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ACOUSTIC CONSULTANTS

Technical Note

Prepared by:	**Sarah Large**	Date:	**30 August 2024**
Project:	**Heidelberg Materials – Machen Quarry**	Ref:	**5478_rev1**
For:	**Mark Frampton**	Page:	**1 of 10**
Subject:	**Noise Assessment for Recycling (Crushing) Operations**		

Introduction

WBM has been retained by Heidelberg Materials to carry out noise measurements at the Machen Quarry site during operation of the recycled asphalt planings (RAP) crusher.

A noise survey was undertaken in the locality on Wednesday 28 August 2024. The survey details, results and findings are set out in this report.

To aid comprehension, a glossary of acoustic terms is presented in Appendix A.

Planning Permission

The site has permission from Caerphilly County Borough Council dated 21 January 2019, application no. 18/0955/FULL, to carry out road planings recycling operations. Condition 04 and Condition 05 set noise limits for the operations at the nearest residential dwellings to the site as follows:

> *"04 Between the hours of 07.00 and 19.00 the level of noise arising from the development shall not exceed 55 dB(A) at Park Cottages, Pandy House, The Volland or noise sensitive properties in The Oaks.*
>
> *05 Between the hours of 19.00 and 07.00 the noise levels arising from the development shall not exceed 42 dB(A) at Park Cottages, Pandy House, The Volland or noise sensitive properties in The Oaks.*

There are no parameters specified with the noise limits set in Conditions 04 and 05. However**,** for the purposes of this report, it is assumed that the limits set out in Conditions 04 and 05 refer to $L_{Aeq,T}$ values over a 1 hour period.

Noise Survey – August 2024

Noise measurements were undertaken of the RAP crusher between 14:00 and 17:00 on Wednesday 28 August 2024 at seven locations representative of the nearest dwellings to the site and crushing operation.

The aim of the survey was to measure noise from the operation of the RAP crusher in isolation. As such all other normal quarry crushing / screening operations on site were ceased between 14:00 and 17:00. It was confirmed with the site during the monitoring that the RAP crusher was running continuously between 14:00 and 17:00 apart from a temporary breakdown in activity between approximately 15:15 and 15:55.

The measurement locations were as follows:

- Park Cottage
- Dwelling between Pen-y-Parc Farm & Park Cottage
- The Volland
- Delfan
- The Oaks (near Cwm Nant Bungalow)
- Pandy House
- Rhyd-y-Gwern Farm

Figure B.1 in Appendix B shows an aerial image of the site and the measurement locations used for this noise monitoring exercise and those used historically for the wider site operations.

Measurements have previously been undertaken at Llandanglws Farm and Pen-y-Parc Farm but were not considered necessary for the purposes of this monitoring given the larger separation distance between the crushing operations and these dwellings. A brief listening test was undertaken at Pen-y-Parc Farm at approximately 14:20 on Wednesday 28 August 2024 and no site noise was audible.

The sound environment in the locality was controlled by local and distant road traffic noise and in some instances by rainfall. Noise from the crushing operations was generally inaudible at most locations with the exception of Locations 3, 7 and 8 where brief instances of mobile plant engine noise, broadband reverse alarms and material movement were audible. Due to the limited duration of these operations they did not control the overall measured noise level ($L_{Aeq,T}$) or background sound level ($L_{A90,T}$).

Where noise from the site was audible, an estimate of the site noise has been provided.

Table 1 below presents a summary of the results from the measurements undertaken on Wednesday 28 August 2024. The detailed results from the survey are presented in Appendix C.

Table 1 – Summary of Results – Wednesday 28 August 2024

Measurement Location	Measured dB $L_{Aeq, T}$	Measured dB $L_{A90, T}$	Estimated Site Noise Level dB $L_{Aeq,T}$	Summary Comments on Noise Climate
3. Park Cottages	45	36	N/A	Site not audible.
	40	36	<36	Site not audible apart from one instance of broadband reverse alarms.
3a. Dwelling between Pen-y-Parc Farm and Park Cottage	51	42	N/A	Site not audible.
	41	36	N/A	
4. The Volland	47	40	N/A	Site not audible.
5. Delfan	55	41	N/A	Site not audible.
6. Cwm Nant Bungalow	42	34	N/A	Site not audible.
	45	40	N/A	
7. Pandy House	48	41	<41	Site not audible apart from three instances of materials loading which was just audible but not reliably measurable.
8. Rhyd-y-Gwern Farm	42	35	<42	Site just audible at times: broadband reverse alarms and engine noise from mobile plant.
	42	36	<42	
Note - Re : 'N/A / Site not audible'. Where site noise was not audible it is reasonable to assume that it was below the measured background sound level ($L_{A90,T}$).				

At all locations the overall measured noise level ($L_{Aeq,T}$), including noise from extraneous sources, was below the daytime site noise limit stipulated in Condition 04 of 55dB(A) by a good margin.

The only exception was at Location 5 Delfan where the overall measured noise level was equal to the site noise limit. However, site noise was not audible at this location and the overall measured noise level was controlled by road traffic noise along the A468. Where site noise was not audible it is reasonable to assume that it was below the measured background sound level, in this instance below 41dB(A).

It is further noted that where site noise was audible and a site noise estimate was made, this was equal to or below the night time noise limit stipulated in Condition 05 of 42dB(A).

Some of the measurement periods were affected by rainfall and all measurements would be influenced to some extent by an increase in the level of noise from local and distant road traffic due to the wet roads. However, the purpose of this survey was to establish whether the RAP crushing operations were compliant with the current site noise limits. This has been demonstrated above and as rainfall and road traffic noise on wet roads would only serve to increase the overall measured noise levels, this provides further confidence that site noise limits can be met.

Summary and Conclusions

WBM has been retained by Heidelberg Materials to carry out noise measurements at the Machen Quarry site during operation of the recycled asphalt planings (RAP) crusher.

Noise measurements were undertaken of the RAP crusher between 14:00 and 17:00 on Wednesday 28 August 2024 at seven locations representative of the nearest dwellings to the site and crushing operation. The survey details, results and findings are set out in this report.

The sound environment in the locality was controlled by local and distant road traffic noise and in some instances by rainfall.

Noise from the crushing operations was generally inaudible at most locations with the exception of Locations 3, 7 and 8 where brief instances of mobile plant engine noise, broadband reverse alarms and material movement were audible.

At all locations the overall measured noise level ($L_{Aeq,T}$), including noise from extraneous sources, was equal to or below the daytime site noise limit stipulated in Condition 04 of 55dB(A) by a good margin.

Where noise from the site was audible and an estimate of site noise was made, this was below the daytime noise limit stipulated in Condition 04 of 55dB(A) and also equal to or below the night time noise limit stipulated in Condition 05 of 42dB(A).

Where site noise was not audible it is reasonable to assume that it was below the measured background sound levels at those locations, which were also all a good margin below the daytime site noise limit of 55dB(A).

The noise from the crushing activity has therefore been found to be compliant with both daytime and night time noise limits as set out in Conditions 04 and 05 of permission 18/0955/FULL**.**

Sarah Large
Senior Consultant

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Appendix A – Glossary of Acoustic Terms

General Noise and Acoustics

The following section describes some of the parameters that are used to quantify noise.

Decibels dB

Noise levels are measured in decibels. The decibel is the logarithmic ratio of the sound pressure to a reference pressure ($2x10^{-5}$ Pascals). The decibel scale gives a reasonable approximation to the human perception of relative loudness. In terms of human hearing, audible sounds range from the threshold of hearing (0 dB) to the threshold of pain (140 dB).

A-weighted Decibels dB(A)

The 'A'-weighting filter emulates human hearing response for low levels of sound. The filter network is incorporated electronically into sound level meters. Sound pressure levels measured using an 'A'-weighting filter have units of dB(A) which is a single figure value to represent the overall noise level for the entire frequency range.

A change of 3 dB(A) is the smallest change in noise level that is perceptible under normal listening conditions. A change of 10 dB(A) corresponds to a doubling or halving of loudness of the sound. The background noise level in a quiet bedroom may be around 20 –30 dB(A); normal speech conversation around 60 dB(A) at 1 m; noise from a very busy road around 70-80 dB(A) at 10m; the level near a pneumatic drill around 100 dB(A).

Façade Noise Level

Façade noise measurements are those undertaken near to reflective surfaces such as walls, usually at a distance of 1m from the surface. Façade noise levels at 1m from a reflective surface are normally around 3 dB greater than those obtained under freefield conditions.

Freefield Noise Level

Freefield noise measurements are those undertaken away from any reflective surfaces other than the ground

Frequency Hz

The frequency of a noise is the number of pressure variations per second and relates to the "pitch" of the sound. Hertz (Hz) is the unit of frequency and is the same as cycles per second. Normal, healthy human hearing can detect sounds from around 20 Hz to 20 kHz.

Octave and Third-Octave Bands

Two frequencies are said to be an octave apart if the frequency of one is twice the frequency of the other. The octave bandwidth increases as the centre frequency increases. Each bandwidth is 70% of the band centre frequency.

Two frequencies are said to be a third-octave apart if the frequency of one is 1.26 times the other. The third octave bandwidth is 23% of the band centre frequency.

There are recognised octave band and third octave band centre frequencies. The octave or third-octave band sound pressure level is determined from the energy of the sound which falls within the boundaries of that particular octave of third octave band.

Appendix A (continued)

Equivalent Continuous Sound Pressure Level $L_{Aeq,T}$

The 'A'-weighted equivalent continuous sound pressure level $L_{Aeq,T}$, is a notional steady level which has the same acoustic energy as the actual fluctuating noise over the same time period T. The $L_{Aeq,T}$ unit is dominated by higher noise levels, for example, the $L_{Aeq,T}$ average of two equal time periods at, for example, 70 dB(A) and 50 dB(A) is not 60 dB(A) but 67 dB(A).

The $L_{Aeq,}$ is the chosen unit of BS 7445-1:2003 "Description and Measurement of Environmental noise".

Maximum Sound Pressure Level L_{Amax}

The L_{Amax} value describes the overall maximum 'A'-weighted sound pressure level over the measurement interval. Maximum levels are measured with either a fast or slow time weighted, denoted as $L_{Amax,f}$ or $L_{Amax,s}$ respectively.

Noise Rating NR

The noise rating level is a single figure index obtained from an octave band analysis of a noise. The NR level is obtained by comparing the octave band sound pressure levels to a set of reference curves and the highest NR curve that is intersected by the sound pressure levels gives the NR level.

Sound Exposure Level L_{AE} or SEL

The sound exposure level is a notional level which contains the same acoustic energy in 1 second as a varying 'A'-weighted noise level over a given period of time. It is normally used to quantify short duration noise events such as aircraft flyover or train passes.

Statistical Parameters L_N

In order to cover the time variability aspects, noise can be analysed into various statistical parameters, i.e. the sound level which is exceeded for N% of the time. The most commonly used are the $L_{A01,T}$, $L_{A10,T}$ and the $L_{A90,T}$.

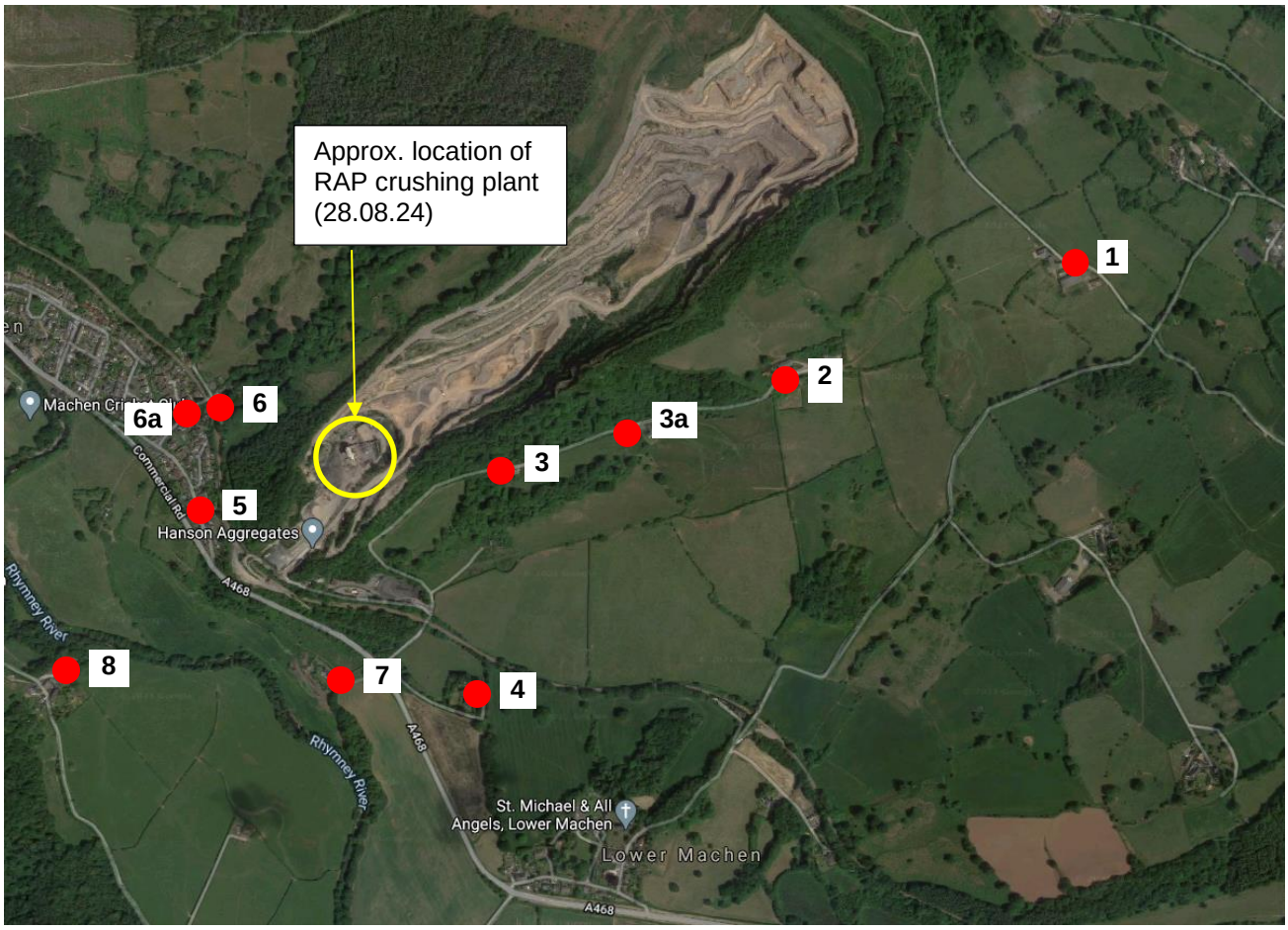
$L_{A01,T}$ is the 'A'-weighted level exceeded for 1% of the time interval T and is often used to gives an indication of the upper maximum level of a fluctuating noise signal.

$L_{A10,T}$ is the 'A'-weighted level exceeded for 10% of the time interval T and is often used to describe road traffic noise. It gives an indication of the upper level of a fluctuating noise signal. For high volumes of continuous traffic, the $L_{A10,T}$ unit is typically 2–3 dB(A) above the $L_{Aeq,T}$ value over the same period.

$L_{A90,T}$ is the 'A'-weighted level exceeded for 90% of the time interval T, and is often used to describe the underlying background noise level.

Appendix B – Site Layout and Monitoring Locations

Figure B1: An aerial image of the site with noise survey locations marked



Location	Description
1. Llandanglws Farm	Side of local lane by property (free field location)
2. Pen-y-Parc Farm	Side of track by property (free field location)
3. Park Cottages	Parking area to north of property (free field location)
3a. Dwelling between Pen-y-Parc Farm & Park Cottage	Side of track by property (free field location)
4. The Volland	On patio to north west of dwelling (free field location)
5. Delfan	Side of local road adjacent to property (free field location)
6. Cwm Nant Bungalow	On track adjacent to property (free field location)
6a. Oak Lane / Near Cwm Nant Bungalow	On track adjacent to property (free field location)
7. Pandy House	In rear garden of dwelling (free field location)
8. Rhyd-y-Gwern Farm	Side of local lane by footpath gate, NW of buildings
Note: Location 6a is used only where access to Location 6 cannot be obtained.	

Appendix C – Survey Details and Results

Date and Location of Surveys

Wednesday 28 August 2024 between 14:00 and 17:00

At locations 3, 3a, 4, 5, 6, 7 and 8 shown in Figure B.1 in Appendix B

Survey carried out by

Sarah Large and Jayan Mistry

Weather Conditions

Gentle SW breeze, generally still with gusts up to ~2m/s. Warm, 19°C. Intermittent rain and drizzle.

Instrumentation and Calibration

The sensitivity of the meter was verified on site immediately before and after the survey. The measured calibration levels were as follows:

Instrumentation	Locations	Start Cal	End Cal
Norsonic 140 Sound Level Meter (1407110)	3, 3a, 4, 7	104.1 dB(A)	104.1 dB(A)
Cirrus CRL 511E Calibrator (021078)*			
Nor1217 weatherproof windshield			
Norsonic 140 Sound Level Meter (1403137)	5, 6**, 8	113.7 dB(A)	113.7 dB(A)
Norsonic 1251 Calibrator (31993)			
Nor 1452 60mm windshield			
Norsonic 140 Sound Level Meter (1403138)	6***	113.8 dB(A)	113.9 dB(A)
Norsonic 1251 Calibrator (31991)			
Nor1217 weatherproof windshield			

* *Note that the reference level for this calibrator is 104 dB (rather than 114 dB).*
** *First measurement only*
*** *Second measurement only*

The meter and calibrator are tested monthly against Norsonic Calibrators, type 1253 (serial number 22906) and type 1256 (serial number 125626100) both with UKAS approved laboratory certificates of calibration. In addition, the meter and calibrator undergo traceable calibration at an external laboratory every two years.

Survey Details

Attended sample measurements of 15 minute duration were taken at seven measurement locations between 14:00 and 17:00 on Wednesday 28 August 2024.

Measurements were made at a height of 1.4-1.5m above ground level.

Due to the presence of intermittent rain a weather proof Norsonic 1217 windshield was used for some of the measurements as identified above. Otherwise a standard Norsonic 1452 windshield was used.

Appendix C (continued)

Observations

The sound environment in the locality was generally controlled by local and distant road traffic noise. Noise from the crushing operations was generally inaudible at most locations with the exception of Locations 3, 7 and 8 where brief instances of mobile plant engine noise, broadband reverse alarms and material movement was audible.

There was some noise from rainfall during intermittent periods of heavier precipitation and notes regarding this have been included in the notes below. Where rain was present during the measurement and found to influence the overall measured noise levels, a repeat measurement was made at that location where rainfall did not influence the measurement. The exception to this was Location 5; however, the overall measured noise level ($L_{Aeq,T}$) at this location was controlled by road traffic noise on the A468 and not from rainfall.

It is noted that the effect of rainfall will increase the level of noise from local and distant road traffic due to the wet roads.

Survey Results

Norsonic 140 Sound Level Meter (1403137) – Locations 5, 6, and 8.						
Location	**Start Time**	**Results dB (T = 15 minutes)**				**Comments / Observations**
		$L_{Aeq,T}$	**$L_{Amax,f}$**	**$L_{A10,T}$**	**$L_{A90,T}$**	
5	14:17	55	74	60	41	Birdsong. Frequent road traffic noise on A468. Aircraft. Wind in trees. Occasional vehicle passes by meter (not paused out). Heavy rain during measurement. Site not audible.
8	15:20	48	72	52	36	Plant not operating. Birdsong. Aircraft. Distant road traffic noise. Distant dog barks.
8	15:55	42	63	44	35	Plant operating. Birdsong. Dog barks. Light rain in trees. Distant road traffic noise. Voices of walkers. Occasional local road traffic (not paused out). Site just audible at times, white noise reverse alarms, site noise estimate <42dB(A).
8	16:13	42	67	44	36	Occasional local road traffic. Birdsong. Distant road traffic. Dog barks. Lawnmower revving and motor on distance to NE. Site just audible at times with broadband reverse alarms and engine noise from mobile plant, estimate of site noise <42dB(A).
6	16:39	42	69	41	34	Birdsong. Wind in trees. Dog barks. Distant lawnmower noise to SW. Occasional vehicle drives past meter (not paused out). Site not audible.

Appendix C (continued)

Norsonic 140 Sound Level Meter (1403138) – Location 6.						
Location	**Start Time**	**Results dB (T = 15 minutes)**				**Comments / Observations**
		$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
6	14:46	45	62	49	40	Heavy rain in trees. Occasional local road traffic (not paused out). Distant road traffic noise. Site not audible.

Norsonic 140 Sound Level Meter (1407110) – Locations 3, 3a, 4 and 7.						
Location	**Start Time**	**Results dB (T = 15 minutes)**				**Comments / Observations**
		$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
3	14:08	45	72	47	36	No rain at start. Agricultural noise from S. Distant road traffic noise. Distant jet aircraft. Gentle breeze in trees. Birds. Clatter from farm to N. Rain starts at 14:16. Site not audible.
3a	14:34	51	76	53	42	Rain from start of measurement. Dog barking in distance. Birds. Car arrives and idles at driveway, car maneuvering near meter (not paused out). Voices at dwelling. Site not audible.
3a	14:51	41	68	42	36	No rain at start. Distant road traffic noise. Dripping of water from trees. Dog barking at dwelling. Voices at dwelling (paused out). Car leaving and returning to dwelling (paused out). Rain at 15:00 but not heavy, reduces towards end of measurement and levels ~36dB(A). Birdsong. Site not audible.
4	15:18	45	68	47	41	No rain. Site not audible. Plant breakdown from ~15:15. Road traffic noise. Birdsong. Sheep.
4	15:34	48	64	52	39	No rain. Plant not operating. Road traffic noise. Birdsong. Dog barking and voices inside dwelling. Jet aircraft overhead (~55-63dB(A)).
4	15:52	47	63	49	40	No rain at start. Plant running again. Road traffic noise. Distant aircraft. Intermittent machine noise from W up to ~46dB(A) at times (does not appear to be crusher). 16:04 rain starts. Site not audible.
7	16:18	48	57	51	41	No rain. Road traffic noise. Birds. Three instances of material movement audible from direction of quarry, not reliably measurable; site otherwise inaudible. Dog barking in distance.
3	16:40	40	53	42	36	No rain. Breeze in trees. Distant road traffic noise. Faint whine / hum from direction of dwelling. Site not audible apart from one instance of a white noise reversing alarm and one instance of material movement (<36dB(A)), just audible but not measurable.