

Acoustic Associates Sussex Ltd

Planning Condition Environmental Noise Assessment

Site: Land at Fontwell Avenue
Client: CD Tarpaulins

Report by: George Orton BEng(Hons) MIOA

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Project: J2232



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1 Introduction

Acoustic Associates have been appointed to undertake an acoustic assessment of the proposed “Land at Fontwell Avenue” development.

The purpose of this assessment is to assess the following:

- Noise levels affecting the proposed development.
- Mitigation Measures to reduce internal noise levels.

The development will build residential dwellings on an empty site. The development has gained planning approval albeit with certain conditions. The planning condition is discussed in section 2

Environmental noise has been measured on the existing empty site for 24hrs

Noise from the nearby commercial properties has also been measured and assessed

Noise propagation around the proposed development has been predicted using the computer program IMMI (Wolfel).

The noise levels for the day and the night time period have been assessed in terms of and following the guidelines of the documents listed below:

- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- BS4142 (2014) Method for rating industrial noise affecting mixed residential and industrial areas

Noise mitigation measures have been recommended and if they are implemented by the developer it is considered that the planning condition would be satisfied.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

The proposed development will build 2 new houses on an empty site. The development has gained planning approval, albeit with certain conditions. The planning condition which relates to noise has been copied below:

“Development shall not begin until a scheme for protecting the proposed dwellings from noise from A29 road traffic and noise from the scrapyards to the West has been submitted and approved by the Local Planning Authority. Any works which form part of the scheme approved by the Authority shall be completed prior to the occupation of any of the dwellings. The noise protection measures shall be retained thereafter.”

The residential development will be built on an empty site next to Fontwell Avenue which is a relatively busy road. To the rear ((west) of the development is the SRC Recycling Scrapyard. Additional dwellings will also be built on the site but they are detailed in a separate planning application. The other dwellings are included in the noise model.

2.2 Proposed Criteria

Based upon Local Authority guidance documents it is recommended in this case that appropriate criteria are provided by:

- BS8233 (Sound insulation and noise reduction for buildings) 2014
- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- BS4142 (2014) Method for rating industrial noise affecting mixed residential and industrial areas

Assessment methodology, predictions of building envelope sound insulation and calculations of noise propagation will follow the principles detailed within:

- ISO9613 (1996) Attenuation of sound during propagation outdoors
- BS8233 (Sound insulation and noise reduction for buildings) 2014

2.3 BS4142: 2014: Method for rating and assessing industrial and commercial sound

This document provides a means of assessing the impact of industrial or commercial sound upon nearby noise-sensitive receptors, including residential properties.

It does this by comparing the Rating Level of the noise from the industrial or commercial source with the pre-existent L_{90} background noise level affecting the same noise-sensitive premises. The Standard provides guidance that:

- a) Typically, the greater the difference, the greater the magnitude of the impact.
- b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact, depending on the context.

2.4 WHO Internal Noise Criteria

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and are as follows:

Room Type	Target Maximum Internal Level - L_{Aeq} dB (A)
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Living rooms	35 (Daytime only)
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Bedrooms	30 (Night)
----------	------------

Room Type	Maximum Internal Level – L_{Amax} dB(A)
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Bedrooms	45 (not more than 10-15 times per Night)
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The target maximum internal noise level for a bedroom during the night time corresponds to the threshold of sleep disturbance. WHO state that the noise level outside a bedroom window would be less than 45dB(A) this assumes that an open window provides 15dB attenuation.

2.5 WHO External Noise Criteria

With regard to outdoor amenity areas WHO states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

2.6 BS8233 Noise Criteria

Table 5 of BS8233 provides the following guideline values:

Activity	Location	Time period of day	
		07:00-23:00	23:00-07:00
Resting	Living Rooms	35dB LAeq,16hour	-
Dining	Dining Room/Area	40dB LAeq,16hour	-
Sleeping (daytime resting)	Bedroom	35dB LAeq,16hour	30dB LAeq,8hour

Table 1: BS8233 Criteria

With regard to external amenity areas BS8233 (7.7.3.2 Design criteria for external noise) states the following:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

Further to the above, Planning Practice Guidance 2014 (Noise) states the following:

Are there further considerations relating to mitigating the impact of noise on residential developments? Yes – the noise impact may be partially off-set if the residents of those dwellings have access to: A relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance).

3 Noise Survey Baseline Conditions and Results

An unattended noise survey was carried out from the 18th to the 19th April 2017 in order to measure noise levels affecting the proposed development. Noise measurements were conducted at ground floor level on the empty site (at a position corresponding to the road-dwelling distance).

Further manned measurements were also completed on the 4th & 7th April 2017 in order to measure noise levels associated with the nearby commercial noise sources. These noise measurements were completed close to the rear (west) boundary close to the scrapyard.

The noise monitoring locations can be seen in the survey noise models that are in the appendix.

3.1 Baseline Conditions

- Survey carried out by: George Orton BEng (Hons) MIOA
- Equipment used: Castle Mirus - Type 1 Sound Level Meter
Norsonic Nor140 - Type 1 Sound Level Meter
- Weather conditions: Variable (dry); Wind: variable direction
Never greater than 5ms⁻²

Meters were calibrated before and after commencing the noise measurements (@94dB no drift). The microphone was approximately 1.5m from the ground and well away from any other reflective surfaces I.E. free field. All noise levels in the report, including those predicted by the noise model, will be free-field unless stated otherwise.

3.2 Commercial Noise Survey Results

The attended survey was completed during 2 separate visits to site. The noise from the scrapyard was sporadic and during another visit to site there was no noise breakout. The noise measurements were completed when there was activity at the scrapyard. The sounds related to air tools and from items being dropped or struck with a hammer. The noise measurements were completed close to the boundary to minimise the effect of road noise. However for the general noise created by the scrapyard it was judged subjectively that the road noise may still have affected the measurements. The impulsive sounds were less affected by the road noise as they created a greater noise level.

Position	Duration	Freefield Level L _{Aeq} - dB(A)		
		L _{Aeq}	L _{Amax}	L _{A90}
ST1	2	51.2	64.8	46.4
ST1	2	53.2	68.9	46.2
ST1	2	50.7	63.5	46.9
ST1	15	50.8	72.1	44.7
ST1	15	50.2	68.6	43.4
ST1	15	52.8	68.3	43.2

Table 2: Commercial Noise Survey Results

3.3 Unattended Noise Survey Results

Position LT1 was located at the roughly the same distance from the road as the proposed dwellings will be. At this position the dominant noise source is the road. The survey data has been used to calculate the 16hr day time and the 8hr night time period noise levels. A graphical representation of results has also been detailed below.

Day	Time Period	Freefield Level $L_{Aeq,16hr/8hr}$ dB(A)
Tuesday	07:00-23:00hrs	54
Tuesday/Wednesday	23:00-07:00hrs	51

Table 3: Survey 1 Noise Levels

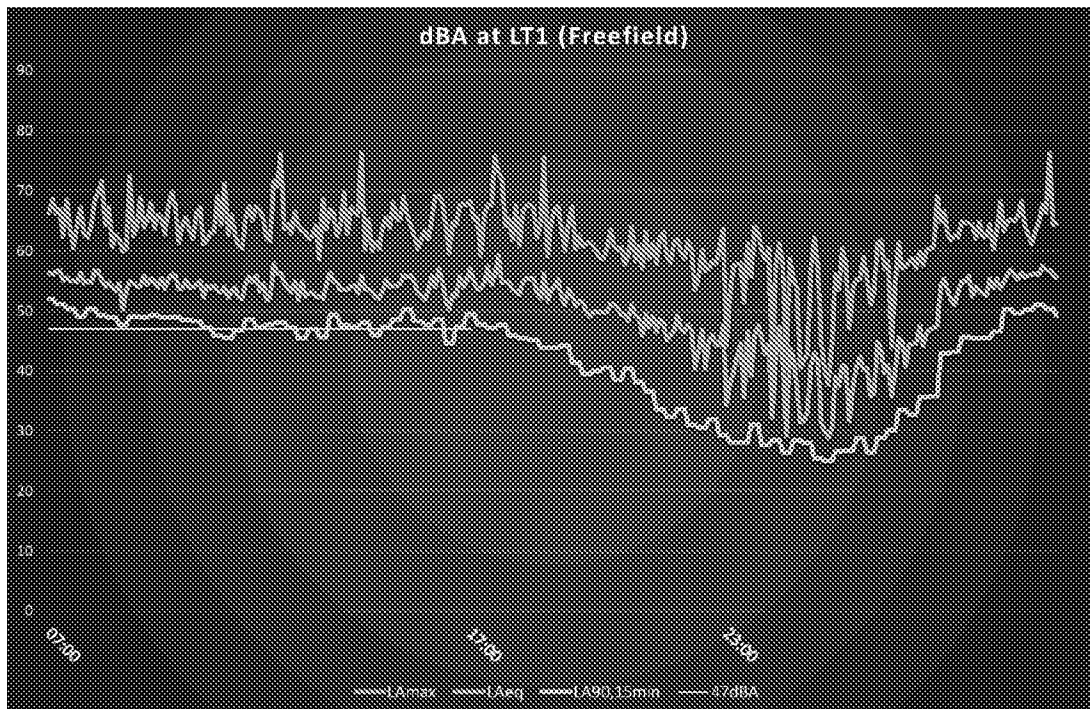


Figure 1: Survey Graphical Data

4 Computer Noise Model

In order to see how noise varies at different positions around the proposed development it is possible to produce a noise contour map.

A computer noise model has been completed using the computer package IMMI. The survey data and drawings of the proposed development have been used to complete the noise models. IMMI faithfully implements the propagation method of ISO-9613:1996; Acoustics – Attenuation of sound during propagation outdoors.

An “existing site” noise model was completed first to allow the calibration of the noise source (road). The existing site model contained nearby buildings.

4.1 Road Survey Noise Model Methodology

The Fontwell Avenue road was added to “Survey” noise model as a line source. The line source day/night time sound power was adjusted until the level at survey reception point (RP) matched the survey data in table 3.

4.2 Commercial Survey Noise Model Methodology

The road noise model was used to predict that the daytime road noise level at the commercial noise survey location is 48dBA. This demonstrates that as suspected the commercial noise measurements have probably been affected by the constant road noise levels.

To predict a worst case hour commercial noise level the survey results will be corrected to reduce the effect of road noise and combined logarithmically. This will probably overestimate the noise level as the measurements were taken when the scrapyard (SY) was creating noise (sometimes there are lulls in activity when no scrapyard noise was audible on the development site). The details of the corrections and the predicted hour noise level, at ST1, can be seen below:

Survey Reading	Survey – 48dBA Road Noise
51	48
53	52
51	47
51	48
50	46
53	51
Scrap Yard 1Hr (Log average)	49dBA

Table 4: Corrected Scrap Yard Noise Levels at ST1

The scrap yard was then added to the noise model at a position close to where it was perceived the majority of the noise was being created. The road noise source was switched off. The noise source was adjusted until the level at ST1 was equal to 49dBA.

4.3 Proposed Development Noise Model Methodology

The development buildings were added to the model. New reception points were added at different heights and locations around the proposed development

Noise contours were plotted for the ground floor daytime and RPs were predicted for the day and night time (Model says dB but levels are actually dBA values).

The first plot detailed only the scrapyard noise. Another plot was completed with the combined noise level of the scrap yard and the road noise. The survey models can be found in the appendix. The scrapyard and road noise models can be seen below:

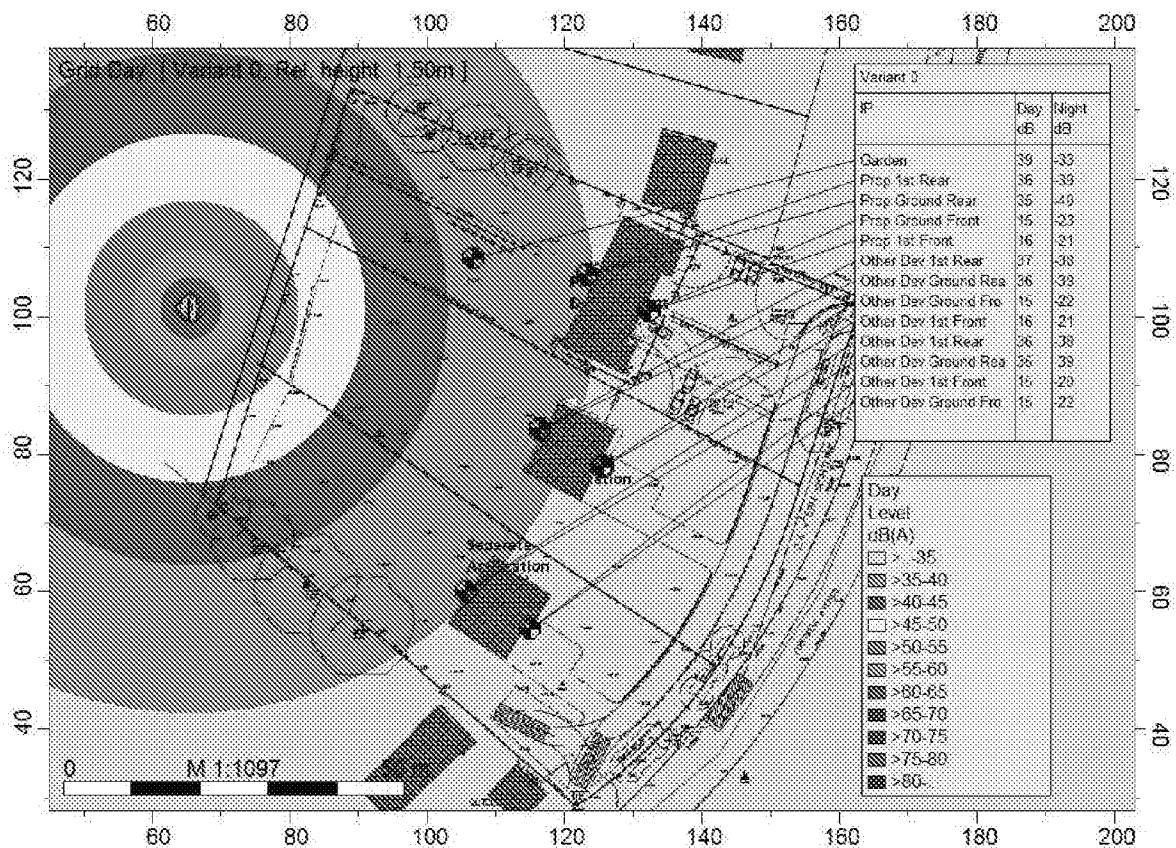


Figure 2: Scrapyard Noise Model

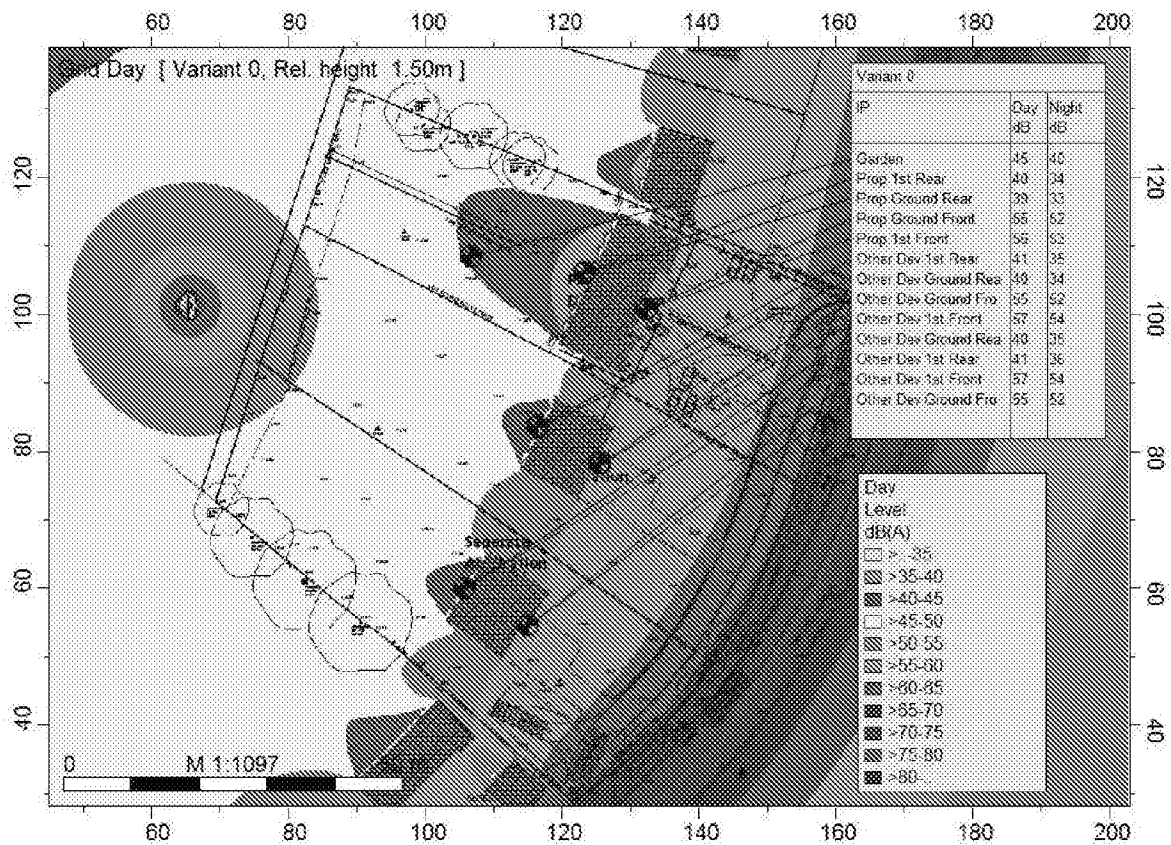


Figure 3: Combined Noise Model

5 BS4142 Industrial Noise Assessment

5.1 Rating Level

It is important to differentiate between noise rating level and specific noise level. Certain acoustic features can increase the likelihood of complaint. BS4142 “subjective method” states the following:

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

The just audible tool noise was judged to be tonal. The banging noise would probably have to attract penalty as the impulsivity was perceptible. This relates to the noise as perceived close to the boundary. Where the houses will be will be subject to lower levels as the houses are further from the scrapyards. Therefore a 2dB tonal penalty and a 6dB impulsive correction will be added to the specific noise level.

Therefore the predicted busy hour rating level would be between 43dBA at the worst case NSR.

5.2 BS4142 Assessment of Impacts

From the graph in section 3 the representative daytime background sound level has been estimated to be 47dBA.

The rating level of the proposed development is at very worst 4dB below background and for cases such as this BS4142 states the following:

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact, depending on the context.

5.3 Uncertainty

It should be noted that the above assessment was completed based on the noise levels when the scrapyards appeared busy. Based on the levels emitted at other times it is considered that the day to day typical rating level may be marginally lower than the predicted worst case rating level.

6 Noise Mitigation Measures

6.1 Noise Criteria

6.1.1 Continuous Noise Levels

The BS8233 2014 and WHO noise criteria (see 2.3 and 2.4) will be used to specify the noise mitigation measures. The maximum internal noise level for each area is as follows:

- Bedrooms 35/30dBA Day/Night
- Lounges 35dBA Day

6.1.2 Maximum Noise Levels

L_{Amax} levels were also measured during the noise survey. The noise models show that the worst case noise level for the proposed development is 3dB(A) higher than the noise level at the survey position. The survey data was recorded in (consecutive) 5 minute measurements.

The survey data was used to predict for a typical night time there will be 6 L_{Amax} events over 45dBA inside if the building SRI is 24dBA (SRI of building envelope required to achieve the 30dBA continuous criterion)

The above would achieve the WHO Guidelines for community noise (1999) criteria.

6.2 Required Sound Reduction of Building Envelope

The Table below shows the required Sound Reduction (SRI) which will have to be achieved by the building envelope (for simplicity only worst case RP results have been detailed).

Location	Time	Ext. Noise Level	Criteria	ReqSRI
Worst Case Front	Day	57	35	22
Worst Case Front	Night	54	30	24
Worst Case Rear	Day	41	35	6
Worst Case Rear	Night	35	30	5

Table 5: Required SRI

The BS8233 “Rigorous Calculation” has been used to predict the sound insulation provided by the building envelope (Calculation detailed in BS8233 (Annex G.2) and full details of the calculations can be found in the appendix of the report.

Calculations have been completed to demonstrate that the required worst case SRI is achievable with off the shelf glazing and attenuated ventilators (as an example Pilkington Glass and Simon Air test data was used).

The frequency profile of passing traffic has been approximated using the “Normalized road traffic noise spectrum” derived from BS EN 1793-3:1998. This traffic noise frequency profile is also discussed in BS8233. The calculation predicts the total building envelope sound reduction index SRI. In the example a large window size is assumed. The calculation shows that the SRI will be 36dB if standard double glazing is used and a 33Dn,e,w trickle ventilator is used.

6.3 Noise Mitigation Rear Plots

The above shows that the criteria will be achieved with windows left open (based on the general assumption that the noise level inside will be 15dB lower, than outside, if a window is open).

Therefore standard double glazing and standard trickle vents could be used.

6.4 Noise Mitigation Front Plots

The calculation shows that for habitable rooms on the front façade the following specifications should be achieved:

- Glazing to achieve a minimum of $R_w + C_{tr} = 25\text{dB}$ (Such as Pilkington 4/12/4 glazing)
- Trickle Vent to achieve a minimum of $D_{n,e,w} = 33\text{dB}$ (Such as RW Simon “Framevent” tricklevent)

7 Conclusion

Noise levels affecting the proposed development have been measured and assessed.

The dominant source of noise affecting the front of the proposed development relates to vehicles traveling on nearby roads.

The noise levels affecting the site are relatively low and the BS8233/WHO criteria can be achieved with simple mitigation measures.

Noise levels in the gardens of the houses will also be relatively low as they are below the WHO low limit value of 50dBA.

Measurements and predictions have been completed to show that the noise rating level, associated with commercial noise sources near to the proposed development, will be lower than the representative background sound level.

Therefore it is considered that the noise impact for future residents of the proposed development would be low.

If the developer implements the basic noise mitigation measures the planning condition should be satisfied. It is possible that the Local Authority may require evidence such as purchase statements for the glazing and ventilators.

8 Appendix

8.1 Survey Noise Models

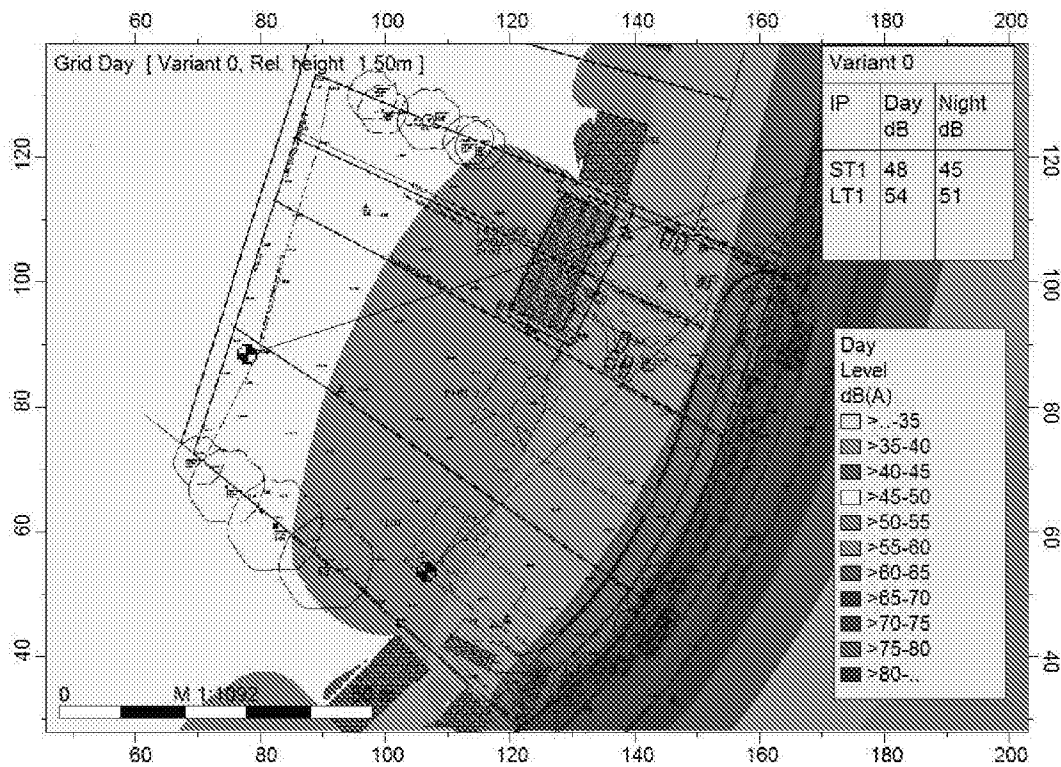


Figure 4: Survey Model Road

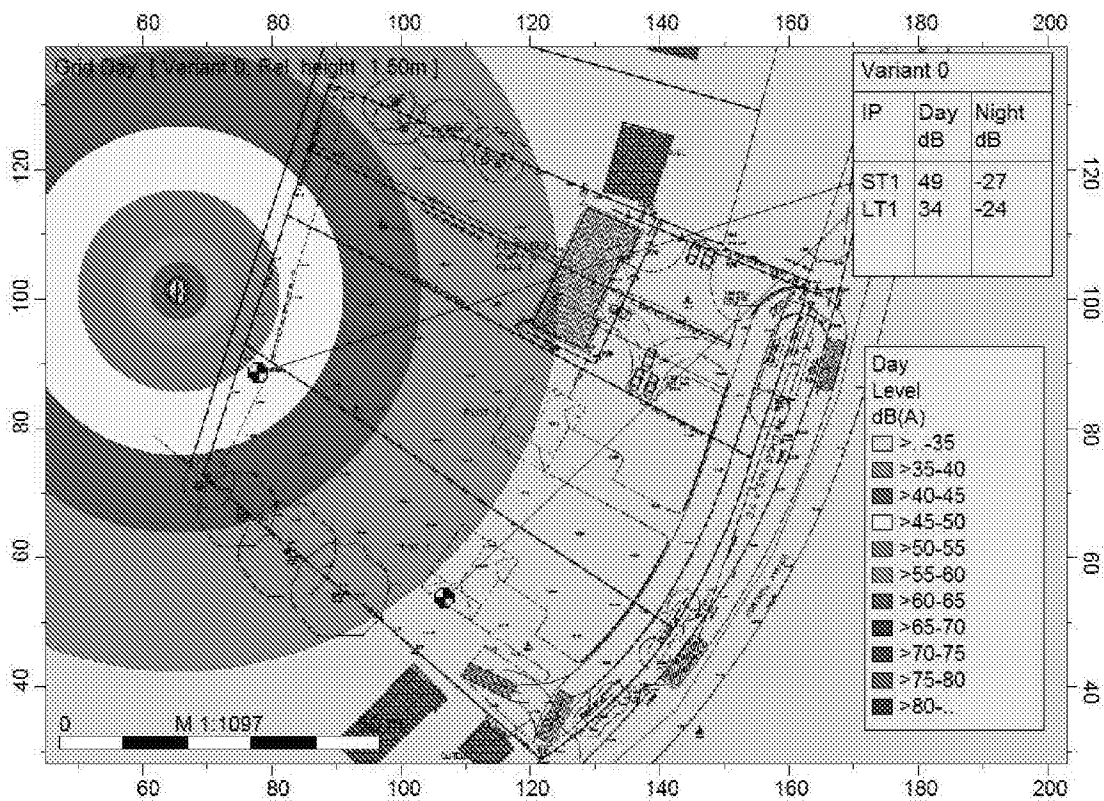


Figure 5: Survey Model Commercial

8.2 BS8233 Calculation

Non Frequency Dependent Variables			Key for Table Below	
Term	Derivation	Value	R_{wi}	Sound Reduction of Window (Octave)
A_0	Given in BS EN 20140-10 = 10 (m ²)	10	R_{ew}	Sound Reduction Index of External Wall (Octave)
S_f	Total Facade Area (m ²)	13	R_{rr}	Sound Reduction Index of Roof/Ceiling (Octave)
S_{wi}	Window Area (m ²)	5	A	Equivalent Absorbition Area of Rx Room
S_{ew}	External Wall Area (m ²)	8	$D_{n,e}$	Insulation of Trickle Vent (BS EN 20140-10)
S_{rr}	Ceiling Area (m ²)	0.00001		
S	Total Area sound enters the room (m ²)	13		

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
$L_{eq,f}$	Free-Field External Noise Level	50	53	53	48	45	40
$D_{n,e}$	Simon Frame Vent 33dB	40	36	35	31	32	37
R_{wi}	4_12_4	24	20	25	35	38	35
R_{ew}	Cavity Masonry (Brick Cavity with Insulation lightweight block)	41	39	44	52	60	65
R_{rr}	No Roof	100	100	100	100	100	100
A	Equivalent Absorbition Area of Room (Copied from BS8233)	10.00	13.00	15.00	15.00	14.00	14.00

BS8233 Calculation Details						
Term From Equation Below	Octave Band Centre Frequency					
	125	250	500	1000	2000	4000
$L_{eq,f}$	50	53	53	48	45	40
$A_0/S \cdot 10^{(-D_{n,e}/10)}$	7.692E-05	0.000193	0.000243	0.000611022	0.000485352	0.000153482
$S_{wi}/S \cdot 10^{(-R_{wi}/10)}$	0.0015312	0.003846	0.001216	0.000121626	6.09574E-05	0.000121626
$S_{ew}/S \cdot 10^{(-R_{ew}/10)}$	4.888E-05	7.75E-05	2.45E-05	3.88281E-06	6.15385E-07	1.94602E-07
$S_{rr}/S \cdot 10^{(-R_{rr}/10)}$	7.692E-17	7.69E-17	7.69E-17	7.69231E-17	7.69231E-17	7.69231E-17
$10 \log_{10}(S/A)+3$	4.1394335	3	2.378521	2.378520933	2.678153166	2.678153166
$L_{eq,2}$	26.332623	32.14565	27.09289	19.05042886	15.05742789	7.076252858
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted L_{eq}	10.232623	23.54565	23.89289	19.05042886	16.25742789	8.076252858

A-Weighted Level Outside	54
BS8233 Predicted Internal A-Weighted Level	28
Prediced Building Envelope SRI	26

Large Window Room
4_12_4

BS8233 Calculation can be seen below:	
$L_{eq,2} = L_{eq,f} + 10 \log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S} 10^{\frac{-R_{rr}}{10}} \right) + 10 \log_{10} \left(\frac{S}{A} \right) + 3$	

Figure 6: BS8233 Calculation