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ENVIRONMENTAL NOISE ASSESSMENT
v.3

Client:
Arun District Council
c/o MH Architects Limited
Ground Floor
Bicentennial Building
Southern Gate
Chichester
West Sussex
PO19 8EZ

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ARUN DISTRICT COUNCIL LU/223/14/PL

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1. SUMMARY

1.1 An assessment of ambient noise has been undertaken at five residential developments on land north of Joyce Close and Greenfields, Wick, Littlehampton. These 'infill sites' are currently used as resident parking facilities (see Figure 1 – Site Locations).

1.2 An acoustic survey has been commissioned to assess the impact of existing environmental noise.

1.3 The existing ambient noise climate affecting the site has been established (Section 3), and the survey has confirmed a typical variation in day time and night time levels.

1.4 An outline assessment of the site's suitability for residential development has been provided (Section 4).

1.5 Means of attenuating the external noise levels have been provided (Section 5.4 - 5.7), in the form of a specification for the façade glazing and possible means of acoustically ventilating the building.

1.6 It is concluded that, with the recommended measures in place, it will be possible to design the new residential buildings to an acceptable internal acoustic environment.

1.7 Furthermore, noise levels in external amenity spaces will be within WHO guideline values, providing the north boundaries are shielded with a 2m high acoustic barrier

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2. INTRODUCTION

2.1 An assessment of environmental noise has been undertaken at Joyce Close and Greenfields, Wick, Littlehampton, on behalf of Arun District Council.

2.2 The five 'infill' sites proposed for development are situated south of the A259 Worthing Road and north of Joyce Close & Greenfields, (see Figure 1 – Site Location).

2.3 It is proposed that the existing land be developed into the following schemes (see Figures 2 to 6 – Proposed Site Layouts);

- Site 1: 4no two bedroom houses;
- Site 3: 3no two bedroom houses & 2no one bedroom flats;
- Site 4: 8no two bedroom houses within 2no blocks of four;
- Site 5: 1no two bedroom house & 2no one bedroom flats;
- Site 6: 2no two bedroom houses.

2.4 Given the acoustic nature of the surrounding acoustic environment, it will be necessary to ensure the scheme provides sufficient protection for any prospective occupants of the new residential buildings.

2.5 Formally, the objectives of the current exercise may be summarised as follows:

(i) To determine the existing ambient noise climate in the vicinity of the development site;
(ii) To assess likely noise levels at the facades of the new buildings, and to specify a suitable façade construction to ensure acceptable conditions;
(iii) To consider external noise levels and advise on any requirements for site screening.

2.6 This report details the investigations carried out in respect of each of these objectives and summarises the conclusions which have been reached.

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3. SURVEY OF EXISTING NOISE LEVELS

3.1 The first step in the assessment of potential noise impact is to measure and describe the existing noise levels affecting the site.

3.2 Given the security of the site, a long term noise survey was not possible. An attended survey was therefore carried out in accordance with the short survey technique described in the Calculation of Road Traffic Noise document, published by the Department of Transport (Welsh Office). This survey was undertaken on Monday 3rd February 2014, between 10.10am and 16.25pm.

3.3 It had been previously agreed to undertake 3hr attended surveys at Sites 1 & 6 and then to extrapolate the noise levels at the intermediate sites.

3.4 A Norsonic 118 sound level meter (details below) was attached to a tripod and set up at a height of 1.5 -1.8m above ground in a free field position with a good line of sight to the A259, (see Figure 7 – Sound Level Meter Positions).

Equipment Description	Type Number	Manufacturer	Serial Number	Date of Last Calibration	Calibration Cert No.
SLM	118	Norsonic	30640	11.09.13	1309409
Microphone	1225	Norsonic	47997	11.09.13	1309408
Preamplifier	1206	Norsonic	30336	11.09.13	1309408
Calibrator	1251	Norsonic	32602	11.09.13	1309402

3.5 The equipment was configured to measure 5 minute samples of the following acoustic parameters:

L_{Aeq} The A-weighted equivalent continuous sound pressure level which, over the sample period, contains the same acoustic energy as the time-varying signal being recorded.

L_{Amax} The A-weighted maximum sound pressure level recorded during each sample period (as measured on fast response).

L_{A10} A statistical parameter representing the A-Weighted noise level exceeded for 10% of each sample period. This is commonly used to describe road traffic noise levels.

3.6 The equipment was calibrated before and after the survey and showed no significant variance. Weather conditions throughout the survey period were cold, dry but breezy.

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3.7 The table below confirms the measured levels for each hourly period at each of the two sites:

SITE 1			
Period	L_{Aeq} dB	L_{Amax} dB	L_{A10} dB
10.10 – 11.10	61.0	73.8	62.3
11.10 – 12.10	60.0	75.8	62.4
12.10 – 13.10	60.3	71.3	62.7

SITE 6			
Period	L_{Aeq} dB	L_{Amax} dB	L_{A10} dB
13.15 – 14.15	55.5	64.7	57.8
14.15 – 15.15	56.1	64.7	58.2
15.15 – 16.15	55.6	64.1	57.7

3.8 The LAmax levels shown in the tables above are the typical peak values and exceptional 'one-off' events such as police sirens, gates banging and car doors slamming, have been excluded.

3.9 The CRTN document provides a formula for converting the 1-hour values of L_{A10} into a day time 18-hour L_{A10} value. The results of these calculations are as follows:

Site 1: $L_{A10, 18hrs}$ = 61.5 dB(A)
Site 6: $L_{A10, 18hrs}$ = 56.9 dB(A)

3.10 In fact, assessments of road traffic noise are now more commonly based on the L_{Aeq} parameter, rather than the L_{A10} parameter. It is therefore necessary to convert the 18-hour L_{A10} into the more usual 16-hour day time L_{Aeq} and the 8 hour night time L_{Aeq}.

3.11 The TRL Project Report PR/SE/451/02[1] provides formulae for making the necessary adjustment, and using these relationships, the figures of the $L_{A10, 18hrs}$ equates to the following:

Location	Day Time $L_{Aeq\ 07.00-23.00}$	Night Time $L_{Aeq\ 2300-07.00}$
Site 1	59.2	51.6
Site 6	54.9	47.4

[1] TRL Project Report PR/SE/451/02 CONVERTING THE UK TRAFFIC NOISE INDEX LA10,18h TO EU NOISE INDICES FOR NOISE MAPPING Prepared for DEFRA 2002

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4. ASSESSMENT OF NOISE LEVELS

4.1 National Planning Policy Framework

4.1.1 The newly introduced National Planning Policy Framework (March 2012) defines the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people, and their answerable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

4.1.2 Section 123 states

Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*

- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*

- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*

- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

4.1.3 The Framework states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution. It does not, however, provide any specific formal guidelines.

4.1.4 In respect of the fourth of the principal aims above, and in consideration of the past use of the site, it is debatable whether this area could be considered to be one of undisturbed tranquillity.

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4.2 Noise Policy Statement for England

4.2.1 The document "Noise Policy Statement for England" sets out the following vision for on-going noise policy:

> *"Promote good health and quality of life through the effective management of noise within the context of Government policy on sustainable development."*

This vision should be achieved through the following Noise Policy 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".*

4.2.2 To achieve these objectives the Noise Policy Statement sets out three noise levels to be defined by the assessor:

- **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. Where levels lie between the LOAEL and SOAEL, the Statement requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development, as set out in the NPPF.

- **SOAEL** - Significant Observed Adverse Effect Level

  This is the level above which significant adverse effects on health and quality of life occur. It notes, however, that "it is not possible to have a single objective noise-based measure that describes SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times".

4.2.3 Paragraph 2.7 states that "… the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications".

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4.2.4 This provides clear guidance that noise must not be considered in isolation but as part of the overall scheme, taking into account the overall sustainability and associated impacts of the proposed development; there is no benefit in reducing noise to an excessively low level if this creates or increases some other adverse impact. Similarly it may be appropriate in some cases for noise to have an adverse impact if this is outweighed by the reduction or removal of some other adverse impact that is of greater significance to the development as a whole.

4.2.5 The Noise Policy Statement considers that noise levels above the SOAEL would be seen to have, by definition, significant adverse effects and would be considered unacceptable. Where the assessed noise levels fall between the LOAEL and the SOAEL noise levels, the Policy Statement requires that:

> *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development... .. This does not mean that such adverse effects cannot occur."*

4.2.6 Where noise levels are below the LOAEL it is considered there will be no adverse effect. Once noise levels are below the NOEL there will be no observable change. An indication of the numerical definition of LOAEL may be derived from the following guidance.

4.3 BS8233:1999 – Sound Insulation and Noise Reduction for Buildings – Code of Practice

4.3.1 There is much guidance on the levels of intrusive noise which would be considered acceptable within residential accommodation such as this. Typical advice is found in British Standard 8233:1999 "Sound Insulation and Noise Reduction for buildings - Code of Practice". Following similar guidance in the 1999 World Health Organisation report "Guidelines for Community Noise", the Standard sets out the following limits for indoor ambient noise levels within living rooms and bedrooms. This suggests:

BS8233 Guideline Values

	Typical Situations	Design Range, $L_{Aeq,t}$ dB	
		Good	Reasonable
Reasonable resting / sleeping conditions	Living Rooms	30	40
	Bedrooms*	30	35

*For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB LAmax.

4.3.2 It is usually considered that an open window will provide a reduction of some 10-15 dB(A)[2]. Therefore the 'good' internal standards quoted above would equate to the following targets immediately outside:

[2] Reference PPG24 Planning & Noise, which adopted a mid-range value of 13 dB(A)

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Externally	Typical Situations	Design Range, $L_{Aeq,t}$ dB	
		Good	Reasonable
Reasonable resting / sleeping conditions	Living Room	43	53
	Bedrooms*	43	48

*For a reasonable standard outside bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 58 dB LAmax.

4.3.3 It should be noted that the levels quoted in BS8233 are intended to reflect the acceptability of steady, continuous noise. Sources of intermittent and tonal noise may generate greater annoyance for a similar overall magnitude. Whilst BS8233 does not explicitly state a correction for those circumstances, it may be appropriate to consider that the Good and Reasonable standards would be achieved with levels which are perhaps 5 dB lower than stated in the table above.

4.3.4 It is also noted that BS8233 was written from a view of designing new buildings to protect occupants from existing noise sources. This does necessarily infer, however, that the acceptability of an occupant to an absolute level noise within a building will be different if the introduction of the noise source post-dates the construction of the building. Other factors may be relevant in certain circumstances, and they are covered in large part by BS4142, discussed below.

4.4 WHO 'Guidelines for Community Noise' (1999)

4.4.1 The World Health Organisation indicates that, to protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}.

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5. RECOMMENDATIONS FOR NOISE ATTENUATION MEASURES

INTERNAL NOISE LEVELS

5.1 Section 4.3.1 of this report has provided guidance for internal noise levels within residential rooms as stated within BS8233.

5.2 It is therefore recommended that any new buildings be designed to achieve the following levels:

Living Rooms:	35 dB(A) $L_{Aeq,\ 07.00 – 23.00}$
Bedrooms:	30 dB(A) $L_{Aeq,\ 23.00 – 07.00}$, and also
	45 dB(A) $L_{Amax,\ 23.00 – 07.00}$

5.3 Table I below defines the outside to inside sound level difference (dB(A)), overall performance targets and possible glazing configurations required through each façade of each block of buildings for each site. These figures are based initially on the targets of Para 5.2 and the measured noise levels given in Para 3.11 & those predicted using IMMI 2010 software, and are the worst case predicted noise levels along that particular facade.

5.4 Levels have been adjusted to account for the façade reflections which will occur in front of the new buildings and the noise levels within bedrooms have been based on the L_{Amax} criteria due to this being more onerous than the L_{Aeq} criteria.

TABLE I – PREDICTED EXTERNAL NOISE LEVELS and OUTSIDE TO INSIDE LEVELS

Site 1			
Elevation	**External Noise Level**	**Target Noise Level**	**Outside to inside level difference**
North Elevation			
Living Rooms	63 dB(A) $L_{Aeq,\ 16\ hrs}$	35 dB(A) $L_{Aeq,\ 16hrs}$	28dB(A)
Bedrooms	55 dB(A) $L_{Aeq,\ 8\ hrs}$ 79 dB(A) $L_{Amax,\ fast}$	30 dB(A) $L_{Aeq,\ 8hrs}$ 45 dB(A) L_{Amax}	34dB(A)
East Elevation			
Living Rooms	61 dB(A) $L_{Aeq,\ 16\ hrs}$	35 dB(A) $L_{Aeq,\ 16hrs}$	26dB(A)
Bedrooms	52 dB(A) $L_{Aeq,\ 8\ hrs}$ 76 dB(A) $L_{Amax,\ fast}$	30 dB(A) $L_{Aeq,\ 8hrs}$ 45 dB(A) L_{Amax}	31dB(A)

(Contd.)

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Site 1 (Continued)			
Elevation	**External Noise Level**	**Target Noise Level**	**Outside to inside level difference**
South Elevation			
Living Rooms	54 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	19dB(A)
Bedrooms	45 dB(A) $L_{Aeq, 8\ hrs}$ 69 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	24dB(A)
West Elevation			
Living Rooms	61 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	26dB(A)
Bedrooms	52 dB(A) $L_{Aeq, 8\ hrs}$ 76 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	31dB(A)

Site 3			
Elevation	**External Noise Level**	**Target Noise Level**	**Outside to inside level difference**
North Elevation			
Living Rooms	64 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	29dB(A)
Bedrooms	56 dB(A) $L_{Aeq, 8\ hrs}$ 78 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	33dB(A)
East Elevation			
Living Rooms	61 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	26dB(A)
Bedrooms	52 dB(A) $L_{Aeq, 8\ hrs}$ 74 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	29dB(A)
South Elevation			
Living Rooms	55 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	20dB(A)
Bedrooms	47 dB(A) $L_{Aeq, 8\ hrs}$ 69 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	24dB(A)
West Elevation			
Living Rooms	62 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	27dB(A)
Bedrooms	54 dB(A) $L_{Aeq, 8\ hrs}$ 76 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	31dB(A)

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Ste 4 (Block 1)			
Elevation	**External Noise Level**	**Target Noise Level**	**Outside to inside level difference**
North Elevation			
Living Rooms	63 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	28dB(A)
Bedrooms	55 dB(A) $L_{Aeq, 8\ hrs}$ 76 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	31dB(A)
East Elevation			
Living Rooms	60 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	25dB(A)
Bedrooms	52 dB(A) $L_{Aeq, 8\ hrs}$ 73 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	28dB(A)
South Elevation			
Living Rooms	55 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	20dB(A)
Bedrooms	46 dB(A) $L_{Aeq, 8\ hrs}$ 67 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	22dB(A)
West Elevation			
Living Rooms	61 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	26dB(A)
Bedrooms	52 dB(A) $L_{Aeq, 8\ hrs}$ 73 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	28dB(A)

Ste 4 (Block 2)			
Elevation	**External Noise Level**	**Target Noise Level**	**Outside to inside level difference**
North Elevation			
Living Rooms	62 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	27dB(A)
Bedrooms	53 dB(A) $L_{Aeq, 8\ hrs}$ 75 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	30dB(A)
East Elevation			
Living Rooms	60 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	25dB(A)
Bedrooms	52 dB(A) $L_{Aeq, 8\ hrs}$ 74 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	29dB(A)
South Elevation			
Living Rooms	53 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	18dB(A)
Bedrooms	45 dB(A) $L_{Aeq, 8\ hrs}$ 67 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	22dB(A)
West Elevation			
Living Rooms	61 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	26dB(A)
Bedrooms	53 dB(A) $L_{Aeq, 8\ hrs}$ 75 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	30dB(A)

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Site 5			
Elevation	**External Noise Level**	**Target Noise Level**	**Outside to inside level difference**
North Elevation			
Living Rooms	62 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	27dB(A)
Bedrooms	54 dB(A) $L_{Aeq, 8\ hrs}$ 72 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	27dB(A)
East Elevation			
Living Rooms	59 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	24dB(A)
Bedrooms	50 dB(A) $L_{Aeq, 8\ hrs}$ 68 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	23dB(A)
South Elevation			
Living Rooms	53 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	18dB(A)
Bedrooms	44 dB(A) $L_{Aeq, 8\ hrs}$ 62 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	17dB(A)
West Elevation			
Living Rooms	60 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	25dB(A)
Bedrooms	51 dB(A) $L_{Aeq, 8\ hrs}$ 69 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	24dB(A)

Site 6			
Elevation	**External Noise Level**	**Target Noise Level**	**Outside to inside level difference**
North Elevation			
Living Rooms	58 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	23dB(A)
Bedrooms	50 dB(A) $L_{Aeq, 8\ hrs}$ 68 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	23dB(A)
East Elevation			
Living Rooms	55 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	20dB(A)
Bedrooms	47 dB(A) $L_{Aeq, 8\ hrs}$ 65 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	20dB(A)
South Elevation			
Living Rooms	50 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	15dB(A)
Bedrooms	42 dB(A) $L_{Aeq, 8\ hrs}$ 60 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	15dB(A)
West Elevation			
Living Rooms	58 dB(A) $L_{Aeq, 16\ hrs}$	35 dB(A) $L_{Aeq, 16hrs}$	23dB(A)
Bedrooms	50 dB(A) $L_{Aeq, 8\ hrs}$ 68 dB(A) $L_{Amax, fast}$	30 dB(A) $L_{Aeq, 8hrs}$ 45 dB(A) L_{Amax}	23dB(A)

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5.5 Table II provides possible glazing configurations and the required glazing performance based on the following traditional external wall constructions and Appendices I - VI provide detailed calculations of the predicted outside to inside noise levels;

- 100mm Brick outer wall;
- 100mm cavity c/w insulation;
- 100mm medium density blockwork inner leaf;
- 1 x 15mm soundbloc on internal leaf.

TABLE II – REQUIRED GLAZING PERFORMANCES and CONFIGURATIONS

SITE 1			
Elevation	**Room**	**Required Glazing Performance, Rw + Ctr**	**Possible Glazing Configuration[3]**
North	Living Rooms	27[4] dB	4 / 16 / 4
	Bedrooms	35 dB	8 / 12 / 8.4A
East	Living Rooms	32 dB	5 / 7 / 6.8A
	Bedrooms	32 dB	5 / 7 / 6.8A
South	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
West	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A

SITE 3			
Elevation	**Room**	**Required Glazing Performance, Rw + Ctr**	**Possible Glazing Configuration**
North	Living Rooms	29 dB	4 / 12 / 6
	Bedrooms	35 dB	8 / 12 / 8.4A
East	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A
South	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
West	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A

[3] To be confirmed by glazing supplier
[4] Lowest threshold value equating to standard 4/16/4 sealed double glazing

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SITE 4 (Block 1)			
Elevation	**Room**	**Required Glazing Performance, Rw + Ctr**	**Possible Glazing Configuration**
North	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A
East	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A
South	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
West	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A

SITE 4 (Block 2)			
Elevation	**Room**	**Required Glazing Performance, Rw + Ctr**	**Possible Glazing Configuration**
North	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A
East	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A
South	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
West	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	32 dB	5 / 7 / 6.8A

SITE 5			
Elevation	**Room**	**Required Glazing Performance, Rw + Ctr**	**Possible Glazing Configuration**
North	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	29 dB	4 / 12 / 6
East	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
South	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
West	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4

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SITE 6			
Elevation	**Room**	**Required Glazing Performance, Rw + Ctr**	**Possible Glazing Configuration**
North	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
East	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
South	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4
West	Living Rooms	27 dB	4 / 16 / 4
	Bedrooms	27 dB	4 / 16 / 4

5.6 At the time of writing the report the floor plans for the flats and houses were unknown, so the room volumes, facade dimensions and glazing areas stated in the outside to inside calculations in Appendices I - VI are based on typical rooms sizes.

5.7 Whichever level of glazing is provided for these sensitive facades, it is of course the case that when the windows are opened, the acoustic performance of the windows will be irrelevant. It may therefore be necessary to provide alternative means by which habitable rooms may be ventilated whilst keeping the acoustic integrity of the façade. The options for achieving this include:

(i) An acoustic trickle vent, such as the Passivent[5] ALdB Acoustic Grille. An external grille providing a reduction of up to 42 dB $D_{n,e,w}$. This fits in conjunction with a standard internal trickle vent;

(ii) A wall ventilation system, such as the Passivent Fresh 90 dB Wall Ventilator. An internal grill and external louvre linked by 150mm diameter duct, providing 300mm^2 - 6000mm^2 ventilation;

(iii) A Mechanical Ventilation Heat Recovery (MVHR) system for each apartment. This operates with a fresh air grill set into the external elevation, providing fresh air to the unit. The air is then ducted to one or more grills across the flat. Return air grills draw exhaust air back through the MVHR unit, which then discharges the air to atmosphere through a second grill in the outside wall or roof. Manufacturers do not provide sound transmission loss figures, but conservative calculations indicate that the outside to inside loss through a typical MVHR system will be in the order of 40 dB(A). This would be quite sufficient for this project

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5.8 The ventilation requirements, and preferred method of ventilation, should first be determined by the Architect (this may involve liaison with the Local Authority to determine any local standards which must be met).

5.9 Details of the preferred means of ventilation should then be passed to Acoustic Consultant for confirmation of appropriate means of attenuation.

5.10 It is confirmed that such treatment would be appropriate to the following blocks/elevations:

Site 1	North (Living Rooms & Bedrooms)
	East & West (Bedrooms only)
Site 3	North (Living Rooms & Bedrooms)
	East & West (Bedrooms only)
Site 4 Block 1	North (Living Rooms & Bedrooms)
	East & West (Bedrooms only)
Site 4 Block 2	North, East & West (Bedrooms only)

EXTERNAL AMENITY SPACE

5.11 The World Health Organisation indicates that, to protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}.

5.12 Figure 8 shows an IMMI produced noise map based on the measured daytime data, and it can be seen that the daytime noise levels around the proposed developments are between 50 – 60 dB(A).

5.13 The proposed layouts for each of the sites indicate that the majority of the garden areas will lie within the 55 – 60 dB(A) noise level range. Areas to the south of the new houses and flats will benefit from the self-screening of the new buildings. However, those areas to the north or sides of the buildings would require additional protection

5.14 In order to attenuate noise to a reasonable level within the garden spaces, it is recommended that a 2m high boundary fence be erected, along the north, east and west boundaries of the gardens. This would be built as either

- Abutting panels not less than 22 mm thick, with joints sealed by cover strips not less than 22 mm thick, and the strip extending not less than 25 % over adjacent panels.
- Not less than 100mm thick brick or rendered block work.

[5] Passivent, by Willan Building Services 0161 962 7113

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6. CONCLUSION

6.1 The foregoing assessment has looked in detail at proposed housing developments on 5no sites at Joyce Close and Greenfields, Wick, Littlehampton, West Sussex, on behalf of Arun District Council.

6.2 The sites are subject to reasonably high levels of noise emanating from the nearby A259 Worthing Rd.

6.3 It has been concluded that, by specifying appropriate glazing and facade construction along with acoustically treated means of ventilation, it will be possible to ensure that an acceptable internal environment within the buildings will be met.

6.4 The majority of amenity areas will be subjected to levels of noise that would be unacceptable under WHO guidelines. However, with the installation of suitable boundary fencing the required noise levels within the amenity areas will be met.

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Figure 1: Site Location

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Figure 2: Proposed Ste 1 layout

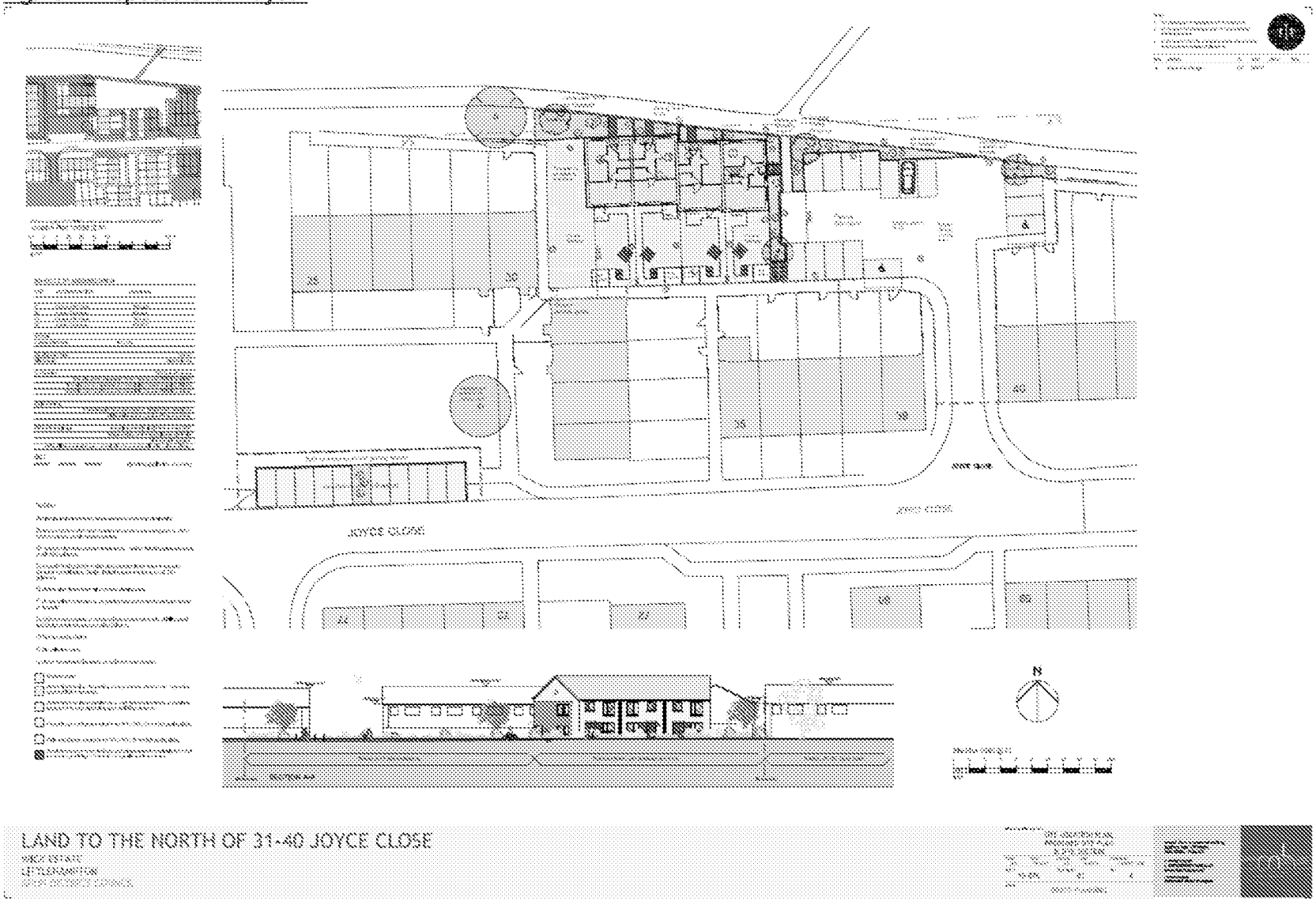

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Figure 3: Proposed Site 3 layout

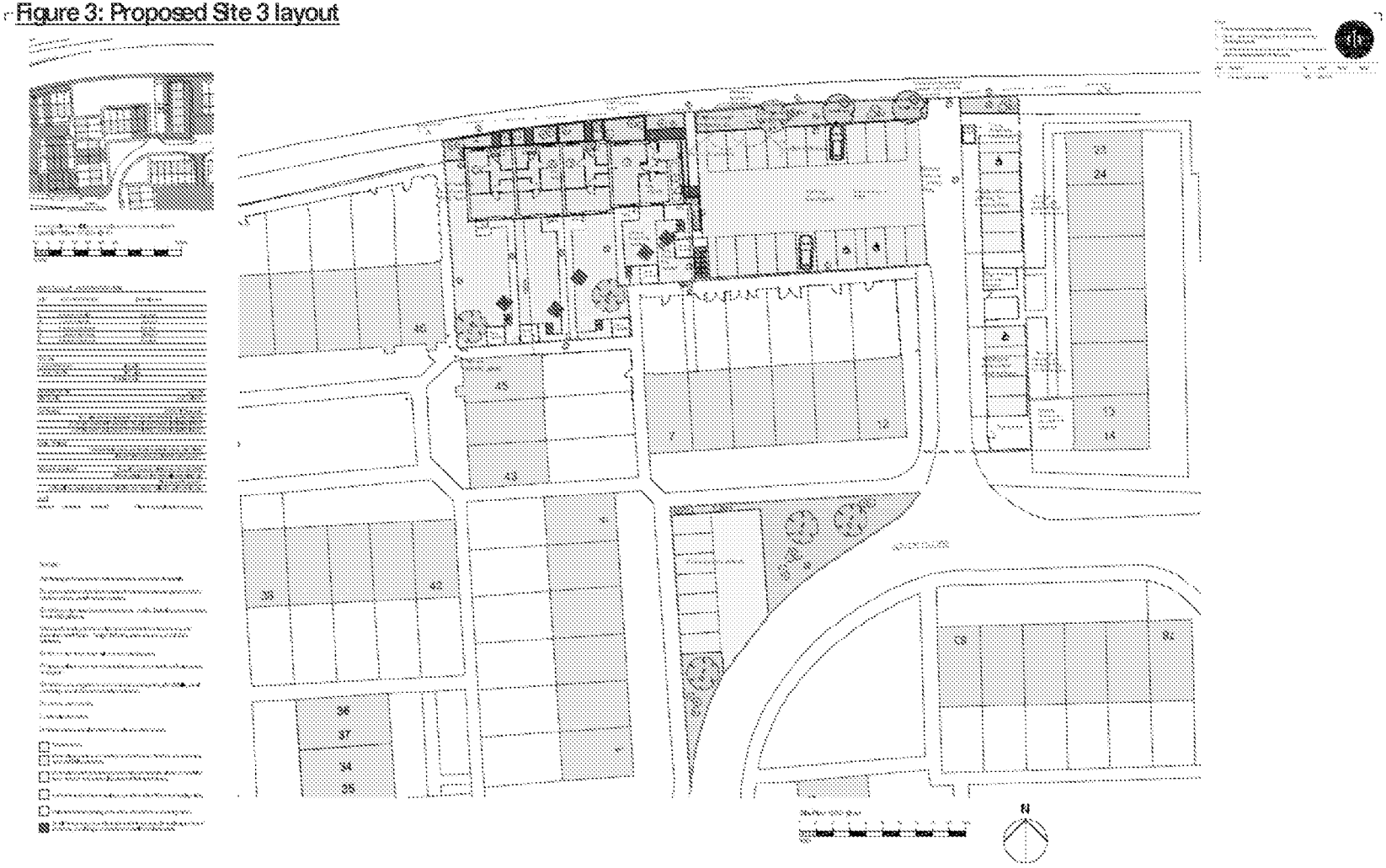

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Figure 4: Proposed Site 4 layout

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Figure 5: Proposed Site 5 layout

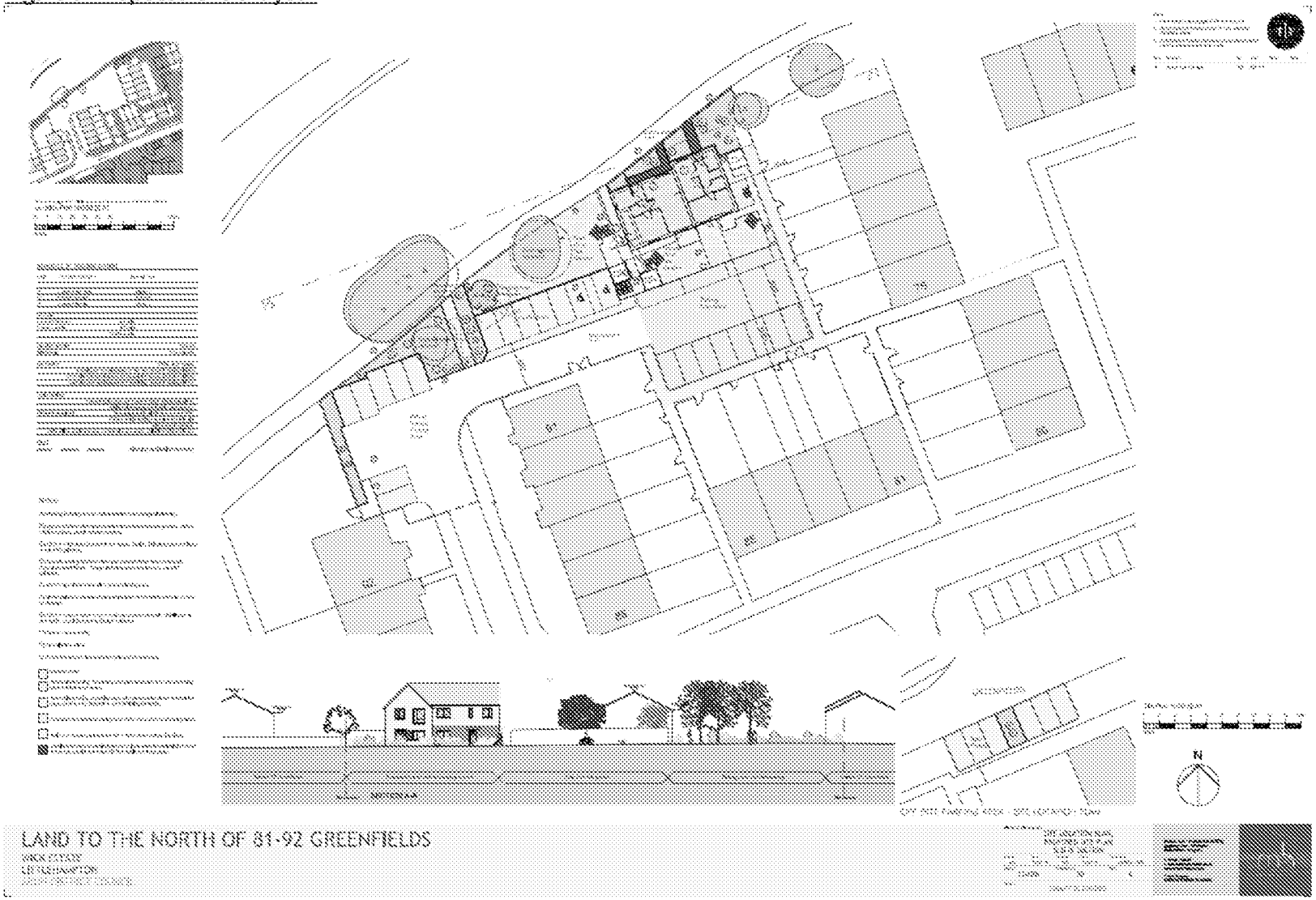

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Figure 6: Proposed Site 6 layout

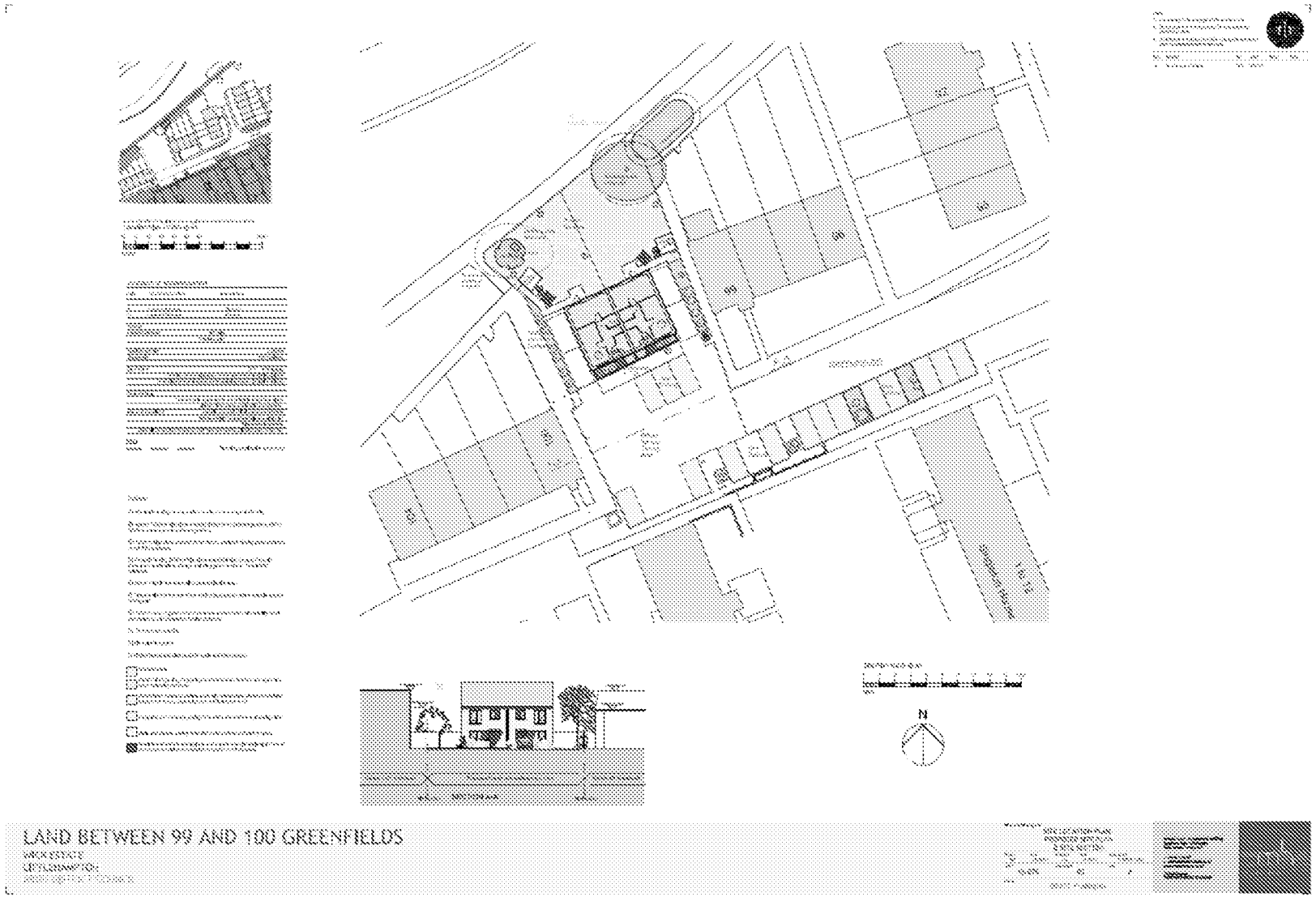

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Figure 7: Sound Level Meter Positions

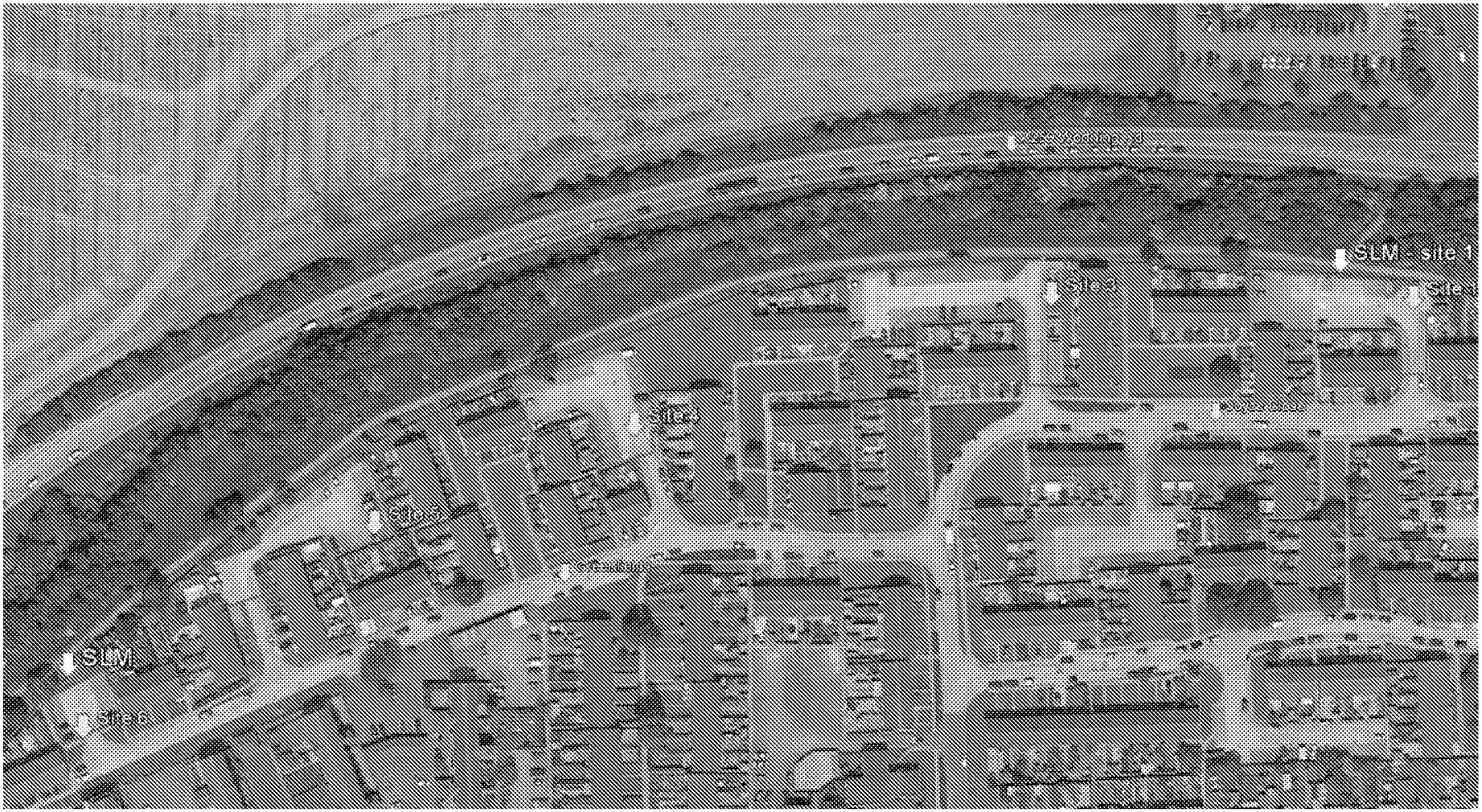

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Figure 8: Daytime Noise Map

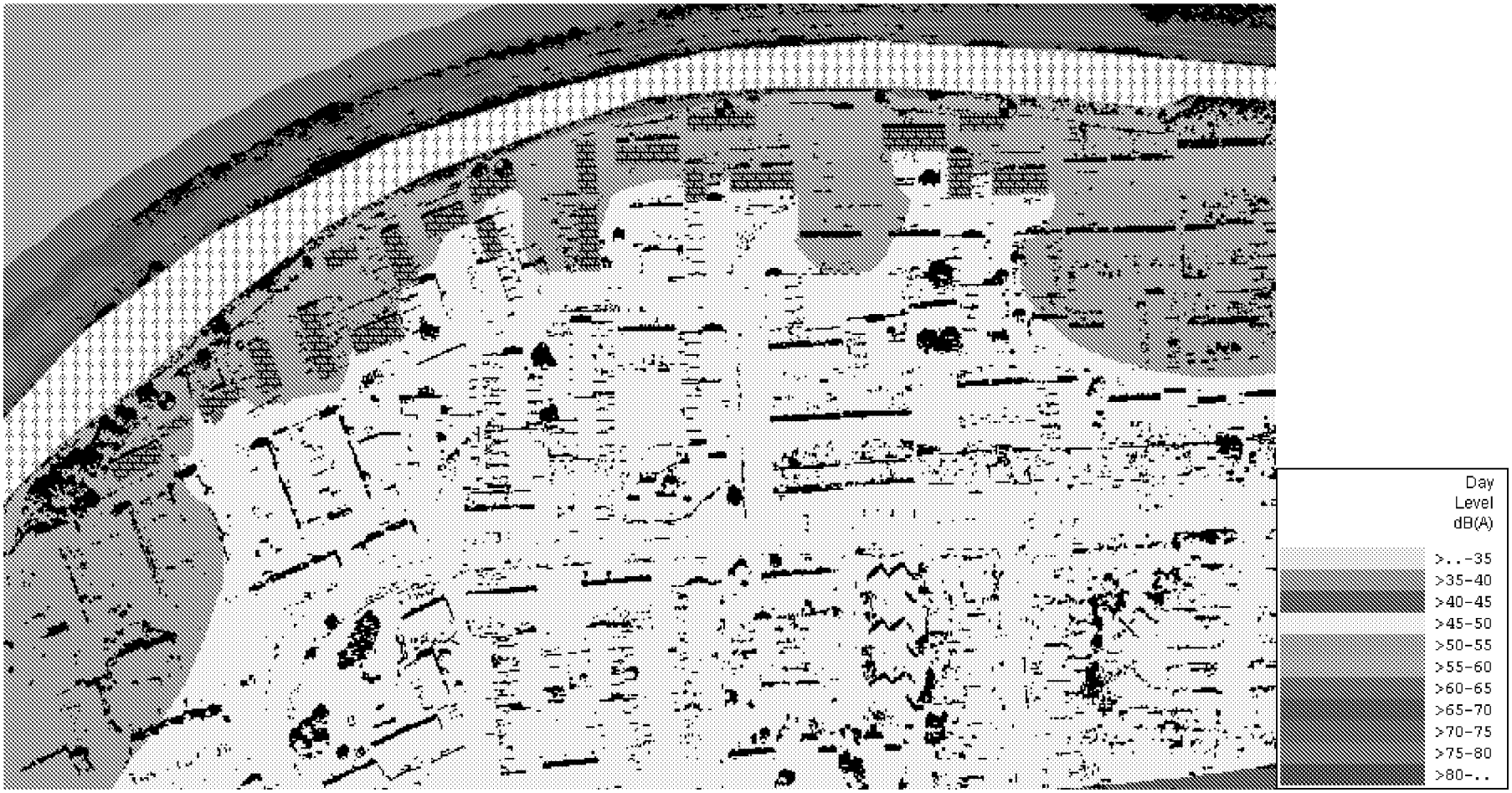

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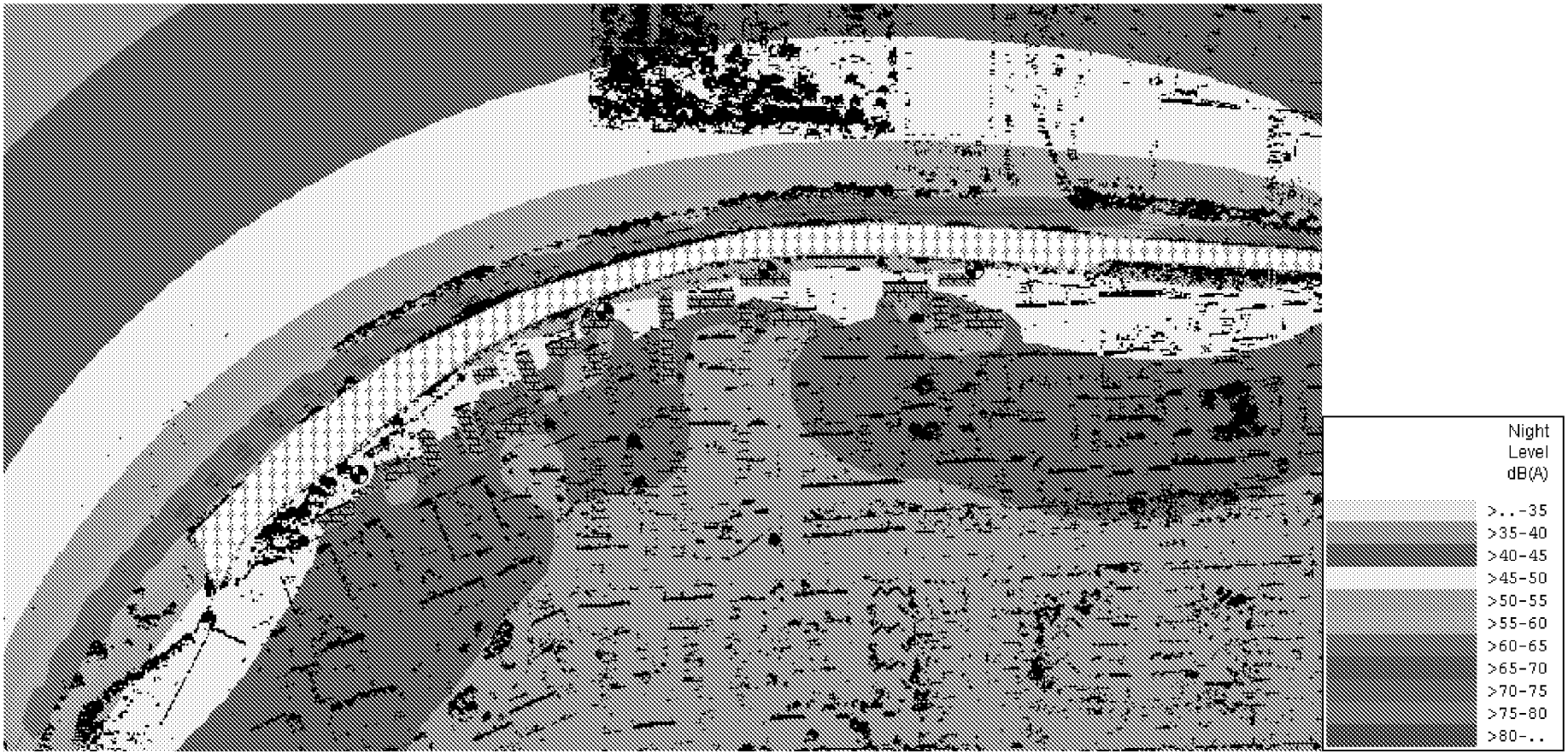
Figure 9: Night-time Noise Map



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Appendix I – Calculation Of Outside To Inside Noise Levels – Site 1

SITE 1: NORTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	89	83	76	74	74	67	73	70	**79**
Glazing Specified: 8 / 12 / 8.4A	dB	28	31	28	36	45	47	54	50	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	58	48	44	33	23	13	12	13	39
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	48	39	33	25	16	0	1	-5	29
Combined Level from window and wall	*dB*	*58*	*49*	*44*	*33*	*24*	*13*	*12*	*13*	*39*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**61**	**52**	**47**	**36**	**27**	**16**	**15**	**16**	**42**

SITE 1: NORTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	67	60	59	57	60	57	51	46	**63**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	49	33	38	26	16	8	7	0	31
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	23	13	13	5	-1	-13	-24	-32	8
Combined Level from window and wall	*dB*	*49*	*33*	*38*	*26*	*16*	*8*	*7*	*0*	*31*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**52**	**36**	**41**	**29**	**19**	**11**	**10**	**3**	**34**

SITE 1: EAST & WEST ELEVATIONS										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	86	80	73	71	71	64	70	67	**76**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	50	47	47	34	23	11	18	18	39
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	45	36	30	22	13	-3	-2	-8	26
Combined Level from window and wall	*dB*	*51*	*48*	*47*	*34*	*23*	*11*	*18*	*18*	*40*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**54**	**51**	**50**	**37**	**26**	**14**	**21**	**21**	**43**

SITE 1: EAST & WEST ELEVATIONS										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	65	58	57	55	58	55	49	44	**61**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	47	31	36	24	14	6	5	-2	29
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	21	11	11	3	-3	-15	-26	-34	6
Combined Level from window and wall	*dB*	*47*	*31*	*36*	*24*	*14*	*6*	*5*	*-2*	*29*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**50**	**34**	**39**	**27**	**17**	**9**	**8**	**1**	**32**

SITE1: SOUTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	79	73	66	64	64	57	63	60	**69**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	62	46	46	34	21	9	20	15	40
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	38	29	23	15	6	-10	-9	-15	19
Combined Level from window and wall	*dB*	*62*	*46*	*46*	*34*	*21*	*9*	*20*	*15*	*40*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**65**	**49**	**49**	**37**	**24**	**12**	**23**	**18**	**43**

SITE1: SOUTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	58	51	50	48	51	48	42	37	**54**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	40	24	29	17	7	-1	-2	-9	22
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	14	4	4	-4	-10	-22	-33	-41	-1
Combined Level from window and wall	*dB*	*40*	*24*	*29*	*17*	*7*	*-1*	*-2*	*-9*	*22*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**43**	**27**	**32**	**20**	**10**	**2**	**1**	**-6**	**25**

Appendix II – Calculation Of Outside To Inside Noise Levels – Site 3

SITE 3: NORTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	88	82	75	73	73	66	72	69	**78**
Glazing Specified: 8 / 12 / 8.4A	dB	28	31	28	36	45	47	54	50	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	57	47	43	32	22	12	11	12	38
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	47	38	32	24	15	-1	0	-6	28
Combined Level from window and wall	*dB*	*57*	*48*	*43*	*32*	*23*	*12*	*11*	*12*	*38*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**60**	**51**	**46**	**35**	**26**	**15**	**14**	**15**	**41**

SITE 3: NORTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	68	61	60	58	61	58	52	47	**64**
Glazing Specified: 4 / 12 / 6	dB	15	27	21	29	40	39	43	40	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	49	30	34	23	14	11	1	-1	29
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	24	14	14	6	0	-12	-23	-31	9
Combined Level from window and wall	*dB*	*49*	*30*	*34*	*23*	*15*	*11*	*1*	*-1*	*29*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**52**	**33**	**37**	**26**	**18**	**14**	**4**	**2**	**32**

SITE 3: EAST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	84	78	71	69	69	62	68	65	**74**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	48	45	45	32	21	9	16	16	37
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	43	34	28	20	11	-5	-4	-10	24
Combined Level from window and wall	*dB*	*49*	*46*	*45*	*32*	*21*	*9*	*16*	*16*	*38*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**52**	**49**	**48**	**35**	**24**	**12**	**19**	**19**	**41**

SITE 3: EAST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	64	57	56	54	57	54	48	43	**60**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	46	30	35	23	13	5	4	-3	28
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	20	10	10	2	-4	-16	-27	-35	5
Combined Level from window and wall	*dB*	*46*	*30*	*35*	*23*	*13*	*5*	*4*	*-3*	*28*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**49**	**33**	**38**	**26**	**16**	**8**	**7**	**0**	**31**

SITE 3: SOUTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	79	73	66	64	64	57	63	60	**69**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	62	46	46	34	21	9	20	15	40
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	38	29	23	15	6	-10	-9	-15	19
Combined Level from window and wall	*dB*	*62*	*46*	*46*	*34*	*21*	*9*	*20*	*15*	*40*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**65**	**49**	**49**	**37**	**24**	**12**	**23**	**18**	**43**

SITE 3: SOUTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	59	52	51	49	52	49	43	38	**55**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	41	25	30	18	8	0	-1	-8	23
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	15	5	5	-3	-9	-21	-32	-40	0
Combined Level from window and wall	*dB*	*41*	*25*	*30*	*18*	*8*	*0*	*-1*	*-8*	*23*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**44**	**28**	**33**	**21**	**11**	**3**	**2**	**-5**	**26**

SITE 3: WEST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	86	80	73	71	71	64	70	67	**76**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	50	47	47	34	23	11	18	18	39
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	45	36	30	22	13	-3	-2	-8	26
Combined Level from window and wall	*dB*	*51*	*48*	*47*	*34*	*23*	*11*	*18*	*18*	*40*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**54**	**51**	**50**	**37**	**26**	**14**	**21**	**21**	**43**

SITE 3: WEST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	66	59	58	56	59	56	50	45	**62**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	48	32	37	25	15	7	6	-1	30
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	22	12	12	4	-2	-14	-25	-33	7
Combined Level from window and wall	*dB*	*48*	*32*	*37*	*25*	*15*	*7*	*6*	*-1*	*30*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**51**	**35**	**40**	**28**	**18**	**10**	**9**	**2**	**33**

Appendix III -- Calculation Of Outside To Inside Noise Levels -- Site 4 (Block 1)

SITE 4 (Block 1): NORTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	86	80	73	71	71	64	70	67	**76**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	50	47	47	34	23	11	18	18	39
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	45	36	30	22	13	-3	-2	-8	26
Combined Level from window and wall	*dB*	*51*	*48*	*47*	*34*	*23*	*11*	*18*	*18*	*40*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**54**	**51**	**50**	**37**	**26**	**14**	**21**	**21**	**43**

SITE 4 (Block 1): NORTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	67	60	59	57	60	57	51	46	**63**
Glazing Specified: 4 / 12 / 6	dB	15	27	21	29	40	39	43	40	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	48	29	33	22	13	10	0	-2	28
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	23	13	13	5	-1	-13	-24	-32	8
Combined Level from window and wall	*dB*	*48*	*29*	*33*	*22*	*14*	*10*	*0*	*-2*	*28*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**51**	**32**	**36**	**25**	**17**	**13**	**3**	**1**	**31**

SITE 4 (Block 1): EAST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	83	77	70	68	68	61	67	64	**73**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	47	44	44	31	20	8	15	15	36
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	42	33	27	19	10	-6	-5	-11	23
Combined Level from window and wall	*dB*	*48*	*45*	*44*	*31*	*20*	*8*	*15*	*15*	*37*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**51**	**48**	**47**	**34**	**23**	**11**	**18**	**18**	**40**

SITE 4 (Block 1): EAST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	64	57	56	54	57	54	48	43	**60**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	46	30	35	23	13	5	4	-3	28
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	20	10	10	2	-4	-16	-27	-35	5
Combined Level from window and wall	*dB*	*46*	*30*	*35*	*23*	*13*	*5*	*4*	*-3*	*28*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**49**	**33**	**38**	**26**	**16**	**8**	**7**	**0**	**31**

SITE 4 (Block 1): SOUTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	77	71	64	62	62	55	61	58	**67**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	60	44	44	32	19	7	18	13	38
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	36	27	21	13	4	-12	-11	-17	17
Combined Level from window and wall	*dB*	*60*	*44*	*44*	*32*	*19*	*7*	*18*	*13*	*38*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**63**	**47**	**47**	**35**	**22**	**10**	**21**	**16**	**41**

SITE 4 (Block 1): SOUTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	59	52	51	49	52	49	43	38	**55**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	41	25	30	18	8	0	-1	-8	23
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	15	5	5	-3	-9	-21	-32	-40	0
Combined Level from window and wall	*dB*	*41*	*25*	*30*	*18*	*8*	*0*	*-1*	*-8*	*23*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**44**	**28**	**33**	**21**	**11**	**3**	**2**	**-5**	**26**

SITE 4 (Block 1): WEST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	83	77	70	68	68	61	67	64	**73**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	47	44	44	31	20	8	15	15	36
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	42	33	27	19	10	-6	-5	-11	23
Combined Level from window and wall	*dB*	*48*	*45*	*44*	*31*	*20*	*8*	*15*	*15*	*37*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**51**	**48**	**47**	**34**	**23**	**11**	**18**	**18**	**40**

SITE 4 (Block 1): WEST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	65	58	57	55	58	55	49	44	**61**
Glazing Specified: 4 / 12 / 4	dB	13	23	18	26	38	44	38	42	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	48	31	34	23	13	3	3	-6	28
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	21	11	11	3	-3	-15	-26	-34	6
Combined Level from window and wall	*dB*	*48*	*31*	*34*	*23*	*13*	*3*	*3*	*-6*	*28*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**51**	**34**	**37**	**26**	**16**	**6**	**6**	**-3**	**31**

Appendix IV – Calculation Of Outside To Inside Noise Levels – Site 4 (Block 2)

SITE 4 (Block 2): NORTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	85	79	72	70	70	63	69	66	**75**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	49	46	46	33	22	10	17	17	38
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	44	35	29	21	12	-4	-3	-9	25
Combined Level from window and wall	*dB*	*50*	*47*	*46*	*33*	*22*	*10*	*17*	*17*	*39*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**53**	**50**	**49**	**36**	**25**	**13**	**20**	**20**	**42**

SITE 4 (Block 2): NORTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	66	59	58	56	59	56	50	45	**62**
Glazing Specified: 4 / 12 / 6	dB	15	27	21	29	40	39	43	40	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	47	28	32	21	12	9	-1	-3	27
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	22	12	12	4	-2	-14	-25	-33	7
Combined Level from window and wall	*dB*	*47*	*28*	*32*	*21*	*13*	*9*	*-1*	*-3*	*27*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**50**	**31**	**35**	**24**	**16**	**12**	**2**	**0**	**30**

SITE 4 (Block 2): EAST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	84	78	71	69	69	62	68	65	**74**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	48	45	45	32	21	9	16	16	37
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	43	34	28	20	11	-5	-4	-10	24
Combined Level from window and wall	*dB*	*49*	*46*	*45*	*32*	*21*	*9*	*16*	*16*	*38*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**52**	**49**	**48**	**35**	**24**	**12**	**19**	**19**	**41**

SITE 4 (Block 2): EAST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	64	57	56	54	57	54	48	43	**60**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	46	30	35	23	13	5	4	-3	28
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	20	10	10	2	-4	-16	-27	-35	5
Combined Level from window and wall	*dB*	*46*	*30*	*35*	*23*	*13*	*5*	*4*	*-3*	*28*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**49**	**33**	**38**	**26**	**16**	**8**	**7**	**0**	**31**

SITE 4 (Block 2): SOUTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	77	71	64	62	62	55	61	58	**67**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	60	44	44	32	19	7	18	13	38
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	36	27	21	13	4	-12	-11	-17	17
Combined Level from window and wall	*dB*	*60*	*44*	*44*	*32*	*19*	*7*	*18*	*13*	*38*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**63**	**47**	**47**	**35**	**22**	**10**	**21**	**16**	**41**

SITE 4 (Block 2): SOUTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	57	50	49	47	50	47	41	36	**53**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	39	23	28	16	6	-2	-3	-10	21
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	13	3	3	-5	-11	-23	-34	-42	-2
Combined Level from window and wall	*dB*	*39*	*23*	*28*	*16*	*6*	*-2*	*-3*	*-10*	*21*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**42**	**26**	**31**	**19**	**9**	**1**	**0**	**-7**	**24**

SITE 4 (Block 2): WEST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	85	79	72	70	70	63	69	66	**75**
Glazing Specified: 5 / 7 / 6.8A	dB	33	29	22	32	42	46	45	42	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	49	46	46	33	22	10	17	17	38
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	44	35	29	21	12	-4	-3	-9	25
Combined Level from window and wall	*dB*	*50*	*47*	*46*	*33*	*22*	*10*	*17*	*17*	*39*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**53**	**50**	**49**	**36**	**25**	**13**	**20**	**20**	**42**

SITE 4 (Block 2): WEST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	65	58	57	55	58	55	49	44	**61**
Glazing Specified: 4 / 12 / 4	dB	13	23	18	26	38	44	38	42	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	48	31	34	23	13	3	3	-6	28
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	21	11	11	3	-3	-15	-26	-34	6
Combined Level from window and wall	*dB*	*48*	*31*	*34*	*23*	*13*	*3*	*3*	*-6*	*28*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**51**	**34**	**37**	**26**	**16**	**6**	**6**	**-3**	**31**

Appendix V -- Calculation Of Outside To Inside Noise Levels -- Site 5

SITE 5: NORTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	82	76	69	67	67	60	66	63	**72**
Glazing Specified: 4 / 12 / 6	dB	15	27	21	29	40	39	43	40	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	64	45	44	33	21	14	16	16	40
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	41	32	26	18	9	-7	-6	-12	22
Combined Level from window and wall	*dB*	*64*	*45*	*44*	*33*	*21*	*14*	*16*	*16*	*40*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**67**	**48**	**47**	**36**	**24**	**17**	**19**	**19**	**43**

SITE 5: NORTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	66	59	58	56	59	56	50	45	**62**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	48	32	37	25	15	7	6	-1	30
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	22	12	12	4	-2	-14	-25	-33	7
Combined Level from window and wall	*dB*	*48*	*32*	*37*	*25*	*15*	*7*	*6*	*-1*	*30*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**51**	**35**	**40**	**28**	**18**	**10**	**9**	**2**	**33**

SITE 5: EAST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	78	72	65	63	63	56	62	59	**68**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	61	45	45	33	20	8	19	14	39
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	37	28	22	14	5	-11	-10	-16	18
Combined Level from window and wall	*dB*	*61*	*45*	*45*	*33*	*20*	*8*	*19*	*14*	*39*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**64**	**48**	**48**	**36**	**23**	**11**	**22**	**17**	**42**

SITE 5: EAST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	63	56	55	53	56	53	47	42	**59**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	45	29	34	22	12	4	3	-4	27
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	19	9	9	1	-5	-17	-28	-36	4
Combined Level from window and wall	*dB*	*45*	*29*	*34*	*22*	*12*	*4*	*3*	*-4*	*27*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**48**	**32**	**37**	**25**	**15**	**7**	**6**	**-1**	**30**

SITE 5: SOUTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	72	66	59	57	57	50	56	53	**62**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	55	39	39	27	14	2	13	8	33
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	31	22	16	8	-1	-17	-16	-22	12
Combined Level from window and wall	*dB*	*55*	*39*	*39*	*27*	*14*	*2*	*13*	*8*	*33*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**58**	**42**	**42**	**30**	**17**	**5**	**16**	**11**	**36**

SITE 5: SOUTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	57	50	49	47	50	47	41	36	**53**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	39	23	28	16	6	-2	-3	-10	21
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	13	3	3	-5	-11	-23	-34	-42	-2
Combined Level from window and wall	*dB*	*39*	*23*	*28*	*16*	*6*	*-2*	*-3*	*-10*	*21*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**42**	**26**	**31**	**19**	**9**	**1**	**0**	**-7**	**24**

SITE 5: WEST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	79	73	66	64	64	57	63	60	**69**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	62	46	46	34	21	9	20	15	40
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	38	29	23	15	6	-10	-9	-15	19
Combined Level from window and wall	*dB*	*62*	*46*	*46*	*34*	*21*	*9*	*20*	*15*	*40*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**65**	**49**	**49**	**37**	**24**	**12**	**23**	**18**	**43**

SITE 5: WEST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	64	57	56	54	57	54	48	43	**60**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	46	30	35	23	13	5	4	-3	28
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	20	10	10	2	-4	-16	-27	-35	5
Combined Level from window and wall	*dB*	*46*	*30*	*35*	*23*	*13*	*5*	*4*	*-3*	*28*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**49**	**33**	**38**	**26**	**16**	**8**	**7**	**0**	**31**

Appendix VI – Calculation Of Outside To Inside Noise Levels – Site 6

SITE 6: NORTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	78	72	65	63	63	56	62	59	**68**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	61	45	45	33	20	8	19	14	39
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	37	28	22	14	5	-11	-10	-16	18
Combined Level from window and wall	*dB*	*61*	*45*	*45*	*33*	*20*	*8*	*19*	*14*	*39*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**64**	**48**	**48**	**36**	**23**	**11**	**22**	**17**	**42**

SITE 6: NORTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	62	55	54	52	55	52	46	41	**58**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	44	28	33	21	11	3	2	-5	26
SRI Blockwork Wall	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	18	8	8	0	-6	-18	-29	-37	3
Combined Level from window and wall	*dB*	*44*	*28*	*33*	*21*	*11*	*3*	*2*	*-5*	*26*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**47**	**31**	**36**	**24**	**14**	**6**	**5**	**-2**	**29**

SITE 6: EAST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	75	69	62	60	60	52	59	56	**65**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	58	42	42	30	17	4	16	11	36
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	34	25	19	11	2	-15	-13	-19	15
Combined Level from window and wall	*dB*	*58*	*42*	*42*	*30*	*17*	*4*	*16*	*11*	*36*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**61**	**45**	**45**	**33**	**20**	**7**	**19**	**14**	**39**

SITE 6: EAST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	59	52	51	49	52	49	43	39	**55**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	41	25	30	18	8	0	-1	-7	23
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	15	5	5	-3	-9	-21	-32	-39	0
Combined Level from window and wall	*dB*	*41*	*25*	*30*	*18*	*8*	*0*	*-1*	*-7*	*23*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**44**	**28**	**33**	**21**	**11**	**3**	**2**	**-4**	**26**

SITE 6: SOUTH ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	70	64	57	55	55	48	54	51	**60**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	53	37	37	25	12	0	11	6	31
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	29	20	14	6	-3	-19	-18	-24	10
Combined Level from window and wall	*dB*	*53*	*37*	*37*	*25*	*12*	*0*	*11*	*6*	*31*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**56**	**40**	**40**	**28**	**15**	**3**	**14**	**9**	**34**

SITE 6: SOUTH ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	54	47	46	44	47	44	38	33	**50**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	36	20	25	13	3	-5	-6	-13	18
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	10	0	0	-8	-14	-26	-37	-45	-5
Combined Level from window and wall	*dB*	*36*	*20*	*25*	*13*	*3*	*-5*	*-6*	*-13*	*18*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**39**	**23**	**28**	**16**	**6**	**-2**	**-3**	**-10**	**21**

SITE 6: WEST ELEVATION										
BEDROOMS										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAmax	dB	78	72	65	63	63	56	62	59	**68**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Area Correction	dB	4	4	4	4	4	4	4	4	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	61	45	45	33	20	8	19	14	39
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	
Area Correction	dB	9	9	9	9	9	9	9	9	
Likely RT in Bedroom	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	25	25	25	25	25	25	25	25	
Absorption		5	6	7	8	10	13	13	13	
Absorption Correction	dB	7	8	8	9	10	11	11	11	
Net SPL Inside	dB	37	28	22	14	5	-11	-10	-16	18
Combined Level from window and wall	*dB*	*61*	*45*	*45*	*33*	*20*	*8*	*19*	*14*	*39*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**64**	**48**	**48**	**36**	**23**	**11**	**22**	**17**	**42**

SITE 6: WEST ELEVATION										
LIVING ROOM										
Frequency	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
External Noise Level LAeq	**dB**	62	55	54	52	55	52	46	41	**58**
Glazing Specified: 4 / 16 / 4	dB	14	23	16	25	37	41	36	38	
Area of Window	dB	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Area Correction	dB	5	5	5	5	5	5	5	5	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	44	28	33	21	11	3	2	-5	26
SRI Blockwork	dB	43	45	44	49	57	65	70	73	
Area of Wall	dB	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Area Correction	dB	8	8	8	8	8	8	8	8	
Likely RT in Living Room	sec	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.3	
Room Volume	m3	40	40	40	40	40	40	40	40	
Absorption		8	9	11	13	16	21	21	21	
Absorption Correction	dB	9	10	10	11	12	13	13	13	
Net SPL Inside	dB	18	8	8	0	-6	-18	-29	-37	3
Combined Level from window and wall	*dB*	*44*	*28*	*33*	*21*	*11*	*3*	*2*	*-5*	*26*
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Internal Noise Level	**dB**	**47**	**31**	**36**	**24**	**14**	**6**	**5**	**-2**	**29**

Appendix VII: Terminology Relating To Noise

Sound Pressure	Sound is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of 20μPa (20x10-6 Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m.
Façade Noise Level	At a distance of 1m in front of a large reflecting object such as a building façade.
Time Weighting	Response times used in sound level meters, typically Fast or Slow
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.

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