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Architectural & Environmental Acousticians

Noise & Vibration Engineers

PLANNING CONDITION 42

STATION HILL, PHASE 1, BLOCK E AND F

MIDGARD LTD

RP02-19194-R3

# PLANNING CONDITION 42

| | |
|---|---|
| **PROJECT:** | STATION HILL, PHASE 1, BLOCK E AND F |
| **CLIENT:** | MIDGARD LTD |
| **CLIENT ADDRESS:** | 4 ELSTREE WAY<br>BOREHAMWOOD<br>HERTFORDSHIRE<br>WD6 1RN |
| **COMPANY ADDRESS:** | CASS ALLEN ASSOCIATES LTD<br>BEDFORD I-LAB<br>PRIORY BUSINESS PARK<br>BEDFORD<br>MK44 3RZ |

## DOCUMENT CONTROL:

| REVISION | ISSUE DATE | REPORT BY | CHECKED BY | NOTES |
|---|---|---|---|---|
| 0 | 21 February 2020 | Ronny Ospina Orozco, MSc TechIOA, Acoustics Consultant | Chris McNeillie, MSc CEng MIOA, Director | Initial issue |
| 1 | 25 February 2020 | Fabio Lassandro, MSc BEng MIOA, Senior Acoustics Consultant | Chris McNeillie, MSc CEng MIOA, Director | Removed Conditions 60-61. Included proposed glazing performance |
| 2 | 02 March 2020 | Fabio Lassandro, MSc BEng MIOA, Senior Acoustics Consultant | Chris McNeillie, MSc CEng MIOA, Director | Included currently proposed glazing |
| 3 | 26 May 2021 | Fabio Lassandro, MSc BEng MIOA, Senior Acoustics Consultant | Chris McNeillie, MSc CEng MIOA, Director | New updated plans in Appendix 1 |
| 4 | 11 June 2021 | Fabio Lassandro, MSc BEng MIOA, Senior Acoustics Consultant | Chris McNeillie, MSc CEng MIOA, Director | Info about optimised scheme |

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# 1. INTRODUCTION

1.1 Cass Allen has been instructed by Midgard Ltd to assess the acoustic design of a new development at Station Hill, Phase 1, Block E and F.

1.2 The assessment has been carried out in accordance with the requirements of pre-commencement noise related Planning Condition 42 that have been imposed on the development. The condition states:

> *Condition 42*
>
> *No development shall be commenced (excepting demolition and groundworks) before details of a sound attenuation scheme informed by an assessment of the current noise environment, for protecting the dwellings from the external noise environment of the area has been submitted to and approved in writing by the Local Planning Authority. The scheme itself shall be designed, specified and constructed so that the sound insulation performance of the structure and the layout of the dwellings are such that the indoor ambient noise levels do not exceed the values detailed in Table 4 of BS 8233:2014 and do not exceed 45dB LAmax for bedrooms within any dwelling. Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded. The development shall not be carried out other than in accordance with the approved scheme which shall be completed before the building to which it relates is first occupied, unless the Local Planning Authority otherwise agrees in writing. The scheme shall be retained as approved at all times thereafter.*

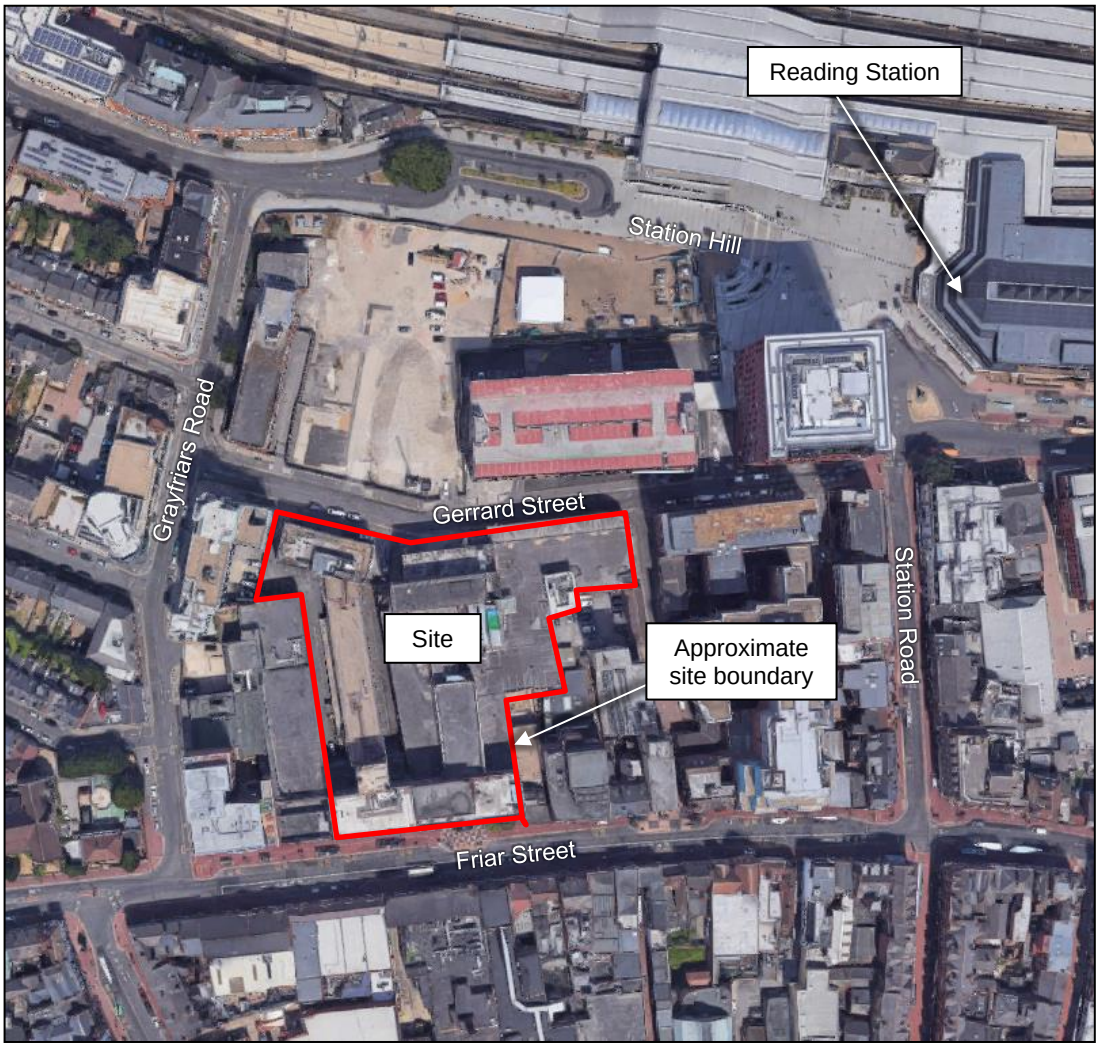
1.3 This report contains technical terminology; a glossary of terms can be found at www.cassallen.co.uk/glossary.

## 2. DEVELOPMENT DESCRIPTION

2.1 The site is located in a mixed-use area bounded to the north and south by Gerrard Street and Friar Street respectively. To the west of the site is Greyfriars Road and to the east is Station Road. There are also commercial premises along the main roads. Reading Train Station is approximately 140m to the north of the site.

2.2 The site and the surrounding area are shown in Figure 1 below.

**Figure 1 Site and Surrounding Area**




2.3 The original Phase 1 of the Station Hill Development consisted of two residential blocks (Block E and F). The residential blocks are up to 12 storeys in height and are connected by a basement. An Optimised Scheme is now been developed.

2.4 The Optimised Scheme consists of providing an additional 61 residential units from the 538 scheme consented in 2019. This is achieved by incorporating two additional levels to the middle wing of block E and raising the southern wing by a single storey. Furthermore an additional storey has been added to Block F to allow for 15 additional units.

2.5 The increase in residential units has resulted in a slight reduction to the amount of commercial/retail space. This is however still provided along the LG and Ground level of the build footprints where the building meet public footway. This has increased the types of commercial uses permitted at ground and lower ground levels and retained an active frontage.

2.6 The Optimised scheme improves internal amenity for residents with ease of access, increased visibility and elevations to courtyards while also increasing the choice of external amenity spaces. Cycle storage consolidated to lower ground floor and directly off Garrard Street.

2.7 A current drawing of the development layout is shown Appendix 1.

2.8 To address the requirements of the noise related planning conditions, noise affecting the habitable areas of the development and facade design (as per Condition 42) has been assessed in this report;

# 3. PLANNING CONDITION 42

**Design criteria – Internal noise levels**

3.1 Planning Condition 42 makes reference to BS8233:2014 2014 '*Guidance on sound insulation and noise reduction for buildings*' (BS8233).

3.2 The criteria in Planning Condition 42 (in-line with BS8233 as referenced) are summarised in Table 1 below.

**Table 1 Planning Condition 42 Criteria**

| Activity | Location | 07:00 to 23:00 | 23:00 to 07:00 |
|---|---|---|---|
| Resting | Living room | 35 dB LAeq,16hour | - |
| Dining | Dining room/area | 40 dB LAeq,16hour | - |
| Sleeping (daytime resting) | Bedroom | 35 dB LAeq,16hour | 30 dB LAeq,8hour |
| Sleeping (night time) | Bedroom | - | 45 dB LAmax |

**Note 1** Planning Condition 42 states: "Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS8233:2014 recommended internal levels, the scheme shall include the provision of alternative mechanical ventilation with minimum performance equivalent to mechanical heat recovery system with cool air bypass".

3.3 The outside to inside noise reduction of a façade with an open window is approximately 15 dB. Consequently, the following acoustic design criteria have been adopted for the development:

- Average noise levels in living rooms and dining rooms during the day should not exceed 35 dB LAeq,0700-2300hrs and 40 dB LAeq,0700-2300hrs respectively;
- Living room and dining room façades exposed to external noise levels of 55 dB LAeq,0700-2300hrs and 60 dB LAeq,0700-2300hrs respectively (or greater) will require mechanical ventilation[1] to achieve the required internal noise levels with the 5 dBA tolerance as per Planning Condition 42;
- Average noise levels in bedrooms should not exceed 35 dB LAeq,0700-2300hrs during the day and 30 dB LAeq,2300-0700hrs during the night;
- Bedroom façades exposed to external noise levels of 55 dB LAeq,0700-2300hrs during the day and 50 dB LAeq,2300-0700 during the night (or greater) will require mechanical ventilation to achieve the required internal noise levels with the 5 dBA tolerance as per Planning Condition 42.
- Maximum noise levels in bedrooms should not normally exceed 45 dB LAmax as per Planning Condition 42. This limit is typically recommended for night time periods in order to prevent adverse effect on the quality of sleep for residents. Therefore night time LAmax levels have been assessed.

[1] Assuming 15 dB sound reduction provided by partially open windows, as per Section G.1 of BS8233.

**Existing site noise levels**

3.4 A detailed baseline noise survey was carried out by Hoare Lea (HL) as part of their Stage 4A report ref. '*REP-1010694-5A-TH-20190708'* ("the HL report"). The results of the HL's survey and façade levels are included in Appendix 2.

3.5 The survey included both short-term attended and long-term noise monitoring over a 14 day period. The survey measured traffic and railway noise emissions from the surrounding roads and railway lines; as well as general background levels at the site. Results are detailed in Section 4 of the HL report.

3.6 Additional noise surveys were carried out by Cass Allen on the 22nd August 2019 and on the 7th February 2020 to verify and augment the data from the HL report. Details of the supplementary Cass Allen survey can be seen in Appendix 3. The survey results were in-line with the data from the HL report.

3.7 Typical noise levels at the facades of the development have been calculated based on the data from the HL and Cass Allen surveys.

3.8 Façades with direct line of sight to the nearby roads will be exposed to the highest noise levels. The noise levels at these locations are summarised as follows:

- Façades on northern edge of the site, facing Gerrard Street:
  - Average noise levels during the daytime – 68 dB LAeq,0700-2300hrs;
  - Average noise levels during the night-time – 59 dB LAeq,2300-0700hrs;
  - Typical maximum noise levels during the night-time – 76 dB LAmax.
- Façades on southern edge of the site, facing Friar Street:
  - Average noise levels during the daytime – 66 dB LAeq,0700-2300hrs;
  - Average noise levels during the night-time – 66 dB LAeq,2300-0700hrs;
  - Typical maximum noise levels during the night-time – 89 dB LAmax.

3.9 The facades facing Friar Street are subject to the highest noise levels. The main noise sources at this location are vehicle movements, and during the evening and night-time; noise breakout from nightclubs directly opposite the site and noise from nightclub patrons on the street.

**Internal noise levels in noise-sensitive rooms**

3.10 The façades of the residential elements of the development will be constructed using the wall details as specified in the project drawings which have been included in Appendix 4. The sound insulation performance of the external wall constructions was predicted using INSUL v9.0 façade modelling software. Results show that the non-glazed elements of the façade build-ups achieve approximately 53 dB Rw+Ctr. Consequently, internal noise levels will be dictated by external noise ingress via glazing and ventilators.

3.11 The ventilation scheme for the project is Mechanical Ventilation with Heat Recovery (MVHR) i.e. System 4 from Building Regulations Part F with the provision of openable windows for purge ventilation. Therefore, there will be no background ventilators installed in the external façades (e.g. trickle ventilators etc).

3.12 It is understood that the MVHR system will be designed to offset overheating during warmer periods of the year keeping the windows close in order to comply with Planning Condition 42.

3.13 Calculations were carried out using façade modelling software in accordance with the "more rigorous" methodology given in BS8233:2014 to calculate the sound insulation performance required of the glazing and ventilation to achieve the nominated internal noise criteria (Table 1) in habitable rooms of the development.

3.14 The calculations were carried out based on the dimensions/details for facade elements taken from project drawings.

3.15 A summary of the minimum glazing specification required to achieve the internal noise criteria (Table 1) are summarised in Table 2 below.

**Table 2 Acoustic Requirements for Glazing**

| Glazing | Glazing Minimum Performance Requirements (inc. Frames) |
|---|---|
| GL01 - Lower Specification | 29 dB Rw+Ctr |
| GL02 – Medium Specification | 37 dB Rw+Ctr |
| GL03 – Higher Specification | 43 dB Rw+Ctr |

3.16 The results of the façade calculations are shown in Appendix 5 which shows that the internal noise levels within habitable rooms will be compliant with the criteria in Table 1. The acoustic data of the proposed glazing (excluding frames) are also presented in Appendix 6.

3.17 Based on the results of the calculations, a specification has been developed showing the sound insulation performance requirements for all facades of the development. The façade specification is shown in Appendix 7.

3.18 In summary, acceptable internal noise levels compliant with Planning Condition 42 will be achieved using the glazing and ventilation specification detailed in this report.

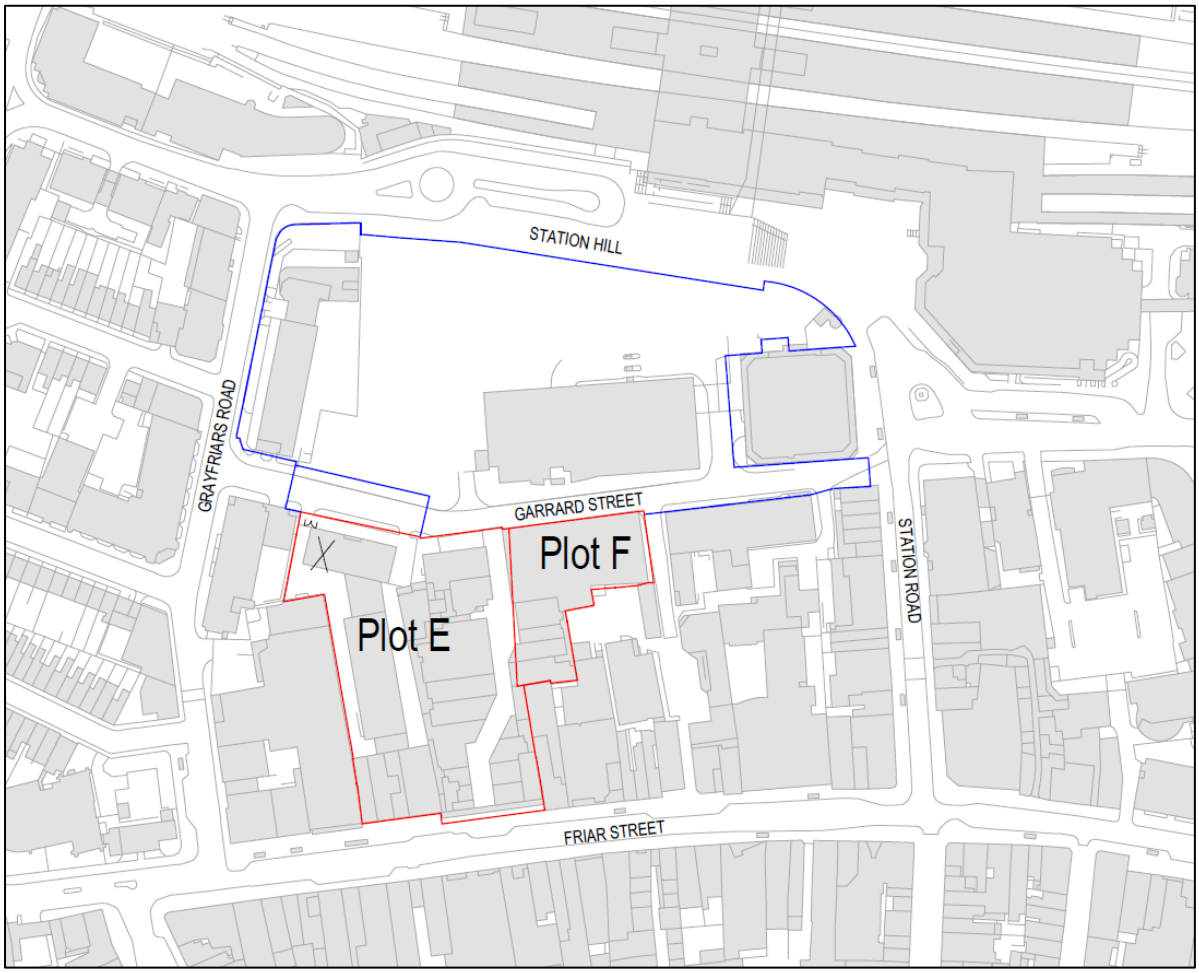
# 4. CONCLUSIONS

4.1 Cass Allen Associates was instructed by Midgard Ltd assess the acoustic design of the proposed development as required by Planning Condition 42.

4.2 Internal noise levels in habitable rooms of the development as a result from external noise ingress have been assessed as per the requirements of Planning Condition 42. Compliant noise levels will be achieved in all habitable rooms in the development using the proposed glazing specification given in Table 2 and the ventilation strategy as specified in Section 3.11 and 3.12.

4.3 It is our view that this report contains the information required to discharge Planning Condition 42 imposed on the development.

# Appendix 1 Site Layout



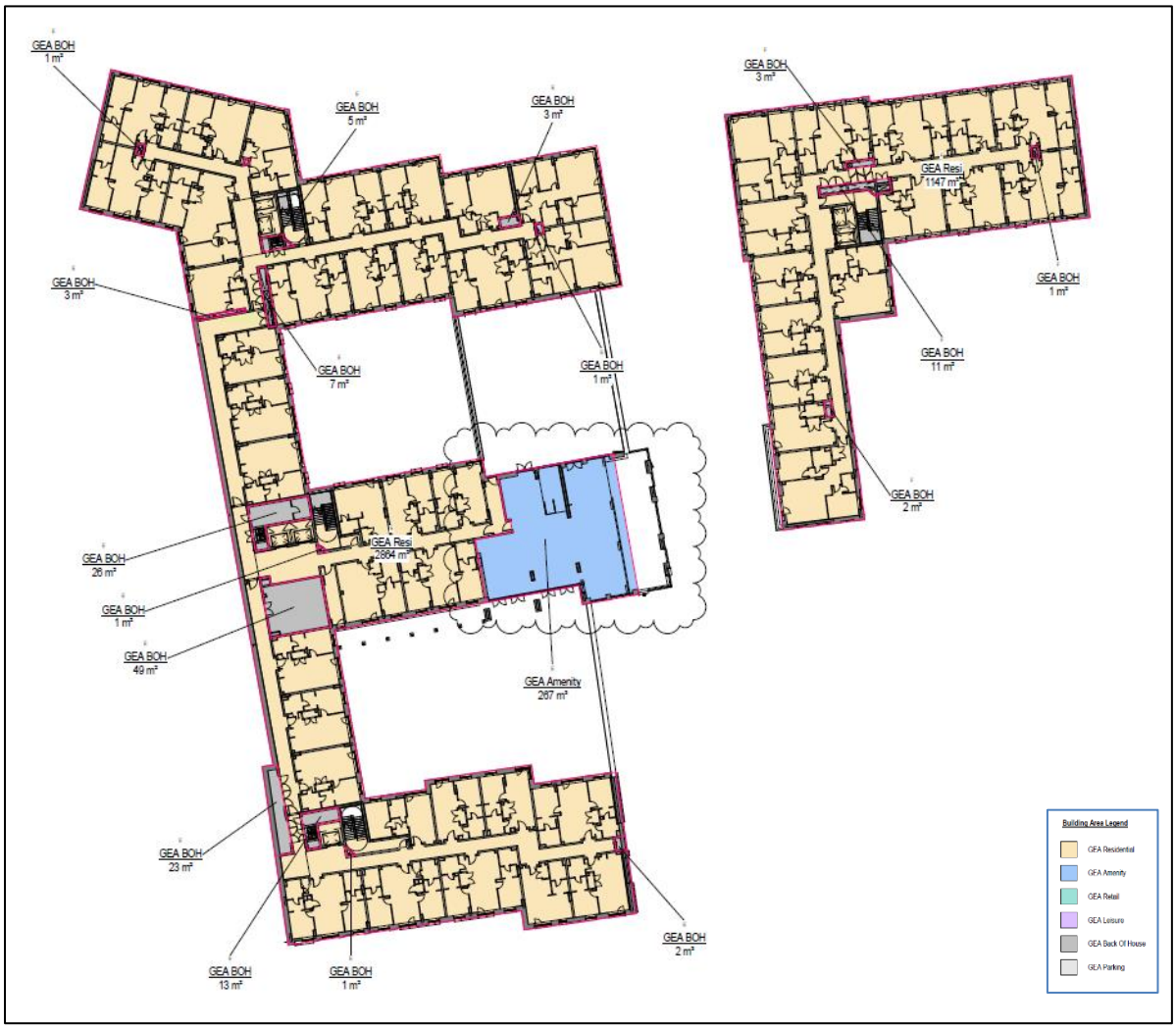

**Lower Ground Floor**

## Mezzanine

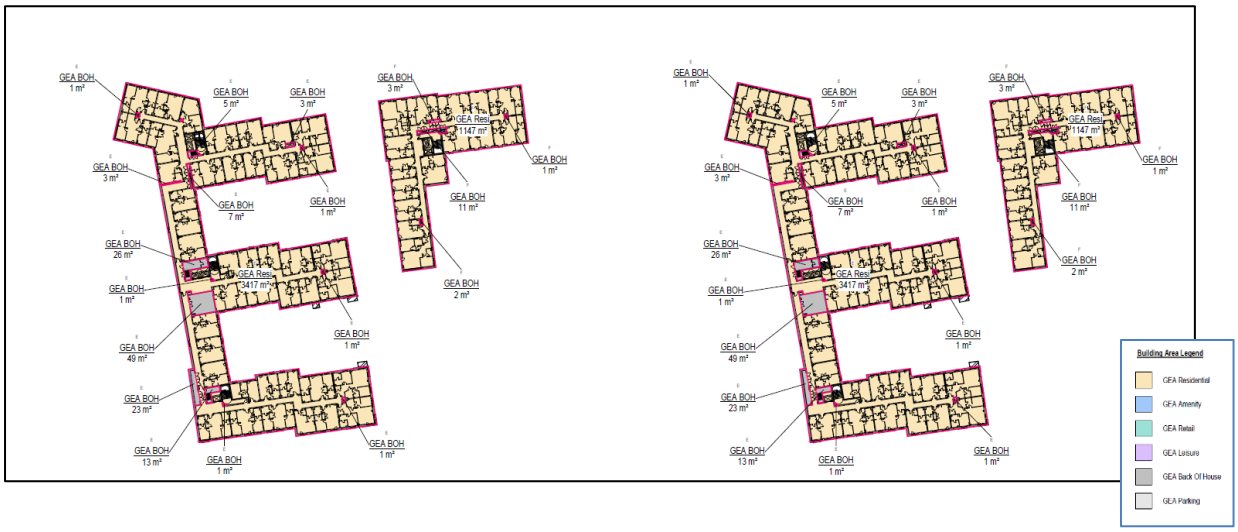
Storage
Resident Entry Lobby
Plant
Residential Entry Lobby
Secure Storage
Up from Garrard Street
Down to Garrard Street
Up to / Down from Upper podium
Tree pit
Commercial Unit
Building Area Legend
GEA Residential
GEA Amenity
GEA Retail
GEA Leisure
GEA Back Of House
GEA Parking

## Ground Floor

## Level 01

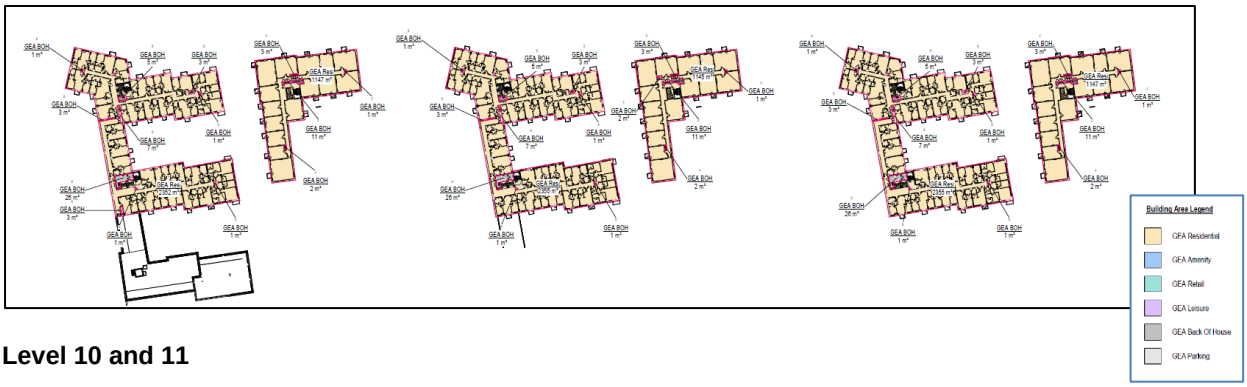



## Level 02 and 03

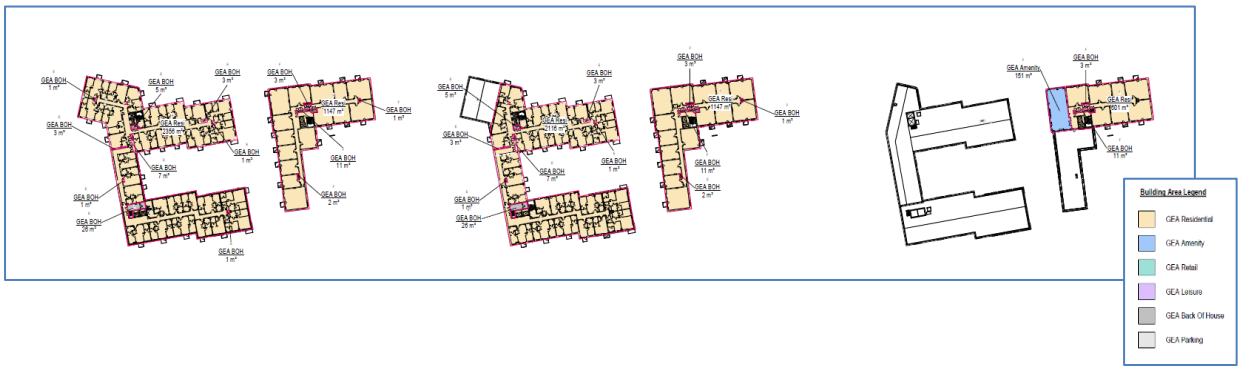


## Level 04, 05 and 06

## Level 07, 08 and 09




## Level 10 and 11



# Appendix 2 Hoare Lea Survey Results and Façade Levels

| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 2.9 | X | 4.9 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Bedroom | Room Volume = | 33.9 | m3 | | | |
| **RUN REF:** | Lamax | Partition Area = | 8.6 | m2 | | | |
| **VARIANT:** | Higher Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 89.2 | 63.4 | 69.3 | 75.4 | 83.6 | 85.5 | 82.2 | 74.9 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 63.4 | 69.3 | 75.4 | 83.6 | 85.5 | 82.2 | 74.9 | **Direct input** |

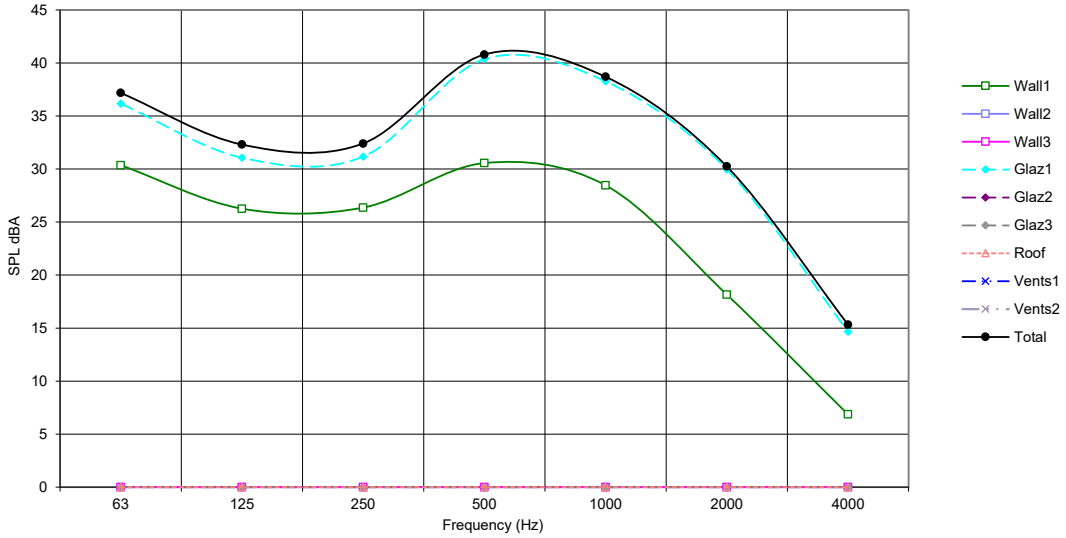
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 5.4 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 13% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 43 - 86.2SIL (24AR) 66.2SIL - With Frame | 3.3 | 25 | 36 | 42 | 41 | 45 | 50 | 58 | 87% | 43dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 28 | 39 | 45 | 45 | 49 | 54 | 62 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 44.7 | 37 | 32 | 32 | 41 | 39 | 30 | 15 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **44.7** | 37 | 32 | 32 | 41 | 39 | 30 | 15 | | | | |

**Element contribution to total internal noise level**



| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 2.9 | X | 4.9 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Bedroom | Room Volume = | 33.9 | m3 | | | |
| **RUN REF:** | LAeq | Partition Area = | 8.6 | m2 | | | |
| **VARIANT:** | Higher Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 66.0 | 45.4 | 54.2 | 55.2 | 61.5 | 61.1 | 57.6 | 50.2 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 45.4 | 54.2 | 55.2 | 61.5 | 61.1 | 57.6 | 50.2 | **Direct input** |

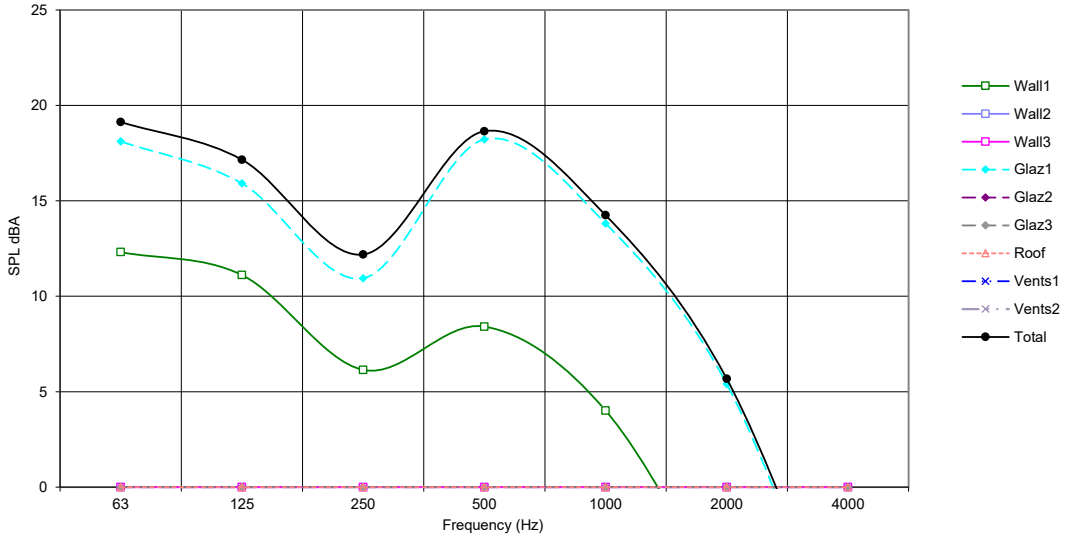
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 5.4 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 17% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 43 - 86.2SIL (24AR) 66.2SIL - With Frame | 3.3 | 25 | 36 | 42 | 41 | 45 | 50 | 58 | 81% | 43dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 28 | 39 | 45 | 45 | 49 | 54 | 62 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 24.0 | 19 | 17 | 12 | 19 | 14 | 6 | -9 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **24.0** | 19 | 17 | 12 | 19 | 14 | 6 | -9 | | | | |

**Element contribution to total internal noise level**



| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 7.1 | X | 5.4 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Living Room - Kitchen | Room Volume = | 91.8 | m3 | | | |
| **RUN REF:** | LAeq | Partition Area = | 21.6 | m2 | | | |
| **VARIANT:** | Higher Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 66.0 | 48.1 | 51.6 | 57.2 | 60.8 | 60.5 | 58.4 | 53.1 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 48.1 | 51.6 | 57.2 | 60.8 | 60.5 | 58.4 | 53.1 | **Direct input** |

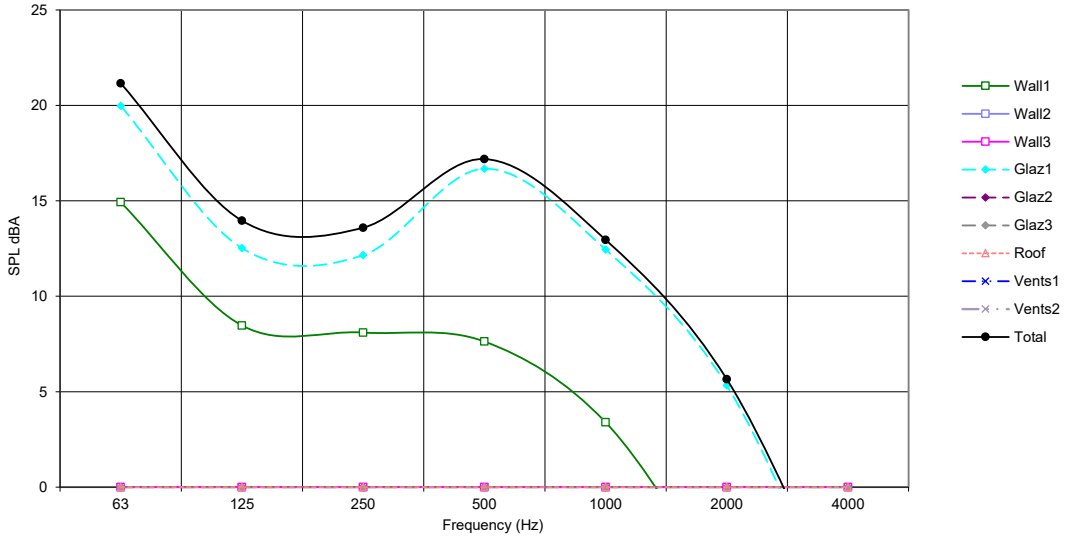
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 14.3 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 20% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 43 - 86.2SIL (24AR) 66.2SIL - With Frame | 7.3 | 25 | 36 | 42 | 41 | 45 | 50 | 58 | 77% | 43dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 29 | 39 | 45 | 45 | 49 | 54 | 62 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 24.1 | 21 | 14 | 14 | 17 | 13 | 6 | -7 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **24.1** | 21 | 14 | 14 | 17 | 13 | 6 | -7 | | | | |

**Element contribution to total internal noise level**



| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 2.9 | X | 4.9 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Bedroom | Room Volume = | 33.9 | m3 | | | |
| **RUN REF:** | Lamax | Partition Area = | 8.6 | m2 | | | |
| **VARIANT:** | Medium Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 75.9 | 57.5 | 63.0 | 62.4 | 69.5 | 67.6 | 71.4 | 67.9 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 57.5 | 63.0 | 62.4 | 69.5 | 67.6 | 71.4 | 67.9 | **Direct input** |

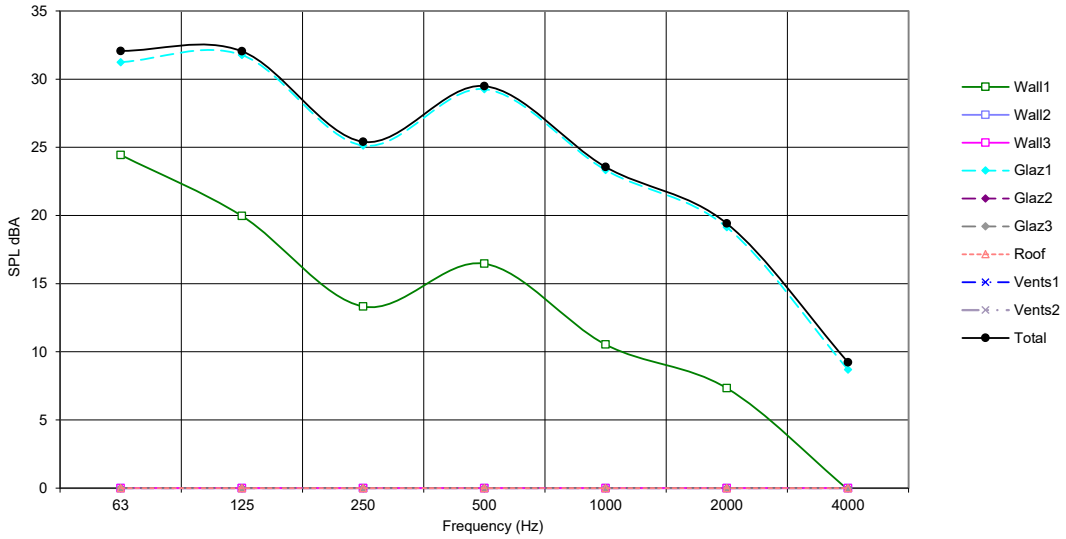
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 5.4 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 10% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 39 - 44.2 24 66.2 - With frames | 3.3 | 24 | 29 | 35 | 38 | 42 | 50 | 57 | 90% | 39dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 27 | 33 | 39 | 42 | 46 | 54 | 61 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 36.8 | 32 | 32 | 25 | 29 | 24 | 19 | 9 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **36.8** | 32 | 32 | 25 | 29 | 24 | 19 | 9 | | | | |

**Element contribution to total internal noise level**



| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 2.9 | X | 4.9 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Bedroom | Room Volume = | 33.9 | m3 | | | |
| **RUN REF:** | LAeq | Partition Area = | 8.6 | m2 | | | |
| **VARIANT:** | Medium Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 58.9 | 40.0 | 45.5 | 46.9 | 52.0 | 53.6 | 53.3 | 49.3 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 40.0 | 45.5 | 46.9 | 52.0 | 53.6 | 53.3 | 49.3 | **Direct input** |

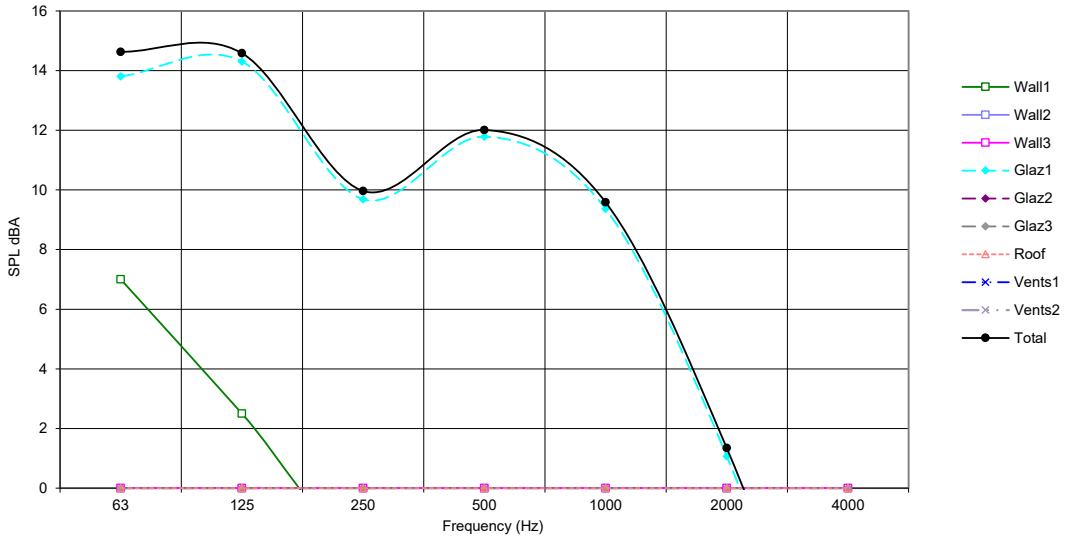
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 5.4 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 9% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 39 - 44.2 24 66.2 - With frames | 3.3 | 24 | 29 | 35 | 38 | 42 | 50 | 57 | 85% | 39dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 27 | 33 | 39 | 42 | 46 | 54 | 61 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 19.7 | 15 | 15 | 10 | 12 | 10 | 1 | -9 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **19.7** | 15 | 15 | 10 | 12 | 10 | 1 | -9 | | | | |

**Element contribution to total internal noise level**



| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 7.1 | X | 5.4 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Living Room - Kitchen | Room Volume = | 91.8 | m3 | | | |
| **RUN REF:** | LAeq | Partition Area = | 21.6 | m2 | | | |
| **VARIANT:** | Medium Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 68.0 | 50.6 | 53.4 | 56.7 | 60.5 | 63.7 | 62.0 | 56.6 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 50.6 | 53.4 | 56.7 | 60.5 | 63.7 | 62.0 | 56.6 | **Direct input** |

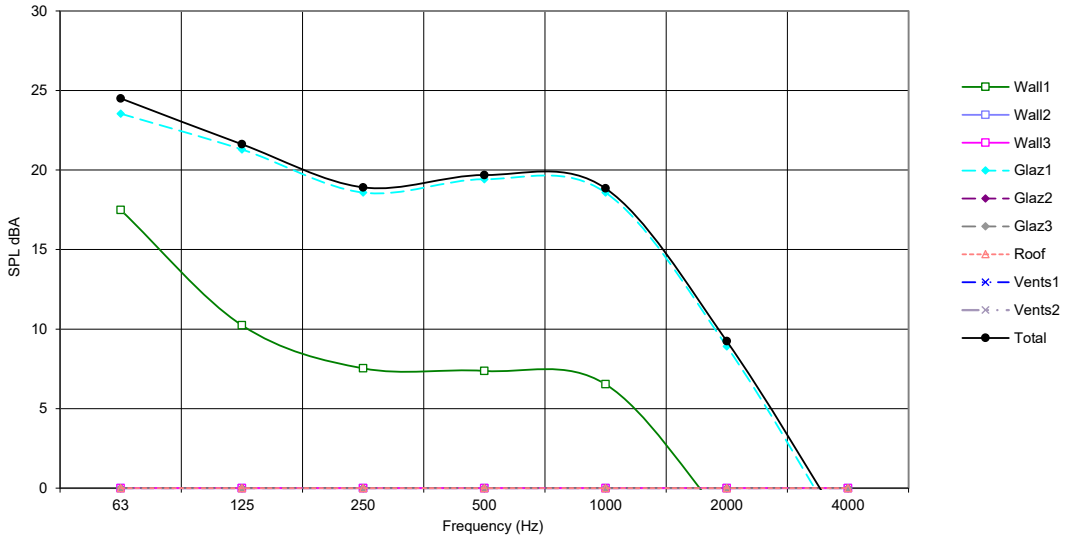
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 14.3 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 12% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 39 - 44.2 24 66.2 - With frames | 7.3 | 24 | 29 | 35 | 38 | 42 | 50 | 57 | 87% | 39dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 28 | 33 | 39 | 42 | 46 | 54 | 61 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 28.3 | 25 | 22 | 19 | 20 | 19 | 9 | -3 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **28.3** | 25 | 22 | 19 | 20 | 19 | 9 | -3 | | | | |

**Element contribution to total internal noise level**



| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 2.9 | X | 4.9 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Bedroom | Room Volume = | 33.9 | m3 | | | |
| **RUN REF:** | Lamax | Partition Area = | 8.6 | m2 | | | |
| **VARIANT:** | Lower Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 64.9 | 46.5 | 52.0 | 51.4 | 58.5 | 56.6 | 60.4 | 56.9 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 46.5 | 52.0 | 51.4 | 58.5 | 56.6 | 60.4 | 56.9 | **Direct input** |

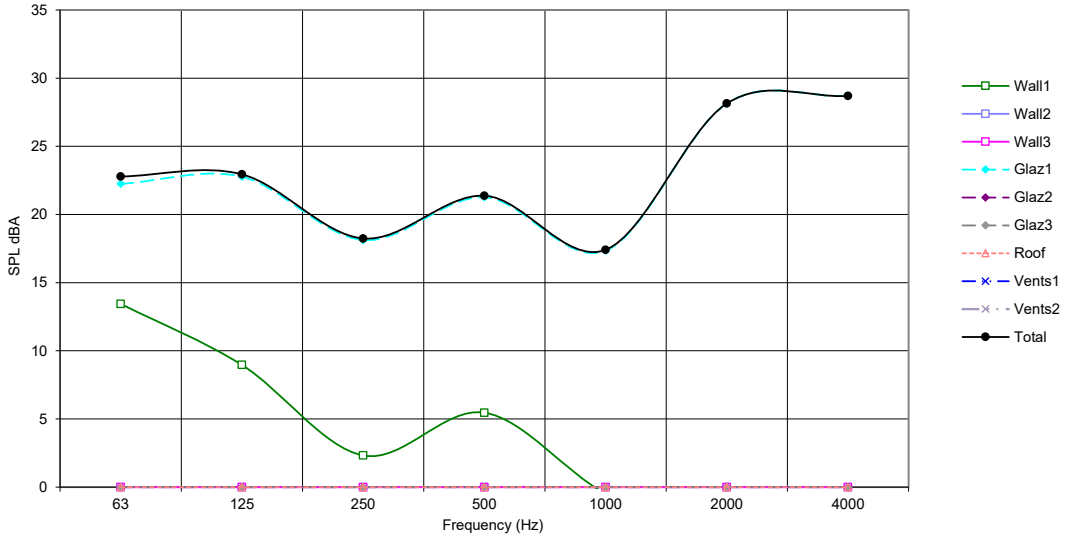
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 5.4 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 2% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 33 - 66 14 33.2 - With frames | 3.3 | 22 | 27 | 31 | 35 | 37 | 30 | 26 | 98% | 33dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 26 | 31 | 35 | 39 | 41 | 34 | 30 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 33.1 | 23 | 23 | 18 | 21 | 17 | 28 | 29 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **33.1** | 23 | 23 | 18 | 21 | 17 | 28 | 29 | | | | |

**Element contribution to total internal noise level**



| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 2.9 | X | 4.9 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Bedroom | Room Volume = | 33.9 | m3 | | | |
| **RUN REF:** | LAeq | Partition Area = | 8.6 | m2 | | | |
| **VARIANT:** | Lower Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 42.9 | 24.0 | 29.5 | 30.9 | 36.0 | 37.6 | 37.3 | 33.3 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 24.0 | 29.5 | 30.9 | 36.0 | 37.6 | 37.3 | 33.3 | **Direct input** |

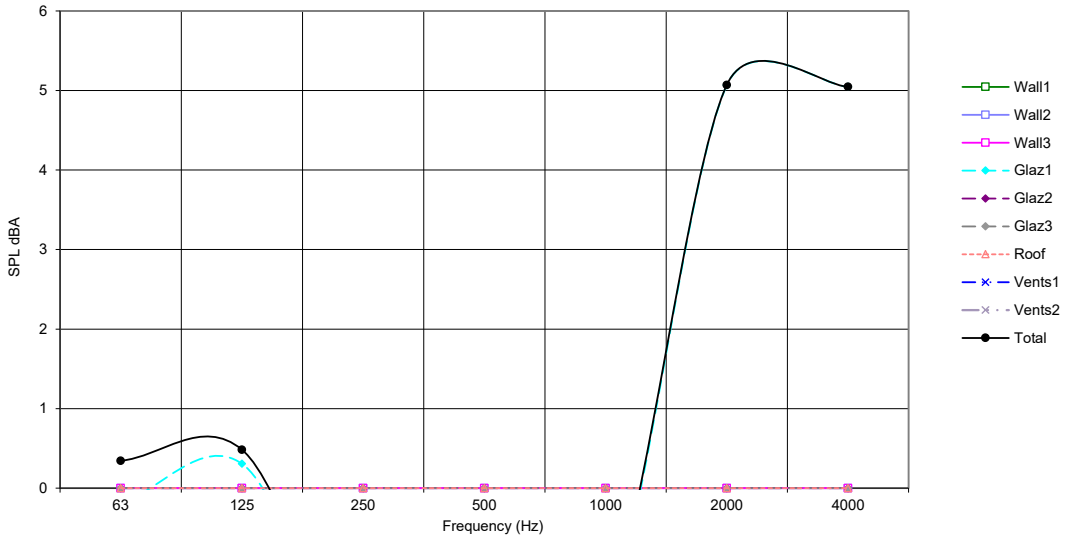
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 5.4 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 6% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 33 - 66 14 33.2 - With frames | 3.3 | 22 | 27 | 31 | 35 | 37 | 30 | 26 | 60% | 33dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 26 | 31 | 35 | 39 | 41 | 34 | 30 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 10.3 | 0 | 0 | -2 | -1 | -2 | 5 | 5 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **10.3** | 0 | 0 | -2 | -1 | -2 | 5 | 5 | | | | |

**Element contribution to total internal noise level**



| | | | W | | L | | H |
|---|---|---|---|---|---|---|---|
| **CLIENT:** | Midgard | Room Dimensions [m] | 7.1 | X | 5.4 | X | 2.4 |
| **PROJECT:** | Station Hill | | | | | | |
| **ROOM:** | Living Room - Kitchen | Room Volume = | 91.8 | m3 | | | |
| **RUN REF:** | LAeq | Partition Area = | 21.6 | m2 | | | |
| **VARIANT:** | Lower Level Glazing Specification | Ventilation ref area = | 10.0 | m2 | | | |
| | SELECT Free Field or Façade SPL for model input >>> | Free Field SPL K = | 3 | dB | | | |

**NOTES:**

## EXTERNAL SPECTRUM (A weighted)

| | dBA | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | |
|---|---|---|---|---|---|---|---|---|---|
| Direct input - Free Field SPL (A weighted octave bands) dB -----> | 46.0 | 28.6 | 31.4 | 34.7 | 38.5 | 41.7 | 40.0 | 34.6 | |
| Road traffic spectrum (according to BS 8233:1999 section 6) | | | | | | | | | |
| | | 28.6 | 31.4 | 34.7 | 38.5 | 41.7 | 40.0 | 34.6 | **Direct input** |

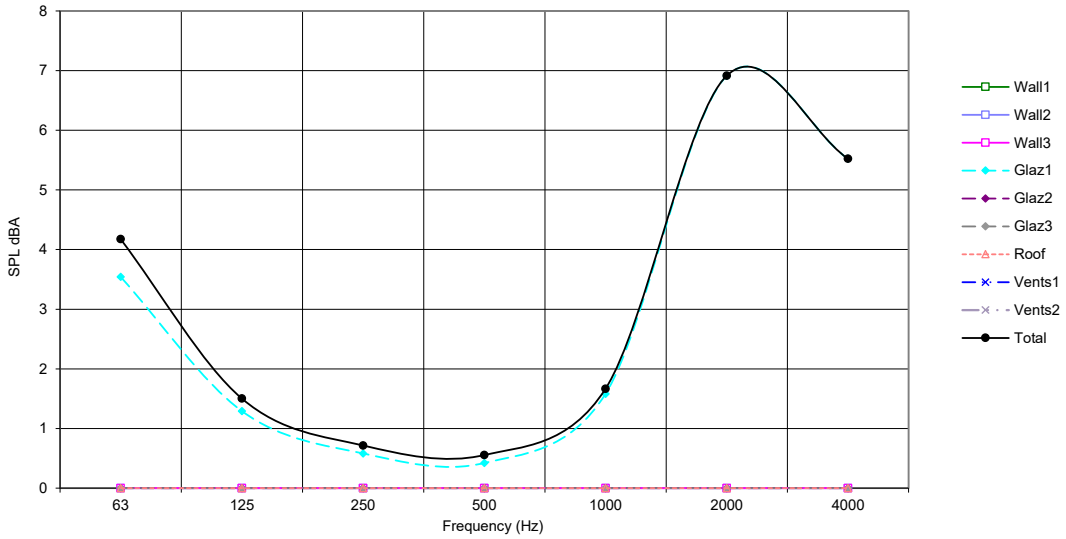
## REVERBERATION TIME

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DIRECT INPUT -----> | | | | | | | | | **No data** |
| EQUAL RT for all bands -----> | | | | | | | | | |
| | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | **Default - RT set to 0.5s** |

| Façade Element | | Area [m2] | SRI dB to BS EN ISO 140-3:1995 | | | | | | | | Rw | C | Ctr | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall 1 | Brick Slip Façade | 14.3 | 33 | 43 | 49 | 53 | 57 | 64 | 68 | 4% | 58 | 0 | -5 | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 2 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Wall 3 | WALLS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 1 | Rw + Ctr 33 - 66 14 33.2 - With frames | 7.3 | 22 | 27 | 31 | 35 | 37 | 30 | 26 | 69% | 33dB + Ctr | 0 | 0 | Perfomance including frames |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 2 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Glazing 3 | GLAZING | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Roof | ROOF / FLOOR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | | |
| ATTENUATION | | | | | | | | | | | | | | |
| Resultant composite Façade SRI | | | 26 | 32 | 36 | 40 | 42 | 35 | 31 | | | | | |
| Resultant SPL inside room excluding ventilators dB | | 12.1 | 4 | 2 | 1 | 1 | 2 | 7 | 6 | 100% | | | | |

| Ventilator Type | | Num | $D_{n,e}$ dB to BS EN 20140-10:1992 | | | | | | | | Dnew | C | Ctr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Ventilation | VENTS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% | | | |
| ATTENUATION | | | | | | | | | | | | | |
| Resultant SPL inside room through ventilators dB | | -99.0 | -96 | -96 | -96 | -96 | -96 | -96 | -96 | 0% | | | |
| **Total SPL inside room** | | **12.1** | 4 | 2 | 1 | 1 | 2 | 7 | 6 | | | | |

**Element contribution to total internal noise level**



## 4. Baseline noise & vibration conditions.

This section sets out the acoustic data to be used for the assessment of potential noise impacts in relation to current development proposals. It presents a summary of the environmental noise levels measured at the site and surrounding area for use in assessing and determining the sound insulation requirements of the building envelope, and the control of noise emissions from building services plant and equipment.

### 4.1 Local noise conditions.

Environmental noise conditions at the site are predominantly formed of road traffic noise from the immediate road network around the Site, in particular buses on Friar Street, but also vehicles (including taxis) using Greyfriars Road, Garrard Street and Station Hill.

Daytime noise activities within the vicinity of the proposed development were observed to include the following:

- Idling buses (with engines running) serving bus stops immediately to the front of the proposed development along Friar Street;
- Idling taxis (with engines running) queuing along Garrard Street as they approach the Reading Station taxi rank on Station Road;
- Trains serving Reading Station to the north of the site. Train movements were observed to be frequent, although slow moving as trains approached / left Reading Station; and
- PA announcements associated with trains serving Reading Station.

Night-time noise activities are predominantly formed of pedestrian activity and noise break-out from the nearby clubs *Popworld* and *Lola Lo*, which are located immediately opposite the site on Friar Street. *Popworld's* typical opening hours are understood to be 2200 to 0200 on Thursdays, 2100 to 0400 on Fridays and 2000 to 0400 on Saturdays, whilst opening hours at *Lola Lo* are understood to be 2000 to 0300 on Tuesdays and Thursdays and 2100 to 0400 on Fridays and Saturdays.

Night-time noise activities within the vicinity of the proposed development were observed to include the following:

- Buses and taxis travelling along Friar Street;
- Music breakout from *Popworld* and *Lola Lo*;
- Pedestrian activity associated with the neighbouring clubs, including use of the smoking and queuing area located to the front of *Popworld;*
- Taxis were observed to travel a circular route from Friar Street, to Station Hill before returning to Station Road via Garrard Street; and
- Trains serving Reading Station to the north of the site, including PA announcements.

### 4.2 Baseline noise survey.

An acoustic survey has been carried out at the proposed development site to establish the prevailing noise conditions local to the site. The survey included the installation of three noise monitors across a fourteen-day period, in addition to attended noise measurements during the daytime and night-time.

An indicative site layout identifying the measurement positions is provided in Figure 1 below.

Figure 1: Site layout (indicative only). © Google Earth

#### 4.2.1 Results summary.

A summary of the results from the unattended measurements taken over the fourteen-day period at positions L1, L2 and L3 (see Figure 1) are provided below.

| Time period | Ambient $L_{Aeq,T}$ dB | Minimum $L_{A90,T}$ dB | Typical 90th Percentile $L_{AFmax}$ dB |
|---|---|---|---|
| Position L1 | | | |
| Daytime (0700 to 2300) | 69 | 44 *(see Note 14.1)* | 85 |
| Night-Time (2300 to 0700) | 63 | 36 *(see Note 14.2)* | 82 |
| Position L2 | | | |
| Daytime (0700 to 2300) | 59 | 43 *(see Note 14.1)* | 82 |
| Night-Time (2300 to 0700) | 56 | 37 *(see Note 14.2)* | 77 |
| Position L3 | | | |
| Daytime (0700 to 2300) | 67 | 47 *(see Note 14.1)* | 88 |
| Night-Time (2300 to 0700) | 69 | 43 *(see Note 14.2)* | 91 |

Table 14: Typical levels at measurement positions.

*Note 14.1: Time period during the daytime is 1 hour ($L_{A90,1hr}$).*

*Note 14.2: Time period during the night-time is 15 minutes ($L_{A90,15mins}$).*

A summary of the attended measurements conducted at positions S1, S2 and S3 is provided below in Table 15.

| Measurement position | Typical $L_{Aeq,T}$ dB | Ninetieth Percentile $L_{Amax,T}$ dB |
|---|---|---|
| Daytime | | |
| S1 | 58 | 71 |
| S2 | 60 | 76 |
| S3 | 65 | 77 |
| S4 | 62 | 78 |
| S5 | 56 | 74 |
| S6 | 63 | 76 |
| Night-time | | |
| S1 | 58 | 67 |
| S2 | 63 | 81 |
| S7 | 71 | 81 |
| S9 | 65 | 77 |

Table 15: Measured noise levels at attended positions.

### 4.2.2 Nearest noise sensitive receptor.

A noise sensitive area is defined as landscapes or buildings where the occupiers are likely to be sensitive to noise created by new plant installed in the proposed development, including residential areas. Noise sensitive receptors around the Site have been identified and are shown in Figure 2 below.

Of the noise sensitive receptors identified in Figure 2, the nearest noise sensitive receptors to the proposed development have been identified as the proposed development itself, existing residential dwellings along Merchant Place to the east including the Novotel and Ibis Hotel and student residences within Central Studios to the west. In addition, future residential dwellings should be considered as noise sensitive as part of the Phase 2 and 3 proposals for the Station Hill site.

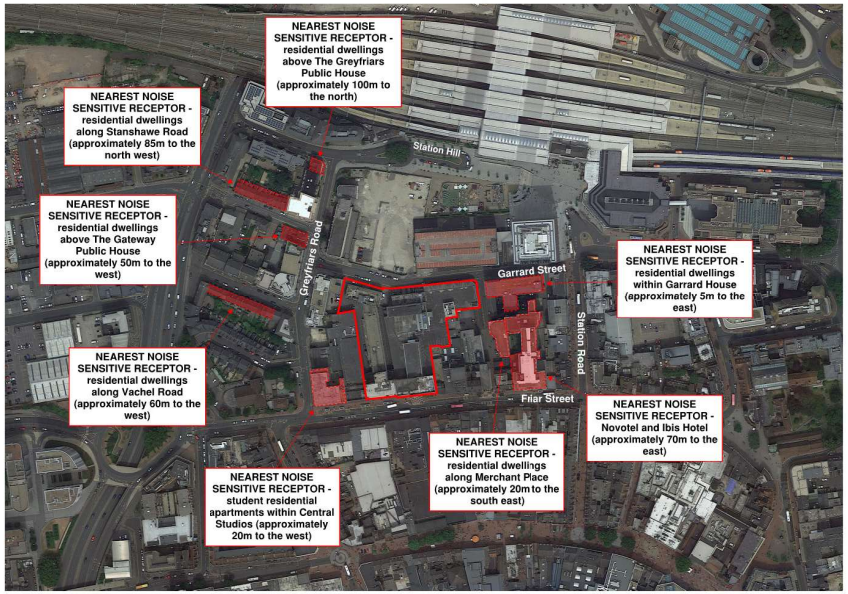



Figure 2: Nearest noise sensitive receptors.

### 4.2.3 Noise prediction model.

In order to predict the external noise levels present at each façade of the proposed development, a noise map has been created using CADNA environmental noise prediction and mapping software.

A baseline noise map was generated of the existing site using the results of the environmental noise survey and calibrated for daytime equivalent noise levels ($L_{Aeq,16hr}$), night-time equivalent noise levels ($L_{Aeq,8hr}$) and the maximum ninetieth percentile night-time $L_{Amax,T}$. The noise map was calibrated each of the noise sources discussed in Section 4.1.

Subsequently, a noise map was generated of the site with the proposed development in-situ. Figures 3 to 6 below display a three-dimensional representation of the noise map prediction for each of the proposed development façades. It should be noted that the noise mapping exercise takes into consideration all noise reflections that may occur off the proposed development and adjacent buildings.

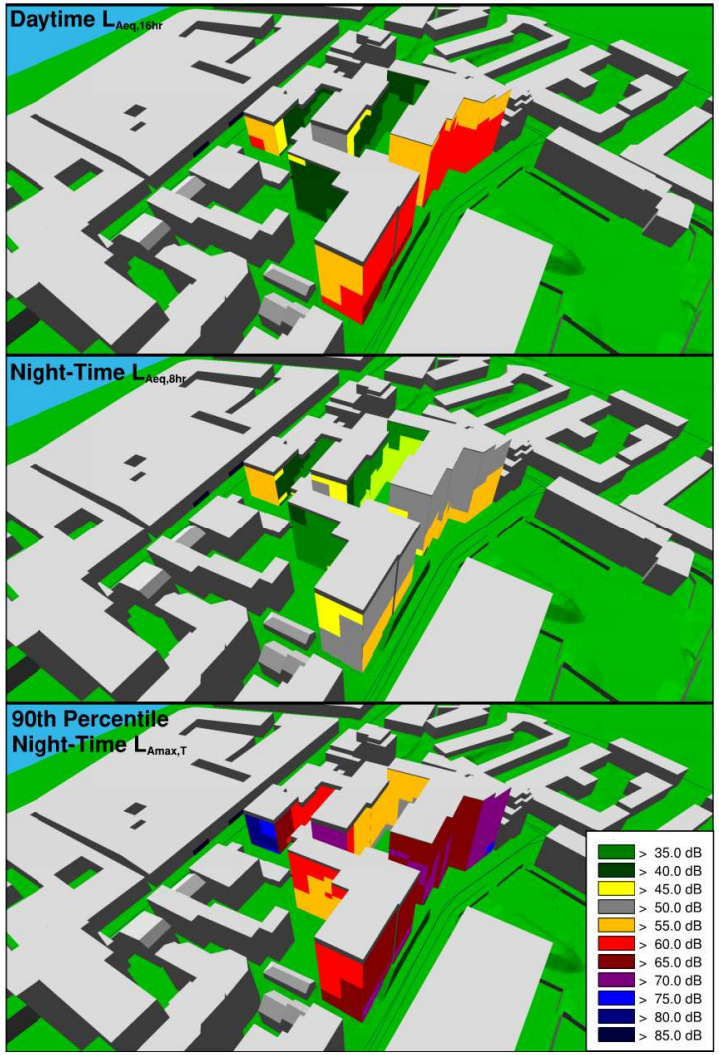



Figure 3: 3D noise map of proposed development from the north east.

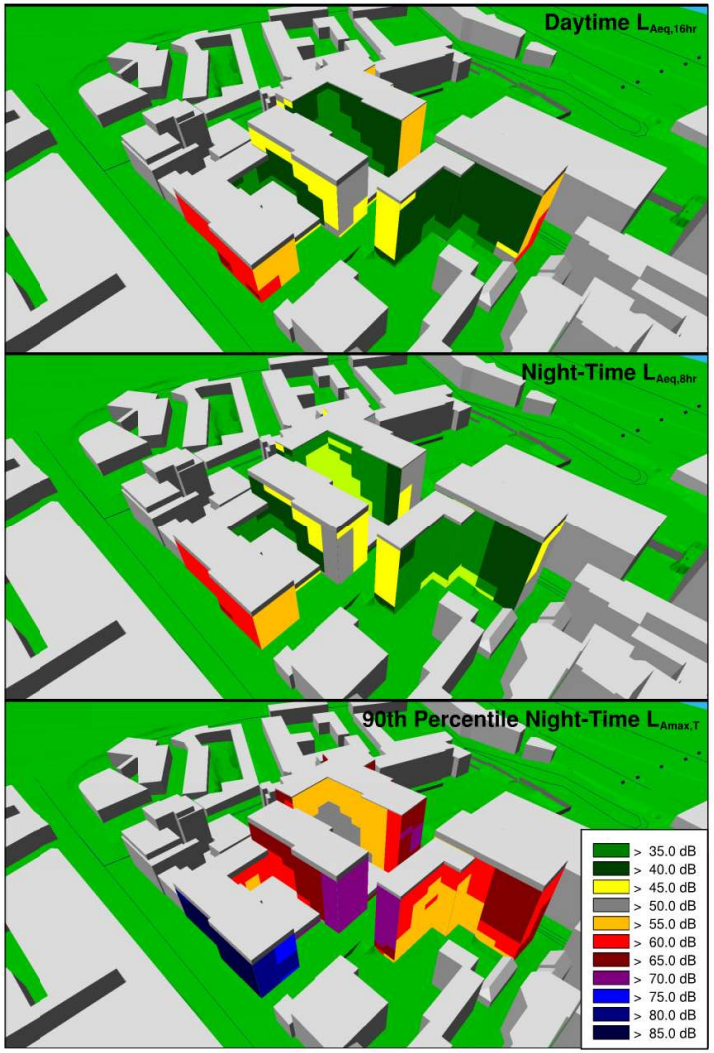



Figure 4: 3D noise map of proposed development from the south east.

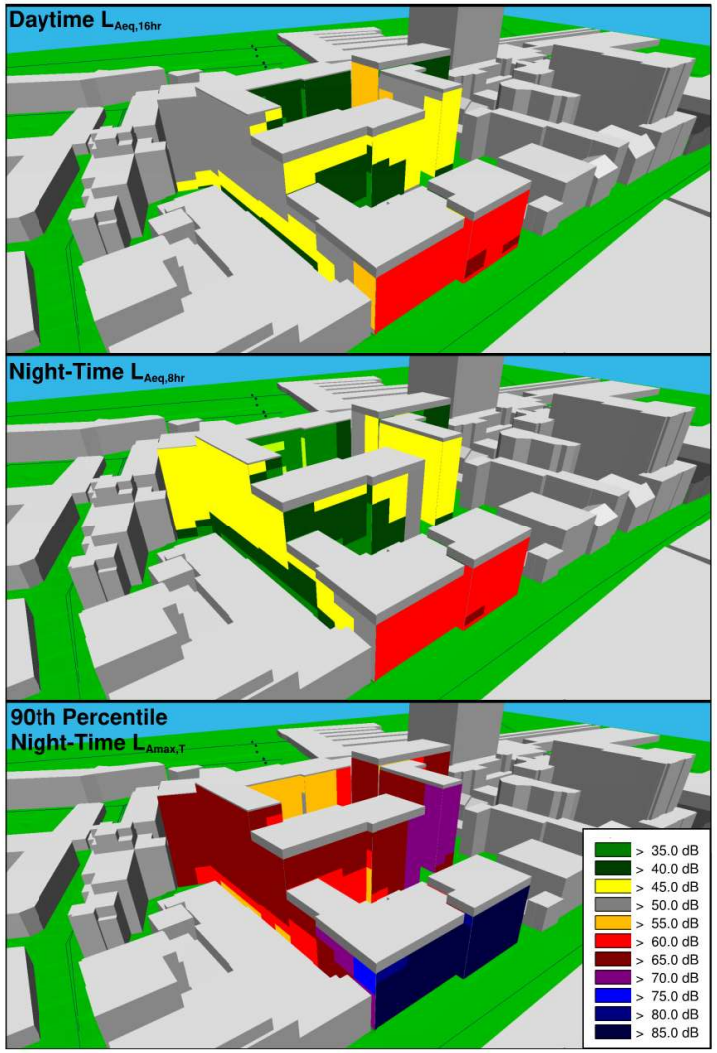



Figure 5: 3D noise map of proposed development from the south west.

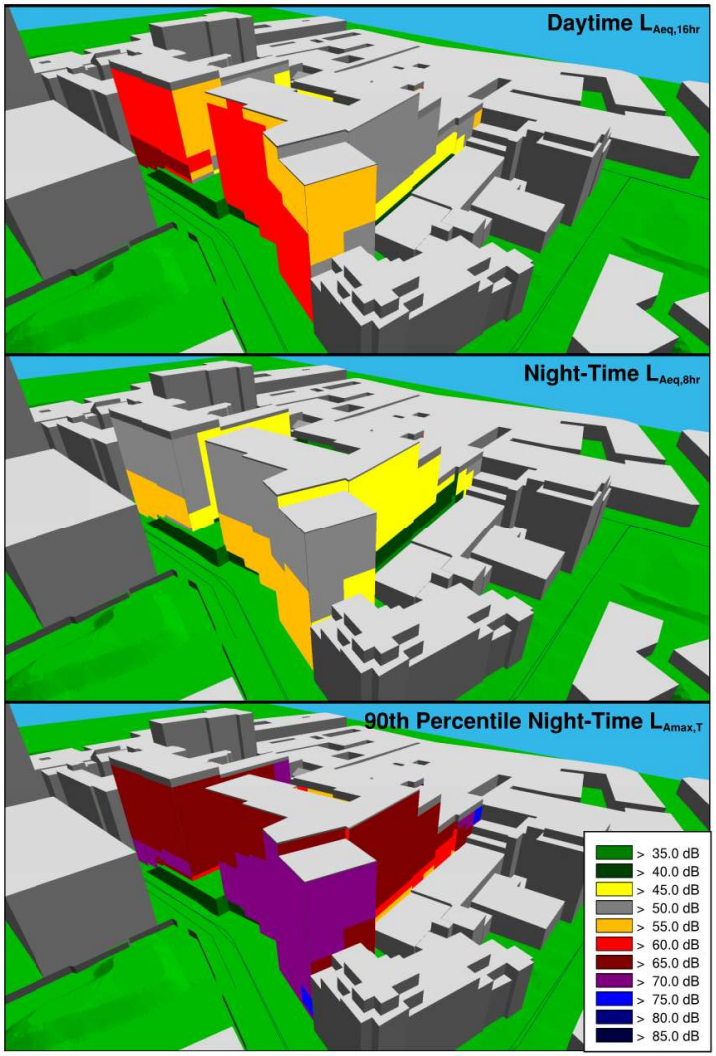



Figure 6: 3D noise map of proposed development from the north west.

# Appendix 3 Validation Noise Survey

**Survey Summary:**

The survey comprised short-term operator attended noise measurements and longer-term unattended noise monitoring at the site. Noise levels at the site were generally dictated by road traffic on surrounding roads and noise from commercial activities (e.g. Night Clubs) and people on Friar Street.

**Survey Period:**

22/08/2019 & 07-08/02/2020

**Survey Objectives:**

- To identify noise sources that contribute to ambient noise levels at the site;
- To measure noise levels around the site over a typical day and night-time period.

**Equipment Used (Appendix 3, Table 1):**

| Type | Manufacturer | Model | Serial Number |
|---|---|---|---|
| Sound Level Meter | Rion | NL-52 SLM | 00965090 |
| Sound Level Meter | Brüel & Kjær | 2250 | 3007539 |
| Preamplifier | Brüel & Kjær | ZC 0032 | 22456 |
| Microphone | Brüel & Kjær | 4189 | 2978462 |
| Calibrator | 01dB | CAL31 | 83380 |

**Note 1:** All sound level meters were calibrated before and after measurement periods and no significant drift in calibration was found to have occurred. The results of the measurements are therefore considered to be representative.

**Weather Conditions:**

The observed weather conditions were acceptable for acoustic measurement throughout the attended survey periods (low-medium wind speeds and no rain). Any periods of unattended monitoring that may have been adversely affected by weather conditions have been excluded from the data analysis.

**Measurement Positions (Appendix 3, Table 2):**

| Position (refer plan below) | Description |
|---|---|
| N1 | Attended noise monitoring position. 1.5m above ground and directly in front of train station. Direct line of site to Station Hill. |
| N2 | Attended noise monitoring position. Attended noise monitoring position. 1.5m above ground and 1m away from nearby road/ taxi rank. Railway within direct line of site. |
| N3 | Attended noise monitoring position. 1.5m above ground. Free-field. Direct line of sight to construction site, 1m from road side. Direct line of site to Grayfriars Road |
| N4 | Attended noise monitoring position. 1.5m above ground. Free-field. Direct line of sight to Gerrard Street |

**Measurement Positions (Appendix 3, Table 2):**

| Position (refer plan below) | Description |
|---|---|
| N5 | Attended noise monitoring position. 1.5m above ground. Free-field. Direct line of sight to Grayfriars Road |
| N6 | Attended noise monitoring position. 1.5m above ground. Free-field. Direct line of sight to Friar Street. 1m from road side. |
| N7 | Attended noise monitoring position. 1.5m above ground. Free-field. Direct line of sight to Friar Street. 1m from road side. |
| N8 | Attended noise monitoring position. 1.5m above ground. Free-field. Direct line of sight to nearby roads. |

**Site Plan showing Measurement Positions (Appendix 3, Figure 2):**

**Attended Noise Monitoring Results (Appendix 3, Table 3):**

| Date | Position | Time | Meas. Length | LAeq, dB | LAmax, dB | LA90, dB | Observations |
|---|---|---|---|---|---|---|---|
| 22/08/2019 | 1 | 13:28:35 | 5mins | 65 | 78 | 62 | Noise levels dictated by pedestrians passing by. |
| 22/08/2019 | 1 | 14:34:19 | 5mins | 64 | 77 | 60 | |

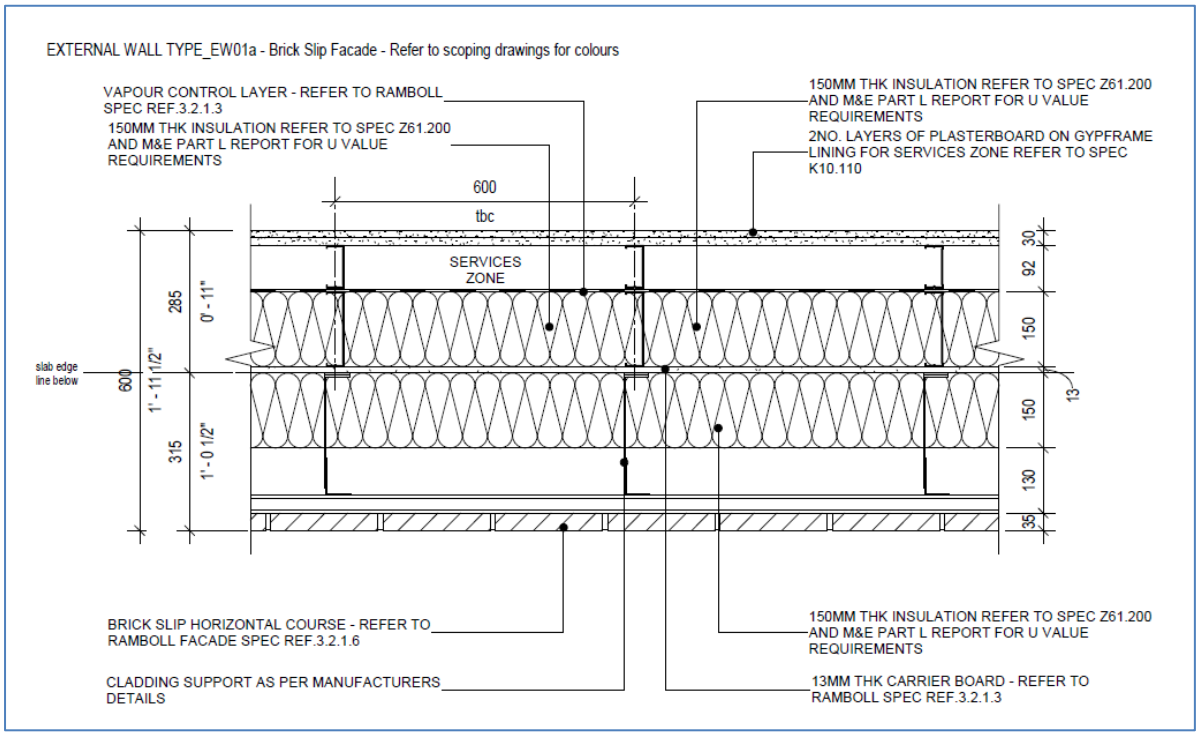
**Attended Noise Monitoring Results (Appendix 3, Table 3):**

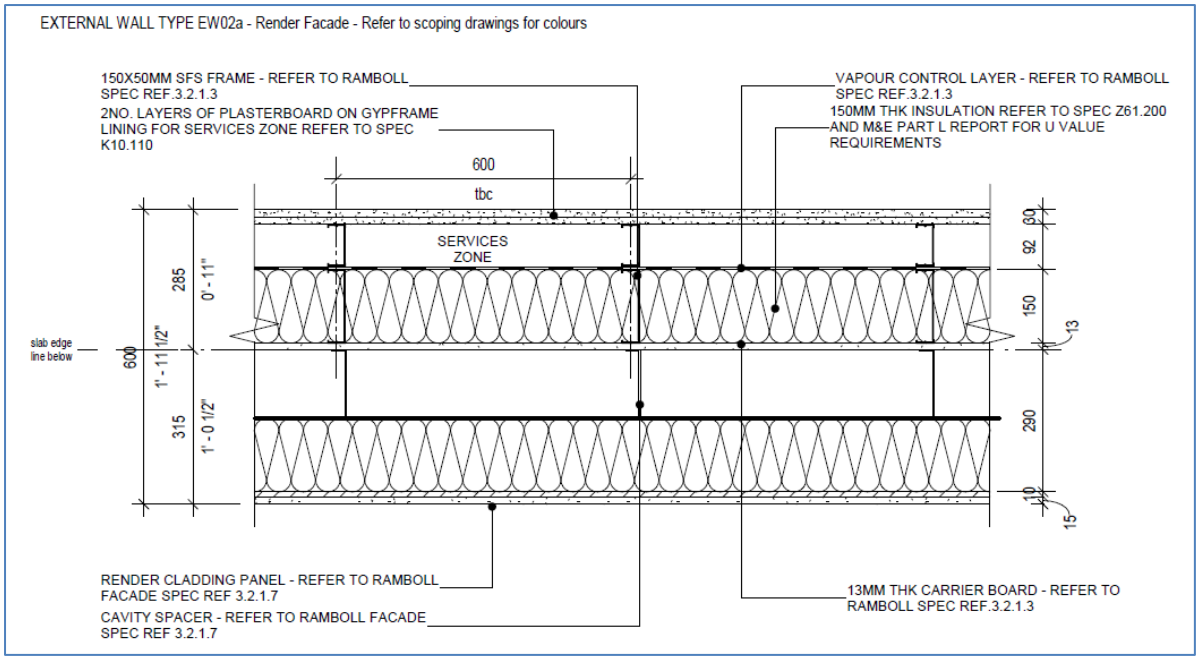
| Date | Position | Time | Meas. Length | LAeq, dB | LAmax, dB | LA90, dB | Observations |
|---|---|---|---|---|---|---|---|
| 22/08/2019 | 2 | 12:00:44 | 5mins | 62 | 70 | 59 | Noise levels dictated by pedestrians passing and road traffic noise from the nearby road and trains passing. |
| 22/08/2019 | 2 | 13:37:23 | 5mins | 64 | 73 | 60 | |
| 22/08/2019 | 3 | 12:12:39 | 5mins | 69 | 77 | 62 | Noise levels dictated by construction noise and road traffic long the surrounding roads. |
| 22/08/2019 | 3 | 13:44:33 | 5mins | 70 | 78 | 62 | |
| 22/08/2019 | 4 | 12:25:42 | 5mins | 67 | 92 | 59 | Noise levels dictated by road traffic and noise from the nearby construction site. |
| 22/08/2019 | 4 | 13:52:26 | 5mins | 67 | 78 | 62 | |
| 22/08/2019 | 5 | 12:37:40 | 5mins | 63 | 88 | 57 | Noise levels generally dictated by road traffic. Plane was noted passing by during measurement taken at 12:27. |
| 22/08/2019 | 5 | 12:53:05 | 5mins | 63 | 77 | 57 | |
| 22/08/2019 | 5 | 13:59:37 | 5mins | 64 | 83 | 58 | |
| 22/08/2019 | 6 | 13:01:40 | 5mins | 68 | 77 | 63 | Noise levels generally dictated by road traffic. Vehicles were mainly busses as the measurement position was adjacent to a bus stop. |
| 22/08/2019 | 6 | 14:07:14 | 5mins | 70 | 81 | 62 | |
| 22/08/2019 | 7 | 13:09:49 | 5mins | 70 | 86 | 64 | Noise levels dictated by road traffic and pedestrian flow. |
| 22/08/2019 | 7 | 14:16:42 | 5mins | 69 | 80 | 62 | |
| 22/08/2019 | 8 | 13:18:34 | 5mins | 59 | 70 | 55 | Very quiet side street. Construction site opposite however no notable noise from site. Very little in terms of road traffic. NB close to entrance site of multi-story car park. |
| 22/08/2019 | 8 | 14:24:04 | 5mins | 59 | 70 | 56 | |

**Maximum Noise Monitoring Results – Friar Street (Appendix 3, Table 4):**

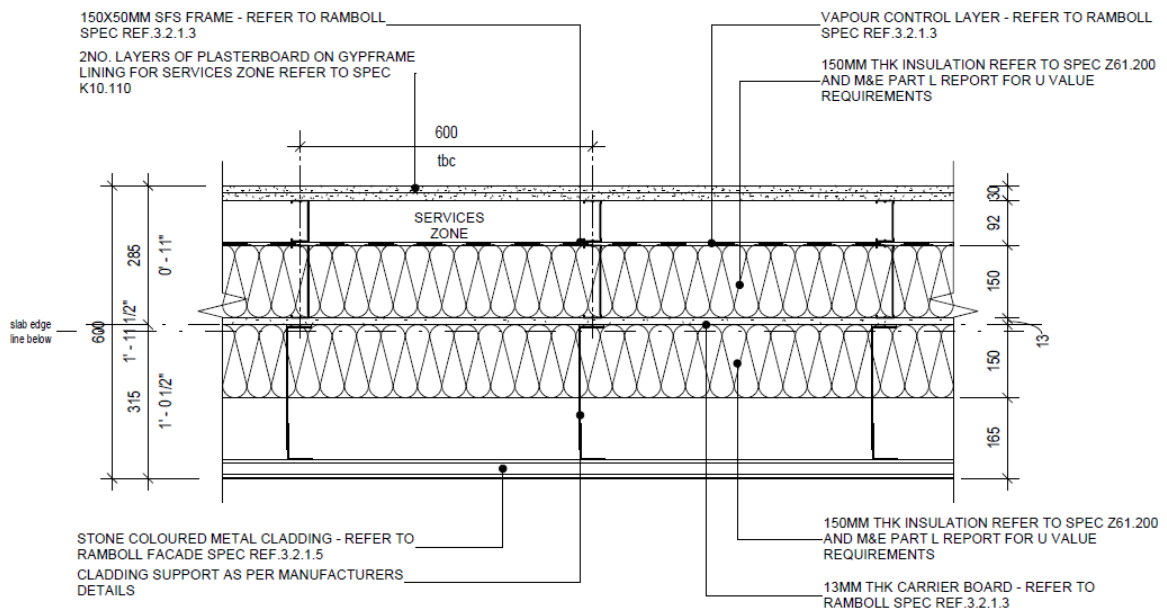
| Date | Position | Time | LAmax, dB | Observations |
|---|---|---|---|---|
| 07/02/2020 to 08/02/2020 | 7 | From 19:30 until 06:00 | 89 | Maximum Noise Levels dictated by vehicle movements and activities at the Night Clubs (including people on the street). |

# Appendix 4 Façade Construction Drawings

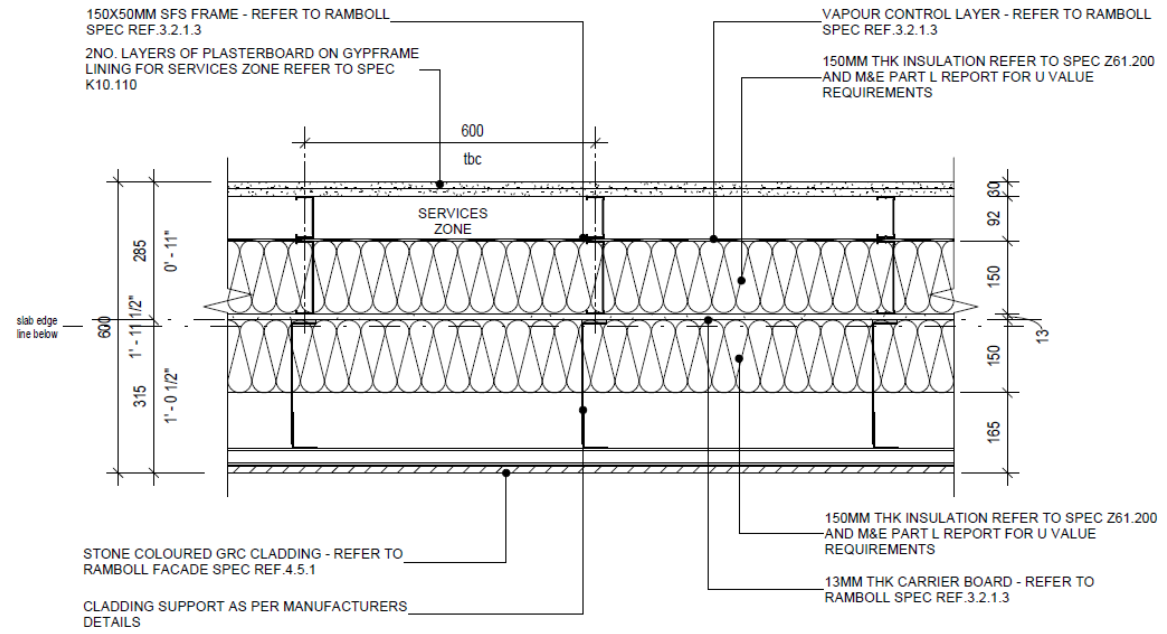


EXTERNAL WALL TYPE EW03a - Metal Cladding - Refer to scoping drawings for colours




EXTERNAL WALL TYPE EW04a - GRC Cladding - Refer to scoping drawings for colours



# Appendix 5 FACSIM CALCULATIONS

# Appendix 6 Acoustic Data of Glazing Systems

Test data of the proposed glazing system do not take into account frames.

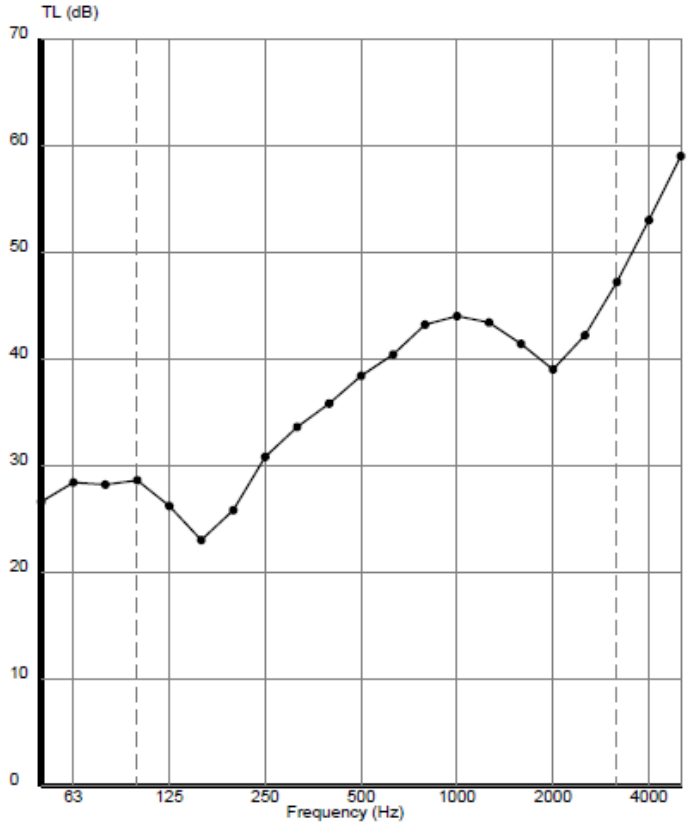
**GL01 – Lower Specification**

**Glazing : 66.2PRO (14AR) 33.2PRO**

**Ratings:** According to ISO 717-1 100Hz - 3150Hz

$R_w(C;C_{tr})$ = 40(-2;-5) dB $R_A$ = 38 dB $R_{A,tr}$ = 35 dB

**Results:** Sound Transmission Loss by third-octave band




| Frequency (Hz) | R (dB) |
|---|---|
| 50 | 26,6 |
| 63 | 28,4 |
| 80 | 28,3 |
| 100 | 28,6 |
| 125 | 26,2 |
| 160 | 23 |
| 200 | 25,8 |
| 250 | 30,8 |
| 315 | 33,6 |
| 400 | 35,7 |
| 500 | 38,4 |
| 630 | 40,5 |
| 800 | 43,3 |
| 1000 | 44 |
| 1250 | 43,3 |
| 1600 | 41,5 |
| 2000 | 38,9 |
| 2500 | 42,1 |
| 3150 | 47,2 |
| 4000 | 52,9 |
| 5000 | 59 |

**Computation details:** **Composition No. 19617 calculated the 1607/20/19**

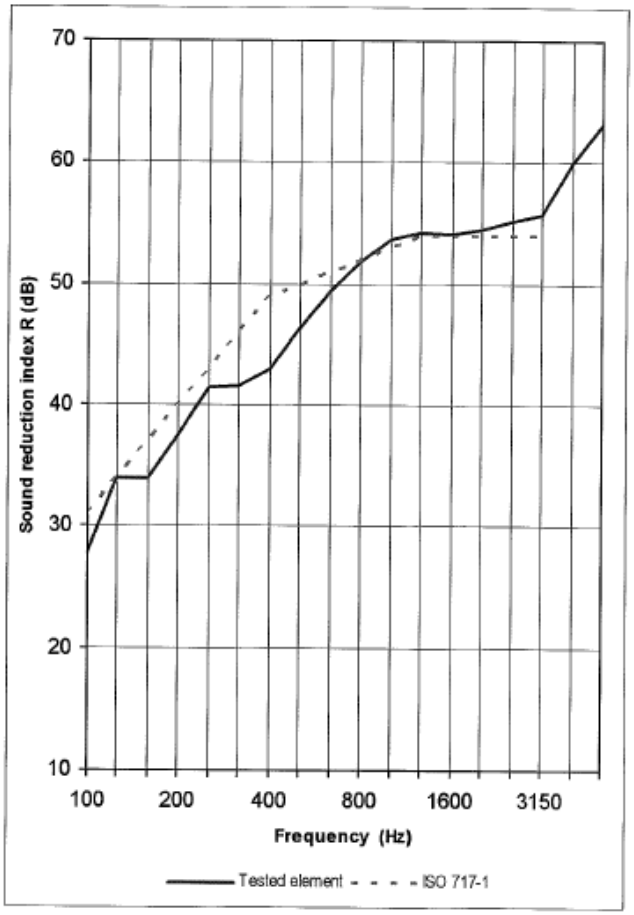
- Dimensions: 1480mm x 1230mm
- Composition: Glass 1: SGG STADIP PROTECT 66.2
  Gaz 1: AR 14
  Glass 2: SGG STADIP PROTECT 33.2

**GL02 – Medium Specification**

Tested element: **SGG STADIP SILENCE 44-2 (24) SGG STADIP SILENCE 66-2**

| | | |
|---|---|---|
| Sample surface area | S = | 1,9 $m^2$ |
| Volume of receiving room | V = | 86 $m^3$ |
| Volume of source room | | 98 $m^3$ |

| FREQ. Hz | R dB |
|---|---|
| 100 | 27,7 |
| 125 | 33,9 |
| 160 | 33,9 |
| 200 | 37,4 |
| 250 | 41,5 |
| 315 | 41,6 |
| 400 | 42,9 |
| 500 | 46,3 |
| 630 | 49,4 |
| 800 | 51,9 |
| 1000 | 53,7 |
| 1250 | 54,2 |
| 1600 | 54,1 |
| 2000 | 54,5 |
| 2500 | 55,2 |
| 3150 | 55,8 |
| 4000 | 60,0 |
| 5000 | 63,1 |




Rating according to ISO 717-1 (in the band 100 ÷3150 Hz) based on laboratory measurements:

**$R_w$ (C;$C_{tr}$) = 50 ( -2 ; -7 ) dB**

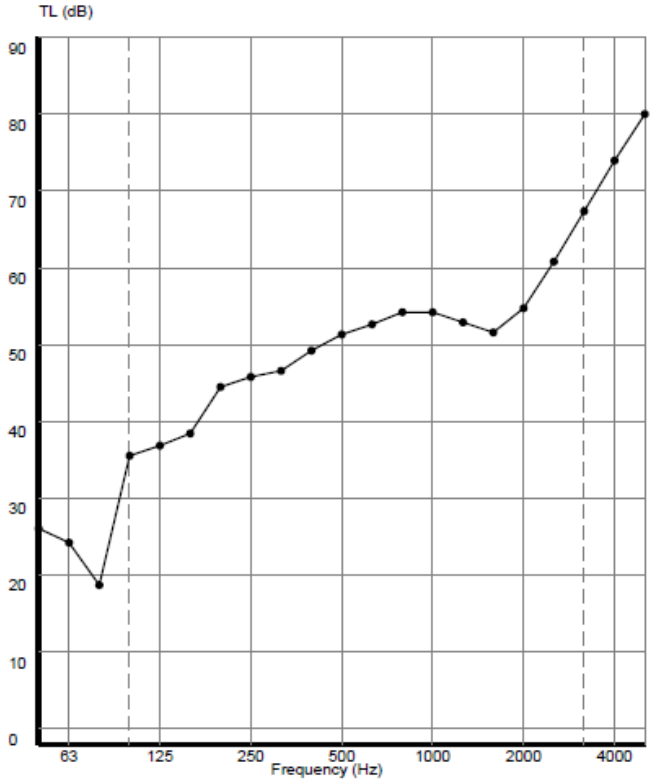
**GL03 – Higher Specification**

**Glazing : 86.2SIL (24AIR) 66.2SIL**

**Ratings:** According to ISO 717-1 100Hz - 3150Hz

$R_w(C;C_{tr})$ = 54(-1;-4) dB  $R_A$ = 53 dB  $R_{A,tr}$ = 50 dB

**Results:** Sound Transmission Loss by third-octave band




| Frequency (Hz) | R (dB) |
|---|---|
| 50 | 27,4 |
| 63 | 25,6 |
| 80 | 20,4 |
| 100 | 36,9 |
| 125 | 38 |
| 160 | 39,5 |
| 200 | 45,6 |
| 250 | 46,7 |
| 315 | 47,6 |
| 400 | 50 |
| 500 | 52,3 |
| 630 | 53,6 |
| 800 | 55 |
| 1000 | 55,1 |
| 1250 | 53,8 |
| 1600 | 52,4 |
| 2000 | 55,5 |
| 2500 | 61,4 |
| 3150 | 67,8 |
| 4000 | 74,3 |
| 5000 | 80,3 |

**Computation details:** **Composition No. 1009 calculated the 30/07/2013**

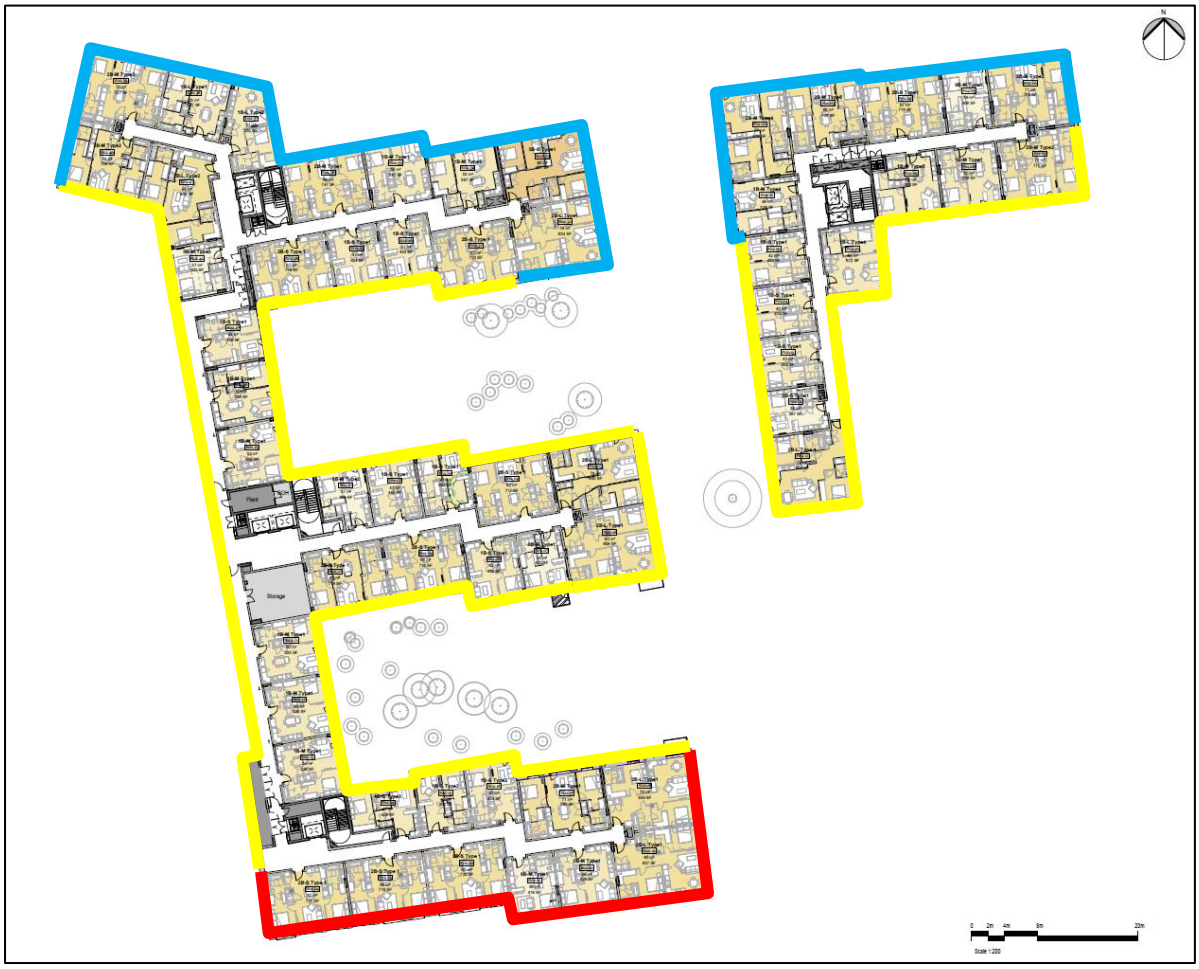
- Overall dimensions: 1480m x 1230m
- Composition: Glass 1: SGG STADIP SILENCE 86.2
  Gaz 1: AIR 24
  Glass 2: SGG STADIP SILENCE 66.2

# Appendix 7 Acoustic Facade Specification

| Reference | Colour | Glazing Minimum Specification (inc. frames) | Ventilator Specification |
|---|---|---|---|
| GL01 – Lower Specification | | 29 dB Rw+Ctr | MVHR |
| GL02 – Medium Specification | | 37 dB Rw+Ctr | MVHR |
| GL02 – Higher Specification | | 43 dB Rw+Ctr | MVHR |

**NOTES:** Values must include the Ctr correction. Manufacturers or suppliers should provide laboratory test data demonstrating that the proposed systems are capable of achieving the values given. Windows should be tested as complete systems (rather than just the glazing in isolation).

**All floors:**



www.cassallen.co.uk