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Freehay Sand & Gravel Quarry, Staffordshire
Planning Application for Revision to Working Scheme
Noise Assessment Report

Date 25 October 2018

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WBM

WBM (the trading name of The Walker Beak Mason Partnership) is an established independent acoustic consultancy specialising in architectural & building acoustics, environmental noise, planning issues and expert work. WBM is a member of the Association of Noise Consultants and is also a Corporate Member of the Institute of Environmental Management & Assessment. The consultants are Members or Fellows of the Institute of Acoustics.

ACOUSTIC CONSULTANTS

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1 Introduction

Hanson has an implemented planning permission for a sand and gravel quarry and processing plant at Freehay Quarry, Staffordshire, for which noise limits are conditioned.

The quarry is to the east of the A522 Cheadle to Uttoxeter Road and north of Freehay Road and School Lane that links the A522 with the roundabout at Counslow Road and Coppice Lane and the entrance to the Croxden Quarry complex.

The site is within the jurisdiction of Staffordshire County Council and the current extraction and processing operations are covered by planning permission Application No. SM.EA/5 dated 29 March 2000.

The permitted hours of operation are 0700 to 1730 Monday to Friday and 0700 to 1200 Saturday for normal operations, with a later start of 0800 Monday to Saturday for specified operations and areas of the site.

In the 2000 planning permission there are noise limits at specified dwellings for 'routine' operations and a higher noise limits for 'temporary' operations for a limited duration.

An application is to be submitted by Hanson for revising the working scheme so that a silt lagoon can be created within the site to allow the continued use of the processing plant.

As part of this application it was deemed appropriate to undertake site noise calculations and noise assessment to check the potential impact of the development on nearby dwellings and the need for mitigation and noise control, albeit most of what is proposed is already permitted.

Surveys of the existing noise climate in the area of the site were undertaken in January 2018 to additionally inform the noise assessment. This report sets out the findings of noise surveys conducted at positions representative of the closest dwellings to the site.

The noise criteria for routine and temporary operations are broadly in line with current advice from the government contained in the web document "*Planning Practice Guidance*" for Minerals (PPGM) dated March 2014, specifically the paragraphs 019 to 022 under the heading "*Noise emissions*" for mineral development proposals.

2 Assessment Methodology

The relevant noise guidance documents used in this assessment are detailed below.

2.1 National Planning Policy Framework 2018

The National Planning Policy Framework (NPPF) July 2018 sets out the Government's planning policies for England. At the heart of the National Planning Policy Framework is a presumption in favour of sustainable development.

Section 15 of the NPPF "*Conserving and enhancing the natural environment*" refers specifically to noise in the following paragraphs:

"*170. Planning policies and decisions should contribute to and enhance the natural and local environment by…*

(e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability..."

"*180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason…"

Paragraph 180 (a) refers to the Explanatory Note to the Noise Policy Statement for England, 2010

Paragraph 182 refers to the integration of new development with existing businesses and facilities:

"*182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship,*

pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

Mineral sites are considered in Section 17 "*Facilitating the sustainable use of minerals*" of the NPPF 2018.

"*204. Planning policies should …*

(g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction..."

"*205. When determining planning applications, great weight should be given to the benefits of mineral extraction, including to the economy. In considering proposals for mineral extraction, minerals planning authorities should…*

(c) ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties..."

Paragraph 205 (c) advises that the national planning guidance on minerals sets out how these policies should be implemented.

2.2 Planning Practice Guidance for Minerals (PPGM)

Paragraphs 19 to 22 inclusive of the "*Minerals*" chapter of the Planning Practice Guidance are under the heading "*Noise emissions*" within the section "*Assessing environmental impacts from mineral extraction*".

Paragraph 019 Reference ID: 27-019-20140306 states:

"*How should minerals operators seek to control noise emissions?*

Those making mineral development proposals, including those for related similar processes such as aggregates recycling and disposal of construction waste, should carry out a noise impact assessment, which should identify all sources of noise and, for each source, take account of the noise emission, its characteristics, the proposed operating locations, procedures, schedules and duration of work for the life of the operation, and its likely impact on the surrounding neighbourhood.

Proposals for the control or mitigation of noise emissions should:

- *consider the main characteristics of the production process and its environs, including the location of noise-sensitive properties and sensitive environmental sites;*
- *assess the existing acoustic environment around the site of the proposed operations, including background noise levels at nearby noise-sensitive properties;*
- *estimate the likely future noise from the development and its impact on the neighbourhood of the proposed operations;*
- *identify proposals to minimise, mitigate or remove noise emissions at source;*
- *monitor the resulting noise to check compliance with any proposed or imposed conditions."*

Paragraph 020 Reference ID: 27-020-20140306 states:

"*How should mineral planning authorities determine the impact of noise?*

Mineral planning authorities should take account of the prevailing acoustic environment and in doing so consider whether or not noise from the proposed operations would:

- *give rise to a significant adverse effect;*

- *give rise to an adverse effect; and*
- *enable a good standard of amenity to be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure would be above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy."

Paragraph 021 Reference ID: 27-021-20140306 states:

"*What are the appropriate noise standards for mineral operators for normal operations?*

Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level (LA90,1h) by more than 10dB(A) during normal working hours (0700-1900). Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) LAeq, 1h (free field). For operations during the evening (1900-2200) the noise limits should not exceed the background noise level (LA90,1h) by more than 10dB(A) and should not exceed 55dB(A) LAeq, 1h (free field). For any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42dB(A) LAeq,1h (free field) at a noise sensitive property.

Where the site noise has a significant tonal element, it may be appropriate to set specific limits to control this aspect. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise (e.g. Lmax in specific octave or third-octave frequency bands – and that should not be allowed to occur regularly at night.)

Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed."

Paragraph 022 Reference ID: 27-022-20140306 states:

"What type of operations may give rise to particularly noisy short-term activities and what noise limits may be appropriate?

Activities such as soil-stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps, construction of new permanent landforms and aspects of site road construction and maintenance.

Increased temporary daytime noise limits of up to 70dB(A) LAeq 1h (free field) for periods of up to eight weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs.

Where work is likely to take longer than eight weeks, a lower limit over a longer period should be considered. In some wholly exceptional cases, where there is no viable alternative, a higher limit for a very limited period may be appropriate in order to attain the environmental benefits. Within this framework, the 70 dB(A) LAeq 1h (free field) limit referred to above should be regarded as the normal maximum."

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

2.3 Planning Permission

The site is within the jurisdiction of Staffordshire County Council and the current extraction and processing operations are covered by planning permission Application No. SM.EA/5 dated 29 March 2000.

The permitted hours of operation are 0700 to 1730 Monday to Friday and 0700 to 1200 Saturday for normal operations, with a later start of 0800 Monday to Saturday for specified operations and areas of the site.

In the 2000 planning permission there are noise limits at specified dwellings for 'routine' operations and a higher noise limits for 'temporary' operations for a limited duration.

Condition 12 from the planning permission states:

“All operations, except those set out in Condition 13 below, shall take place at all times such that the free field site attributable noise levels shall not exceed the levels set out below

1. Plantation House 49 dB LAeq,1 hour
2. Bank Top 52.5 dB LAeq,1 hour
3. Freehay Farm 56.5 dB LAeq,1 hour
4. West View 66.5 dB LAeq,1 hour
5. Blacks Farm 58.5 dB LAeq,1 hour
6. The Foxes 49 dB LAeq,1 hour
7. Pear Tree House 47 dB LAeq,1 hour
8. Property West of Freehay Quarry 46 dB LAeq,1 hour
9. Corner Shop 57 dB LAeq,1 hour”

Condition 13 from the planning permission states:

“During temporary operations such as soil stripping and respreading, bund formation and removal, restoration or any other activity approved in writing by the Mineral Planning Authority, the equivalent continuous noise level dB LAeq 1hour freefield at the noise sensitive properties set out in Condition 12 above, shall not exceed 70 dB(A). Seven days prior written notice shall be given to the Mineral Planning Authority for each such event (24 hours for soil stripping and soil spreading works). Temporary operations defined in this condition shall be limited to a total of 8 weeks in any 12-month period at any individual noise sensitive property. All measurements shall be undertaken at a height above ground level of between 1.2 and 1.5 metres and at least 3.5 metres from any other sound-reflecting surface.”

3 Site Description

The quarry is to the east of the A522 Cheadle to Uttoxeter Road and north of Freehay Road and School Lane that links the A522 with the roundabout at Counslow Road and Coppice Lane and the entrance to the Croxden Quarry complex.

It is proposed that overburden and soils stored in the north eastern most part of the quarry will be moved and the mineral extracted to leave a bank of in-situ mineral across the site, with faces at a gradient of 1 in 1. Access roads will be created on either side of the bank of mineral at a gradient of 1 in 6 for use by dumpers hauling the mineral.

The overburden and soils will be used for restoration elsewhere on site and the mineral and placed within the existing quarry void to an upper height of 224 m AOD. Following extraction of the mineral reserves, the north eastern most part of the quarry will be used to create a silt lagoon that is a requirement to allow the processing of the mineral reserves to continue with mineral from the placement area.

The proposed operating hours for normal operations are the same as those permitted namely 0700 to 1730 Monday to Friday and 0700 to 1200 Saturday. There will be no extraction or processing activity on Saturday afternoons, Sundays or Bank Holidays.

The nearest dwellings to the north eastern most part of the quarry have been identified from plans and during a site visit on 14 December 2017. The dwellings selected for calculation of site noise levels for this assessment are Bank Top, Corner Shop, New House Farm, Freehay Farm, Cherry House Farm and Plantation House to the north west.

Surveys of the existing noise climate in the area of the site were undertaken in January 2018 to additionally inform the noise assessment. This report sets out the findings of noise surveys conducted at positions representative of the closest dwellings to the site.

A site location plan including noise survey measurement locations from January 2018 is included in this report as Appendix B.

4 Measurement Methodology

4.1 Measurement Description

The six locations at which measurements were made on Thursday 11 January 2018 were chosen as being representative of the nearest properties to the area of the site most affected by the revision to the working scheme.

The measurements were taken at a microphone height of approximately 1.4 metres above local ground level away from reflecting surfaces other than the ground, with a wind shield used throughout each measurement. The sample measurements were of 15 minute duration.

The parameters reported are the statistical indices $L_{A10,T}$ and the Background Noise Level, $L_{A90,T}$ as well as the Equivalent Continuous Noise Level, $L_{Aeq,T}$ and the maximum noise level. An explanation of the noise units presented is given in Appendix A.

4.2 Measurement Results

The instrumentation and calibration details used for the sample measurements and for the installation are shown in Appendix C.

The detailed results of the attended sample measurements are set out in Appendix D.

Noise levels were generally affected by road traffic noise, with HGVs to and from Croxden Quarry on Freehay Road and School Lane, and birdsong. Other noise sources noted were Freehay Quarry at two locations and non-quarry activity at some locations.

At Freehay Farm an excavator working at the nearest face in Freehay Quarry was clearly audible at times, with an estimated noise level of less than 50 dB $L_{Aeq,\ 15\ minutes,\ free\ field}$. The 'routine' site noise limit in the planning permission for Freehay Farm is 56.5 dB $L_{Aeq,1\ hour}$.

5 Calculated Site Noise Levels

5.1 Approach to Calculated Site Noise Levels

The Equivalent Continuous Noise Level, $L_{Aeq, T}$, is the preferred unit for assessing noise sources. It is the value of a continuous level that would have equivalent energy to the continuously varying noise over the specified period "T". This unit is recommended internationally for the description of environmental noise and is in general use. It is the chosen unit of BS 5228 for Construction and Open site noise; Planning Practice Guidance for the National Planning Policy Framework and BS 7445 for the Description and Measurement of Environmental noise.

The noise levels likely to arise at dwellings depend on the method of working and the sound power levels of the plant chosen to work a site as much as on the distance to the properties and the effects of intervening ground. Proper allowance can be made for these variables in order to calculate site noise levels.

5.2 Noise Calculation Methodology

The Planning Practice Guidance for Minerals in paragraph 019 states those making development proposals should consider "*estimating the likely future noise from the development and its impact on the neighbourhood of the proposed operations*".

The Planning Practice Guidance published in March 2014 does not contain details of noise prediction methods and in the absence of detailed guidance in the PPGM, the calculations in this report are based on the methods contained in BS5228-1: 2009 +A1:2014 "*Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*".

Further details of the calculation methods are set out in Appendix E to this report. A summary site noise calculation sheet for one of the six dwellings considered is included in Appendix F.

For the purposes of examining a reasonable worst case, the various items have been assumed to operate at the closest practical position of the proposed extraction area to each dwelling. It has also been assumed that the plant items work 100% of each hour.

5.3 Noise Sources and Sound Power Levels

Sound Power Levels of the machinery to be used are based on measurements at Hanson's Freehay Quarry (dozer ripping) and Shardlow Quarry (dump truck) and elsewhere which are contained on the WBM plant noise database.

At Shardlow Quarry the dump truck was loaded travelling up the slope and empty travelling down the slope.

The plant items used in the calculations are listed in the table below along with the Sound Power Levels, dB L_{WA}, used in the calculations.

Plant Item	Comment	dB L_{WA}
Komatsu 275 AX Dozer / ripping mineral	Measured Freehay Quarry 11.01.18	110
Excavator for mineral (once overburden removed)	Contractor's plant - 45 tonne	106
Volvo A40G Articulated Dump Trucks - up full	Measured Shardlow Quarry 06.02.18	104
Volvo A40G Articulated Dump Trucks - up empty	Contractor's plant	104
Volvo A40G Articulated Dump Trucks - down full	Contractor's plant	104
Volvo A40G Articulated Dump Trucks - down empty	Measured Shardlow Quarry 06.02.18	104
Dozer for overburden / mineral in existing void	Contractor's plant - Caterpillar D9T	110
Dozer for overburden / mineral in existing void	Contractor's plant - Caterpillar D6T	108
Tractor and bowser on haul road	Contractor's plant	106
Excavator for overburden (above ground level)	Contractor's plant - 45 tonne	106

5.4 Site Operation Assumptions

In order to assess the noise levels for the proposed site operations, the contribution from each significant specific noise source has been evaluated separately and then combined together to give the overall noise level at each of the six receiver locations.

It is proposed that overburden and soils stored in the north eastern most part of the quarry will be moved and the mineral extracted and placed within the existing quarry void to an upper height of 224 m AOD. Following extraction of the mineral reserves, the north eastern most part of the quarry will be used to create a silt lagoon that is a requirement to allow the processing of the mineral reserves to continue with mineral from the placement area.

The dozer will be used for ripping mineral once the overburden has been removed for a particular phase of the working but retaining a 2 m high perimeter bund, along the eastern and southern edges of the extraction area, when the remainder of the overburden is removed from existing stockpiles. As well as the overburden in stockpiles above original ground level, there is between 1 to 3 metres depth of overburden below original ground level across the area. This means that the dozer ripping activity will be shielded from the receiver locations by an effective barrier of between 3 and 5 metres above the mineral.

A perimeter bund will be created along the southern boundary of the existing quarry void by building up material along the southern face once the placement of material has reached 222 m AOD along the southern face. Where the existing ground is 224 m AOD the bund will be created with an apex of 227 m AOD, an effective barrier of 3 metres above existing ground. The remaining mineral placement within the existing quarry void to an upper height of 224 m AOD will then be shielded by the 3 m high bund for the dwellings to the south.

When the dozer is ripping at the highest level of the mineral, the dozers for mineral in the existing void will be at least 15 m below the upper height of 224 m AOD. When the dozers for mineral in the existing void are near the upper height of 224 m AOD, the dozer for ripping will be at least 15 m below the highest level of the mineral.

5.5 Calculated Noise Levels at Dwellings

Site noise calculations have been undertaken for six receiver locations corresponding to those selected for the attended sample noise measurements. Calculated site noise levels are presented below for mineral extraction, including dozer ripping, and mineral placement. The calculated site noise levels in the tables below are all in terms of dB $L_{Aeq,\ 1\ hour,\ free\ field}$.

The Permitted Site Noise Limit values are from the planning permission for four of the six locations. A site noise limit of 55 dB $L_{Aeq,\ 1\ hour,\ free\ field}$ is used for New House Farm and Cherry House Farm.

Location / Dwelling	**Calculated Site Noise Level dB $L_{Aeq,\ 1\ hour,\ free\ field}$**	**Permitted Site Noise Limit dB $L_{Aeq,\ 1\ hour,\ free\ field}$**
Bank Top	52	52.5
“Corner Shop”	54	57
New House Farm	55	*55*
Freehay Farm	63	56.5
Cherry House Farm	50	*55*
Plantation House	41	49

It can be seen from the above table that the calculated noise level for the proposed operations exceed the permitted site noise limits for one of the six locations, Freehay Farm.

5.6 Temporary Operations

The operations of topsoil and overburden stripping, bund formation and the final restoration processes are often noisier than extraction, as noted in Paragraph 022 of the Planning Practice Guidance for Minerals, as they tend to be closer and are usually unscreened. They are relatively short duration operations that are capable of completion in a total period of no more than eight weeks in any twelve month period.

Paragraph 022 Reference ID: 27-022-20140306 states:

"Increased temporary daytime noise limits of up to 70dB(A) LAeq 1h (free field) for periods of up to eight weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs…Where work is likely to take longer than eight weeks, a lower limit over a longer period should be considered."

For this proposal the removal of overburden and soils from the above ground location is to be subject to the noise limits for temporary operations.

The highest $L_{Aeq,T}$ noise levels expected from the closest temporary operations are shown in the table below. The duration of these activities are discussed in the "*Proposed Noise Control Measures*" section.

Location	**Calculated Noise Level dB $L_{Aeq,\ 1\ hour,\ free\ field}$**	**Permitted Site Noise Limit dB $L_{Aeq,\ 1\ hour,\ free\ field}$**
Bank Top	62	70
"Corner Shop"	61	70
New House Farm	60	70
Freehay Farm	63	70
Cherry House Farm	57	70
Plantation House	42	70

6 Proposed Noise Control Measures

Three noise control measures are "built-in" to the proposed scheme namely:

Mineral placement to an upper height of 224 m AOD

Retaining 2 m high perimeter bunds when the overburden stockpiles are removed

Creating a 3 m high perimeter bund along the southern boundary of the quarry void

Other noise control measures that will be incorporated into the proposals are:

An upper site noise limit at dwellings of 55 dB $L_{Aeq, 1 hour, free field}$ for routine operations

An upper site noise limit at dwellings of 65 dB $L_{Aeq, 1 hour, free field}$ for temporary operations, for up to 12 weeks a year.

Temporary operations are primarily to include above ground overburden removal from the stockpiles, material placement associated with the bund formation and bund removal.

The proposed noise control measures are shown on drawings and sections to accompany the application.

With the noise control measures in place the calculated site noise levels for the operations associated with the revised working scheme comply with the proposed site noise limits.

7 Assessment of Residual Impacts

For Freehay Farm the calculated noise level for the proposed operations of 63 dB $L_{Aeq, 1 hour, free field}$ exceeds the permitted site noise limit for this dwelling for mineral placement between 221 m AOD and 224 m AOD without a perimeter bund.

Noise control measures, as described above, will be employed for the top 3 metres and the calculated noise level for Freehay Farm is 55 dB $L_{Aeq, 1 hour, free field}$.

At a distance, noise from machinery used at mineral workings does not usually contain a distinguishable tone nor does it tend to be impulsive. The use of reversing alarms on site plant is a separate matter. Hanson UK has a policy that all vehicles and equipment, including contractors, are fitted with white noise reversing alarms. Should reversing alarms used on mobile site plant give rise to noise problems, the use of quieter or silent types of alarm or warning devices that are more environmentally acceptable will be explored.

8 Summary and Conclusions

An application is to be submitted by Hanson for revising the working scheme so that a silt lagoon can be created within the site to allow the continued use of the processing plant.

As part of this application it was deemed appropriate to undertake site noise calculations and noise assessment to check the potential impact of the development on nearby dwellings and the need for mitigation and noise control, albeit most of what is proposed is already permitted.

The proposed noise control measures are described in this report and shown on drawings and sections to accompany the application.

The calculated overall “reasonable worst case” site noise levels for routine and temporary operations in the proposed extraction area, with the introduction of the noise control measures, are at or below the proposed daytime site noise limits of 55 dB $L_{Aeq,\ 1\ hour,\ free\ field}$ for normal operations and 65 dB $L_{Aeq,\ 1\ hour,\ free\ field}$ for temporary operations at all dwellings.

Dr Paul Cockcroft BEng PhD CEng MIMMM FIOA
Senior Partner

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Appendix A – Glossary of Acoustic Terms

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.

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

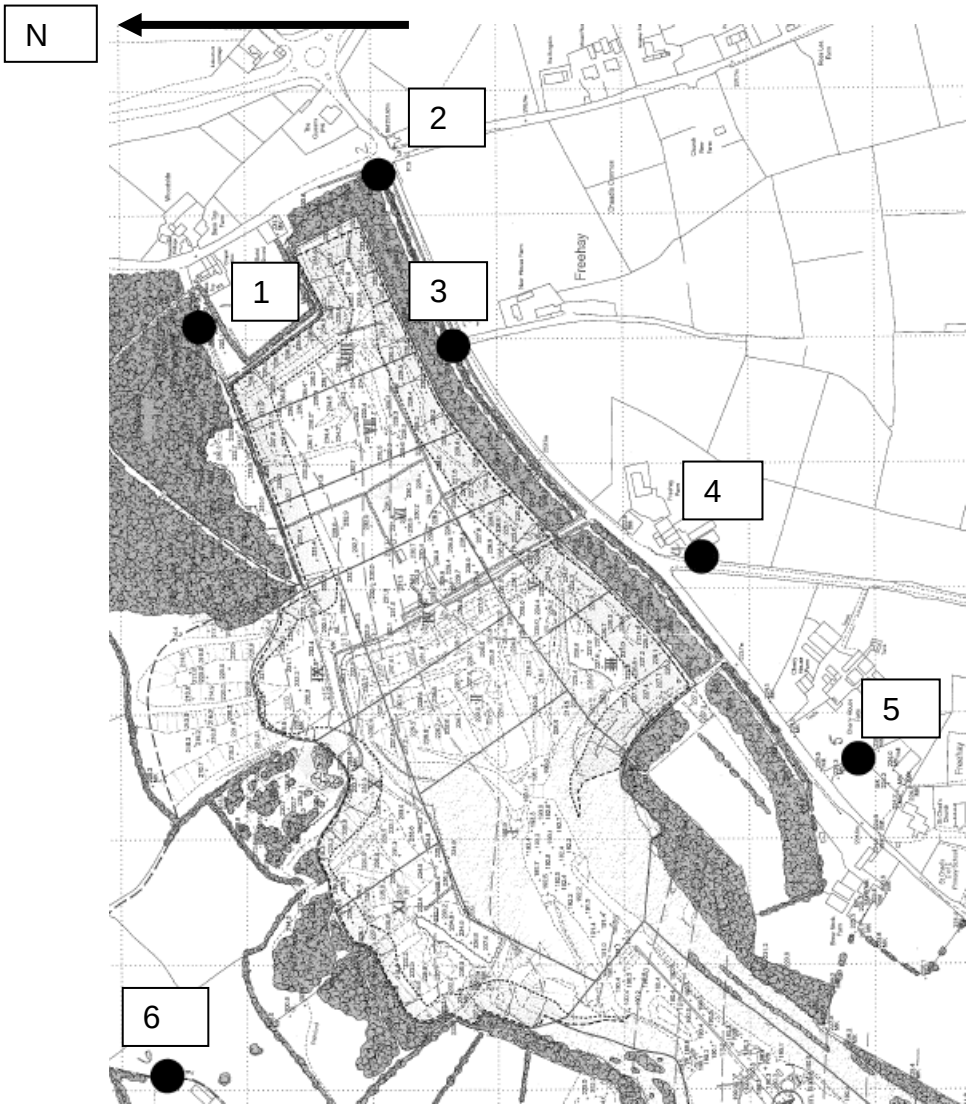
In order to cover the time variability aspects, noise can be analysed into various statistical parameters, i.e. the sound level which is exceeded for N% of the time. The most commonly used are the $L_{A01,T}$, $L_{A10,T}$ and the $L_{A90,T}$.

$L_{A01,T}$ 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 level.

Appendix B – Site Location Plan and Measurement Locations



● Approximate positions of attended sample noise survey locations

Ref No.	Description of Measurement Location
1	In woods, east of footpath, 5 m to Bank Top garden boundary fence
2	By side of footpath, west of road sign, opposite corner to dwelling at crossroads
3	On footpath, 6 m to side of lane, opposite driveway entrance to New House Farm
4	On verge at side of lane to west of farm buildings at Freehay Farm
5	By village hall gates, west of Cherry House Farm
6	On footpath, 5 m to boundary fence east of Plantation House

Appendix C – Instrumentation and Calibration Details

Date and Location of Survey

Thursday 11 January 2018

In vicinity of Hanson Freehay Quarry, Staffordshire

Survey carried out by

Dr Paul Cockcroft

Instrumentation used (Serial Number)

Norsonic 140 Sound Level Meter (1403138)

Norsonic 1251 Calibrator (31991)

Calibration

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

Survey Date	Start Cal	End Cal
Thursday 11 January 2018	113.9 dB(A)	114.0 dB(A)

The meter and calibrator are tested monthly against a Brüel and Kjær Pistonphone, type 4220 (serial number 375806) and a Norsonic Calibrator, type 1253 (serial number 22906) with UKAS approved laboratory certificate of calibration.

Survey Details

Attended sample measurements of 15 minute duration were taken at each of the chosen locations. The microphone was at a height of approximately 1.4 metres above local ground level, with a windshield used throughout.

The start times of each sample are tabulated with the results in Appendix D.

Appendix D – Attended Sample Measurements

Results and Observations from Attended Sample Measurements

Thursday 11 January 2018 between ~11.00 and 16.00

Dry, 50% cloud, blue sky, ~ 3°C, wind ~1 m/s, ~ NW

Position	Start Time	Results dB (T = 15 minutes)				Comments
		$L_{A10,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{Amax,\ F}$	
Pos 2 Cross Roads	11:30	50	41	62	81	Local road traffic, Croxden Quarry HGVs, birdsong
Pos 1 Bank Top	11:50	42	39	43	55	Road traffic, birdsong, distant chainsaw, distant helicopter
Pos 6 Plantation House	12:15	40	37	42	65	Distant road traffic, birdsong
Pos 6 Plantation House	12:35	42	39	43	57	Distant road traffic, birdsong
Pos 3 New House Farm	13:00	39	34	60	80	Local road traffic, Croxden Quarry HGVs, birdsong
Pos 4 Freehay Farm	13:20	46	42	58	75	Local road traffic, activity at farm, radio, excavator working face nearest Pos 4
Pos 5 Village Hall	13:40	40	38	49	71	Local road traffic, Croxden Quarry HGVs, excavator just audible, birdsong
Pos 2 Cross Roads	14:05	46	40	59	80	Local road traffic, Croxden Quarry HGVs,
Pos 1 Bank Top	14:25	40	38	42	53	Road traffic, birdsong, distant chainsaw,
Pos 3 New House Farm	14:45	40	38	57	76	Quarry activity just audible, birdsong, local road traffic, Croxden Quarry HGVs
Pos 4 Freehay Farm	15:05	47	46	60	78	Local road traffic, Croxden Quarry HGVs, excavator clearly audible at times
Pos 5 Village Hall	15:25	43	41	52	69	Quarry activity audible, road traffic

Freehay Quarry – Komatsu D275 AX Dozer 10 to 15 m to side

Position	Start Time	Results dB (T = 15 minutes)				Comments
		$L_{A10,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{Amax,\ F}$	
Dozer working on site	10:50	78	75	78	88	Ripping, forward, reverse, working hard and slowly, pushing ripped material over edge. Dozer engine, exhaust, tracks, white noise reversing alarm

Appendix E – BS5228 Noise Calculation Methods

Specific noise levels are predicted or measured in terms of the Equivalent Continuous Noise Level, $L_{Aeq,T}$ over a given reference time interval, T. In the Planning Practice Guidance for Minerals the time interval for daytime, evening and night the reference time interval is 1 hour.

The calculation method for any plant which is relatively fixed in location is that set out in BS 5228-1: 2009 + A1: 2014, Annex F, and is the "Method for activity L_{Aeq}" described in section F.2.2 or the "Method for plant sound power level" described in section F.2.3.

The calculation method for site mobile plant such as lorries and dump trucks is that set out in BS 5228-1: 2009 + A1: 2014, Annex F, and is the "Method for mobile plant using a regular well defined route (e. g. haul roads)" described in section F. 2. 5.

Ground Absorption has been calculated using the technique set out in BS 5228-1: 2009 + A1: 2014, Annex F, assuming 60 to 90% soft ground between the extraction area and the receiver locations.

The method of assessing screening is that attributed to Maekawa as used in BS 5228-1: 2009 + A1: 2014, Annex F and various other Government published documents. This method uses the calculated path difference and octave band noise data for each noise source over the frequency range stated in BS 5228-1: 2009 + A1: 2014, Annex F.

The effects of ground absorption are not used in the calculations if screening has been assessed and offers a higher attenuation.

The nearest distances to the respective dwellings, from the various items of plant, have been used in an acoustic model for the site to calculate the reasonable worst case $L_{Aeq,T}$ site noise levels.

A summary site noise calculation sheet for one of the nearest receiver location is included below.

Appendix F – Sample Site Noise Calculation Summary Sheet

	HANSON AGGREGATES	**4764**	**13-Mar-18**	**PWC**				Receiver Height :	1.5	m		Mineral Placement Upper Level :	224	m AOD							
								Retained Barrier Height :	2	m		Depth for Dozer / Ripping Mineral :	0	m							
	FREEHAY QUARRY - REVISION TO WORKING SCHEME							Proposed Barrier Height :	3	m		Depth of Dozers on Placed Mineral :	15	m							
				Activity	Power LWA	1 hour	Capacity	Source		Vehicles	Speed	10		BS5228							
Ref	Plant Item	Comments on Plant		LAeq @ 10 m	or LWA / m	On-time %	Tonnes	Height		Q per hour	V kph	Plant Set back(m)		method							
1	Komatsu 275 AX Dozer / ripping mineral	Measured Freehay Quarry 11.01.18		82	110	100		2				10	m back	1	Activity						
2	Excavator for mineral (once overburden removed)	Contractor's plant - 45 tonne		78	106	100		2				10	m back	1	Activity						
3	Volvo A40G Articulated Dump Trucks - up full			76	104	100		2		20	10	0	m back	4	Haul Road						
4	Volvo A40G Articulated Dump Trucks - up empty			76	104	100		2		20	16	0	m back	4	Haul Road						
5	Volvo A40G Articulated Dump Trucks - down full			76	104	100		2		20	16	0	m back	4	Haul Road						
6	Volvo A40G Articulated Dump Trucks - down empty			76	104	100		2		20	16	0	m back	4	Haul Road						
7	Dozer for overburden / mineral in existing void	Contractor's plant - Caterpillar D9T		82	110	100		2				10	m back	1	Activity						
8	Dozer for overburden / mineral in existing void	Contractor's plant - Caterpillar D6T		80	108	100		2				10	m back	1	Activity						
9	Tractor and bowser on haul road	Contractor's plant		78	106	100		2		4	10	0	m back	4	Haul Road						
10	Excavator for overburden (above ground level)	Contractor's plant - 45 tonne		78	106	100		2				0	m back	1	Activity						
11	Plant Item 11			-1027	-999	100		2				0	m back	1	Activity						
12	Bund formation / bund removal			80	108	100		2				0	m back	1	Activity						
13	Plant Item 13			-1027	-999	100		2				0	m back	1	Activity						
14	Plant Item 14			-1027	-999	100		2				0	m back	1	Activity						
15	Plant Item 15			-1027	-999	100		2				0	m back	1	Activity						
	Location No.	**1**	**Bank Top**																		
										Suggested / Existing											
	Receiver Height	234.5	m AOD							Site Noise Limit dB LAeq, 1 hour											
	Site Noise Level for Items 1 to 9	52	dB LAeq, 1 hour, free field		Mineral (below surrounding ground level)					52.5	Condition 12										
	Site Noise Level for Items 3 to 10	60	dB LAeq, 1 hour, free field		Overburden (above surrounding ground level)					70	Condition 13										
	Site Noise Level for Item 13	62	dB LAeq, 1 hour, free field		Bund formation / bund removal					70	Condition 13										
Ref	Plant Item	Plan	Working	Ground	Working	Source	Angle	Range	Barrier	Barrier	Path	Barrier	Soft	Ground	Resultant						
		Distance	Distance	Height	Height/depth	Height	Degrees	Metres	-Receiver	Height	Diff.	Atten.	Ground %	Atten.	LAeq						
1	Komatsu 275 AX Dozer / ripping mineral	70	80	229.0	0.0	231.0	0	0	70	234.0	0.366	15.0	60.0	1.5	48.9						
2	Excavator for mineral (once overburden removed)	70	80	229.0	0.0	231.0	0	0	70	234.0	0.366	14.0	60.0	1.5	45.9						
3	Volvo A40G Articulated Dump Trucks - up full	50	50	230.0	0.0	232.0	10	0	25	232.0	-0.062	0.0	60.0	0.9	43.6						
4	Volvo A40G Articulated Dump Trucks - up empty	40	40	225.0	-7.5	219.5	5	0	20	232.0	1.021	17.9	60.0	0.6	22.5						
5	Volvo A40G Articulated Dump Trucks - down full	40	40	225.0	-7.5	219.5	5	0	20	232.0	1.021	17.9	60.0	0.6	22.5						
6	Volvo A40G Articulated Dump Trucks - down empty	50	50	230.0	0.0	232.0	10	0	25	232.0	-0.062	0.0	60.0	0.9	41.5						
7	Dozer for overburden / mineral in existing void	300	310	224.0	-15.0	211.0	0	0	270	230.0	3.431	21.8	60.0	3.3	30.4						
8	Dozer for overburden / mineral in existing void	300	310	224.0	-15.0	211.0	0	0	270	230.0	3.431	21.8	60.0	3.3	28.4						
9	Tractor and bowser on haul road	40	40	225.0	0.0	227.0	5	0	20	232.0	0.074	9.2	60.0	0.6	28.2						
10	Excavator for overburden (above ground level)	70	70	233.0	0.0	235.0	0	0	60	230.0	-1.347	0.0	60.0	1.3	59.8						
11	Plant Item 11	10000	10000	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	0.0	0.0	-1087.0						
12	Bund formation / bund removal	70	70	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	60.0	1.3	61.8						
13	Plant Item 13	10000	10000	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	0.0	0.0	-1087.0						
14	Plant Item 14	10000	10000	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	0.0	0.0	-1087.0						
15	Plant Item 15	10000	10000	0.0	0.0	2.0	0	0	0	0.0	-1.000	0.0	0.0	0.0	-1087.0						