SOUND ANALYSIS

Consultants in Noise and Vibration

Acoustic Consultancy Report
4330-ENV-ATN-1B

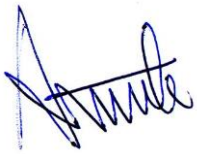
Report on: Concrete Crusher Noise in the Local Environment

Client: R.D.Marsh Surfacing Ltd

8th January 2020

An appraisal of Crusher noise at nearest residential properties, and at general locations

Report Author



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i) Summary of Brief.

Sound Analysis Ltd (SAL), were commissioned to carry out an acoustic survey to establish the current working site noise levels of a Concrete Crusher at RD Marsh Surfacing Ltd, Whitchurch Drive, Telford, and then conduct an appraisal of the noise radiated to nearest residential property, and other selected locations

ii) Document History

Issue	Date	Issue Details	Issued by	Surveyed by
1	2.11.18	Initial Issue	ATN	LCP
1A	14.1.18	Operating time change	ATN	-
1B	8.1.20	BS4142 added	ATN	-
1C	28.8.20	EHO Response added	ATN	-

1 Introduction

Sound Analysis Ltd (SAL), were commissioned to carry out an acoustic survey to establish the current working site noise levels of a Concrete Crusher at RD Marsh Surfacing Ltd, Whitchurch Drive, Telford, and then conduct an appraisal of the effect on the local environment.

This was to establish the exposure levels at nearest residential properties, and compare the results to recommendations contained in BS8233:2014, and WHO Guidelines.

The site would operate from 07:30Hrs to 17:30 hrs Monday to Friday, and 08:00 to 13:00hrs on Saturday, therefore daytime criteria will be applied.

However, the Concrete Crusher will only operate one weekday per week.

2 Instrumentation

Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003.

Meter No1

Svantek 977 Sound Level Meter S/N: 12232
Svantek pre-amplifier SV12L S/N: 13028 with GRAS microphone capsule 40AE S/N: 20859

Meter No 2

Svantek 949 Sound Level Meter S/N:36121
Svantek pre-amplifier SV12L S/N: 33636 with GRAS microphone capsule 40AE S/N: 58002

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10801 complying with Class 1 specification of BS EN 60942:2003, calibration level 114.0 dB @ 1.0 kHz.

3 Analysis Method.

The Crusher Noise Source was continually monitored by Meter 1 at 12.5m from the machine, from 08:44 hrs to 10:28 hrs, on 31st October 2018.

Using Meter No2, Crusher noise levels were measured at various locations, all taken with the Crusher machine ON and OFF.

Measurements were Sound Pressure levels taken, and provided L_{Aeq} dB(A) and LA90 dB(A) Sound Levels

4 Results.

The full record of the measurements taken is given in Appendix A and shows the sound pressure levels measured, at general locations MP1 to MP6 with the Crusher ON and OFF.

5 Environment Appraisal

The World Health Organisation (WHO) Guidelines for Community Noise (1999) gives guideline levels not to be exceeded for outdoor areas of residential properties.

Table 1: Guideline values for community noise, from Guidelines for Community Noise (WHO, 1999)

Specific Environment	$L_{Aeq, T}$ dB(A)
Outdoor living area (serious annoyance, daytime and evening)	55
Outdoor living area (moderate annoyance, daytime and evening)	50

BS8233 Recommended outdoor ambient noise levels is given as L_{Aeq} 55 dB(A)

6 Conclusion

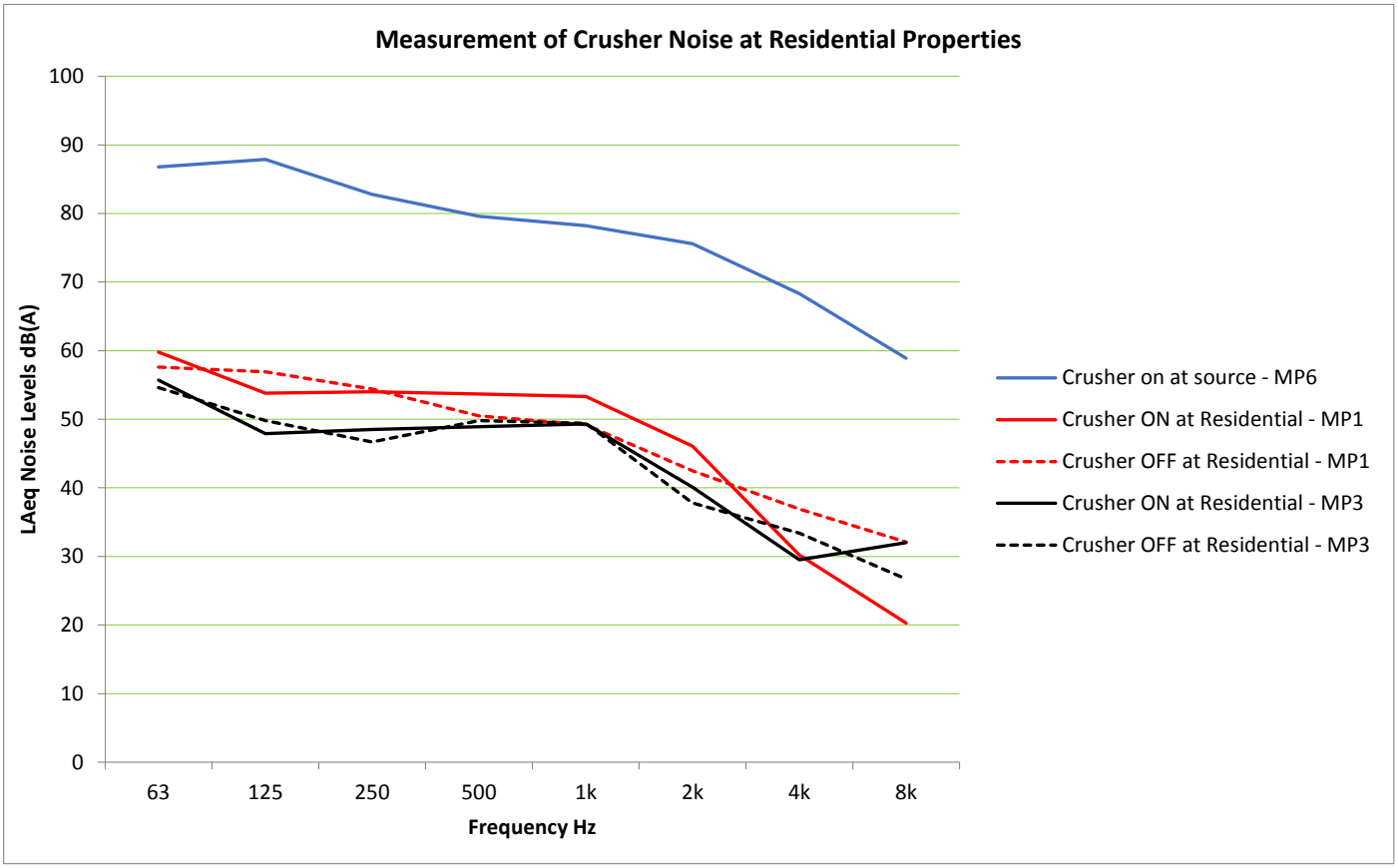
The measured levels at the residential positions, generally align with the above standards.

The graph shown in Appendix A, indicates the level difference at the two residential areas, MP1 and MP3 and the levels only show a small level change as indicated in the Table below the graph.

As it is generally accepted that an increase of 3dB, is the first perceived increase by the human ear, we would not anticipate complaints from residents.

It should be borne in mind that the Crusher will not operate every day.

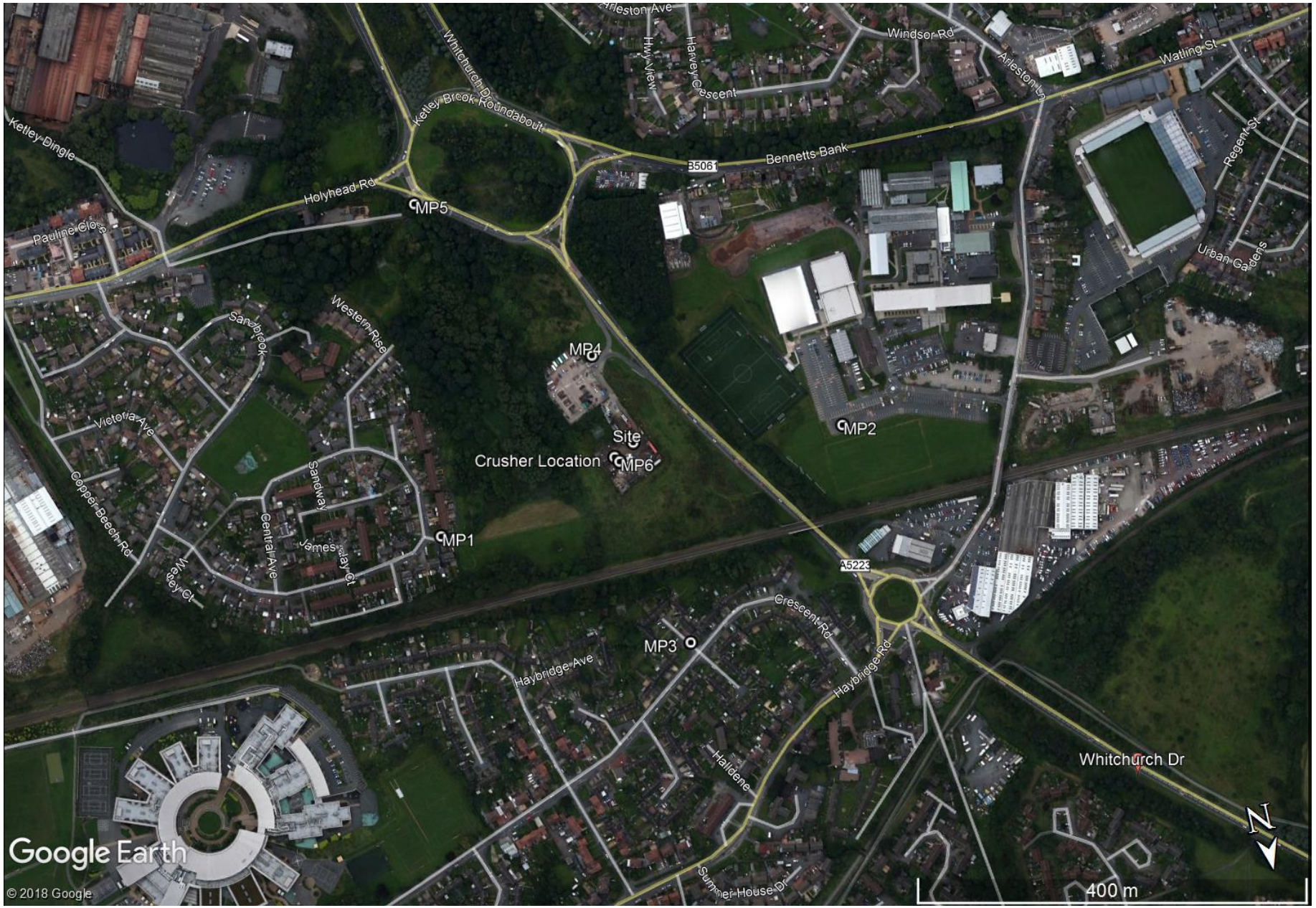
Appendix A: Graph and Table of Sound Pressure Level Measurements



AVERAGE OVER THE TWO MEASUREMENTS

Crusher	Site	Date & time	LAFmax	LASmax	LAeq	Diff
On	MP1 - Wedgewood Crescent	31/10/2018 08:54:30	59.3	57.5	56	
OFF	MP1 - Wedgewood Crescent	31/10/2018 08:55:00	59.3	58.2	52	4
On	MP2 - College	31/10/2018 09:03:30	57.1	56.2	56	
OFF	MP2 - College	31/10/2018 09:04:00	58.1	57.4	57	-1
On	MP3 - Crescent Road	31/10/2018 09:08:30	57.1	56.1	52	
OFF	MP3 - Crescent Road	31/10/2018 09:09:00	54.5	52.9	51	1
On	MP4 - Site Entrance	31/10/2018 09:12:32	69.7	68.6	65	
OFF	MP4 - Site Entrance	31/10/2018 09:13:02	68.5	67.3	62	3
On	MP5 - Roundabout	31/10/2018 09:16:30	82.5	79.2	73	
OFF	MP5 - Roundabout	31/10/2018 09:17:00	76.2	74.5	71	2

Appendix B: Location of Measurement positions MP1 to MP6



Addendum A

In response to Local Authority comments, this addendum considers the measured results using a BS4142:2014 appraisal, and also considers the new location of the Public Habitation Site which has been granted the location after the date of our original report.

BS4142:2014 Appraisal

The results of a BS4142 analysis are given in the following table.

Consultants in Noise and Vibration

BS4142:2014 Assessments - Daytime operation Only 07:00hrs to 17:30hrs

Measurement Position			MP1	MP2	MP3	MP4	MP5	HS
Measured max ambient sound level		$L_{A\,eq}$	56	56	52	65	73	67
Residual sound level		$L_{A\,eq}$	52	57	51	62	71	62
Min Background sound level		$L_{A\,90}$	48	52	48	62	65	57
Calculated specific sound level			54	**	45	62	69	65
Acoustic Feature correction	Yes		3	3	3	3	3	3
Rating level			59	59	55	68	76	70
Min Background Level		$L_{A\,90}$	48	52	50	57	62	62
Excess of rating over background level			11	7	5	11	14	8
Excess of rating over BS8233:2014 recommended max external level of 55dB(A)			4	4	0	13	21	15
This would indicate that complaints are likely								

HS = Closest perimeter position of Habitation Site

This form of assessment means that to comply, some form of noise control measure would need to be taken, in particular for positions MP4, MP5, and HS

Practically this would mean that the Crusher needs to be placed in one position so that a barrier can be in place.

Addendum B

In response to comments from Anthony Watts, Senior Permitting Officer at the Environment Agency, contained in an E-Mail dated 20th July 2020, we would respond as follows:-

Sound Power Levels cannot be measured in the field, and therefore all measured levels are Sound Pressure Levels.

As both source and receptor levels are measured, calculation of receptor noise levels was not necessary.

The previous report has already stated the need for an acoustic barrier if BS4142 is to be considered as the basis of consideration.

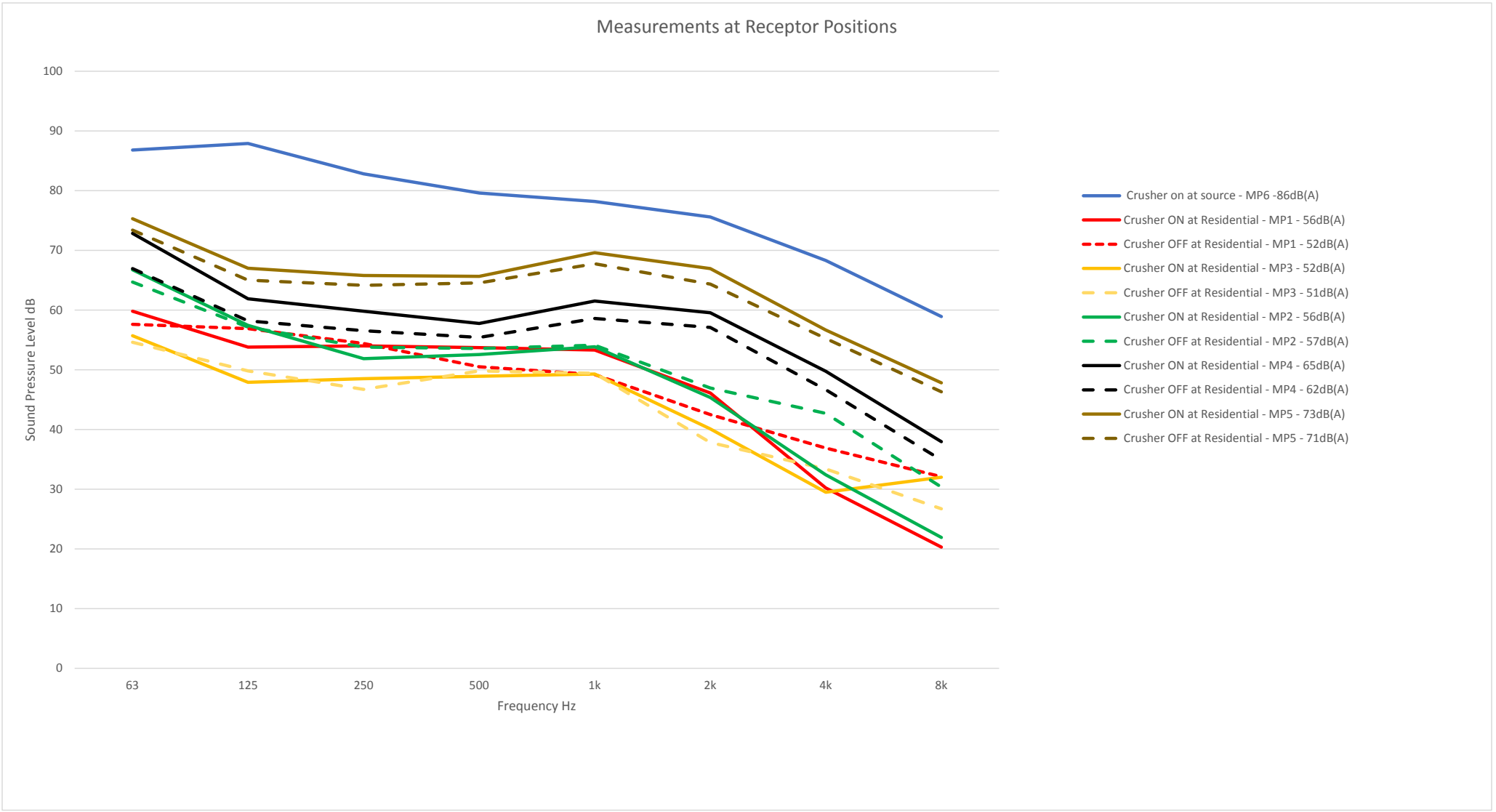
All data taken on site is given on the following pages.

Measurements at Receptor Positions

Crusher	Site	Date & time	LAFmax	LASmax	63	125	250	500	1k	2k	4k	8k	**LAeq**	63	125	250	500	1k	2k	4k	8k	**LA90**
On	MP1 - Wedgewood Crescent	31/10/2018 08:54:30	59.3	57.5	60	54	53	53	53	46	30	20	56	57	51	51	51	51	43	28	18	54
On	MP1 - Wedgewood Crescent	31/10/2018 08:55:00	59.3	58.2	60	54	54	54	53	46	30	20	56	56	52	51	51	52	43	28	18	54
				Avg	60	54	54	53	53	46	30	20	56	57	51	51	51	52	43	28	18	54
On	MP2 - College	31/10/2018 09:03:30	57.1	56.2	66	57	51	52	53	44	30	20	56	62	54	50	51	52	43	28	18	54
On	MP2 - College	31/10/2018 09:04:00	58.1	57.4	67	58	52	53	55	46	35	24	57	62	54	50	51	53	45	32	18	56
				Avg	67	57	52	53	54	45	32	22	56	62	54	50	51	53	44	30	18	55
On	MP3 - Crescent Road	31/10/2018 09:08:30	57.1	56.1	56	48	49	49	49	40	30	42	52	52	46	47	48	48	39	25	21	51
On	MP3 - Crescent Road	31/10/2018 09:09:00	54.5	52.9	55	48	48	48	49	41	29	32	52	51	45	46	47	48	39	25	18	50
				Avg	55	48	48	49	49	40	29	37	52	52	45	46	47	48	39	25	20	50
On	MP4 - Site Entrance	31/10/2018 09:12:32	69.7	68.6	72	62	58	57	62	60	50	38	65	68	57	54	54	55	53	42	31	59
On	MP4 - Site Entrance	31/10/2018 09:13:02	68.5	67.3	74	62	61	58	61	59	49	38	65	67	56	56	55	58	55	45	33	61
				Avg	73	62	60	58	62	60	50	38	65	67	57	55	55	57	54	44	32	60
On	MP5 - Roundabout	31/10/2018 09:16:30	82.5	79.2	79	69	68	67	71	68	58	49	74	69	62	58	59	64	61	49	38	67
On	MP5 - Roundabout	31/10/2018 09:17:00	76.2	74.5	72	65	64	64	68	66	56	46	71	65	59	57	58	62	59	47	37	65
				Avg	75	67	66	66	70	67	57	48	73	67	60	58	59	63	60	48	38	66
Off	MP1 - Wedgewood Crescent	31/10/2018 09:56:56	50.8	50.3	53	49	45	46	48	36	29	24	49	50	46	43	44	46	35	25	20	48
Off	MP1 - Wedgewood Crescent	31/10/2018 09:57:26	65.2	63.4	57	52	49	49	52	48	37	25	55	51	45	42	44	46	35	23	17	48
					55	51	47	48	50	42	33	24	52	51	45	42	44	46	35	24	19	48
Off	MP2 - College	31/10/2018 10:03:56	63.8	61.4	64	56	52	50	52	44	39	29	55	58	51	48	48	50	40	27	19	52
Off	MP2 - College	31/10/2018 10:04:26	68.4	66.5	65	59	56	57	56	50	46	32	59	58	52	49	49	50	40	27	18	53
					65	57	54	54	54	47	43	30	57	58	52	49	48	50	40	27	18	52
Off	MP3 - Crescent Road	31/10/2018 10:08:30	53.3	51.9	55	50	47	49	48	38	33	28	51	51	47	44	46	47	35	26	22	49
Off	MP3 - Crescent Road	31/10/2018 10:09:00	53.2	52.4	55	50	47	50	49	38	33	27	52	50	47	45	48	48	36	26	22	50
					55	50	47	49	49	38	33	28	51	51	47	44	47	47	36	26	22	50
Off	MP4 - Site Entrance	31/10/2018 10:35:36	67.2	66.4	67	57	56	55	59	57	46	34	62	61	51	50	50	54	51	38	28	57
Off	MP4 - Site Entrance	31/10/2018 10:36:06	68.7	67.6	67	60	57	56	59	57	48	36	62	61	53	52	53	54	51	42	31	58
					67	58	57	55	59	57	47	35	62	61	52	51	51	54	51	40	30	57
Off	MP5 - Roundabout	31/10/2018 10:38:12	77.5	75.7	75	67	66	65	68	65	55	47	71	64	58	57	59	61	58	46	37	65
Off	MP5 - Roundabout	31/10/2018 10:38:42	78.1	76.7	72	63	63	64	67	64	55	46	70	63	55	53	55	57	52	41	31	59
					73	65	64	65	68	64	55	46	71	63	57	55	57	59	55	43	34	62

Summary of Receptor Data

AVERAGE OVER THE TWO MEASUREMENTS								
Crusher	Site	Date & time	LAFmax	LASmax	LAeq	Diff	LA90	Diff
On	MP1 - Wedgewood Crescent	31/10/2018 08:54:30	59.3	57.5	56		54	
OFF	MP1 - Wedgewood Crescent	31/10/2018 08:55:00	59.3	58.2	52	4	48	6
On	MP2 - College	31/10/2018 09:03:30	57.1	56.2	56		55	
OFF	MP2 - College	31/10/2018 09:04:00	58.1	57.4	57	-1	52	3
On	MP3 - Crescent Road	31/10/2018 09:08:30	57.1	56.1	52		50	
OFF	MP3 - Crescent Road	31/10/2018 09:09:00	54.5	52.9	51	1	50	0
On	MP4 - Site Entrance	31/10/2018 09:12:32	69.7	68.6	65		60	
OFF	MP4 - Site Entrance	31/10/2018 09:13:02	68.5	67.3	62	3	57	3
On	MP5 - Roundabout	31/10/2018 09:16:30	82.5	79.2	73		66	
OFF	MP5 - Roundabout	31/10/2018 09:17:00	76.2	74.5	71	2	62	4


Measurements at Receptor Positions
Sound Pressure Level dB
100
90
80
70
60
50
40
30
20
10
0
63
125
250
500
1k
2k
4k
8k
Frequency Hz
Crusher on at source - MP6 -86dB(A)
Crusher ON at Residential - MP1 - 56dB(A)
Crusher OFF at Residential - MP1 - 52dB(A)
Crusher ON at Residential - MP3 - 52dB(A)
Crusher OFF at Residential - MP3 - 51dB(A)
Crusher ON at Residential - MP2 - 56dB(A)
Crusher OFF at Residential - MP2 - 57dB(A)
Crusher ON at Residential - MP4 - 65dB(A)
Crusher OFF at Residential - MP4 - 62dB(A)
Crusher ON at Residential - MP5 - 73dB(A)
Crusher OFF at Residential - MP5 - 71dB(A)

Appendix C: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

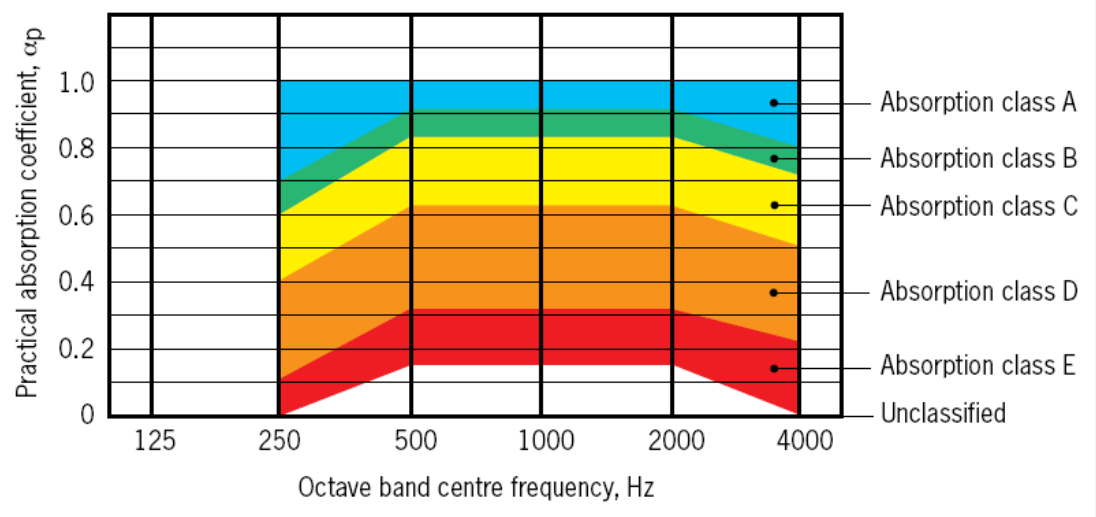
'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Absorption Class

In order to categorise the absorptive effects of different elements (such as ceiling tiles), classes from A to E were derived, as per BS EN ISO 11654:1997. A class 'A' absorber would be very acoustically absorptive, a Class 'E' absorber would be less absorptive and more reflective. A product that is highly reflective may not be classified.

The chart shown below has been extracted from BB93, and demonstrates the characteristics of each class according to BS EN ISO 11654:1997.



Absorption Coefficient (α)

A value usually between 0 and 1 assigned to a material to indicate how acoustically absorptive it is. 0 indicates a material is entirely reflective (and therefore not absorptive), and 1 indicates a material is entirely absorptive (and therefore not reflective). Absorption coefficients are usually given for each octave band between 125Hz and 4kHz, or as an overall 'practical' coefficient.

Airborne Noise

Noise transmitted through air.

Ambient Noise

The total noise level including all 'normally experienced' noise sources.

dB or Decibel

Literally meaning ‘a tenth of a bel’, the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB ≠ 60 dB	30 dB + 30 dB = 33 dB

$D_{nTw}+C_{tr}$

The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.

D	Is simply L1 – L2.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Impact Noise

Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors. Measured in L'_{nTw}.

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The ‘A’ weighted noise level exceeded for 90% of the time period T, described or measured. The ‘90’ can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The ‘A’ weighted ‘equivalent’ noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The ‘A’ weighted maximum measured noise level. Can be measured with a ‘slow’ (1 sec) or ‘fast’ (0.125 sec) time weighting.

L_{Amin}

The ‘A’ weighted minimum measured noise level.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L	Is the spatially averaged impact sound pressure level measured in a receive room.
L'_{nT}	Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.
L'_{nTw}	Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf}, RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to $2x10^{-5}$ Pa.

Speech Intelligibility, Speech Transmission Index (STI)

Speech intelligibility is the measure of how well a speaker's voice can be heard within a given space. Speech intelligibility within a room depends on a number of factors, including reverberation time and background noise.

The Speech Transmission Index or STI has emerged as the favoured method of describing speech intelligibility.

Subjective Effect of Changes in Sound Pressure Level

A basic example to illustrate the assessment of difference in noise levels follows.

A background noise survey is undertaken that yields a lowest background noise level of L_{A90} 30 dB.

As the existing background noise level is low, a rating level for new plant noise of $L_{Aeq,\,T}$ 30 dB is set.

After calculation, the plant noise is predicted to achieve $L_{Aeq,T}$ 30 dB at the nearest residential property.

After the addition of the plant predicted noise level (or Rating Level), the new overall ambient noise level will be 33 dB. The background noise level measured originally will therefore be increased by 3 dB. In terms of the subjective impression of an increase of this order, the change in levels will be 'just perceptible'.

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.