NOISE ASSESSMENT

on behalf of

GLADMAN DEVELOPMENTS LTD.

for the site at

NORTH ROAD, GLOSSOP

REPORT DATE: 13TH NOVEMBER 2013

REPORT NUMBER: 100663

Matt Hopley
MIOA

Miller Goodall Environmental Services Ltd.
214 Turton Road
Bradshaw
Bolton
BL2 3EE

01204 596166

www.millergoodall.co.uk

Summary

A noise assessment was undertaken to predict the potential impact of a proposed development of housing at North Road, Glossop, Derbyshire. This assessment is intended to support a planning application for the development.

Measurements were made at the site to assess the pre-development background noise levels. This data along with noise modeling was used to assess the impact of the existing noise climate on the proposed housing.

The assessment has shown that the main noise sources are from North Road and Cemetery Road and that noise levels from these sources do not exceed any National Standards for both external and internal noise. Noise mitigation has been recommended in the form of standard double glazing for the facades facing onto North Road and in the direction of Cemetery Road, along with trickle acoustic ventilation. No further external noise mitigation is required for the garden amenity areas.

I see no reason why this application should be refused on the grounds of noise.

Prepared By	Matt Hopley	Reviewed By	Joanne Miller
Signed	Matt Hopley	Signed	JMiller
Date	20th March 2013	Date	13th November 2013

Version	Date	Change	Initials
1	20th March 2013	First daft	MH
2	5th November 2013	Reviewed as result of review of scheme.	JLM
3	13th Novermber 2013	Minor amendments.	JLM

Contents

1 Introduction

1.1 Miller Goodall Environmental Services Ltd (MGES) has, on behalf of Gladman Developments Ltd, undertaken a noise assessment in respect of the impact of existing noise from road traffic and a depot attached to a garden centre on a proposed residential development to the east of North Road, Glossop, Derbyshire.

1.2 This report provides an update to the noise assessment report issued in March 2013 for the same site and reflects the changes to the scheme following consultation with HPBC. In essence the scheme remains the same with the exception of alterations to the Framework Plan which will see the PoS and Play Area to the north east of the site removed. The original report, therefore, remains valid.

2 Site Description

2.1 The proposed development is a green field site located to the east of North Road and to the west of Cemetery Road in Glossop. The site lies approximately 1.5 km north of Glossop town centre. The surrounding area is predominantly rural with residential developments to the south of the site accessed along Heath Road.

2.2 The western boundary of the site runs adjacent to North Road, and the eastern boundary runs to Wimberry Hill Garden Centre and depot which lies adjacent to Cemetery Road. Near the centre of the site there is a relatively large reservoir of water. The altitude of the site increases steadily moving north from the southern border to the northern site border.

2.3 There are 3 football playing fields approximately 100 m to the north.

2.4 The closest residential developments lie approximately 15 m from the southern boundary of the site on Bexley Close. Further residential development lies on the south eastern boundary on The Heath and the south western boundary on Heath Road.

2.5 Figure 1 shows the location of the site along with the noise monitoring positions and the garden centre and depot.

Figure 1: Site plan indicating approximate site boundary and measurement locations

2.6 The proposal is to develop a green field site for residential use involving the erection of up to 150 dwellings. Road access to the development site is located at the site's frontage onto North Road. The mix of dwellings has not been fixed and the layout is reserved for consideration at a later date. Please see Framework Plan 5376-L-03 as contained within the Design and Access Statement for further details.

3 Policy Context

3.1 National Planning Policy and Guidance

3.1.1 The Noise Policy Statement for England (NPSE), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy Aims, as presented in this document, are:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse effects on health and quality of life;

- mitigate and minimise adverse effects on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

3.1.2 The National Planning Policy Framework (NPPF) was published in March 2012. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise".

3.1.3 Paragraph 109 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) "preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability".

3.1.4 The NPPF goes on to state in Paragraph 123 "planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including thorough use of conditions;
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land use since they were established, and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value".

3.1.5 The NPPF document does not refer to any other documents regarding noise other than NPSE.

3.2 **BS 8233:1999**

3.2.1 BS 8233:1999 – 'Sound Insulation and Noise Reduction for Buildings – Code of Practice' gives recommended design criteria for internal noise levels for different types of rooms within residential dwellings. This design criterion is based on guidance contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999). The criteria for bedrooms and living rooms, which have been set to avoid sleep disturbance and ensure suitable living/resting conditions are shown in Table 1.

Table 1: BS 8233: 1999 recommended sound levels in habitable rooms

Room	Criteria	Reasonable ($L_{Aeq,T}$)	Good ($L_{Aeq,T}$)
Bedrooms	Sleeping	35	30
Living Rooms	Resting	40	30

3.2.2 In addition to the above, this document recommends that maximum noise levels (L_{Amax}) of individual noise events should not normally exceed 45 dB in bedrooms at night. BS 8233:1999 does not provide guidance on how this may be interpreted, however a criteria of between 10-15 times per night-time period has commonly been adopted.

3.3 World Health Organisation (WHO) Guidelines for Community Noise 1999

3.3.1 The WHO Guidelines 1999 state that external amenity areas should not be subjected to daytime averaged noise levels greater than L_{Aeq} 55 dB, and preferably below L_{Aeq} 50 dB.

3.4 Local Authority Requirements

3.4.1 MGES requested confirmation of the methodology used from the Local Authority and received a response from Peter Hollingsworth of High Peak Borough Council. The Local Authority agreed with our proposed methodology, however requested the aim shall be for external areas to be exposed to levels below 50 dB L_{Aeq} during the daytime.

3.4.2 Measurement position MP1 was chosen as being in line with the facades along North Road and MP5 as being close to the facades on the Cemetery Road side of the site, other measurement positions MP2, MP3 and MP4 were used to correlate the computer model.

4 Noise Survey

4.1 Current Noise Sources Impacting the Site

4.1.1 The dominant noise sources for this area are road traffic noise from North Road and Cemetery Road, there was also low noise levels from activity from the depot associated with Wimberry Garden Centre during the daytime period. The noise from the depot started around 07:25 on the day of monitoring and was due to the occasional movement of light goods vehicles around the depot.

4.1.2 Measurements were made between 05.50 and 08:30 on Friday 8th February with a sound level meter at the position MP5 near the depot, in order to capture both the worst-case daytime and night time road traffic noise levels for the site. Noise measurements were also taken on site adjacent to North Road at the positions MP1 to MP4 between 06:00 and 10.25 on Tuesday 12th February 2013.

4.1.3 There were no other significant noise sources on the site.

4.2 Measurement Procedure

4.2.1 Noise measurements were undertaken at a location consistent with the proposed development in accordance with BS 7445-1 2003: 1991[1] by Matt Hopley of Miller Goodall Environmental Services Ltd. The test equipment used was calibrated before and after measurements, with negligible deviation (<0.1 dB). Details of the equipment used are shown in Table 2 below.

Table 2: Noise monitoring equipment

Equipment Description	Type Number	Manufacturer	Serial No:	Date calibrated	Calibration Certification Number
Class 1 Integrating Real Time 1/3 Octave Sound Analyzer	Type 2260	Brüel & Kjær	2467009	15.09.11	C1107367
Class 1 Sound Analyzer	Type 2250	Brüel & Kjær	2435919	18.05.12	2012-0527
Calibrator	Type 4231	Brüel & Kjær	2478249	24.08.12	01010/1
Microphone	Type 4189	Brüel & Kjær	2508884	15.09.11	C1107367
Microphone	Type 4189	Brüel & Kjær	2643144	17.05.12	2012-0531

4.3 Date of Monitoring and Weather Conditions

4.3.1 Specific, background and ambient noise monitoring was undertaken at the times specified in Table 3 below at the measurement locations shown in Figure 1.

Table 3: Dates, times and weather conditions during noise measurements

Measurement Locations	Date	Time	Weather conditions
MP1, MP2, MP3, MP4	12/02/2013	06:00– 10:25	Dry, 0℃, still
MP5	08/02/2013	05:50 – 08:30	Dry, 0℃, still

4.3.2 Measurements were taken at times considered to be representative of the periods during which the proposed residential accommodation would be subject to the highest levels of ambient noise. Measurements were made under free-field conditions at a height of 1.5 m above the ground. The B&K 2250 meter was installed at location MP5 and set to log broadband data continuously in 5 minute intervals from 05:50 to 08:30. The B&K 2260 meter was set to log broadband and spectral data continuously in 5 minute intervals from 06:00 to 09:00 at position MP1, it was then moved to other

[1] BS 7445-1: 2003 Part 1 Description and Measurement of Environmental Noise

locations on the site adjacent to North Road at positions MP2, MP3 and MP4 to measure data for shorter 15 minute periods.

4.4 Details of Noise Sources and Measurement Locations

4.4.1 The measurement locations are detailed below and indicated on Figure 2:

MP1 In field approximately 10 m in easterly direction perpendicular to the nearside carriageway of North Road by the current entrance to the field.

MP2 In field approximately 10 m in easterly direction perpendicular to the nearside carriageway of North Road and 20m south of MP1

MP3 In field approximately 10 m in easterly direction perpendicular to the nearside carriageway of North Road and 30m north of MP1

MP4 In field approximately 60 m in easterly direction perpendicular to the nearside carriageway of North Road by the current entrance to the field.

MP5 In field to the west of the depot, approximately 10 m perpendicular from the farm gate entrance to the field (at intersection of footpath and access road) as shown in Fig1.

4.4.2 The noise sources within the vicinity of the measurement locations can be summarised in Table 4

Table 4: Description of noise sources affecting the site

Measurement Location	Noise Sources
MP1	Road traffic along North Road. Some birdsong
MP2	Road traffic along North Road. Some birdsong
MP3	Road traffic along North Road. Some birdsong
MP4	Road traffic along North Road. Some birdsong
MP5	Road traffic along Cemetery Road and after 07.25 on the day of measurements there were low levels of noise from the depot/garden centre.

4.5 Ambient and Background Noise Levels

4.5.1 A summary of the measurement data is provided in Table 5 below with full data in Appendix 1. All data are sound pressure levels in dB re 20 µPa.

Table 5 Summary of noise measurements

Location	Date	Start Time	Elapsed Time (hr:min:sec)	$L_{Aeq,T}$ (dB)	L_{AFmax} (dB)	L_{AF90} (dB)
MP1	12/02/2013	06:00	1:00:00	45.4	67.6	35.1
MP1	12/02/2013	07:00	1:00:00	48.3	72.6	38.2
MP1	12/02/2013	08:00	1:00:00	52.5	73.9	41.1
MP2	12/02/2013	09:02	0:15:00	51.7	68.0	41.6
MP1	12/02/2013	09:19	0:15:00	49.1	68.3	38
MP3	12/02/2013	09:37	0:15:00	46.9	62.2	37.8
MP4	12/02/2013	10:13	0:15:00	44.2	59.5	39.4
MP5	08/02/2013	06:00	0:60:00	41.8	64.3	32.7
MP5	08/02/2013	07:00	0:60:00	46.2	73.9	37.4
MP5	08/02/2013	08:00	0:30:00	50.7	71.7	38.5

4.5.2 Each measurement period consisted of sequential 5 minute samples which therefore allowed the variation in noise level over time to be assessed. This data was subsequently used to determine a 'typical' L_{AFmax} noise level and octave band spectrum based on the 95th percentile of individual 5 minute measurements which were then utilised within the noise model. Time histories of the worst case night-time (06.00 – 07.00) and day time (07.00 – 09.00) noise measurements at North Road (MP1) and near the depot (MP5) are provided in Appendix 4.

5 Prediction of Road Traffic Noise Levels

5.1 Computer Modeling

5.1.1 Predictions of existing noise levels on the site have also been undertaken using the CadnaA noise modelling package. Specific model parameters were applied as follows:

- Propagation of noise using algorithms within ISO 9613: 1993 *Acoustics - Attenuation of sound during propagation outdoors*. Roads were modeled as line sources at a height of 0.5 m above ground level and calibrated using spectral data measured during the survey.
- Ground attenuation: spectral all sources
- No adverse meteorological effects
- Two orders of reflection
- Topographical data for site provided by the client since the site has distinctive topography.

5.2 Validation of the Noise Model

5.2.1 Noise level receptor points were incorporated into the CadnaA model at the noise survey measurement locations to calibrate the model using the measured octave band L_{Aeq} and L_{AFmax} noise levels. The modelled results agreed with the measured results to within around ± 1 dB for both the L_{Aeq} *and* L_{AFmax}.

5.3 Noise Model Predictions

5.3.1 Three scenarios were modelled: daytime L_{Aeq} noise levels affecting the site, night-time L_{Aeq} noise levels and night-time L_{AFmax} noise levels. The noise modelling was undertaken using an illustrative master plan; screen shots from each model are provided in Appendix 2.

5.3.2 The noise modelling shows how the levels of noise drop with distance from North Road and Cemetery Road. The results show that the external noise at the closest properties to North Road and to Cemetery Road and the depot are within the criteria for external noise of 50 dB $L_{Aeq.}$

6 Noise Impact Assessment

6.1 Internal BS 8233 Criteria

6.1.1 It is proposed that noise from the development is controlled to 30 dB L_{Aeq} in bedrooms at night and 35 dB L_{Aeq} in habitable rooms during the day. This is in line with the 'good' levels advised in BS 8233[2] for night-time noise and 'good' to 'reasonable' levels for daytime noise (see section 3.2). The proposed upper limit for individual noise events such as vehicle pass-bys is an indoor level of 45 dB L_{AFmax}.

6.1.2 The generally accepted rule of thumb is that a window left open for ventilation provides 10 – 15 dB attenuation from external noise sources with the WHO Guidelines for Community Noise suggesting 15 dB. The DEFRA report NANR116: Open/Closed Window Research 2007 suggests the figure to be between 12 and 18 dB for road and rail traffic. Where external noise levels are more than around 15 dB higher than the internal noise targets, openable windows should not be relied upon as the sole means of ventilation and some form of acoustically attenuated ventilation may be required.

6.1.3 In order to assess the potential glazing and ventilation requirements for dwellings, noise ingress calculations were undertaken based on the methodology in BS EN 12354-3. The following assumptions were made regarding the internal rooms:

- Assessed within first floor bedrooms with an internal volume of 30 m^3
- 'Normal' internal surface finishes e.g. carpeted with curtains etc

- Glazed area of 1.5 m^2 per room.

6.1.4 The areas where the predicted facade levels are highest are at the houses closest to North Road and to Cemetery Road due to road traffic noise.

6.1.5 Noise ingress calculations are provided in Appendix 3 with a summary of the results below in Table 6, below:

Table 6 Predicted night time internal noise levels

Description	External Noise Levels		Predicted Internal Noise Levels		BS 8233 Criteria		Exceedance of Criteria		Proposed Glazing and Ventilation
	dB $L_{Aeq,1hr}$	dB L_{AFmax}	dB $L_{Aeq,1hr}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	
Bedrooms facing North Road	44	65	24	36	30	45	-6	-9	4/12/4 thermal double glazing; acoustic trickle vents
Bedrooms facing Cemetery Road	46	59	27	42	30	45	-3	-3	4/12/4 thermal double glazing; acoustic trickle vents

Table 7 Predicted day time internal noise levels

Description	External Noise Levels	Predicted Internal Noise Levels	BS 8233 Criteria	Exceedance of Criteria	Proposed Glazing and Ventilation
	dB $L_{Aeq,1hr}$	dB $L_{Aeq,1hr}$	dB $L_{Aeq,T}$	dB $L_{Aeq,T}$	
Living Rooms facing North Road	50	30	35	-5	4/12/4 thermal double glazing; acoustic trickle vents
Living Rooms facing Cemetery Road	49	28	35	-7	4/12/4 thermal double glazing; acoustic trickle vents

6.1.6 The night-time levels were measured between 06:00 and 07:00 when noise from North Road and Cemetery Road was dominant and increasing as the morning rush hour approached. When averaged over a typical 8 hr period, night-time noise levels would be expected to be lower.

6.1.7 It can be seen from Tables 6 and 7 that rooms on the noisiest facades are predicted to satisfy the internal noise level requirements with glazing with a sound reduction index of 27 dB $R_w + C_{tr}$; this could be achieved using double glazing with a 4/12/4 configuration. Background ventilation could be provided by trickle ventilators with a minimum element normalised sound level difference of between 27 $D_{ne,w} + C_{tr}$ for North Road facade and 29 dB $D_{ne,w} + C_{tr}$ for Cemetery Road facade.

6.1.8 For dwellings with habitable rooms facing away from North Road and Cemetery Road or where shielding from other buildings is provided, a lower specification of glazing and ventilation may be feasible.

6.1.9 Final proposals for glazing and ventilation options would need to be reviewed as the masterplan of the site is developed at the reserved matters stage.

6.2 External Noise Levels

6.2.1 The predicted daytime noise levels across the open site are below 50 dB L_{Aeq} and as such would achieve the Local Authority's daytime noise criteria in external amenity spaces. It is predicted and expected this level would reduce further across the site as the distance from North Road and Cemetery Road increased, therefore no additional screening or noise barriers will be required.

7 Conclusions

7.1 Miller Goodall Environmental Services has undertaken a noise survey and assessment of a green-field site located on land to the east of North Road, Glossop, Derbyshire to support an outline planning application for a proposed residential development.

7.2 Noise data collected during the survey has been used to correlate a noise model of the site. Using predictions from the model, noise ingress calculations have been undertaken to predict the potential internal noise levels within dwellings. Based on these findings, recommendations have been made for glazing and ventilation to help mitigate noise levels in order to achieve the Local Authority's preferred criteria.

7.3 Both the internal and external noise levels are predicted to fall well within the criteria for BS 8233 and WHO with minimal additional noise mitigation. Noise levels in gardens, even those closest to North Road and Cemetery Road achieve the external limit without the need for additional noise mitigation. No special noise attenuation measures are required other than those outlined on the facades facing North Road and Cemetery Road.

7.4 This assessment has been undertaken at the worst case periods of the day and night and consequently noise levels over longer averaging periods throughout the day would be lower than those measured and predicted for the site.

7.5 I see no reason why this development cannot proceed on the grounds of noise.

Glossary of Terms

Decibel (dB) The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μPa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

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 people'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 halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 meter; heavy road traffic about 80 dB(A) at 10 meters; the level near a pneumatic drill about 100 dB(A).

$L_{A90,T}$ The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1990 it is used to define background noise level.

$L_{Aeq,T}$ The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax} The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

R_w The weighted sound reduction index, a single figure rating used to describe the sound insulation of building elements. It is defined in BS EN ISO 717-1: 1997.

$D_{ne,w}$ The weighted element-normalized level difference, a single figure rating used to describe the sound insulation of small building elements such as trickle vents. It is defined in BS EN ISO 717-1: 1997.

C_{tr} A spectrum adaptation term used to characterise the sound insulation with respect to urban traffic

Appendix 1a: Survey Results – North Road

Location	Start date	Start time	Elapsed time	L_{Aeq}	L_{AFmax}	L_{AF90}
P1	12/02/2013	05:54:54	0:00:06	43.2	48.8	37.7
P1	12/02/2013	05:55:00	0:05:00	42.4	63.8	33.3
P1	12/02/2013	06:00:00	0:05:00	37.3	51.3	34.0
P1	12/02/2013	06:05:00	0:05:00	41.9	63.9	34.2
P1	12/02/2013	06:10:00	0:05:00	41.8	59.6	35.3
P1	12/02/2013	06:15:00	0:05:00	40.8	62.2	35.4
P1	12/02/2013	06:20:00	0:05:00	47.6	65.8	35.9
P1	12/02/2013	06:25:00	0:05:00	48.6	67.3	37.1
P1	12/02/2013	06:30:00	0:05:00	44.7	64.5	37.1
P1	12/02/2013	06:35:00	0:05:00	40.2	54.3	36.6
P1	12/02/2013	06:40:00	0:05:00	48.6	67.6	38.4
P1	12/02/2013	06:45:00	0:05:00	48.0	66.8	38.9
P1	12/02/2013	06:50:00	0:04:54	46.5	65.7	37.5
P1	12/02/2013	06:58:25	0:01:35	48.5	64.9	37.8
P1	12/02/2013	07:00:00	0:05:00	47.8	65.5	37.4
P1	12/02/2013	07:05:00	0:05:00	46.3	65.1	38.2
P1	12/02/2013	07:10:00	0:05:00	46.2	64.5	38.2
P1	12/02/2013	07:15:00	0:05:00	47.2	66.3	39.0
P1	12/02/2013	07:20:00	0:05:00	44.7	61.8	37.5
P1	12/02/2013	07:25:00	0:05:00	48.6	64.7	38.2
P1	12/02/2013	07:30:00	0:05:00	51.3	72.6	37.4
P1	12/02/2013	07:35:00	0:05:00	46.0	67.6	38.3
P1	12/02/2013	07:40:00	0:05:00	49.0	66.3	38.5
P1	12/02/2013	07:45:00	0:05:00	48.9	64.1	40.4
P1	12/02/2013	07:50:00	0:05:00	50.3	66.5	40.3
P1	12/02/2013	07:55:00	0:03:25	48.9	66.1	40.3
P1	12/02/2013	07:59:53	0:00:07	55.4	63.3	45.3
P1	12/02/2013	08:00:00	0:05:00	48.3	63.3	40.3
P1	12/02/2013	08:05:00	0:05:00	48.4	63.5	40.2
P1	12/02/2013	08:10:00	0:05:00	50.5	65.8	40.6
P1	12/02/2013	08:15:00	0:05:00	50.6	68.9	40.5
P1	12/02/2013	08:20:00	0:05:00	51.1	67.0	40.5
P1	12/02/2013	08:25:00	0:05:00	51.7	67.1	41.9
P1	12/02/2013	08:30:00	0:05:00	53.8	73.4	43.2
P1	12/02/2013	08:35:00	0:05:00	53.5	66.2	44.7
P1	12/02/2013	08:40:00	0:05:00	53.6	74.3	42.4
P1	12/02/2013	08:45:00	0:05:00	52.0	64.7	42.3
P1	12/02/2013	08:50:00	0:05:00	51.1	65.2	40.8
P1	12/02/2013	09:19:37	0:00:23	48.4	58.1	42.1
P1	12/02/2013	09:20:00	0:05:00	48.5	65.7	38.5
P1	12/02/2013	09:25:00	0:05:00	50.0	67.5	38.3

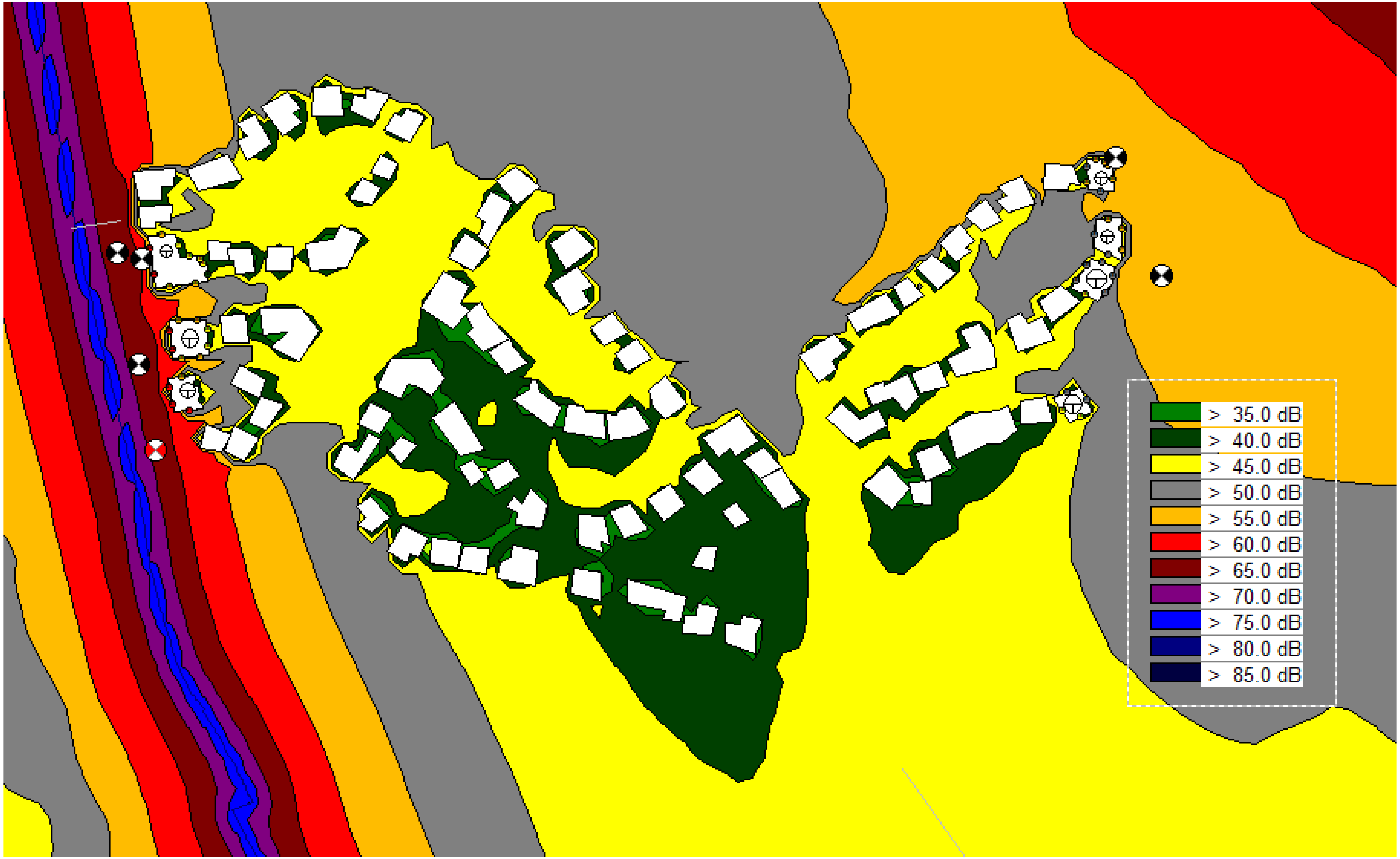
Location	Start date	Start time	Elapsed time	L_{Aeq}	L_{AFmax}	L_{AF90}
P1	12/02/2013	09:30:00	0:04:37	48.7	68.3	37.3
P2	12/02/2013	09:02:47	0:02:13	53.71	64.63	43.3
P2	12/02/2013	09:05:00	0:05:00	50.04	62.41	41.0
P2	12/02/2013	09:10:00	0:05:00	49.83	60.75	41.0
P2	12/02/2013	09:15:00	0:02:47	54.2	68.0	43.5
P3	12/02/2013	09:37:00	0:03:00	46.15	57.29	37.1
P3	12/02/2013	09:40:00	0:05:00	45.87	58.21	36.8
P3	12/02/2013	09:45:00	0:05:00	46.68	60.15	39.3
P3	12/02/2013	09:50:00	0:02:00	49.82	62.15	40.3
P4	12/02/2013	10:13:53	0:01:07	42.99	52.04	40.6
P4	12/02/2013	10:15:00	0:05:00	42.24	49.03	39.0
P4	12/02/2013	10:20:00	0:05:00	43.4	54.74	40.1
P4	12/02/2013	10:25:00	0:03:53	46.57	59.54	39.3

Appendix 1b: Survey Results – Cemetry Road

Location	Start date	Start time	Elapsed time	L_{Aeq}	L_{AFmax}	L_{AF90}
P5	08/02/2013 05:50	05:50	00:05:00	34.6	43.1	31.2
P5	08/02/2013 05:55	05:55	00:05:00	33.4	43.1	31.1
P5	08/02/2013 06:00	06:00	00:05:00	36.7	47.1	32.7
P5	08/02/2013 06:05	06:05	00:05:00	39.8	47.8	35.0
P5	08/02/2013 06:10	06:10	00:05:00	37.9	44.1	34.7
P5	08/02/2013 06:15	06:15	00:05:00	36.6	51.4	34.0
P5	08/02/2013 06:20	06:20	00:05:00	40.7	58.7	35.2
P5	08/02/2013 06:25	06:25	00:05:00	45.2	58.6	36.8
P5	08/02/2013 06:30	06:30	00:03:41	45.0	71.1	36.3
P5	08/02/2013 06:35	06:35	00:05:00	38.6	47.4	36.4
P5	08/02/2013 06:40	06:40	00:05:00	39.4	47.7	36.4
P5	08/02/2013 06:45	06:45	00:05:00	41.4	51.2	36.8
P5	08/02/2013 06:50	06:50	00:05:00	40.4	56.3	37.1
P5	08/02/2013 06:55	06:55	00:05:00	38.8	51.0	36.5
P5	08/02/2013 07:00	07:00	00:05:00	45.4	59.1	38.2
P5	08/02/2013 07:05	07:05	00:05:00	42.4	54.4	37.4
P5	08/02/2013 07:10	07:10	00:05:00	42.7	57.7	37.7
P5	08/02/2013 07:15	07:15	00:05:00	43.1	58.4	38.6
P5	08/02/2013 07:20	07:20	00:05:00	44.7	55.6	38.2
P5	08/02/2013 07:25	07:25	00:05:00	43.2	50.7	40.1
P5	08/02/2013 07:30	07:30	00:03:17	46.5	73.6	38.6
P5	08/02/2013 07:35	07:35	00:05:00	44.3	74.2	38.2
P5	08/02/2013 07:40	07:40	00:05:00	46.4	58.6	39.1
P5	08/02/2013 07:45	07:45	00:05:00	44.7	53.0	40.4
P5	08/02/2013 07:50	07:50	00:05:00	51.6	65.6	41.8
P5	08/02/2013 07:55	07:55	00:05:00	45.6	57.0	41.3
P5	08/02/2013 08:00	08:00	00:05:00	48.7	67.0	39.9
P5	08/02/2013 08:05	08:05	00:05:00	56.9	73.8	41.7
P5	08/02/2013 08:10	08:10	00:05:00	42.9	53.4	38.5
P5	08/02/2013 08:15	08:15	00:05:00	51.7	66.8	40.6
P5	08/02/2013 08:20	08:20	00:05:00	42.7	51.5	40.0
P5	08/02/2013 08:25	08:25	00:05:00	42.9	51.7	40.2
P5	08/02/2013 08:30	08:30	00:03:27	41.6	46.0	40.3

Appendix 2a: Screen shot of modelling results – Night-time L_{Aeq}

Appendix 2b: Screen shot of modelling results – Night-time L_{AFmax}



Appendix 2c: Screen shot of modelling results – Day-time L_{Aeq}

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Appendix 3a: Noise Ingress Calculations – North Road - Nighttime

Noise Ingress Calculation **Miller Goodall Environmental Services**

Project:	Glossop	**Calcs By:**	Matt Hopley
Description:	Night time (6am) - Houses nearest North Road	**Date:**	21/02/2013

This calculation is based on the methodology within BS 8233:1999 which in turn is based on BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A - C + 6$$

where A = 0.16V/T and C = 10 x log (cosθ), an angle of incidence correction varying from 0 (normal to axis) to -6 dB (for maximum AOI). This can be broken down further to:

Leq,2 = Leq,ff + 10 x log ((A0/S x 10^(-Dn,e/10)) + (Swi/S x 10^(-Rwi/10)) + (Sew/S x 10^(-Rew/10)) + (Srr/S x 10^(-Rrr/10))) + 10 x log (S/A) - C + 6

The above terms are described below.

Part 1: External envelope excluding roof

Term	Description	Value
Sf	Total facade area (m2)	7.5
Swi	Window area (m2)	1.5
Sew	External wall area (Sf - Swi)	6
Srr	Area of ceiling (m2)	0
S	Total area of elements through which sound enters room (Sf + Srr)	7.5
V	Volume of receiving room (m3)	30
A0	Reference absorption area (m2)	10
	Number of ventilators in facade:	1
θ	Angle of incidence of sound source to facade (degrees):	0

		Octave band centre frequency, Hz											
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**	**Rw**	**Ctr**	**Rw+ Ctr**
Result A: Leq,ff	External Leq, freefield	56.5	47.4	38.7	33.9	38.9	38.1	30.6	20.4	44	-	-	-
Result A': Lmax,ff	External Lmax, freefield	66	57	50	50	52	44	47	65	65	-	-	-
Dne (each)	Element normalised sound level difference of each ventilator	*16*	20	22	27	31	39	*49*	*49*		31	-4	27
Dne (all)	Total element normalised sound level difference of all ventilators	16	20	22	27	31	39	49	49	-	31	-4	27
Rwi	Sound reduction index of window	*18*	24	20	25	35	38	35	*35*		31	-4	27
Rew	Sound reduction index of external wall	*35*	37	42	52	60	63	68	*68*		54	-6	48
Rrr	Sound reduction index of roof and ceiling	27	33	39	45	50	54	60	*60*		49	-5	44
T	Reverberation time of receiving room (secs)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5				
Equation "B"	All ventilators	0.0342	0.014	0.008	0.003	0.001	2E-04	2E-05	2E-05				
Equation "C"	Glazing	0.0032	8E-04	0.002	6E-04	6E-05	3E-05	6E-05	6E-05				
Equation "D"	External wall	0.0003	2E-04	5E-05	5E-06	8E-07	4E-07	1E-07	1E-07				
Equation "E"	Ceiling	0	0	0	0	0	0	0	0				
10 x log "B"	All ventilators	-14.7	-18.7	-21.0	-25.3	-29.5	-37.9	-48.2	-48.2				
10 x log "C"	Glazing	-25.0	-31.0	-27.0	-32.0	-42.0	-45.0	-42.0	-42.0				
10 x log "D"	External wall	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0				
10 x log "E"	Ceiling	######	#####	#####	#####	#####	#####	#####	#####				
Equation "F"	*All elements combined*	-14.2	-18.4	-20.0	-24.4	-29.3	-37.1	-41.0	-41.0				
Absorption area	Equivalent absorption area of receiving room (m2)	10	10	10	10	10	10	10	10				
Equation "G"	10*log(S/A)	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1				
Equation "H"	Angle of incidence correction (10*log(cos θ) up to max of -6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				

		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**		**Target**	**Exc.**
Leq,2	Internal Leq	47	34	24	14	15	6	-5	-16	24		30	-6
Lmax,2	Internal Lmax	56	43	35	30	27	12	11	29	36		45	-9

Appendix 3b: Noise Ingress Calculations – Cemetery Road - Night time

Noise Ingress Calculation **Miller Goodall Environmental Services**

Project:	Glossop	**Calcs By:**	Matt Hopley
Description:	Night time (6am) - Houses nearest Cemetry Road	**Date:**	21/02/2013

This calculation is based on the methodology within BS 8233:1999 which in turn is based on BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A - C + 6$$

where A = 0.16V/T and C = 10 x log (cosθ), an angle of incidence correction varying from 0 (normal to axis) to -6 dB (for maximum AOI). This can be broken down further to:

Leq,2 = Leq,ff + 10 x log ((A0/S x 10^(-Dn,e/10)) + (Swi/S x 10^(-Rwi/10)) + (Sew/S x 10^(-Rew/10)) + (Srr/S x 10^(-Rrr/10))) + 10 x log (S/A) - C + 6

The above terms are described below.

Part 1: External envelope excluding roof

Term	**Description**	**Value**
Sf	Total facade area (m2)	7.5
Swi	Window area (m2)	1.5
Sew	External wall area (Sf - Swi)	6
Srr	Area of ceiling (m2)	0
S	Total area of elements through which sound enters room (Sf + Srr)	7.5
V	Volume of receiving room (m3)	30
A0	Reference absorption area (m2)	10
	Number of ventilators in facade:	1
θ	Angle of incidence of sound source to facade (degrees):	0

		Octave band centre frequency, Hz											
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**	**Rw**	**Ctr**	**Rw+ Ctr**
Result A: Leq,ff	External Leq, freefield	60.2	49.8	40	34.6	40.8	40.5	30	10	46	-	-	-
Result A': Lmax,ff	External Lmax, freefield	73	60	62	51	52	54	45	19	59	-	-	-
Dne (each)	Element normalised sound level difference of each ventilator	*16*	20	22	27	31	39	*49*	*49*		31	-4	27
Dne (all)	Total element normalised sound level difference of all ventilators	16	20	22	27	31	39	49	49	-	31	-4	27
Rwi	Sound reduction index of window	*18*	24	20	25	35	38	35	*35*		31	-4	27
Rew	Sound reduction index of external wall	*35*	37	42	52	60	63	68	*68*		54	-6	48
Rrr	Sound reduction index of roof and ceiling	27	33	39	45	50	54	60	*60*		49	-5	44
T	Reverberation time of receiving room (secs)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5				
Equation "B"	All ventilators	0.0342	0.014	0.008	0.003	0.001	2E-04	2E-05	2E-05				
Equation "C"	Glazing	0.0032	8E-04	0.002	6E-04	6E-05	3E-05	6E-05	6E-05				
Equation "D"	External wall	0.0003	2E-04	5E-05	5E-06	8E-07	4E-07	1E-07	1E-07				
Equation "E"	Ceiling	0	0	0	0	0	0	0	0				
10 x log "B"	All ventilators	-14.7	-18.7	-21.0	-25.3	-29.5	-37.9	-48.2	-48.2				
10 x log "C"	Glazing	-25.0	-31.0	-27.0	-32.0	-42.0	-45.0	-42.0	-42.0				
10 x log "D"	External wall	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0				
10 x log "E"	Ceiling	######	#####	#####	#####	#####	#####	#####	#####				
Equation "F"	*All elements combined*	-14.2	-18.4	-20.0	-24.4	-29.3	-37.1	-41.0	-41.0				
Absorption area	Equivalent absorption area of receiving room (m2)	10	10	10	10	10	10	10	10				
Equation "G"	10*log(S/A)	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1				
Equation "H"	Angle of incidence correction (10*log(cos θ) up to max of -6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				

		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**		**Target**	**Exc.**
Leq,2	Internal Leq	51	36	25	15	16	8	-6	-26	27		30	-3
Lmax,2	Internal Lmax	64	47	47	31	27	22	9	-17	42		45	-3

Appendix 3c: Noise Ingress Calculations – North Road – daytime

Noise Ingress Calculation **Miller Goodall Environmental Services**

Project:	Glossop	**Calcs By:**	Matt Hopley
Description:	Day-time - Houses nearest North Road	**Date:**	21/02/2013

This calculation is based on the methodology within BS 8233:1999 which in turn is based on BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A - C + 6$$

where A = 0.16V/T and C = 10 x log (cosθ), an angle of incidence correction varying from 0 (normal to axis) to -6 dB (for maximum AOI). This can be broken down further to:

Leq,2 = Leq,ff + 10 x log ((A0/S x 10^(-Dn,e/10)) + (Swi/S x 10^(-Rwi/10)) + (Sew/S x 10^(-Rew/10)) + (Srr/S x 10^(-Rrr/10))) + 10 x log (S/A) - C + 6

The above terms are described below.

Part 1: External envelope excluding roof

Term	Description	Value
Sf	Total facade area (m2)	7.5
Swi	Window area (m2)	1.5
Sew	External wall area (Sf - Swi)	6
Srr	Area of ceiling (m2)	0
S	Total area of elements through which sound enters room (Sf + Srr)	7.5
V	Volume of receiving room (m3)	30
A0	Reference absorption area (m2)	10
	Number of ventilators in facade:	1
θ	Angle of incidence of sound source to facade (degrees):	0

		Octave band centre frequency, Hz											
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**	**Rw**	**Ctr**	**Rw+ Ctr**
Result A: Leq,ff	External Leq, freefield	60.9	54	45.2	39.4	45.2	45.2	37.3	24.2	50	-	-	-
Result A': Lmax,ff	External Lmax, freefield												
Dne (each)	Element normalised sound level difference of each ventilator	*16*	20	22	27	31	39	*49*	*49*		31	-4	27
Dne (all)	Total element normalised sound level difference of all ventilators	16	20	22	27	31	39	49	49	-	31	-4	27
Rwi	Sound reduction index of window	*18*	24	20	25	35	38	35	*35*		31	-4	27
Rew	Sound reduction index of external wall	*35*	37	42	52	60	63	68	*68*		54	-6	48
Rrr	Sound reduction index of roof and ceiling	27	33	39	45	50	54	60	*60*		49	-5	44
T	Reverberation time of receiving room (secs)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5				
Equation "B"	All ventilators	0.0342	0.014	0.008	0.003	0.001	2E-04	2E-05	2E-05				
Equation "C"	Glazing	0.0032	8E-04	0.002	6E-04	6E-05	3E-05	6E-05	6E-05				
Equation "D"	External wall	0.0003	2E-04	5E-05	5E-06	8E-07	4E-07	1E-07	1E-07				
Equation "E"	Ceiling	0	0	0	0	0	0	0	0				
10 x log "B"	All ventilators	-14.7	-18.7	-21.0	-25.3	-29.5	-37.9	-48.2	-48.2				
10 x log "C"	Glazing	-25.0	-31.0	-27.0	-32.0	-42.0	-45.0	-42.0	-42.0				
10 x log "D"	External wall	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0				
10 x log "E"	Ceiling	######	#####	#####	#####	#####	#####	#####	#####				
Equation "F"	*All elements combined*	-14.2	-18.4	-20.0	-24.4	-29.3	-37.1	-41.0	-41.0				
Absorption area	Equivalent absorption area of receiving room (m2)	10	10	10	10	10	10	10	10				
Equation "G"	10*log(S/A)	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1				
Equation "H"	Angle of incidence correction (10*log(cos θ) up to max of -6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				

		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**		**Target**	**Exc.**
Leq,2	Internal Leq	52	41	30	20	21	13	1	-12	30		30	0
Lmax,2	Internal Lmax												

Appendix 3d: Noise Ingress Calculations – Cemetry Road – daytime

Noise Ingress Calculation **Miller Goodall Environmental Services**

Project:	Glossop	**Calcs By:**	Matt Hopley
Description:	Day-time - houses nearest Cemetry Road	**Date:**	21/02/2013

This calculation is based on the methodology within BS 8233:1999 which in turn is based on BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A - C + 6$$

where A = 0.16V/T and C = 10 x log (cosθ), an angle of incidence correction varying from 0 (normal to axis) to -6 dB (for maximum AOI). This can be broken down further to:

Leq,2 = Leq,ff + 10 x log ((A0/S x 10^(-Dn,e/10)) + (Swi/S x 10^(-Rwi/10)) + (Sew/S x 10^(-Rew/10)) + (Srr/S x 10^(-Rrr/10))) + 10 x log (S/A) - C + 6

The above terms are described below.

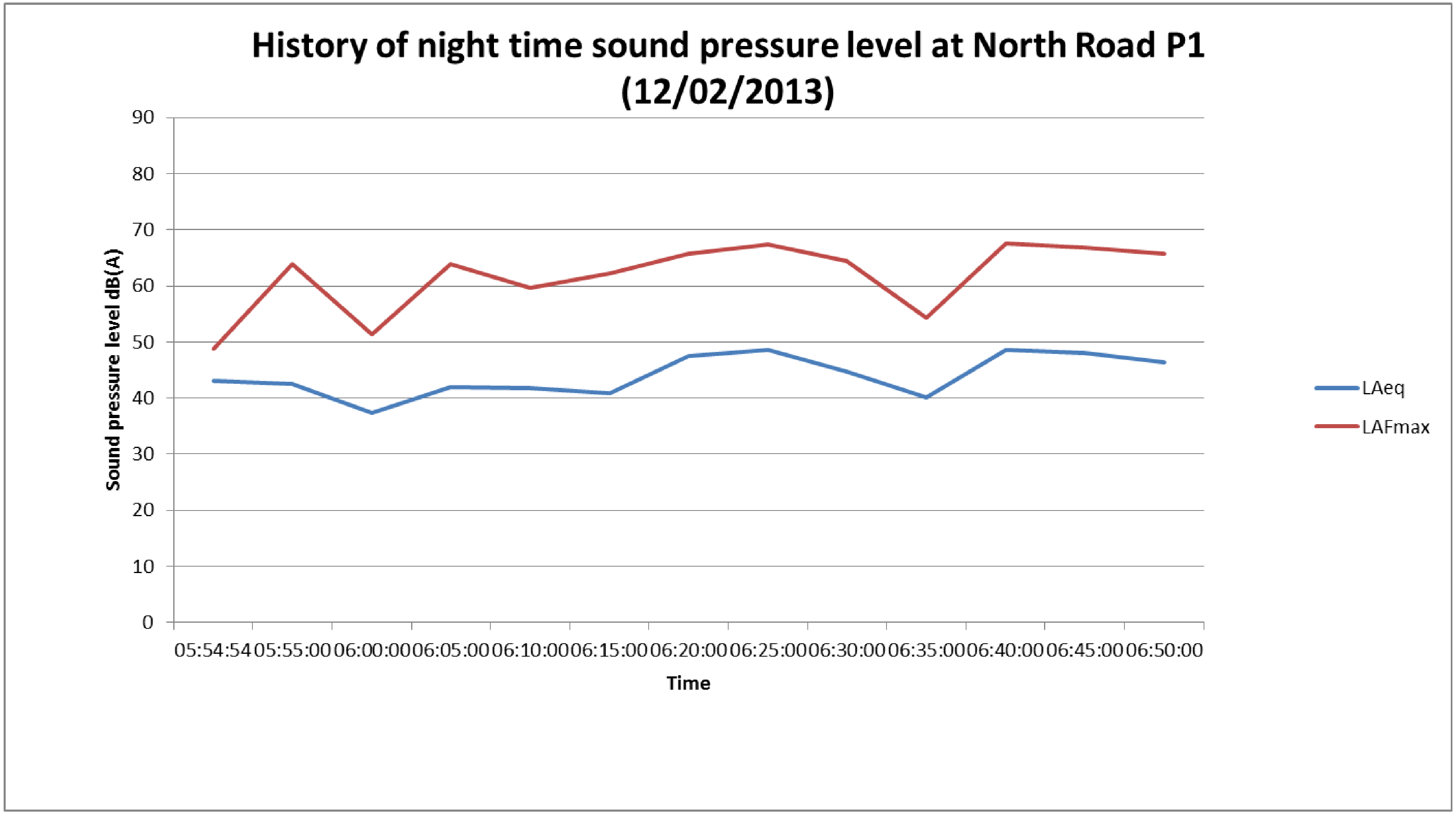
Part 1: External envelope excluding roof

Term	Description	Value
Sf	Total facade area (m2)	7.5
Swi	Window area (m2)	1.5
Sew	External wall area (Sf - Swi)	6
Srr	Area of ceiling (m2)	0
S	Total area of elements through which sound enters room (Sf + Srr)	7.5
V	Volume of receiving room (m3)	30
A0	Reference absorption area (m2)	10
	Number of ventilators in facade:	1
θ	Angle of incidence of sound source to facade (degrees):	0

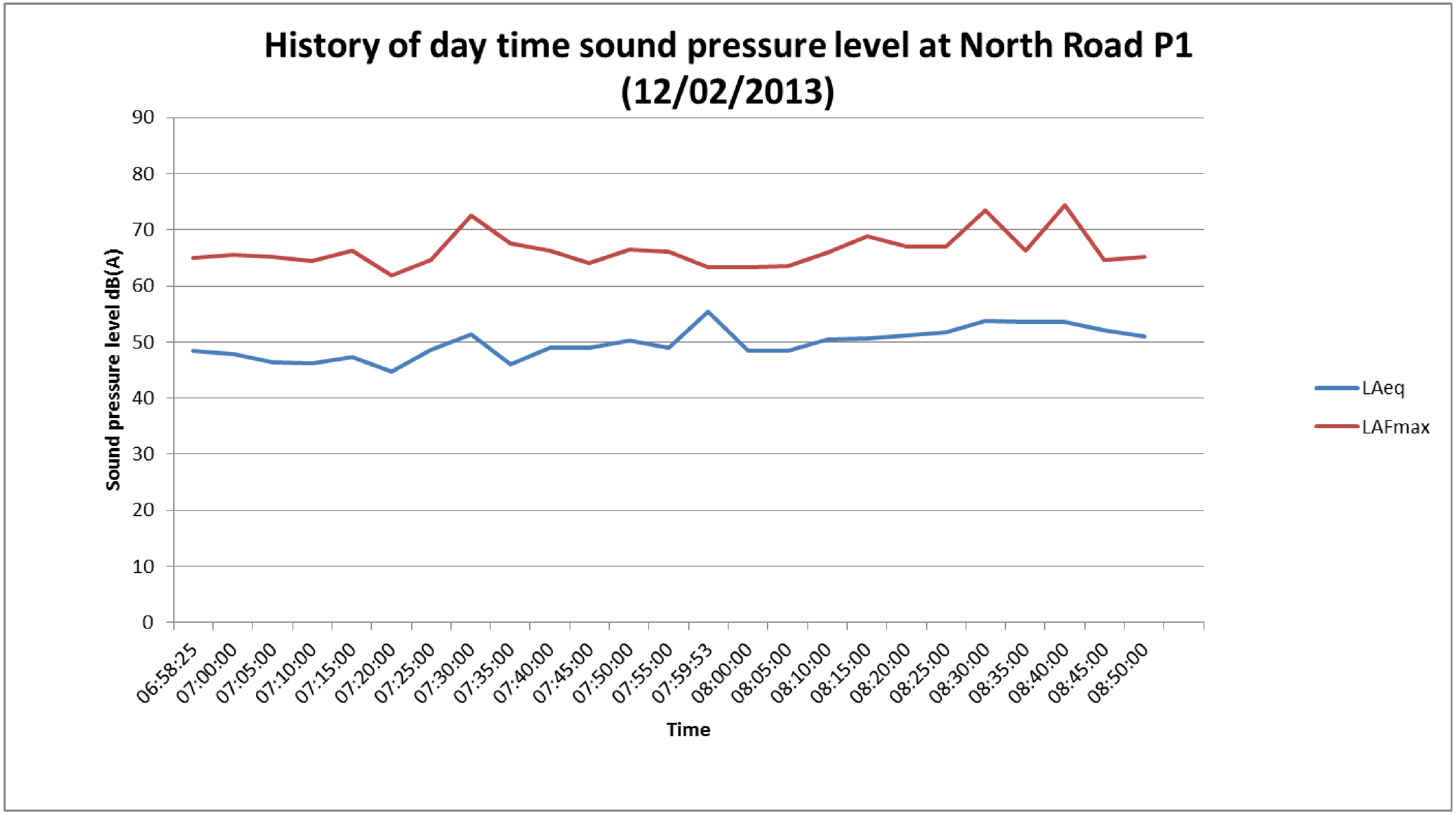
		Octave band centre frequency, Hz											
		63	125	250	500	1k	2k	4k	8k	dBA	Rw	Ctr	Rw+ Ctr
Result A: Leq,ff	External Leq, freefield	65.5	51.5	44.3	37.8	45.1	44.1	33.8	15.4	49	-	-	-
Result A': Lmax,ff	External Lmax, freefield	86	72	67	55	71	71	58	32	75	-	-	-
Dne (each)	Element normalised sound level difference of each ventilator	*29*	33	32	29	28	30	34	*40*		30	-1	29
Dne (all)	Total element normalised sound level difference of all ventilators	29	33	32	29	28	30	34	40	-	30	-1	29
Rwi	Sound reduction index of window	*18*	24	20	25	35	38	35	*35*		31	-4	27
Rew	Sound reduction index of external wall	*35*	37	42	52	60	63	68	*68*		54	-6	48
Rrr	Sound reduction index of roof and ceiling	27	33	39	45	50	54	60	*60*		49	-5	44
T	Reverberation time of receiving room (secs)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5				
Equation "B"	All ventilators	0.0017	7E-04	8E-04	0.002	0.002	0.001	5E-04	1E-04				
Equation "C"	Glazing	0.0032	8E-04	0.002	6E-04	6E-05	3E-05	6E-05	6E-05				
Equation "D"	External wall	0.0003	2E-04	5E-05	5E-06	8E-07	4E-07	1E-07	1E-07				
Equation "E"	Ceiling	0	0	0	0	0	0	0	0				
10 x log "B"	All ventilators	-27.8	-31.8	-30.8	-27.8	-26.8	-28.8	-32.8	-38.8				
10 x log "C"	Glazing	-25.0	-31.0	-27.0	-32.0	-42.0	-45.0	-42.0	-42.0				
10 x log "D"	External wall	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0				
10 x log "E"	Ceiling	######	#####	#####	#####	#####	#####	#####	#####				
Equation "F"	*All elements combined*	-22.9	-27.9	-25.4	-26.4	-26.6	-28.6	-32.3	-37.1				
Absorption area	Equivalent absorption area of receiving room (m2)	10	10	10	10	10	10	10	10				
Equation "G"	10*log(S/A)	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1				
Equation "H"	Angle of incidence correction (10*log(cos θ) up to max of -6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				

		63	125	250	500	1k	2k	4k	8k	dBA		Target	Exc.
Leq,2	Internal Leq	48	29	24	16	23	20	6	-17	28		30	-2
Lmax,2	Internal Lmax												

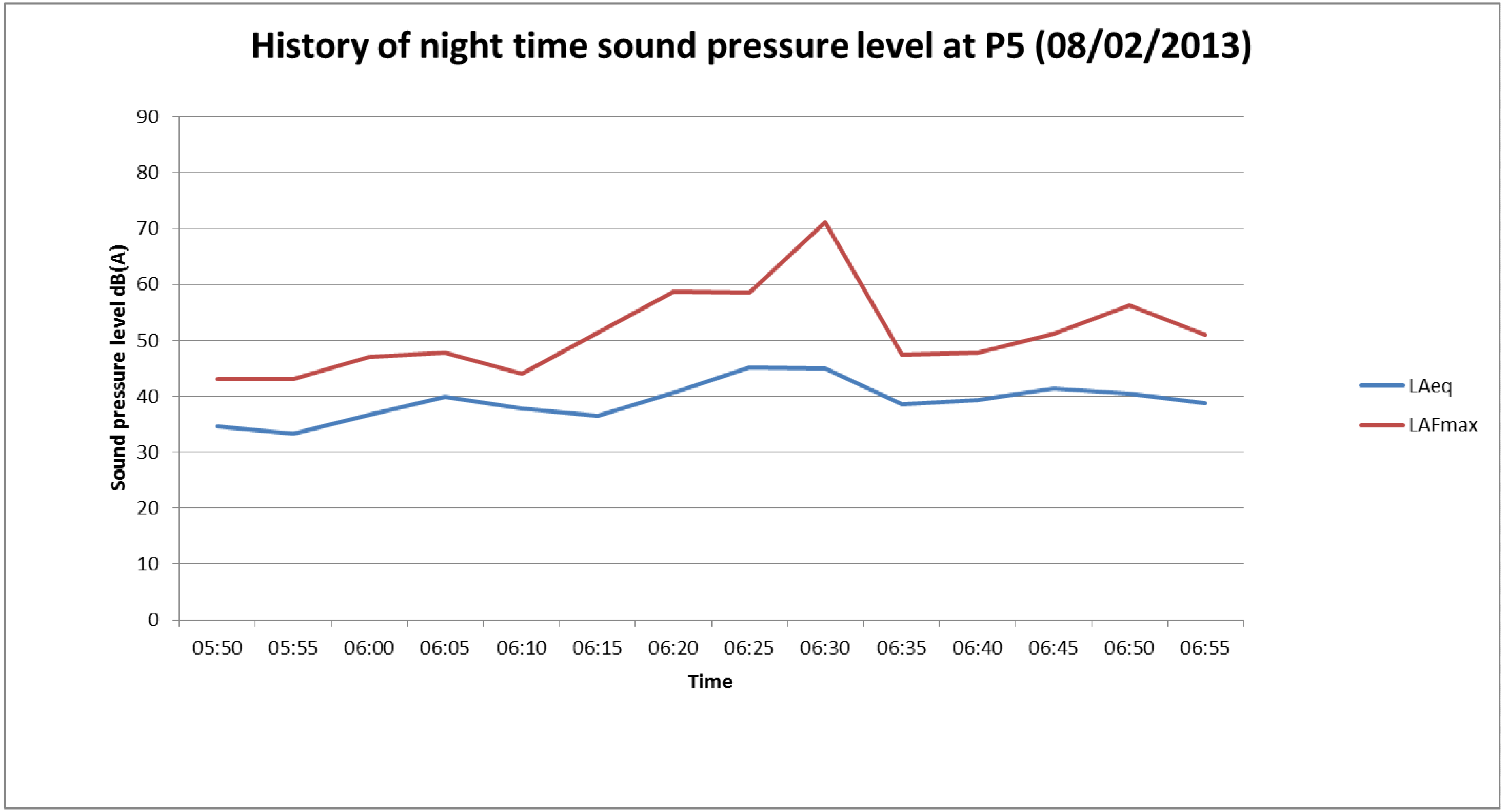
Appendix 4a: Time history of noise levels at North Road - postion 1



Appendix 4b: Time history of noise levels at North Road - postion 1.



Appendix 4c: Time history of noise levels at Cemetery Road - postion 5.



Appendix 4d: Time history of noise levels at Cemetery Road - postion 5.