

Calder Vale Park- Noise Assessment



Prepared by: 
Debbie Preston MIOA
Environmental Scientist

Checked by: 
Nigel Triner MIOA
Associate Director

Approved by: 
Nigel Triner MIOA
Associate Director

Calder Vale Park- Noise Assessment

Rev No	Comments	Checked by	Approved by	Date
0	Internal Review	NT	NT	8/11/10
1	Draft issued to Client for comments	NT	NT	9/11/10
2	Final Version	NT	NT	12/11/10

Lynnfield House, Church Street , Altrincham, Cheshire, WA14 4DZ
Telephone: 0161 927 8200 Website: <http://www.aecom.com>

Job No 60161156

Reference DJP

Date Created October 2010

This document has been prepared by AECOM Limited for the sole use of our client (the "Client") and in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM Limited and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM Limited, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM Limited

This document is confidential and the copyright of AECOM Limited. Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

c:\documents and settings\warddj\desktop\fort vale\fort vale noise assessment v1-draft.doc

Table of Contents

1 **Introduction 2**

2 **Site Description.....3**

3 **Assessment Methodology and Criteria.....4**

4 **Noise Monitoring 9**

5 **Noise Assessment 15**

6 **Mitigation 22**

7 **Summary & Conclusions.....25**

Noise Assessment

Capabilities on project:
Environment

1 Introduction

- 1.1 AECOM Acoustics was commissioned by Fort Vale Engineering Ltd to assess the potential noise impacts resulting from the proposed relocation of their foundry from Southfield Road, Nelson, to Calder Vale Park, Simonstone Lane, west of Padiham.
- 1.2 The proposed site is at the Calder Vale Park to the west of Simonstone Lane, near Padiham. Currently the site accommodates the company's international headquarter offices and production base; however, the existing foundry is located approximately 11 km to the north east.
- 1.3 Fort Vale Engineering Ltd plans to extend their existing manufacturing facilities at Simonstone by erecting a single storey investment casting foundry, integrated with the existing production plant, in order that the present casting facilities can be transferred from the existing premises in Nelson to create a more modern, efficient and sustainable process on a single site. The proposed site for the foundry is to the east of the existing buildings (Building S) at Calder Vale Park and bounded to the west, south and north by open farmland, although part of the site lies within Green Belt land.
- 1.4 As part of the noise assessment a site visit to the existing foundry was undertaken to determine the existing noise sources at the existing foundry, during which noise measurements were taken to determine the noise emissions from various items of plant and operations at the current foundry. Site visits were also undertaken to establish the existing background noise levels at the nearest noise sensitive receptors (NSR) to the proposed foundry.
- 1.5 Using the noise data from the site visit, noise models have been built using the CadnaA © noise modelling software to predict the future noise levels at nearby NSRs with the proposed foundry in operation. Outline mitigation measures have been recommended to minimise the impact at the NSRs.

2 Site Description

2.1 Proposed Site

- 2.1.1 The proposed site is at the Calder Vale Park to the west of Simonstone Lane, near Padiham. Currently the site accommodates the company's international headquarter offices and production base. Figure 2.1 shows the proposed location for the foundry which is to the east of the existing buildings (Building S) at Calder Vale Park and bounded to the west, south and north by open farmland, although part of the site lies within Green Belt land.
- 2.1.2 The new site forms part of the extensive former Mullard's premises located to the west of Simonstone Lane. The majority of the Mullard's Plant and buildings were demolished in 2005/2006. The foundry building will be single storey. And will have a footprint of approximately 3250 m² adjacent to the western end of the main premises (to the rear of the existing production building). The siting has been selected for operational reasons, allowing the most efficient working relationship between the two buildings. The location also enables a class B2 foundry use to be located in a more peripheral location where it is remote from the residential properties on Simonstone Lane.
- 2.1.3 The vehicular access to the foundry will use the existing entrance at the Calder Vale site. As part of the development the existing internal access road network will be extended, being linked with new service and parking areas. A transport yard will be situated to the north of the foundry, the yard will accommodate waste skips, skip wagons and 40 ft articulated delivery lorries. The proposed building will be 7 m to gutter level.
- 2.1.4 The nearest NSRs (all residential dwellings) to the proposed foundry are located to the east and north east of the proposed foundry building. The properties on Railway Terrace are 190 m from the proposed foundry building and properties on Bank Terrace, located to the north of the disused railway line are 217 m away. To the south and south west are the residential properties in Altham
- 2.1.5 It should be noted that the Calder Vale site has a historic class B2/B8 use.

2.2 Operations of the foundry.

- 2.2.1 The existing foundry located in Nelson operates 2 shifts, day shift from 07:30 to 17:30 and a night shift from 22:00 to 07:30 on Monday to Thursdays and 07:30 to 13:00 on Fridays. It is proposed the relocated foundry will operate the same shift patterns. All deliveries and vehicle movement (apart from staff vehicles arriving/departing shifts) currently occur between 07:30 and 17:30.
- 2.2.2 At the Calder Vale site the on-site vehicle movements (e.g. fork lift trucks) will occur between 07:00 and 19:30. Deliveries to the proposed site will occur between 08:00 and 16:30.
- 2.2.3 During the daytime shift all plant and extracts will potentially be operational. The shell room and dust extract, which is a separate room with the foundry building, operates on a 24 hours basis. During the night shift the following plant and activities are undertaken:
- Furnaces in use and pouring molten metal into casts.
 - Linishing machine (when in use the linishing extract is on)
 - Fettle machines (when in use the fettling extract is on)

3 Assessment Methodology and Criteria

3.1 Assessment Methodology

3.1.1 In order to assess the impacts of noise associated with the proposed foundry relocation, it was necessary to establish the noise levels of the plant and site operations at the existing foundry and to determine the ambient and background noise levels in the vicinity of the of the proposed site. Accordingly, an environmental noise survey was undertaken to quantify the existing baseline ambient and background noise levels at NSRs near to the proposed site. Sample noise measurements were also undertaken of various items of plant and operational activities at the existing foundry site. All of the noise surveys were undertaken using a Type 1 Sound level Meter. The noise monitoring was undertaken in accordance with the principles of BS 7445: 2003 'Description and measurement of environmental noise'. Further details of the noise survey can be found in Chapter 4.

3.1.2 To assess the change in noise levels at NSRs as a consequence of the proposed Foundry relocation 3-dimensional noise model was created using CadnaA® noise modelling software, which utilises the methodologies of the ISO 9613– 'Propagation of noise outdoors'. The likely noise impacts at the nearest NSRs, associated with the proposed redevelopment were the assessed using relevant guidance relating to noise.

3.2 Noise Perception and Terminology

3.2.1 Between the quietest audible sound and the loudest tolerable sound, there is a ten million to one ratio in sound pressure (measured in Pascal's, Pa). Because of this wide range, a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

3.2.2 The human auditory system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB L_A .

3.2.3 The effects of noise on man can be divided into two categories, physiological damage and annoyance. The physiological aspects of noise include hearing damage, sleep disturbance, and stress effects; whilst annoyance includes speech and activity interference and interference with well-being.

Capabilities on project:
Environment

- 3.2.4 Potential impacts during the key phases of development may include an increase in noise levels as a result of construction activity and increased traffic generation. Increased traffic noise from the access road is potentially the most significant impact. Table 3.1 shows typical sound levels experienced in common environments. Appendix A provides more information on noise units and their measurement.

Table 3.1 Sound Pressure Level in dB L_A for Common Situations

Typical Noise Level, dB L_A	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2 m
50	Quiet office, no machinery Boiling kettle at 0.5 m
60	Normal conversation
70	Telephone ringing at 2 m Vacuum cleaner at 3 m
80	General factory noise level
90	Heavy goods vehicle from pavement Powered lawnmower, operator's ear
100	Pneumatic drill at 5 m
120	Discotheque – 1 m in front of loudspeaker
140	Threshold of pain

- 3.2.5 The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB, whereas in a suburban area this may increase up to 40 dB or more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.
- 3.2.6 An indicator that is widely accepted as reflecting the underlying background noise level is the L_{A90} index. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a 1-hour period, the L_{A90} will be the noise level exceeded for 54 minutes.

Capabilities on project:
Environment

- 3.2.7 The equivalent continuous A-weighted sound pressure level, L_{Aeq} , is the single number that represents the average sound energy measured over a period. L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to describe environmental noise from individual sources that vary in level over their operational cycle.
- 3.2.8 The L_{AFmax} measurement indicator is the maximum instantaneous sound pressure level attained during the measurement period, measured with 'Fast' response setting of the sound level meter. It is most commonly used to assess potential night-time sleep disturbance.
- 3.2.9 Human subjects, under laboratory conditions, are generally only capable of noticing changes in steady levels of greater than 3 dB. It is generally accepted that a change of 10 dB in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient, non-steady or intermittent noise sources).
- 3.3 BS 4142:1997 – 'Method for rating industrial noise affecting mixed residential and industrial areas'**
- 3.3.1 This British Standard provides guidance on the assessment of the likelihood of complaints relating to industrial noise from fixed plant.
- 3.3.2 The principal terms used in BS 4142 are broadly defined as follows:
- Specific noise – the noise source under consideration
 - Rating level – Specific noise corrected to allow for certain distinctive acoustic features
 - Residual noise – the ambient noise remaining when the specific noise is sufficiently suppressed so as not to contribute to the ambient noise level
 - Background noise – the measured L_{A90} level of the residual noise
- 3.3.3 The standard presents a method of rating noise levels by comparing the noise level of the new source (the Rating Level) with the existing background noise level in the area in the absence of the plant and equipment noise (the Background Noise Level).
- 3.3.4 The standard states that the appropriate reference time interval for daytime and night-time periods is 1 hour and 5 minutes respectively.
- 3.3.5 The rating method according to BS 4142:1997 accounts for unusual acoustic features such as a whine, hiss, impulsive or irregular noise by the addition of a single 5 dB correction to the actual Specific Noise Level of the source. The corrected Specific Noise Level is the Rating Level.
- 3.3.6 The BS 4142:1997 rating is determined by arithmetically subtracting the Background Noise Level from the Rating Level. A difference of around +10 dB or more indicates that complaints about noise are likely. A difference of +5 dB is said to be of marginal significance. If the Rating Level is more than 10 dB below the Background Noise Level it is a positive indication that complaints are unlikely. Table 3.2 shows the BS 4142 Assessment Criteria.

Table 3.2 BS 4142 Assessment Criteria

Difference Between Rating and Background Noise Level	BS 4142 Assessment Method
-10	If the rating level is more than 10 dB below the measured background noise level, then this is a positive indication that complaints are unlikely.
+5	A difference of around +5 dB is of marginal significance.
+10	A difference of around +10 dB or more indicates complaints are likely.

Capabilities on project:
Environment

3.3.7 It should be noted however that the standard is not suitable for use where both the Background Noise Level and the Rating Level are very low. For the purpose of the standard, Background Noise Levels below about 30 dB and Rating Levels below about 35 dB are considered to be very low. In these instances a different assessment methodology is typically deemed to be more appropriate.

3.3.8 The background noise varies throughout the day and night. For plant that may operate on a 24-hour basis, it is appropriate to measure the representative lowest Background Noise Level (which would normally occur in the early hours of the morning) at the nearest residential property and to use this value for comparison against the predicted Rating Level from the new plant. If it can be shown that the Rating Level from the proposed new fixed plant will not exceed the existing Background Noise Level for the quietest period of the night, then it follows the impact will be lower at all other times throughout a 24-hour period.

3.4 WHO Guidance

3.4.1 The World Health Organisation's (WHO) 'Guidelines for Community Noise' report for external daytime environmental noise levels (in a garden, for example) states that;

'During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50 dB.....'

3.4.2 For night-time noise sources the WHO guidelines provide a precautionary night-time (23.00-07.00) noise level of 45 dB $L_{Aeq,8h}$ 'outside bedroom windows' (for a reasonably steady noise source) and on a sleep disturbance basis (for intermittent or impulse noise) the guidelines state in Section 3.3 that:

'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night.....'

3.4.3 This bedroom internal maximum noise limit is repeated in Table 5 of BS 8233:1999. However, the WHO guidelines also convert the internal maximum noise level limit to an equivalent external façade noise level limit of 60 dB L_{Amax} , free field, 'Outside bedrooms, sleep disturbance, window open, outdoor values'. This assumes that an open window of a typical dwelling will provide approximately 15 dB reduction between internal and external noise levels. Consequently a noise level of 60 dB L_{Amax} , external to an open bedroom window would lead to a resulting internal level of around 45 dB L_{Amax} .

3.4.4 In January 2010 the World Health Organisation published the document 'Night Noise Guidelines for Europe', which gave an inspirational night noise level of $L_{night,outside}$ 40 dB and an interim guideline value of $L_{night,outside}$ 55 dB.

Capabilities on project:
Environment

3.5 BS 8233: 1999 – ‘Sound insulation and noise reduction for buildings – code of practice’.

3.5.1 BS 8233:1999 gives recommendations for the control of noise in and around buildings, and suggests appropriate criteria and limits for indoor ambient noise levels for different situations. Table 5 from BS 8233 is reproduced in Table 3.3 below:

Table 3.3: Indoor ambient noise levels in space when they are unoccupied

Criterion	Typical situations	Design range $L_{Aeq, T}$	
		Good	Reasonable
Reasonable industrial working conditions	Heavy engineering	70	80
	Light engineering	65	75
	Garages, warehouses	65	75
Reasonable speech or telephone communications	Department store	50	55
	Cafeteria, canteen, kitchen	50	55
	Wash-room, toilet	45	55
	Corridor	45	55
Reasonable conditions for study and work requiring concentration	Library, cellular office, museum	40	50
	Staff Room	35	45
	Meeting room, executive office	35	40
Reasonable listening conditions	Classroom	35	40
	Church, lecture theatre, cinema	30	35
	Concert hall, theatre	25	30
	Recording studio	20	25
Reasonable resting/sleeping conditions	Living rooms	30	40
	Bedrooms	30	35
For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{Amax}			

3.6 Consultation with Environmental Health.

3.6.1 The Environmental Health Manager at Ribble Valley Borough Council was consulted regarding the noise assessment to support the planning application. He said he would like more information about the proposed scheme, what are the operating hours and what will be the emissions in relation to noise. The Environmental Health Manager agreed the best approach would be to undertake a BS 4142 assessment and establish the background noise levels at the nearest residential properties and noise levels from the existing foundry.

3.6.2 Ribble Valley Borough Council does not have any specific policies on noise levels or noise limits, but would expect that the ambient noise levels not to significantly increase. The Environmental Health Manager said ideally the proposed foundry should not lead to an increase to the existing background noise levels and not to cause a nuisance to local residents.

Capabilities on project:
Environment

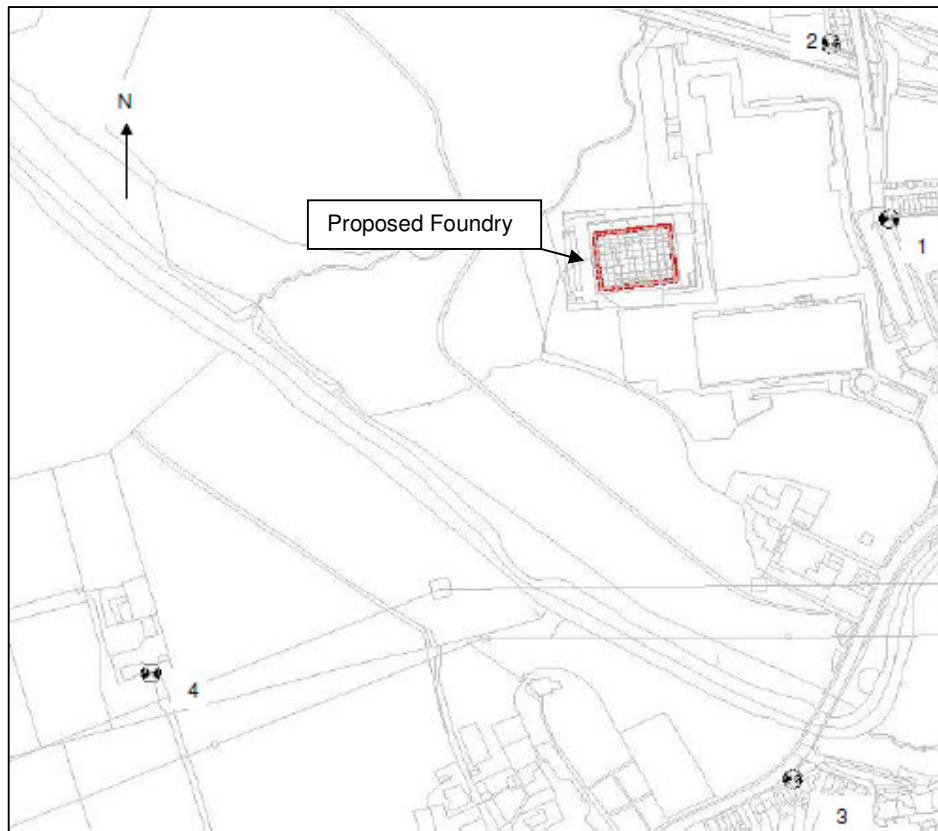
4 Noise Monitoring

4.1 Ambient and Background Noise Levels at NSRs

4.1.1 The ambient and background noise measurements at the nearest NSRs were undertaken during the afternoon of 30 September 2010, evening of 11 October 2010 and during the early and mid morning of 12 October 2010. Figure 4.1 shows the noise monitoring locations.

4.1.2 Noise sources which contribute to the existing noise environment include road traffic road, noise from the current operations at Calder Vale, noise from other nearby commercial units, occasional air craft, bird song and wind in the trees.

Figure 4.1 Noise Monitoring Locations



4.2 Indicators

4.2.1 The noise monitoring was undertaken using the following equipment:

- Brüel & Kjær 2238 Type 1 Integrating sound level meter s/n 2106193
- Brüel & Kjær 4231 Sound level calibrator s/n 2326978

4.2.2 Various A-weighted noise indicators were measured including the equivalent noise level (L_{Aeq}) and statistical indices such as Background noise levels (L_{A90}).

Capabilities on project:
Environment

- 4.2.3 The calibration of the equipment was checked before and after each set of measurements and there was no drift in calibration levels. All of the staff involved with noise measurements suitably trained and experienced, being members of the Institute of Acoustics. The instrument calibration certificates can be viewed in Appendix B.

4.3 Meteorological Conditions

- 4.3.1 The weather conditions during the monitoring periods were conducive to environmental noise measurements. On 30 September 2010 it was dry and partly cloudy, the temperature was about 15°C, with a south westerly wind, with a maximum speed of 3.6 m/s. During the evening of 11 October it was dry, with some cloud cover, the temperature was about 8°C, with north easterly wind up to 3 m/s. During the early hours of 12 October, it was mostly cloudy, the temperature was about 7°C, and there was a north easterly wind up to 2 m/s with some occasional gusts of wind. During the morning of 12 October it was partly cloudy, the temperature was about 7°C, with a gentle north easterly wind up to 2 m/s.

4.4 Measurement Locations

- 4.4.1 The measurement locations are identified in Figure 4.1. At each location the sound level meter was mounted on a tripod 1.2 m above the ground in free field conditions. A description of the monitoring locations is given below:

Location 1 Railway Terrace, Simonstone Lane. The noise measurements were taken adjacent to 3 Railway Terrace, the tripod was located 3 m from the façade of 3 Railway Terrace and 1.5 m from the road (Simonstone Lane). At this location road traffic noise from Simonstone Lane and A678 Burnley Road was the dominant noise source. Operations from Calder vale could occasionally be heard, which include delivery vehicles, loading of vehicles and clinks and clanks of metal. There were also the occasional aircraft flying overheads.

Location 2 Bank Terrace, Simonstone Lane. The tripod was located in the rear access lane 5 m from number 8 Bank Terrace. The trees along the disused railway line screen the Calder vale site, however some operational noises could be heard, in particular banging and dropping of metal. Other noise sources include road traffic noise from Simonstone Lane, bird song and wind blowing the leaves in the nearby trees.

Location 3 River Bank Terrace, Burnley Road. The tripod was located 4.5 m from the façade of 1 River Bank Terrace and 4.5 m from the road. Road traffic noise was the dominant noise source at this location. It should be noted that some road works were in operation during the daytime out the church and temporary traffic lights were in operation.

Location 4 Calder Vale Farm. The tripod was located 4 m from the farm house building and 520 m from the road (Burnley Road). At this location running water or a water pump could be heard continuously during the noise monitoring period and this was the dominant noise source. It should be noted noise monitoring was only undertaken at this location during the evening as the occupiers did not want anyone on their land during the night, as it would cause their dogs to bark.

4.5 Noise Monitoring Results

- 4.5.1 A summary of the ambient and background noise levels are shown in Tables 4.1- 4.5

Table 4.1 Noise Monitoring Results Location 1 Railway Terrace

Date	Start Time (hh:mm)	Duration (minutes)	Noise Levels (dB)			
			$L_{Aeq(T)}$	$L_{A10(T)}$	$L_{A90(T)}$	L_{Amax}
12/10/2010	11:14	30	63.2	69.4	38.4	84.9
30/09/2010	12:46	30	64.8	70.6	44.6	84.1
30/09/2010	15:13	30	67.6	73.6	46.2	88.5
11/10/2010	20:23	15	62.2	68.3	38.0	83.3
12/10/2010	01:12	15	63.5	74.0	35.3	88.5

Notes:-All values are in dB re 20µPa, Free-field, fast time-weighting

Capabilities on project:
Environment

Table 4.2 Noise Monitoring Results Location 2 Bank Terrace

Date	Start Time (hh:m:)	Duration (minutes)	Noise Levels (dB)			
			$L_{Aeq}(T)$	$L_{A10}(T)$	$L_{A90}(T)$	L_{Amax}
12/10/2010	10:02	53	44.6	49.5	36.0	73.9
30/09/2010	14:35	30	43.9	47.3	39.1	63
30/09/2010	16:26	30	47.5	52.7	40.9	70.8
11/10/2010	20:02	15	46.9	44.5	36.0	83
12/10/2010	00:51	15	40.9	44.3	32.7	71.2

Notes:-All values are in dB re 20μPa, Free-field, fast time-weighting

Table 4.3 Noise Monitoring Results Location 3 River Bank Terrace

Date	Start Time (hh:m:)	Duration (minutes)	Noise Levels (dB)			
			$L_{Aeq}(T)$	$L_{A10}(T)$	$L_{A90}(T)$	L_{Amax}
12/10/2010	11:49	30	68.1	74.6	44.0	80.5
30/09/2010	13:54	25	67.3	73.7	44.5	84.7
30/09/2010	15:49	30	68.7	74.2	49.2	80.7
11/10/2010	20:55	15	59.4	65.5	41.5	77.4
12/10/2010	01:31	15	60.1	69.3	35.0	81.4

Notes:-All values are in dB re 20μPa, Free-field, fast time-weighting

Table 4.4 Noise Monitoring Results Location 4 Calder Vale Farm

Date	Start Time (hh:m:)	Duration (minutes)	Noise Levels (dB)			
			$L_{Aeq}(T)$	$L_{A10}(T)$	$L_{A90}(T)$	L_{Amax}
11/10/2010	21:17	14	45.8	47.8	43.2	68.8

Notes:-All values are in dB re 20μPa, Free-field, fast time-weighting

4.6 Noise monitoring of existing plant and activities at current Foundry in Nelson

4.6.1 During the site visit on 11 October 2010 noise level measurements were undertaken of various items of fixed plant, forklift truck movements on site and operational activities inside the foundry building. Where necessary the residual noise from other activities was also recorded.

4.6.2 The noise monitoring was undertaken using the following equipment:

- Rion NA 28 Sound Level Analyser s/n 00570400
- Rion NC74 Sound Calibrator s/n 34973231

Capabilities on project:
Environment

- 4.6.3 Various A-weighted noise indicators were measured including the equivalent noise level (L_{Aeq}) and statistical indices such as Background noise levels (L_{A90}). Octave band data was also measured during the short term attended measurements. For all measurements the sound level meter was mounted on a tripod 1.5 m above the ground.
- 4.6.4 As there are a number of items of plant and activities are in operation at the same time with in the foundry building it was not possible to determine the specific noise levels for each individual activity. Therefore measurements of the overall noise levels inside the main foundry building were taken during the day and night shift. Measurements were also taken in the wax room, shell casting room and the compressor room. The noise measurements were taken over 5 minute periods during the day and night shifts, and the activities taking place were noted. Table 4.5 summaries the noise levels inside the foundry.

Table 4.5 Summary of noise levels measured inside the foundry

Area/ Time Period	Start Time (hh:m:)	Duration (minutes)	Noise Levels (dB)		
			$L_{Aeq(5mins)}$	$L_{A90,5mins}$	L_{Amax}
Foundry - day	11/10/2010 14:31	5	86.4	84.4	92.8
Foundry - day	11/10/2010 14:36	5	85.3	83.5	97.6
Foundry - day	11/10/2010 14:41	5	85.8	84.8	90.1
Foundry - day	11/10/2010 14:46	5	84.8	83.4	91.9
Foundry - day	11/10/2010 14:51	5	84.8	83.6	90.3
Foundry - day	11/10/2010 14:56	5	85.9	84.5	93.7
Foundry - day	11/10/2010 15:01	5	85.9	84.7	95.2
Foundry - day	11/10/2010 15:06	5	85.8	84.2	93.3
Foundry - day	11/10/2010 15:11	5	85.3	84.1	96.9
Foundry - day	11/10/2010 15:16	5	86.1	84.3	94.1
Foundry - day	11/10/2010 15:21	5	86.0	84.9	92.7
Foundry - day	11/10/2010 15:26	5	85.9	84.7	96.1
Shell Casting Room - day	11/10/2010 14:16	5	82	81	87.2
Shell Casting Room - day	11/10/2010 14:21	5	81.8	81.1	86.8
Shell Casting Room - day	11/10/2010 14:26	5	81.5	80.7	82.4
Shell Casting Room - day	11/10/2010 16:50	5	84.9	81.8	102
Shell Casting Room - day	11/10/2010 16:55	5	84.6	81.4	99.2
Shell Casting Room - day	11/10/2010 17:00	5	81.4	80.7	82.4
Wax Room – day	11/10/2010 14:04	5	79.2	76.8	87.9
Wax Room - day	11/10/2010 14:09	5	80.1	77.5	87.9
Wax Room - day	11/10/2010 14:14	5	77.2	76.9	77.8
Wax Room - day	11/10/2010 16:39	5	78.4	76.3	92.4

Capabilities on project:
Environment

Wax Room – day	11/10/2010 16:44	5	80.4	76.8	95.6
Compressor Room – day	11/10/2010 16:23	5	78.9	77.8	93.8
Foundry area - night	11/10/2010 23:35	5	80.3	79	99.8
Foundry area - night	11/10/2010 23:40	5	79.2	78.8	83.8
Foundry area - night	11/10/2010 23:45	5	79.6	78.8	91.6
Foundry area - night	11/10/2010 23:50	5	80.2	78.9	91.7
Foundry area - night	11/10/2010 23:55	5	80.6	79	98.1
Foundry area - night	12/10/2010 00:00	5	80.3	79.3	81.8
Shell casting room - night	12/10/2010 00:10	5	84.0	80.8	101.6
Wax room - night	12/10/2010 00:05	5	75.7	75.0	78.2
Compressor room - night	12/10/2010 00:17	5	76.2	73.5	96.8

Notes:-All values are in dB re 20μPa, Free-field, fast time-weighting

- 4.6.5 During the site visit noise measurements were taken of the forklift truck moving and tipping waste. To determine the specific noise levels of the external extracts and fans on the current building, each extract was switched on individually after the day shift had finished. The noise measurements were taken at 1.5 m above the ground, the distance and height of the noise source was noted. In some instances it was not possible to measure the ambient noise level with the specific noise present such that the residual noise level was not less than 3 dB below that of the measured ambient noise level. In these instances, a maximum residual correction of 3 dB has been adopted, which is worst case, and aligns with Table 1 of BS 4142. An asterisk [*] identifies those sources where the maximum 3 dB residual correction has been applied. Table 4.6 below summarises the specific noise levels of various items of existing plant and activities.

Capabilities on project:
Environment

Table 4.6 summary of specific noise levels of various items of existing plant and activities

Noise Source	Ambient $L_{Aeq,T}$ (dB)	Residual correction (dB)	Specific Noise (dB)	Distance to Source (m)	Source Elevation (m)
Fork Lift Truck with metal containers	73.6	0	73.5	5	1
Fork Lift Truck driving past	71.3	1	70.3	5	1
Fork Lift Truck reversing	72.7	0	72.7	7	1
Fork Lift Truck tipping waste casts into skip	82.4	1.9	80.5	2	1
Fork Lift Truck driving past	72.8	3	69.8*	5	1
Fork Lift Truck reversing	76.1	3	73.1*	2	1
Fork Lift Truck driving away	75.1	3	72.1*	2	1
Extract for wax room	68.0	0	68.0	1	4
Compressor extract	62.4	0	62.4	1	3
1 air conditioning unit on (there were 2 on site)	82.3	0	82.3	1	1
Linishing machine extract	76.4	0	76.4	1	2
Cutting machine extract	71.3	0	71.3	1	2
Knock out and fettling machine extract	81.6	0	81.6	1	7
Furnace cooling fans	68.7	0	68.7	1	1
Water cooling plant	61.9	0	61.9	1	6

Notes:-All values are in dB re 20μPa, Free-field, fast time-weighting *Maximum 3dB residual correction applied

5 Noise Assessment

5.1 Noise Models

- 5.1.1 To assess the potential noise impacts of relocating the foundry has on the on the nearby noise sensitive receptors, noise models have been created using CadnaA© software package. Separate models have been created to assess the day and night time impacts. The CadnaA© software package utilises standardised noise prediction methodologies and algorithms, appropriate for use in the UK, to model the propagation of noise from source to receiver. The CadnaA© noise model was constructed using OS mapping. Height points from the OS Opendata were incorporated into the model so the effects of the terrain could be modelled.
- 5.1.2 The noise data (Tables 4.5 and 4.6) gathered at the existing foundry was incorporated into the model. As a worst case scenario the noise levels measured inside the existing foundry during the day and night shift were used for the internal noise levels of the new foundry building. The sound reduction of the different elements of the building, e.g. brick walls up to 3 m, 80 mm thick Kingspan composite cladding to the walls, 90 mm thick Kingspan composite cladding for the roof, roller doors and personnel doors. The sound reduction used for each element of the building can be seen in Appendix C.
- 5.1.3 The following key parameters and assumptions were set for the model:
- The ground absorption, G, was set to 0, i.e. acoustically reflecting for the Calder Vale site and built up areas. The intervening land between the site boundary and residential properties was modelled with G = 0.8, i.e. predominantly acoustically absorbent.
 - Buildings were set as acoustically reflective, with a reflection loss of 1 dB; the maximum order of reflections was 2.
 - Noise levels were determined at residential properties representing the nearest residential facades. The height of each receiver was 4.0 m, consistent with the height of a typical first storey window. The predicted noise levels were free-field, A-weighted, sound pressure levels. The noise contours generated within the model are also at a height of 4.0 m, assumed to be the worst-case scenario.
 - Surrounding residential properties were modelled at a height of 8.0 m.
- 5.1.4 As previously stated, it is proposed that the foundry will operate 2 shifts, day shift from 07:30 to 17:30 and a night shift from 22:00 to 07:30 on Monday to Thursdays and 07:30 to 13:00 on Fridays.

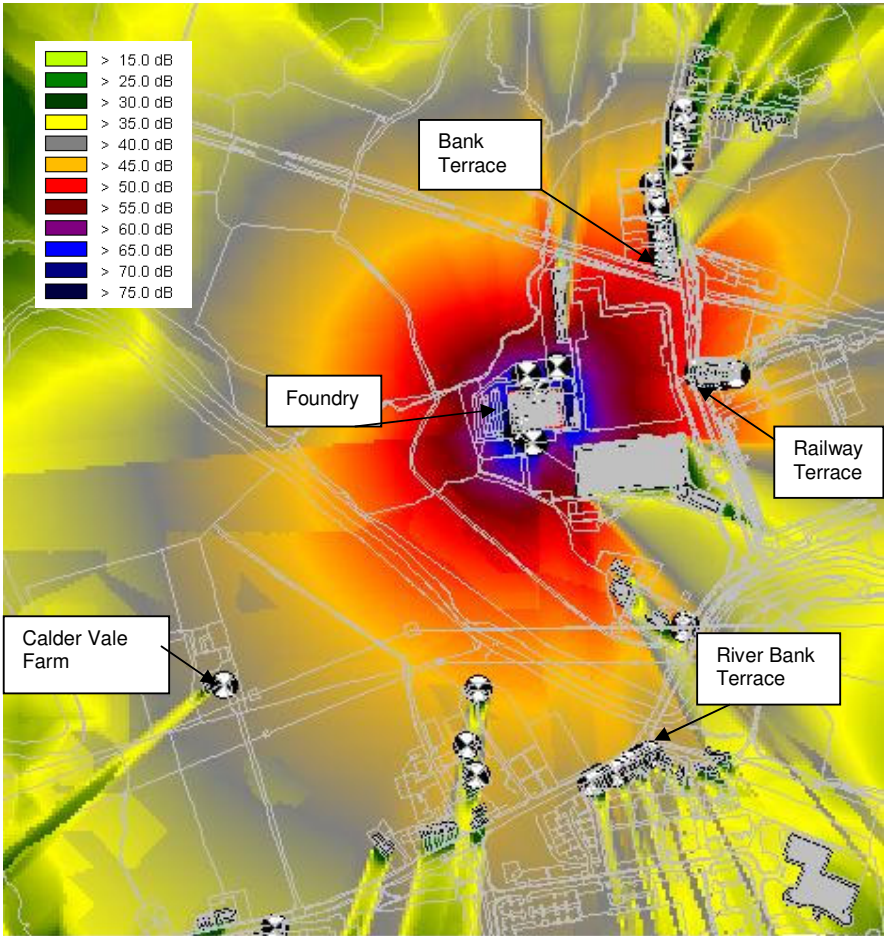
5.2 Daytime Noise Models

- 5.2.1 The noise levels measured inside the existing foundry during the afternoon of 11th October 2010 were used for the internal noise levels of the proposed foundry building. The daytime noise model was run with all the roller doors open during the daytime shift. It has been assumed that the personnel doors will be kept closed except when being used for access. During the day time shift all the external extracts and plant will be operating, the noise model also includes the fork lift truck movements around the site.
- 5.2.2 A 5 dB correction has been applied to the Specific Noise Level since it has been assumed that noise from the operations of the foundry will have distinguishable acoustic features (e.g. banging of metal) which may increase the likelihood of attracting attention.
- 5.2.3 Table 5.1 shows the Specific Noise Level and the BS 4142 assessment for the nearby NSRs. Figure 5.1 shows a noise contour plot indicating the propagation of noise across the site and the predicted noise levels at key receivers.

Table 5.1 BS 4142 Assessment Daytime operations

NSRs	Background Noise Level $L_{A90,T}$ (dB)	Specific Noise Level (dB)	Rating Level (dB)	BS 4142 Rating (dB)
1 Railway Terrace	40	49	54	+14 (complaints likely)
Bank Terrace	37	50	55	+18 (complaints likely)
River Bank Terrace	44	43	48	+ 4 (less than marginal significance)

Figure 5.1 Predicted noise levels- Daytime



Capabilities on project:
Environment

- 5.2.4 Table 5.1 shows that complaints would be likely at Railway Terrace and Bank Terrace when the proposed foundry is in operation. Possible mitigation measures are discussed in Chapter 6 to reduce the noise impact.

5.3 Night time Noise Models

- 5.3.1 The noise levels measured inside the existing foundry during the night shift of 11th October 2010 were used for the internal noise levels of the proposed foundry building. At the time of the noise monitoring the finishing machine and the furnaces were in operation. The other activity which occurs during the night shift is fettling. From spot measurements of different activities in operation at the foundry, the finishing machine is louder than the fettling activities. Therefore the night time assessment is based on the noisiest night time activities taking place. The night-time noise model was run with all the roller and personnel doors closed. There will be no fork lift truck movements during the night time shift.
- 5.3.2 As a worst case scenario the night time noise model was initially run with the following extracts in operation: water cooling plant and furnace cooling plant (these turn on and off as required, therefore can operate during the night), extract on north façade for shell room, extract for finishing machine and extract for the fettling machines.
- 5.3.3 The noise model was re-run without the extract for the fettling machine (which is the same extract for the knockout machines). Then again without either the extracts for the finishing or fettling machine.
- 5.3.4 Tables 5.2-5.4 show the Specific Noise Level and the BS 4142 assessments for the nearby NSRs. Figure 5.2 shows a noise contour plot indicating the propagation of noise across the site and the predicted noise levels at key receivers with both finishing and fettling extracts operating. Figure 5.3 shows a noise contour plot indicating the propagation of noise across the site and the predicted noise levels at key receivers without both finishing and fettling extracts operating. A 5 dB correction has been applied to the Specific Noise Level since it has been assumed that noise from the operations of the foundry will have distinguishable acoustic features (e.g. banging of metal) which may increase the likelihood of attracting attention.

Table 5.2 BS 4142 Assessment night time operations with both finishing and fettling extracts on

NSRs	Background Noise Level $L_{A90,T}$ (dB)	Specific Noise Level (dB)	Rating Level (dB)	BS 4142 Rating (dB)
Railway Terrace	36	34	39	+3 (less than marginal significance)
Bank Terrace	33	32	37	+6 (marginal significance)
River Bank Terrace	35	39	44	+9 (above marginal significance)

Capabilities on project:
Environment

Table 5.3 BS 4142 Assessment night time operations with linishing extract on

NSRs	Background Noise Level $L_{A90,T}$ (dB)	Specific Noise Level (dB)	Rating Level (dB)	BS 4142 Rating (dB)
Railway Terrace	36	33	38	+2 (less than marginal significance)
Bank Terrace	33	31	36	+3 (less than marginal significance)
River Bank Terrace	35	25	30	-5 (less than marginal significance)

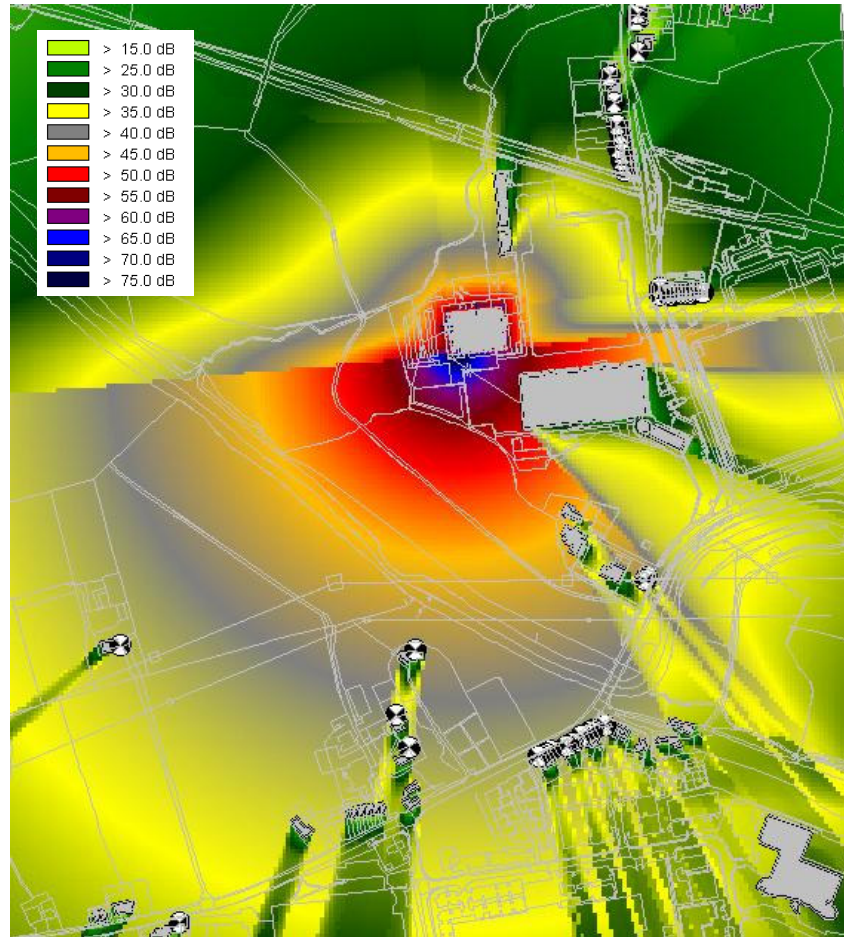
Table 5.4 BS 4142 Assessment night time operations without linishing and fettling extracts

NSRs	Background Noise Level $L_{A90,T}$ (dB)	Specific Noise Level (dB)	Rating Level (dB)	BS 4142 Rating (dB)
Railway Terrace	36	32	37	+1 (less than marginal significance)
Bank Terrace	33	31	36	+3 (less than marginal significance)
River Bank Terrace	35	24	29	-6 (less than marginal significance)

5.3.5 Table 5.2 shows if both the linishing and fettling extracts are operating the predicted Rating Level is greater than the existing background levels at Railway Terrace, Bank Terrace and River Bank Terrace. It is predicted that the Rating Level at River Bank Terrace will be +9 dB above the existing background noise levels. If the fettling extract is not turned on during the night shift there is a significant reduction in the predicted noise levels at River Bank Terrace, and also a reduction in noise levels at Railway Terrace and Bank Terrace. There is not a significant difference in noise levels when the linishing extract is also not in use; this is because the noise from the fettling extract is one of the dominant noise sources.

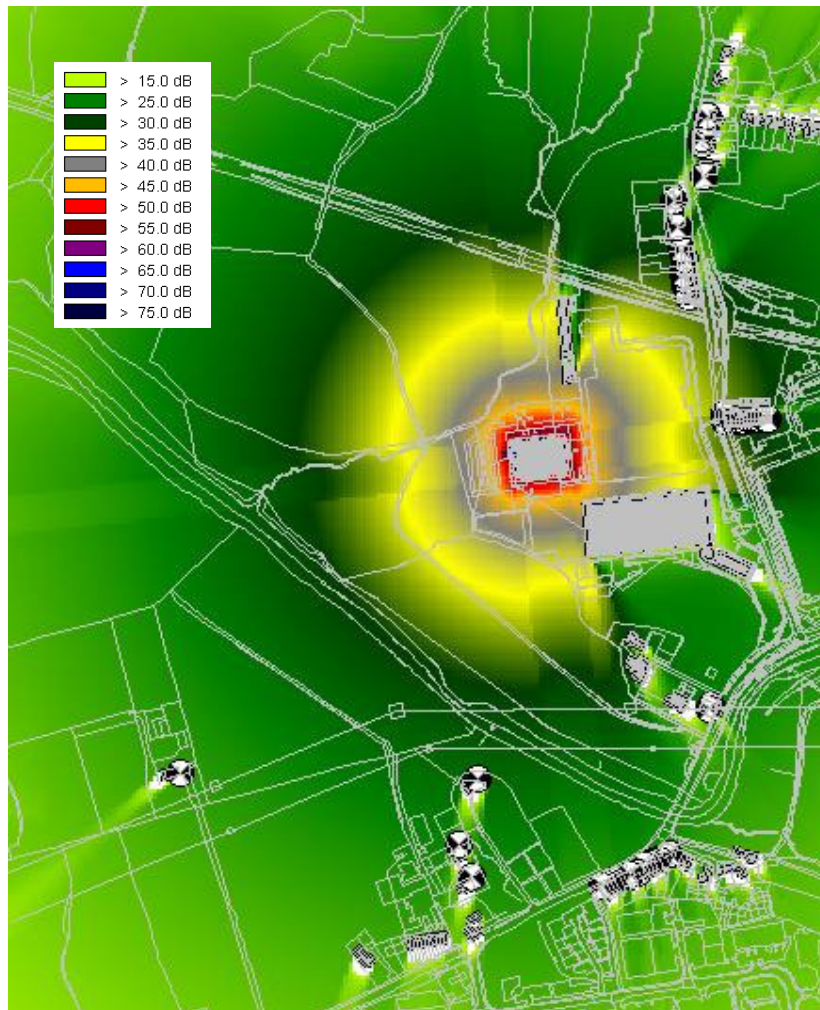
Capabilities on project:
Environment

Figure 5.2 Predicted noise levels- Night time with linishing and fettling operating



Capabilities on project:
Environment

Figure 5.3 Predicted noise levels- Night time without linishing and fettling operating



Capabilities on project:
Environment

5.4 Traffic movements

- 5.4.1 To the north of the foundry building is the transport yard where raw materials for the foundry will be delivered to. Based on the deliveries to the existing foundry it has been assumed that there will be the following deliveries to the site:
- Shell cast material and wax delivered once a month
 - Metal- delivered once a fortnight
 - Small vans delivering consumables once a week
- 5.4.2 The deliveries to the site will arrive between 08:00 and 16:30. Due to the small number and frequency of deliveries which will occur during the day, there will not be a significant noise impact due to deliveries to the site.
- 5.4.3 Currently there are daily movements between the Simonstone and Calder Vale site, which will cease when the foundry is relocated.
- 5.4.4 There are currently 1088 weekly vehicle movements to and from the Calder Vale site, once the foundry has been relocated it has been estimated that there will be an additional 115-125 weekly vehicle movements (which includes the reduction of vehicle movements between the 2 sites). With the foundry in place there will be an 11.4% increase in weekly traffic to and from the site. The Design Manual for Roads and Bridges HA 213/08 requires that an assessment is undertaken where an increase in road traffic flow of 25% or greater is predicted (equivalent to an increase or decrease in road traffic noise of approximately 1 dB L_{Aeq}). This implies that road traffic flow increases of up to 25% offer no significant impact in environmental noise terms
- 5.4.5 It is generally accepted that changes in road traffic noise levels up to 3 dB are not widely perceptible, confirmed in Department for Transport document Analysis Guidance Unit 3.3.2:
- “For freely flowing traffic, a difference of about 3 dB in noise level is required before there is a statistically significant change in the average assessment of nuisance”.*
- 5.4.6 It can be concluded that the small increase in vehicle movements to the site will not have a significant impact on nearby NSRs.

6 Mitigation

- 6.1 The BS 4142 assessment has suggested that complaints would be likely at the nearest NSRs to the proposed foundry during the daytime period. The assessment has been undertaken as a worst case scenario based on the measured noise levels inside the existing foundry. BS 4142 states 5 dB above the background noise level is of 'marginal significance'. Therefore additional mitigation is required to minimise the adverse impacts at the nearest NSRs.
- 6.2 The most effective way to reduce noise is at the source, however there are a number of different noise sources from the various activities within the foundry, the noisier activities include the finishing and knockout machines, and the tipping of metal off-cuts which will need to be considered. As it is proposed that the machinery and plant from the existing foundry will be relocated to the proposed foundry it may not be practicable to use alternative quieter items of plant or processes.
- 6.3 However there is some scope of noise reduction at source, if new plant or equipment is to be purchased to replace existing equipment. When considering replacement equipment it is important to consider the noise output, and wherever possible choose the quietest option.
- 6.4 As part of the foundry processes there are a number of impact noises arising from metal to metal impacts, e.g. tipping metal off cuts into containers, moving/ dropping containers. There are a number of ways to minimise impact noise, which include: reducing the height from which pieces fall on to hard surfaces e.g. raising stillages at fettling stations and reducing the number of transfer operations of items. It is understood that the layout of the new foundry has been designed to minimise the movement of the casts throughout the process.
- 6.5 Another way of reducing the noise levels is to increase the sound insulation of the foundry building and reduce the reverberant noise inside the building. Treating internal surfaces with sound absorbent materials will reduce the reverberant noise level. It is considered that a reduction of around 5 dB might be achieved by lining the inside of the roof. Some proprietary double skinned steel sheeting systems have a perforated inner skin which exposes the mineral wool between the skins and provides sound absorption.
- 6.6 Increasing the sound insulation of the building itself, through improving the specification of the sound reduction index, will reduce the noise levels outside the building, although any benefits would be compromised when the roller doors are left open. It is important to improve the sound insulation of the roof as well as the walls as the roof covers a large surface area.
- 6.7 At Railway Terrace and Bank Terrace one of dominant sources is the breakout of noise from the open roller doors. By keeping doors and openings closed whenever possible will also help to reduce the noise levels, although the closed door will need to provide sound insulation to match the rest of the building. During the day time whilst it may not be practicable to be keep the roller doors shut due to the fork lift truck movements around the site, acoustic curtains could be fitted to the open doors to provide some noise attenuation. Calder Vale has a rule that all roller doors on their site will be closed at 19:30 and not be reopened until 07:00 the following morning to help minimise the breakout of noise from the building.
- 6.8 Appropriately designed acoustic barriers along the northern side of the transport yard and along the access road on the eastern side of the foundry will help to reduce the noise levels at Railway Terrace and Bank Terrace. To give an indication of the attenuation offered by acoustic barriers, the day time noise model was re-run with a 5 m barrier along the northern foundry of the transport yard and along the access road on the eastern side of the foundry. With these barriers in place there was a 7 dB reduction on noise levels at Railway Terrace and a 5 dB reduction in noise levels at Bank Terrace. The barrier will also provide screening to activities in the transport yard.
- 6.9 If the required level of acoustic mitigation is to be provided by an acoustic barrier, it is essential that it is adequately designed and constructed. Assuming the barrier has been properly designed and is located correctly and is sufficiently high to provide the required level of attenuation, the two primary factors which determine the acoustic insulation performance of a barrier are airborne sound insulation performance and quality of construction.

Capabilities on project:
Environment

- 6.10 The control of acoustic reflections from barriers is also an important issue. Barriers with acoustically absorbing faces are used where reflected noise would unacceptably increase noise levels, for example with parallel and high sided barrier installations.
- 6.11 Barriers can be constructed from a range of materials, including soil (in the form of an earth mound), timber, metal and concrete. The choice will depend on a range of factors including visual impact, required level of acoustic performance and cost.
- 6.12 To ensure good acoustic performance, the barrier needs to have sufficient mass to provide the required level of acoustic insulation and to avoid severely compromising the performance, should be designed and constructed so that the joints are well sealed. The barrier should also be well engineered, with sufficient structural integrity to cope with the prevailing ground conditions and wind loading and resist the effects of weathering and corrosion.
- 6.13 Equipment is usually noisier if it is defective, therefore it is important to have a regular maintenance programme to for all items of plant or equipment whose deterioration may give rise to increase in noise (e.g. maintenance of bearings, air handling plant, the buildings fabric as well as specific noise attenuation measures associated with plant, equipment to machinery).
- 6.14 To help minimise noise from operations outside the foundry building, e.g. fork lift truck movements, tipping of waste materials into skips and deliveries it is important to minimise reversing movements where possible and consider installing or use vehicles with broadband directional reversing alarms which focus the sound within the area of immediate danger. Also, the roadways/ paths for vehicle movements should be well maintained to ensure there are no pot holes or other surface irregularities, which will help to reduce 'body rattle' in HGVs and reduce the noise from fork lift truck especially when unloading or carrying an empty steel stillage.. The restricted delivery times (08:00 and 16:30) and operating hours of the fork lift truck (07:00 to 19:30) will help to minimise the noise impact.
- 6.15 There are a number of site management measures which should be adopted to help minimise noise:
- .Make regular patrols of the site boundary to identify new noise sources and possible defective equipment.
 - Shutting off tannoy systems and muting alarms during unsocial hours
 - Close doors carefully instead of slamming shut
 - Maintain a closed door policy wherever possible
 - Fit noise reducing acoustic curtains to outside doors, which need to be kept open during operational hours.
 - Wherever possible avoid dropping items from height
 - Remind staff to be considerate to neighbours, e.g. no unnecessary shouting, loud stereos etc,
 - Vehicles to only beep horn in emergency situations
 - Wherever possible vehicles should try to avoid reversing movements
 - Ensure that there is regular maintenance programme for all plant and equipment.
- 6.16 It is important to keep good relations with nearby residents; therefore there should be a proper method for dealing with complaints. Experience shows that if a company deals with complaints in a courteous and organised way and makes efforts to reduce 'avoidable' noise , then residents are far more tolerant of other noise sources which they appreciate is more difficult to reduce.

Capabilities on project:
Environment

- 6.17 As shown above there are a number of mitigation measures which can be utilised to reduce the noise levels at the nearby NSRs to an acceptable level. Based on the existing background noise levels it is recommended that the following noise limits should be met at Railway Terrace Bank Terrace and River Bank Terrace;

Day: 45 dB $L_{Aeq, 10hr}$ at Railway Terrace
42 dB $L_{Aeq, 10hr}$ at the rear of Bank Terrace
49 dB $L_{Aeq, 10hr}$ at River Bank Terrace

Night 41 dB $L_{Aeq, 9hr 30mins}$ at Railway Terrace
38 dB $L_{Aeq, 9hr 30mins}$ at the rear of Bank Terrace
40 dB $L_{Aeq, 9hr 30mins}$ at River Bank Terrace

- 6.18 The time period for the noise limits are based on the length of the proposed shifts.

7 Summary & Conclusions

- 7.1 A noise assessment has been undertaken to determine the noise impact of relocating the existing foundry operations in Nelson to the Calder Vale site at Simonstone.
- 7.2 Noise surveys have been undertaken to determine existing ambient and background noise levels at the nearest noise sensitive receptors (NSRs) in the vicinity of the proposed foundry. Noise measurements have also been undertaken at the existing foundry.
- 7.3 Using the noise measurements gathered at the existing foundry site, noise models were created for the day and night time scenarios to predict the noise levels at the nearby NSRs. The BS 4142 assessment has indicated that complaints would be likely at Railway Terrace and Bank Terrace during the day time operation of the foundry. During the night time operation of the foundry with both the finishing and fettling extracts on, the BS 4142 assessment has indicated the predicted noise levels will be above marginal significance at River Bank Terrace. However if the fettling extract is not used, there is significant reduction in noise levels at River Bank Terrace and a slight reduction in noise levels at Railway Terrace and Bank Terrace. Provided the fettling extract is not used during the night time period the BS 4142 assessment at the nearby NSRs is less than Marginal Significance.
- 7.4 A number of ways to mitigate the noise levels from the foundry have been identified. Further detailed mitigation assessment will be required to determine the actual level of attenuation that could be achieved by the mitigation measures. But providing the noise limits recommended in paragraph 6.17 are met, it is considered that the proposed foundry will not have an adverse impact on the nearby NSRs.

Appendix A Glossary of Acoustic Terms

Jargon Buster

Many words have more specific meanings when used in acoustics than in every-day language.	
sound	is used to describe the physical phenomenon of the transmission of energy through gaseous or liquid media via rapid fluctuations in pressure.
level	used solely to describe values measured in decibels
loudness	is the human perception of the level of sound
noise	has no strict definition and is often used interchangeably with sound however it is usually taken to mean unwanted sound
index	a value based on the mathematical processing of raw data
indicator	a value used to indicate the likelihood of a particular response of effect eg. $L_{10,18hr}$ is an index based on statistical processing of sound pressure data that is used as an indicator for road traffic noise response.
weighted	values modified to reflect sensitivities at particular frequencies.
insulation	resistance to the passage of airborne sound
insertion loss	actual reduction in noise achieved by a structure or system in situ
dynamic insertion loss	in a ducted system the actual reduction in sound achieved by an attenuator in real flow conditions
static insertion loss	in a ducted system the actual reduction in sound achieved by an attenuator in the absence of fluid flow
attenuation	amount by which sound or vibration is reduced when passing through a structure or system
directivity	the amount by which a source radiates more sound in one direction than another.

Capabilities on project:
Environment

decibels dB	The decibel is not a true measurement unit nor is it exclusive to acoustics. The decibel is a logarithmic ratio of two values of a variable. Decibels are used because they can represent very wide ranges of ratios (from trillionths and billionths to billions and trillions) with a small range of decibel values. Decibels can be used to represent measured values by using a known reference value in the ratio. When using decibels to measure something it is therefore important to specify what variable is actually being measured and what reference level has been used. This is done by adding a reference value statement in the form "dB re x units", where the units indicate the variable being measured and x is the reference value. Decibels are used in acoustics because the human ear responds to sound in a logarithmic way and the quantities measured in acoustics vary over wide ranges. However, decibels are used in acoustics to measure several different things which it is important not to confuse with each other. To avoid confusion there is a notation system that identifies what a decibel value is for. The notations take the form of an italic capital letter and some subscript characters. The capital identifies the general type of value and the subscripts give specific details of what is being represented. L_{xxx} denotes a level (ie a value measured in dB by comparison with a reference value); D_{xxx} denotes a difference between two levels; R_{xxx} denotes a rating (or index), which is a measure of the generalised acoustic performance of a material or construction based on a difference between two levels; C_{xxx} denotes a correction (or constant) Of these only those with <i>L</i> notations require a reference value statement. Those with <i>D</i> or <i>R</i> notations are effectively ratios of two measured values not one measured value and a reference value and those with <i>C</i> notations are not based on reference values at all. A reference value statement therefore has no meaning when describing <i>D</i>, <i>R</i> and <i>C</i> decibels. Because decibels are logarithmic they have to be added, subtracted, multiplied, divided and averaged using different techniques from normal numbers.
Sound Pressure Level L_p obsolete – SPL	This is the basic measure of how much sound there is at a given location. It is a measure of the size of the pressure fluctuations in the air that we perceive as sound. Sound Pressure Level is expressed in decibels with a reference level of 20 μPa (L_p in dB re 20 μPa)
Sound Power Level L_w obsolete – SWL	This is the total amount of sound produced by a source. It cannot be measured directly but it can be calculated from Sound Pressure Level measurements in known conditions. It can be used to predict the Sound Pressure Level at any point. Sound Power Level is expressed in decibels with a reference level of 1 pW (L_w in dB re 1 pW). In the US a reference of 100 fW is sometimes used

Capabilities on project:
Environment

Pitch, frequency tonal sound broadband sound impulsive sound frequency analysis	The sound we perceive can have different characteristics. These can range from low-pitched hums to high-pitched squeals and impulsive sounds. In engineering acoustics the word frequency rather than pitch tends to be used when describing the characteristics of a sound. The unit of frequency is the Hertz (Hz), which is the number of pressure fluctuations per second. Any sound can be defined by its frequency content. Some sounds comprise just one discrete frequency (tonal sounds). Others are distributed over wide frequency ranges (broad band sound). Impulsive sounds are made up short pulses of high frequency components. Sources often produce all of these types of sound at the same time. There are different ways of analysing and displaying the frequency content of a sound: <table border="0"> <tr> <td>Octave Band Analysis</td><td>is the simplest method. The audible range of frequencies is divided into 10 bands.</td></tr> <tr> <td>Third-Octave Band Analysis</td><td>more detailed with 30 bands</td></tr> <tr> <td>Narrow Band Analysis</td><td>12th Octave (120 bands), 24th Octave (240),</td></tr> <tr> <td>Fast Fourier (FFT) Analysis</td><td>a high resolution technique that can give extremely detailed information on frequency content</td></tr> </table>	Octave Band Analysis	is the simplest method. The audible range of frequencies is divided into 10 bands.	Third-Octave Band Analysis	more detailed with 30 bands	Narrow Band Analysis	12 th Octave (120 bands), 24 th Octave (240),	Fast Fourier (FFT) Analysis	a high resolution technique that can give extremely detailed information on frequency content
Octave Band Analysis	is the simplest method. The audible range of frequencies is divided into 10 bands.								
Third-Octave Band Analysis	more detailed with 30 bands								
Narrow Band Analysis	12 th Octave (120 bands), 24 th Octave (240),								
Fast Fourier (FFT) Analysis	a high resolution technique that can give extremely detailed information on frequency content								
A-weighting L_A or L_{pA}, L_{WA}, obsolete – dBA, dB(A) similar – C-weighting L_C or L_{pC}, L_{WC}	The human ear does not sense all frequencies of sound equally. Our sensitivity is at a maximum at around 2 kHz and steadily decreases above and below. Below 20 Hz and above about 20 kHz we can't hear at all. Within its operating limits a precision measurement microphone measures all frequencies the same so the output it produces does not reflect what we would actually hear. The A-weighting is an electronic filter that matches the response of a sound level meter to that of the human ear. When A-weighted the Sound Pressure Level L_p becomes L_{pA} (or L_A) and the Sound Power Level L_W becomes L_{WA}. It used to be common to identify that a level was A-weighted by writing dB(A) or dBA instead of dB. These terms are now obsolete and should not be used as they conflict with other, non-acoustic, uses of decibels The response of the human ear varies depending on how loud the sound is. A-weighting matches the response of a sound level meter to human hearing at low levels (~ 40-90 dB). For higher levels there are other weightings the most common of which is the C-weighting.								
Different types of decibels commonly used in acoustics									
L_p L_{pA} (or L_A) L_{AF}, L_{AS}	<i>The instantaneous sound pressure level (L_p)</i> <i>The A-weighted instantaneous sound pressure level (L_{pA} or L_A)</i> This is the root mean square size of the pressure fluctuations in the air. This level can fluctuate wildly even for seemingly steady sounds. To make sound level meters easier to read the values on the display are smoothed or damped out. This is effectively done by taking a rolling average of the previous 0.125 s (FAST time constant) or the previous 1 s (SLOW time constant). The letters F or S are added to the subscripts in the notation to indicate when the FAST or SLOW time constant has been used. These are often omitted but it is good practice to include them.								

Capabilities on project:
Environment

$L_{\max}$ $L_{A\max}$ $L_{AF\max}$ $L_{\min}$, $L_{F\min}$	<i>The maximum instantaneous sound pressure level ($L_{\max}$),</i> <i>The A-weighted maximum instantaneous sound pressure level ($L_{A\max}$)</i> <i>The A-weighted maximum instantaneous sound pressure level with a FAST time constant ($L_{AF\max}$).</i> This is the highest instantaneous sound pressure level reached during a measurement period. The opposite of the $L_{\max}$ is the <i>minimum instantaneous sound pressure level</i> or $L_{\min}$ etc. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
L_{peak} $L_{A\text{peak}}$, $L_{C\text{peak}}$	<i>The peak sound pressure level (L_{peak})</i> <i>The A (or C)-weighted peak sound pressure level ($L_{A\text{peak}}$ or $L_{C\text{peak}}$)</i> This is the size of the single largest pressure fluctuation during a measurement. It is different from the $L_{A\max}$ as it is not based on the RMS value. This value is sometimes quoted as a <i>peak acoustic pressure</i> in Pascals rather than a <i>peak sound pressure level</i> in dB re 20 μPa.
$L_{N,T}$ $L_{AN,T}$, $L_{AFN,T}$ N = %age value, 0-100 T = measurement time eg. L_{A90} , L_{A10} , L_{AF90} , 5 min	<i>The percentage exceedence sound pressure level ($L_{N,T}$),</i> <i>The A-weighted percentage exceedence sound pressure level ($L_{AN,T}$), the A-weighted percentage exceedence sound pressure level with a FAST time constant ($L_{AFN,T}$).</i> This is the sound pressure level exceeded for $N\%$ of time period T. eg. If an A-weighted level of x dB is exceeded for a total of 6 minutes within one hour, the level will have been above x dB for 10% of the measurement period. This is written as $L_{A10,1\text{hr}} = x$ dB. L_{A0} (the level exceeded for 0 % of the time) is equivalent to the $L_{A\max}$ and L_{A100} (the level exceeded for 100 % of the time) is equivalent to the $L_{A\min}$. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{\text{eq},T}$ $L_{A\text{eq},T}$ T = measurement time eg. $L_{A\text{eq},5\text{min}}$	<i>The equivalent continuous sound pressure level over period T ($L_{\text{eq},T}$),</i> <i>The A-weighted equivalent continuous sound pressure level over period T ($L_{A\text{eq},T}$).</i> This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the L_{eq} is not a simple arithmetic mean value. The L_{eq} is calculated from the raw sound pressure data. It is not appropriate to include a reference to the FAST and SLOW time constants in the notation
L_E , L_{AE} obsolete – SEL, L_X	<i>The sound exposure level (L_E),</i> <i>A-weighted sound exposure level (L_{AE}).</i> This is a means of comparing the sound energy in discrete noise events like train passes or aircraft flyovers. It is the notional level of a sound lasting 1 second that would contain the same sound energy the whole event being measured. As a result a short loud event can have the same L_E as a longer duration lower level event. The L_E is identical to the <i>single event equivalent sound pressure level</i> L_X

Capabilities on project:
Environment

L_n (NB. different from L_N see above)	<i>The normalised impact sound pressure level</i> The value is a measure of the performance of a floor system and its ability to attenuate foot fall or impact noise under laboratory conditions. The L_n is the level of noise produced by a standard tapping machine measured in the room below the floor being tested. The <u>lower</u> the L_n the better the impact isolation achieved. L_n values are measured and quoted in third-octaves between 100 Hz and 3.15 kHz
$L'_{nT,w}$	<i>The normalised weighted impact sound pressure level</i> A single value of the L_{nT} derived from the third octave values using the method described in BS EN ISO 717-2.
R	<i>The sound reduction index</i> This a measure of the sound insulation performance a material or construction measured under laboratory conditions in accordance with BS EN ISO 140-3. R differs from D in that it takes account of the area of the construction under test as well as the absorption in the receiving room, both of these factors influence the measured D. Taking into account these factors allows the R for different constructions to be compared on a like for like basis. R values are quoted in third-octaves between 31.5 Hz and 8kHz
R_w	<i>The weighted sound reduction index</i> A single value of the R derived from the third octave values of R using the method described in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.

Capabilities on project:
Environment

Appendix B Calibration Certificates

Capabilities on project:
Environment

Certificate of Calibration Issued by University of Salford (Acoustics Calibration Laboratory) UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801 Date of Issue: 10 March 2009 Certificate Number: AC/09/048/02		 0801
Page 1 of 2		
APPROVED SIGNATORIES	Claire Lomax ☒ Gary Phillips ☐	Andy Moorhouse ☐ David Waddington ☐ <i>Claire</i>



acoustic calibration laboratory

The University of Salford, Salford, Greater Manchester, M5 4WT, UK
<http://www.acoustics.salford.ac.uk>
 t 0161 295 3030/0161 295 3319 f 0161 295 4442 e c.lomax1@salford.ac.uk

VERIFICATION OF A SOUND LEVEL METER to BS7580 Part 1

FOR:	Faber Maunsell Lynnfield House Church Street Altrincham Cheshire, WA14 4DZ		
FOR THE ATTENTION OF:	Adam Mottershead		
CALIBRATION DATE:	9 March 2009		
TEST PROCEDURE:	CTP08 (Laboratory Manual)		
Sound Level Meter			
Manu:	Brüel & Kjær	Model:	2238 Serial No: 2106193
Microphone			
Manu:	Brüel & Kjær	Model:	4188 Serial No: 2141095
Preamplifier			
Manu:	Brüel & Kjær	Model:	ZC0030 Serial No: 3525
Associated Calibrator			
Manu:	Brüel & Kjær	Model:	4231 Serial No: 2326978 Adaptor: UC0210

Test Engineer (initial):

GP

Name:

Gary Phillips

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to the units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Capabilities on project:
Environment

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

Date of Issue: 10 March 2009

Certificate Number: AC/09/048/02

Page 2 of 2

SET-UP INFORMATION

The instrument was running software module BZ7125 version 1.1.1. The reference range, reference SPL, primary indicator range, pulse range and linearity range as specified by the manufacturer have been used. The instrument was adjusted to read 93.6 dB (A) in response to the associated calibrator. This reading was obtained from the calibration certificate of the calibrator, AC/09/048/01 and information in the manufacturer's instruction manual when the instrument is fitted with the supplied windshield.

MEASUREMENTS

The levels of self-generated noise were:

A: 12.7 dB

C: 17.0 dB

Lin: 23.0 dB

At the end of the tests the indication of the sound level meter in response to the associated sound calibrator was 93.7 dB (A) which corresponds to the following level at 101.325kPa:

Sound Pressure Level 93.7 dB (A)

This reading should be used henceforth to set up the sound level meter for field use.

THE SOUND LEVEL METER WAS VERIFIED ACCORDING TO THE PROCEDURE GIVEN IN BS7580: Part 1 1997 WITH THE FOLLOWING EXCEPTIONS:

The microphone corrections applied as specified in BS 7580: Part 1: 1997 were obtained from a frequency response measured by this Laboratory using the electrostatic actuator method. This response in isolation is not covered by our UKAS accreditation.

A stricter test than that specified 5.5.10 and 5.5.11 of BS 7580 has been used by not applying the low level signal.

STATEMENT OF RESULT:

THE SOUND LEVEL METER CONFORMS TO BS7580: PART1 1997

Instruments used in the verification procedure were traceable to National Standards. The method of acoustic calibration employed a standard sound pressure calibrator for the 1kHz test whilst the tests at 125Hz and 8kHz were performed by the electrostatic actuator method. The uncertainty of the Laboratory's 1kHz calibrator was ± 0.11 dB. The uncertainty of the standard calibrator is not included in the applied tolerances. It is assumed that the sound level meter was manufactured in accordance with BSEN60651: 1994 Type 1, and BSEN60804: 1994 Type 1.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. All measurement results are retained at the acoustic calibration laboratory for at least four years.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to the units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Capabilities on project:
Environment

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

Date of Issue: 22 March 2010

Certificate Number: AC/10/43/02

Page 1 of 2

APPROVED SIGNATORIES

Claire Lomax []

Gary Phillips [J

Andy Moorhouse []

Danny McCaul []



acoustic calibration laboratory

The University of Salford, Salford, Greater Manchester, M5 4WT, UK

<http://www.acoustics.salford.ac.uk>

t 0161 295 3030/0161 295 3319 f 0161 295 4442 e c.lomax1@salford.ac.uk

CALIBRATION OF A SOUND CALIBRATOR

FOR: AECOM
Lynnfield House
Church Street
Altrincham
WA14 4DZ

FOR THE ATTENTION OF: Adam Mottershead

DESCRIPTION: Calibrator with housing for one-inch microphones and adaptor type UC0210 for half-inch microphones.

MANUFACTURER: Briel & Kjaer

TYPE: 4231

SERIAL NUMBER: 2326978

DATE OF CALIBRATION: 17 March 2010

TEST PROCEDURE: CTP06 (Laboratory Manual)

Test Engineer (initial):  .

Name: Claire Lomax

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to the units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Capabilities on project:
Environment

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

Date of Issue: 22 March 2010

Certificate Number: AC/10/43/02

Page 2 of 2

MEASUREMENTS

The sound pressure level generated by the calibrator was measured using a calibrated, WS2P condenser microphone as specified in the certificate. The calibration was carried out with the calibrator in the half-inch configuration.

Five determinations of the sound pressure level, frequency and total distortion were made.

The results have been corrected to the reference pressure of 101.325kPa using manufacturer's data.

RESULTS

Coupler configuration: Half-inch
Microphone type: Gras 40AG
Output level (dB re 20 μ Pa): 93.87 dB $\pm$ 0.11dB
Frequency (Hz): 1000.04 Hz $\pm$ 0.15Hz
Total Harmonic Distortion (%): 0.40% $\pm$ 0.20%

Average environmental conditions at the time of measurement and maximum deviation from the stated average:

Pressure: 100.386kPa $\pm$ 0.017kPa
Temperature: 23.2°C $\pm$ 0.1°C
Relative humidity: 35.5% $\pm$ 0.3%

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

All measurement results are retained at the acoustic calibration laboratory for at least four years.

Capabilities on project:
Environment



CERTIFICATE OF CALIBRATION

Certificate Number CAL090932
Date of Issue 22nd September 2009
Customer AECOM Ltd
Description of Instrument Including Manufacturer / Supplier
Sound Level Meter Rion NA-28 Sound Level Analyser [Serial No. 00570400] with
Rion UC-59 Microphone [Serial No. 00496] and
Rion NH-23 preamplifier [Serial No. 60412]
Fitted with a WS-10 foam windshield.

The instrument conforms to Class 1 of BS EN 61672-1:2003
The instrument was running Version 1.6 Firmware
Associated Calibrator Rion NC-74 Acoustic Calibrator [Serial No. 34973231]

Date of Calibration 22nd September 2009
Test Procedure ..\..\Calibration Results Sheets\Current Approved Results
Sheets\NA-28 Master 61672-Approved Issue 3 (BK 2590976).xls

Test procedures in accordance with BS EN 61672-3:2006
NOTE: Test 10.1 (Self Generated Noise with Microphone Installed)
omitted.

Test Engineer Ben MacIsaac

APPROVED SIGNATORY
Les Jephson ☐ / Mike Breslin ☒

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL

☎ 01908 642846 ☎ 01908 642814

✉ info@noise-and-vibration.co.uk 🌐 www.noise-and-vibration.co.uk

ACOUSTICS NOISE AND VIBRATION LIMITED. REGISTERED IN ENGLAND NO. 3549028. REGISTERED OFFICE AS ABOVE.

Capabilities on project:
Environment

CERTIFICATE OF CALIBRATION



CERTIFICATE No. CAL090932
DATE OF ISSUE 22/09/2009

Information relating to the operation and adjustment of the sound level meter were obtained from the data contained in the Rion Instruction Manual 50490 and associated Technical Notes 50860. Additional information relating to measurement uncertainties required by clause 11.3 has been provided by the Rion European Office and is available for inspection upon request.

Results

When the Acoustic Calibrator supplied with the instrument was applied the Sound Level Meter initially read 94.0dB
No adjustment was made to the meter.

The environmental conditions at the start and end of the calibration were within the specified range for calibration and were noted to be as follows:

Conditions	Measured Value at Start	Measured Value at End
Temperature	22.2 °C	24.5 °C
Relative Humidity	40.5 %	45.4 %
Atmospheric Pressure	101.3 kPa	101.3 kPa

The self generated noise levels of the instrument with the microphone replaced by the electrical input device were as follows:

11.2 dB (A);
15.5 dB(C); and
23.2 dB (Z).

These measured levels were within the specified limits defined within the instruction manual.

The evidence was available to the public, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter submitted for periodic testing successfully completed the applicable pattern evaluation tests of BS EN 61672-2:2003.

The sound level meter submitted for testing has successfully completed the Class 1 Periodic tests of BS EN 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with BS EN 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to

CERTIFICATE OF CALIBRATION



CERTIFICATE NO. CAL090932
DATE OF ISSUE 22/09/2009

the requirements in BS EN 61672-1:2003, the sound level meter submitted for testing conforms to the Class 1 requirements of BS EN 61672-1:2003.

No information on the uncertainty of measurement, required by 11.7 of BS EN 61672-3:2006, of the adjustment data given in the instruction manual or obtained from the manufacturer of the Sound Level Meter, or the manufacturer of the Microphone, or the manufacturer of the multi-frequency Sound Calibrator was published in the instruction manual or made available by the manufacturer or supplier. The uncertainty of measurement of the adjustment data has therefore been assumed to be numerically zero for the purpose of this periodic test. If these uncertainties are not actually zero, there is a possibility that the frequency response of the Sound Level Meter may not conform to the requirements of BS EN 61672-1:2003.

The total expanded measurement uncertainties associated with the calibration equipment and procedures is based on a standard uncertainty multiplied by a coverage factor $k=2$ to provide a confidence of approximately 95% in the results. The assessment of uncertainty has been carried out in accordance with national and international guidance upon the calculation of uncertainties in metrology.

Notes

1. The wind screen correction on the instrument was set to *on* and the diffuse field correction set to *off* for the duration of the calibration.
2. The tests were conducted principally on the main channel, with a limited number of tests conducted for the sub channel. The Peak C sound level measurements were carried out for the sub channel as they are only available on this channel.

Capabilities on project:
Environment

Certificate of Calibration Issued by University of Salford (Acoustics Calibration Laboratory)	
Date of Issue: 10 March 2010 Certificate Number: AC/10/43/01	
Page 1 of 2	
APPROVED SIGNATORIES	Claire Lomax [] Gary Phillips [x] Andy Moorhouse [] David Waddington []



acoustic calibration laboratory

The University of Salford, Salford, Greater Manchester, M5 4WT, UK
<http://www.acoustics.salford.ac.uk>
t 0161 295 3030/0161 295 3319 f 0161 295 4442 e c.lomax1@salford.ac.uk

CALIBRATION OF A SOUND CALIBRATOR

FOR: AECOM
Lynnfield House
Church Street
Altrincham
WA14 4DZ

FOR THE ATTENTION OF: Adam Mottershead

DESCRIPTION: Calibrator with housing for one-inch
microphones and adaptor NC-74-002 for
half-inch microphones.

MANUFACTURER: Rion

TYPE: NC-74

SERIAL NUMBER: 34973231

DATE OF CALIBRATION: 10 March 2010

TEST PROCEDURE: CTP06 (Laboratory Manual)

Test Engineer (initial):

GP

Name: Gary Phillips

Capabilities on project:
Environment

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

Date of Issue: 10 March 2010

Certificate Number: AC/10/43/01

Page 2 of 2

MEASUREMENTS

The sound pressure level generated by the calibrator was measured using a calibrated, WS2P condenser microphone as specified in the certificate. The calibration was carried out with the calibrator in the half-inch configuration.

Five determinations of the sound pressure level, frequency and total distortion were made.

The manufacturer states that automatic compensation is applied for the effects of changes in atmospheric pressure.

The measured sound pressure level has been corrected for the effects of the load volume of the GRAS 40AG reference microphone so that the stated output level is correct for use with a Rion UC-53A microphone. Consult the manufacturer's instruction manual for any corrections, due to slight differences in microphone load volumes, to the stated level which may be required when using this sound calibrator with other microphone models.

RESULTS

Coupler configuration: Half-inch

Microphone type: Gras 40AG

Output level (dB re 20 μ Pa): 94.02 dB $\pm$ 0.13 dB

Frequency (Hz): 1002.14 Hz $\pm$ 0.16 Hz

Total Harmonic Distortion (%): 1.34 % $\pm$ 0.20 %

Average environmental conditions at the time of measurement and maximum deviation from the stated average:

Pressure: 102.763 kPa $\pm$ 0.002 kPa

Temperature: 20.9 °C $\pm$ 0.1 °C

Relative humidity: 41.9 % $\pm$ 0.4 %

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

All measurement results are retained at the acoustic calibration laboratory for at least four years.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to the units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

