

Our ref: NIA/8813/20/9235/v1/Yorkshire House

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NOISE IMPACT ASSESSMENT FOR PROPOSED RESIDENTIAL DEVELOPMENT FORMED BY THE CONVERSION/EXTENSION OF YORKSHIRE HOUSE, SHAMBLES STREET, BARNSELY

BARNSELY METROPOLITAN BOROUGH COUNCIL PLANNING REFERENCE 2018/1189

1.00 INTRODUCTION

- 1.01 Environmental Noise Solutions has been commissioned by Empire Property Concepts to carry out a noise impact assessment for the proposed residential development formed by the conversion/extension of Yorkshire House, Shambles Street, Barnsley, S70 2SW (hereafter referred to as the subject site).
- 1.02 Planning Permission ref: 2018/1189 was granted by Barnsley Metropolitan Borough Council (BMBC) in October 2018 for the change of use of the first and second floors (former offices) to form 19 no. apartments, subject to conditions. Condition 1 relates to noise as follows:
1. *The development shall be carried out in accordance with the recommendations and mitigation measures set out in the 'Assessment of Proposed Residential Conversion' by Sharps Gayler dated 5th July 2018. The measures shall be installed prior to occupation and retained as such thereafter.*
- 1.03 The objectives of the noise impact assessment were to:
- Determine the ambient noise level at the subject site
 - Assess the potential impact of the ambient noise climate on the proposed residential development with reference to pertinent guidance
 - Review the mitigation measures set out in the 'Assessment of Proposed Residential Conversion' by Sharps Gayler for the existing first and second floors
 - Provide recommendations for a scheme of sound attenuation works, as necessary, to ensure that the future occupants of the proposed residential development do not experience any unacceptable loss of amenity due to noise
- 1.04 This report details the methodology and results of the assessment and provides recommendations for the building envelope (fenestration and ventilation).
- 1.05 This report has been prepared for Empire Property Concepts for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult Empire Property Concepts and ENS as to the extent to which the findings may be appropriate for their use.
- 1.06 A glossary of acoustic terms used in the main body of the text is contained in Appendix 1.

2.00 SUBJECT SITE SETTING AND PROPOSED DEVELOPMENT

- 2.01 Yorkshire House is a 3-storey former office building (ground, first and second floors). The building is located in a mixed-use setting in Barnsley town centre and is bound by:
- Shambles Street to the north
 - The Londoner public house to the east
 - No. 32 Shambles Street to the west
 - A surface car park to the south
- 2.02 As stated, planning permission (ref: 2018/1189) has already been granted for the conversion of the first and second floors of Yorkshire House to form 19 no. apartments, with a planning condition requiring compliance with the recommendations and mitigation measures set out in the 'Assessment of Proposed Residential Conversion' by Sharps Gayler dated 5th July 2018.
- 2.03 For reference, the façade mitigation measures set out in the accompanying Sharps Gayler report comprise acoustic double-glazing or secondary glazing rated at least **49 dB R_w (45 dB R_w+C_{tr})** in conjunction with acoustically-treated ventilation.
- 2.04 Development proposals are now to create a new third floor by rooftop extension to form a further 8 no. apartments.
- 2.05 The ambient noise climate on the northern elevation is characterised (dominated) by road traffic on Shambles Street, with no other significant noise sources noted. The ambient noise climate on the southern (car park) elevation is characterised by distant road traffic during the daytime with entertainment noise (music and patron noise) from pubs and clubs in the locality audible during the night time.
- 2.06 In terms of relevant planning history in the vicinity of the subject site, it is noted that Planning Permission ref: 2019/0001 was granted by BMBC in May 2019 for a new rooftop bar at the adjacent Londoner public house, subject to conditions. Condition 3 relates to noise as follows:
3. *The development hereby approved shall strictly comply with the maximum permissible music noise levels set out in table 4.2 of the Noise Impact Assessment by ENS Ltd. (Ref: NIA/8232/18/8201/v1 The Londoner PH)*

3.00 BASELINE NOISE SURVEY

- 3.01 In order to establish the ambient noise levels at the subject site, a baseline noise survey was carried out on Friday 15th November through to Saturday 16th November 2019.
- 3.02 For the purpose of the assessment, the following noise monitoring positions were adopted (the approximate location of the noise monitoring positions is contained in Appendix 2 for reference):
- MP1 was located on the northern (Shambles Street) elevation of the existing building, at second floor level and at 1 metre from the façade
 - MP2 was located on the southern (car park) elevation of the existing building, at second floor level and at 1 metre from the façade
- 3.03 Noise measurements were undertaken using Bruel & Kjaer 2250 Type 1 integrating sound level meters. The measurement system calibration was verified immediately before the commencement of the measurement sessions and again at the end, using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration level was noted. Weather conditions throughout the survey were appropriate for monitoring.

- 3.04 Measurements consisted of A-weighted broadband parameters, together with linear octave and 1/3rd octave band L_{eq} levels. Table 3.1 contains a summary of the measurement data for each measurement session, at each measurement position, rounded to the nearest decibel. As external measurements were made at 1 metre from the existing building façade, a –3 decibel façade enhancement correction has been applied in order to establish the free field noise levels.

Table 3.1 – Summary of Noise Measurement Data

Position	Date	Time	L_{Aeq} (dB)	L_{A90} (dB)	L_{A10} (dB)	Comment
MP1	15/11/19	1044–2300	68	61	70	Road traffic noise on Shambles Street dominant
MP1	15/11/19	2300–0101	64	52	68	Road traffic noise on Shambles Street dominant Maximum noise levels typically 78 dB L_{AFMax}
Daytime and night ambient noise level circa 68 dB $L_{Aeq, T}$ and 64 dB $L_{Aeq, T}$ respectively Maximum noise level typically 78 dB L_{AFMax} during the night time						
MP2	15/11/19	1251–2300	55	52	57	Distant road traffic
MP2	15/11/19	2300–0101	57	55	59	Music and pedestrian noise associated with neighbouring pubs and clubs, distant road traffic Maximum noise levels typically 75 dB L_{AFMax}
Daytime and night ambient noise level circa 55 dB $L_{Aeq, T}$ and 57 dB $L_{Aeq, T}$ respectively Maximum noise level typically 75 dB L_{AFMax} during the night time						

- 3.05 The ambient noise climate on the northern elevation was characterised (dominated) by road traffic on Shambles Street with no other significant noise sources. Daytime and night time ambient noise levels at MP1 were circa **68 dB $L_{Aeq, T}$** and **64 dB $L_{Aeq, T}$** respectively, with maximum noise levels of typically **78 dB L_{AFMax}** during the night time.
- 3.06 For reference, these levels correlate well with the noise levels described in the Sharps Gayler noise assessment for the conversion of the existing building, which reported free field noise levels of **68 dB $L_{Aeq, T}$** during the daytime, **65 dB $L_{Aeq, T}$** during the night time peak hour (2300–0000 hours) and a typical maximum noise level **79 dB L_{AFMax}** during the night time.
- 3.07 Daytime ambient noise levels on the southern (car park) elevation were due to distant road traffic and anonymous plant noise and were measured at circa **55 dB $L_{Aeq, T}$** at MP2.
- 3.08 Night time ambient noise levels on the southern elevation were due to music and patron noise associated with pubs and clubs in the locality and distant road traffic noise. Night time ambient noise levels were measured at **57 dB L_{Aeq} (2300–0100)** at MP2, with maximum noise levels of typically **75 dB L_{AFMax}** during the night time.
- 3.09 The following table contains the octave band frequency data for the night time measurement at MP2.

Table 3.2 – Night Time Octave Band Frequency Data at MP2

Octave Band L_{eq}								dB L_{Aeq}
63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
67	61	57	54	52	49	44	32	57

- 3.10 As stated, Planning Permission ref: 2019/0001 was granted by BMBC in May 2019 for a new rooftop bar at the adjacent Londoner public house, with Condition 3 setting maximum permissible music noise levels at the façade of Yorkshire House. The maximum permissible music noise levels referenced in the planning condition are reproduced below:

Table 3.3 – Londoner Maximum Permissible Music Noise Levels at Development Façade

Octave Band L _{eq}								dB L _{Aeq}
63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
79	72	71	70	68	73	79	32	82

4.00 NOISE ASSESSMENT CRITERIA

National Planning Policy Framework

- 4.01 The National Planning Policy Framework (NPPF) was updated in February 2019 and sets out the Government's planning policies for England and how these are expected to be applied.

- 4.02 Where issues of noise impact are concerned the NPPF provides brief guidance in paragraph 170 where it states that planning policies and decisions should contribute to and enhance the natural and local environment by:

'preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of.....noise pollution'.

- 4.03 Paragraph 180 advises that:

'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.....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'.

- 4.04 With regard to extant community noise sources and the potential to affect proposed new developments, Paragraph 182 states that:

'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 of 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.'

- 4.05 The NPPF also refers to the 2010 DEFRA publication, the Noise Policy Statement for England (NPSE) which reinforces and supplements the NPPF

Noise Policy Statement for England

- 4.06 The Noise Policy Statement for England (NPSE) sets out the long-term vision of promoting good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development. This long-term vision is supported by the following aims:
- Avoid significant adverse impacts on health and quality of life.
 - Mitigate and minimise adverse impacts on health and quality of life.
 - Where possible, contribute to the improvement of health and quality of life.
- 4.07 NPSE describes the following levels at which noise impacts may be identified:
- NOEL – No Observed Effect Level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
 - LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.
 - SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

Planning Practice Guidance – Noise

- 4.08 In July 2019, Planning Practice Guidance (PPG) was updated online which provides additional guidance and elaboration on the NPPF. It advises that the Local Planning Authority should consider the acoustic environment in relation to:
- Whether or not a significant adverse effect is occurring or likely to occur.
 - Whether or not an adverse effect is occurring or likely to occur.
 - Whether or not a good standard of amenity can be achieved.
- 4.09 In line with the Explanatory Note of the NPSE, the PPG references the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that:
- ‘...the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation’.*
- 4.10 The PPG also provides general advice on the typical options available for mitigating noise. It goes on to suggest that Local Plans may include noise standards applicable to proposed developments within the Local Authority’s administrative boundary, although it states that:

‘Care should be taken, however, to avoid these being implemented as fixed thresholds as specific circumstances may justify some variation being allowed’.

ProPG Planning and Noise: New Residential Development

- 4.11 ProPG Planning and Noise: New Residential Development (ProPG) was published in May 2017 by the Association of Noise Consultants, Institute of Acoustics and the Chartered Institute of Environmental Health.
- 4.12 Stage 2: Element 2 of ProPG sets indoor ambient noise levels for residential dwellings based on the guidance contained in British Standard 8233:2014 ‘Guidance on Sound Insulation and Noise Reduction for Buildings’ (BS 8233) (see table below).

Table 4.1 – Indoor Ambient Noise Levels in Dwellings

Activity	Location	Good Indoor Ambient Noise Levels	
Resting	Living Room	35 dB L_{Aeq} (0700–2300)	-
Dining	Dining Room/Area	40 dB L_{Aeq} (0700–2300)	-
Sleeping (daytime resting)	Bedroom	35 dB L_{Aeq} (0700–2300)	30 dB L_{Aeq} (2300–0700) 45 dB L_{AFMax} (2300–0700)

4.13 Note 4 to the above table states:

‘A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night.’

4.14 Note 5 to the above table states:

‘Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the “open” position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7’.

4.15 This is consistent with the guidance contained within the PPG, which states that:

‘... consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations’.

4.16 The NPPF PPG requires that the character of the noise is taken into account. Where entertainment noise is present, the DEFRA document *‘Noise from Pubs and Clubs – Phase 1’* describes methods for assessing the acceptability of a noise spectrum for a given application through the use of Noise Rating (NR) curves. This is a graphical method for assigning a single-number rating to a noise spectrum, and many local authorities have a requirement to comply with **NR20** in bedrooms at night where entertainment (i.e. music) noise is present.

4.17 On the basis of the above, the following criteria (with windows closed and an alternative means of ventilation provided) are considered appropriate for the proposed residential development and considered to represent good resting and sleeping conditions:

- ≤ 35 dB L_{Aeq} (0700–2300) during the daytime
- ≤ 30 dB L_{Aeq} (2300–0700) and NR20 (music noise) during the night time
- 45 dB L_{AFMax} not regularly exceeded during the night time.

5.00 SOUND ATTENUATION SCHEME PROPOSALS

- 5.01 The daytime and night time ambient design noise levels at MP1 have been measured at **68 dB L_{Aeq, T}** and **64 dB L_{Aeq, T}**, respectively (with maximum noise levels of typically **78 dB L_{AFMax}** measured during the night time).
- 5.02 The daytime and night time ambient design noise levels at MP2 have been measured at **55 dB L_{Aeq, T}** and **57 dB L_{Aeq, T}**, respectively (with maximum noise levels of typically **75 dB L_{AFMax}** measured during the night time).
- 5.03 The glazing specification set out in the Sharps Gayler report was acoustic double-glazing or secondary glazing rated at least **45 dB R_w+C_{tr}**. Whilst no specific ventilation strategy was outlined within the report, Appendix B indicates that ventilation was to be provided via 2 no. Greenwood AAB-400 acoustic wall vents (rated at **46 dB D_{n,e,w}** per unit).
- 5.04 A comparison of external and internal noise levels within the appendix indicates that the façade reduction of the above specification is circa **34 dB(A)**. The façade performance is limited in this instance by the performance of the acoustic wall vents, and it therefore follows that the glazing specification can be reduced if the vent performance is improved, without compromising the composite façade performance.
- 5.05 The following table provides a range of example glazing/ventilation specifications which will achieve 34 dB(A) reduction. The performances have been derived using the methodology advocated in BS 8233, based on the external noise levels at MP1, worst case room dimensions, and parameters for the various elements of the building envelope.

Table 5.1 – Example Glazing Specifications to meet 34 dB(A)

Vents	No/Length	Glazing	R _w +C _{tr}
Greenwood AAB-400	2	Pilkingtons 10-12-6-100-6	45
		10 - 200 - 6 secondary glazing	45
		10.8 Phon / 24 argon / 16.8 Phon	46
Greenwood 5000EAW.AC2	1	10 / 16 argon / 9.1 Optiphon	40
Invisivent@EVO AK Ultra	1 metre	8 float / 16 air / 10.8 SGG Stadip	37
		6.4 SGG Stadip Silence / 16 argon / 8.4 SGG Stadip Silence	37
No Vent	n/a	6 float / 16 argon / 8.4 SGG Stadip Silence	36
		8 float / 16 argon / 9.1 Optiphon	36

- 5.06 The following table indicates that the target criteria contained in Table 4.1 will be met throughout the development providing the façade reduction is at least 34 dB(A). See Appendix 3 for glazing/ventilation markup.

Table 5.2 – Calculated Internal Noise Levels

Location	External Noise Level	Façade Reduction	Internal Noise Level	Internal Criteria
Front (Shambles St) elevation	68 dB L _{Aeq} (0700–2300) 64 dB L _{Aeq} (2300–0700) 78 dB L _{AFMax} (2300–0700)	–34 dB(A)	≤ 34 dB L _{Aeq} (0700–2300) ≤ 30 dB L _{Aeq} (2300–0700) ≤ 44 dB L _{AFMax} (2300–0700)	≤ 35 dB L _{Aeq} (0700–2300) ≤ 30 dB L _{Aeq} (2300–0700) ≤ 45 dB L _{AFMax} (2300–0700)
Rear elevation	55 dB L _{Aeq} (0700–2300) 57 dB L _{Aeq} (2300–0700) 75 dB L _{AFMax} (2300–0700)	–34 dB(A)	≤ 21 dB L _{Aeq} (0700–2300) ≤ 23 dB L _{Aeq} (2300–0700) ≤ 41 dB L _{AFMax} (2300–0700)	≤ 35 dB L _{Aeq} (0700–2300) ≤ 30 dB L _{Aeq} (2300–0700) ≤ 45 dB L _{AFMax} (2300–0700)

- 5.07 In relation to potential music noise at the rear of the development, the following example calculation demonstrates that bedrooms on the rear elevation will achieve NR20 compliance with glazing/ventilation as specified in Table 5.1.

Table 5.3 – NR20 Assessment for Rear Bedrooms (32 m³ volume)

	Octave Frequency Band (Hz)							
	63	125	250	500	1000	2000	4000	8000
EXTERNAL NOISE LEVEL (MP2 2300-0100)	67	61	57	54	52	49	44	32
6.4 SGG Stadip Silence / 16 argon / 8.4 SGG Stadip Silence (6 m ²)	25	28	29	36	48	55	62	62
Invisivent®EVO AK Ultra (1 metre)	44	47	38	36	41	55	62	62
Total Façade Reduction	-26	-29	-29	-33	-40	-52	-59	-59
10 log (S/A)	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
External to Internal Correction	+3	+3	+3	+3	+3	+3	+3	+3
INTERNAL NOISE LEVEL	43	34	30	23	14	0	0	0
NR20	51	39	31	24	20	17	14	13
Compliant	✓	✓	✓	✓	✓	✓	✓	✓

Noise Associated with Consented Adjacent Rooftop Bar

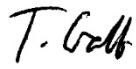
- 5.08 The maximum permissible music noise levels at the consented rooftop bar at the adjacent Londoner public house were derived on the assumption that glazing rated at least 45 dB R_w+C_{tr} was to be installed at the subject site.
- 5.09 Although it is unlikely that the maximum permissible music noise level will be reached (it is understood that music is to be kept to quiet 'conversational' levels), as a precaution the bedrooms of **Flats 102, 202 and 302** (which directly overlook the consented rooftop bar) must be provided with glazing rated at 45 dB R_w+C_{tr} (see Table 5.1 for example configurations).
- 5.10 In order to avoid compromising the performance of the glazing, trickle/wall vents should be avoided in these bedrooms. The recommended solution is an individual room ventilator (e.g. Titon Sonair F+ or equivalent) – 1 no. unit required per bedroom.
- 5.11 See Appendix 3 for glazing/ventilation markup.

6.00 CONCLUSIONS

- 6.01 A noise impact assessment has been undertaken for a proposed residential development formed by the conversion/extension of Yorkshire House, Shambles Street, Barnsley, S70 2SW.
- 6.02 The ambient noise climate on the northern elevation is characterised (dominated) by road traffic on Shambles Street, with no other significant noise sources noted. The ambient noise climate on the southern (car park) elevation is characterised by distant road traffic during the daytime with entertainment noise (music and patron noise) from pubs and clubs in the locality audible during the night time.
- 6.03 A scheme of sound insulation works has been developed to protect the development from the ambient noise climate, in accordance with pertinent guidance.

I trust the foregoing is sufficient for your needs. Should you have any queries regarding the above, please do not hesitate to contact me.

Yours sincerely

A handwritten signature in black ink, appearing to read 'T. Crabb'. The signature is written in a cursive, slightly stylized font.

Thomas Crabb
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Environmental Noise Solutions Limited

Appendix 1

Glossary of Acoustic Terms

Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 μPa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log_{10}(p/p_0)$$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_0 = reference sound pressure (20 μPa).

A-weighting Network

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T , has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T . $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T . L_{A90} is typically taken as representative of background noise.

$L_{AF \max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

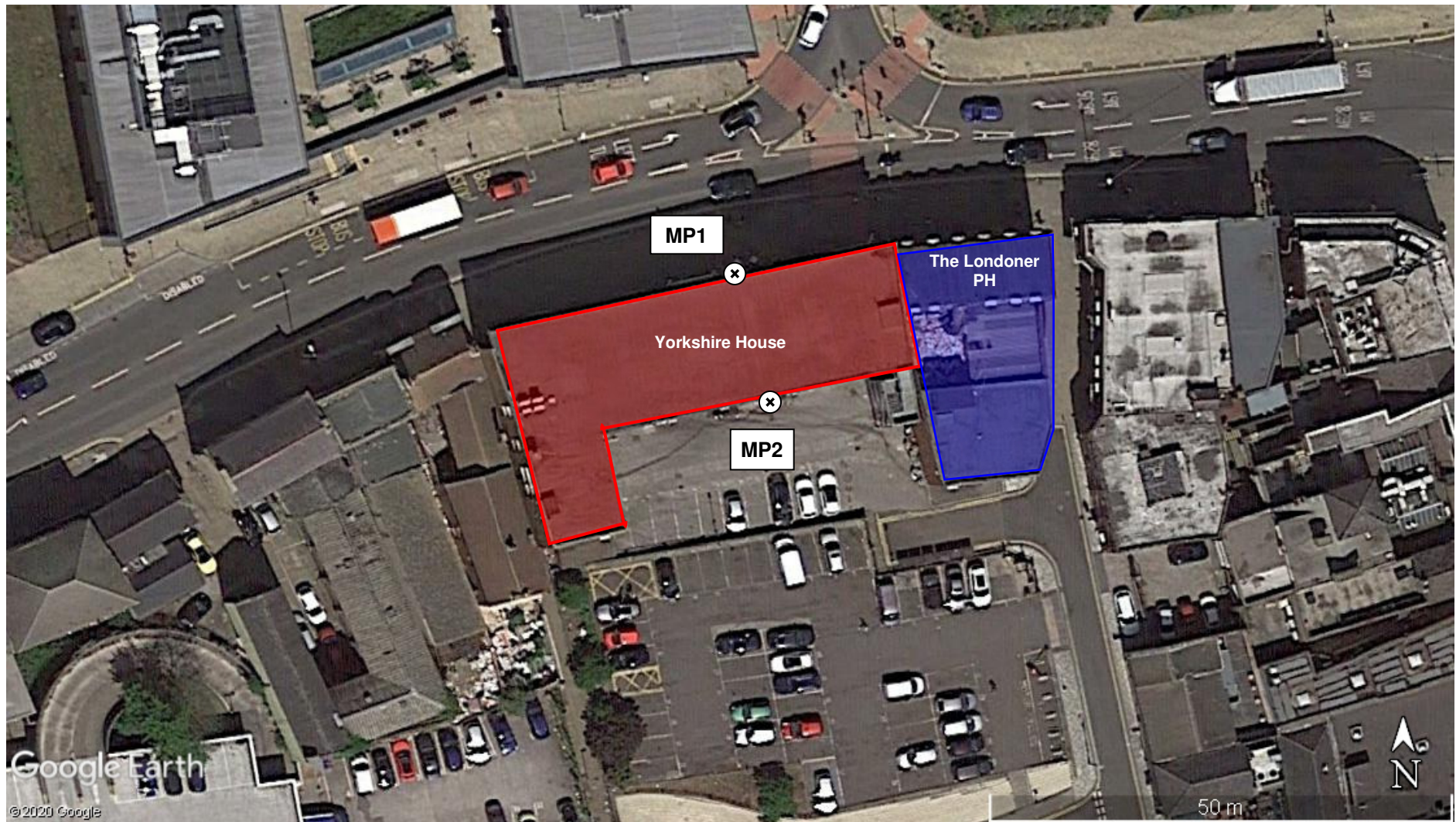
Sound Exposure Level (SEL or L_{AE})

The energy produced by a discrete noise event averaged over one second, no matter how long the event actually took. This allows for comparison between different noise events which occur over different lengths of time.

Weighted Sound Reduction Index (R_w)

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_w is used to characterise the insulation of a material or product that has been measured in a laboratory).

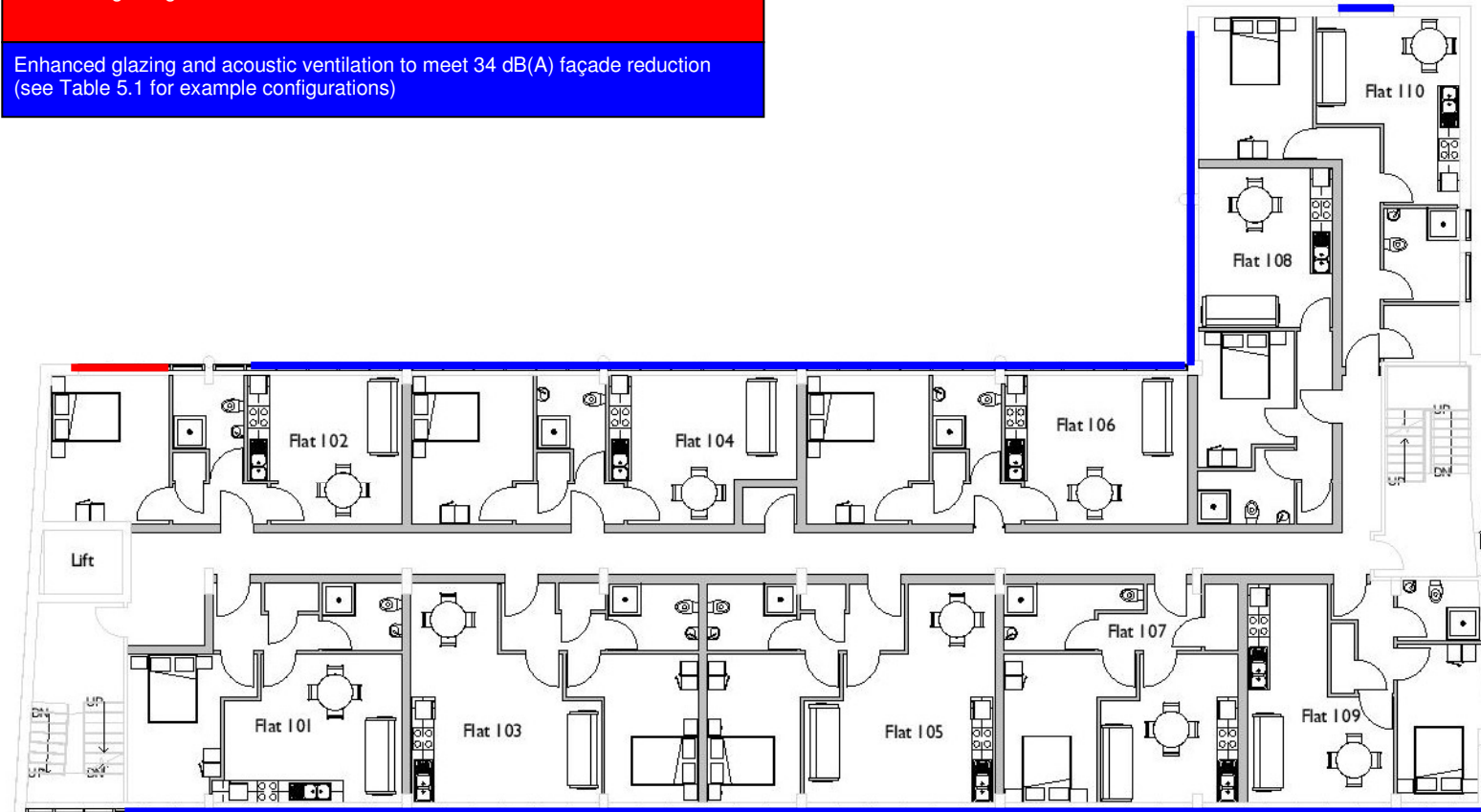
Appendix 2
Annotated Site Location Plan and Noise Monitoring Positions



Appendix 3 – Glazing/Ventilation Markup (First Floor Conversion)

Enhanced glazing rated at 45 dB Rw+Ctr and Titen Sonair ventilator

Enhanced glazing and acoustic ventilation to meet 34 dB(A) façade reduction
(see Table 5.1 for example configurations)



SHAMBLES STREET

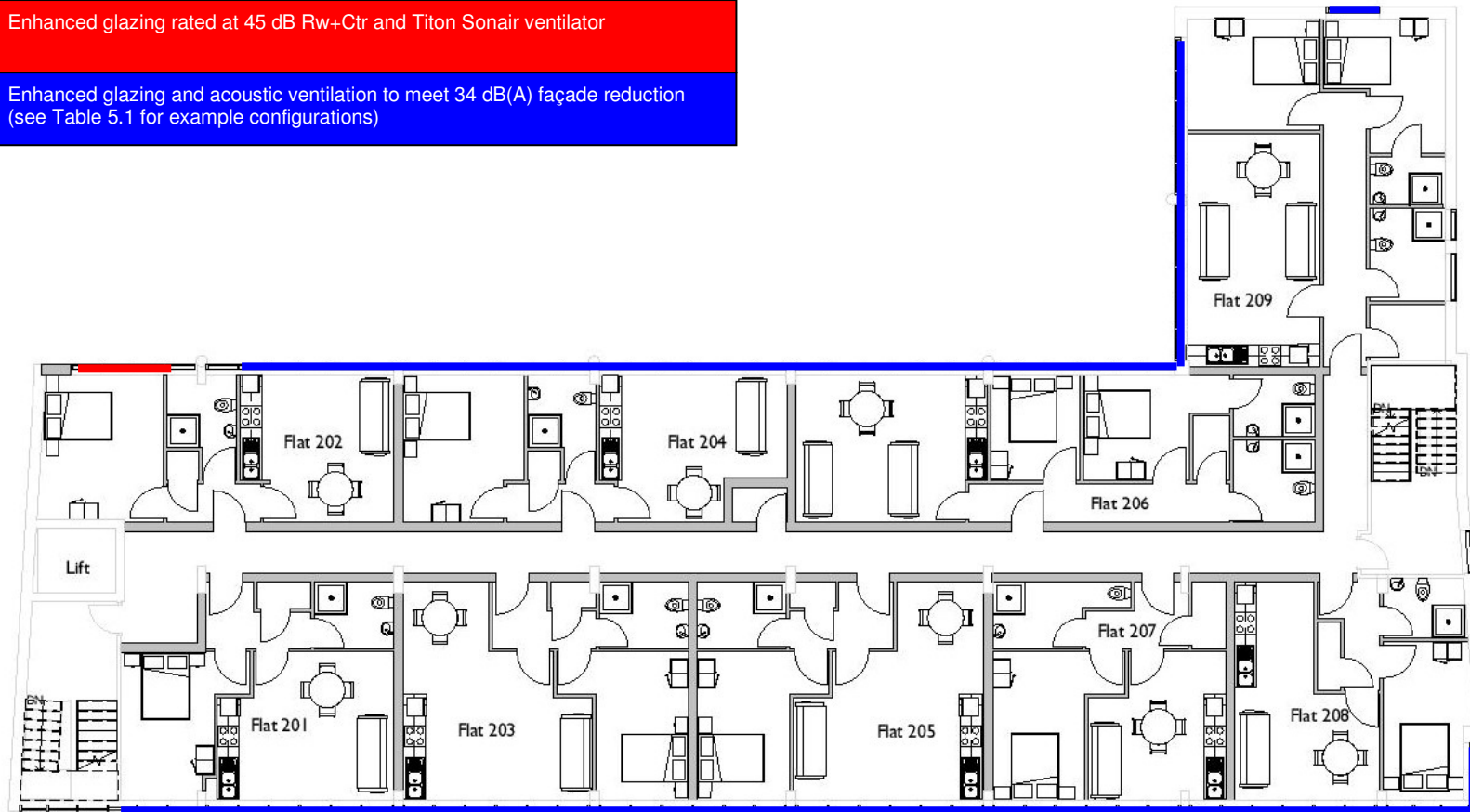
10 First Floor Proposed

0 m 5 m

Appendix 3 – Glazing/Ventilation Markup (Second Floor Conversion)

Enhanced glazing rated at 45 dB Rw+Ctr and Titen Sonair ventilator

Enhanced glazing and acoustic ventilation to meet 34 dB(A) façade reduction
(see Table 5.1 for example configurations)



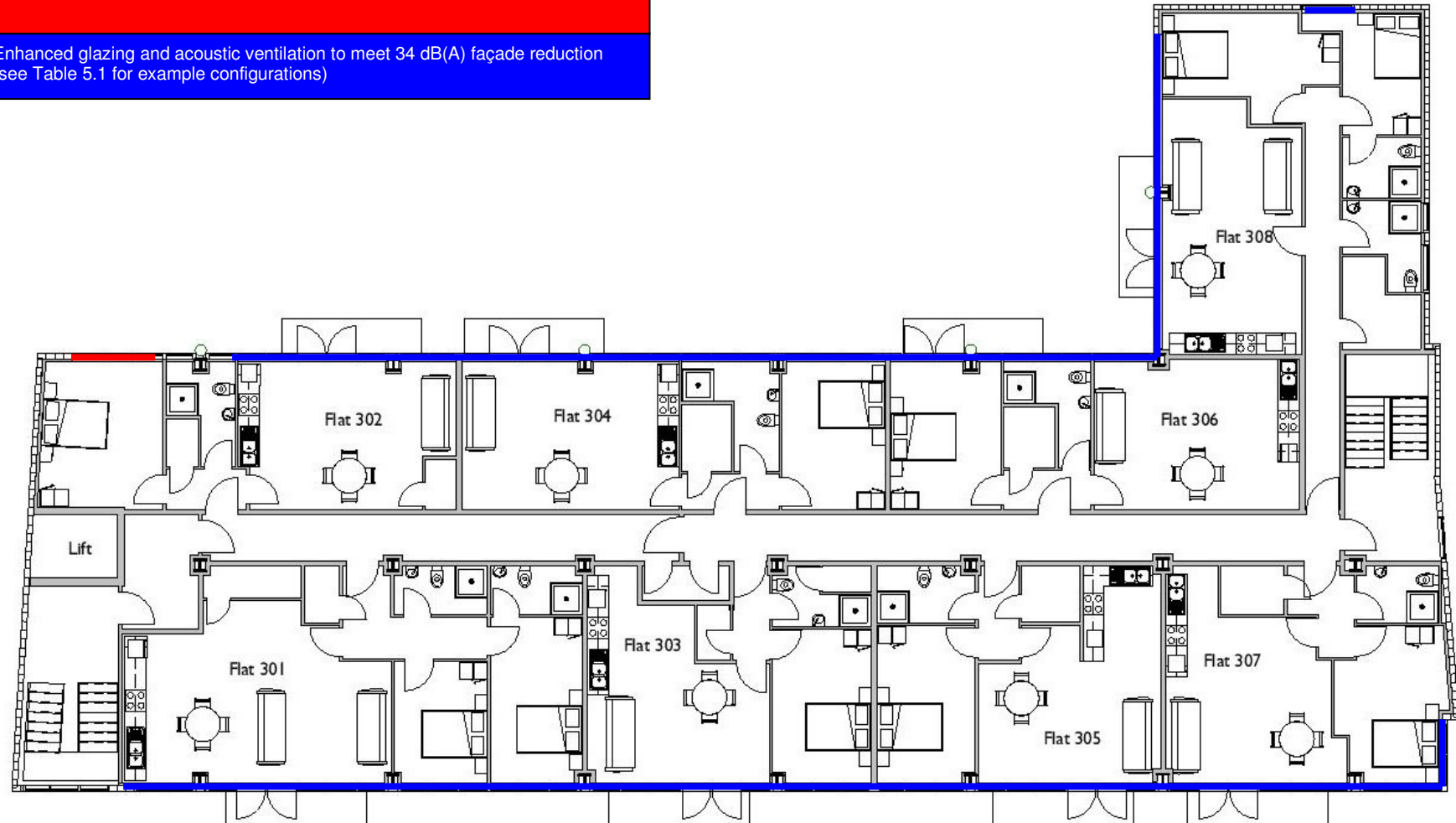
SHAMBLES STREET

20 Second Floor Proposed

Appendix 3 – Glazing/Ventilation Markup (Third Floor Extension)

Enhanced glazing rated at 45 dB Rw+Ctr and Titen Sonair ventilator

Enhanced glazing and acoustic ventilation to meet 34 dB(A) façade reduction
(see Table 5.1 for example configurations)



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