PEAK acoustics

Noise Impact Assessment

Client:	Frankie Pye
Site:	47 – 49 High Street, Dartford, DA1 1DJ
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Project Consultant

T. Brown BSc (Hons) MIOA
Acoustic Consultant
tom@acousticsurveys.co.uk

Proofing Consultant

J. Parrott BEng (Hons) AMIOA
Acoustic Consultant
jack@acousticsurveys.co.uk

Email: sales@acousticsurveys.co.uk | **Office** 0330 043 1764
Web: www.acousticsurveys.co.uk
Peak Acoustics Ltd, PO Box 724, Macclesfield, SK10 9DH

Revision History

Revision	Date	Author	Description
0.0 – 1404216NR	02/07/2021	K. Donald	First issue report
1.0 – 0706237NR	20/09/2023	T. Brown	Verification survey undertaken on-site to determine current noise levels. BS8233 calculations updated to reflect current noise levels and revised site plans

Executive Summary

An Environmental Noise Assessment has been undertaken at 47 – 49 High Street, Dartford for the proposed development of the site to provide 14 residential apartments.

Environmental noise monitoring was undertaken at the site from the 11th – 15th June 2021 and further verification measurements were undertaken from 25th – 29th August 2023. Noise affecting the development was determined to be primarily from road traffic, High Street activity, public houses and plant equipment.

Due to the nature and character of the external noise affecting the development, bespoke design limits were derived for internal noise levels with guidance drawn from BS8233:2014 and ProPG. The derived design criteria are summarised below.

Selected Assessment Criteria

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	32 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	32 dB $L_{Aeq,16hour}$	27 dB $L_{Aeq,8hour}$ 45 dB L_{AFmax}

From the noise survey data and proposed floor plans, two facades 'Zones' were defined based on the differing noise levels affecting those areas. A glazing and ventilation scheme has been given to ensure conditions in habitable rooms remain within the desired design criteria. The derived scheme for the two Zones is given below.

Glazing & Ventilation Scheme

Internal Space	Glazing		Ventilation	
	Minimum Performance R_w *(+*C_{tr}*)*	*Example Specification*	*Minimum Performance* $D_{ne,w}$,+C_{tr} (Open)	*Example Specification*
A - Living Areas	42 (35)	*Laminated Double Glazing: 8/16/8.8SC*	N/A	*Multi-room heat recovery system*
A - Bedrooms	44 (38)	*Laminated Double Glazing: 10/16/8.8SC*		
B - Living Areas	39 (33)	*Double Glazing: 6/16/9.5*		
B - Bedrooms	39 (33)	*Double Glazing: 6/16/9.5*		

A mechanical ventilation strategy has been given for Zones A & B due to the levels and character of noise affecting those areas. This strategy permits occupants to fully close their windows whilst still maintaining thermal comfort and respite from the external noise.

An existing array of plant equipment is located on the roof that is associated with the ground floor Iceland supermarket. To ensure noise transfer from this plant does not result in any loss of amenity for residents directly below, a ceiling specification was given and is summarised below.

- *Existing 100mm Precast concrete roof (assumed minimum depth)*
- MF suspended ceiling system
- 100mm mineral wool insulation within MF ceiling void (Min. Density = 10kg/m^3)
- 2x No. 12.5 Gyproc Soundbloc plasterboard (or equivalent)

This enhanced ceiling specification need only apply to habitable rooms within Flats 5, 13 and 14 which are shown on plans to be directly below the roof plant area.

Calculations of sound transmission from the ground-floor supermarket to the first-floor habitable rooms were undertaken and indicated that no enhancement to the separating floor is required.

Contents

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1. Introduction

Proposal

It is proposed to redevelop the 1st and 2nd floors of 47 - 49 High Street, Dartford to provide 14 residential apartments. The ground floor of the site is currently an Iceland supermarket.

Reason for Assessment

A noise assessment is to be submitted as part of the planning application to ensure desirable noise levels are met within the habitable rooms of the proposed development and external amenity areas. The assessment aims to provide a sound insulation scheme for the development.

Planning Conditions

No conditions have been set in relation to noise however an up-to-date noise assessment has been requested as part of the planning submission taking into account the most recent site layout.

Assessment Guidance Documentation

Guidance on the assessment and design criteria will be drawn from BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings.* Table 4 in Section 7.7.2 of this standard suggests indoor ambient noise levels for dwellings.

Additional guidance will be drawn from 'ProPG: Planning & Noise' which was published "*to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.*"

Where necessary, mitigation recommendations will be given to comply with the requirements of the National Planning Policy Framework (2021) and the Noise Policy Statement for England (2010). Further information on all guidance documentation can be found in **Appendix H**.

2. Environmental Noise Survey

Survey Measurement

To assess the environmental noise levels affecting the proposed development, unattended noise surveys have been undertaken at the site from 11th – 15th June 2021 and 25th – 29th August 2023. These periods were selected to capture events and noise levels over typical weekday and weekend periods given the High Street location of the site.

Measurements of $L_{Aeq,T}$ and L_{AFmax} were logged in 5- 5-minute intervals in accordance with the provisions of BS7445 - *'Description and Measurement of Environmental Noise'*.

Measurement Location

Monitoring position M1 (2021) was located at the Northern façade of the site out of a 2nd-floor window overlooking the High Street. The microphone was positioned approximately 4.5 metres above ground level.

Monitoring positions M2 (2021) and M3 (2023) were located at the Southern façade of the site out of a 1st-floor window overlooking the entrance to Iceland and the Market Place. The microphone was positioned approximately 4.5 metres above ground level.

Data from all measurement positions is subject to a -3dB correction to account for proximity to the building façade.

The site and monitoring locations are shown below in **Figure 1**.

Figure 1: ***Site & Measurement Locations – google.co.uk/maps***

Monitoring Location (M1)

Monitoring Location (M2 & M3)

Site Boundary (Approx.)

Site Descriptions

The site is located in the centre of Dartford between High Street and Market Street (A226). The portion of the High Street to the North of the site is pedestrianised and contains shops, restaurants and cafes including 'The Clipper' public house opposite the site. Adjoining the building to the East is 'Daniel's Grill & Restaurant'.

Market Street (A226) passes East of the site and runs to the South and West. This road is a main access route past the site as High Street is pedestrianised. The East side of Market Street includes Estate Agents, shops and restaurants.

The area immediately South of the site is a public amenity space, 'Market Place'. This area is understood to have previously been a public car park.

An Iceland supermarket is situated on the ground floor of the site. Access to the store is provided at both the South and North elevations of the building. The service bay for the store is located on the West elevation and sees regular home delivery vans loading goods throughout the day.

Air handling equipment associated with the Iceland supermarket and neighbouring Daniel's Grill & Restaurant is located on the roof of the associated properties.

Noise Affecting the Development

The noise sources identified on the North elevation arising from activity on the High Street included conversing pedestrians and passing road traffic on Market Street to the East which included regular buses. Although roof-mounted plant equipment associated with 'Daniel's Grill & Restaurant' was visible on this elevation, noise from the units could not be distinguished over the continuous and steady High Street activity and road traffic.

On the South and East elevations, continuous road traffic on Market Street was most dominant. Passing conversing pedestrians could also be heard. The roof-mounted plant equipment associated with the Iceland supermarket could be faintly distinguished during periods of low traffic and activity. Noise event recording was utilised at positions M2 and M3 to identify noise sources within Market Place during the unattended survey. Key events included people congregating and conversing loudly during the early hours of the morning and what is thought to be leaf-blowing on the mornings of Monday 14th and Tuesday 15th June 2021. The majority of captured events were passing vehicles, including loud motorbikes and scooters.

Environmental Noise Survey Results

The results from all the noise monitoring locations across the two reports are summarised below.

The full-time history of the noise monitoring data is given in **Appendix E.**

Measurement	Date(s)	Period	L_{Aeq} (dB)	Typical* L_{AFmax} (dB)
M1	11th & 15th June 2021	Day *(16hr Aggregate Periods)*	57	-
	11th - 12th June 2021	Night *(8hr)*	61**	89
	12th June 2021	Daytime *(16hr)*	58	-
	12th - 13th June 2021	Night *(8hr)*	58**	86
	13th June 2021	Daytime *(16hr)*	54	-
	13th - 14th June 2021	Night *(8hr)*	56**	84
	14th June 2021	Daytime *(16hr)*	59	-
	14th - 15th June 2021	Night *(8hr)*	56	79
M2	11th & 15th June 2021	Day *(16hr Aggregate Periods)*	59	-
	11th - 12th June 2021	Night *(8hr)*	53	79
	12th June 2021	Daytime *(16hr)*	59	-
	12th - 13th June 2021	Night *(8hr)*	54	82
	13th June 2021	Daytime *(16hr)*	56	-
	13th - 14th June 2021	Night *(8hr)*	60***	78

	14th June 2021	Daytime *(16hr)*	58	-
	14th - 15th June 2021	Night *(8hr)*	57	81
M3	25th August 2023	Daytime (13:50 – 23:00)	58	-
	25th – 26th August 2023	Night (8hr)	57	83
	26th August 2023	Daytime	59	-
	26th – 27th August 2023	Night (8hr)	51	76
	27th August 2023	Daytime	56	-
	27th – 28th August 2023	Night (8hr)	54	80
	28th August 2023	Daytime	57	-
	28th – 29th August 2023	Night (8hr)	55	85
	29th August 2023	Daytime	62	-

Table 1: Environmental Measurement Summary

** The given 'Typical' L_{AFmax} levels above are an average of the spectra of the noisiest 10 events of the night-time periods; the maxima levels selected would not ordinarily be exceeded more than 10 times within the night-time, in accordance with the WHO L_{AFmax} parameter guidance.*

*** M1 measurement data shows that noise levels during the night were equal to or above daytime levels from Friday 11th to Monday 14th June. Although the specific source of this is unclear, due to this pattern being absent during the night of Monday 14th to Tuesday 15th June, it is deemed to be associated with the night-time economy and the nearby public houses.*

**** Data from measurement M2 shows similar patterns during the nights of the 13th & 14th, however, noise event recording data shows this was associated with leaf blowing occurring from approximately 06:30 – 07:00. This event is not thought to be regular and will be seasonal. It is therefore not considered representative of typical night-time noise levels.*

Weather Conditions

Daytime temperatures of between 15 - 28°C were noted during the 2021 survey with winds between 2 and 5m/s. During the 2023 survey, temperatures of 20°C were noted with winds between 2 and 4 m/s. Detailed weather conditions are given in **Appendix D**.

Measurement Equipment

Measurement equipment complies with accuracy requirements for common environmental noise measurement standards. Equipment was calibrated before and after use and no significant drift occurred during measurements. Up-to-date calibration certification can be provided upon request. A detailed equipment list is given in **Appendix B** with calibration information in **Appendix C**.

3. Internal Noise Level Assessment

Design Criteria

BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings* suggests indoor ambient noise levels for dwellings in Table 4, Section 7.7.2. These are summarised below.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 2: Indoor Ambient Noise Levels for Dwellings

BS8233 states that the guideline values given above are for 'noise without character', further stating:

> *"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

Table 4 of BS8233 also has accompanying notes that were subject to additions in ProPG. The relevant notes with the additions of ProPG are given below.

> *"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 LAmax,F more than 10 times a night."*

In considering the noise climate affecting the proposed development, as discussed in Section 3.6, it is deemed appropriate to consider lower guideline indoor ambient noise level values. BS8233 and ProPG do not specify lower limits for such noise climates, however, a 3 dB correction to the indoor ambient noise level criteria is deemed appropriate. The criteria to be considered in the assessment are summarised below.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	32 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	37 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	32 dB $L_{Aeq,16hour}$	27 dB $L_{Aeq,8hour}$

Table 3: Assessment Criteria

Façade Zone Definition

For the assessment of internal noise levels and determining a façade sound insulation scheme, two zones have been defined based on the measured and assumed noise exposure in these areas.

Zone 2 facades are shielded from the dominating noise sources as they are within an enclosed lightwell area.

The zones are illustrated below in **Figure 2** on the first-floor plan, the specified zones apply to the relevant areas of facades on all levels.

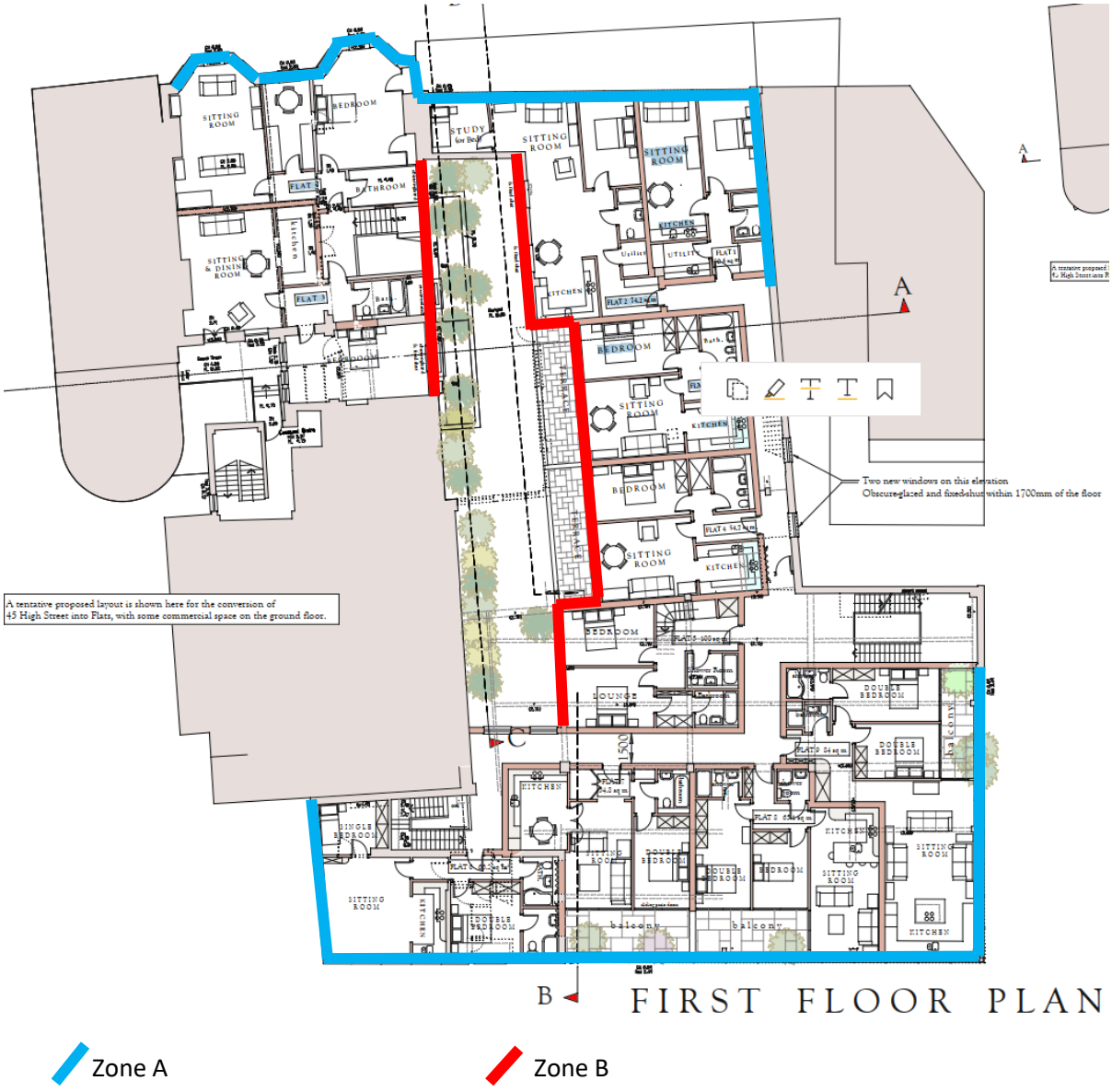


Figure 2: Facade Zones

Assessment Noise Levels

In the interest of a robust assessment, the loudest of the measurement intervals (subject to irregular events discussed in Section 2) are to be considered in the assessment of internal noise levels and determining the sound insulation scheme.

For Zone B within the enclosed lightwell area, a 5 dB correction to measurement data M3 has been applied due to this area being fully blocked from the surrounding dominating noise sources on the High Street and elsewhere.

The resultant external noise levels for the assessment of internal ambient noise levels in each Zone are summarised in the table below.

Zone	Period	$L_{Aeq,T}$ (dB)	L_{Amax} (dB)
Zone A	Daytime *(1hr)*	66	-
	Night *(1hr)*	62	85
Zone B	Daytime *(1hr)*	61	-
	Night *(1hr)*	57	80

Table 4: Assessment Noise Levels

Internal Noise Calculations

Internal noise levels have been calculated to demonstrate that the proposed dwellings can achieve the desired design criteria when appropriate glazing and ventilation systems are utilised.

Internal arrangements of the dwellings have been submitted by the client, proposed drawings by *'Graham Rix RIBA'* have been used to scale room and glazing dimensions and can be found in **Appendix G**.

Assessment is not required for each individual room therefore a worst-case situation will be used in which the worst affected rooms/floors will be used.

Calculations of internal ambient noise levels have been undertaken using the 'rigorous calculation' method given in Annex G2 of BS8233:2014. Full details of the calculations are provided in **Appendix F.**

4. Sound Insulation Scheme

External Building Envelope

Material build-up of the façade will significantly dictate the noise levels within the proposed dwelling. For the purposes of this report, the heavyweight construction of the façade is assumed to provide a minimum sound reduction of 49 dB R_w.

Where the roof is to be utilised as a voided loft space with thermal insulation, no further details are required. If the proposed dwelling has rooms within the roof space, the additional material build-up will be assumed at a minimum sound reduction of 39 dB R_w.

Glazing and Ventilation

The following glazing and ventilation scheme for the development has been derived with a view of achieving the internal noise level criteria given in Table 2.

Internal Space	Glazing		Ventilation	
	Minimum Performance R_w *(+*C_{tr}*)*[1]	*Example Specification*[2]	*Minimum Performance* $D_{ne,W}$,+$C_{tr\ (Open)}$	*Example Specification*[3]
A - Living Areas	42 (35)	*Laminated Double Glazing: 8/16/8.8SC*	N/A	*Multi-room heat recovery system*
A - Bedrooms	44 (38)	*Laminated Double Glazing: 10/16/8.8SC*		
B - Living Areas	39 (33)	*Double Glazing: 6/16/9.5*		
B - Bedrooms	39 (33)	*Double Glazing: 6/16/9.5*		

Table 5: Glazing & Ventilation Scheme

N.B. Note that other glazing configurations and ventilators can achieve the given minimum performance requirements.

[1] *The sound insulation value of the glazing should take into account the glass as well as the frame and perimeter seal.*

[2] *Example glazing specification format given as 'XXmm Float / 16mm Air gap / XXmm Float'*

[3] *It is noted that BS8233 section 7.2.2 states 'If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level'. This statement implies that the use of closed windows and an alternative means of ventilation is acceptable.*

A mechanical ventilation strategy has been recommended for all apartments given the character of noise affecting these areas. This ventilation strategy is to permit occupants to fully close their windows whilst still maintaining thermal comfort and respite from external noise and activity. Guidance on Mechanical Ventilation Design is given below.

Mechanical Ventilation Design Guidance

For a mechanical ventilation strategy, the following guidance should be adhered to in order to control self-generated noise from the systems.

- Noise from the mechanical ventilation system, inclusive of fan case breakout and internal grilles should not exceed 35 dB L_{Aeq} / NR35 and 30 dB L_{Aeq} / NR25 within living rooms and bedrooms respectively.
- Where required, silencers should be installed at the fan inlet and/or outlet.
- Rooms which share supply and/or extract terminations from the same main duct should have cross-talk attenuators implemented within at least one of the corresponding branch ducts to minimise cross-talk between the rooms.

- Ventilation fans should be located within non-habitable rooms or within built-in cupboards. If located in a built-in cupboard, ensure that the access door provides a tight seal to prevent flanking transmission to habitable rooms.
- Fans and ductwork should be fitted using resilient mountings to mitigate vibration and re-radiated structural noise.
- All windows should not include trickle ventilators and walls should not contain passive through-wall vents. As ventilation is to be provided via mechanical means, the passive ventilators will introduce an unnecessary weakness to the building envelope.
- Façade penetrations for inlets/outlets should be routed to the quietest façade where possible to benefit from the quieter noise climate and reduce noise transfer through the ductwork.

5. Internal Noise Levels

It is determined that by using mitigation as specified in **Table 5** for the building façades, the outcome summarised in the following table is achieved.

Internal Space	Noise Parameter	Internal Noise Level (dB)	Within Design Criteria?
A - Living Room	Daytime $L_{Aeq,\ 16hr}$	32	Yes
A - Bedroom	Daytime $L_{Aeq,\ 16hr}$	30	Yes
	Night-time $L_{Aeq,\ 8hr}$	23	Yes
	Night-time $L_{Amax\ F}$	45	Yes
B - Living Room	Daytime $L_{Aeq,\ 16hr}$	30	Yes
B - Bedroom	Daytime $L_{Aeq,\ 16hr}$	30	Yes
	Night-time $L_{Aeq,\ 8hr}$	23	Yes
	Night-time $L_{Amax\ F}$	45	Yes

Table 6: Internal Noise Levels

The following statements on L_{Aeq} take into account a 3dB criteria correction for the assessment:

For the daytime assessment for living areas, the desirable limit of BS8233:2014 suggests a guideline of 32 dB $L_{Aeq,16hr}$ for resting conditions, and up to 37 dB is considered acceptable for necessary developments.

All results, with the implementation of the derived sound insulation scheme given in **Table 5**, would place the internal daytime noise levels below 32 dB, therefore within the desired limit.

For the night-time assessment for bedrooms, BS8233:2014 suggests a desirable guideline of 27 dB $L_{Aeq,\ 8hr}$ for sleeping conditions, with an acceptable limit of 32 dB $L_{Aeq,\ 8hr}$.

Implementation of the derived sound insulation scheme given in **Table 5** would place the internal continuous night-time noise levels below 27 dB, therefore within the desirable category.

For the night-time assessment for bedrooms, ProPG suggests that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night.

Implementation of the derived sound insulation scheme given in **Table 5** would place the internal $L_{Amax,F}$ night-time events below 45 dB, therefore within the criteria.

6. External Amenity Areas

BS8233:2014 provides a desirable guideline of 50 dB $L_{Aeq,16hr}$ for external amenity spaces and an acceptable guideline of 55 dB $L_{Aeq,16hr}$ for noisier environments. External average daytime noise levels were measured between 54 - 61dB $L_{Aeq,16hr}$ at all monitoring positions.
Select apartments on the South elevation (Zone C) are proposed to include external balconies. Noise levels within these balconies may exceed the acceptable limit. However, for such scenarios, '*ProPG: Planning & Noise guidance'* states the following:

> *"Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*
>
> - *A relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5-minute walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations." – P.17 Element 3*

BS8233:2014 also states:

> *"Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses." – 7.7.3.2, P.16.*

All residents of the proposed development are provided quick access to Dartford Central Park, which is immediately South of the site location, approximately 50m away and therefore a short walk. This Park can therefore serve as a quiet publicly accessible external amenity space for residents.

Plans also show private roof garden areas designated for particular apartments within the centre of the site. The noise levels within this area are expected to be 5dB lower in general meaning that noise within these areas is likely to sit between 49 – 56dB and it is expected that parts of each garden will be within the 'desirable' category.

7. Rooftop Plant Noise

An array of plant equipment is located on the roof of the existing building that is associated with the ground floor Iceland supermarket. To ensure noise transfer via the roof into habitable rooms directly below does not adversely affect future residents, calculations of sound transmission have been undertaken and an enhanced ceiling specification is to be provided.

Plant Noise Levels

Measurements of the roof plant equipment were undertaken on Friday 11th July 2021. The measured sound pressure levels at 1m are given below.

Source	63	125	250	500	1k	2k	4k	8k	dBA
Roof Plant Equipment	72	74	73	71	72	70	64	54	76

Table 7: Rooftop Plant Noise Levels

Ceiling Specification

The existing roof was observed to be precast concrete with a minimum depth of 100mm being assumed. Sound insulation modelling software, *Insul* (Marshall Day Acoustics), has been utilised to derive a suitable ceiling enhancement to control sound transmission.

A summary of the roof with the proposed ceiling enhancements is given below.

- *Existing 100mm Precast concrete roof (assumed minimum depth)*
- MF suspended ceiling system
- 100mm mineral wool insulation within MF ceiling void (Min. Density = 10kg/m^3)
- 2x No. 12.5 Gyproc Soundbloc plasterboard (or equivalent)

A detailed sound insulation model is given in **Appendix J.**

Sound Transmission Outcome

Criteria for internal noise levels within habitable rooms has been selected as NR15.

A summary of the sound transmission calculations is tabulated below.

Source/Internal Space/Criteria	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	dBA
Roof Plant Equipment (Source)	72	74	73	71	72	70	64	**76**
Habitable Room (Receiver)	23	14	16	15	9	1	-20	**15**
NR15	*47.3*	*35.0*	*25.9*	*19.4*	*15.0*	*11.7*	*9.3*	-
Difference, dB	*-24*	*-21*	*-10*	*-4*	*-6*	*-11*	*-9*	-

Table 8: Rooftop Plant Sound Transmission Outcome

Table 8 demonstrates that the proposed ceiling enhancements (as detailed above) serve to control noise from the roof plant, with sound pressure levels within habitable rooms directly below being within the limits of NR15.

Full calculations are given in **Appendix J.**

N.B. It is deemed that this enhanced ceiling specification need only apply to habitable rooms directly below the roof plant area, from current plans these would include Flats 5, 13 and 14.

8. Internal Sound Transmission from Supermarket

To ensure noise from the ground floor Iceland supermarket is sufficiently controlled within the habitable rooms above, a sound transmission calculation has been undertaken using assumed noise levels and assumed construction for the separating floor.

Assumed Supermarket Noise Levels

Noise levels have been assumed for the ground floor supermarket comprising of spoken voice and low-level music. These noise levels are summarised below.

Source	63	125	250	500	1k	2k	4k	dBA
Iceland Supermarket	40	50	62	65	59	54	49	**65**

Table 9: Supermarket Internal Noise Levels

Assumed Sound Insulation

Based on observations and discussions with the architect, the separating floor construction from the ground to the first floor is assumed to comprise of a minimum 150mm precast concrete. The suspended ceiling within the supermarket has also been considered. The assumed floor construction has been modelled in sound insulation modelling software, *Insul* (Marshall Day Acoustics). A detailed sound insulation model is given in **Appendix J.**

Sound Transmission Outcome

Criteria for internal noise levels within habitable rooms has been selected as NR15.

A summary of the sound transmission calculations is tabulated below.

Source/Internal Space/Criteria	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	dBA
Supermarket (Source)	40	50	62	65	59	54	49	**65**
Habitable Room (Receiver)	14	9	20	14	-2	-17	-31	**15**
NR15	*47.3*	*35.0*	*25.9*	*19.4*	*15.0*	*11.7*	*9.3*	-
Difference, dB	*-33*	*-26*	*-5*	*-5*	*-15*	*-12*	*-9*	-

Table 10: Supermarket Sound Transmission

Table 10 demonstrates that the existing separating floor should sufficiently control noise transmission from the ground-floor supermarket into first-floor habitable rooms. No specific enhancement to the floor is deemed necessary.

Full calculations are given in **Appendix K.**

9. Conclusions

A noise assessment has been undertaken at 47 - 49 High Street, Dartford for the proposed development of the site to provide 14 residential apartments. Environmental noise monitoring was undertaken from Friday 11th June to Tuesday 15th June 2021 at two positions on the North and South elevations, and from 25th – 29th August 2023 on the South elevation.

Due to the nature of the external noise affecting the development, bespoke design limits were derived for internal noise levels with guidance drawn from BS8233:2014 and ProPG. A glazing and ventilation scheme has been given to ensure conditions in habitable rooms remain within the design criteria. This has been provided for two designated zones around the property.

An enhanced ceiling specification has been provided for habitable rooms directly below the existing roof plant to ensure noise transfer is controlled.

Calculations of internal sound transmission from the ground-floor supermarket to first-floor residential areas indicated no specific enhancements to the floor are required.

APPENDIX A - Measurement Details

Measurement	Kit	Start Date	Start Time	End Date	End Time
M1	A5	11/06/2021	11:00	15/06/2021	11:30
M2	A3	11/06/2021	11:00	15/06/2021	11:30
M3	A3	25/08/2023	13:50	29/08/2023	13:00

Table 11: Measurement Dates

Figure 3: Site Location Measurement Pictures

APPENDIX B - Equipment Details

Kit	Equipment	Make	Model	Class	Serial Number
A5	Sound Meter	RION	NL-52	1	00219828
A5	Pre-Amp	RION	NH-25	1	00344
A5	Microphone	RION	UC-59	1	18806
A5	Calibrator	RION	NL-75	1	34212936
A3	Sound Meter	Svantek	971	1	41980
A3	Pre-Amp	Svantek	SV18	1	44331
A3	Calibrator	Svantek	SV33A	1	43086
1	Calibrator	Svantek	SV33	1	90273

Table 12: Measurement Equipment Details

APPENDIX C - Calibration Details

Measurement	Calibrator Ref Level (dB)	Deviation Before (dB)	Deviation After (dB)
M1	94.00	0.00	0.00
M2	113.90	0.70	0.60
M3	113.80	0.37	0.51

Table 13: Calibration Details

APPENDIX D – Meteorological Details

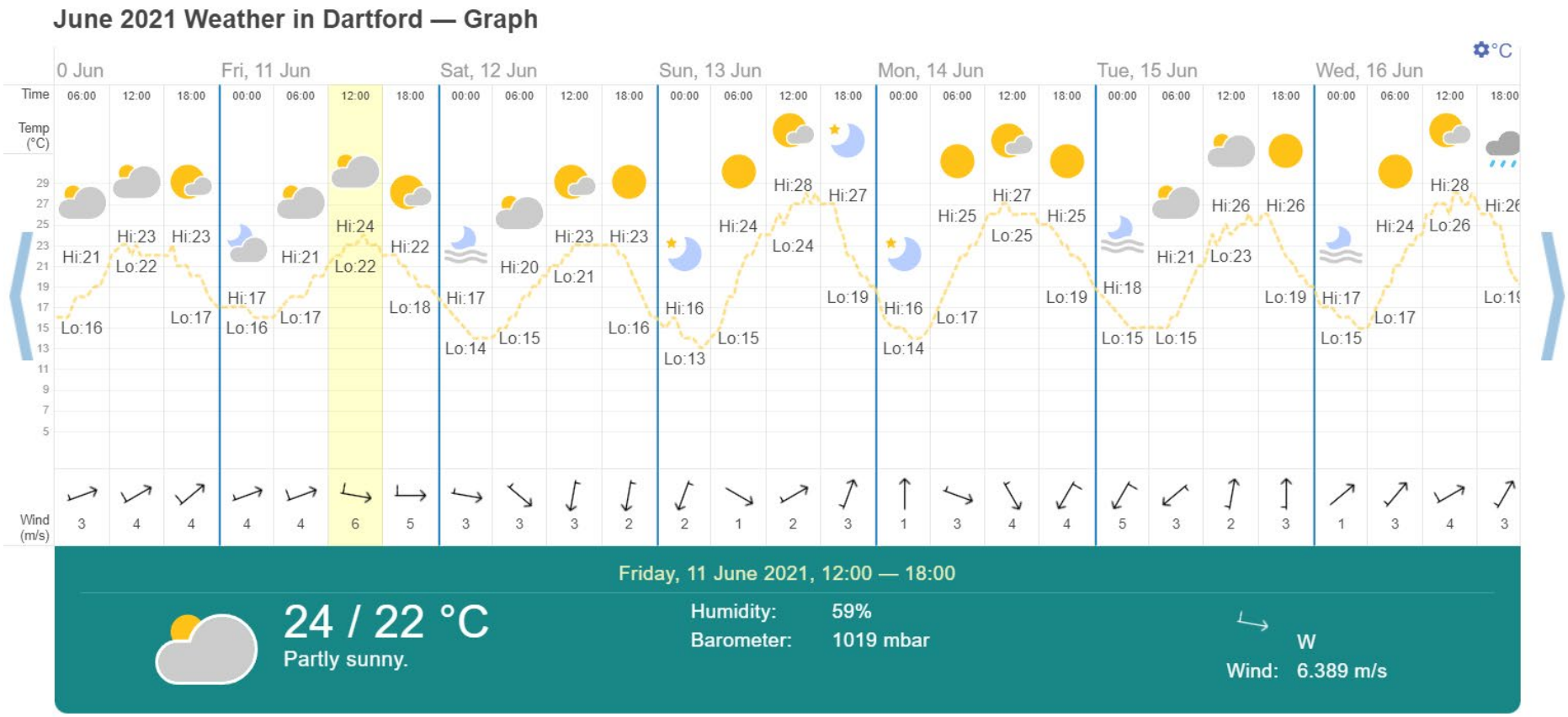


Figure 4: M1 Meteorology Data - https://www.timeanddate.com/weather

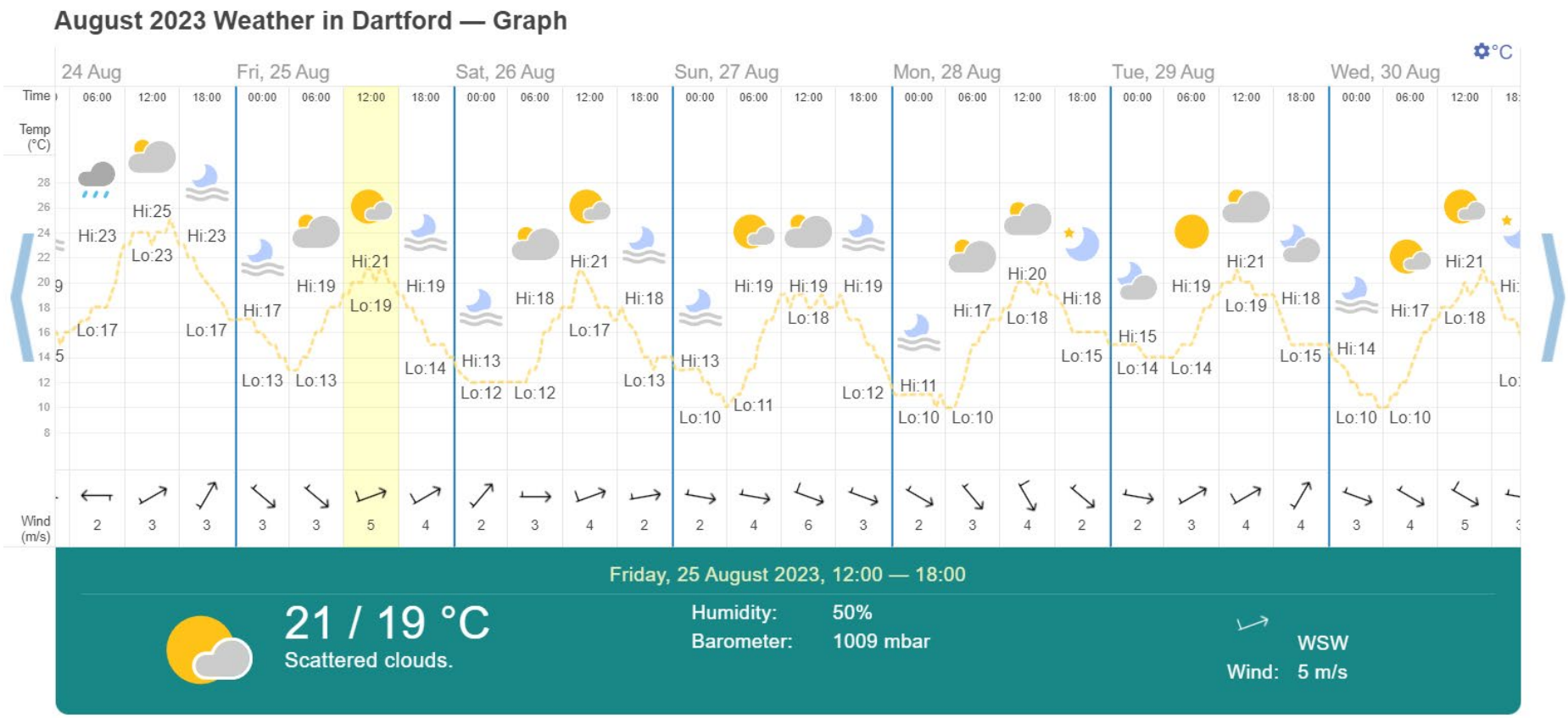


Figure 5: M3 Meteorology Data - https://www.timeanddate.com/weather

APPENDIX E – Noise Survey Results

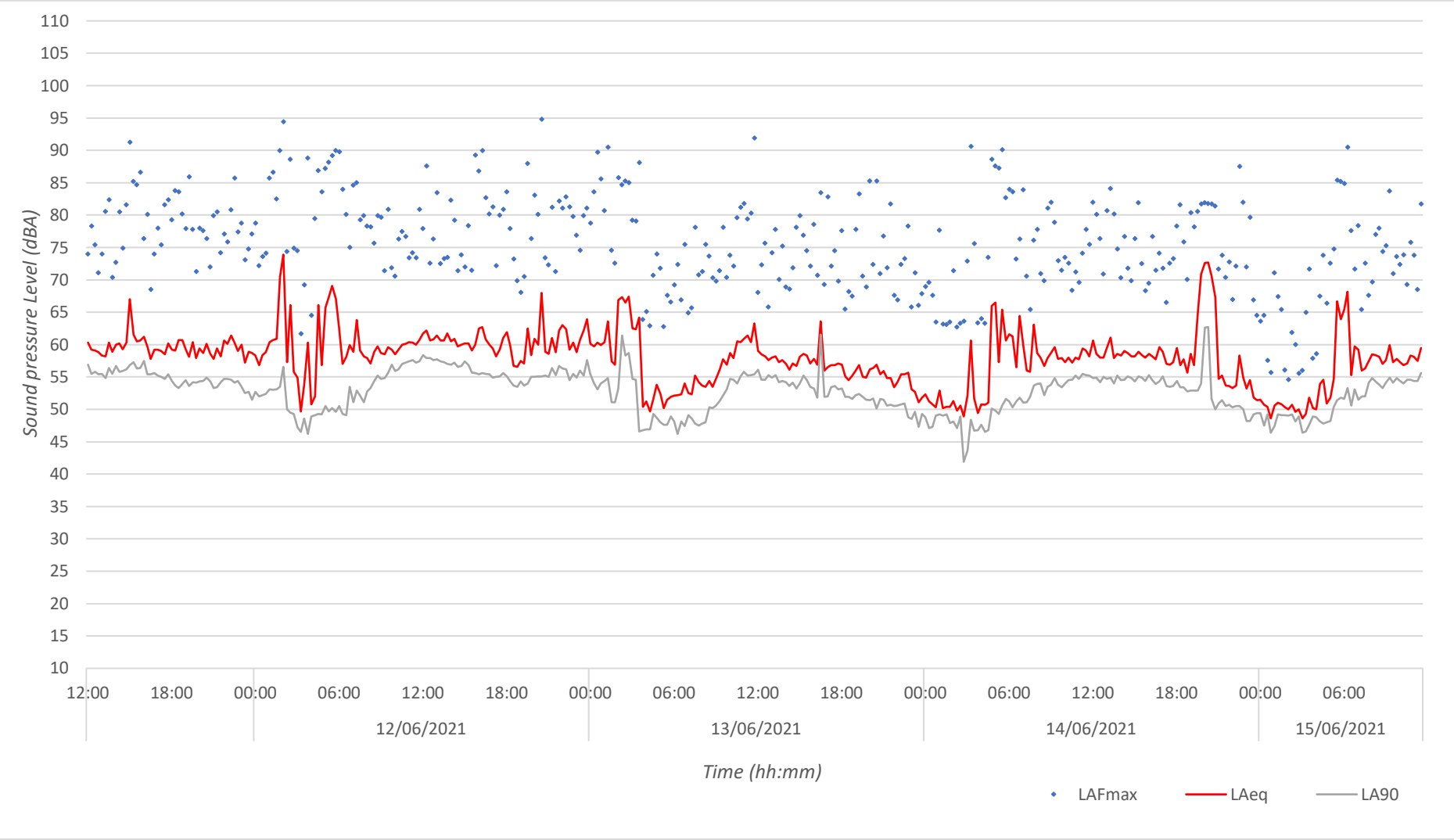


Figure 6: Measured Background Sound Levels Time History (M1): 11th – 15th June 2021

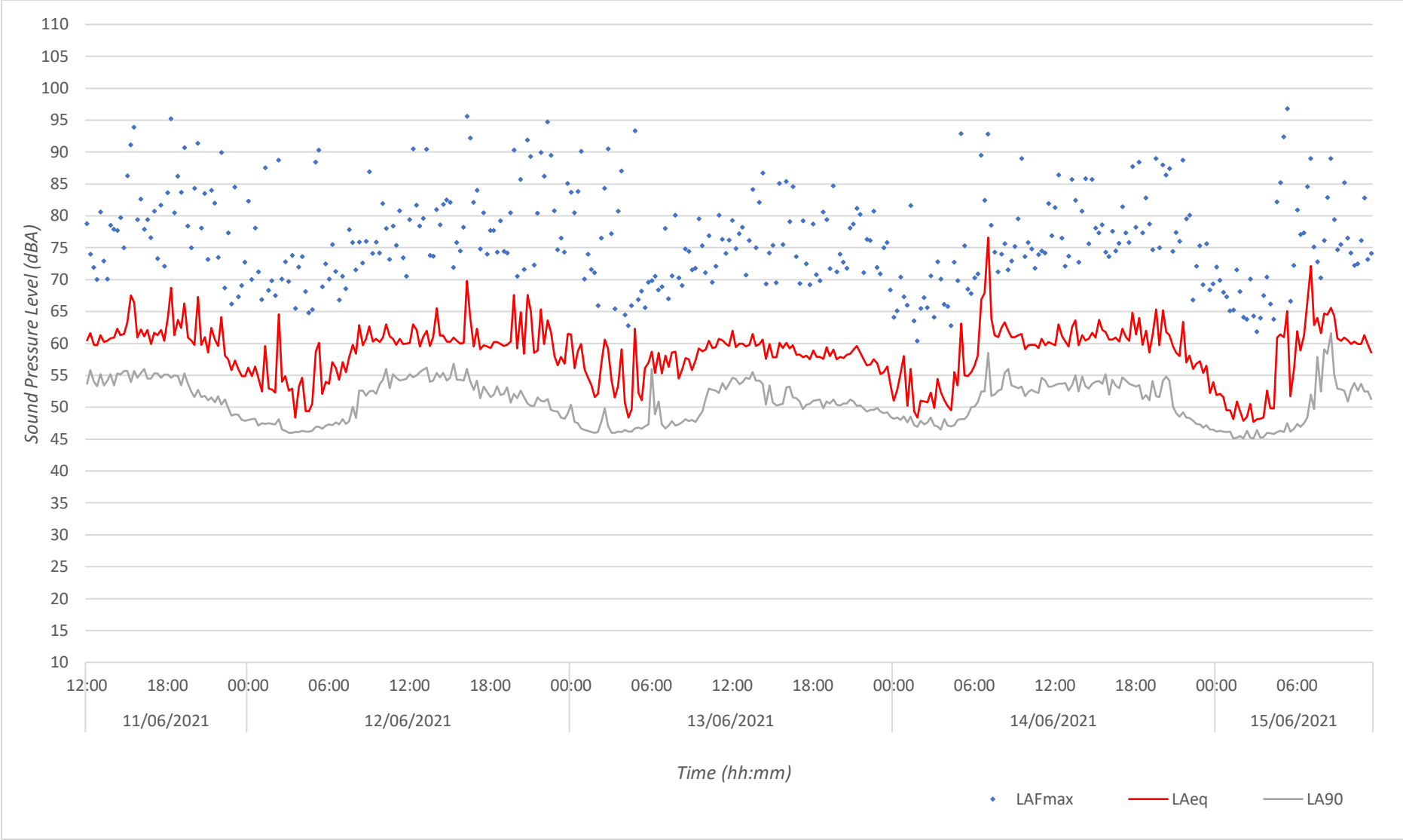


Figure 7: Measured Background Sound Levels Time History (M2): 11th – 15th June 2021

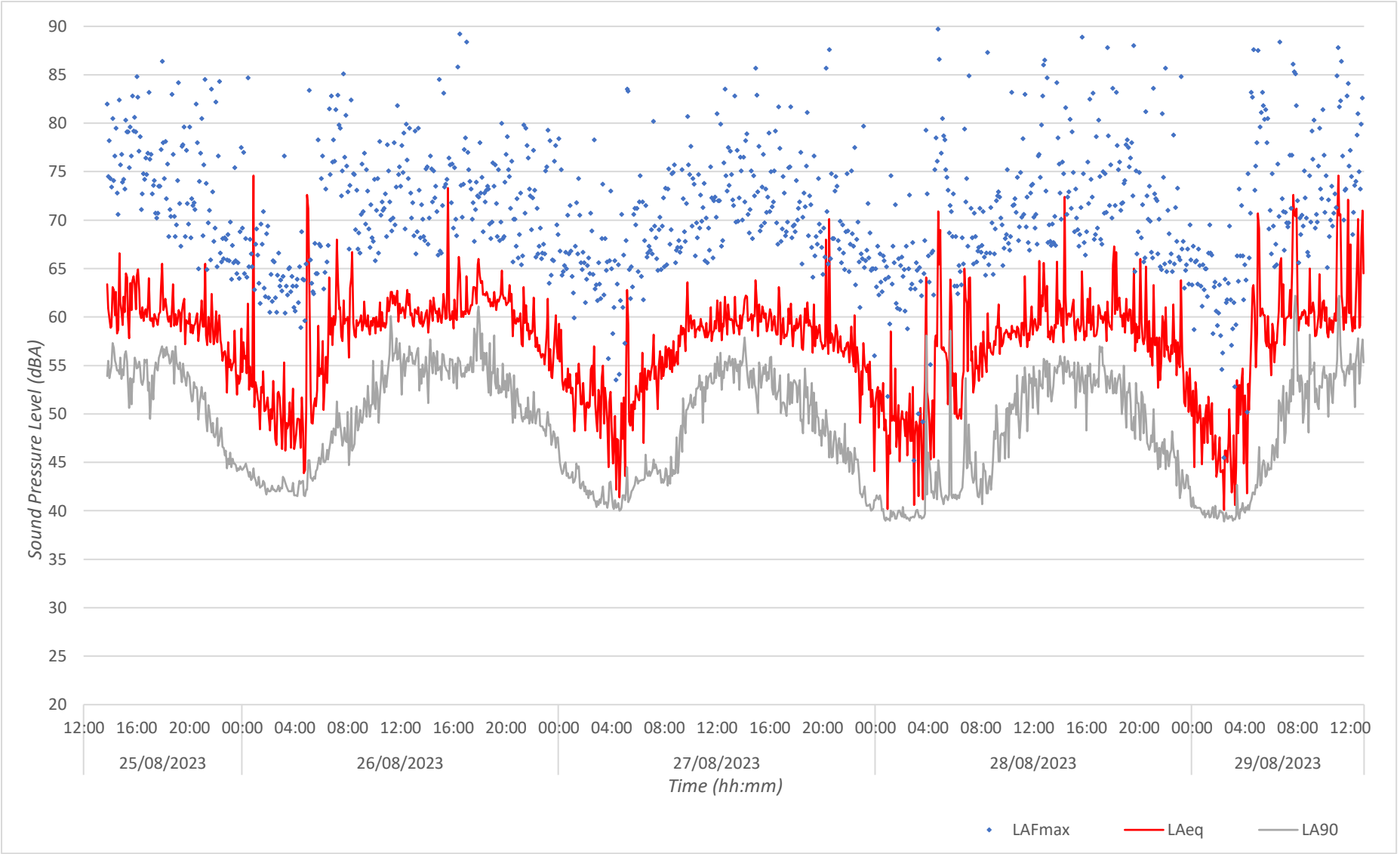


Figure 8: Measured Background Sound Levels Time History (M3): 25th – 29th August 2023

APPENDIX F – BS8233 Rigorous Design Calculations

Living Room Zone A

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - Leq - 1 hour	63.8	65.5	66.5	58.6	54.2	66
Night-time External Noise Level - Leq - 1 hour						
Night-time Lmax Noise Levels						

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	6	6	6	7	7	A
3	2.4	3	5	0.6	0.6	0.6	0.6	0.5	0.5	RT

Façade Construction		SRI (Sound Reduction Index)					Rw
Wall Construction	Brick and block, 75mm cavity, 60mm Fibreglass	31	46	43	49	56	49(44)
Roof Construction	Not Within Roof Space	0	0	0	0	0	N/A
Glazing Spec	8 / 16 / 8.8SC	24	31	40	49	51	42(35)
Ventilation Spec	Heat Recovery System	0	0	0	0	0	N/A

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	32	26.3	28.3	26.2	12.9	6.7	31.9
Night-time Internal Noise Level - LAeq	Target Value <							
Internal LAmax Noise Levels	Target Value <							

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**42(35)**	dB $R_{W(+Ctr)}$	*Laminated Double Glazing*
			8 / 16 / 8.8SC
Ventilation	**N/A**	$D_{n,e,w+Ctr}$	*Heat Recovery System*
			Multi-room Heat Recovery System

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Bedroom Zone A

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - Leq - 1 hour	63.8	65.5	66.5	58.6	54.2	66
Night-time External Noise Level - Leq - 1 hour	60.0	57.9	52.0	53.0	58.4	61
Night-time Lmax Noise Levels	78.4	80.3	81.2	77.8	77.3	83

Room Properties

Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time
2.7	2.4	4.3	4	0.6

Room Coefficient					
7	7	8	8	8	A
0.6	0.6	0.6	0.5	0.6	RT

Façade Construction		SRI (Sound Reduction Index)					Rw
Wall Construction	Brick and block, 75mm cavity, 60mm Fibreglass	31	46	43	49	56	49(44)
Roof Construction	Not Within Roof Space	0	0	0	0	0	N/A
Glazing Spec	10 / 16 / 8.8SC	27	32	43	46	48	44(38)
Ventilation Spec	Heat Recovery System	0	0	0	0	0	N/A

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	32	23.4	25.7	24.7	15.1	8.4	29.7
Night-time Internal Noise Level - LAeq	Target Value <	27	19.6	18.1	10.1	9.4	12.6	22.9
Internal LAmax Noise Levels	Target Value <	45	38.0	40.4	39.4	34.3	31.4	44.8

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**44(38)**	dB $R_{W(+Ctr)}$	*Laminated Double Glazing*
			10 / 16 / 8.8SC
Ventilation	**N/A**	$D_{n,e,w+Ctr}$	*Heat Recovery System*
			Multi-room Heat Recovery System

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{ls}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Living Room Zone B

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - Leq - 1 hour	58.8	60.5	61.5	53.6	49.2	61
Night-time External Noise Level - Leq - 1 hour						
Night-time Lmax Noise Levels						

Room Properties					Room Coefficient					
Width (m)	**Height (m)**	**Depth (m)**	**Glazing**	**Reverb Time**	**11**	**11**	**11**	**12**	**11**	**A**
4	2.4	4.7	9	0.6	**0.7**	**0.7**	**0.6**	**0.6**	**0.6**	**RT**

Façade Construction		SRI (Sound Reduction Index)					
		31	**46**	**43**	**49**	**56**	**49(44)**
Wall Construction	Brick and block, 75mm cavity, 60mm Fibreglass						
Roof Construction	Not Within Roof Space	**0**	**0**	**0**	**0**	**0**	**N/A**
Glazing Spec	6 / 16 / 9.5	**24**	**26**	**39**	**45**	**42**	**39(33)**
Ventilation Spec	Heat Recovery System	**0**	**0**	**0**	**0**	**0**	**N/A**

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	**Target Value <**	32	**21.1**	**28.2**	**21.7**	**10.8**	**10.4**	**29.8**
Night-time Internal Noise Level - LAeq	**Target Value <**							
Internal LAmax Noise Levels	**Target Value <**							

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**39(33)**	dB $R_{W(+Ctr)}$	*Double Glazing*
			6 / 16 / 9.5
Ventilation	**N/A**	$D_{n,e,w+Ctr}$	*Heat Recovery System*
			Multi-room Heat Recovery System

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{ls}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Bedroom Zone B

BS8233:2014 Façade Noise Break In Calculator

	125	250	500	1k	2k	dBA
Daytime External Noise Level - Leq - 1 hour	58.8	60.5	61.5	53.6	49.2	61
Night-time External Noise Level - Leq - 1 hour	55.0	52.9	47.0	48.0	53.4	56
Night-time Lmax Noise Levels	73.4	75.3	76.2	72.8	72.3	78

Room Properties					Room Coefficient					
Width (m)	Height (m)	Depth (m)	Glazing	Reverb Time	8	8	8	9	9	A
2.7	2.4	4.7	6.5	0.6	0.6	0.6	0.6	0.6	0.6	RT

Façade Construction		SRI (Sound Reduction Index)					Rw
Wall Construction	Brick and block, 75mm cavity, 60mm Fibreglass	31	46	43	49	56	49(44)
Roof Construction	Not Within Roof Space	0	0	0	0	0	N/A
Glazing Spec	6 / 16 / 9.5	24	26	39	45	42	39(33)
Ventilation Spec	Heat Recovery System	0	0	0	0	0	N/A

Calculation Results			125	250	500	1k	2k	dBA
Daytime Internal Noise Level - LAeq	Target Value <	32	21.5	28.2	22.4	11.4	10.3	30.0
Night-time Internal Noise Level - LAeq	Target Value <	27	17.7	20.6	7.9	5.7	14.5	23.3
Internal LAmax Noise Levels	Target Value <	45	36.0	42.9	37.1	30.6	33.4	45.1

Sound Insulation Requirement

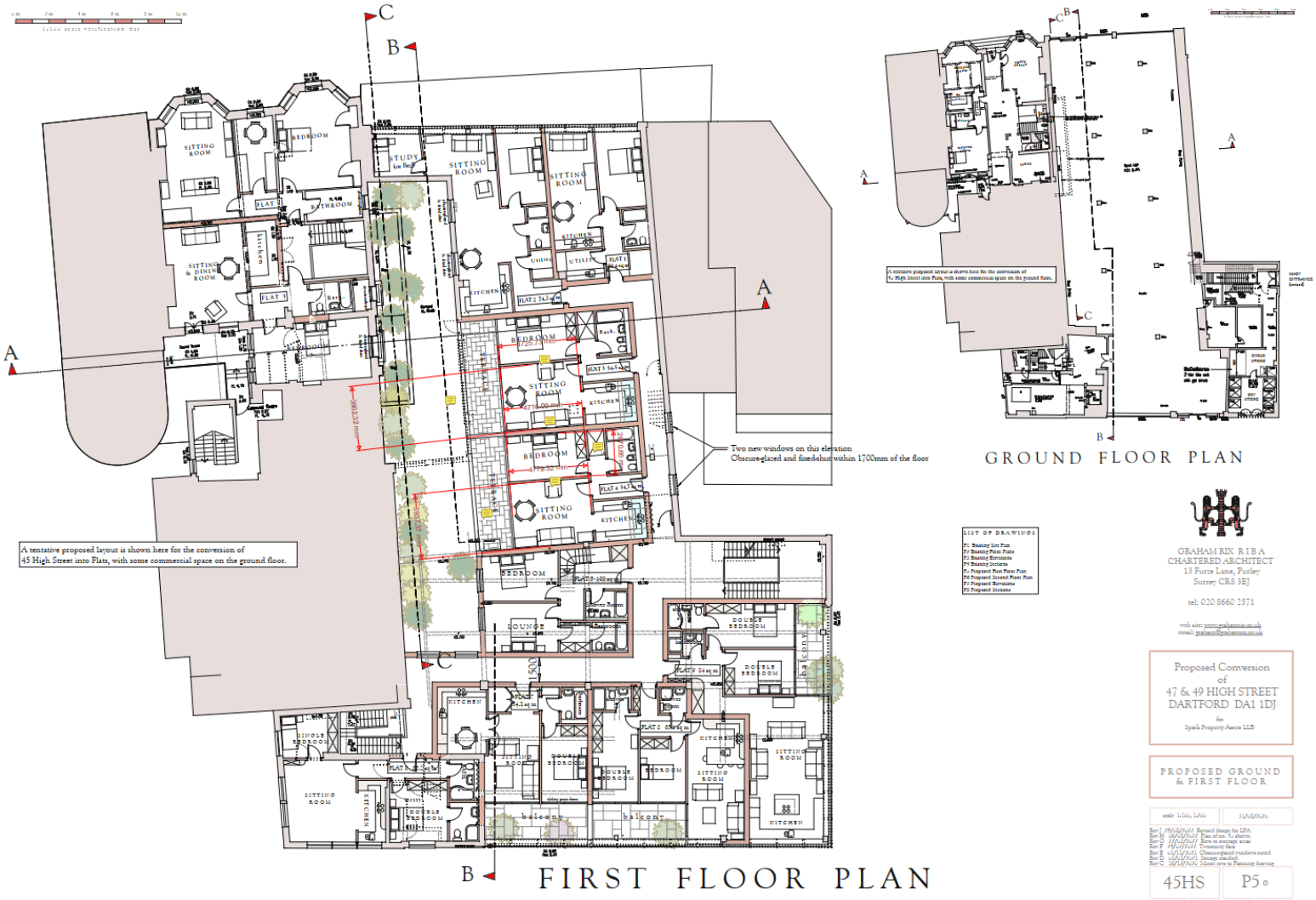
	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**39(33)**	dB $R_{W(+Ctr)}$	*Double Glazing*
			6 / 16 / 9.5
Ventilation	**N/A**	$D_{n,e,w+Ctr}$	*Heat Recovery System*
			Multi-room Heat Recovery System

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

APPENDIX G – Site Plans



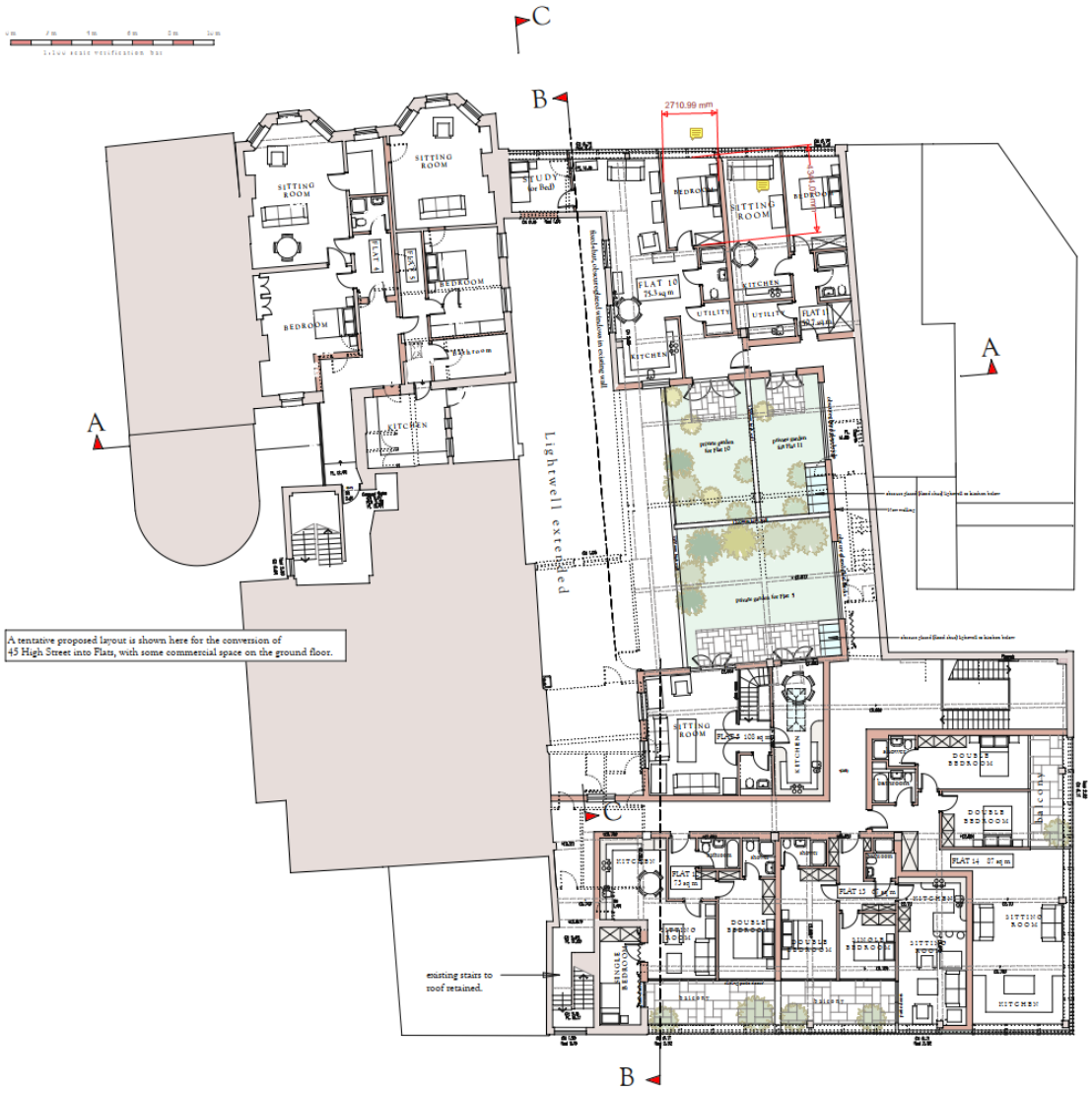


Figure 9: Site Plans Provided by 'Graham Rix RIBA'

APPENDIX H – Legislation, Policy and Guidance

Guidance for the assessment of noise affecting new residential development is given in the National Planning Policy Framework (NPPF). Section 15 of the NPPF states:

> *"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:*
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of…noise pollution."*

Section 185 further states:

> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *A. Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
>
> *B. Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

Section 187 states:

> *"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."*

To avoid and mitigate adverse noise effects on health arising from and impacting on new development, the NPPF makes reference to NPSE. The Noise Policy Statement for England (NPSE) was published in March 2010 and covers all forms of noise other than occupational noise.

The Noise Policy Statement for England (NPSE) states the following aims in paragraph 2.2.

> **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.*

The NPSE does not define the SOAEL numerically, stating in paragraph 2.22:

> *"It is not possible to have a single objective noise-based measure that defines 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. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the "NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

There is no local or national guidance on how the three terms should be defined numerically, it is for the assessor to collate and interpret appropriate guidance on noise, such as may be found in British Standards, and correlate the guidance with the concepts of NOEL, LOAEL and SOAEL.

BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings* suggests indoor ambient noise levels for dwellings in Table 4, Section 7.7.2. These are summarised below.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

BS8233 states that the guideline values given above are for 'noise without character', further stating:

> *"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

Table 4 of BS8233 also has accompanying notes that were subject to additions in ProPG. The relevant notes with the additions of ProPG are given below.

> *"NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,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 LAmax,F more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events."*

"NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal LAeq target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

APPENDIX I – Acoustic Terminology

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140 dB. Here are some examples of common environments and their typical noise levels.

Noise Level	Environment
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a moving car
60 to 70 dB(A)	Typical high street
100 to 110 dB(A)	Fire alarm at 1 meter away
140 dB(A)	Threshold of pain

Terminology

dB (decibel) – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level ($2x10^{-5}$ Pa – threshold of hearing).

$L_{Aeq,\,T}$ – The equivalent continuous sound pressure level over a stated period. It quantifies a fluctuating sound level over a given period as the equivalent continuous sound level over which the same amount of acoustic energy is contained over. This is A-weighted in order to assess human perception.

L_{Amax} – the maximum RMS A-weighted sound pressure level occurring within a specified time period; the time weighting is typically either Fast or Slow.

A-Weighting – A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

R_w – The Weighted Sound Reduction Index (R_w) is a number used to rate the effectiveness of a soundproofing system or material.

$D_{n,e,W}$ – The Weighted Sound Reduction Index specifically for ventilators.

C_{tr} – C_{tr} is a spectrum adaptation term which method is defined in BS EN ISO 717. The standard uses a reference curve to determine the weighted value of airborne sound insulation. The spectrum adaptation terms C and C_{tr} may are used to take into account different source spectra. 'C_{tr}' is the A-weighted urban traffic noise spectrum.

APPENDIX J – Sound Insulation Models

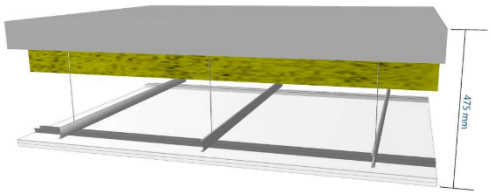
Roof / Ceiling Enhancement

Sound Insulation Prediction (v9.0.22)

INSUL

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within Rw ±3 dB
Peak Acoustics - Key No. 5547
Job Name:
Job No.: Initials:kyle
Date:28/06/2021
File Name:

Notes:



Rw 65 dB
C 0 dB
Ctr -2 dB

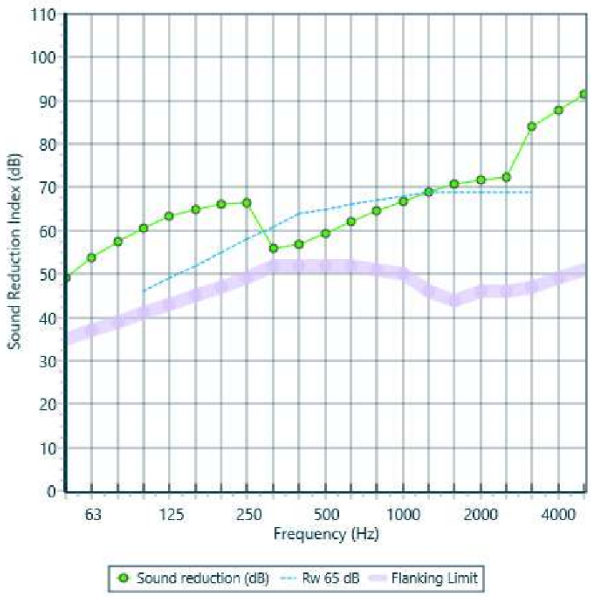
Mass-air-mass resonant frequency = =20 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 256 kg/m²

System description

Panel 1 : 1 x 100 mm Concrete

Frame: Suspended Light Steel Grid (3.5E2 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 350 mm , 1 x Fibreglass (10kg/m3) Thickness 100 mm ...
Panel 2 : 2 x 12.5 mm Gyproc SoundBloc 12.5mm

freq.(Hz)	R(dB)	R(dB)
50	49	
63	54	52
80	57	
100	61	
125	63	63
160	65	
200	66	
250	66	60
315	56	
400	57	
500	59	59
630	62	
800	64	
1000	67	66
1250	69	
1600	71	
2000	72	72
2500	72	
3150	84	
4000	88	87
5000	92	



Ground to First Floor

Sound Insulation Prediction (v9.0.22)

INSUL

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within Rw ±3 dB
Peak Acoustics - Key No. 5547
Job Name:
Job No.: Initials:kyle
Date:28/06/2021
File Name:Ground to First floor.ixl

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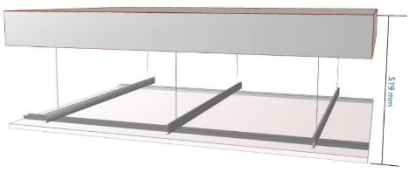


Rw 58 dB
C -1 dB
Ctr -5 dB

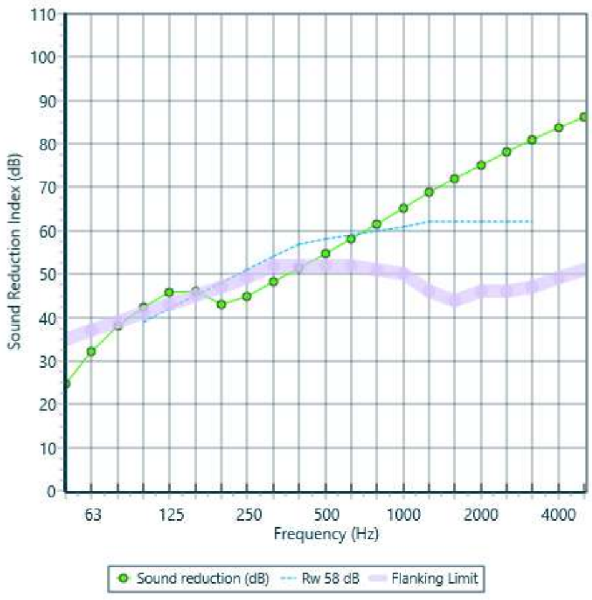
Mass-air-mass resonant frequency = =41 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 358 kg/m²

System description

Panel 1 : 1 x 150 mm Concrete

Frame: Suspended Light Steel Grid (3.5E2 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 350 mm
Panel 2 : 1 x 19 mm ineral fibre ceiling tile (Generic)

freq.(Hz)	R(dB)	R(dB)
50	25	
63	32	29
80	38	
100	42	
125	46	44
160	46	
200	43	
250	45	45
315	48	
400	51	
500	55	54
630	58	
800	61	
1000	65	64
1250	69	
1600	72	
2000	75	74
2500	78	
3150	81	
4000	84	83
5000	86	



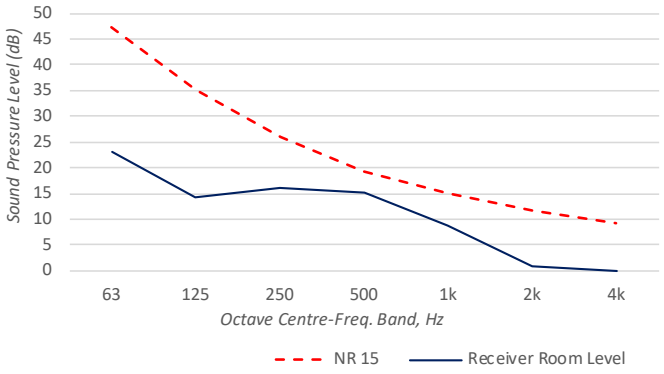
APPENDIX K – Sound Transmission Calculations

Sound Transmission Calculation

Description:
Calculation of sound trasmission from roof plant to habitable rooms below.

1/1 Octave Centre-Freq. Band	Hz	63	125	250	500	1k	2k	4k	dBA
Roof Plant, dB	dB	72	74	73	71	72	70	64	**76**
R1 Proposed Roof/Ceiling	R, dB	52	63	60	59	66	72	87	
R2	R, dB	0	0	0	0	0	0	0	
R3	R, dB	0	0	0	0	0	0	0	
Comp R	Rcomp, dB	-52	-63	-60	-59	-66	-72	-87	
Receiver Room Level	**dB**	**23**	**14**	**16**	**15**	**9**	**1**	**-20**	**15**

Partition & Receiver Room Details		
S1	m2	40.0
S2	m2	0.0
S3	m2	0.0
S Total	m2	40.0
S Shared Area	m2	40.0
Receiver Room Volume	m3	60.0
RT60	s	0.5
Absorptive Area	A, m2	19.3
Source Room Level	dBA	76
Receiver Room Level	dBA	**15.1**



Sound Transmission Calculation

Description:
Calculation of sound trasmission from Iceland supermarket to habitable rooms above.

1/1 Octave Centre-Freq. Band	Hz	63	125	250	500	1k	2k	4k	dBA
Supermarket Noise, dB	dB	40	50	62	65	59	54	49	**65**
R1 Ground / First floor	R, dB	29	44	45	54	64	74	83	
R2	R, dB	0	0	0	0	0	0	0	
R3	R, dB	0	0	0	0	0	0	0	
Comp R	Rcomp, dB	-29	-44	-45	-54	-64	-74	-83	
Receiver Room Level	**dB**	**14**	**9**	**20**	**14**	**-2**	**-17**	**-31**	**15**

Partition & Receiver Room Details		
S1	m2	40.0
S2	m2	0.0
S3	m2	0.0
S Total	m2	40.0
S Shared Area	m2	40.0
Receiver Room Volume	m3	60.0
RT60	s	0.5
Absorptive Area	A, m2	19.3
Source Room Level	dBA	65
Receiver Room Level	dBA	**14.6**