Noise Assessment for Planning Purposes

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Prepared for:

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Signature					[redacted]

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BRIEF FOR CONSULTANCY

This report has been prepared by Acoustics & Noise Limited, Newport, South Wales, for Mrs Sian Colderley, 62 Heol y Frenhines, Dinas Powys, Vale of Glamorgan, CF64 4UH.

Order No: n/a

OBJECTIVES

To investigate the noise climate on the proposed site.

To establish the suitability for developing the site for residential purposes.

NON TECHNICAL SUMMARY

It is proposed to develop the land adjacent to 62 Heol y Frenhines for residential purposes with a four bedroom, detached property.

A planning application was submitted to Vale of Glamorgan Council, ref: 2016/01437/FUL. In response to the application, Ms Rebecca Athay, Environmental Health Officer, has provided the following comment in a memorandum, ref: REA/301445 dated 17th January 2017:

"…there are some concerns regarding this development as details have not been submitted in relation to noise. Considering the premises is backing onto a railway line, it is fundamental to the development.

Unless a TAN 11 is provided that demonstrates the WHO Guideline values for community noise can be achieved (including outdoor living), we object to the application."

The site is located in a predominantly residential area. The noise climate at the site is characterised by rail traffic noise from the Cardiff to Barry rail line at the north-west boundary.

This report details the rail noise levels at the proposed development with reference to the above comments.

A 24-hour noise survey was carried out to allow an assessment of the rail traffic noise on the site as per the general procedures of TAN 11[1] and the results were compared with the guideline noise levels described in the World Health Organization (WHO) document 'Guidelines for Community Noise'.

The results of this assessment indicate that all habitable rooms within the development, have a direct line of site to the rail traffic and these rooms will require sound mitigation measures to meet the guideline internal noise values described in the WHO document.

The recommended sound mitigation measures comprise standard, thermal 4/20/4 glazing in the closed position. Note there are no requirements for these windows to be permanently closed.

For all rooms where sound mitigation measures are recommended, an alternative ventilation system may be required to provide the required ventilation rates to meet Building Regulation requirements.

It is important that the alternative ventilation scheme does not compromise the façade sound reduction or the resultant internal noise levels.

Daytime noise levels within the external garden areas of the development were 59 dB $L_{Aeq,16hrs}$.

Whilst this is 4dB above the guideline value, it should be noted that there are a number of existing properties exposed to the same noise levels.

Also, given the elevated position of the railway line a standard height fence or barrier of 2.1m will exert little to no effect on the garden area.

1.0 DESCRIPTION OF SITE

1.1 The site is located at on land adjacent to 62 Heol y Frenhines, Dinas Powys, Vale of Glamorgan, CF64 4UH and is currently utilised as an amenity space for the adjacent property.

1.2 The site is bounded by the Cardiff to Barry rail line which overlooks the site from a height of approximately 4m (see Figure 3).

1.3 The area is residential in nature and the noise climate at the site is characterised by regular rail traffic travelling along the adjacent rail line.

1.4 A satellite view of the site is presented in Appendix 2.

2.0 DISCUSSION

2.1 It is proposed to develop the site for residential purposes with a four bedroom, detached property.

2.2 A planning application has been submitted to Vale of Glamorgan Council, ref: 2016/01437/FUL.

2.3 In response to the application, Ms Rebecca Athay, Environmental Health Officer, has provided the following comment in a memorandum, ref: REA/301445 dated 17th January 2017:

"…there are some concerns regarding this development as details have not been submitted in relation to noise. Considering the premises is backing onto a railway line, it is fundamental to the development.

Unless a TAN 11 is provided that demonstrates the WHO Guideline values for community noise can be achieved (including outdoor living), we object to the application."

2.4 Acoustics and Noise were engaged by Mrs Sian Colderley, to assess the noise climate at the site to satisfy the above concerns.

3.0 ASSESSMENT OF RAIL TRAFFIC NOISE

3.1 The requirements for the assessment of rail traffic noise impact on a proposed development site are detailed in TAN11 (Noise) [1]. TAN11 prescribes the measurement methods and standards to be used for the noise survey. The results of the survey are separated into day and night periods which are normally compared with four Noise Exposure Categories (NECs).

3.2 However, where the local authority has specific criteria, in this case detailed in the comments from Ms Athay, the results of the survey are still separated into day and night periods following the procedures in TAN 11 [1] and then compared with the specific requirements detailed above.

3.3 An assessment of the free-field rail traffic noise at the site was conducted over a 24-hour period using a monitoring position located at the centre of the proposed site. This position was overlooked by the rail traffic travelling along the Cardiff to Barry rail line.

3.4 The survey was conducted in 5 minute periods to establish trends. The data is presented in day time and the night time periods as per the requirements of TAN11 [1] and detailed in Appendix 4.

3.5 The calculated daytime and night time free-field noise are summarised in Table 1.

Table 1 – Calculated Free-field Rail Traffic Noise Levels

Period	**Measured Free-Field Level** $L_{Aeq,t}$ **(dB)**	**Measured Maximum Level** L_{AFmax} **(dB)**
Daytime (t=16hrs)	59	--
Night time (t=8hrs)	54	86

3.6 The calculated free-field rail traffic noise levels detailed in Table 1 can now be compared with the requirements of Vale of Glamorgan Council.

3.7 The Vale of Glamorgan Council requirements refer to the WHO Guideline values for community noise which are discussed in the next section.

3.8 **Guidelines for Community Noise [2]**

3.8.1 Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. The main sources of community noise include road, rail, and air traffic; industries; construction and public work; and the neighbourhood.

3.8.2 The World Health Organisation (WHO) has derived a range of guideline values for community noise to protect people from its harmful health effects in non-industrial environments.

3.8.3 The WHO defines 'health' as "*A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*". This broad definition of health embraces the concept of well-being and, thereby, renders noise impacts such as population annoyance, interference with communication, and impaired task performance as 'health' issues.

3.8.4 For dwellings, the critical effects of noise are on sleep, annoyance and speech interference.

3.8.5 To avoid sleep disturbance, indoor guideline values for bedrooms at night time are 30 dB $L_{Aeq,T}$ for continuous noise and 45 dB L_{AFmax} for single sound events.

3.8.6 Sleep disturbance from intermittent noise events increases with the maximum level. Even if the total equivalent noise level is low, a small number of noise events with high maximum sound pressure level will affect sleep.

3.8.7 Therefore, to avoid sleep disturbance, it is important that the number of events are recorded in addition to the maximum sound pressure levels. For a good sleep, the WHO guidelines state that "*indoor sound pressure levels should not exceed 45 L_{AFmax} more than 10 – 15 times per night*".

3.8.8 To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level in outdoor living areas should not exceed 55 dB $L_{Aeq,T}$ for a steady continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB $L_{Aeq,T}$.

3.8.9 At night, sound pressure levels at the outside façade should not exceed 45 dB $L_{Aeq,T}$ and 60 dB L_{AFmax}, so that people may sleep with the bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB as per the WHO guidelines.

3.8.10 The time base, T, for the above guideline values are '16 hours' and '8 hours' for 'daytime' and 'night time' respectively.

3.8.11 The WHO guideline values for dwellings are summarised in Table 2 below.

Table 2 – Guideline Values for Community Noise for Dwellings

Specific Environment	**Critical Health Effect(s)**	**$L_{Aeq,T}$ (dB)**	**Time Base, T (hours)**	**L_{AFmax} (dB)**
Outdoor Living Area	Serious annoyance, daytime and evening	55	16	--
Outdoor Living Area	Moderate annoyance, daytime and evening	50	16	--
Dwellings, Indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	--
Inside Bedrooms	Sleep disturbance, night time	30	8	45
Outside Bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

3.9 Affected Rooms

3.9.1 Whenever possible, the internal guideline values should be achievable with the windows open for ventilation purposes.

3.9.2 With reference to the proposed plans in Appendix 3 all windows with the exception of the Dining Room doors will have a line of site to the rail line.

3.9.3 If we assume that the noise reduction from outside to inside is 15 dB as described in the WHO guidelines, we can calculate the maximum outside noise levels that would achieve the internal guideline values using the following simplified relationship.

$$SPL_{out} = SPL_{int} + R_{Wopen}$$

where SPL_{out} is the maximum outside noise levels, SPL_{int} is the internal guideline value and R_{wopen} is the sound reduction performance of a partially open window.

Table 3 – Outdoor Noise Levels that Achieve Guideline Internal Values with Open Window

Description	WHO Guideline Value (dB)	Sound Reduction Open Window (dB)	Outdoor Noise Level (dB)
Daytime ($L_{Aeq,16hrs}$)	35	15	50
Night Time ($L_{Aeq,8hrs}$)	30	15	45
Event L_{AFmax}	45*	15	60

** Value to be exceeded no more than 15 times per night*

3.9.4 To demonstrate that the guideline internal noise levels can be achieved with an open window, external free-field noise levels determined from the survey should be lower than the calculated maximum allowable value detailed in Table 3 above.

3.9.5 Comparing the calculated maximum outdoor noise levels detailed in Table 3 above, with the measured free field noise levels recorded during the survey detailed in Table 1, it is clear that an open window ventilation strategy is not suitable for the proposed development and sound insulation measures are required to achieve the guideline internal noise levels within the proposed property.

3.10 **Sound Mitigation Measures**

3.10.1 The internal noise levels can be controlled by keeping the glazing in the closed position.

3.10.2 For façades exposed to external noise, the internal noise level is calculated from the external noise level and the composite sound reduction of the façade using procedures set out in ‘Sound Control for Homes’ [3].

3.10.3 In this case, we have an internal noise criteria limit which must be satisfied. Therefore, the procedures in ‘Sound Control for Homes’ [3] are followed in reverse to determine the maximum allowable external noise levels.

3.10.4 To demonstrate that the guideline internal noise levels can be achieved with glazing in the closed position, external free-field noise levels determined from the survey should be lower than the calculated maximum allowable value.

3.10.5 Detailed calculations are presented in Appendix 5 for the composite sound reduction for a typical façade and for the maximum level of external noise before the internal noise criteria is exceeded. Calculations assume that the glazing units are standard thermal 4/20/4 units in the closed position.

3.10.6 To satisfy the daytime internal noise criteria of 35 dB $L_{Aeq,16hrs}$ the maximum external noise is calculated to be 66 dB $L_{Aeq,16hrs}$ (see Appendix 5).

3.10.7 The free-field noise level of 59 dB $L_{Aeq,16hrs}$ is comfortably below this and clearly demonstrates that the use of standard thermal 4/20/4 glazing in the closed position will be effective in achieving the internal day time noise level.

3.10.8 To satisfy the night time internal noise criteria of 30 dB $L_{Aeq,8hrs}$ the maximum external noise is calculated to be 61 dB $L_{Aeq,8hrs}$ (see Appendix 5).

3.10.9 The free-field noise level of 54 dB $L_{Aeq,8hrs}$ is comfortably below this and clearly demonstrates that the use of standard thermal 4/20/4 glazing in the closed position will be effective in achieving the internal night time noise level.

3.10.10 To satisfy the night time internal noise criteria of 45 dB L_{AFmax} the maximum external noise is calculated to be 76 dB L_{AFmax} (see Appendix 5).

3.10.11 Analysis of the L_{AFmax} data indicates that there were only 13 events with a L_{AFmax} value of greater than 76 dB which demonstrates that the use of standard thermal 4/20/4 glazing in the closed position will be effective in controlling the maximum internal night time noise level to less than 15 events per night with a noise level of greater than 45 dB L_{AFmax}.

3.11 **Private Open Spaces**

3.11.1 Daytime noise levels within the external garden areas of the development were calculated to be 59 dB $L_{Aeq,16hrs}$.

3.11.2 Whilst this is 4dB above the guideline value, it should be noted that there are a number of existing adjacent properties exposed to the same noise levels.

Also, given the elevated position of the railway line a standard height fence or barrier of 2.1m will exert little to no effect on the garden area.

4.0 CONCLUSIONS:

4.1 In response to a planning application for the proposed development, the Vale of Glamorgan Council has provided the following comment in a memorandum, ref: REA/301445 dated 17th January 2017:

"…there are some concerns regarding this development as details have not been submitted in relation to noise. Considering the premises is backing onto a railway line, it is fundamental to the development.

Unless a TAN 11 is provided that demonstrates the WHO Guideline values for community noise can be achieved (including outdoor living), we object to the application."

4.2 The assessed rail traffic noise levels following the procedures in TAN 11 indicate that all habitable rooms within the development should be subject to sound insulation measures in order that the required internal WHO guideline levels can be achieved.

4.3 The assessed rail traffic noise levels following the procedures in TAN 11 indicate that daytime noise levels within the external garden areas of the development were calculated to be 59 dB $L_{Aeq,16hrs}$.

4.3.1 Whilst this is 4dB above the guideline value, it should be noted that there are a number of existing properties exposed to the same noise levels.

Also, given the elevated position of the railway line a standard height fence or barrier of 2.1m exert little to no effect on the garden area.

5.0 RECOMMENDATIONS

5.1 The assessment of rail traffic noise at the proposed site indicates that all habitable rooms within the development should be subject to sound mitigation measures in order to achieve the required WHO guideline internal noise levels. This should comprise standard thermal 4/20/4 glazing in the closed position. Note there are no requirements for these windows to be permanently closed.

For all rooms where sound mitigation measures are recommended, an alternative ventilation system may be required to provide the necessary ventilation rates. The ventilation system should be agreed with Building Control. It is important that any agreed scheme does not compromise the façade insulation or the resultant internal noise levels.

P.A.T. 16/03/17
M.Sc., I.Eng., M.I.O.A.,
M.Inst.SCE., M.A.E.S.

Appendix 1
Survey Details

A1.0 SURVEY DETAILS

A1.1 **Programme of Measurements:**

A1.1.1 The meter was calibrated at the start of the measurement procedure and checked after each set of measurements. No significant deviation i.e. > 0.5 dB was recorded.

A1.1.2 Measurements were carried out on the 9th March 2017 for a period of 24 hours commencing 11:05 hours.

A1.1.3 Weather conditions: 40% cloud cover, 9°C, dry, slight intermittent breeze.

A1.2 **Measurement Procedure:**

A1.2.1 The meter was located in a weather-proof container and powered with the heavy duty rechargeable batteries. The microphone was located on a tripod at a height of 1.2m at the centre of the site approximately 12m from the site boundary with the rail line. The microphone was inside an approved weather-proof microphone housing.

A1.2.2 This location enjoyed an uninterrupted view of the rail traffic travelling along the Cardiff-Barry rail line.

A1.2.3 The meter was adjusted to log and store L_{Aeq} an L_{AFmax} in 5 minute periods (see Figure 1).

A1.2.4 At appropriate periods, the data was down-loaded to a computer for further analysis.

A1.2.5 The analysis consisted of dividing the results into the time periods 07:00-23:00 and 23:00-07:00. Using B & K Evaluator Software the relevant $L_{Aeq,T}$ value was calculated.

A1.3 **SUBJECTIVE IMPRESSIONS**

A1.3.1 The acoustic environment during the survey was characterised by train pass-by, birdsong, distant road traffic and distant, intermittent, reversing alarms.

A1.3.2 Rail traffic along the line was observed to comprise 2 carriage passenger trains with occasional freight traffic. Analysis of the data indicates the frequency of trains was approximately 6 – 8 per hour.

A1.4 Equipment Used:

Table 4 – Equipment Used

ITEM	Serial No	UKAS calibration Certificate Date (if applicable)
(ANL-M4) B&K 2250 Handheld Analyser	2567736	Certificate: 14994 Date: 19/05/16
(ANL-C4) B&K 4231 Calibrator	2567363	Certificate: 14993 Date: 18/05/16

Figure 1 – Meter Details

Instrument:		2250
Application:		BZ7224 Version 4.7.2
Start Time:		03/09/2017 11:04:40
End Time:		03/10/2017 12:00:59
Elapsed Time:		1.00:56:19
Bandwidth:		1/1-octave
Max Input Level:		142.71
	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	Z
Instrument Serial Number:		2567736
Microphone Serial Number:		2560565
Input:		Top Socket
Windscreen Correction:		None
Sound Field Correction:		Free-field
Calibration Time:		03/09/2017 11:01:09
Calibration Type:		External reference
Sensitivity:		40.8253595232964 mV/Pa

Appendix 2
View of Measurement Position

A2.0 VIEW OF MEASUREMENT POSITION

Figure 2 – Measurement Position

Figure 3 – View of Survey Location

Appendix 3
Proposed Development Plans

A3.0 PROPOSED DEVELOPMENT PLANS

Figure 4 – Proposed Site Layout

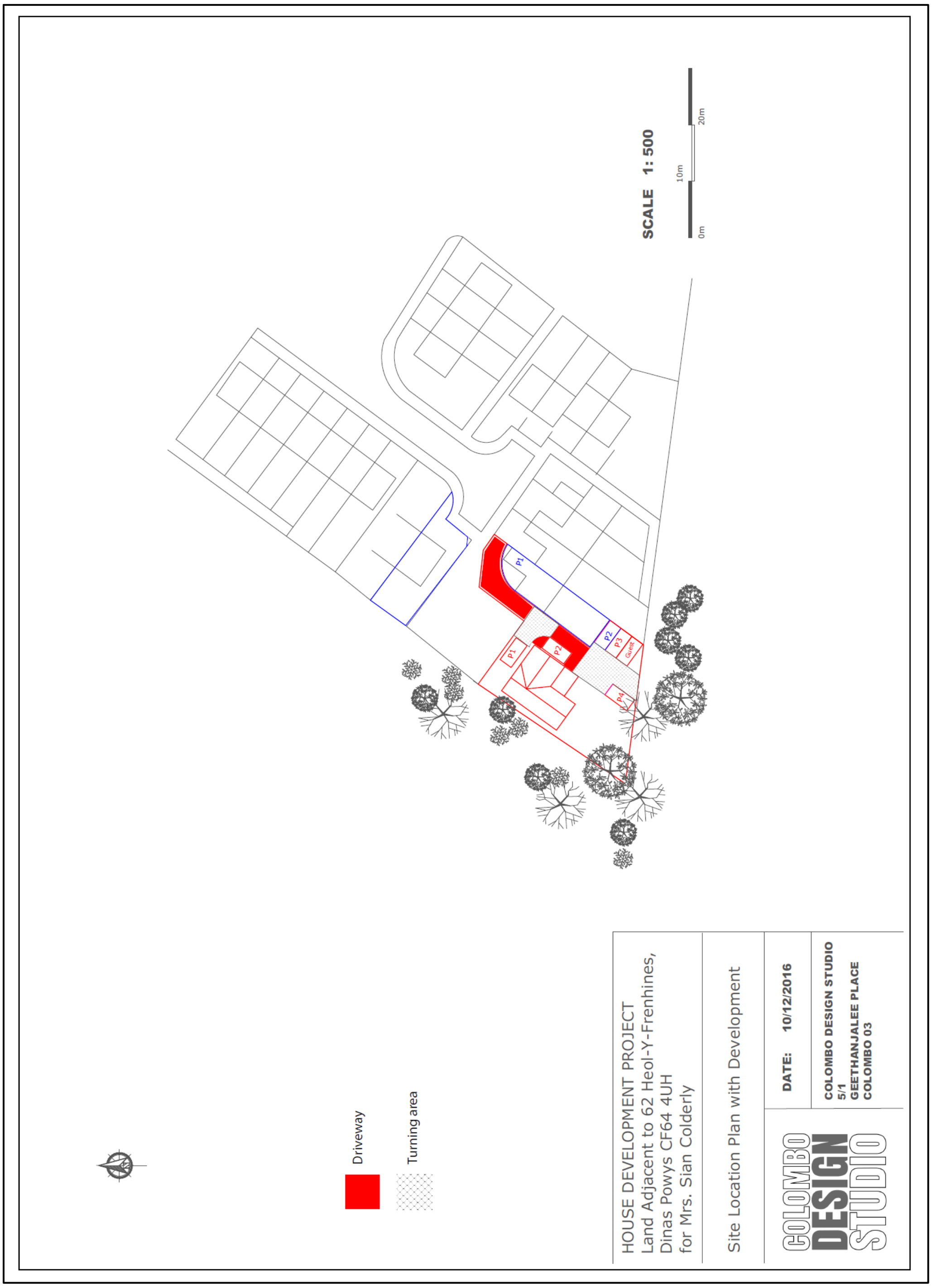


Figure 5 – Proposed Elevations

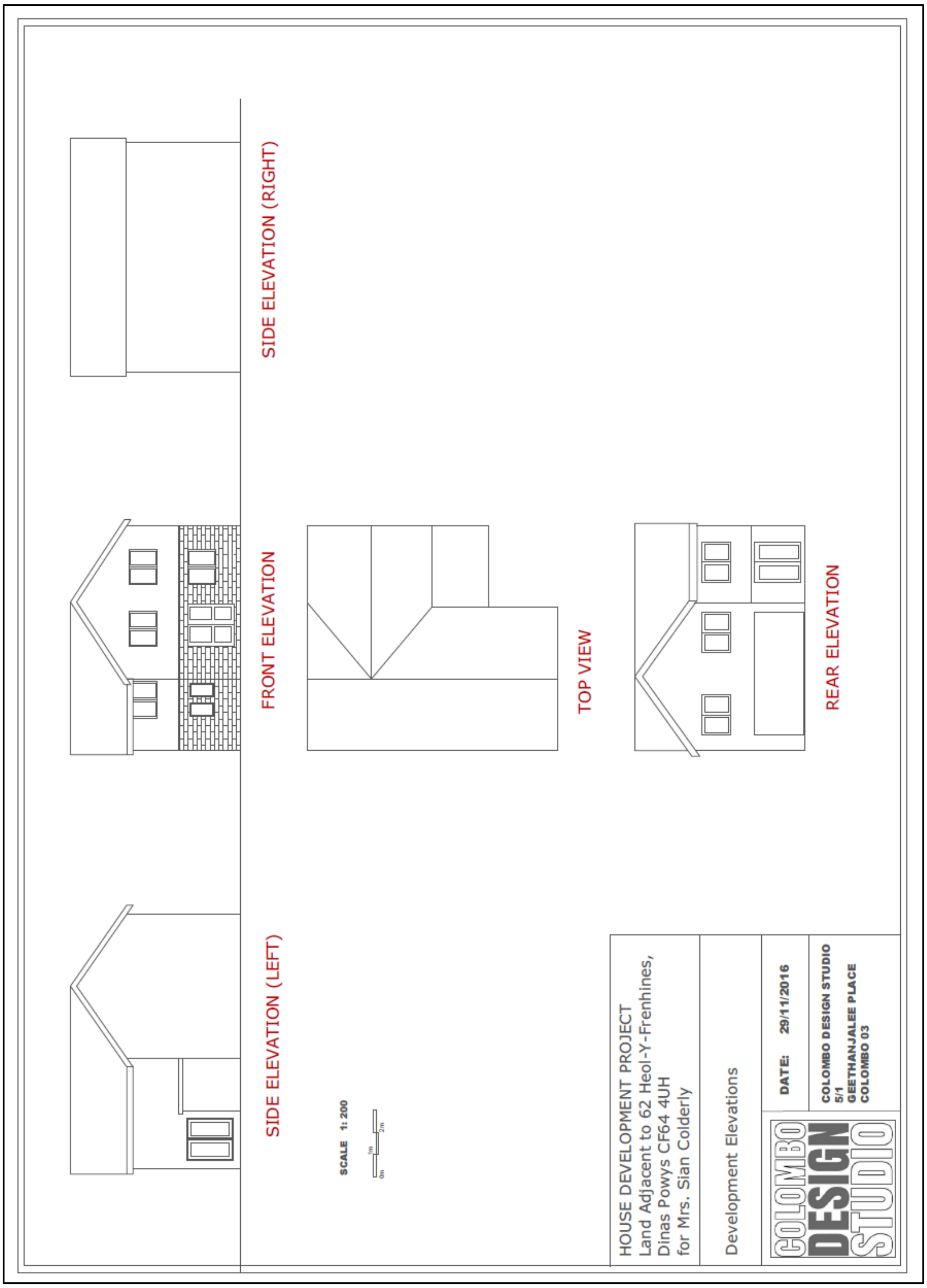
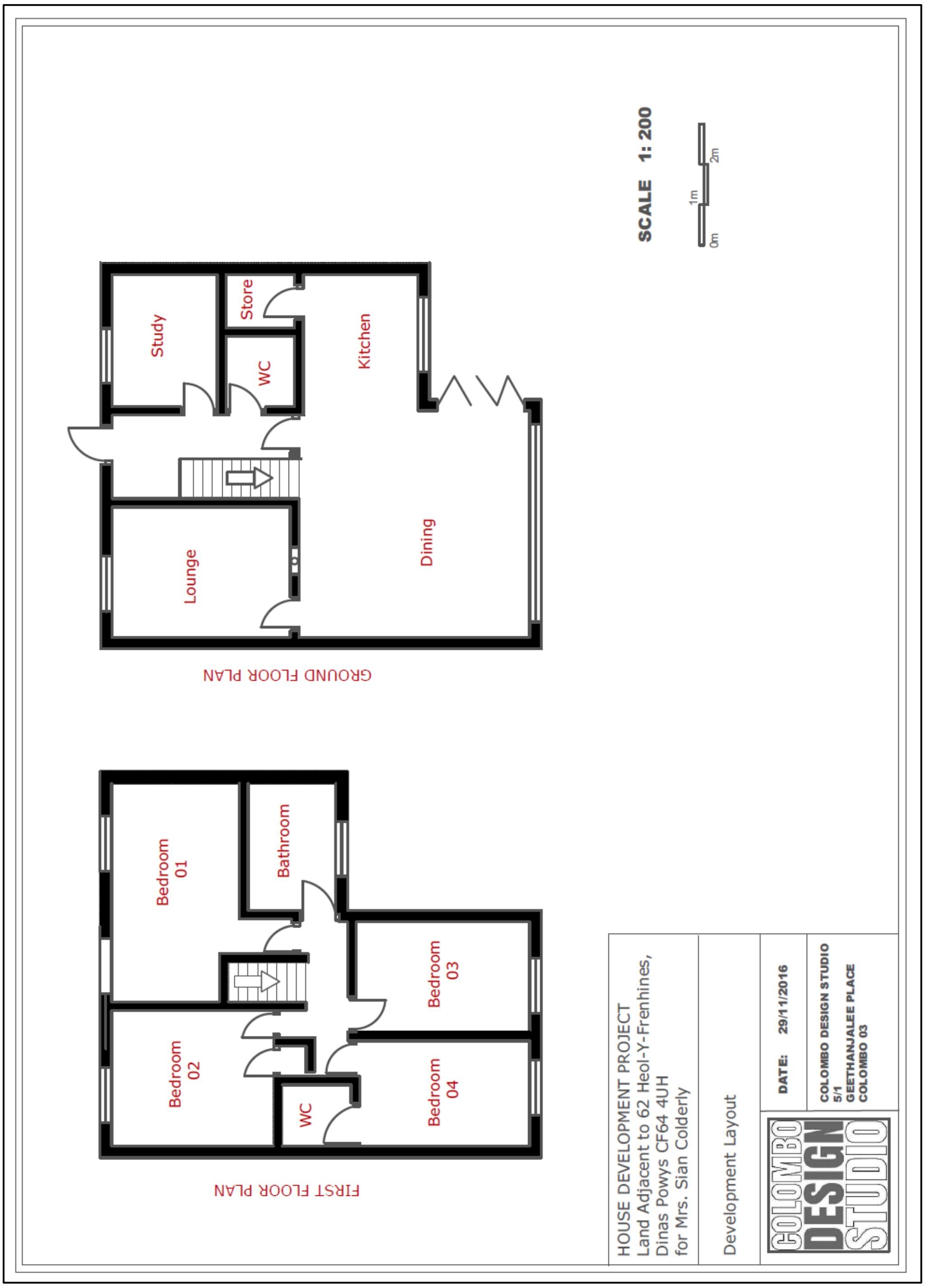


Figure 6 – Proposed Floor Plans



Appendix 4
Survey Results

A4.0 RESULTS

Figure 7 – External Free Field Noise Levels (Daytime Profile)

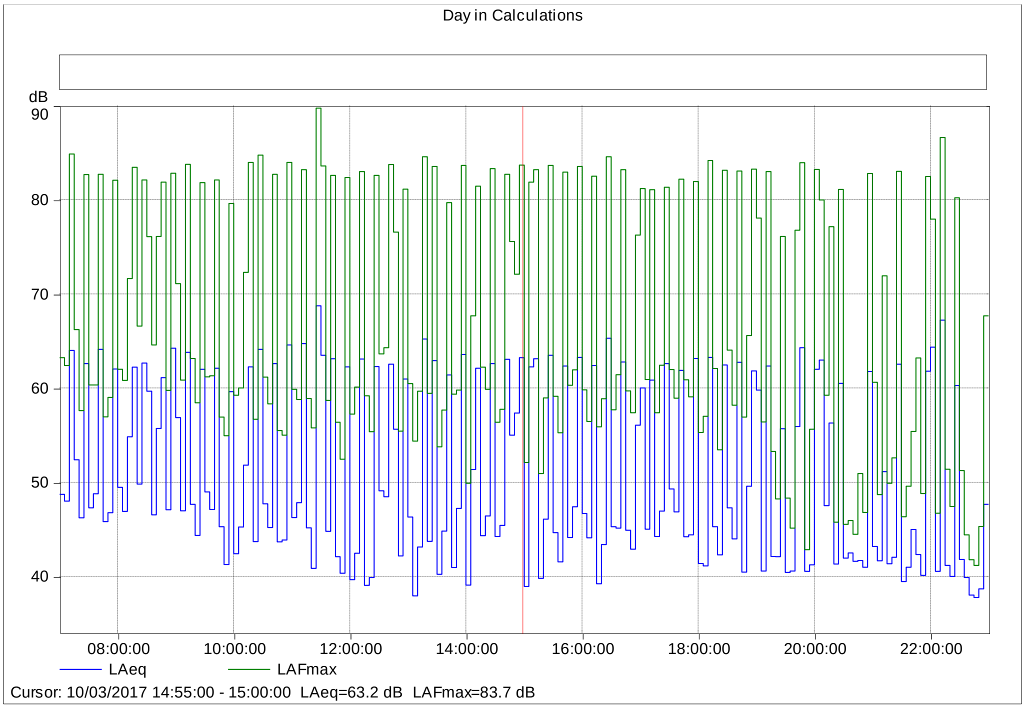


Table 5 – External Free Field Noise Levels (Daytime Summary)

Name	Start time	Duration, t	Overload [%]	$L_{Aeq,t}$ [dB]
Total	10/03/2017 07:00:00	16:00:00	0.0	58.5
Unmarked	10/03/2017 07:00:00	16:00:00	0.0	58.5

Figure 8 – External Free Field Noise Levels (Night Time Profile)

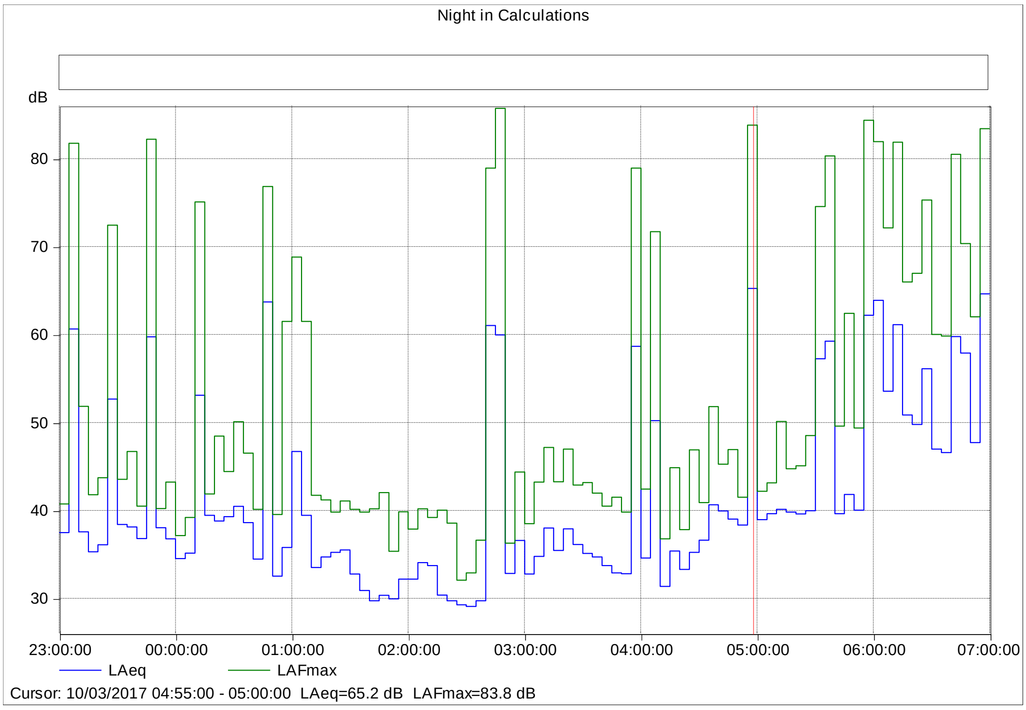


Table 6 – External Free Field Noise Levels (Night Time Summary)

Name	Start time	Duration, t	Overload [%]	$L_{Aeq,t}$ [dB]	L_{AFmax} [dB]
Total	09/03/2017 23:00:00	8:00:00	0.0	53.9	85.7
Unmarked	09/03/2017 23:00:00	8:00:00	0.0	53.9	85.7

Table 7 – Survey Data

Start date	Start time	$L_{Aeq,5mins}$ (dB)	L_{AFmax} (dB)
09/03/2017	11:04:40	49.3	65.2
09/03/2017	11:05:00	43.5	57.0
09/03/2017	11:10:00	62.5	83.2
09/03/2017	11:15:00	59.5	76.1
09/03/2017	11:20:00	43.2	71.9
09/03/2017	11:25:00	63.0	81.5
09/03/2017	11:30:00	48.4	63.1
09/03/2017	11:35:00	46.4	58.9
09/03/2017	11:40:00	62.9	82.9
09/03/2017	11:45:00	42.1	56.3
09/03/2017	11:50:00	40.3	52.4
09/03/2017	11:55:00	62.2	82.4
09/03/2017	12:00:00	39.6	57.2
09/03/2017	12:05:00	42.4	60.1
09/03/2017	12:10:00	63.1	83.0
09/03/2017	12:15:00	39.0	59.2
09/03/2017	12:20:00	39.8	55.3
09/03/2017	12:25:00	62.3	82.6
09/03/2017	12:30:00	49.1	63.6
09/03/2017	12:35:00	48.4	64.3
09/03/2017	12:40:00	62.5	83.7
09/03/2017	12:45:00	55.6	76.6
09/03/2017	12:50:00	42.2	55.4
09/03/2017	12:55:00	60.9	81.1
09/03/2017	13:00:00	46.3	60.4
09/03/2017	13:05:00	37.9	54.4
09/03/2017	13:10:00	43.1	59.7
09/03/2017	13:15:00	65.2	84.6
09/03/2017	13:20:00	43.7	59.4
09/03/2017	13:25:00	62.9	83.5
09/03/2017	13:30:00	40.2	53.7
09/03/2017	13:35:00	44.8	57.7
09/03/2017	13:40:00	61.4	79.7
09/03/2017	13:45:00	40.9	59.3
09/03/2017	13:50:00	47.2	59.8
09/03/2017	13:55:00	63.5	83.6
09/03/2017	14:00:00	39.1	49.9
09/03/2017	14:05:00	51.3	67.6
09/03/2017	14:10:00	62.1	81.4
09/03/2017	14:15:00	44.3	62.2
09/03/2017	14:20:00	46.4	59.8

Start date	Start time	$L_{Aeq,5mins}$ (dB)	L_{AFmax} (dB)
09/03/2017	14:25:00	62.6	83.3
09/03/2017	14:30:00	44.2	56.4
09/03/2017	14:35:00	45.4	57.7
09/03/2017	14:40:00	63.0	82.7
09/03/2017	14:45:00	55.0	75.5
09/03/2017	14:50:00	57.3	72.1
09/03/2017	14:55:00	63.2	83.7
09/03/2017	15:00:00	38.9	52.1
09/03/2017	15:05:00	62.2	81.8
09/03/2017	15:10:00	63.1	83.2
09/03/2017	15:15:00	39.8	50.9
09/03/2017	15:20:00	46.0	58.9
09/03/2017	15:25:00	63.5	83.6
09/03/2017	15:30:00	44.6	59.1
09/03/2017	15:35:00	41.5	55.2
09/03/2017	15:40:00	62.3	82.9
09/03/2017	15:45:00	44.1	60.3
09/03/2017	15:50:00	47.4	61.9
09/03/2017	15:55:00	63.2	83.5
09/03/2017	16:00:00	46.7	59.8
09/03/2017	16:05:00	44.1	56.4
09/03/2017	16:10:00	62.4	82.5
09/03/2017	16:15:00	39.2	55.9
09/03/2017	16:20:00	43.4	58.8
09/03/2017	16:25:00	65.3	84.6
09/03/2017	16:30:00	45.2	57.7
09/03/2017	16:35:00	45.1	61.4
09/03/2017	16:40:00	62.7	83.2
09/03/2017	16:45:00	44.9	59.7
09/03/2017	16:50:00	42.9	57.4
09/03/2017	16:55:00	56.0	76.2
09/03/2017	17:00:00	60.0	81.2
09/03/2017	17:05:00	45.0	60.9
09/03/2017	17:10:00	60.8	81.1
09/03/2017	17:15:00	44.2	57.4
09/03/2017	17:20:00	46.9	62.4
09/03/2017	17:25:00	62.6	81.3
09/03/2017	17:30:00	49.3	62.0
09/03/2017	17:35:00	46.8	58.9
09/03/2017	17:40:00	61.9	82.2
09/03/2017	17:45:00	44.2	60.8
09/03/2017	17:50:00	44.4	59.0

Start date	Start time	$L_{Aeq,5mins}$ (dB)	L_{AFmax} (dB)
09/03/2017	17:55:00	63.1	81.9
09/03/2017	18:00:00	41.3	55.3
09/03/2017	18:05:00	41.1	57.0
09/03/2017	18:10:00	63.2	84.1
09/03/2017	18:15:00	45.3	62.1
09/03/2017	18:20:00	42.3	53.4
09/03/2017	18:25:00	62.4	83.1
09/03/2017	18:30:00	47.3	64.0
09/03/2017	18:35:00	44.0	58.2
09/03/2017	18:40:00	62.7	83.0
09/03/2017	18:45:00	40.4	56.9
09/03/2017	18:50:00	49.6	65.6
09/03/2017	18:55:00	61.8	83.2
09/03/2017	19:00:00	59.8	78.1
09/03/2017	19:05:00	40.5	56.4
09/03/2017	19:10:00	62.3	83.0
09/03/2017	19:15:00	42.1	53.2
09/03/2017	19:20:00	42.1	48.2
09/03/2017	19:25:00	55.7	76.1
09/03/2017	19:30:00	40.4	48.3
09/03/2017	19:35:00	40.6	45.1
09/03/2017	19:40:00	55.9	76.8
09/03/2017	19:45:00	64.3	83.9
09/03/2017	19:50:00	40.5	42.8
09/03/2017	19:55:00	41.2	55.6
09/03/2017	20:00:00	62.0	83.2
09/03/2017	20:05:00	63.0	80.0
09/03/2017	20:10:00	47.5	59.2
09/03/2017	20:15:00	56.3	77.1
09/03/2017	20:20:00	41.3	45.7
09/03/2017	20:25:00	60.5	81.1
09/03/2017	20:30:00	41.9	45.5
09/03/2017	20:35:00	42.5	45.9
09/03/2017	20:40:00	41.6	44.4
09/03/2017	20:45:00	41.7	50.9
09/03/2017	20:50:00	40.9	46.8
09/03/2017	20:55:00	61.7	82.8
09/03/2017	21:00:00	43.1	60.6
09/03/2017	21:05:00	41.6	48.7
09/03/2017	21:10:00	51.1	71.9
09/03/2017	21:15:00	41.3	49.9
09/03/2017	21:20:00	42.0	52.6

Start date	Start time	$L_{Aeq,5mins}$ (dB)	L_{AFmax} (dB)
09/03/2017	21:25:00	62.5	83.0
09/03/2017	21:30:00	39.4	46.3
09/03/2017	21:35:00	40.9	49.5
09/03/2017	21:40:00	45.0	55.4
09/03/2017	21:45:00	42.3	63.2
09/03/2017	21:50:00	40.1	48.8
09/03/2017	21:55:00	61.8	82.5
09/03/2017	22:00:00	64.3	77.9
09/03/2017	22:05:00	40.5	46.7
09/03/2017	22:10:00	67.2	86.6
09/03/2017	22:15:00	41.1	51.4
09/03/2017	22:20:00	40.0	47.4
09/03/2017	22:25:00	60.2	80.2
09/03/2017	22:30:00	41.8	51.2
09/03/2017	22:35:00	39.9	44.4
09/03/2017	22:40:00	38.0	41.8
09/03/2017	22:45:00	37.7	41.2
09/03/2017	22:50:00	38.6	45.3
09/03/2017	22:55:00	47.6	67.6
09/03/2017	23:00:00	37.5	40.7
09/03/2017	23:05:00	60.6	81.7
09/03/2017	23:10:00	37.6	51.8
09/03/2017	23:15:00	35.3	41.8
09/03/2017	23:20:00	36.1	43.7
09/03/2017	23:25:00	52.7	72.4
09/03/2017	23:30:00	38.4	43.5
09/03/2017	23:35:00	38.1	46.7
09/03/2017	23:40:00	36.8	40.5
09/03/2017	23:45:00	59.7	82.2
09/03/2017	23:50:00	38.0	40.2
09/03/2017	23:55:00	36.8	43.2
10/03/2017	00:00:00	34.5	37.1
10/03/2017	00:05:00	35.1	39.2
10/03/2017	00:10:00	53.1	75.1
10/03/2017	00:15:00	39.4	41.9
10/03/2017	00:20:00	38.8	48.4
10/03/2017	00:25:00	39.3	44.4
10/03/2017	00:30:00	40.4	50.1
10/03/2017	00:35:00	38.6	46.5
10/03/2017	00:40:00	34.4	40.1
10/03/2017	00:45:00	63.7	76.8
10/03/2017	00:50:00	32.5	39.5

Start date	Start time	$L_{Aeq,5mins}$ (dB)	L_{AFmax} (dB)
10/03/2017	00:55:00	35.8	61.5
10/03/2017	01:00:00	46.7	68.8
10/03/2017	01:05:00	39.4	61.5
10/03/2017	01:10:00	33.5	41.7
10/03/2017	01:15:00	34.7	41.2
10/03/2017	01:20:00	35.2	39.8
10/03/2017	01:25:00	35.5	41.1
10/03/2017	01:30:00	32.8	40.1
10/03/2017	01:35:00	30.9	39.8
10/03/2017	01:40:00	29.7	40.2
10/03/2017	01:45:00	30.3	42.0
10/03/2017	01:50:00	29.9	35.3
10/03/2017	01:55:00	32.2	39.8
10/03/2017	02:00:00	32.2	37.9
10/03/2017	02:05:00	34.1	40.2
10/03/2017	02:10:00	33.7	39.2
10/03/2017	02:15:00	30.4	40.0
10/03/2017	02:20:00	29.7	38.5
10/03/2017	02:25:00	29.3	32.1
10/03/2017	02:30:00	29.1	32.9
10/03/2017	02:35:00	29.7	36.6
10/03/2017	02:40:00	61.0	78.9
10/03/2017	02:45:00	59.9	85.7
10/03/2017	02:50:00	32.8	36.3
10/03/2017	02:55:00	36.6	44.3
10/03/2017	03:00:00	32.8	38.5
10/03/2017	03:05:00	34.8	43.2
10/03/2017	03:10:00	38.0	47.2
10/03/2017	03:15:00	35.4	43.2
10/03/2017	03:20:00	37.9	47.0
10/03/2017	03:25:00	36.1	42.9
10/03/2017	03:30:00	35.1	43.2
10/03/2017	03:35:00	34.7	42.0
10/03/2017	03:40:00	33.7	40.5
10/03/2017	03:45:00	32.9	41.5
10/03/2017	03:50:00	32.8	39.8
10/03/2017	03:55:00	58.6	78.9
10/03/2017	04:00:00	34.6	42.4
10/03/2017	04:05:00	50.2	71.7
10/03/2017	04:10:00	31.3	36.8
10/03/2017	04:15:00	35.4	44.8
10/03/2017	04:20:00	33.3	37.8

Start date	Start time	$L_{Aeq,5mins}$ (dB)	L_{AFmax} (dB)
10/03/2017	04:25:00	35.2	46.9
10/03/2017	04:30:00	36.6	40.9
10/03/2017	04:35:00	40.6	51.8
10/03/2017	04:40:00	39.9	45.3
10/03/2017	04:45:00	39.0	46.9
10/03/2017	04:50:00	38.3	41.5
10/03/2017	04:55:00	65.2	83.8
10/03/2017	05:00:00	38.9	42.2
10/03/2017	05:05:00	39.6	43.1
10/03/2017	05:10:00	40.1	50.1
10/03/2017	05:15:00	39.8	44.7
10/03/2017	05:20:00	39.6	45.1
10/03/2017	05:25:00	39.9	48.5
10/03/2017	05:30:00	57.2	74.6
10/03/2017	05:35:00	59.2	80.3
10/03/2017	05:40:00	39.6	49.6
10/03/2017	05:45:00	41.8	62.4
10/03/2017	05:50:00	40.0	49.4
10/03/2017	05:55:00	62.2	84.4
10/03/2017	06:00:00	63.9	81.9
10/03/2017	06:05:00	53.5	72.1
10/03/2017	06:10:00	61.1	81.8
10/03/2017	06:15:00	50.8	66.0
10/03/2017	06:20:00	49.8	66.9
10/03/2017	06:25:00	56.1	75.3
10/03/2017	06:30:00	47.0	60.0
10/03/2017	06:35:00	46.6	59.8
10/03/2017	06:40:00	59.7	80.5
10/03/2017	06:45:00	57.9	70.3
10/03/2017	06:50:00	47.7	62.0
10/03/2017	06:55:00	64.6	83.4
10/03/2017	07:00:00	48.7	63.2
10/03/2017	07:05:00	48.0	62.4
10/03/2017	07:10:00	64.0	84.8
10/03/2017	07:15:00	52.4	66.2
10/03/2017	07:20:00	46.2	57.6
10/03/2017	07:25:00	62.6	82.7
10/03/2017	07:30:00	47.3	60.3
10/03/2017	07:35:00	48.7	60.3
10/03/2017	07:40:00	64.1	82.7
10/03/2017	07:45:00	45.8	56.9
10/03/2017	07:50:00	46.7	59.0

Start date	Start time	$L_{Aeq,5mins}$ (dB)	L_{AFmax} (dB)
10/03/2017	07:55:00	62.0	82.1
10/03/2017	08:00:00	49.4	62.0
10/03/2017	08:05:00	46.9	60.8
10/03/2017	08:10:00	54.8	71.6
10/03/2017	08:15:00	62.2	83.4
10/03/2017	08:20:00	49.8	66.6
10/03/2017	08:25:00	62.6	82.1
10/03/2017	08:30:00	59.7	76.1
10/03/2017	08:35:00	46.5	64.6
10/03/2017	08:40:00	55.7	76.1
10/03/2017	08:45:00	61.1	81.9
10/03/2017	08:50:00	47.1	59.7
10/03/2017	08:55:00	64.2	82.8
10/03/2017	09:00:00	56.8	71.1
10/03/2017	09:05:00	46.9	60.8
10/03/2017	09:10:00	63.8	83.8
10/03/2017	09:15:00	47.6	63.1
10/03/2017	09:20:00	44.3	58.4
10/03/2017	09:25:00	62.0	81.8
10/03/2017	09:30:00	48.9	61.2
10/03/2017	09:35:00	47.1	61.3
10/03/2017	09:40:00	62.1	82.1
10/03/2017	09:45:00	45.3	56.9
10/03/2017	09:50:00	41.2	54.9
10/03/2017	09:55:00	59.6	79.6
10/03/2017	10:00:00	42.4	59.2
10/03/2017	10:05:00	45.2	60.0
10/03/2017	10:10:00	51.8	72.3
10/03/2017	10:15:00	62.2	84.0
10/03/2017	10:20:00	43.7	56.7
10/03/2017	10:25:00	64.1	84.7
10/03/2017	10:30:00	47.7	61.1
10/03/2017	10:35:00	45.2	58.3
10/03/2017	10:40:00	62.6	82.7
10/03/2017	10:45:00	43.6	55.5
10/03/2017	10:50:00	43.9	55.0
10/03/2017	10:55:00	64.6	83.9
10/03/2017	11:00:00	46.2	59.9
10/03/2017	11:05:00	47.8	58.8
10/03/2017	11:10:00	64.7	83.2
10/03/2017	11:15:00	45.1	58.9
10/03/2017	11:20:00	40.8	55.7

Start date	Start time	$L_{Aeq,5mins}$ (dB)	L_{AFmax} (dB)
10/03/2017	11:25:00	68.7	89.7
10/03/2017	11:30:00	63.5	83.6
10/03/2017	11:35:00	44.8	58.7
10/03/2017	11:40:00	63.1	82.6
10/03/2017	11:45:00	45.2	58.9
10/03/2017	11:50:00	48.0	70.2
10/03/2017	11:55:00	61.4	82.4
10/03/2017	12:00:00	49.7	59.9

Appendix 5
Detailed Calculations

A5.0 INTERNAL NOISE CALCULATIONS

A5.1 It is assumed that the measured noise levels represent the external noise levels outside all habitable rooms with a clear line of site to the rail traffic travelling along the Cardiff to Barry rail line.

A5.2 **Building Envelope**

A5.2.1 The following calculations apply the procedures detailed in 'Sound Control for Homes' [3].

A5.2.2 These procedures require the following information for accurate calculation of the sound insulation requirements of the building envelope:

External noise level.
Maximum allowable sound level in the room.
Surface area of the relevant portion of the building envelope.
Area of sound absorption in the room.

A5.2.3 The following formula is used to determine the façade sound insulation against road traffic noise:

Level Difference = $L_1 - L_2 = R - 10 \log (S/A)$

Where L_1 *- Sound level 2m outside the façade (dB)*
L_2 *- Received sound level in the room (dB)*
R - Sound reduction index (dB)
S - Surface area, room façade element (m²)
A - Absorption in the room (m²)

A5.2.4 For housing design purposes a simpler approach is proposed by 'Sound Control for Homes':

The surface area and area of sound absorption can be ignored. In typically furnished domestic rooms they have little effect on the final result.

A typical external noise spectrum is adopted and the sound insulation of the building envelope described in terms of the difference between inside and outside levels in dB(A).

A5.2.5 This outside-inside level difference, denoted by $R_{A(traffic)}$, is based on the typical urban road traffic noise spectrum.

A5.2.6 This term can also be represented by $R_w + C_{tr}$ where R_w is the weighted sound reduction index and C_{tr} is the correction against low frequency performance and is based on urban road traffic noise or railway traffic at low speed (<80km/hr) as stated in BS EN ISO 717-1 [4].

A5.2.7 In this case, the significant source of noise is rail traffic travelling at low speeds.

A5.2.8 If we assume that the glazing area is 30% of the total internal wall area for a typical habitable room then using the chart in Figure 49 presented in 'Sound control for homes' [3] we can calculate the composite sound insulation for the façade by adding a correction factor to the sound reduction for the glazing.

A5.2.9 Composite façade sound reduction calculations are shown in Table 8 below.

Table 8 – Composite façade sound reduction

Description	**Term**	**Value**	**Comment**
Total Glazing Area as percentage of Wall Area	%	30	Assumption for typical room
Walls, R_{wall}	$R_{A(Traffic)}$	47	Sound Control for Homes, Table 14, Cavity brick/block
Glazing, R_{window}	$R_w + C_{tr}$	26	Saint Gobain Acoustic Database, 4/20/4
R_{wall} - R_{window}		21	
Add to R_{window}		5	from Figure 49
Composite Facade	$R_w + C_{tr}$	31	

A5.3 **Maximum Allowable External Noise Calculations**

A5.4 Using the calculated composite façade sound reduction and the required internal noise criteria we have predicted the maximum external noise levels outside the properties as shown in Table 9 below.

Table 9 – Maximum External Noise Levels (Free-Field)

Description	**Daytime External Level** $L_{Aeq,16hrs}$ **(dB)**	**Night Time External Level** $L_{Aeq,8hrs}$ **(dB)**	**Night Time External Level** L_{AFmax} **(dB)**
Internal Noise Criteria	35	30	45
Composite Sound Reduction	31	31	31
External Free-Field Noise Level	66	61	76

The above calculations assume that the glazing is 4mm glass/20mm air gap/4mm glass and that they are in the closed position.

Appendix 6
Glossary of Acoustic Terms

A6.0 GLOSSARY OF ACOUSTIC TERMS

A6.1 **A-weighting:**

Normal hearing covers the frequency (pitch) range from about 20 Hz to 20,000 Hz but sensitivity is greatest between about 500 Hz and 5,000 Hz. The 'A-weighting' is an electrical circuit built into noise meters to approximate this characteristic of human hearing.

A6.2 **Decibel (dB):**

The logarithmic measure of sound level. 0dB (A) is the threshold of normal hearing. 140 dB (A) is the level at which instantaneous damage to hearing is caused. A change of 1 dB is detectible only under laboratory conditions.

A6.3 **dB(A):**

Decibels measured on a sound level meter incorporating a frequency weighting (A-weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with an individual's assessment of loudness. A change of 3 dB (A) is the minimum perceptible under normal conditions and a change of 10 dB(A) corresponds roughly to doubling or halving the loudness of a sound.

A6.4 **Free Field:**

A sound field in which no significant sound reflections occur

A6.5 **$L_{Aeq,T}$:**

The equivalent continuous sound level - the sound level of a notional steady sound having the same energy as a fluctuating sound over a specified measuring period (T). This is used to describe many types of noise, and can be measured directly with an integrating sound level meter.

Appendix 7
References

A7.0 REFERENCES

1 Planning Guidance (Wales) TAN (Wales) 11 Noise, Welsh Office

2 Guidelines for Community noise, Berglund, Lindvall, Schwela, World Health Organization, 1999

3 "Sound Control for Homes", Building Research Establishment and Construction Industry Research and Information Association, 1993

4 BS EN ISO 717-1:1997, 'Acoustics - Rating of sound insulation in buildings and of building elements, Part 1: Airborne sound insulation', British Standards