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REFURBISHMENT OF BARNSLEY CIVIC - REVISED PROPOSALS

PLANNING NOISE ASSESSMENT

On behalf of:

HLM Architects

Report No. P19-389-R05v2
May 2022

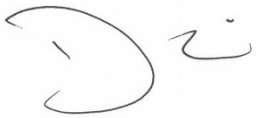
REFURBISHMENT OF BARNSLEY CIVIC – REVISED PROPOSALS

PLANNING NOISE ASSESSMENT

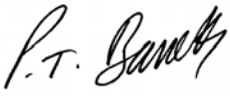
Report prepared by:
Hepworth Acoustics Ltd
21 Little Peter Street
Manchester
M15 4PS

On behalf of:
HLM Architects

Report prepared by:
Donald Quinn BSc FIOA – Managing Director



Report checked by:
Paul Bassett BSc MSc FIOA - Technical Director



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1.0 INTRODUCTION

1.1 Hepworth Acoustics Ltd was commissioned by HLM Architects on behalf of The Civic, Barnsley, to carry out a noise impact assessment in connection with a planning application for the revised proposals for refurbishment of Barnsley Civic which is located between Eldon Street and Hanson Street in Barnsley town centre.

1.2 Barnsley Civic comprises the original building (which is substantial solid masonry external wall construction with timber separating floors) on the Eldon Street side of the site, with a large steel-framed newer extension with brick and curtain wall façade which backs onto Hanson Street and Civic Gardens.

1.3 The revised refurbishment proposals focus predominantly only on the original building on Eldon Street, with only a small section of the newer building at ground floor level adjoining the Eldon Street building and a small area of the fourth floor towards the Hanson Street elevation included. These revised proposals supersede the previous proposals for refurbishment of the majority of both the original and newer buildings.

1.4 The revised proposals are for the refurbishment of the original building on Eldon Street and a small section of newer building at ground floor level to form circulation spaces and WCs on the ground floor, retail/food and beverage demises at ground and first floor levels, with offices on the second floor and a 'creation space' to be used for a range of activities (including as a dance studio) on the third floor. On the fourth floor towards the Hanson Street elevation of the newer building, an area is to be refurbished to form new WCs and associated circulation space.

1.5 In terms of noise, the key issues are considered to be the control of noise impact from new external plant/equipment on occupants of nearby dwellings and the control of noise within the 'creation space'. This is addressed in more detail in Section 2.

1.6 This assessment has therefore included:

i. Adopting appropriate acoustic design criteria;

ii. A baseline noise survey to establish the existing noise climate at the site;

iii. Setting appropriate noise design limits for new plant/equipment; and

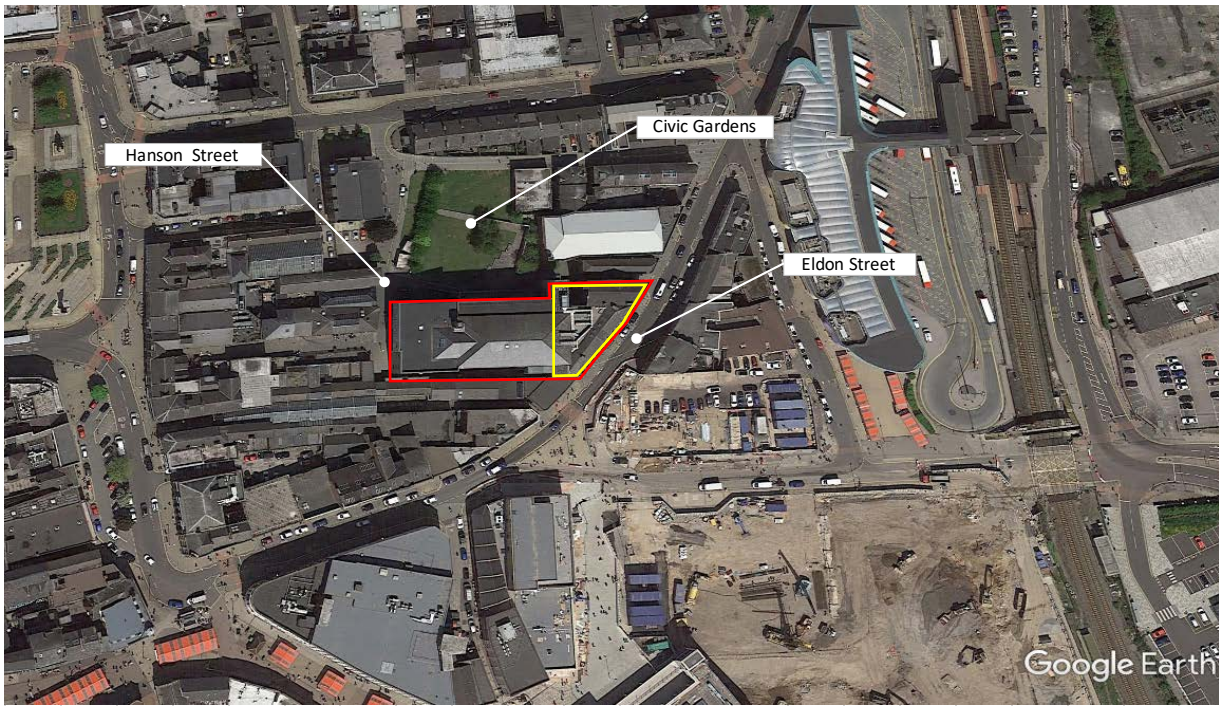
iv. Assessment of potential indoor ambient noise levels within the 'creation space'; and

v. Making recommendations where appropriate.

1.7 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible. This report has been based upon the drawings and specifications issued to us by HLM Architects. A list of the drawings this report is based on is shown in Appendix II.

2.0 SITE DESCRIPTION AND PROPOSALS

2.1 Barnsley Civic is a large multi-purpose building in Barnsley town centre comprised of the original building on Eldon Street which has a traditional substantial masonry external wall construction on the Eldon Street side of the site, with a large steel-framed extension with brick and curtain wall façade which backs onto Hanson Street and Civic Gardens. The site location, with the whole of the existing Barnsley Civic edged red and the Eldon Street building edged yellow, is shown below:



2.2 The revised proposals for the refurbishment works are shown in Figures 1 - 4.

2.3 The ground and first floor spaces within the Eldon Street building are proposed to be circulation spaces and food and beverage units, with tenants yet to be confirmed. It is anticipated that these would be let as shell units and fitted out by the tenants. The second-floor space is proposed to be open plan offices, again with no tenant yet confirmed. The third-floor space will be a multi-purpose 'creation space' with associated ancillary spaces.

2.4 There are understood to be no noise sensitive buildings in the vicinity of the Eldon Street elevation of the building, but there are some in the vicinity of the rear. Due to the presence of the newer part of the Civic adjoining the rear of the Eldon Street building, there will be no significant noise break-out from the proposed uses to the rear.

2.5 Much of the new external building services equipment (e.g. kitchen ventilation plant) is however likely to be installed at roof level towards the rear of the Eldon Street building (with some rooftop heat recovery unit air intake and exhaust vents at roof level towards the centre of the arts centre building. No new equipment is proposed on the Eldon Street elevation.

3.0 ACOUSTIC CRITERIA

3.1 The sound insulation of the building envelope for the lower floor commercial spaces (which are not especially acoustically sensitive) will be dealt with as part of the redevelopment design at a later stage. For the purposes of this planning noise assessment, we have focussed on the following:

- Control of noise impact from new building services equipment outside nearby dwellings; and
- Control of external noise ingress to the proposed third floor 'creation space'.

Environmental Noise Limits for Mechanical Services Plant

3.2 It is noted that the most significant/noisy new building services equipment that is likely to be installed at the site as part of the refurbishment proposals is the kitchen ventilation equipment associated with the proposed food and beverage units. The precise specification and design of these systems can only be determined once proposed tenants have been confirmed. As such, this assessment provides guidance on overall noise design limits that can be used as the basis for an appropriate planning condition that requires submission of a suitable scheme (or schemes) of noise mitigation measures in due course.

BS 4142:2014+A1:2019

3.3 British Standard 4142:2014+A1:2019, *Methods for rating and assessing industrial and commercial sound* (referred to hereafter as BS 4142), is appropriate guidance for assessing and controlling the potential noise impact at residential locations from noise sources such as mechanical services plant installations.

3.4 BS 4142 requires a 'rating' level ($L_{Ar,Tr}$) to be calculated from the operation of the noise source and compared with the background sound level ($L_{A90,T}$) which is measured in the absence of the noise source, evaluated over a 1-hour period for daytime operations and a 15-minute period for night-time operations.

3.5 The rating level ($L_{Ar,Tr}$) is based on the 'specific' sound level ($L_s = L_{Aeq,Tr}$) attributed to the operating noise source, with 'character corrections' added for sound sources where 'certain acoustic features can increase the significance of impact' at the residential locations.

3.6 The character correction applied to the specific sound level in order to obtain the rating level can take into account tonality, intermittency, impulsivity and characteristics otherwise distinctive against the prevailing noise climate in the area of the residential properties.

3.7 An initial estimate of the potential noise impact from the operating noise source is determined by comparing the difference between the background sound level and the rating level.

3.8 Regarding the outcome of the initial estimate, BS 4142 states that:

- Typically, the greater this difference, the greater the magnitude of impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and,

3.9 The lower the rating level is relative to the measured background sound level, the less likely it is that the operation will have an adverse impact or a significant adverse impact. Where the rating level is does not exceed the background sound level, this is an indication of the specific sound BS 4142 states that all pertinent factors must be taken into account regarding the context in which the noise occurs, including but not limited to:

- The absolute level of sound.
- The character and level of the residual sound compared to the character of the specific sound; and,
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will incorporate design measures that ensure good internal and/or outdoor acoustic conditions such as acoustic screening.

3.10 As BS 4142 is applicable guidance for assessing plant noise, appropriate design targets for noise from the proposed plant at this site would be to control the noise rating level ($L_{Ar,Tr}$) from any/all new externally mounted plant to no more than the existing representative background sound levels ($L_{A90,T}$) at the nearest dwellings.

Noise Levels in Third Floor Creation Space

3.11 There are no acoustic guidance documents that refer specifically to 'creation spaces', so we have referred to the following which include broadly applicable guidance for similar uses:

- BS 8233: 2014 *Guidance on sound insulation and noise reduction for buildings*
- Building Bulletin 93: Acoustic design of schools: Performance standards (February 2015)

3.12 BS 8233 includes guidance on appropriate indoor ambient noise levels (IANLs) for a range of spaces including ballrooms, with BB93 including guidance for drama studios, dance studios and multi-purpose halls including those formed by refurbishment. Based on this guidance, we have adopted the following acoustic design targets. A target reverberation time has also been adopted since this influences the IANL.

Table 1: Adopted Acoustic Performance Targets (IANL, RT)

Room Use	Indoor Ambient Noise Level in dB $L_{Aeq,T}$	Reverberation Time in T_{mf} [s]
Creation Space	45	≤1.2

3.13 Measures to meet the adopted reverberation time target will be developed as part of the detailed acoustic design of the project in due course. As such, only the control of IANL needs to be considered as part of this planning noise assessment.

3.14 The resulting IANL in the 'creation space' will be due to a combination of external noise ingress and noise from any building services equipment. As such, we recommend that both external noise ingress and building services noise are controlled to values at least 3 dB below the overall IANL target (i.e. 42 dB $L_{Aeq,T}$).

4.0 BASELINE NOISE SURVEY

4.1 A baseline noise survey has been carried out establish the existing ambient and background noise climate in the vicinity of the site.

4.2 The survey was carried out with automatic data-logging sound analysers installed at two locations at the site to measure prevailing noise levels over a typical 24-hour period during the week.

4.3 The measured locations were as described and shown below:

1. With the microphone protruding approximately 0.5m from a partially open first floor window towards the centre of the Eldon Street elevation. Note - the usual microphone placement at 1m from the building elevation was not feasible due to the presence of bird netting across the entire Eldon Street façade; and

2. With the microphone mounted at the edge of and approximately 1.5m above the top of the fire escape staircase to the south side of the rear of the building.

4.4 The noise survey was carried out between the early afternoon of Thursday 17 March 2022 and the early afternoon of Friday 18 March 2022 using two NTi Audio XL2 'Class 1' sound analysers (serial nos. A2A-20228-E0 and A2A-20361-E0) each with an environmental enclosure and microphone protection kit. The equipment was field-calibrated before and after the measurements with no variance observed.

The weather conditions during the survey were dry, clear, mild (12°C in the daytime dropping to around 5°C at night) and with winds approximately 4-5 m/s at the start of the survey dropping to below 2 m/s by the early evening of 17 March 2022 onwards.

4.5 Noise measurements at Location 1 (i.e. the Eldon Street elevation) were taken in consecutive five-minute periods. At the rear, however, measurements were taken in terms of consecutive 15-minute periods since the focus of these measurements was to establish the representative background sound levels in line with BS 4142 (with 15-minute measurements being the minimum recommended measurement interval under normal circumstances).

4.6 Full results of the noise survey are shown in Appendix II and summarised below:

Table 2: Summary of existing noise climate

Location	Period	Ambient noise levels in dB $L_{Aeq,T}$		Background noise levels in dB $L_{A90,T}$	
		Range	Logarithmic average	Mean	Mode
1	Daytime (07:00 – 19:00)	57 – 75	65	56	56
	Evening (19:00 – 23:00)	59 – 71	64	52	54
	Night-time (23:00 – 07:00)	43 – 71	58	44	42
2	Daytime (07:00 – 19:00)	55 – 62	59	54	53
	Evening (19:00 – 23:00)	56 – 61	59	55	55
	Night-time (23:00 – 07:00)	48 – 58	53	49	47

4.7 The corresponding logarithmic average octave band noise levels for daytime and evening periods at Location 1 (Eldon Street elevation) to be used to assess/control external noise break-in to the 'creation space during daytime and evening periods are as follows:

Table 3: Octave band noise levels on Eldon Street elevation (dB L_{eq})

Period	Octave Band Centre Frequency (Hz)							A
	63	125	250	500	1k	2k	4k	
Daytime (07:00 – 19:00)	72	66	62	61	62	58	52	65
Evening (19:00 – 23:00)	70	65	61	60	60	56	47	64

5.0 ASSESSMENT & RECOMMENDATIONS

Environmental Noise Design Limits for Mechanical Services Plant

5.1 We have referred to the lowest of either the mode or mean of the measured background noise levels at Location 2 in order to establish the representative background sound levels to derive design noise limits for mechanical service plant.

5.2 It is noted that the representative background sound level for the evening period (19:00 – 23:00) was actually higher than the corresponding daytime (07:00 – 19:00) value. As such, as a robust approach, we have adopted the lower value for the whole of the 07:00 – 23:00 period.

5.3 On this basis, we recommend that new external plant/equipment is designed to ensure that the following noise limits are met outside the nearest/most exposed dwellings (the precise location of which can only be determined following confirmation of the plant/equipment positions):

Table 4: Noise limits for all new external plant/equipment combined

Period	Noise limit in dB $L_{Ar,Tr}$
All equipment that could operate in the daytime (07:00 – 23:00)	53
All equipment that could operate at any time throughout 24 hours	47

5.4 It should be noted that the above limits refer to all plant/equipment combined and so the contribution from each item individually will need to be below these values. Once full details of the proposed plant/equipment (including installation locations) are known, it will be possible to determine the maximum permissable source noise levels from each item or from each demise's plant/equipment combined.

5.5 The need to ensure that the above noise limits are met can be secured by way of an appropriate planning condition that requires details of the proposed plant/equipment to be submitted and approved by the Local Planning Authority prior to the equipment being brought into use.

5.6 We would recommend the following general noise control measures in order to assist in meeting the relevant noise limits in due course:

- Specifying low noise equipment;
- Careful siting of equipment away from dwellings (i.e. as far as is feasible);

- Installation of acoustic enclosures around the fixed plant and machinery where necessary;
- Installation of noise attenuators, acoustic louvres, etc;
- Carrying regular maintenance of equipment to minimise noise emissions.

Control of Noise in Third Floor Creation Space

External Noise Ingress

5.7 Existing external walls are of substantial solid masonry construction which will provide a high level of airborne sound insulation. As such, external noise ingress will be dictated by that via the windows and, to a lesser extent, the roof.

5.8 The third-floor space in the Eldon Street elevation features small porthole type windows with two small arched sliding sash windows at the centre. The space features pitched ceilings/roof, assumed to be formed of slate tiles over lath and plaster ceiling.

5.9 Taking into account the worst-case measured external noise levels, the sound reduction indices and relative areas of the various elements of the building envelope, we have calculated the likely resulting IANL due to the ingress of external noise using the methodology set out in BS 8233 as shown in Appendix III. The calculations assume that windows are closed, with ventilation provide by alternative means incorporating appropriate noise attenuation where necessary.

5.10 The calculated noise ingress level is 41 dB L_{Aeq} and therefore just within the adopted noise criterion. It is however noted that noise ingress is likely to be lower in practice since the roof is set back from the main elevation and hence less exposed to noise from Eldon Street than the main elevation.

Building Services Noise

5.11 Building services equipment noise is often quantified in terms of 'noise rating', which is a graphical method for assigning a single-number rating to a noise spectrum. It can be used to specify the maximum acceptable level in each octave band of a frequency spectrum. The method was originally proposed for use in assessing environmental noise, but it is now used in the UK mainly for describing noise from mechanical ventilation systems in buildings. Whilst there is no direct relationship between NR and dBA values (such as noise levels denoted in terms of $L_{Aeq,T}$), the following approximate relationship applies: dBA ≈ NR + 6.

5.12 As such, taking into account the above, we recommend that building services noise within the 'creation space' is controlled to be no more than NR36.

5.13 On this basis, we conclude that noise within the 'creation space' will be controlled to within appropriate levels.

6.0 SUMMARY

6.1 Hepworth Acoustics Ltd was commissioned by HLM Architects on behalf of The Civic, Barnsley, to prepare a noise assessment in connection with a planning application for revised refurbishment proposals for the Civic. The revised proposals include redevelopment of the original Eldon Street building including food and beverage units at ground and first floor, offices at second floor and a new multi-purpose 'creation space' at third floor level.

6.2 In noise terms, the key issues are the control of new external building services equipment noise outside the nearest/most exposed dwellings and the achieving appropriate indoor ambient noise levels within the 'creation space'.

6.3 The assessment has included adopting appropriate noise criteria for the development and a baseline noise survey to establish the existing noise climate in the vicinity of the site.

6.4 Whilst no firm details on proposed external plant/equipment are available at this stage, we have recommended environmental noise limits which can be used as a basis for an appropriate planning condition to adequately control plant/equipment noise impact outside the nearest/most exposed dwellings in due course.

6.5 Our calculations indicate that ingress of external noise to the proposed third floor 'creation space' will be within relevant limits and we have recommended a noise design limit to adequately control building services noise within the space.

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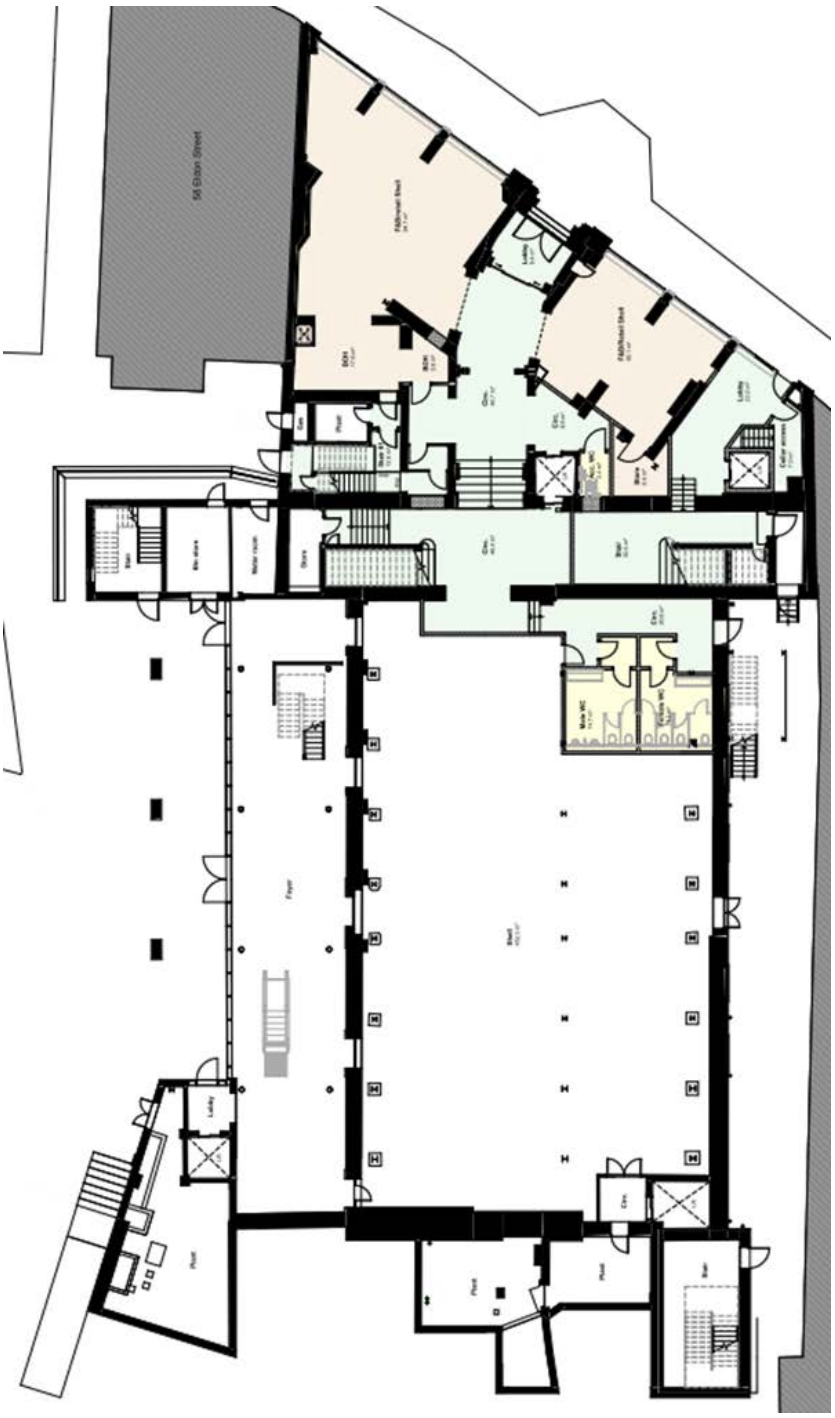
Title: Figure 1: Proposed Layout - 0F

Project: P19-389



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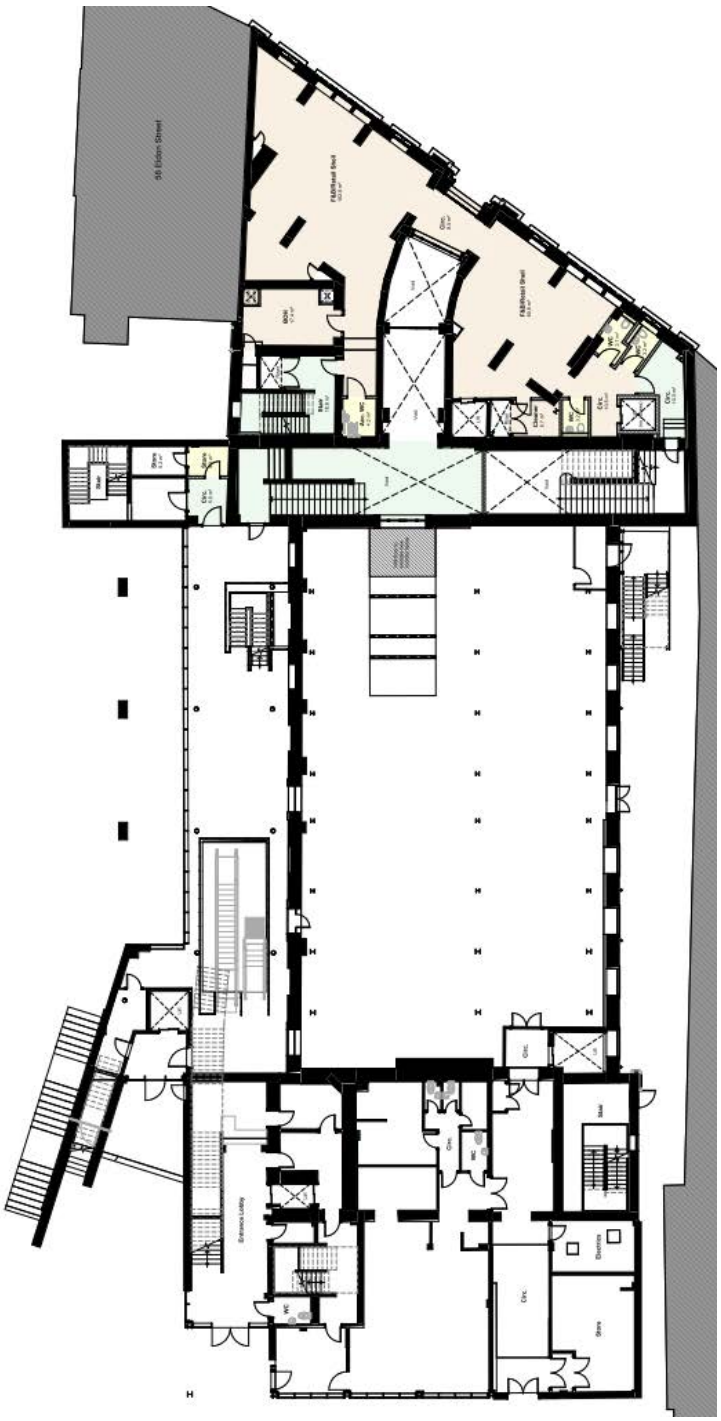
Title: Figure 2: Proposed Layout - 1F

Project: P19-389



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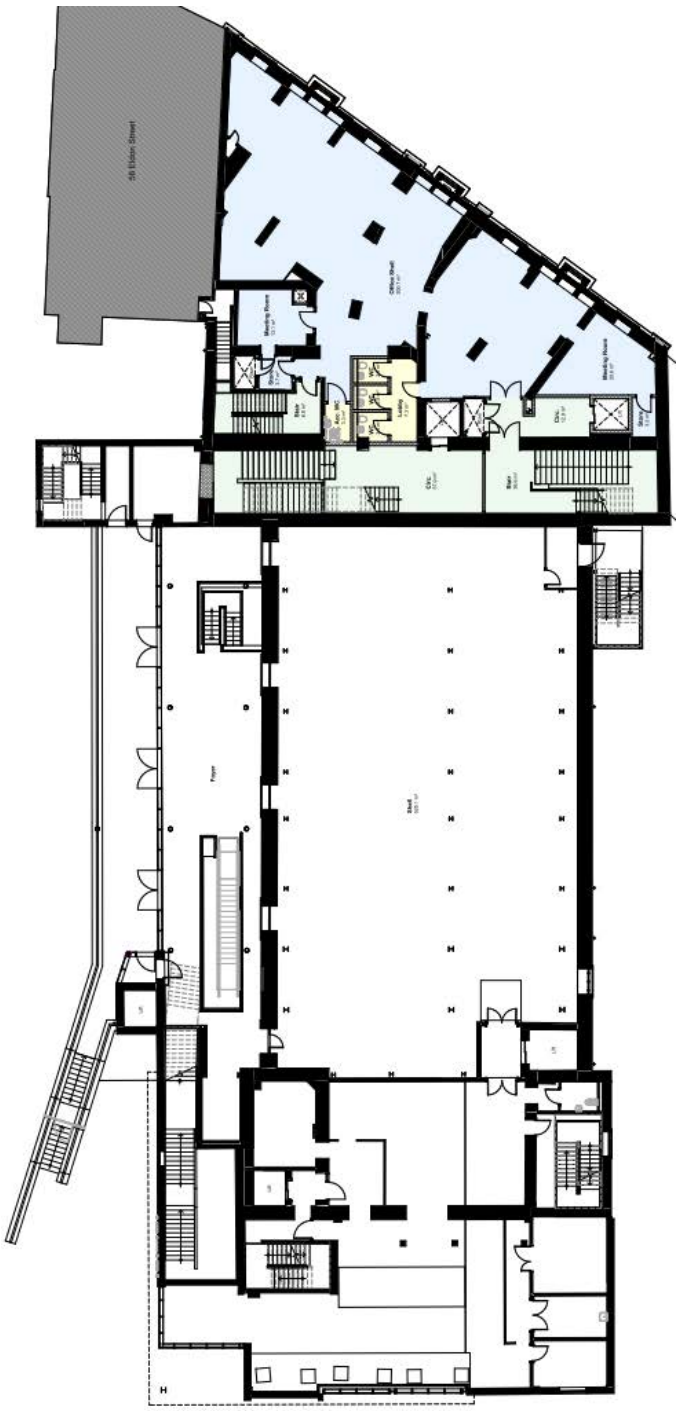
Title: Figure 3: Proposed Layout - 2F

Project: P19-389



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Title: Figure 4: Proposed Layout - 3F

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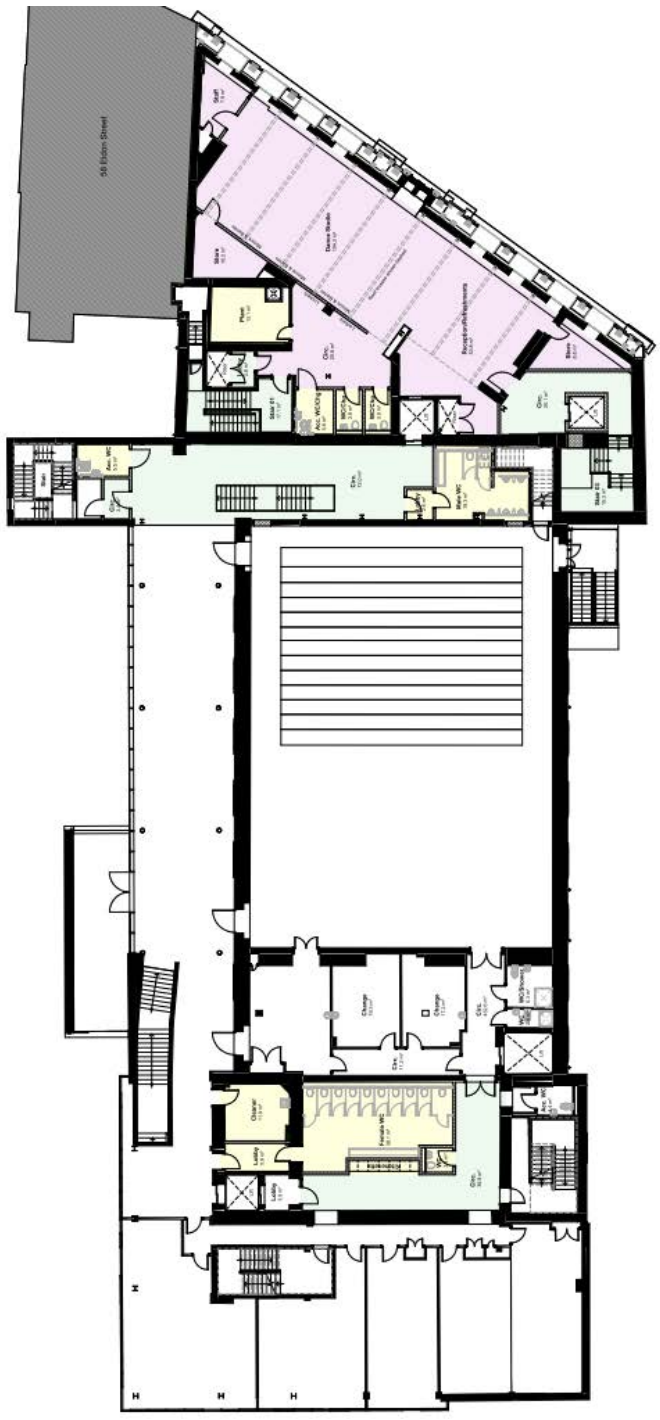

Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the pressure values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that the human response to sound most closely follows a logarithmic relationship. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (at the threshold of hearing) to 120 dB (at the threshold of pain).

Due to the logarithmic nature of decibels, when two sounds of the same level are combined together, the total sound level is (under normal circumstances) 3 dB higher than each of the individual sound levels e.g. 60 dB plus 60 dB = 63 dB. In terms of perceived 'loudness', a 3 dB(A) variation in sound level is a relatively small (but nevertheless just noticeable) change. An increase in sound level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in sound level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' the frequency spectrum appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using a mathematical filter called the 'A' weighting, which is built into sound level meters. Sound levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or Hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Relevant Sound & Vibration Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case, it is therefore not possible to represent the noise with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The various indices used in this report, along with other relevant terms are described below.

$L_{Aeq,T}$ This is the A-weighted 'Equivalent Continuous Sound Level' which is an average of the total sound pressure measured over a specified time period. In other words, $L_{Aeq,T}$ is the level of a steady sound which has the same total (A-weighted) sound pressure as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for most forms of environmental noise.

L_{A90} This is the A-weighted sound level exceeded for 90% of a measurement time period. L_{A90} is used as a measure of background sound level.

$L_{Ar,Tr}$ This is an A-weighted value most commonly used in BS 4142 assessments, which is the sound level of the noise source under assessment, at the assessment location, evaluated over the reference assessment period (*T*r) and includes numerical adjustments for the characteristic features of the sound.

NR Each 'Noise Rating' (NR) level (e.g. NR20, NR35 etc.) has a different value at each 1/3 octave or whole octave band; the value at each band defines the limit which a noise level cannot exceed in order for the level to fall within the NR level.

RT/T_n The 'Reverberation Time' is the time it takes in seconds for a sound level, typically within an enclosed space, to reduce by 60 dB (T_{60}) after the source of the sound has ceased. However, reverberation time is often measured based on the time it takes for the sound level to decrease by 20 dB (T_{20}) or 30 dB (T_{30}).

Appendix II: Noise Survey Results

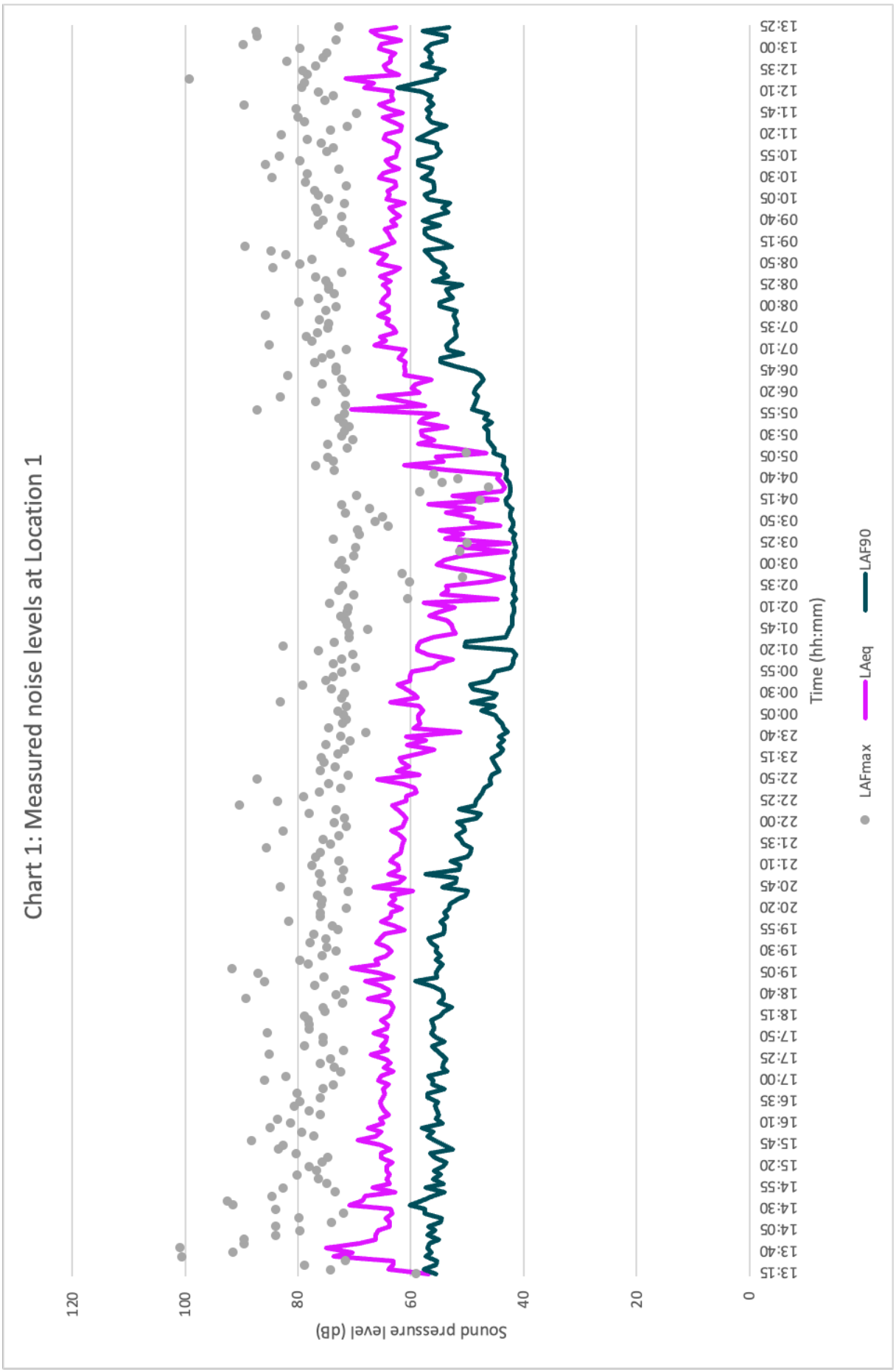
Chart 1: Measured noise levels at Location 1
Sound pressure level (dB)
120
100
80
60
40
20
0
Time (hh:mm)
13:15
13:40
14:05
14:30
14:55
15:20
15:45
16:10
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LAFmax
LAeq
LAF90

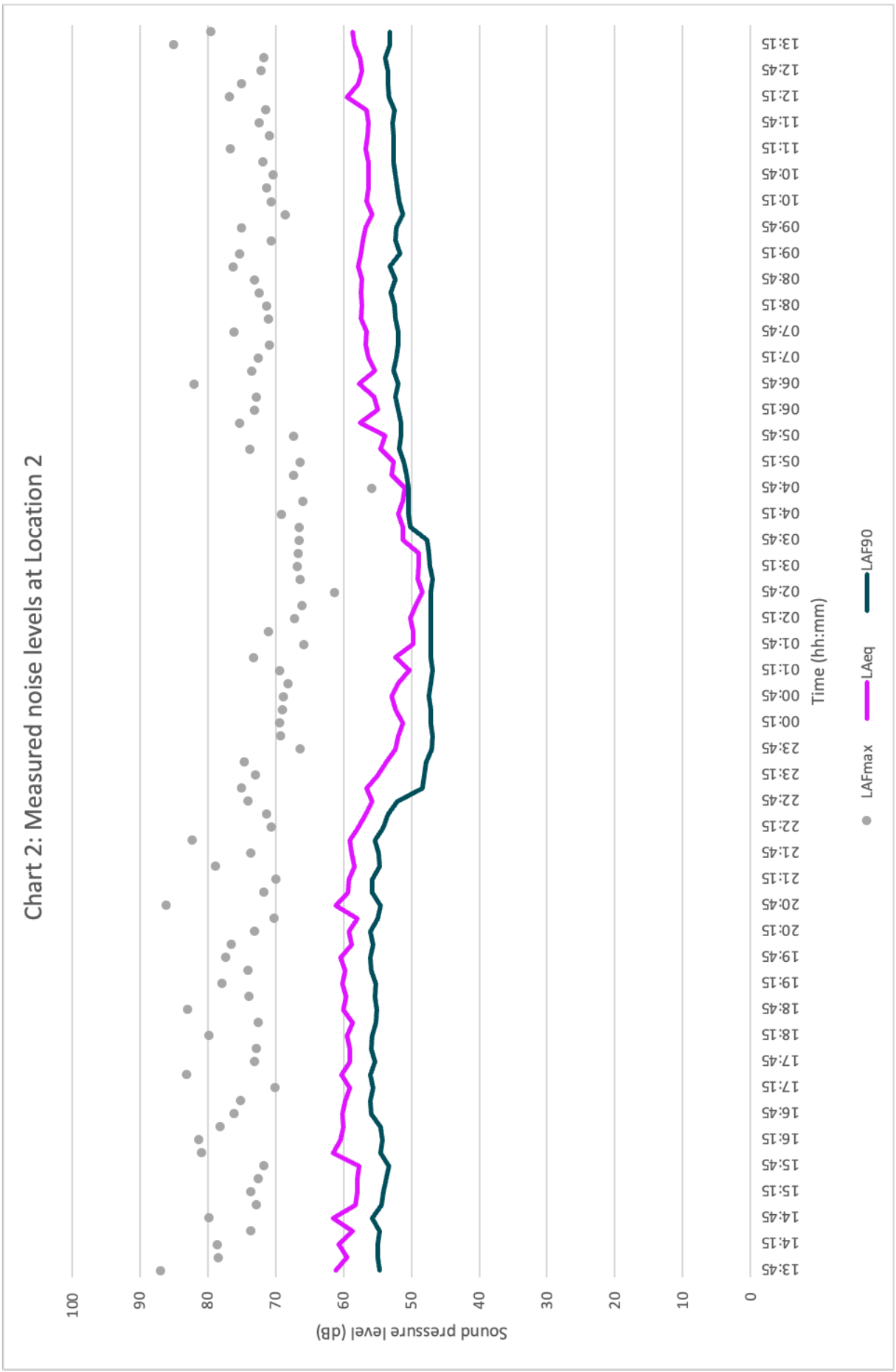
Chart 2: Measured noise levels at Location 2
Sound pressure level (dB)
100
90
80
70
60
50
40
30
20
10
0
Time (hh:mm)
13:45
14:15
14:45
15:15
15:45
16:15
16:45
17:15
17:45
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11:45
12:15
12:45
13:15
LAFmax
LAeq
LAF90

Appendix III: External Noise Ingress Calculations

BS8233 Calculation of Noise Breakin

The expected precision of this calculation is ±2 dB

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Version 8.0 February 2019

Project Number	P19-389
Site	Barnsley Civic
Period	Day
Plot/Room	Third Floor Creation Space
Consultant	DQ

Term	Term Description	Value
S_f	Façade area (incl. window) (m^2)	72.0
S_{wi}	Area of the windows (m^2)	5.5
S_{rr}	Area of the ceiling (m^2)	75.0
S_{ew}	Area of the external wall (m^2)	66.5
S	Area of facade and roof	147.0
x	Room Dimension x	21.0
y	Room Dimension y	7.5
z	Room Dimension z	3.5
	Façade correction	0.0
r	Distance to window / vent (m)	3.00
V	Volume of Room (m^3)	551

	63 - 8k	BS 8233	NR
L_{Amax}	-32.4	-33.3	1

	63 - 8k	BS 8233	NR
L_{Aeq}	40.7	38.8	33

RT	Receiving Room RT	Octave Band Centre Frequency								
		63	125	250	500	1000	2000	4000	8000	T_{mf}
		2.0	1.8	1.5	1.2	1.2	1.2	1.0	1.0	1.2

standard rev times for a furnished room from worked example in BS 8233, V= 35m^3

			Octave Band Centre Frequency										
			63	125	250	500	1000	2000	4000	8000	dBA	NR	BS8233
L_{max}	Free-field L_{max} outside room	Enter the Octave Band L_{max} Data									7	7	5
$L_{eq,ff}$	Free-field L_{eq} outside room	Enter the Octave Band L_{eq} Data	72	66	62	61	62	58	52	52	66	61	65
$D_{n,e}$	SRI of the vent	Ignore Trickle Vent	130	130	130	130	130	130	130	130	131 -1;-1		
R_{wi}	SRI of the window	4 mm	13	20	22	28	33	34	28	28	31 -1;-3		
R_{ew}	SRI of the external wall	200mm solid wall, plastered	21	36	39	45	53	59	62	64	50 -2;-5		
R_{rr}	SRI of roof/ceiling	Tiled/slated roof, 12mm plasterboard ceiling, no quilt above ceiling	17	21	26	33	33	34	37	40	34 -2;-4		
A	Equivalent Absorption Area	$\frac{0.161V}{RT}$	44	49	59	74	74	74	89	89			
		10 x log (S/A)	5	5	4	3	3	3	2	2			

L_{eq} - Direct + Reverberant

negate element size correction 0

Term	Term Description	Octave Band Centre Frequency								A	NR
		63	125	250	500	1000	2000	4000	8000		
$L_{eq,2}$	Vent	-61	-68	-73	-75	-74	-78	-84	-84	-70.0	
	Glazing	53	39	33	25	21	16	15	15	31.2	
	Wall	56	35	27	19	11	1	-8	-10	30.5	
	Ceiling	60	50	40	31	32	27	17	14	39.7	
	Total	**62**	**50**	**41**	**32**	**32**	**27**	**19**	**18**	**40.7**	**33**