.4 The measured noise levels from the short-term location of the potential noise sources enhances the subjective nature because they were bound to be very quiet and did not affect the long term measurements of the area as it was evident in the table above.

6.5 There were no prominent tonal frequencies that could be attributed to any of the sources measured. The difference in level between the 63Hz band and the following 125Hz band on all measurements is common of distant traffic noise which once A weighted would be removed. No tonal or impulsive correction would need to be added for any of these potential noise sources.

Vibration Monitoring Results

6.6 The results from the measured vibration dose values taken during the 24 hours survey on the 24th / 25th July 2017 have been shown below.

Period	Longitudinal Acceleration m/s^2	Transverse Acceleration m/s^2	Vertical Acceleration m/s^2	Total Vibration m/s^2
Day Time 07:00 – 23:00	0.024	0.026	0.023	0.073
Night time 23:00-07:00	0.055	0.060	0.058	0.173

Table 6.3: VDV levels measured at approximately 40m from trackside.

6.7 The resultant levels of vibration were within the required levels as stipulated by BS6472-1:2008, suggesting that the level of vibration would be below than "Low Probability of Adverse Comment" for both day time and night time. The required vibration levels stipulated by BS6472-1:2008 have been shown below. Therefore, on the basis of these findings vibration need not be considered any further.

Place and period	Low probability of adverse comment $m*s^{-1.75}$	Adverse comment possible $m*s^{-1.75}$	Adverse comment probable $m*s^{-1.75}$
Residential buildings 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 6.4: vibration dose values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings.

7.0 DISCUSSION

7.1 The measurement location at MP1 and MP2 was shown to be very quiet with the exception of the occasional freight and passenger train and/or airplane passing by. The freight trains on the rails near Ingestre Road were seen to travel at low speed, the freight train slowing down and passing by at low speed was the main source of noise from the railway.

7.2 Other noise sources were present at the site during the long term noise monitoring. On the 25th July 2017 at around midday there were some pavement works being carried out at Ingestre Road, this works started from 10:00 approximately and finished around 13:00.

7.3 The pavement work noise has been excluded using NorReview for the $L_{Aeq,T}$ calculations since it was only a temporal source which would not be considered typical of the ambient noise levels at Ingestre Road.

7.4 A set of short term measurements were carried out in order to evaluate potential noise sources around the site, for AHU's and similar that might have affected the monitoring. The potential sources of noise found by doing a visual check were the community center within Ingestre Road, 2 x Gas pressure reducing station, a playground and an AHU within the site.

7.5 It has been assumed that the AHU noise levels were very low and could not be distinguished above ambient at a distance of 0.3m. This unit was placed beside the stairs that leads to the first floor flats.

7.6 It was later found that the AHU unit mentioned above will be removed during the demolition process of the development therefore, this AHU unit has not been considered for the purposes of noise survey.

7.7 Both the Gas pressure reducing stations were very quiet. For this reason, this sources were not considered to have a significant effect on the long-term noise monitoring or the proposed demolition site.

8.0 ACOUSTIC DESIGN PROCESS

Requirements to Glazing & Ventilation To Protect Future Internal Ambient Sound Level

8.1 The day time ambient sound level was measured to be 51dB $L_{Aeq,16h}$ and the night time ambient level of 48dB $L_{Aeq,8h}$. As specified within BS8233:2014 and the WHO Night Noise Guidelines the ambient levels within the properties should be 35dB $L_{Aeq,16h}$ and 30dB $L_{Aeq,8h}$ within bedroom spaces. This would suggest that a minimum reduction of 16dB would need to be achieved through the glazing and ventilation systems in order to comply with these internal noise targets.

8.2 It has been proposed that a double glazing system, 4/20/4 would be used with standard "non-acoustic" trickle vents. This style of glazing would offer a sound reduction index of around 35(-1;-4)dB $R_w(C:C_{tr})$, or 31dB R_w+C_{tr}. A plain slot vent would offer sound reduction in the region of 28dB $D_{n,e,w}$ in the open position and 35dB $D_{n,e,w}$ when closed. The use of the proposed glazing and ventilation would result in a suitable internal acoustic environment.

8.3 It would generally be considered "good acoustic design" to orientate noise sensitive rooms, such as bedrooms, away from the main noise sources, however in this instance, the main noise source, the Freight Train railway, would be sufficiently low that the effect on future inhabitants would be negligible.

External Amenity Areas Sound Levels

8.4 The external noise levels measured were 51dB $L_{Aeq,T}$, this level is found to be above 50dB $L_{Aeq,T}$, and below the upper guideline value of 55dB $L_{Aeq,T}$, which is the recommendation for amenity spaces. Therefore, it satisfies the BS 8233:2014 guidance for external noise levels for all balconies and courtyard areas.

9.0 PLANT NOISE

9.1 The motors for the two pedestrian and single car lifts would be housed within separate lift shaft head rooms internally so would not generate significant noise to the existing residents.

9.2 It has been understood that the only noise emitting plant positioned externally would be two sets of seven Mitsubishi CAHV-P500YA-HPB hot water heat pumps. From manufacturer's data, these units have a sound pressure level of 59dB(A) at a distance of 1m. It has been proposed that each set of six pumps be located within roof top plant compounds, each measuring 10m(L) x 5m(W) x 1.8m(H).

9.3 Assuming a straight line distance of 17m from the Plant Compound 1 and an increased distance of 35m to the Plant Compound 2, and assuming a path difference of 0.75m and 0.5m for Plant Compound 1 and Plant Compound 2 respectively, the predicted cumulative sound pressure level at the closest receptors would be approximately 43dB $L_{Aeq,T}$.

For Plant Compound 1 at 17m

	63	125	250	500	1000	2000	4000	8000	dB(A)
Linear SPL for Single Unit	70	65	60	55	51	46	49	45	59
Linear SPL for 7 Units	78	73	68	63	59	54	57	53	66
A Weighting Scale	-26	-16	-9	-3	0	1	1	-1	-
A Weighted SPL for 6 Units	**52**	**57**	**60**	**61**	**59**	**56**	**58**	**52**	**66**
Path Difference (m) (δ)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	-
Wavelength (m) (λ)	5.4	2.7	1.4	0.7	0.3	0.2	0.1	0.0	-
Fresnel Number (N)	0.3	0.6	1.1	2.2	4.4	8.8	17.6	35.3	-
Attenuation (dB)	8	9	11	14	17	20	23	26	-
Distance Attenuation (dB)	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	-
SPL With Screening (dB)	**32**	**36**	**36**	**35**	**30**	**24**	**24**	**15**	**41**

Table 9.1: Calculation From Closest Plant Compound 1

For Plant Compound 2 at 25m

	63	125	250	500	1000	2000	4000	8000	dB(A)
Linear SPL for Single Unit	70	65	60	55	51	46	49	45	59
Linear SPL for 7 Units	78	73	68	63	59	54	57	53	66
A Weighting Scale	-26	-16	-9	-3	0	1	1	-1	-
A Weighted SPL for 6 Units	**52**	**57**	**60**	**61**	**59**	**56**	**58**	**52**	**66**
Path Difference (m) (δ)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-
Wavelength (m) (λ)	5.4	2.7	1.4	0.7	0.3	0.2	0.1	0.0	-
Fresnel Number (N)	0.2	0.4	0.7	1.5	2.9	5.9	11.8	23.5	-
Attenuation (dB)	7	8	10	12	15	18	21	24	-
Distance Attenuation (dB)	14	14	14	14	14	14	14	14	-
SPL With Screening (dB)	**31**	**35**	**36**	**34**	**30**	**24**	**24**	**15**	**41**

Table 9.2: Calculation From Furthest Plant Compound 2

9.4 In line with BS4142:2014, a correction penalty of +3dB should be applied for intermittency. This would result in a rated sound pressure level of approximately 47dB $L_{Aeq,T}$ at the closest noise sensitive receptor.

9.5 When compared to the existing day time background sound level, the excess over background would be considered to be +5dB and for night time would be +11dB. This would be gauged as being an indication of adverse impact during the day time and an indication of significant adverse impact during the night time hours.

9.6 It must be noted that the above calculations have been prepared using a worst case scenario where all units are operating simultaneously, which in reality would be highly unlikely to happen.

Rooftop Plant Noise Mitigation Through Design

9.7 In order to increase the effectiveness of the plant compounds, it has been proposed that the plant compounds be constructed as 'penthouse enclosures'. Typically these consist of louvred walls to the plant compound and a roof. It is also quite common to introduce acoustic splitters into the roof section to provide ventilation.

9.8 The louvres in the walls should be double acoustic louvres, and 600mm deep acoustic splitters positioned directly above the top of the Mitsubishi units in the roof of the penthouse enclosure.

9.9 The most applicable guidance or British Standards for assessing the noise from external plant is the current 2014 version of BS4142. It states that the rated sound pressure level should at least be equal to, or below the representative background sound level to minimise the likelihood of adverse comment from a noise perspective.

3D Noise Propagation Model

9.10 In order to predict the propagation of noise to the nearest noise sensitive receptors, the calculated area sources were fed into a computerized noise model which meets the requirements of ISO 9613 Part 2:1996.

9.11 The noise model has taken into account the following assumptions;

- Source sound power level(S);
- Reflection from nearby surfaces and structures has been set as a structured surface;
- Two orders of reflections;
- Source directivity;
- Distance from noise sources to receivers using geometric spreading;
- Height of noise sources being positioned internally within the rooftop penthouse enclosures;
- Sound reduction provided by the double banked acoustic louvres and the acoustic roof splitters was rated as in Table 9.3
- Atmospheric absorption;
- Acoustic screening of fences, buildings and natural topography;
- Ground absorption has been assumed to be a hard reflective surface;
- Ground effects; and
- The receivers were set out at a distance of 1m from the closest facades of the surrounding properties, on the top floor. These included Fletcher Court, Grangemill, Calver, Hambrook and Tideswell.

	63	125	250	500	1000	2000	4000	8000
Louvre	7	9	11	20	32	35	31	31
Splitter	8	11	20	29	35	33	25	17

Table 9.3: Details of Sound Insulation Used in Acoustic Model

9.12 The acoustic louvres have been displayed on the following illustration by the navy blue rectangles.

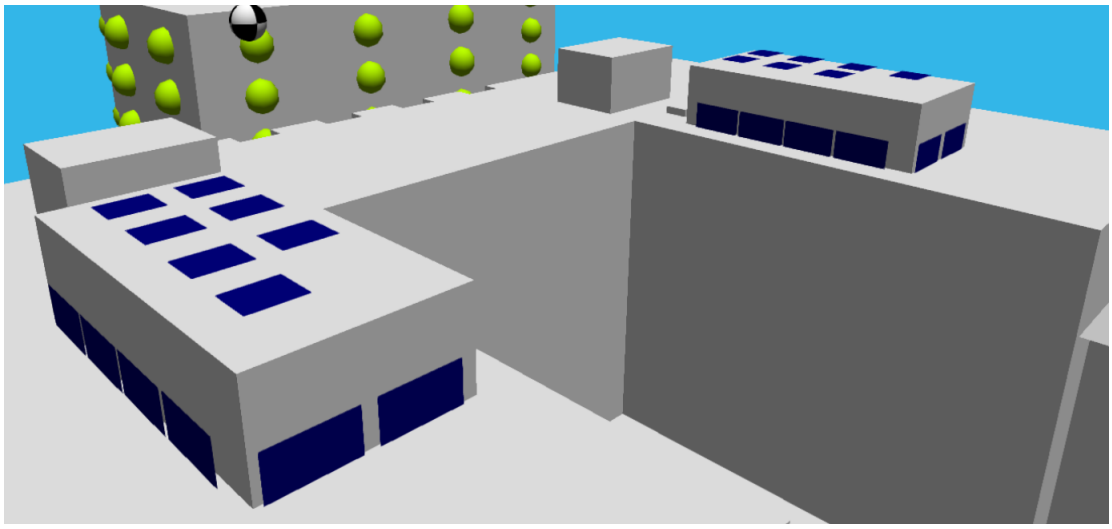


Figure 9.1: View of 3D Noise Model Showing the Rooftop Penthouse Enclosures with Noise Sources (Building in Background is Grangemill)

Results of Noise Modelling

Assumed Typical Trading Scenario

9.13 At the closest receptor, at the front of Tideswell, the predicted patron noise levels under these normal trading conditions (circa 48dB $L_{Aeq,T}$) were below the measured ambient sound levels, but above the background sound level. In reality, for the majority of the time, it is anticipated that the outside occupancy would be lower than that which was modelled, thus resulting in lower sound levels.

9.14 Calculations have been performed using double acoustic louvres at 600mm deep and 600mm deep acoustic splitters in the roof. All other aspects of the roof and walls have been assumed to be solid.

9.15 As can be seen in Table 9.4, the specific sound level has been calculated as being 32.7dB $L_{Aeq,T}$ at Grangemill. As stated previously, a correction factor of +3dB should be applied for intermittency, due to the typically intermittent nature of operation.

Receiver		Existing Background Sound Level		Plant Noise Specific Sound Level		Correction	Rated Sound Level		Excess of Rating Over Background	
Name	ID	Day	Night	Day	Night	Intermittency	Day	Night	Day	Night
		dB(A)	dB(A)	dB(A)	dB(A)	dB	dB(A)	dB(A)	dB	dB
Grangemill	Top Floor	42	36	32.7	32.7	3	35.7	35.7	-6.3	-0.3
Top Left Building	Top Floor	42	36	22.8	22.8	3	25.8	25.8	-16.2	-10.2
Calver	Top Floor	42	36	24.1	24.1	3	27.1	27.1	-14.9	-8.9
Hambrook	Top Floor	42	36	30.0	30.0	3	33.0	33.0	-9.0	-3.0
Tideswell	Top Floor	42	36	31.5	31.5	3	34.5	34.5	-7.5	-1.5
Fletcher Court	Top Floor	42	36	23.3	23.3	3	26.3	26.3	-15.7	-9.7
Fletcher Court	Top Floor	42	36	23.7	23.7	3	26.7	26.7	-15.3	-9.3
Fletcher Court	Top Floor	42	36	23.3	23.3	3	26.3	26.3	-15.7	-9.7

Table 9.4: Results of 3D Noise Propagation Modelling

9.16 This would result in a rated sound pressure level of 35.7dB $L_{Aeq,T}$, equal to the existing background sound level.

9.17 BS4142:2014 states that "where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

10.0 OPERATIONAL / SERVICE VEHICLE NOISE EFFECTS

Collection and Delivery Noise

10.1 This section of the acoustic report has assessed the servicing and deliveries as described in the DSMP provided by Create Consulting Engineers Ltd, in report reference TA/CS/P17-1282/07.

10.2 The proposed development comprises communal facilities including a café, salon, mini gym and launderette. The following delivery and service activities are anticipated during the normal operation of the site. These activities have been tabulated for ease.

Activity	Type of vehicle	Location	Frequency
Site Visitors	Cars & Small Vans	8 Parking Spaces in Basement	Daily
Staff commuting	Cars & Public Transport	2 Parking Spaces in Basement	Daily
Deliveries for Cafe	Transit Van	Delivery area to east of building or within basement	Daily
Other Commercial Deliveries	Transit Van	Delivery area to east of building or within basement	Weekly
Refuse collection	Refuse Collection Vehicle	Allocated area to north east of building	Weekly

Table 10.1: Type, Location and Frequency of Deliveries/Activities

10.3 As can be seen in the above table, with the exception of the refuse collection, all other activities would typically be low noise activities. The small number of parking spaces would dictate that the additional traffic flow as a result of this development would be negligible against the existing traffic in the area.

10.4 The noisiest activity would be the refuse collection service, which would occur once per week. In particular, the noise from the kerbside collection of glass would be the noisiest of these collection services, but would be conducted at the same time as the existing refuse collection services, which has been noted to currently be on a weekly basis, every Tuesday.

10.5 The commercial waste would typically be collected through the use of private contractors, which would typically be restricted to between the hours of 07:30h and 22:00h within residential areas.

10.6 It is anticipated that the noise from these collection and delivery activities would not adversely impact on the existing acoustic environment due to the relatively infrequent and limited activities.

Prediction of Noise From Café Area

10.7 There is no set guidance or British Standards for assessing the noise from external seating areas, so the approach used to assess the future sound level from the external café seating area has been derived from Create Consulting Engineers extensive experience of previous public house and other external event noise assessments. This approach considers three trading level scenarios, which have been detailed below:

- Normal Trading where 50% of the seating has been occupied with the patrons talking in relaxed normal voices, with this being the anticipated trading level for the majority of the time;
- Additional trading where 75% of the seating has been occupied with the patrons talking in relaxed normal voices; and
- Peak trading at full capacity with 100% seating allocation and patrons talking in relaxed and normal voices.

10.8 Noise levels from the patrons in these scenarios have been modelled using the sound pressure level of human voices taken from Table 14.1 of "Handbook of Noise Control" 2nd edition. This data provides average sound levels at various levels of volume. The data has been scaled up according to the café occupancy rate and converted into a series of area sources. This approach neglects the effect of voice directivity, therefore, it effectively assumes that all speakers face all surrounding noise receptors, i.e. are omnidirectional. This would result in an overestimation of the predicted sound levels as many of the speakers would be facing away from the noise sensitive receptors.

10.9 This analysis procedure has been validated numerous times by various site measurements at similar external events and locations and, therefore, show a good level of alignment between measurements and predictions.

3D Noise Propagation Model

10.10 In order to predict the propagation of noise to the nearest noise sensitive receptors, the calculated area sources were fed into a computerized noise model which meets the requirements of ISO 9613 Part 2:1996.

10.11 The noise model has taken into account the following assumptions;

- Source sound power level;
- Reflection from nearby surfaces and structures has been set as a structured surface;
- Two orders of reflections;
- Source directivity;
- Distance from noise sources to receivers using geometric spreading;
- Height of noise sources being an average height of 1.5m;
- Quantity of noise sources being limited to 32 (8 tables of 4);

- Atmospheric absorption;
- Acoustic screening of fences, buildings and natural topography;
- Ground absorption has been assumed to be a hard reflective surface;
- Ground effects; and
- The receivers were set out around the front facades of Tideswell and Hambrook Court, at a height of 1.8m, at a distance of 0.5m from the building.

Initial results

Assumed Typical Trading Scenario

10.12 At the closest receptor, at the front of Tideswell, the predicted patron noise levels under these normal trading conditions (circa 48dB $L_{Aeq,T}$) were below the measured ambient sound levels, but above the background sound level. In reality, for the majority of the time, it is anticipated that the outside occupancy would be lower than that which was modelled, thus resulting in lower sound levels.

Trading with 75% External Seating Occupied

10.13 At the closest receptor, the predicted noise levels under these trading conditions (circa 50dB $L_{Aeq,T}$) were below the measured ambient sound level.

Peak Trading with 100% External Seating Occupied

10.14 At the closest receptor, the predicted sound levels under these full trading conditions (circa 51dB $L_{Aeq,T}$) were equal to the measured ambient sound level.

Objective Assessment of Noise From Proposed External Café Seating Area

10.15 Predicted sound levels have been provided in Table 10.2 below. They have been assessed against the existing current acoustic climate.

Receiver	Existing Ambient Level		50% Capacity	75% Capacity	100% Capacity
	Day dB(A)	Night dB(A)	SPL dB(A)	SPL dB(A)	SPL dB(A)
Tideswell Front	51	48	***48***	***50***	***51***
Tideswell Mid	51	48	***38***	***40***	***42***
Tideswell Side	51	48	***43***	***45***	***45***
Hambrook Front	51	48	***45***	***47***	***49***
Hambrook Mid	51	48	***40***	***42***	***43***
Hambrook Side	51	48	***38***	***39***	***40***

Table 10.2: Predicted Sound Levels Rated Against Ambient Sound Level

10.16 During peak periods with full trading capacity, we believe that the predicted sound levels from patrons would be acceptable, even at the closest receptors, due to the sound levels being equal to, or below, the existing measured ambient sound level.

11.0 CONCLUSIONS

11.1 The proposed site at Ingestre Road is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed.

11.2 In line with BS8233:2014, the ambient noise levels were found to be sufficiently low, so that the standard "thermal" double glazing and standard passive ventilation would be suitable for the proposed new residential properties. This also satisfies the World Health Organisation requirements.

11.3 The external noise levels measured were 51dB $L_{Aeq,T}$, this level is found to be slightly above the 50dB $L_{Aeq,T}$ threshold but below the upper guideline value of 55dB $L_{Aeq,T}$ therefore, it satisfies the BS 8233:2014 guidance for external noise levels.

11.4 The short-term measurements of the noise sources around the proposed development site have been shown to be unlikely to cause adverse impact since their levels were measured to be very low as demonstrated on Table 6.2.

11.5 As was seen from the vibration monitoring results within Table 6.4, the proposed development site, being 40 meters approximately from the railway was below the threshold for "Low probability of adverse comment" in line with BS 6472:2008. The vibration levels at the proposed site are therefore acceptable.

11.6 Regarding plant noise, the assessment presented in this report has been conducted in line with BS 4142:2014 by rating the sound from fourteen hot water heat pumps, spread over two roof top plant compounds. With the initial proposed design, the excess over background sound level would have been an indication of adverse impact for day time hours and an indication of significant adverse impact for night time hours.

11.7 It has therefore been recommended that the plant compounds be upgraded acoustically to include double banked acoustic louvres in the walls and acoustic splitters in the roof sections directly above the fan units. This would increase the effectiveness of the screening, whilst not affecting the air flow required for the units. This would reduce the rated sound levels to below the existing background sound level for both, the day and night time hours.

11.8 The sound level from services and deliveries associated with this proposal would have minimal effect on the current acoustic climate as the quantity and frequency of occurrence would be low for all aspects.

11.9 For the worst case scenario, the sound level from the external café seating area has been shown to be equal to the existing ambient sound level and normal trading levels would be below that level. We would therefore recommend that the sound levels relating to the café seating area should not be of concern to this planning application.

12.0 DISCLAIMER

12.1 Create Consulting disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report.

12.2 The copyright of this report is vested in Create Consulting Engineers Ltd and Four Quarters (Ingestre Road) Ltd. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd or Four Quarters (Ingestre Road) Ltd.

12.3 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

APPENDICES

APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter can be used to duplicate the ear's variable sensitivity to sound across a spectrum of frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the average ear. This is called an "A-weighting filter". Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

$L_{eq,T}$

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 (T).

$L_{10,T}$

This is the minimum level exceeded for not more than 10% of the time period (T). This parameter is often used as a "not to exceed" criterion for noise.

$L_{90,T}$

This is the minimum level exceeded for not more than 90% of the time period (T). This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{fmax}

This is the maximum sound pressure level that has been measured over a period using a fast time constant.

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 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combine, on a logarithmic scale, 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 one alone and 3 identical sources produce a 5dB 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

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception 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 reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

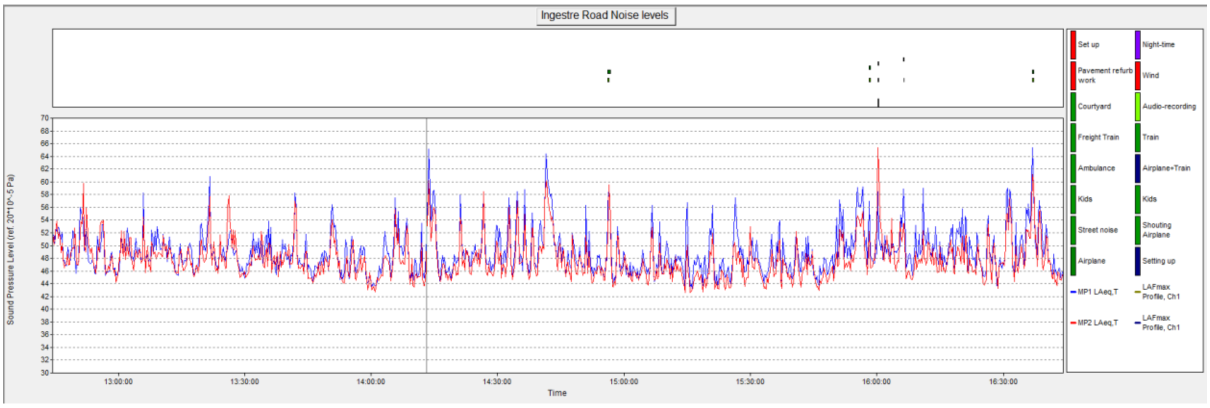
When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX B

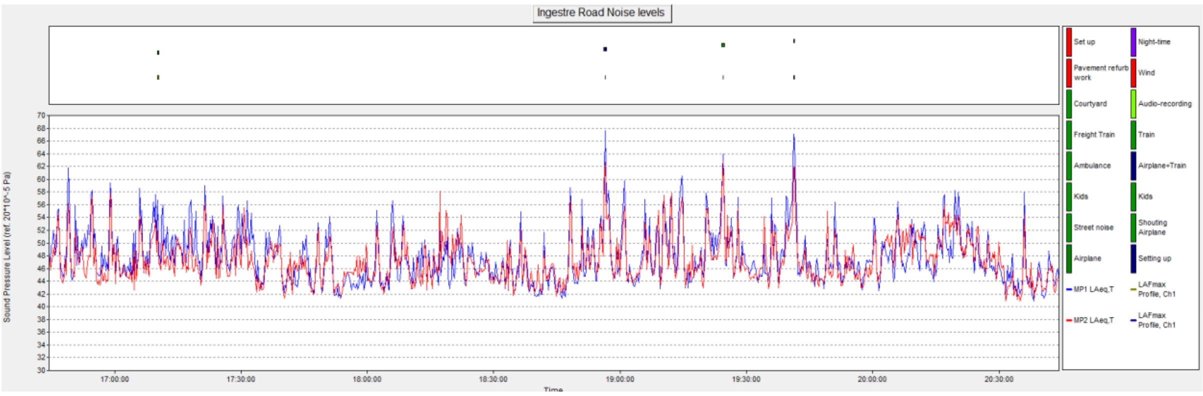
DETAILED RESULTS OF THE ACOUSTIC SURVEY

MEASURED NOISE DATA

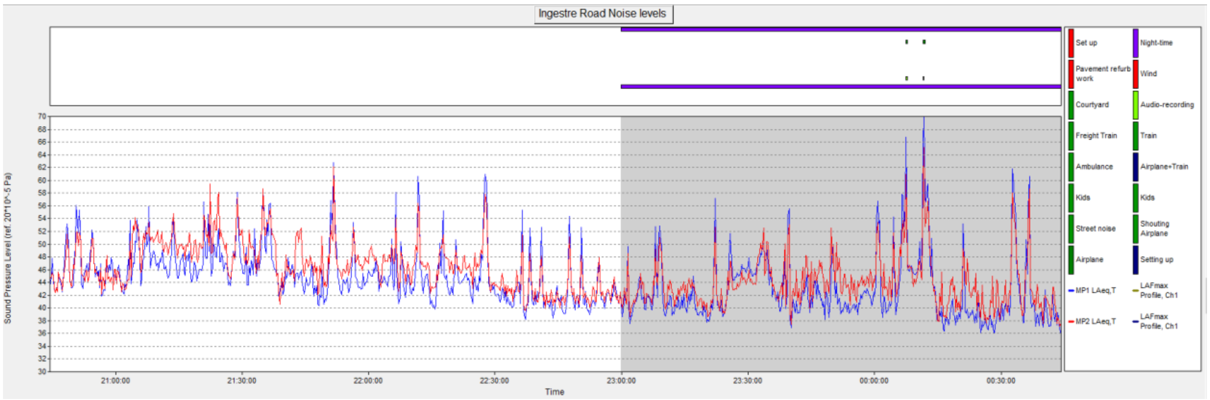
24th July 2017



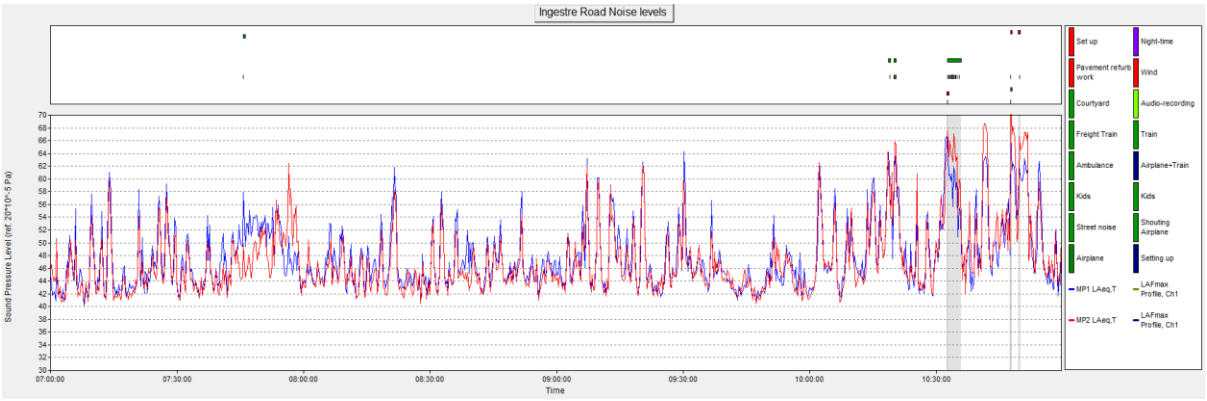
24th July 2017



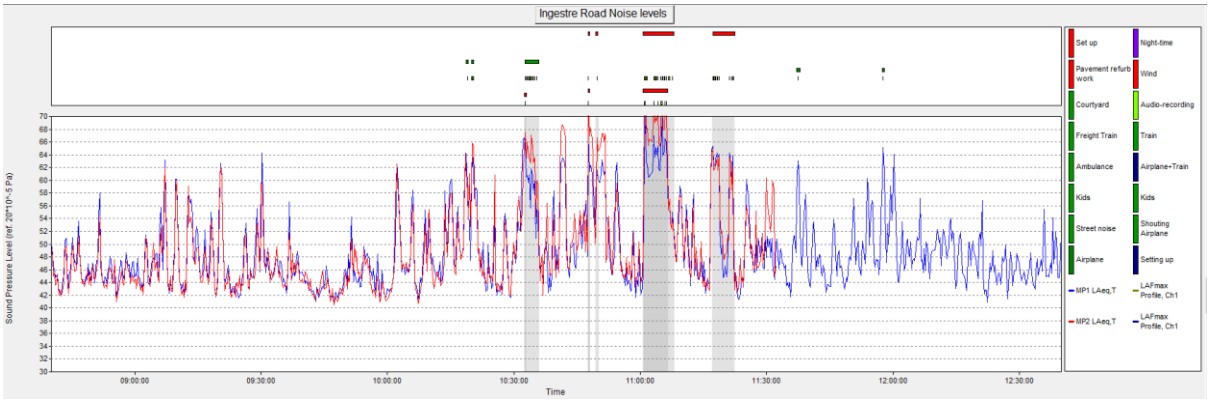
24th July 2017



25th July 2017



25th July 2017

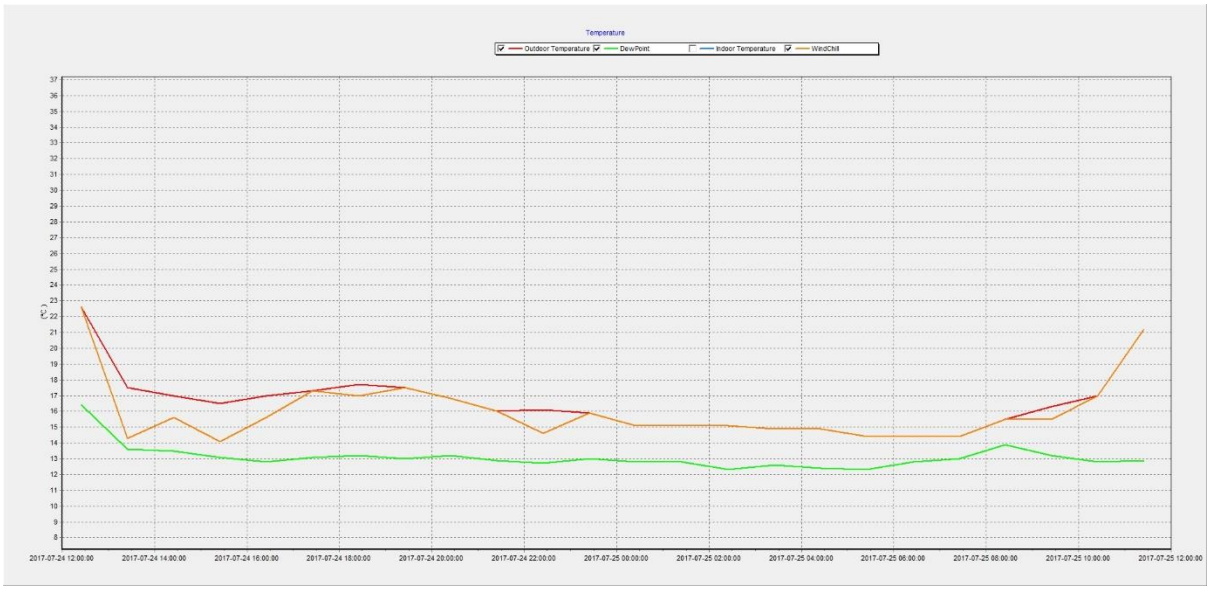


APPENDIX C

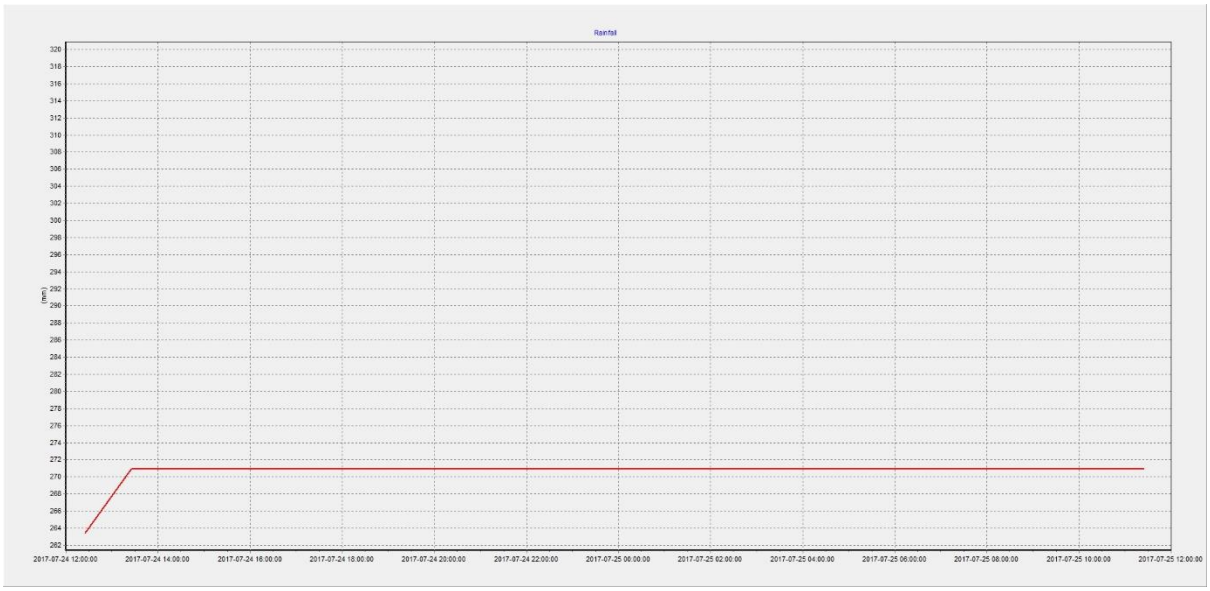
WEATHER RECORDS FOR NOISE MONITORING

WINDSPEED

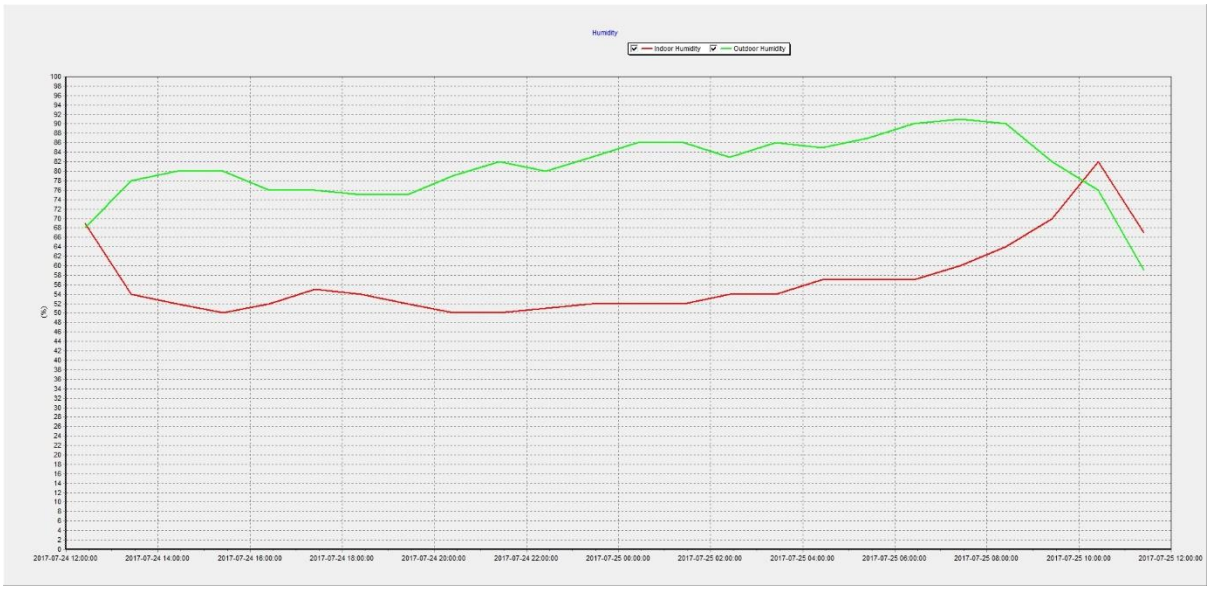
TEMPERATURE



RAINFALL



HUMIDITY



APPENDIX D

PROPOSED MASTER PLAN FOR DEVELOPMENT

Note

Each external CCTV camera will be restricted by means of 'privacy masking' inline with The Data Protection Act 2018 & The Human Rights Act 1998.

INGESTRE ROAD

FIXED
PTZ
FIXED
PTZ
FIXED
FIXED
FIXED

Deliveries/ drop off point

Bed 14,5 m²
En Suite 3,5 m²
Bath 4,5 m²
Cupb'd 0,8 m²
Hall 8,2 m²
Cupb'd 1,6 m²
Bed 12,2 m²
A-G.01
KL/D 23,0 m²
Winter Garden
Bed 13,2 m²
En Suite 3,4 m²
Bath 4,3 m²
Hall 5,0 m²
Cupb'd 2,4 m²
Bed 12,4 m²
A-G.02
KL/D 27,2 m²
Winter Garden
Bed 13,4 m²
En Suite 3,4 m²
Bath 4,3 m²
Cupb'd 1,6 m²
Bed 12,1 m²
Cupb'd 1,6 m²
Hall 4,9 m²
Cupb'd 1,6 m²
A-G.03
KL/D 27,2 m²
Winter Garden
Lightwell
Bath 4,4 m²
A-G.04
KL/D 30,5 m²
Bed 13,8 m²
Reception 104,3 m²
Cafe/Newsagents 94,5 m²
Riser 1,8 m²
Smoke vent 1,6 m²
Riser 1,8 m²
Riser 1,8 m²
Smoke vent 1,6 m²
Riser 1,8 m²
Multi-use 21,4 m²
Multi-use 21,4 m²
Residents Lounge 268,3 m²
Hairdressers 37,2 m²
Cycle/Scooter Store 33,5 m²
Louvred door
Female WC 14,2 m²
Bar store 10,8 m²
Male WC 11,8 m²
Accessible WC 3,7 m²
Staff WC 3,0 m²
En Suite 4,2 m²
Guest Acco. 25,0 m²
En Suite 4,2 m²
Guest Acco. 25,0 m²
high level glazing
high level glazing
Vent Shaft
Kitchen Store 8,0 m²
Commercial Kitchen 35,2 m²
Staff facilities 43,6 m²
Staff office 11,4 m²
Rooflight to basement
Rooflight to basement
Plant screening to provide privacy to mechanical activity
Plant screening for privacy
Plant screening for privacy
PRIVATE COURTYARD
PRIVATE COURTYARD
Bridge above dotted
Air conditioning units to Mckee Associates details
UP

0m 2m 4m 6m 8m

VISUAL SCALE 1:100 @ A1

Ground Floor Plan

1 : 100

Rev	Date	Revision	Drawn	Ck'd
P	05.06.18	PLANNING ISSUE	AK	DM

Client

Project

ASSISTED LIVING DEVELOPMENT
INGESTRE ROAD, CAMDEN

Drawing Title

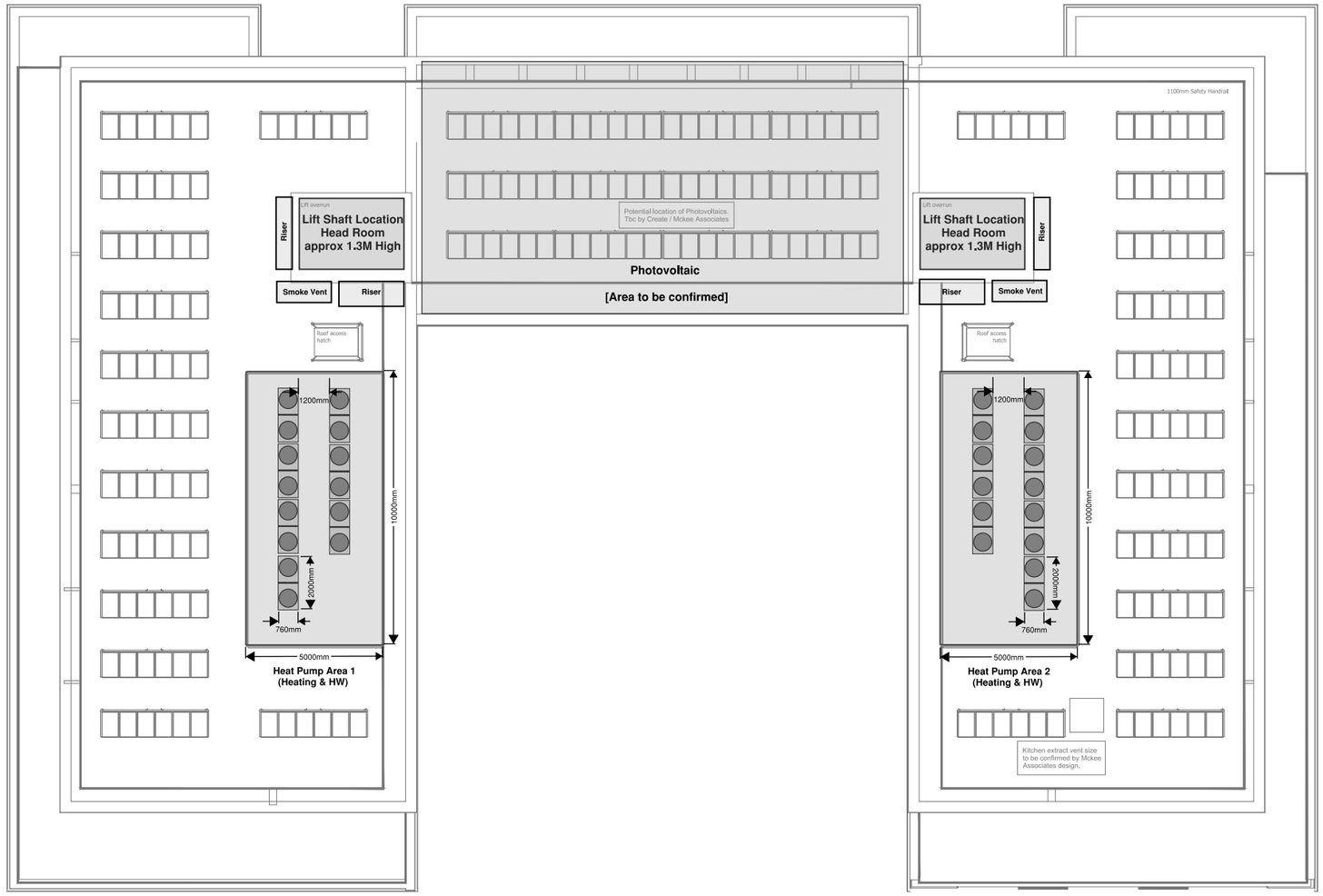
GROUND M&E SERVICES

McKee Associates Ltd
Unity House
Westwood Park
Wigan
WN3 4HE

Web : www.mckeeassociates.co.uk

Cad Drawn	Date	Scale
MS	JUNE 2018	1:100 @ A1
Checked	Date	Rev.
DM	JUNE 2018	P

Dwg No : P0097 ME (60) 002



1 **06 Roof Plan**
1 : 100

0m 2m 4m 6m 8m
VISUAL SCALE 1:100 @ A1

Rev	Date	Revision	Drawn	Ck'd
P	05.06.18	PLANNING ISSUE	AK	DM

Client

Project
ASSISTED LIVING DEVELOPMENT
INGESTRE ROAD, CAMDEN

Drawing Title
ROOF M&E SERVICES

McKee Associates Ltd
Unity House
Westwood Park
Wigan
WN3 4HE
Web : www.mckeeassociates.co.uk

Cad Drawn	Date	Scale
MS	JUNE 2018	1:100 @ A1
Checked	Date	Rev.
DM	JUNE 2018	P

Dwg No : P0097 ME (60) 006

APPENDIX E

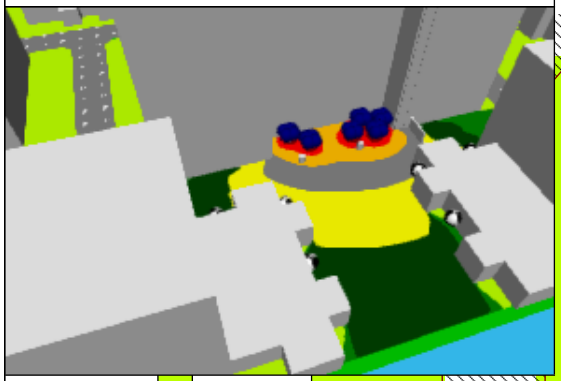
DETAILS OF 3D NOISE PROPAGATION MODELLING OF CAFE

3D View of Proposed Site

Typical Trading With 50% Seating Capacity

create
CONSULTING
ENGINEERS LTD

3D View of Proposed Site



Trading With 75% Seating Capacity

create CONSULTING ENGINEERS LTD

39.4

46.9

41.7

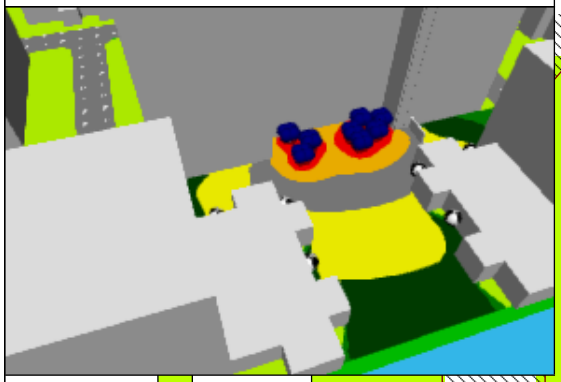
49.7

39.8

45.2

> -99.0 dB
> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB
> 85.0 dB

3D View of Proposed Site



Peak Trading With 100% Seating Capacity

create CONSULTING ENGINEERS LTD

40.3

49.2

43.1

51.2

41.9

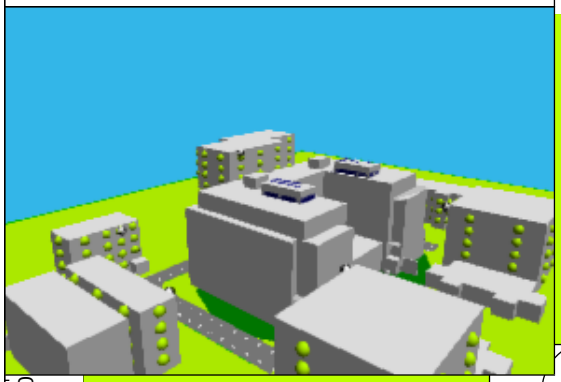
45.5

> -99.0 dB
> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB
> 85.0 dB

APPENDIX F

DETAILS OF 3D NOISE PROPAGATION MODELLING OF ROOFTOP PLANT

3D View of Proposed Site



Noise From Roof Top Plant