PLANNING NOISE ASSESSMENT

THE QUADRANT, 60 MARLBOROUGH ROAD, LANCING

STICKLAND WRIGHT

SEPTEMBER 2020

PLANNING NOISE ASSESSMENT
THE QUADRANT, 60 MARLBOROUGH ROAD, LANCING

Our Ref: **4912_001R_1-0_JE**

Client:	**Stickland Wright** 4 Gloucester Passage Brighton BN1 4AS
Report by:	**Anderson Acoustics Limited** 3 Trafalgar Mews 15 – 16 Trafalgar Street Brighton BN1 4EZ www.andersonacoustics.co.uk T: 01273 696 887
Date:	**24 September 2020**
Project No:	**4912**
Status:	**Final**

Author	**Jamie Easton** Consultant AMIOA		**24 September 2020**
Reviewed	**Pau Santamaria** Principal Consultant BEng MIOA		**24 September 2020**
Approved	**Pau Santamaria** Principal Consultant BEng MIOA		**24 September 2020**

This document has been prepared using all reasonable skill and care. Anderson Acoustics Ltd accepts no responsibility or liability for any third-party data presented in this report or used for the basis of drawing any conclusions. This document is confidential to the named client above and Anderson Acoustics Ltd accepts no responsibility or liability resulting from third party use of this document or for a purpose other than for which it was commissioned.

REVISION HISTORY

Version	Comments	Date	Changes made by	Approved by
1.0	First issued version	24/09/20	JE	PS

PAGE LEFT INTENTIONALLY BLANK

CONTENTS

1	INTRODUCTION	6
2	POLICY AND CRITERIA	7
3	SITE DESCRIPTION	12
4	NOISE LEVELS ON SITE	14
5	COMMERCIAL NOISE ASSESSMENT	20
6	BS8233 NOISE ASSESSMENT	23
7	CONCLUSIONS	26
8	REFERENCES	27
NOISE UNITS AND NATIONAL PLANNING GUIDANCE		29
FIGURES AND MARK-UPS		34

1 INTRODUCTION

Anderson Acoustics Ltd was commissioned by Stickland Wright in September 2020 to undertake a planning noise assessment for the proposed residential development at The Quadrant, 60 Marlborough Road, Lancing; to be used in support of a planning application. The project involves the change of use from B1(a) (offices) to Class C3 (dwelling houses) to provide 53 no apartments.

This report presents the results of an environmental noise survey and provides guidance on appropriate façade elements to ensure that an acceptable internal noise environment is capable of being achieved. The report also presents a noise assessment of the proposed external amenity areas, based on the measured levels on site; and measures taken to control noise from nearby roads and commercial premises to the proposed development.

Environmental noise criteria relevant to the assessment have been presented and briefly discussed in Section 2 of this report.

A brief description of the site and proposed development is given in Section 3.

The methodology and results of an environmental noise survey undertaken at the site are given in Section 4.

Section 5 details an assessment and discussion of commercial noise from the surrounding commercial estate.

Section 6 provides detail of facade elements required to ensure internal ambient noise levels can be achieved with consideration of the noise environment at the development site.

The report is concluded in Section 7.

2 POLICY AND CRITERIA

Noise units and national planning guidance documents including Noise Policy Statement for England (NPSE) [1], Planning Practice Guidance – Noise [2] and National Planning Policy Framework (NPPF) [3] are detailed in Appendix A.

2.1.1 Planning Noise Advice Document: Sussex

The Planning Noise Advice Document: Sussex July 2015 [4] Paragraphs 1.36. and 1.3.7. provide the following regarding planned residential developments located near to existing transport and commercial noise sources:

1.3.6. For a new noise sensitive development near an existing source of transport noise (road, rail, ports or aircraft) the LAeq (16hr day and 8hr night), or the shortened calculation method, should be measured, as agreed. In addition, suitable shorter term L_{Aeq}, L_{A90}, L_{A10} and L_{Amax} would be expected to give a clearer picture of the existing noise environment. This could also apply to extensions /alterations to existing development.

Paragraphs 5.5.2. and 5.5.3. state the following with regard to achieving suitable in internal ambient noise levels in habitable rooms:

5.5.2. Design control measures should aim to meet the recommended standards set out in table 4 of BS 8233:2014 and the night-time L_{Amax} level recommended in the WHO's Night Noise Guidelines for Europe (2009), unless there are particular reasons why this is not considered appropriate. In such cases, a clear explanation of the reasons should be provided.

5.5.3. While it is acknowledged that noise mitigation measures can be used in a lot of cases to achieve suitable internal levels, it is important that preference is given to criteria based on windows being partially open. If it is not possible to achieve suitable internal levels with the windows opened, then details of alternative ventilation must be supplied.

2.1.2 British Standard 8233

British Standard BS 8233:2014: *Sound insulation and noise reduction for buildings* [5] provides guideline values for internal noise levels within a number of building types including residential dwellings.

In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 2-1:

Table 2-1: British Standard 8233 Indoor Noise Levels

Activity	Location	Daytime	Night-time
Resting	Living room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 8hour}$

Notes: Daytime assessment period – 07:00 to 23:00 hrs
Night-time assessment period – 23:00 to 07:00 hrs

In respect of external noise levels, the guidance in BS 8233:2014 suggests that "*it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments*". BS 8233:2014 however acknowledges that "*these guideline values are not achievable in all circumstances where development might be desirable*", and that "*…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".

In respect of balconies, roof gardens and terraces, BS 8233:2014 states that "*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*".

BS 8233:2014 suggests that proposed development within noisy environments should be designed to ensure that the recommended internal design standards are achieved, and that noise levels in external amenity areas are designed to effectively control and reduce noise levels; although it acknowledges that in certain circumstances meeting the external design recommendations may not be feasible, or necessary, especially where the provision of such spaces is desirable for other technical, planning or policy reasons.

2.1.3 British Standard 4142:2014+A1:2019

Guidance on the rating of noise from fixed installations and sources of an industrial nature is provided in British Standard (BS) 4142:2014+A1:2019 [6]. The "+A1:2019" in the reference reflects that the 2014 version of the Standard received minor (mostly typographical) amendments in 2019. It provides a procedure for the measurement and rating of noise levels outside dwellings from industrial or commercial type sources. It includes guidance on determining the likely degree of adverse impact, but the assessment of nuisance explicitly falls outside the scope of this British Standard. This is for the Council to determine as the need arises.

The rating level ($L_{Ar,Tr}$) is defined in BS 4142 as the level from the industrial or commercial source(s) in question (known as the specific sound level ($L_{Aeq,Tr}$)) outside residential dwellings, having been corrected for any (potentially) noticeable characteristics. The "subjective method" is typically used for this purpose, where a correction of between 0 and 6 dB is considered for tonal noise sources, and/or a correction of between 0 and 9 dB for impulsive sources. Additionally or alternatively, a correction of up to 3 dB can be made for other sound characteristics, such as intermittency of the noise source, or "*Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment…*"

The reference time intervals, Tr, are 1 hour and 15 minutes during the day and night, respectively. Where the on-time of the source or sources is less than these periods, a time correction is applied.

In terms of the assessment of impacts, the Standard states:

"*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.*

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9).

"*NOTE 1 More than one assessment might be appropriate.*

"a) Typically, the greater this difference, the greater the magnitude of the impact.

b) *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
c) *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context.*
d) *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 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.*"

"NOTE 2 Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

"1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

"Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

"2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

"NOTE 3 Consideration should be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the "Effects on humans of industrial and commercial sound" portion of the "Further reading" list in the Bibliography.

"3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

i) facade insulation treatment;
ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
iii) acoustic screening."

An assessment, therefore, is effectively split into two parts. The first part results in an initial indication of the impact, which is subsequently considered in terms the context unique to the situation at hand; and where this second part may require consideration of alternative guidance and metrics. Alternatively, the context can be

considered upfront and a specific threshold (or set of thresholds) determined accordingly in place of the default values presented in points *a)* to *d)* quoted above.

2.1.4 World Health Organisation Guidelines

The following guideline values for community ambient noise levels in specific environments are presented in the World Health Organization (WHO) Guidelines for Community Noise [7].

Table 2-2: WHO Guideline Noise Values

Specific Environment	Critical Health Effect(s)	dB $L_{Aeq,T}$	Time Base hours	dB $L_{Amax,F}$
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

2.1.5 WHO Noise Guidelines for Europe

To ensure compliance with Planning Noise Advice Document: Sussex, night-time max levels should not exceed the L_{Amax} level recommended in WHO Night Noise Guidelines for Europe [8]. The document states "*42 dB(A) is proposed as the currently best estimate of the threshold for conscious awakening by transportation noise. This would mean that the no observed effect level (NOEL L_{Amax}) for transportation noise events is at most 42 dB(A). The most sensitive instantaneous effect that has been studied extensively in field studies is motility. A single interval with (onset of) noise-induced motility by itself cannot be considered to be adverse*".

2.1.6 Local Authority Consultation

In an email received on 15th September 2020 from Jay Singh (Adur and Worthing Council's case officer), the following information and local authority concerns were raised:

"The local business improvement district team (who have also submitted objections) suggest there are currently very high levels of occupancy (99%) within the estate."

"It is most likely that there will be episodes of noisy activity from the surrounding industry rather than a steady noise flow and there is a danger that this impact can be ironed out over a 16hr or 8hr measurement period so I would recommend that they use BS4142 to quantify the impact of these industrial sources. Maximum noise levels over the night time are picked up in the standards but these day time peaks will not. It is likely that several BS4142 assessments will be necessary to accurately quantify the noise impact the surrounding industry will have on the proposed development. I would also like to see 15minute LAeq and LAMax data during the day so we can identify the number of noisy daytime episodes and 5 minute LAeq and LAmax data during the night time, again to identify the number of noisy episodes, presented in an appendix to the report."

2.1.7 Criteria Summary

Table 2-3 details the proposed criteria for internal noise levels at the development site. This summary criteria has been determined by use of the guidance and documents detailed above.

Due to the noise environment at the development site it is considered appropriate to achieve the criteria of L_{AFMax} 45 dB in line with World Health Organization Guidelines for Community Noise which 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". Whilst the Planning Noise Advice Document: Sussex targets a limit of 42 dB L_{AMax}, this level cannot be guaranteed with the maximum reasonably practicable glazing proposed within this report.

Table 2-3: Summary of proposed internal criteria at the development site

Activity	Location	Daytime	Night-time
Resting	Living room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 8hour}$ 45 dB L_{AFmax}

Notes: Daytime assessment period – 07:00 to 23:00 hrs
Night-time assessment period – 23:00 to 07:00 hrs

Given the comments made by the local planning authority, periods of high levels of industrial noise have been identified and assessed to determine the potential impact of noisy episodes that occur during sensitive hours. A worst case 5-minute period has been assessed where commercial activity is likely to regularly occur.

3 SITE DESCRIPTION

3.1 Existing Site

The site is situated approximately 25 metres to the north of Marlborough Road. The site is located in the Lancing Business Park with operational commercial premises surrounding the proposed development. The Quadrant is currently an operational office. Existing residential dwellings are located approximately 70 metres to the south of the proposed development.

An aerial view of the site location is shown in Figure 3-1, which highlights the proposed site and surrounding area.

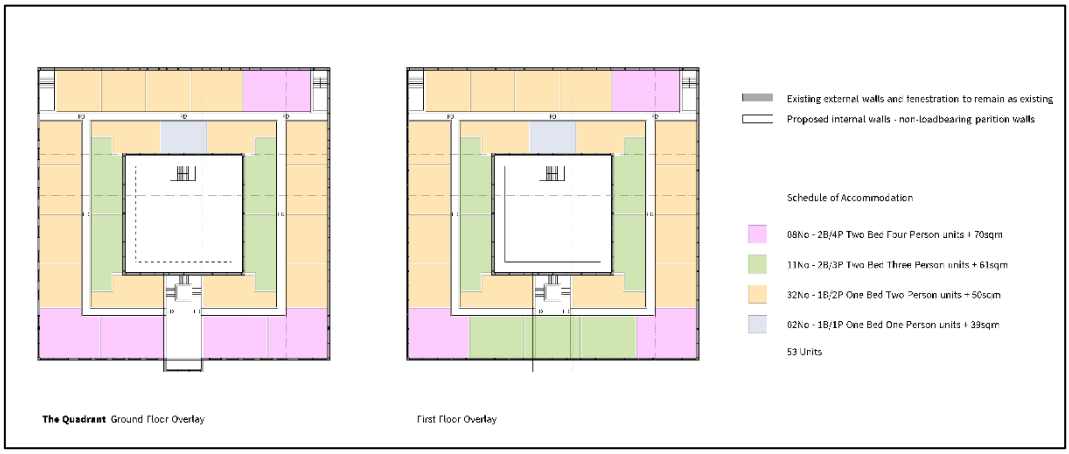
Figure 3-1: Site location (highlighted in red). © 2020 Google



3.2 Proposed Development

The project involves the construction of 53 dwellings. All proposed dwellings are understood to be single story consisting of 8 no. two bed four person units, 11 no. two bed three person units, 32 no. one bed two person units and 2 no. one bed one person units. Figure 3-2 shows a proposed layout plan of the proposed development. The main noise source incident on the proposed development is road traffic noise from Marlborough Road to the south of the site. The noise environment at the site is dominated by fixed plant and road traffic noise across daytime and night-time periods. Individual road traffic noise events from commercial vehicle movements to the north of the site are considered to be audible at the northern façade of the proposed development. Commercial noise from surrounding units was clearly audible at the façade of the proposed development.

Figure 3-2: Site plan of the proposed development. © Stickland Wright



4 NOISE LEVELS ON SITE

The prevailing noise conditions across the development have been determined by detailed by environmental noise surveys, comprising a mix of attended and unattended measurements. The unattended survey was undertaken over a 3-day period at two measurement locations, between Wednesday 16th and Friday 18th September 2020, in order to determine the environmental noise associated with road traffic movements on Marlborough Road and commercial activity from the Lancing Business Park.

It should be noted that the surveys were undertaken during periods potentially impacted by COVID-19 lockdown restrictions. It is understood that levels of occupancy across the industrial estate were almost normal (pre-Covid time) at the time of surveying, according to the Council. Road traffic on Marlborough Road is considered to be dominated by commercial vehicles (including waste disposal lorries, HGVs and vans).

A number of businesses were operating within The Quadrant at the time of surveying. Typical activity includes employee car movements for work arrival and departure, deliveries, movement of stock, catering activity and areas designated for smoking. Minor construction works involving the installation of a bike storage area were also active at the time of surveying, however, periods where unattended monitoring may have been significantly impacted by these works have been removed from the assessment.

4.1 Instrumentation

All noise measurements were undertaken by a consultant certified as competent in environmental monitoring. All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672 [9]. A full inventory of this equipment is shown in Table 4-1 below. All equipment's calibration certificates are available on request.

Table 4-1: Inventory of Measurement Equipment

Measurement type	Item	Make and Model	Serial Number	Calibration	
				Certificate number	Expiry Date
Noise (Unattended Position 1 and Attended Measurement)	Sound Level Meter	Rion NL-52	00732147	UCRT18/2194	30/11/2020
	Preamplifier	Rion NH-25	32175		
	Microphone	Rion UC-59	05339		
	Calibrator	Rion NC-74	35015349	UCRT20/1205	19/02/2021
Noise (Unattended Position 2 and Attended Measurement)	Sound Level Meter	Rion NL-52	00620960	UCRT20/1812	25/08/2022
	Preamplifier	Rion NH-25	21001		
	Microphone	Rion UC-59	03878		
	Calibrator	Rion NC-74	35015349	UCRT20/1205	19/02/2021

The noise measurement equipment used during the survey was calibrated at the start and end of each measurement. The calibrator used had itself been calibrated by a UKAS accredited calibration laboratory within the twelve months preceding the measurements. No significant drift in calibration was found to have occurred.

4.2 Unattended noise survey

Continuous unattended noise measurements were undertaken to the front (south) and to the rear (north) of the development site, overlooking Marlborough Road and Lancing Business Park, as detailed in Appendix B. The locations were chosen in order to characterise road traffic noise emissions and commercial activity noise impacting on the site throughout day and night periods.

Measurements were undertaken at a height of 5.4 metres above ground level, under free-field conditions at the southern position and under façade conditions at the northern position. Spectral was gathered to obtain the frequency content of the noise impacting on the proposed development, needed to determine the sound insulation performance requirements of the building envelope.

During site visits, continuous plant noise from commercial premises was noted to be audible at the measurement positions.

4.3 Attended noise survey

Attended daytime noise measurements were undertaken on Wednesday 16th September 2020 to understand typical sound levels across the proposed development, as detailed in Appendix B. Measurements and observations were undertaken at each corner of the existing office building to provide further detail into the noise environment across the site during periods of increased operation across Lancing Business Park.

4.4 Weather Conditions

Weather conditions were dry with light winds whilst undertaking daytime attended measurements and setting up unattended equipment on 16th September 2020. Weather conditions were noted to be dry with light winds whilst undertaking night-time attended measurements and collection of unattended equipment on 18th September 2020. The weather conditions were considered acceptable for noise measurements and have not impacted on the noise monitoring exercise.

4.5 Noise Survey Results

4.5.1 Unattended monitoring positions 1 (North) and 2 (South)

Consecutive 5-minute measurements of $L_{Aeq,T}$, L_{Amax} and $L_{A90,T}$ noise indices were obtained using the 'Fast' time weighting. A summary of the daytime ambient $L_{Aeq,16hr}$ and night-time ambient $L_{Aeq,8hr}$ noise levels measured is presented below in Table 4-2 (Position 1) and Table 4-4 (Position 2), along with the derived night-time L_{AFmax} level. Full time history results are shown in Appendix A.

To establish a L_{AFmax} value from which to calculate internal noise levels, the eleventh highest measured value was identified on a night by night basis, in line with recommendations detailed in Section 2. An average of all octave band frequencies with a night-time L_{AFmax} event equal to the eleventh highest value was then calculated to provide a representative spectrum.

The modal $L_{A90,\ 5min}$ value measured at the measurement position has been presented within Table 4-2 for both daytime and night-time periods.

Table 4-2: Summary results of the unattended noise survey, UP1 (daily periods)

Date	Period	Ambient Noise Level $L_{Aeq,\,T}$, dB	Night-time Noise Level $L_{Amax,F}$ dB (Top 10 excluded)	Modal Background Noise Level $L_{A90,\,5min}$ dB
Wednesday 16/09/2020	Daytime (15:45-23:00)	59	70	52
	Night-time (23:00-07:00)	58		50
Thursday 17/09/2020	Daytime (07:00-23:00)[1]	58	65	52
	Night-time (23:00-03:25)	52		51

NOTE:

[1] Data measured from 12:00 to 15:40 has been removed from the assessment due to activities undertaken at the development site.

An average L_{AFmax} spectrum has been established using L_{AFmax} dB measurements from across the survey period.

Table 4-3: Typical $L_{Amax,\,F}$ Noise Levels and associated spectrum (UP1), dB

125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	$L_{Amax,F}$
70	66	61	67	64	61	70

Table 4-4: Summary results of the unattended noise survey, UP2 (daily periods)

Date	Period	Ambient Noise Level $L_{Aeq,\,T}$, dB	Night-time Noise Level $L_{Amax,F}$ dB (Top 10 excluded)	Modal Background Noise Level $L_{A90,\,5min}$ dB
Wednesday 16/09/2020	Daytime (15:30-23:00)	58	69	50
	Night-time (23:00-07:00)	55		48
Thursday 17/09/2020	Daytime (07:00-23:00)[1]	59	65	53
	Night-time (23:00-03:40)	50		47

NOTE:

[1] Data measured from 12:00 to 15:40 has been removed from the assessment due to activities undertaken at the development site.

An average L_{AFmax} spectrum has been established using L_{AFmax} dB measurements from across the survey period.

Table 4-5: Typical $L_{Amax,\,F}$ Noise Levels and associated spectrum (UP2), dB

125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	$L_{Amax,F}$
55	62	61	65	65	67	69

4.5.2 Attended noise survey

Consecutive 1-minute measurements of $L_{Aeq,T}$, L_{AFMax}, $L_{A10,T}$ and $L_{A90,T}$ noise indices were obtained using the 'Fast' time weighting. Noise levels measured during the daytime and night-time periods are presented below in Table 4-6 and Table 4-7, respectively. Measurement positions are detailed within Appendix B.

Table 4-6: Daytime Attended Measurements – Results

Position	Time	Duration (hh:mm)	$L_{Aeq,T}$	$L_{AFmax,T}$	$L_{A10,T}$	$L_{A90,T}$	Note
DAP1	13:25	01:45	60	79	63	53	Road traffic noise dominant throughout measurements. HGV movements were regular. Commercial activity from WSM Plastics and Whistle Stop Plastics clearly present during measurement period. Delivery at nearby commercial premises to west of development. Slightly audible continuous plant noise located to south of the development site.
DAP2	13:50	00:30	56	77	58	48	Road traffic noise dominant throughout measurements. Activity from nearby auto repair shop was audible throughout measurement period. Loading and unloading activity at glazing premises to south of development site were also present during measurement period.
DAP3	14:30	00:15	56	78	57	50	Road traffic noise dominant throughout measurements. Skip lorry movement and loading activity present during measurement period. Continuous plant noise was also audible from commercial premises located to the west of the development.
DAP4	14:50	00:14	56	78	56	49	Road traffic noise dominant throughout measurements. Lorry movements to north of development active during measurement period.

Attended measurements are considered to be representative of the typical activity across the development site. The noise environment is made up of road traffic noise from Marlborough Road and commercial activity from nearby units.

Table 4-7: Night-time Attended Measurements – Results

Position	Time	Duration (hh:mm)	$L_{Aeq,T}$	$L_{AFmax,T}$	$L_{A10,T}$	$L_{A90,T}$	Note
NAP1	03:40	00:40	55	74	56	52	Plant operational at time of arrival. Fixed plant thought to be associated with Star Catering Supplies to the north and WSM Plastics to the west of the development were continuous. Loading activity associated with Star Catering Supplies to the north of the development dominant when started at 03:55. Lorry movements and idling

Position	Time	Duration (hh:mm)	$L_{Aeq,T}$	$L_{AFmax,T}$	$L_{A10,T}$	$L_{A90,T}$	Note
							audible. Plant associated with Star Catering dominant during activity with "other" acoustic characteristic.
NAP2	03:55	00:05	47	61	48	39	Plant located to west of site not clearly audible. Lorry movements and idling to north of development site audible. Waste Disposal trucks and HGV movements dominant and frequent during measurement.
NAP3	04:06	00:05	50	63	51	46	Fixed plant located to west of site thought to be associated with WSM Plastics clearly audible. Lorry movements and idling to north of development site audible and dominant during movements. Reversing beeper from loading activities audible during measurements.
NAP4	04:20	00:50	51	73	54	47	Fixed plant thought to be associated with Micron Semiconductor to the south west of the proposed development constant and audible. Plant thought to be associated with WSM Plastics located to west of proposed development clearly audible. Road traffic movements dominant when active. HGV movements frequent during measurement.

Night-time measurements and observations confirm that fixed plant from surrounding commercial premises is operational and audible at the façade of the proposed development.

4.5.3 Existing Façade Performance

Simultaneous 30-minute measurements were undertaken at an internal and external position to estimate the performance of the existing glazing system, which will be retained in the proposed development. Table 4-8 details the measured values and the variation between internal and external noise levels.

Table 4-8: Simultaneous Attended $L_{Aeq,T}$ Measurements Results

Start Time	Measurement Duration	External, $L_{Aeq,T}$ dB	Internal, $L_{Aeq,T}$ dB	Variation, dB
12:35h	30min	61	35	27

Note: Values in table are rounded

Façade noise break-in calculations have been undertaken using octave band sound reduction levels associated with the above overall estimated performance of the retained glazing.

4.6 Impact of COVID-19

As discussed in the introduction of Section 4, commercial activity and road traffic flows may have been impacted by the COVID-19 pandemic. A consultation with Adur and Worthing Council indicated that occupancy levels at the industrial estate were considered to be almost normal at the time of the survey. This figure was provided by the Local Business Improvement district team on Tuesday 15th September 2020.

During our time on site, it was noted that the majority of road traffic movements were undertaken by trade vehicles and HGV's travelling to and from the industrial estate. A number of council operated waste disposal vehicles were noted to be active during the daytime attended survey period. Measured levels are therefore considered to be representative of typical activity and have not been adjusted.

Traffic flows are not considered to impact on L_{AFMax} events during the survey period, therefore, no adjustment has been made to these levels.

5 COMMERCIAL NOISE ASSESSMENT

Daytime and night-time attended measurements and observations have been undertaken to determine the impact of operational noise levels from the commercial sources surrounding the site. Dwellings located to the north and west of the proposed development are most likely to be impacted by commercial operations undertaken by a number of premises. Proposed dwellings located to the south and east of the development are likely to be impacted by road traffic movements and some commercial noise from premises located to the south of Marlborough Road.

During daytime attended measurements to the south of the site, commercial activity from Alverstone Autos, Universal Metals and Benchmark Windows Limited was noted to be audible but not dominant.

Commercial activities to the west and north of the site are associated with Rabbit Skips, WSM Plastics, Star Catering Supplies, SIG and Brighton Paper Round. Application of the same acoustic design measures to the entire development is considered appropriate to ensure internal ambient noise levels do not exceed guideline values.

A worst case $L_{Aeq,5min}$ measured at UP2 from 0650 hrs on Thursday 17th September 2020 has been used to assess the impact of commercial noise on the proposed development. This measurement contains a skip movement and drop, as well as continuous plant noise from surrounding premises and activity from Star Catering Supplies. Comments made online by these businesses indicate that these activities are likely to occur regularly at this time throughout the week. This activity occurs during the early hours of the morning during the night-time period.

Table 5-1: Representative 5-minute commercial noise level

Description	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Overall
$L_{Aeq,5min}$, dB	69	65	60	73	62	56	74
L_{AFMax}, dB	94	89	82	94	86	78	93

A 9 dB correction has been applied to this measurement due to impulsive and “other” sound characteristics.

Table 5-2: Commercial Noise Impact Assessment

Receptor	Measured Specific Sound Level, $L_{Aeq, 5min}$ (dB)	Façade Correction	Character Correction (dB)	Rating Level $L_{ar,5min}$ (dB)	Background Sound Level, L_{A90} (dB)	Rating Level vs Background Level (dB)
North/West	74	-3	+9	80	50	+30

Notes
1. Correction of 9 dB applied for impulsive/“other” noise activity

Based on the above assessments, noise from the nearby commercial premises, when assessed under worst-case operation and in the absence of any mitigation, is likely to give rise to a significant adverse impact when assessed in line with BS 4142:2014+A1:2019. It is also appropriate to consider the absolute levels in terms of the BS8233 criteria, which is discussed below.

Agent of change in NPPF (see Appendix A for details) suggests that new development should aim to minimise the risk of any complaints that could impact the operation of existing commercial premises.

5.1 Discussion and Mitigation

The assessment has shown that without mitigation, noise from existing commercial sources poses a potential risk to the amenity of future occupants of the building. Given the operation of all the commercial noise sources falls outside the control of the developer, as does the location/orientation of the application building, mitigation via the building envelope is the only viable measure to manage the noise impact.

To ensure commercial noise is not detrimental to the amenity of future occupants, it will be necessary to ensure that adequate glazing is provided to the proposed dwellings to control internal noise levels to guideline values detailed in BS8233. $L_{Aeq,5min}$ and L_{AFMax} levels measured from 0650 to 0655 hours on Thursday 17th September have been used to determine the sound reduction performance requirements of the relevant façade elements.

To ensure commercial noise is not detrimental to the internal amenity of future occupants, it will be necessary to upgrade the existing glazing and to ensure adequate ventilation is provided to the apartments such that opening windows is not a necessity to provide whole dwelling ventilation to habitable rooms.

5.2 External Building Fabric

We understand that the developer's preference is to retain, where possible, the existing external fabric of the former office building in the proposed residential development. The current external fabric is understood to comprise a combination of masonry cavity wall and curtain walling on the corners of the building, standard thermal double glazing, and a lightweight roof construction with a suspended MF ceiling. Given the potential impacts discussed in Section 5, the glazing and roof constructions are likely to require an upgrade as these are the two weakest elements of the façade.

5.2.1 Glazing

The existing glazing performance is estimated to be approximately 27 dB R'_w (please note this was estimated based on the external to internal sound level difference). Given free field external levels of up to 71 dB $L_{Aeq,5min}$ and 90 L_{AFMax} were measured at site, with an internal target of 30 dB $L_{Aeq,8hr}$ and 45 dB L_{AFMax}, the approximate sound reduction requirement is 49 dB R_w+C_{tr}. On this basis, the existing windows would either need to be replaced or a secondary unit added.

This glazing performance may only be achievable by adding an additional double glazed unit made up of 6 mm glazing/10 mm air gap/6 mm glazing and with a 200 mm void between the secondary and existing unit. The sides and top of the reveal should be lined with sound-absorbing material.

Further glazing information is detailed in Section 6.1.7.

5.2.2 Ventilation

The recommended ventilation system the proposed dwellings should be provided with is a System 4 as defined in Approved Document F – Continuous Mechanical Supply and Extract Ventilation with Heat Recovery (MVHR) [10], which would provide whole dwelling ventilation to the dwellings without the need to rely on opening windows. The windows should still be openable for purge ventilation, during which internal noise level guidelines are not applicable.

It is essential the type of equipment provided incorporates, as standard, a 100 % full and filtered summer bypass' to avoid the heat in the warm extract air being transferred to the incoming warm but, comparatively cooler external fresh air, thus reducing the potential for overheating.

It is best practice, from an energy efficiency standpoint, to allow the opening of windows for occupant control of overheating. This, however, may lead to increased risk of excessive noise intrusion where the proposed

building(s) are exposed to external noise sources, forcing the occupant to choose between excessive heat or excessive noise break-in.

The risk of overheating and the impact of opening windows to control internal temperatures on internal noise levels has not been assessed in this report, as this requires the input of an energy consultant/thermal modelling specialist. Based on the measured noise levels shown in Section 4.5 of this report, it is likely that opening windows will result in the internal ambient noise criteria being exceeded. Alternative methods of mitigating overheating are recommended to avoid requiring opening windows.

Where mechanical systems are required, any resultant noise generated within the dwellings should be controlled appropriately.

It is considered that future occupants of the development will be aware of the surrounding environment they are moving into, and are, therefore, more likely to tolerate existing ambient noise conditions and accept the usage of alternative means of ventilation and overheating control when suitably designed to provide good quality living conditions within dwellings. The reliance of opening windows to always provide suitable living conditions should not be the only defining factor to the Council when determining whether external noise intrusion causes a significant impact on the living conditions the development can provide, especially when standard industry practice allows for alternative means of achieving such quality conditions in much needed residential developments.

Further ventilation information is detailed in Section 6.1.6.

5.2.3 Roof

The existing office building is understood to have a lightweight roof construction with a suspended ceiling, however, the exact construction is not currently known. Due to the noise environment at the site and the location of the proposed dwellings in relation to the dominant noise source, an enhanced roof construction is proposed to ensure that impulsive commercial noise during the early hours can be mitigated to maintain a suitable internal noise level within habitable rooms.

The following construction has been used to undertake our façade noise break-in calculations: 18 mm cement particle board, 100 mm cavity fully filled with dense mineral wool, 18 mm cement particle board, 150 mm cavity filled with dense mineral wool and a suspended plasterboard ceiling comprising 2 layers of 15 mm dense plasterboard (combined mass ≥ 24 kg/m^2) ceiling. The predicted sound reduction performance of the enhanced roof is detailed in Section 6.1.5.

6 BS8233 NOISE ASSESSMENT

In order to achieve the internal noise guidelines as set out in Section 2, it is necessary to estimate internal noise levels with windows closed using glazing and ventilation products.

An assessment of the external building fabric elements has been undertaken based on the unattended spectral data of $L_{Aeq,T}$ and L_{AFmax} levels measured during daytime and night-time periods, as set out in Section 4.5.1 of this report. Guidance is given in the following sections regarding suitable glazing and ventilation configurations to achieve the required internal ambient noise levels within the proposed dwellings. Calculations have been undertaken following the general method set out in BS EN 12354-3:2017 [11].

Façade elements and constructions detailed in Section 5 to provide sufficient mitigation are considered necessary across the development. This assessment has been undertaken with the proposed mitigation in place. Attended measurements and observations on site indicate that the noise environment across the proposed development is unlikely to differ significantly in the future from that measured recently.

6.1 Assumptions

6.1.1 Drawings

Our assessment has been based on the following Architect's drawings.

Table 6-1: Drawings used in the assessment

Drawing Title	Drawing Number	Date
Proposed Layouts	20038-P-111-C	-

6.1.2 Room Reverberation

In order to calculate the internal ambient noise levels within habitable rooms, our analysis has assumed typical reverberation times in furnished bedrooms and living rooms, which have been based on a flat reverberation time of 0.5 seconds across the frequency spectrum between 125 Hz and 4kHz.

6.1.3 Internal Layout

No proposed dwelling plans were available at the time of this assessment. To undertake façade noise break-in calculations, the following standard dimensions have been used:

- Living Room: 5 m x 4 m x 2.5 m with 6 m^2 of glazing
- Bedrooms: 4 m x 3 m x 2.5 m with 7.5 m^2 of glazing

The assumed bedroom size is considered to meet the Nationally Described Space Standard [12] technical requirements detailed in Section 10 of the document.

6.1.4 Non-glazed External Wall Areas

It is understood that the proposed external wall areas are of masonry construction. The below sound reduction performance has been assumed for external masonry wall construction, based on previous experience.

Table 6-2: Assumed sound reduction index (dB) of the external wall construction

Wall	125	250	500	1k	2k	4k	R_w / R_w + C_{tr}
Masonry	41	45	45	54	58	58	52 / 48

6.1.5 Roof Construction

Table 6-3 details the estimated sound reduction performance of the proposed construction (calculated with Insul software). Please note that alternative constructions, capable of achieving the below sound reduction performance, may also be suitable.

Table 6-3: Predicted sound reduction index (dB) of the proposed roof construction

Roof	125	250	500	1k	2k	4k	R_w / R_w + C_{tr}
Enhanced	41	47	53	57	52	57	54 / 51

6.1.6 Ventilation

It is proposed that an MVHR system is installed to provide whole dwelling ventilation to residential units. Calculations with an MVHR system assume that noise break-in through the ventilation system is negligible. It is noted that noise levels from the proposed system should be assessed to ensure that guideline levels detailed within Section 2 of this report are not exceeded. A 33 dB L_{Aeq} and a 28 dB L_{Aeq} mechanical services noise limit is recommended in living rooms and bedrooms, respectively.

Windows should be openable for purge or rapid ventilation, as requested by ADF. Internal noise level guidelines are generally not applicable under these exceptional events, which should only occur occasionally (i.e. to remove odour from painting, cooking etc.).

6.1.7 Glazing

Based upon the drawings provided by the architect, detailed calculations have been undertaken in accordance with BS 12354-3 to determine the required worst-case acoustic performances for the glazed elements of the façade, in order to provide appropriate internal noise levels in habitable rooms, during both daytime and night-time periods. The resulting worst-case performance requirements are presented in Table 6-4.

Table 6-4: Minimum sound reduction performance (dB) for the secondary glazed elements per octave band frequency.

Room	Glazing example	125	250	500	1k	2k	4k	R_w / R_w + C_{tr}
All	Existing glazing with 200 mm airgap with absorption in void and 6/10/6mm double glazing.	37	48	50	56	60	62	55 / 49

The sound insulation requirements of the glazing are applicable to the window system as a whole, including frames, mullions, and panels. They are based on BS EN ISO 10140: 2010 "*Acoustics - Laboratory measurement of sound insulation of building elements*" [13] and rated in accordance with BS EN ISO 717-1:2013 "*Acoustics – Rating of sound insulation in buildings and of building elements Part 1. Airborne sound insulation*" [14].

All glazing systems should be capable of meeting the performance specifications detailed above. Glazing proposals which only reflect the guidance constructions indicated in this report will not be sufficient evidence that a glazing system will achieve the required performance specification.

The above sound reduction performances would ensure that appropriate BS 8233 internal noise levels are achieved using suitable façade treatments, when utilising the proposed ventilation strategy, which should then in turn equate to No Observed Adverse Effect according to NPSE.

6.2 External Amenity Area Noise Assessment

As detailed in Section 2.1.2, BS 8233 states that "*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*".

6.2.1 External outdoor amenity areas

It is not currently known whether external amenity areas are proposed as part of the development. Currently, an external amenity area is located at the centre / courtyard area of the existing building. Noise levels within this area are unlikely to exceed the lower guideline value of 50 dB $L_{Aeq,16hr}$ due to the acoustic screening provided by the building itself.

6.3 Other Relevant Issues

No plant is proposed at this stage, however, should plant be installed at a future stage the potential impact could cause disturbance to neighbouring receptors when in operation. This will require consideration and will likely be subject to Local Authority requirements. The nearest off-site residential receptors are located to the east of the proposed development.

Noise levels from mechanical plant are usually controlled using standard noise control techniques such as enclosures, acoustic screens, attenuators and selecting appropriate plant.

Past experience indicates that noise emissions from building services plant will not give rise to a significant impact if they are controlled to a BS4142 rating of 10 dB below the prevailing background noise level measured at a distance 1m from the nearest residential facade.

In order to meet the above requirements, we have set out plant noise emissions criteria based on the measured typical background sound. The following plant noise emissions criteria have been set out for the nearest residents.

Table 6.6: Proposed Plant Noise Emissions Criteria $L_{Ar,Tr}$

Measured Typical Daytime Background Noise $L_{A90,T}$	Proposed Daytime criteria, dB	Measured Typical Night-time Background Noise, $L_{A90,T}$ dB	Proposed Night-time criteria, dB
50	40	47	37

7 CONCLUSIONS

Anderson Acoustics Ltd was commissioned by Stickland Wright in September 2020 to undertake a planning noise assessment for the proposed residential development at The Quadrant, 60 Marlborough Road, Lancing; to be used in support of a planning application to obtain prior approval.

Accordingly, this report details an assessment of the site with regards to commercial noise from surrounding premises and road traffic noise from Marlborough Road, and sets out necessary mitigation measures to ensure the development complies with national planning policies and relevant guidance documents.

A scheme for improved sound insulation has been proposed, such that suitable internal ambient L_{Aeq} and L_{AFMax} levels are achieved during periods of increased commercial activity, which is considered to be a suitable worst-case assessment. The scheme includes improvements to the façade with the introduction of secondary glazing and mechanical ventilation. Further investigation and assessment of overheating risk and control strategy may be required at detailed design stage to achieve good quality living conditions in terms of acoustics, ventilation and overheating. Openable windows are not considered to be a suitable method of ventilation to control overheating. Windows would be openable for purge ventilation, during which noise criteria do not apply.

With the recommended mitigation measures implemented, the site is considered suitable for residential development.

8 REFERENCES

[1] Department for Environment, Food and Rural Affairs, “Noise Policy Statement for England,” DEFRA, London, 2010.

[2] Ministry of Housing, Communities & Local Government, “Planning Practice Guidance - Noise,” 2019. [Online]. Available: https://www.gov.uk/guidance/noise--2. [Accessed 2020].

[3] C. &. L. G. Ministry of Housing, “National Planning Policy Framework,” London, 2019.

[4] “Planning Noise Advice Document: Sussex,” 2015.

[5] The British Standards Institution, “BS 8233:2014 Guidance on sound insulation and noise reduction for buildings,” 2014.

[6] The British Standards Institution, “BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound,” BSI Standards Limited 2019, 2019.

[7] World Health Organization, “Guidelines for Community Noise,” Geneva, 1999.

[8] World Health Organization, “Night Noise Guidelines for Europe,” 2009.

[9] British Stands Institution, “British Standard 61672 - Electroacoustics. Sound level meters. Specifications,” 2013.

[10] HM Government, “The Building Regulations 2010 Approved Document F - Means of Ventilation,” 2013.

[11] The British Standards Institution, “Building acoustics - Estimation of acoustic performance of buildings from the performance of elements,” 2017.

[12] Department for Communities and Local Government, “Technical Housing Standards - Nationally Described Space Standard,” London, March 2015.

[13] ISO, “Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation,” 2010.

[14] ISO, “Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation,” 2013.

PAGE LEFT INTENTIONALLY BLANK

APPENDIX A

NOISE UNITS AND NATIONAL PLANNING GUIDANCE

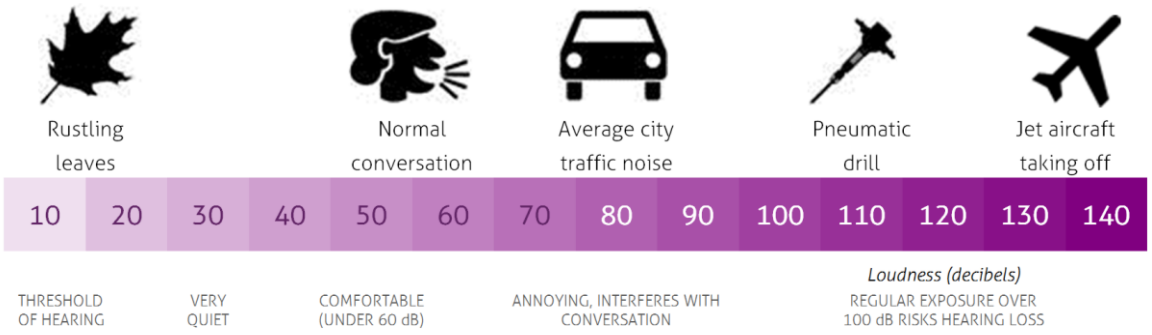
Noise Units

There is a ten million to one ratio between the acoustic energy associated with the threshold of hearing and the highest tolerable sound pressure. Noise is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB). Noise is defined as unwanted sound and the range of audible sound varies from around 0 dB to 140 dB.

The human ear is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz, however its response varies depending on the frequency and is most sensitive to sounds in the mid frequency range of 1 kHz to 5 kHz. Instrumentation used to measure noise is therefore weighted across the frequency bands to represent the sensitivity of the ear. This is called 'A weighting' and is represented as dB(A).

It is generally accepted that under normal conditions humans are capable of detecting changes in steady noise levels of 3 dB, whilst a change of plus or minus 10 dB is perceived as a doubling or halving of the noise level. An indication of the range of noise levels commonly found in the environment is given below.

Figure A-1: Typical Noise Levels



A number of different indices are used to describe the fluctuations in noise level over certain time periods. The main indices include:

$L_{A90,T}$ This is the noise level exceeded for 90% of the measurement period and provides a measurement of the quieter 'lull' periods in between noise events. It is often referred to as the background noise level.

$L_{Aeq,T}$ This is the "equivalent continuous A weighted sound pressure level" and is the level of a notional steady sound which has the same acoustic energy as the fluctuating sound over a specified time period. It is often used for measuring all sources of noise in the environment, which can be referred to as the ambient noise.

$L_{Amax,F}$ This is the maximum sound pressure level measured in a given time period with the sound level meter set to 'fast' response.

Reference is often made to acoustic measurements being undertaken in 'free-field' or 'façade' locations. Free-field measurements represent a location away from vertical reflecting surfaces, normally by at least 3.5 metres. A façade measurement is undertaken or calculated to a position 1 metre from an external façade and a correction of up to 3 dB can be applied to account for the sound reflected from the façade. This latter position is often used when assessing the impact of external noise affecting residents inside properties.

National Planning Guidance

Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) [1] was published on 15 March 2010. It sets out the long-term vision of the Government's noise policy, which is to promote good health and a good quality of life through the management of noise within the context of sustainable development.

The NPSE sets out the following aims:

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

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

The NPSE describes a number of effect levels that may be used to define effects in the context of noise policy, as follows:

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

Planning Practice Guidance – Noise

In March 2014 further guidance on interpreting the effect levels was published on the Government's Planning Practice Guidance – Noise [2]. This planning practice guidance was updated and expanded on the 22nd of July 2019. This includes a table that summarises noise exposure hierarchy, noting this is based on the likely average response of a population. This is presented in Table A-1.

This guidance has been prepared to assist in the planning permission process relating to noise. Recommendations within this guidance has been used to determine the potential impact of the proposed development. The following is stated within this guidance; *"Noise needs to be considered when development may create additional noise, or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced). When preparing plans, or taking decisions about new development, there may also be opportunities to make improvements to the acoustic environment. Good acoustic design needs to be considered early in the planning process to ensure that the most appropriate and cost-effective solutions are identified from the outset."*

When considering the impact of noise as part of any planning concerns it is important to consider the context and wider characteristics of a development proposal, its likely users and its surrounding, as these can have an important effect on whether noise is likely to pose a concern. It is noted that noise, where justified, may be used to override other planning concerns

Considerations should be made in line with Noise Policy Statement for England, summarised above.

Observed effect levels may indicate the potential impact of a proposed development, however, this does not mean that the effects can only be defined in terms of a single value of noise exposure. In some circumstances adverse effects are defined in terms of a combination of more than one factor such as noise exposure, the

number of occurrences of the noise in a given time period, the duration of the noise and the time of day the noise occurs.

Table A-1: Noise exposure hierarchy and effect levels

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behavior, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in quality of life	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behavior, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behavior, attitude or other physiological response, 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.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behavior, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

National Planning Policy Framework

The National Planning Policy Framework (NPPF) [3] was first published on 27 March 2012, revised in July 2018 and updated in June 2019.

The NPPF sets out the Government's planning policies for England and how these are expected to be applied; with a main focus on economic, environmental and social planning policies. Clause 170 states that:

"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."

At clause 180, the document goes on to state:

"*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;
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…"

With regard to the impact of development on existing uses, it states at clause 182:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

APPENDIX B

FIGURES AND MARK-UPS

Figure B-1: Unattended monitoring – time history results (UP1)

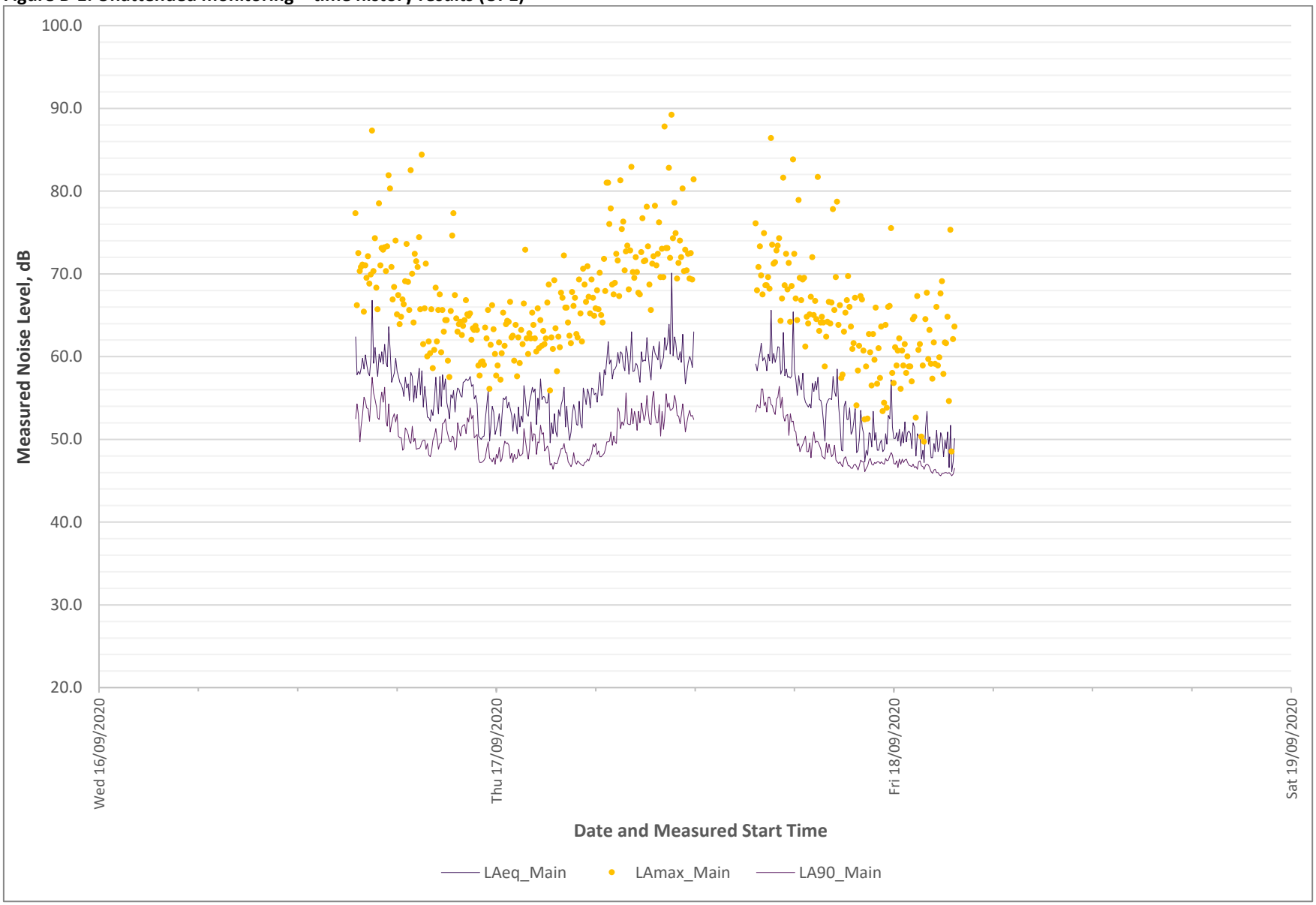


Figure B-2: Unattended monitoring – time history results (UP2)

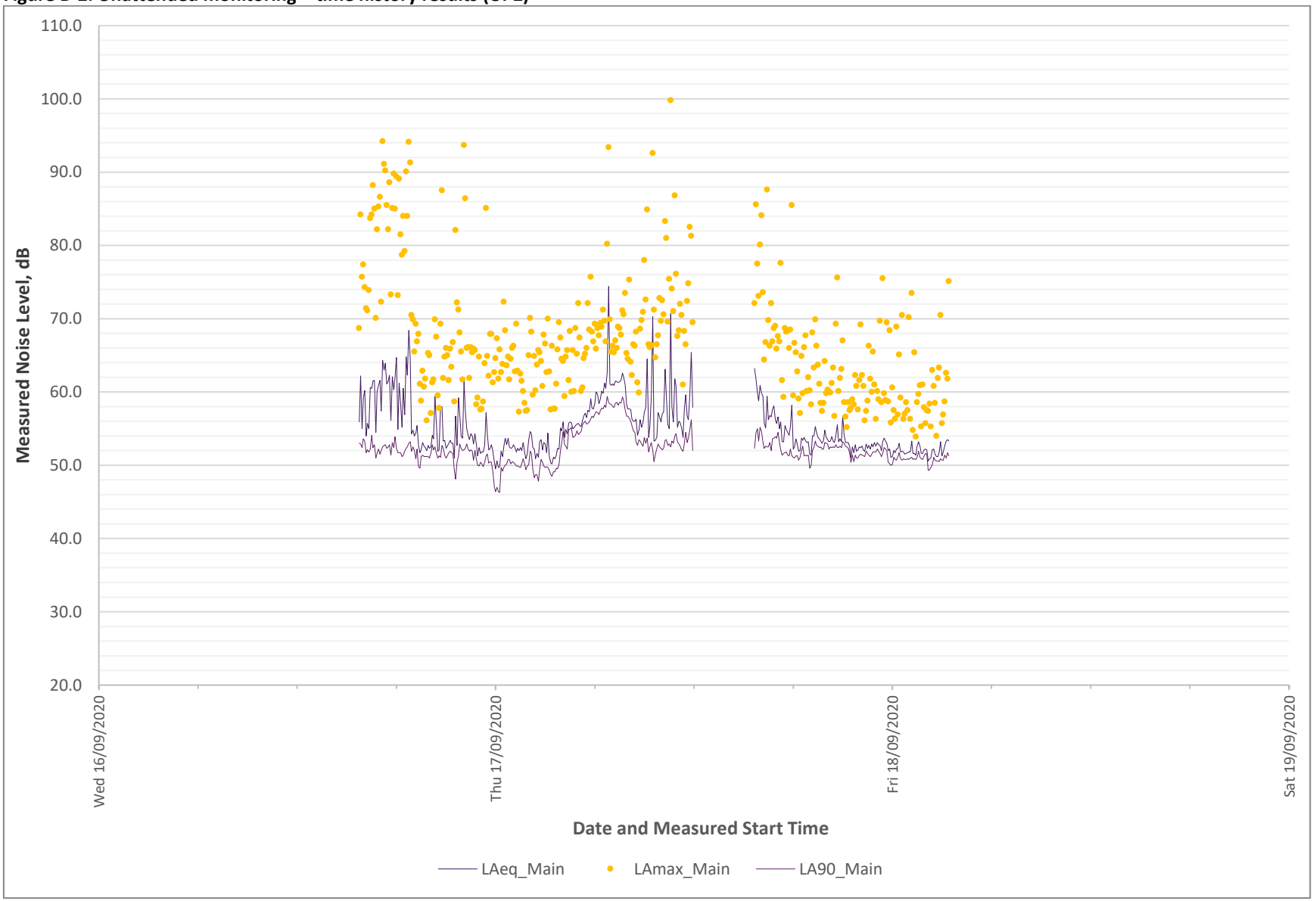
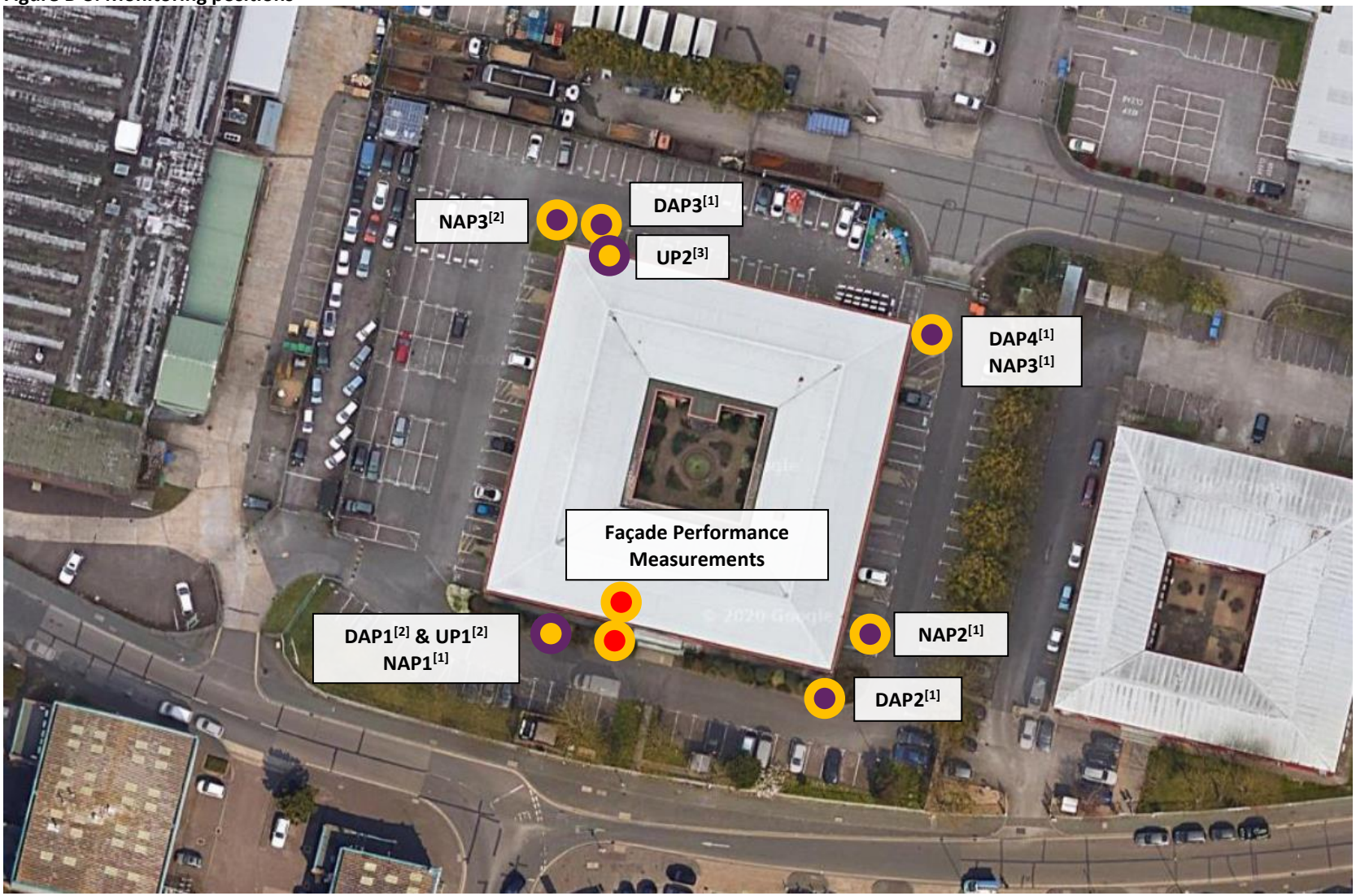


Figure B-3: Monitoring positions



Note:

1. ***Measurement undertaken at 1.5 m under free field conditions.***
2. ***Measurements undertaken at 5.4 m under free field conditions.***
3. ***Measurements undertaken at 5.4 m under façade conditions.***