



Architectural & Environmental Acousticians

Noise & Vibration Engineers

Noise & Vibration Assessment

Land South of Barnham Station



Noise & Vibration Assessment

Project: LAND SOUTH OF BARNHAM STATION

Report reference: RP01-20473-R1

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TABLE OF CONTENTS

1. INTRODUCTION
2. PROJECT DESCRIPTION
3. PLANNING POLICY
4. NOISE AFFECTING THE DEVELOPMENT
5. GROUND-BORNE VIBRATION AFFECTING THE DEVELOPMENT
6. CONCLUSIONS

APPENDIX 1 ARUN DISTRICT COUNCIL'S LOCAL PLAN (JULY 2018)

APPENDIX 2 SURVEY RESULTS

APPENDIX 3 FACADE CALCULATIONS



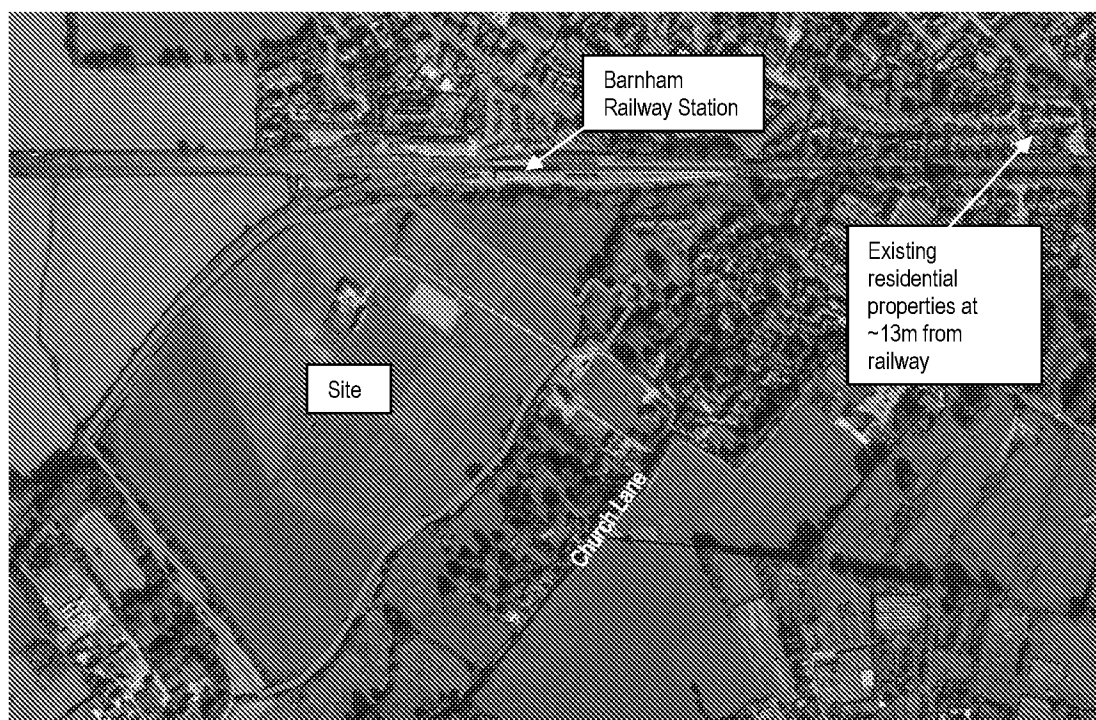
1. INTRODUCTION

- 1.1 Cass Allen has been instructed by Gleeson Strategic Land Ltd to assess noise and vibration affecting a proposed new residential development at Land South of Barnham Station in Barnham.
- 1.2 The assessment has been carried out in accordance with relevant local and national planning guidance.
- 1.3 The aims of the assessment were:
- To establish the suitability of existing noise and vibration levels at the site for the proposed development;
 - Where required, identify appropriate measures to optimise the acoustic design of the development and achieve acceptable noise and vibration levels in habitable areas.
- 1.4 This report contains technical terminology; a glossary of terms can be found at www.cassallen.co.uk/glossary.

2. PROJECT DESCRIPTION

- 2.1 The site currently contains paddocks, stables and land used for grazing and exercising horses. The site is located in a predominantly residential area, bounded to the north and west by the West Coastway Line and to the south by residential area and grassland. The site is bounded to the east by residential properties with Church Lane situated further east. The closest existing residential properties from the railway are to the northeast of the site, positioned at approximately 13m from the railway tracks.
- 2.2 An annotated aerial photo of the site is shown in Figure 1 below.

Figure 1 Annotated Aerial Photo



- 2.3 The proposal is to develop the site into residential properties with associated public open spaces and an area allocated for allotments.

3. PLANNING POLICY

National Policy

- 3.1 Outline guidance for the assessment of noise affecting new developments is given in the National Planning Policy Framework (NPPF). Section 170 of the NPPF states:

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

and in Section 180:

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 impacts 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.

Local policy

- 3.2 Arun District Council's Local Plan (July 2018) provides outline guidance on the assessment of noise affecting new development in the borough. Section 21.2 of the Local Plan relates to noise and requires that proposed residential development sites are assessed using the Noise Exposure Categories (NECs) given in Table 1 below. The relevant category for each site is dictated by the ambient noise levels at the site. The range of ambient noise levels corresponding to each category are shown in Table 2 below. The concept of NECs was initially introduced in Planning and Policy Guidance 24, which has since been withdrawn. Full details of the NEC approach in Arun District Council's Local Plan can be viewed in Appendix 1.

Table 1 Noise Exposure Categories for Residential Development

NEC	Advice
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 2 Noise Levels Corresponding to Noise Exposure Categories

Noise Source	Time Period	External Noise Levels Corresponding to Each Category (LAeq,T dB)			
		A	B	C	D
Road Traffic	0700-2300hrs	< 55	55 – 63	63 – 72	> 72
	2300-0700hrs (see Note 1)	< 45	45 – 57	57 – 66	> 66
Rail Traffic	0700-2300hrs	< 55	55 – 66	66 – 74	> 74
	2300-0700hrs (see Note 1)	< 45	45 – 59	59 – 66	> 66
Air Traffic	0700-2300hrs	< 57	57 – 66	66 – 72	> 72
	2300-0700hrs (see Note 1)	< 48	48 – 57	57 – 66	> 66
Mixed Sources	0700-2300hrs	< 55	55 – 63	63 – 72	> 72
	2300-0700hrs (see Note 1)	< 45	45 – 57	57 – 66	> 66

Note 1 Sites where individual noise events regularly exceed 82 dB LAmax several times in any hour should be treated as NEC C regardless of the LAeq,8h (except where the LAeq,8h already puts the site in NEC D)

- 3.3 The key determining factor in the suitability of a site for a proposed residential development is the acoustic environments that are achieved in the noise sensitive areas of the finished development. Noise sensitive areas include habitable rooms (e.g. bedrooms and living rooms) and external amenity areas (e.g. gardens).
- 3.4 Acceptable noise environments will generally be achievable in residential developments in NEC A sites without any specific noise mitigation measures. However, some form of noise mitigation measures will normally be required for NEC B, C or D sites.
- 3.5 It should be noted that residential development within NEC C and D sites is generally acceptable subject to the adoption of appropriate noise mitigation in the design of the developments. Most urban development sites located near to a main road or railway would fall into NEC C or D.

3.6 Policy QE DM1 of the Local Plan also relates to noise:

Policy QE DM1

Noise pollution

1. New noise sensitive development

Residential development likely to experience noise from road, rail or air, in particular development in close proximity to:

- A284/A259 Wick roundabout
- Stretches of the A27 around Arundel and Fontwell
- Sections of the A29 and A259 in Bognor Regis
- A284 in Littlehampton and
- The stretch of railway line that runs through Barnham station

must:

- a. Be supported by a noise exposure category (NEC) assessment and designed to ensure that residents will not be adversely affected by noise.
- b. Consider both the likely level of exposure at the time of application and any increase that might be reasonably expected in the foreseeable future.

To safeguard the continued use of existing industrial and commercial uses and to protect amenity, noise sensitive development should not normally be permitted where:

- c. High levels of noise will continue throughout the night, especially during the hours when people are normally sleeping.
- d. There is a likelihood of complaints about noise from industrial development. ⁽⁸¹⁾

3.7 To address the requirements of the national and local policies, the key acoustic matter to be assessed in this case is noise affecting the habitable areas of the proposed development. Given the proximity to the railway line, ground-borne vibration levels at the site have also been assessed.



4. NOISE AFFECTING THE DEVELOPMENT

4.1 Specific guidance on the assessment of noise affecting new residential development is given in ProPG: Planning and Noise for New Residential Development, May 2017 (ProPG). The process within the ProPG guidance for the appraisal of noise levels affecting new residential development is considered to be current 'best practice' and therefore has been followed for the assessment with reference to NECs, where appropriate, as required by Arun District Council's Local Plan. The assessment process can be summarised as follows:

- Stage 1 – measure noise levels at the site and carry out an initial noise risk assessment of the proposed development site based on the measured levels.
- Stage 2 – where a higher noise risk is identified, carry out a detailed assessment including the following four considerations:
 - Element 1 – the overall acoustic design and layout of the site
 - Element 2 – internal noise levels in habitable areas
 - Element 3 – noise levels in external amenity areas
 - Element 4 – consideration of other relevant issues
- Based on the results of the Stage assessment, provide a recommendation to the decision maker on whether planning permission can and should be granted.

4.2 The process is shown visually in Figure 2 below

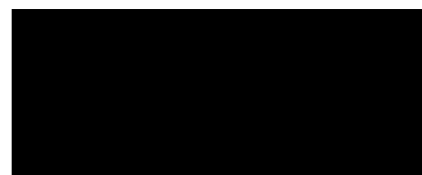
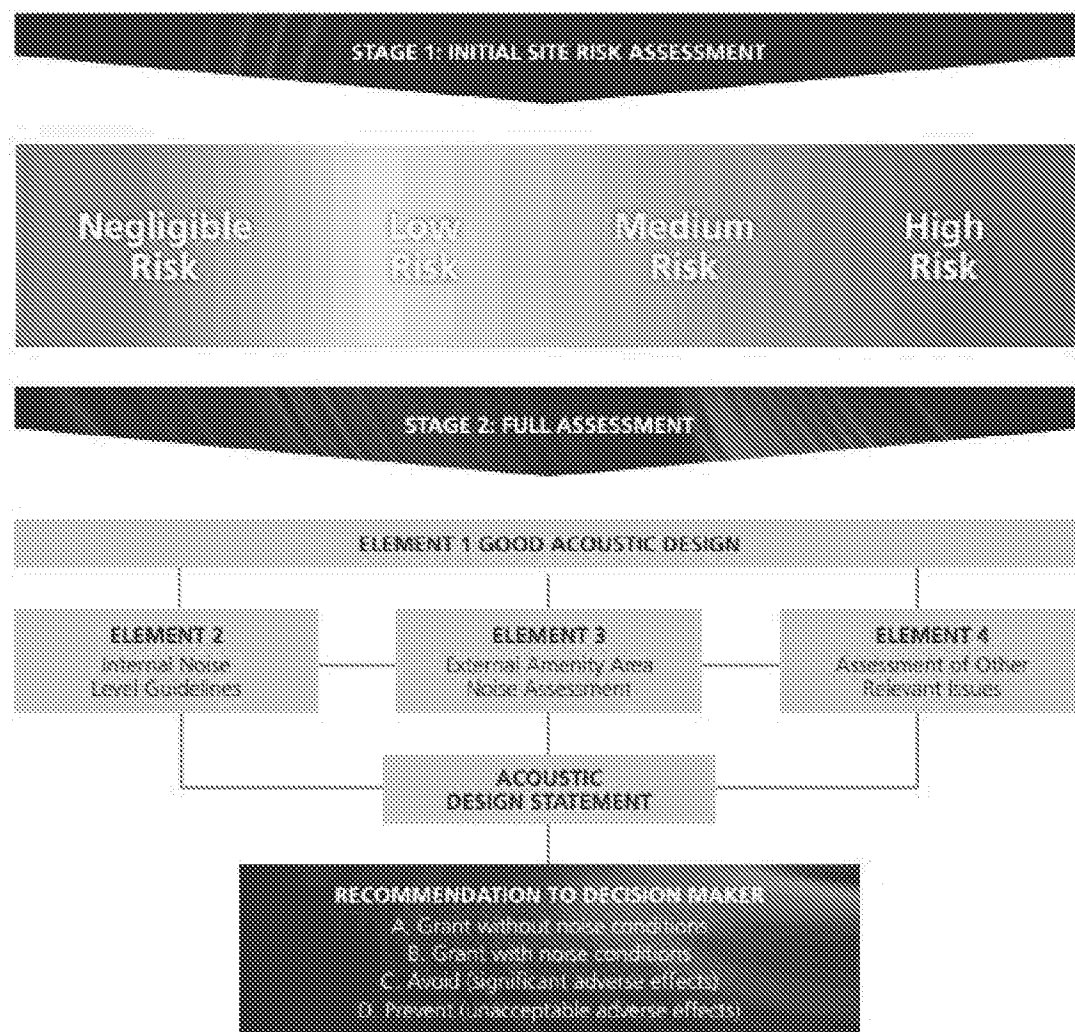


Figure 2 ProPG Assessment Process



Stage 1 – Noise survey and initial assessment

- 4.3 A noise survey was carried out at the site from 11th to 12th August 2020 to assess existing noise levels in the area. The full methodology and results of the noise survey are provided in Appendix 1.
- 4.4 Average (LAeq) and maximum (LAm_{ax}) noise levels to the north and west of the site were dictated by train movements on the West Coastway Line railway. No significant noise was identified from Barnham Railway Station itself (e.g. tannoy noise etc). Across the remainder of the site, average (LAeq) and maximum (LAm_{ax}) noise levels were generally dictated by aircraft overflights, vehicle passes from Church Lane to the east and natural sources (birdsong).
- 4.5 Background noise levels (LA90) across the site were dictated by distant road traffic and natural sources.

4.6 Areas of the development at the western edge of the site will be subject to the highest noise levels because of train passes on the West Coastway Line railway. The noise survey results show that noise levels at this position are as follows:

- Average noise levels during the daytime - 54 dB LAeq,0700-2300hrs;
- Average noise levels during the night-time - 50 dB LAeq,2300-0700hrs;
- Typical maximum noise levels during the night-time - 68 dB LMax.

The above noise levels are at a distance of 20m from the nearest railway tracks (this is the proposed distance of the nearest dwelling in the development).

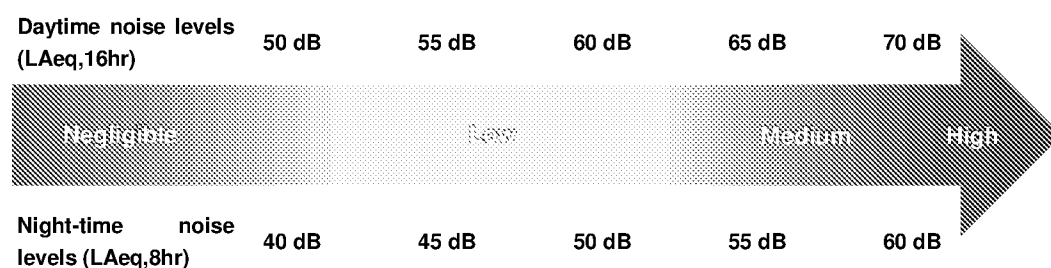
4.7 It can be seen from a comparison of the noise levels above and the relevant Noise Exposure Category (NEC) levels in Table 2 that the western edge of the site (20m from the railway) would be categorised (for rail noise) as follows:

- NEC A for daytime average noise levels and NEC B for night-time average noise levels.

4.8 The advice given in PPG24 (now withdrawn) for NEC Category B sites was '*noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise*'. Noise levels are discussed further below through a ProPG assessment to identify suitable mitigation measures.

4.9 The measured noise levels can also be compared with Figure 3 below to assess the 'noise risk' of the site in accordance with ProPG.

Figure 3 Noise Risk Assessment (Adaption of Figure 1 from ProPG)



4.10 Similarly to the NEC assessment, it can be seen from a comparison of the measured noise levels in paragraph 4.6 above with Figure 3 that the site is a 'Low' risk in relation to daytime and night-time noise levels. It is normally straight forward to achieve acceptable noise levels in low risk sites and this can be shown through a detailed ProPG 'Stage 2' assessment as set out below.

Stage 2 – Element 1 – Overall acoustic design of the site

4.11 The acoustic design of the development has been reviewed in relation to the measured noise levels at the site. In this case, the nearest dwelling has been positioned approximately 20m back from the edge of the railway to the west of the site in order to provide an acoustic buffer and reduce noise levels affecting the habitable areas. The 20m buffer is also larger than the existing residential properties to the north of the site which are approximately 13m from the tracks.

- 4.12 To further reduce noise levels in habitable rooms facing the railway the detailed design of the facades has also been considered and is discussed further below.

Stage 2 – Element 2 - Internal noise levels

- 4.13 Appropriate design criteria for acceptable noise levels in acoustically sensitive areas of new developments are given in BS8233:2014 '*Guidance on sound insulation and noise reduction for buildings*'.
- 4.14 Relevant BS8233 design criteria are summarised in Table 3 below.

Table 3 BS8233:2014 Internal Noise 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

- 4.15 It is also considered appropriate in this case to assess the potential impact of noise emissions from individual train passes on the adjacent railway line on the bedrooms of the development during the night-time. This is in line with guidance given in BS8233:2014 and ProPG, which both point out that regular individual noise events during the night have the potential to cause sleep disturbance.
- 4.16 Appropriate design criteria for acceptable maximum noise levels in habitable rooms of new residential developments are given in the ProPG guidance, which states that "*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 45 dB L_{Amax,F} more than 10 times a night.*"
- 4.17 The following acoustic design criteria have therefore 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;
 - 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;
 - Maximum noise levels should not regularly exceed 45 dB L_{Amax} in bedrooms during the night.
- 4.18 Full construction details for the development have not been finalised as the project is at an early design stage. It has therefore been assumed that the external walls of the development will be constructed using a standard masonry construction (e.g. 102mm brick, 100mm insulated cavity, 100mm concrete block) or a light-weight construction designed to achieve a similar level of sound insulation (this is technically achievable subject to detailed design). Consequently, internal noise levels would be dictated by external noise ingress via glazing and ventilators.
- 4.19 The ventilation scheme for the project has not yet been decided and therefore, for the purpose of the assessment, it has been assumed that units will be ventilated via trickle ventilators in the

external facades with openable windows for the provision of purge ventilation (as per System 1 or System 3 from Building Regulations Part F).

- 4.20 Calculations were carried out using facade modelling software in accordance with the methodology given in BS8233:2014 to calculate the sound insulation performance required of the glazing and ventilation to achieve the nominated internal noise criteria in the 'worst-case' habitable rooms of the development (i.e. the habitable rooms that will be subject to the highest external noise levels). The calculations included a 3 dBA design margin.
- 4.21 If acceptable internal noise levels can be achieved in 'worst case' habitable rooms then it follows that acceptable internal noise levels can be achieved in all other habitable rooms of the development using similar glazing and ventilator types.
- 4.22 The calculations were carried out based on the following typical dimensions/details for facade elements:
- Glazing – 1.5m² for bedrooms and 2m² for living rooms;
 - External walls – 8m² for bedrooms and 15m² for living rooms; and
 - 2 in-frame trickle ventilators in bedrooms and 3 in-frame trickle ventilators in living rooms.
- 4.23 The results of the calculations are shown in Appendix 3 and are summarised in Table 4 below.

Table 4 Acoustic Requirements for 'Worst Case' Habitable Rooms

'Worst Case' Rooms	Glazing Performance Requirements (inc. Frames)	Ventilator Performance Requirements
All habitable rooms	27 dB Rw+Ctr	31 dB D _{ne,w} + Ctr
Note The requirements given are approximate only and should be confirmed at the detailed design stage when full design details are available.		

- 4.24 The required sound insulation performance values in Table 4 could typically be achieved by standard thermal double glazing with standard in-frame trickle ventilators. The sound insulation performance of these standard facade elements are shown in Table 5.

Table 5 Typical Glazing & Ventilator Acoustic Performances

Glazing (in Good Quality Sealed Frames)	Typical Weighted Sound Reduction (Rw + Ctr)
4/16/4mm standard thermal double glazing	27
Ventilators	Typical Acoustic Performance (D _{new} + Ctr)
Standard 'hit & miss' in-frame trickle ventilator	31

- 4.25 It can be seen from the above that acceptable internal noise levels will be achievable in the development with standard thermal double glazing and "hit & miss" trickle ventilation. It is our view

therefore that the proposed development is, in principle, acceptable with regards to the noise levels that will exist within the habitable rooms.

- 4.26 It should be noted that the above assessment is based on windows being closed whereas the ProPG guidance suggests that internal noise levels should also be assessed with windows in the open position, which will likely be required at times to control overheating. In this case, the internal noise levels in habitable rooms are approximately 5dB higher than the BS8233 recommended levels when windows are open given that an open window provides up to 15dB attenuation, as noted in ProPG. In our view, this is acceptable as residents would be tolerant to a slight increase in noise levels as this would be expected when opening a window. This is inline with relevant guidance including the Acoustics Ventilation and Overheating guide (January 2020).

Stage 2 – Element 3 – Noise levels in external amenity areas

- 4.27 BS8233 states that it is desirable that noise levels in external amenity areas of residential developments do not exceed 50 dB LAeq and that 55 dB LAeq,T should be regarded as a upper guideline value. BS8233 recognises however that these guideline values will not always be achievable in city centres or urban areas adjoining main roads or other transport sources. In these cases, BS8233 states that the development should be designed to achieve the lowest practical noise levels in the amenity spaces.
- 4.28 The noise survey results indicate that noise levels in external amenity areas at 20m from the railway are at the upper limit of the BS8233 recommended levels. These could be reduced to comply with the lower limit through the adoption of 1.8m high close-boarded timber fencing to the gardens closest to the railway. Gardens are mostly positioned behind the dwellings and therefore will comply with the lower limit of BS8233.
- 4.29 It is important to note that the railway is raised at the far western edge of the site and therefore screening to gardens via fencing would be less effective in this area. As above, the majority of external amenity areas in this area are screened by dwellings, reducing the noise levels in gardens as far as practicable.
- 4.30 In summary of the above, noise levels across the majority of gardens are predicted to achieve the BS8233 recommended lower limit (50 dB LAeq,T) due to the inherent screening in the design. The adoption of 1.8m high close-boarded timber fencing around gardens closest to the railway would help to further reduce noise levels as far as practicable. The proposed development is therefore acceptable based on noise levels in external amenity areas.

Stage 2 – Element 4 – Other relevant issues

- 4.31 In our view the design and acoustic approach outlined above is in line with both local and national noise policy. It is common for residential properties to be situated near to railways and this is an acceptable scenario provided that the properties are designed to achieve acceptable noise levels in habitable areas. In this case it has been shown that acceptable noise levels will be readily achievable with standard building elements.

- 4.32 The assessment of ground-borne vibration due to train passes is also necessary. This is assessed under Section 5.

Recommendation to decision maker

- 4.33 It is our view that planning permission should be granted in relation to noise affecting habitable areas of the development.

5. GROUND-BORNE VIBRATION AFFECTING THE DEVELOPMENT

- 5.1 The vibration levels that will exist within the habitable areas of the finished development have been assessed based on the existing ground-borne vibration levels at the site.

Design criteria – Ground-borne vibration

- 5.2 Appropriate criteria for ground-borne vibration affecting residential dwellings are given in BS 6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings - Part 1: Vibration sources other than blasting*'. The criteria in BS6472-1 are provided as Vibration Dose Values, as summarised in Table 6.

Table 6 BS6472-1:2008 Vibration Criteria

Place	Low Probability of Adverse Comment (VDV) $\text{m}\cdot\text{s}^{-1.75\ 1}$	Adverse Comment Possible (VDV) $\text{m}\cdot\text{s}^{-1.75}$	Adverse Comment Probable (VDV) $\text{m}\cdot\text{s}^{-1.75\ 2}$
Residential buildings 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

- 5.3 Measured ground-borne vibration levels at the site have been assessed against the criteria above.

Existing ground-borne vibration levels

- 5.4 Ground-borne vibration measurements were carried out as part of the site survey. The methodology and results of the measurements are outlined in Appendix 2.
- 5.5 Tri-axial Vibration Dose Value (VDV) measurements were taken across the low-frequency range (1-80Hz) and logged at 1-minute intervals for approximately one hour at each position, to ensure an adequate quantity of train movements were recorded. Barnham timetables indicate that between 8 and 17 trains passed through the station in each hour during the monitoring period. A total sample of 34 train movements past the site were measured during the survey.
- 5.6 Using the measured VDV levels during the survey, the total day and night-time VDV levels have been calculated based on the total number of train passes that occur on the railway per day. The extrapolated VDV levels are summarised below in Table 7.

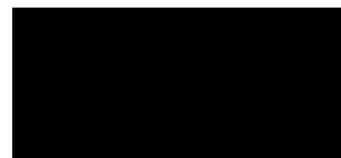
Table 7 Vibration Data Summary (Vibration Dose Values)

Position	Period	X Axis ($\text{m}\cdot\text{s}^{-1.75}$) Wd	Y Axis ($\text{m}\cdot\text{s}^{-1.75}$) Wd	Z Axis ($\text{m}\cdot\text{s}^{-1.75}$) Wb
V1	Daytime (0700-2300hrs)	0.036	0.027	0.210
	Night time (2300-0700hrs)	0.030	0.023	0.176
V2	Daytime (0700-2300hrs)	0.033	0.036	0.231
	Night time (2300-0700hrs)	0.028	0.030	0.195
V3	Daytime (0700-2300hrs)	0.030	0.046	0.303
	Night time (2300-0700hrs)	0.025	0.038	0.254

- 5.7 Vibration levels were highest in the vertical z-axis (compared to the X and Y axes).
- 5.8 From a comparison of Table 6 and Table 7, vibration levels at the site are within the “*Low probability of adverse comment*” rating for daytime periods according to BS6472:2008. During the night-time, vibration levels at positions V1 and V2 have a “*Low probability of adverse comment*”. At position V3 the vibration levels are rated as “*Adverse Comment Possible*”.
- 5.9 Position V3 was measured at approximately 10m from the site boundary and dwellings are expected to be built at approximately 20m from the site boundary. As such, vibration levels will be significantly lower at the nearest dwelling than the measured results. Our assessment is also based on extrapolation of the absolute ‘worst case’ vibration levels recorded during the survey and in practise, vibration levels will be lower. Therefore, it is expected that vibration levels at 20m will have a “*Low probability of adverse comment*”.
- 5.10 It should also be noted that there are existing residential properties positioned closer to the railway line than the proposed dwellings, as shown in Figure 1.
- 5.11 In our view, therefore the levels of vibration at the site are acceptable for the proposed development.

6. CONCLUSIONS

- 6.1 Cass Allen was instructed by Gleeson Strategic Land Ltd to assess the suitability of the site for the proposed development with regards to noise and vibration.
- 6.2 The assessment was carried out in accordance with relevant local and national planning guidance.
- 6.3 A noise and vibration survey was carried out at the site. Noise levels at the site are dictated by railway noise emissions from the West Coastway Line.
- 6.4 Noise levels at the site are relatively low, as confirmed by an NEC and ProPG assessment. Acceptable noise levels will be readily achieved through the implementation of the buffer zone, standard facade elements and the orientation of gardens closest to the railway behind dwellings or 1.8m closed-board timber fencing. In our view, the design of the development is considered to be acceptable subject to the above adopted measures.
- 6.5 Ground-borne vibration levels at the site have been measured and are acceptable for the development.
- 6.6 In summary of the above it is our view that the site is suitable for the development in terms of noise and vibration levels and that planning permission can be granted.



Appendix 1 Arun District Council's Local Plan (July 2018)

21 Quality of the environment

21.2 Noise pollution

- 21.2.1** It is recognised that noise exposure can impact upon quality of life and give rise to adverse health effects. The Noise Policy Statement for England⁽⁷³⁾ (NPSE) seeks, where possible, to positively improve health and quality of life through the pro-active management of noise.
- 21.2.2** Tranquillity is a key characteristic of the natural environment. Tranquil spaces, often located within the more rural parts of the District, play a multi functional role as part of the District's Green Infrastructure network. The Green Infrastructure Study identifies that tranquillity is at risk due to noise pollution from roads and new development. These areas will be protected from noise pollution. The principle of this protection is established through the Green Infrastructure Policy.
- 21.2.3** One of the most common causes of noise pollution is from traffic noise. The Environmental Noise Regulations⁽⁷⁴⁾ require that noise mapping is undertaken to identify areas that are experiencing the greatest noise impacts from roads, railways, airports and industry. The Department of Food and Rural Affairs (DEFRA) are going to be undertaking a second round of mapping and as such account would need to be taken of any subsequent productions and any subsequent declarations that may result.
- 21.2.4** The outcome of the noise mapping is the designation of Important Areas and First Priority Locations. The Brighton Agglomeration⁽⁷⁵⁾ extends into the eastern part of the District. Within this Agglomeration area, 'Important Areas' are identified and "defined as being those areas where 1% population are affected by the highest noise levels from roads". First Priority Locations are also identified within the Agglomeration area and are defined as locations where the noise index is at least 76dB according to the results of the noise mapping.
- 21.2.5** The First Priority Locations within the District include:
- A284/A259 Wick roundabout
 - Stretches of the A27 at Arundel and Fontwell
 - Sections of the A29 and A259 in Bognor Regis
 - A284 in Littlehampton and
 - The stretch of railway that runs through Barnham station
- 21.2.6** Residential development proposed within First Priority Areas, or in close proximity to noise sources from road, rail and air, should be assessed to determine the noise exposure category (NEC) which the site falls into. This assessment must be carried out at an early stage in order to identify the suitability of the site. Where the NEC

73 Defra, 2010

74 Environmental Noise Regulations, 2006

75 An agglomeration is an area covered by a Noise Action Plan

21 Quality of the environment

assessment has shown that habitable rooms will be exposed to noise levels in excess of NEC A, noise mitigation will be required as part of the design of the development (useful advice is set out in the BRE document 'Sound Control for Homes').

- 21.2.7** It should be noted however that NEC noise levels should not be used for assessing the impact of industrial noise on proposed residential development because the nature of this type of noise, and local circumstances, may necessitate individual assessment. However, at mixed use sites where industrial noise is present but not dominant, its contribution should be included in the noise level used to establish the appropriate NEC.

NEC	
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 21.1 Noise exposure categories for residential development

Noise Source	Noise Exposure Categories			
	A	B	C	D
Road traffic				
07.00-23.00	<55	55-63	63-72	>72
23.00-07.00 ⁽⁷⁷⁾	<45	45-57	57-66	>66
Rail traffic				
07.00-23.00	<55	55-66	66-74	>74

⁷⁷ Night-time noise levels (23.00-07.00): sites where individual noise events regularly exceed 82dB LAmax (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the LAeq, 8h (except where the LAeq, 8h already puts the site in NEC D).

21 Quality of the environment

	Noise Exposure Categories			
23.00-07.00 ⁽⁷⁸⁾	<45	45-59	59-66	>66
Air traffic ⁽⁷⁹⁾				
07.00-23.00	<57	57-66	66-72	>72
23.00-07.00	<48	48-57	57-66	>66
Mixed Sources ⁽⁸⁰⁾				
07.00-23.00	<55	55-63	63-72	>72
23.00-07.00	<45	45-57	57-66	>66

Table 21.2 Noise levels⁽⁷⁸⁾ corresponding to the Noise Exposure Categories for New Dwellings LAeq,T dB

21.2.8 The NEC procedure only applies to the proposed development of residential buildings. For noise sensitive commercial developments such as offices it is more appropriate to refer to the latest specific guidance on internal noise standards in respect of each activity.

21.2.9 Where new noise generating development such as industrial and commercial and outdoor sport and recreation uses are proposed, it is expected that they will be located at an appropriate distance away from noise sensitive development ie. residential areas, schools and hospitals. If the development is likely to cause unacceptable levels of disturbance, the developer should consider alternative locations for the site.

21.2.10 If there are no alternative sites available then the applicant will need to demonstrate that all steps have been taken to reduce noise at source. Finally, if all reasonable steps have been taken to reduce the noise at source, but the development is still likely to have adverse effects, then adequate measure to mitigate against the noise should be put in place to protect the noise sensitive use. This could include consideration of noise barriers and site layout first, then insulation of buildings as a last resort.

78 Night-time noise levels (23.00-07.00): sites where individual noise events regularly exceed 62dB LAmax (5 time weighting) several times in any hour should be treated as being in NEC C, regardless of the LAeq, 8h (except where the LAeq, 8h already puts the site in NEC D).

79 Aircraft Noise: daytime values accord with the contour values adopted by the Department for Transport which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2dBM(A) higher than those of other sources because of ground reflection effects.

80 This refers to any combination of road, rail, air and industrial noise sources. The "mixed source" NECs should only be used where no individual noise source is dominant.

76 The noise level(s) (LAeq,T) used when deciding the NEC of a site should be representative of typical conditions.

21 Quality of the environment

21.2.11 In most cases, proposed noise generating development will need to be accompanied by a Noise Report unless the proposal requires an Environmental Impact Assessment, in which case, the impact of noise will be considered in the Environmental Statement. Developers should seek advice at an early stage to ascertain whether a Noise Report is required.

Policy QE DM1

Noise pollution

1. New noise sensitive development

Residential development likely to experience noise from road, rail or air, in particular development in close proximity to:

- A284/A259 Wick roundabout
- Stretches of the A27 around Arundel and Fontwell
- Sections of the A29 and A259 in Bognor Regis
- A284 in Littlehampton and
- The stretch of railway line that runs through Barnham station

must:

- a. Be supported by a noise exposure category (NEC) assessment and designed to ensure that residents will not be adversely affected by noise.
- b. Consider both the likely level of exposure at the time of application and any increase that might be reasonably expected in the foreseeable future.

To safeguard the continued use of existing industrial and commercial uses and to protect amenity, noise sensitive development should not normally be permitted where:

- c. High levels of noise will continue throughout the night, especially during the hours when people are normally sleeping
- d. There is a likelihood of complaints about noise from industrial development. ⁽⁸¹⁾

2. New noise generating development

Developers proposing new noise generating development must seek advice from an early stage to determine the level of noise assessment required. Proposals will need to be supported by:

- a. Evidence to demonstrate that there are no suitable alternative locations for the development.

81 this may be assessed, where appropriate, using guidance in BS4142: 2014

21 Quality of the environment

- b. A noise report which provides accurate information about the existing noise environment, and the likely impact of the proposed development upon the noise environment. The report must also demonstrate that the development meets appropriate national and local standards for noise, as set out in Annex 1 of the Planning Noise Advice Document Sussex, and any mitigation measures required to ensure noise is managed to an acceptable level.
- c. Evidence to demonstrate that the development will not impact upon areas identified and valued for their tranquility, including Gaps Between Settlements which are important to the enjoyment of Arun's countryside, its habitats and biodiversity.

Appendix 2 Survey Results

Survey Summary:

The survey comprised short-term operator attended noise and vibration measurements and longer-term unattended noise monitoring at the site. Noise levels at the site were generally dictated by train movements on the adjacent railway lines, occasional aircraft overflights, sporadic building activity nearby (hand tools, banging etc) and natural sources (birdsong etc). Occasional train horns dictate the highest maximum noise levels. Vibration levels were measured at the edge of the site bordering the railway.

Survey Period:

11/08/2020 to 12/08/2020

Survey Objectives:

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

Equipment Used (Appendix 2, Table 1):

Type	Manufacturer	Model	Serial Number
Sound level meter ¹	Bruel & Kjaer	2250 (G1)	2630237
Calibrator	Bruel & Kjaer	4231	2115551
Sound level meter ¹ (noise logger)	Rion	NL-32	00530374
Tri-Axial Vibration Meter	Rion	VM-54	00360145
Tri-axial accelerometer	Rion	PV-83CW	63643

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 wind speeds and no rain). Weather records for the area confirmed that weather conditions were also generally acceptable for acoustic measurement during the unattended monitoring.

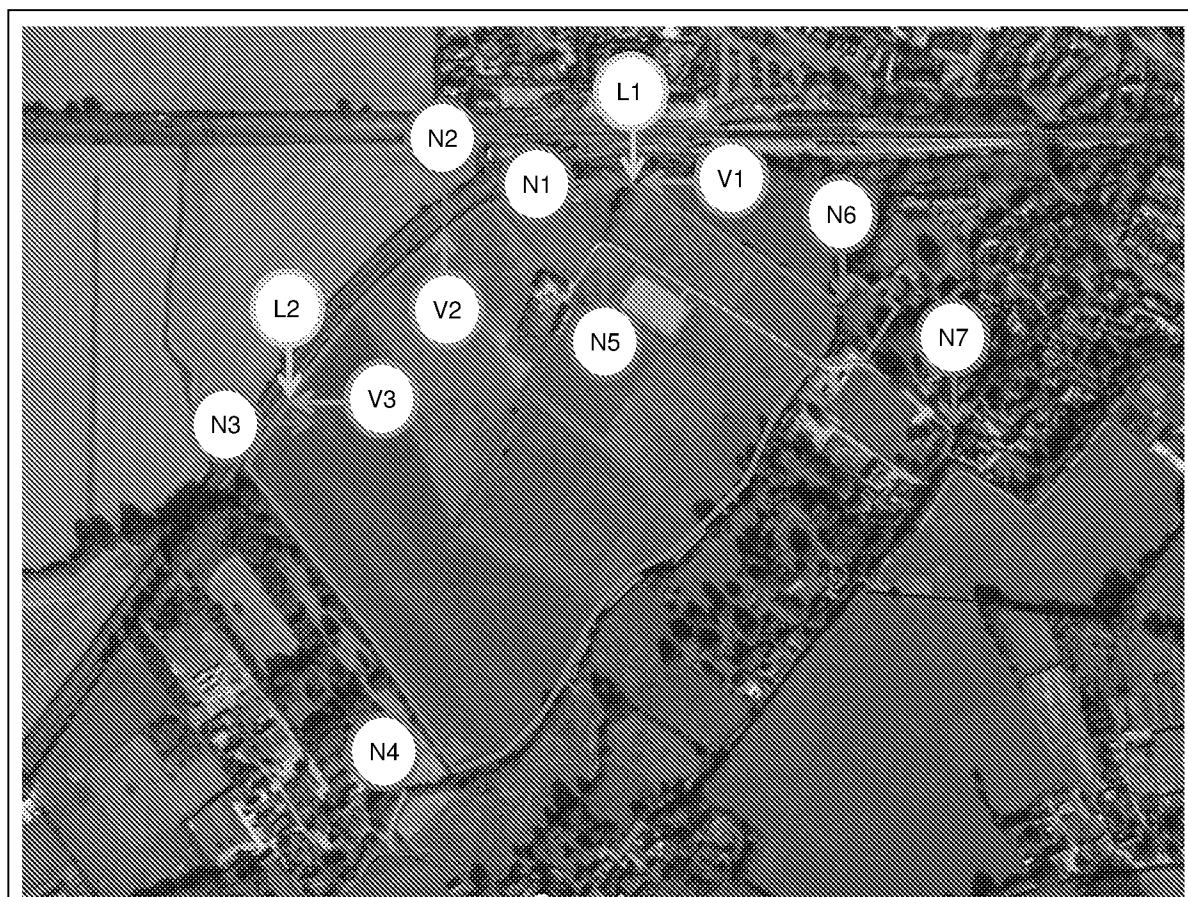
Measurement Positions (Appendix 2, Table 2):

Position (refer plan below)	Description
L1 & L2	Longer-term unattended noise monitoring positions. 1.5m above ground level with line of sight to the railway. L2 approx 3.5 from track
V1 - V3	Attended vibration monitoring position. Vibration measurements were taken in compacted soil at the edge of the site (the vibration sensor was buried in the soil)

Measurement Positions (Appendix 2, Table 2):

Position (refer plan below)	Description
N1 – N7	Attended noise monitoring position. 1.5m above ground level.

Site Plan showing Measurement Positions (Appendix 2, Figure 1):



Attended Noise Monitoring Results (Appendix 2, Table 3):

Date	Position	Time	Meas. Length	LAeq, dB	LAmix, dB	LA90, dB	Observations
11/08/2020	N1	10:37	34 mins	54	75	31	Noise dictated by train passes on the adjacent railway. Noise levels were low between train passes and dictated by distant aircraft, road traffic and natural sources (birdsong). Sporadic construction activities (hand tools etc) associated with nearby building works also contributed to the measured levels. No noise from Barnham Station
11/08/2020	N1	11:14	9 mins	54	72	32	As above.
11/08/2020	N2	11:33	23 mins	62	87	31	Train passes and natural sources. No construction works.
11/08/2020	N4	12:03	8 mins	41	55	35	Natural sources, distant traffic, occasional train passes and construction activities.
11/08/2020	N3	12:20	9 mins	55	76	32	Train passes and natural sources. No construction works. Position N3 is 10m away from the boundary of the site.
11/08/2020	N5	12:42	6 mins	47	60	33	Aircraft overflight, one quiet train pass, natural sources.
11/08/2020	N6	12:59	4 mins	44	56	39	Aircraft overflight, distant train passes, natural sources. No noise from Barnham Station.
11/08/2020	N5	13:08	5 mins	44	68	34	Aircraft overflight, one quiet train pass, natural sources. Some construction noise.
11/08/2020	N7	13:30	4 mins	51	69	38	Natural sources, distant road traffic, occasional vehicle pass (two during measurement)

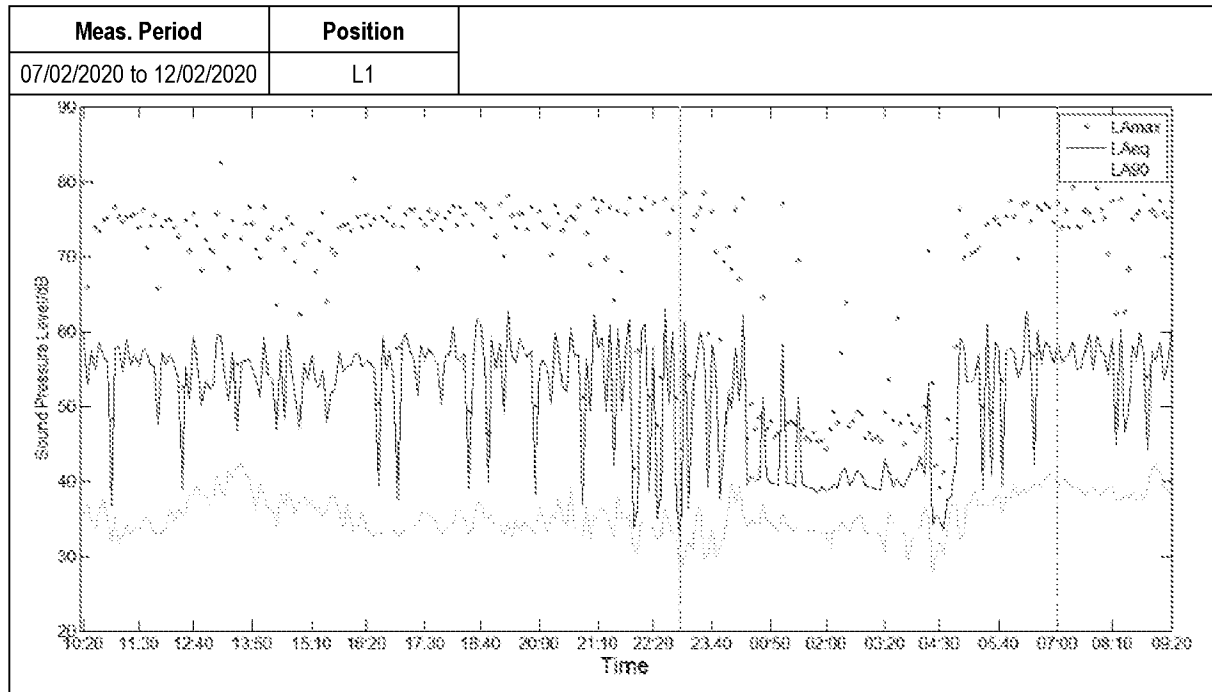
Unattended Noise Monitoring Results (Appendix 2, Table 4):

Meas. Period	Position	Daytime (0700-2300hrs)		Night-time (2300-0700hrs)		
		LAeq,16hr, dB	LA90,1hr dB ¹	LAeq,8hr, dB	LA90,5mins, dB ¹	LAmix, dB ²
11/08/2020 to 12/08/2020	L1	57	34	54	33	77
11/08/2020 to 12/08/2020	L2	62	37	58	27	84

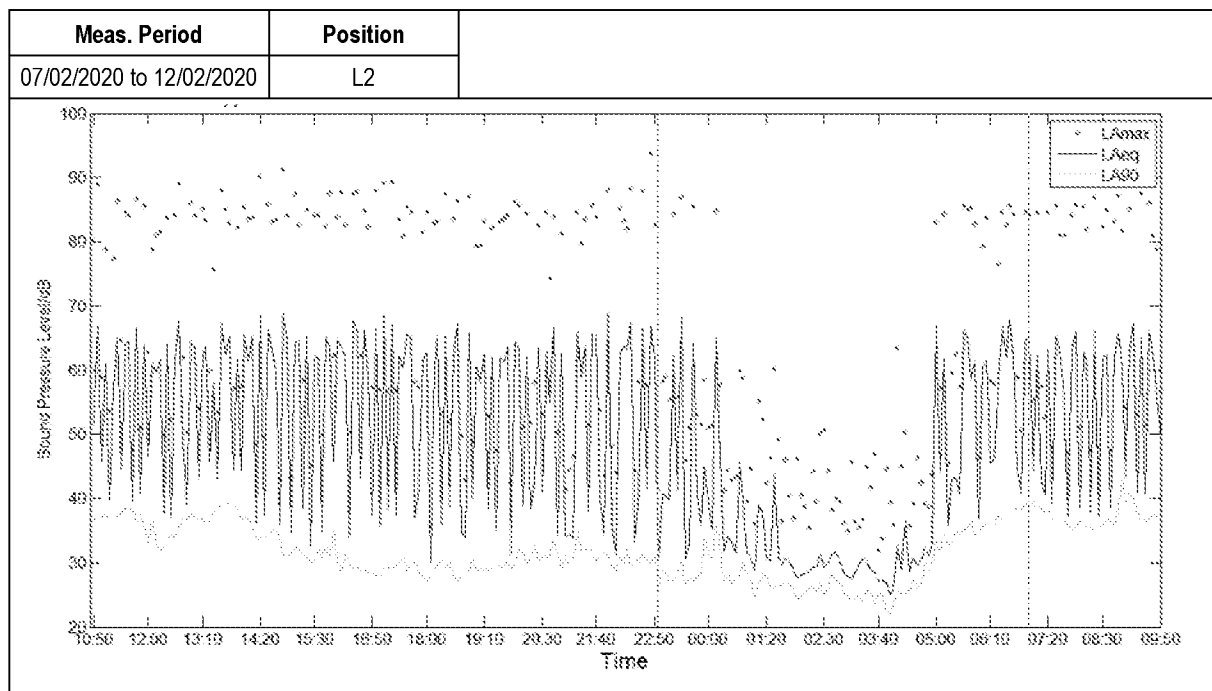
Note 1: Typical lowest measured during the period shown.

Note 2: Highest typical maximum noise level during the night-time (not exceeded more than 10-15 times per night).

Unattended Noise Monitoring Results (Appendix 2, Figure 4):



Unattended Noise Monitoring Results (Appendix 2, Figure 5):



Attended Vibration Monitoring Results (Appendix 2, Table 5):

Date	Position	Time	Meas. Length	X-VDV Daytime (16hrs)	X-VDV Night- time (8hrs)	Y-VDV Daytime (16hrs)	Y-VDV Night- time (8hrs)	Z-VDV Daytime (16hrs)	Z-VDV Night- time (8hrs)	Observations
11/08/2020	V1	10:37	57 mins	0.036	0.030	0.027	0.023	0.210	0.176	Measurement range – 1 - 56
11/08/2020	V2	11:29	52 mins	0.033	0.028	0.036	0.030	0.231	0.195	Measurement range – 57 - 108
11/08/2020	V3	12:30	55 mins	0.030	0.025	0.046	0.038	0.303	0.254	Measurement range – 109 - 164

Appendix 3 Facade Calculations

CLIENT:Gleeson Strategic Land Ltd

PROJECT:Land South of Barnham Station

ROOM:Bedroom, 20m from railway edge

RUN REF:Daytime

VARIANT:Laeq 0700-2300

Room Dimensions [m]3.04.0X2.4

Room Volume = 28.8 m3

Partition Area = 9.5 m2

Ventilation ref area = 10.0 m2

Free Field SPL K = 3 dB

SELECT Free Field or Façade SPL for model input >>>

EXTERNAL SPECTRUM (A weighted)

dBA	63	125	250	500	1000	2000	4000	
Direct input - Free Field SPL (A weighted octave bands) dB ----->	-							No data
Road traffic spectrum (according to BS 8233:1999 section 6)	53.7							
	35.5	39.6	43.1	46.5	49.7	46.9	41.7	Reference spectrum

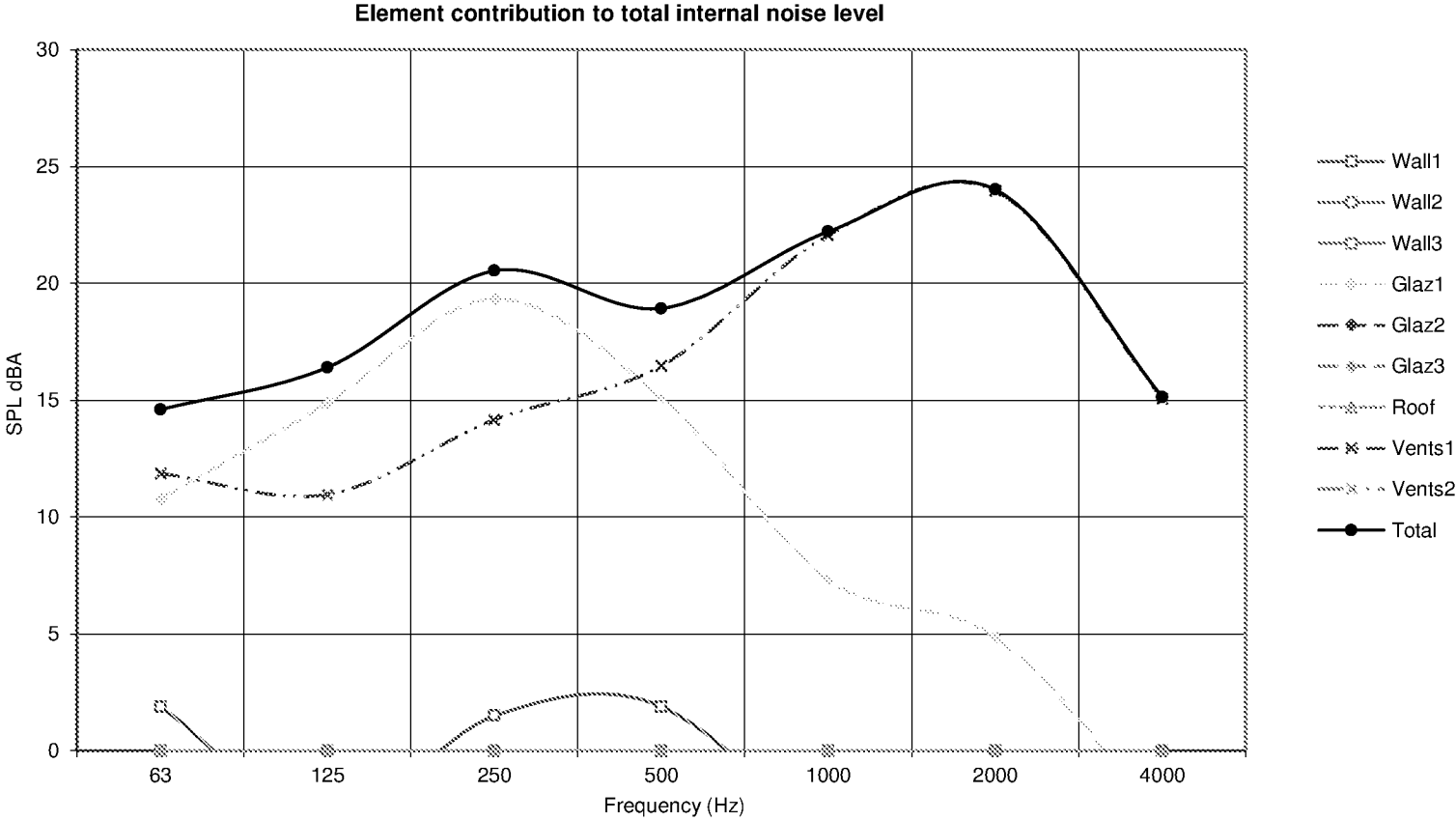
REVERBERATION TIME

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

NOTES:

Façade Element		Area [m2]	SRI dB to BS EN ISO 140-3:1995								Rw	C	Ctr
Wall 1	Typical - 102mm brick/50mm cavity/100mm block	8.0	36	45	44	47	57	67	77	0%	54	0	-4
	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	27 dB Rw + Ctr - Standard Thermal Double Glazing	1.5	20	20	19	27	38	37	40	24%	27 (inc Ctr)	-	-
	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	28	27	34	45	45	48				
Resultant SPL inside room excluding ventilators dB			22.4	11	15	19	15	8	5	-3	24%		

Ventilator Type		Num	Dn,e dB to BS EN 20140-10:1992								Dnew	C	Ctr
Ventilation	Hit and miss trickle (4000mm²) e.g. Titon Trimvent XS13	2	30	35	35	36	34	29	33	75%	32	0	-1
	ATTENUATION												
Ventilation	VENTS		0	0	0	0	0	0	0	0%			
	ATTENUATION												
Resultant SPL inside room through ventilators dB			27.3	12	11	14	16	22	24	15	78%		
Total SPL inside room			28.5	15	16	21	19	22	24	15			



CLIENT:Gleeson Strategic Land Ltd

PROJECT:Land South of Barnham Station

ROOM:Bedroom, 20m from railway edge

RUN REF:Night-time

VARIANT:Laeq 2300-0700

Room Dimensions [m]3.04.0X2.4

Room Volume = 28.8 m3

Partition Area = 9.5 m2

Ventilation ref area = 10.0 m2

Free Field SPL K = 3 dB

SELECT Free Field or Façade SPL for model input >>>

EXTERNAL SPECTRUM (A weighted)

Direct input - Free Field SPL (A weighted octave bands) dB ----->

Road traffic spectrum (according to BS 8233:1999 section 6)

dBA	63	125	250	500	1000	2000	4000
-							
49.7							
	31.5	35.6	39.1	42.5	45.7	42.9	37.7

No dataReference spectrum

REVERBERATION TIME

DIRECT INPUT ----->

EQUAL RT for all bands ----->

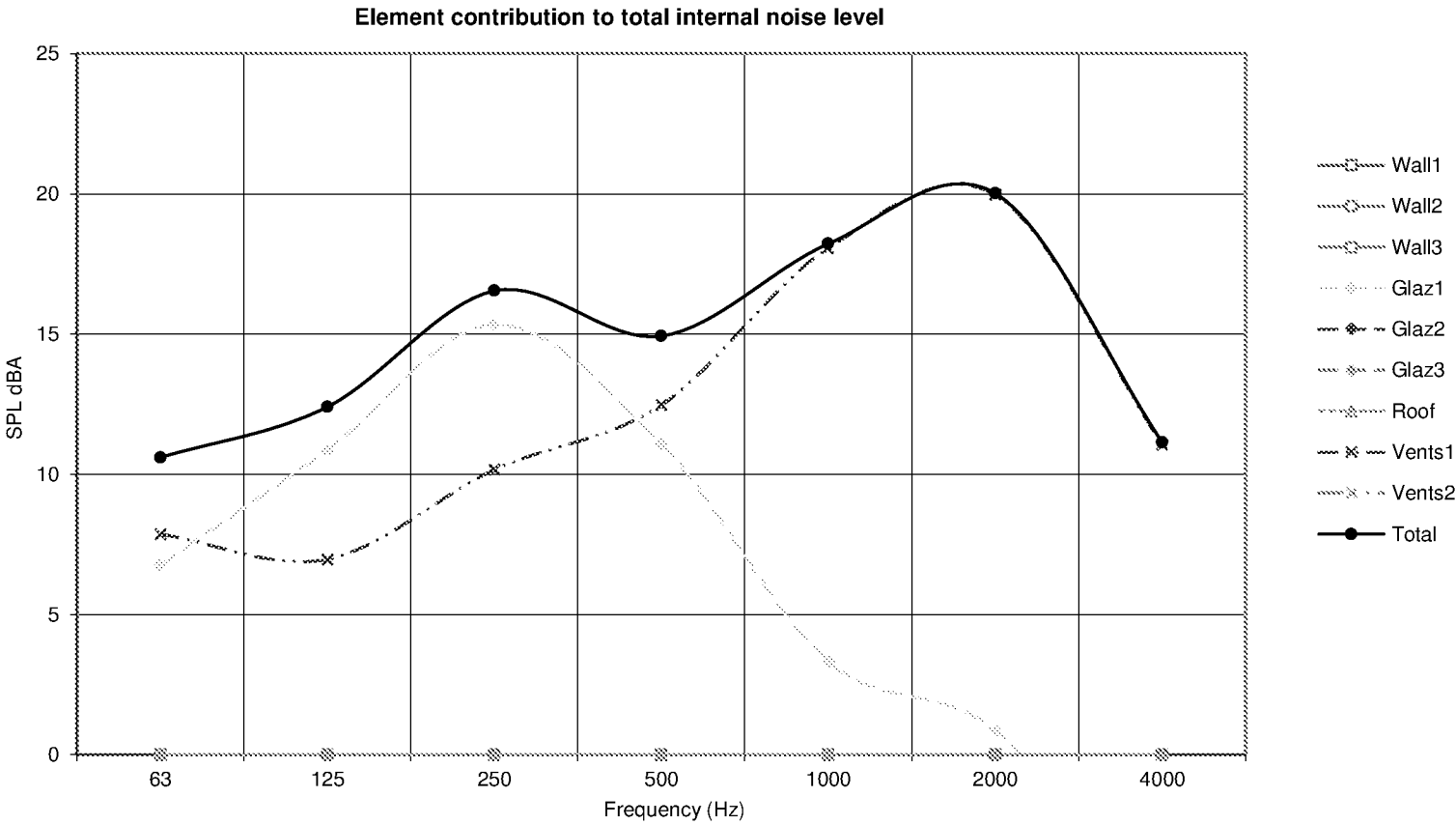
	0.5	0.5	0.5	0.5	0.5	0.5	0.5

No dataDefault - RT set to 0.5s

NOTES:

Façade Element			Area [m2]	SRI dB to BS EN ISO 140-3:1995									Rw	C	Ctr
Wall 1	Typical - 102mm brick/50mm cavity /100mm block	▼	8.0	36	45	44	47	57	67	77	0%	54	0	-4	
	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	27 dB Rw + Ctr - Standard Thermal Double Glazing	▼	1.5	20	20	19	27	38	37	40	23%	27 (inc Ctr)	-	-	
	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	28	27	34	45	45	48					
Resultant SPL inside room excluding ventilators dB			18.4	7	11	15	11	4	1	-7	24%				

Ventilator Type			Num	D _{n,e} dB to BS EN 20140-10:1992								Dnew	C	Ctr
Ventilation	Hit and miss trickle (4000mm²) e.g. Titon Trimvent XS13	▼	2	30	35	35	36	34	29	33	75%	32	0	-1
	ATTENUATION													
Ventilation	VENTS	▼		0	0	0	0	0	0	0	0%			
	ATTENUATION													
Resultant SPL inside room through ventilators dB			23.3	8	7	10	12	18	20	11	78%			
Total SPL inside room			24.5	11	12	17	15	18	20	11				



CLIENT:Gleeson Strategic Land Ltd

PROJECT:Land South of Barnham Station

ROOM:Bedroom, 20m from railway edge

RUN REF:Night-time Max

VARIANT:Laeq 2300-0700

Room Dimensions [m]3.04.0X2.4

Room Volume = 28.8 m3

Partition Area = 9.5 m2

Ventilation ref area = 10.0 m2

Free Field SPL K = 3 dB

SELECT Free Field or Façade SPL for model input >>>

EXTERNAL SPECTRUM (A weighted)

dBA	63	125	250	500	1000	2000	4000
Direct input - Free Field SPL (A weighted octave bands) dB ----->	67.5	39.3	47.1	57.3	62.2	63.2	59.3
Road traffic spectrum (according to BS 8233:1999 section 6)							

REVERBERATION TIME

DIRECT INPUT ----->

EQUAL RT for all bands ----->

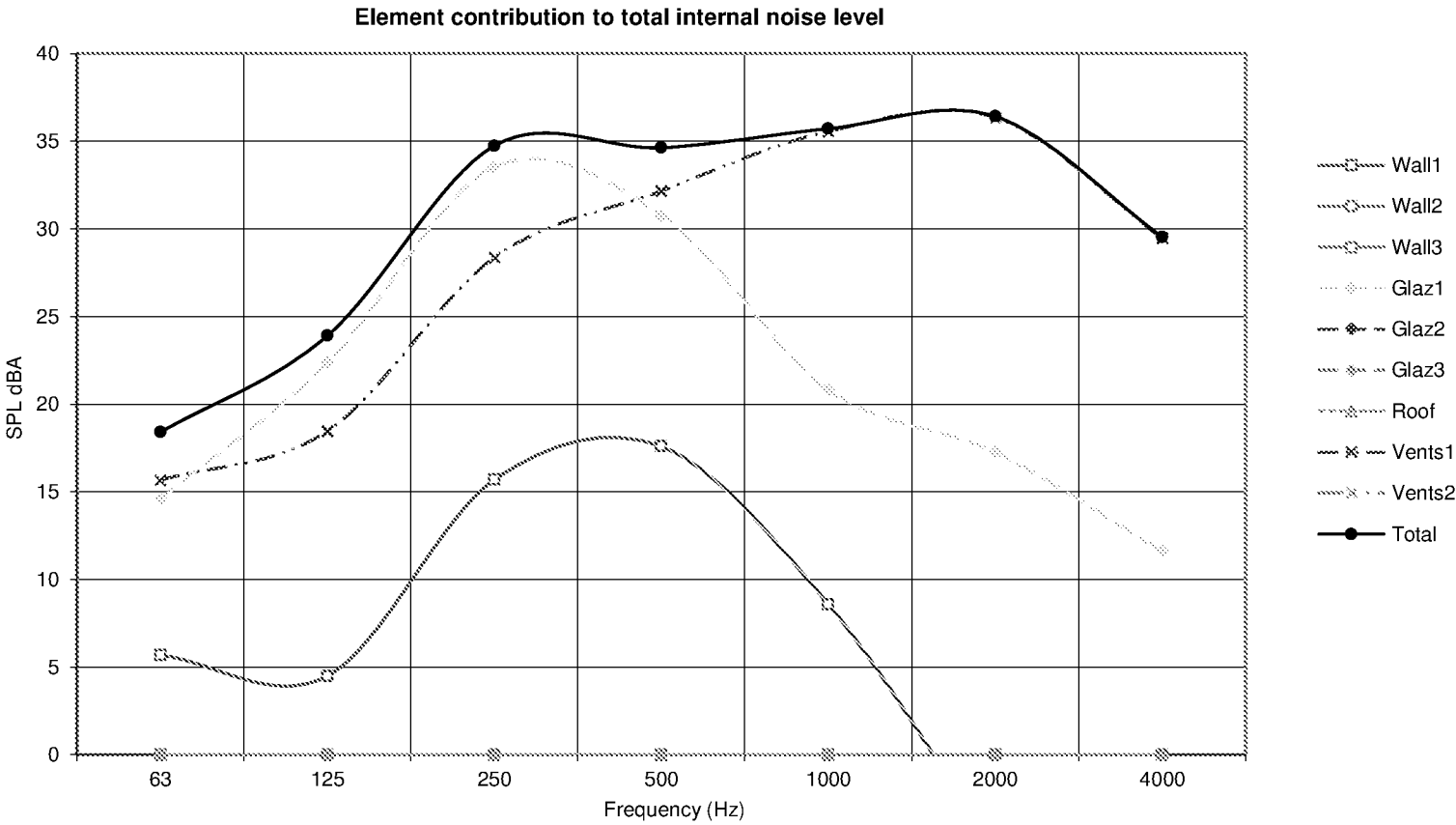
No data

Default - RT set to 0.5s

NOTES:

Façade Element		Area [m2]	SRI dB to BS EN ISO 140-3:1995								Rw	C	Ctr
Wall 1	Typical - 102mm brick/50mm cavity/100mm block	8.0	36	45	44	47	57	67	77	1%	54	0	-4
	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	27 dB Rw + Ctr - Standard Thermal Double Glazing	1.5	20	20	19	27	38	37	40	25%	27 (inc Ctr)	-	-
	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	28	27	34	45	45	48				
Resultant SPL inside room excluding ventilators dB			36.0	15	22	34	31	21	17	26%			

Ventilator Type		Num	D _{n,e} dB to BS EN 20140-10:1992								Dnew	C	Ctr
Ventilation	Hit and miss trickle (4000mm²) e.g. Titan Trimvent XS13	2	30	35	35	36	34	29	33	74%	32	0	-1
	ATTENUATION												
Ventilation	VENTS		0	0	0	0	0	0	0	0%			
	ATTENUATION												
Resultant SPL inside room through ventilators dB			40.5	16	18	28	32	36	36	74%			
Total SPL inside room			41.8	18	24	35	35	36	36	30			



CLIENT:Gleeson Strategic Land Ltd

PROJECT:Land South of Barnham Station

ROOM:Living Room, 20m from railway edge

RUN REF:Daytime

VARIANT:Laeq 0700-2300

Room Dimensions [m]4.0 X 5.0 X 2.4

Room Volume = 48.0 m3
Partition Area = 17.0 m2
Ventilation ref area = 10.0 m2
Free Field SPL K = 3 dB

SELECT Free Field or Façade SPL for model input >>>

EXTERNAL SPECTRUM (A weighted)

dBA	63	125	250	500	1000	2000	4000	
Direct input - Free Field SPL (A weighted octave bands) dB ----->	-							No data
Road traffic spectrum (according to BS 8233:1999 section 6)	53.7							
	35.5	39.6	43.1	46.5	49.7	46.9	41.7	Reference spectrum

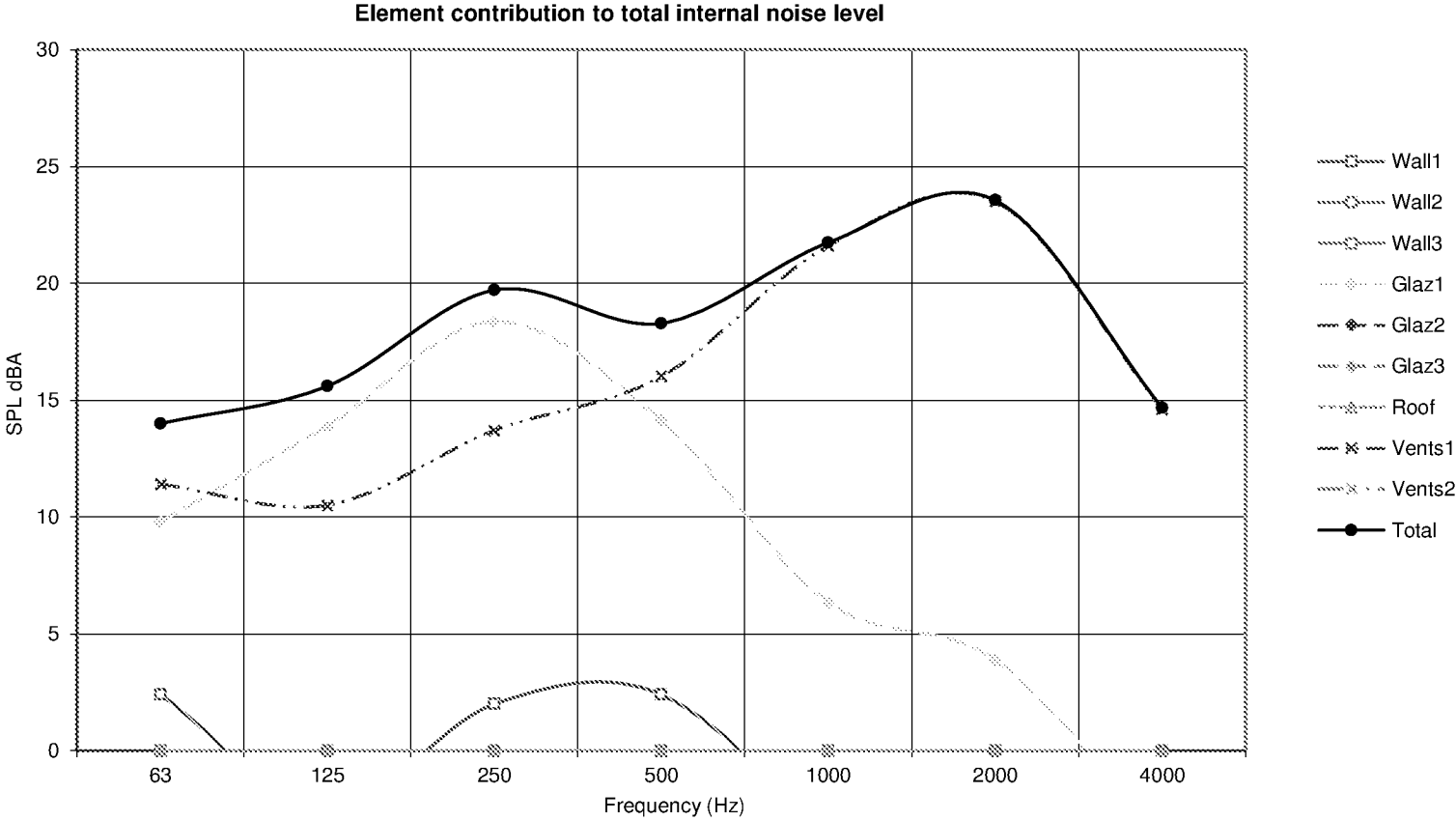
REVERBERATION TIME

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

NOTES:

Façade Element		Area [m2]	SRI dB to BS EN ISO 140-3:1995								Rw	C	Ctr
Wall 1	Typical - 102mm brick/50mm cavity/100mm block	15.0	36	45	44	47	57	67	77	0%	54	0	-4
	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	27 dB Rw + Ctr - Standard Thermal Double Glazing	2.0	20	20	19	27	38	37	40	22%	27 (inc Ctr)	-	-
	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	29	28	36	46	46	49				
Resultant SPL inside room excluding ventilators dB			21.5	11	14	18	14	7	4	-4	23%		

Ventilator Type		Num	Dn,e dB to BS EN 20140-10:1992								Dnew	C	Ctr
Ventilation	Hit and miss trickle (4000mm²) e.g. Titan Trimvent XS13	3	30	35	35	36	34	29	33	77%	32	0	-1
	ATTENUATION												
Ventilation	VENTS		0	0	0	0	0	0	0	0%			
	ATTENUATION												
Resultant SPL inside room through ventilators dB			26.9	11	11	14	16	22	24	15	77%		
Total SPL inside room			28.0	14	16	20	18	22	24	15			





Architectural & Environmental Acousticians

Noise & Vibration Engineers

This report has been prepared by Cass Allen Associates Ltd in accordance with the CDM regulations with all reasonable skill, care and diligence, and taking account of the resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid at the time of collection. This report is for the exclusive use of the client named above; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from Cass Allen Associates Ltd. Cass Allen Associates Ltd disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of work.



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