NOVA ACOUSTICS

Noise Impact Assessment of a Proposed Dimension Stone Quarry

Client Name: A. D. Calvert Care of The Mineral Planning Group Ltd.

Site Address: Horn Crag Quarry off Fishbeck Lane, Silsden, West Yorkshire, BD20 0NP

Date: 05/01/2022

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Executive Summary

An environmental noise survey and noise impact assessment have been undertaken at Horn Crag Quarry off Fishbeck Lane, Silsden, West Yorkshire, BD20 0NP to assess the potential increase in noise levels from a proposed Dimension Stone Quarry on the surrounding Noise Sensitive Receptors. The measured ambient sound levels have allowed a BS5228:2009 noise assessment to be carried out.

The BS5228:2009 assessment indicates that the noise emissions from the quarry will be a minimum of 7.0 dB below the threshold value calculated using the ABC method. This is within the BS5228:2009 criteria and as such, the impact is classed as 'Not Significant'.

An overview of the recommendations can be found below:

Recommendations and Mitigation Measure Overview
• Stationary plant such as generators should be located as far as possible away from the closest Noise Sensitive Receptor and engines should be turned off whilst idling. • Plant should be used in accordance with the manufacturers' recommendations. • Plant which may be used intermittently should be shut down between work periods or throttled down to a minimum. • Appropriate screens or enclosures should be provided where practicable. • All plant and machinery should be regularly maintained to control noise emissions, with emphasis on lubrication of bearings and integrity of silencers. • Use quiet reversing alarms/methods. • Site staff should be aware that they are working adjacent to residential properties and avoid all unnecessary noise due to misuse of tools and equipment, shouting and radios. • Adherence to any restrictions of operating hours or activities imposed by the Local Authority. • Further Recommendations can be found in the body of the report.

The findings of this report will require written approval from the Local Authority prior to work commencing.

1. Introduction

Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a proposed Dimension Stone Quarry (the Proposed Development') at Horn Crag Quarry off Fishbeck Lane, Silsden, West Yorkshire, BD20 0NP ('the Site').

The applicant is preparing a planning application to be submitted ('the Application') and has received pre-application advice from the City of Bradford Metropolitan District Council.

The following technical noise assessment has been prepared to support the planning application to the City of Bradford Metropolitan District Council. This report details the existing background sound climate at the nearest receptors, as well as the sound emissions associated with the Proposed Development.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

Scope & Objectives

The scope of the noise assessment can be summarised as follows:

- Baseline sound monitoring survey to evaluate the prevailing background sound levels at the nearest sensitive receptor ('NSR') to Site;
- Detailed sound modelling, acoustic calculation and analysis in accordance with; ISO9613 – 1 ISO 9613-2 - Attenuation of sound during propagation outdoors prediction methodology, to predict sound levels at the NSR;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the proposed sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Policy Framework (2019), Noise Policy Statement for England (2010) and British Standard BS5228:2009 – 'Code of practice for noise and vibration control on construction and open sites'. Further information on the legislation can be found in Appendix B.

Local Policy Guidance & Discussions with the Local Authority

The following assessment has been requested by the council:

Prediction of anticipated noise levels during the mineral extraction phase must be carried out in accordance with BS 5228: 2009 "Code of practice for noise and vibration control on construction and open sites". Sources of vibration including crushing and other site operations should be included in the noise impact assessment.

- Other legislation controlling noise from mobile plant to be considered includes:
- EC Directive 98/37/EC, The Machinery Safety Directive
- EC Directive 86/662/EC Limitation of noise emitted by hydraulic excavators, rope operated excavators, dozers, loaders and excavator loaders.

The noise impact assessment must also include details of proposed noise and vibration monitoring during the operation of the process appropriate to the activities taking place. Mitigation measures must be included.

If the quarry waste material is to be reworked and re-engineered then there is potential for noise, vibration, dust, odour, lighting and other environmental nuisance to be caused to surrounding properties. The applicant must submit proposals for how such environmental issues will be managed during the mineral extraction works.

2. Environmental Noise Survey

Measurement Methodology

In order to characterise the sound profile of the area at the closest Noise Sensitive Receptor (NSR), an environmental sound survey was carried out from the 19/03/21 to 22/03/21. For the long-term monitoring, a sound level meter was attached to a lamppost approximately 3.5m from the ground. The monitoring position was chosen in order to collect representative sound levels at the NSR during the typical operational periods of the proposed development. The monitoring location is shown in Figure 1.0 below.

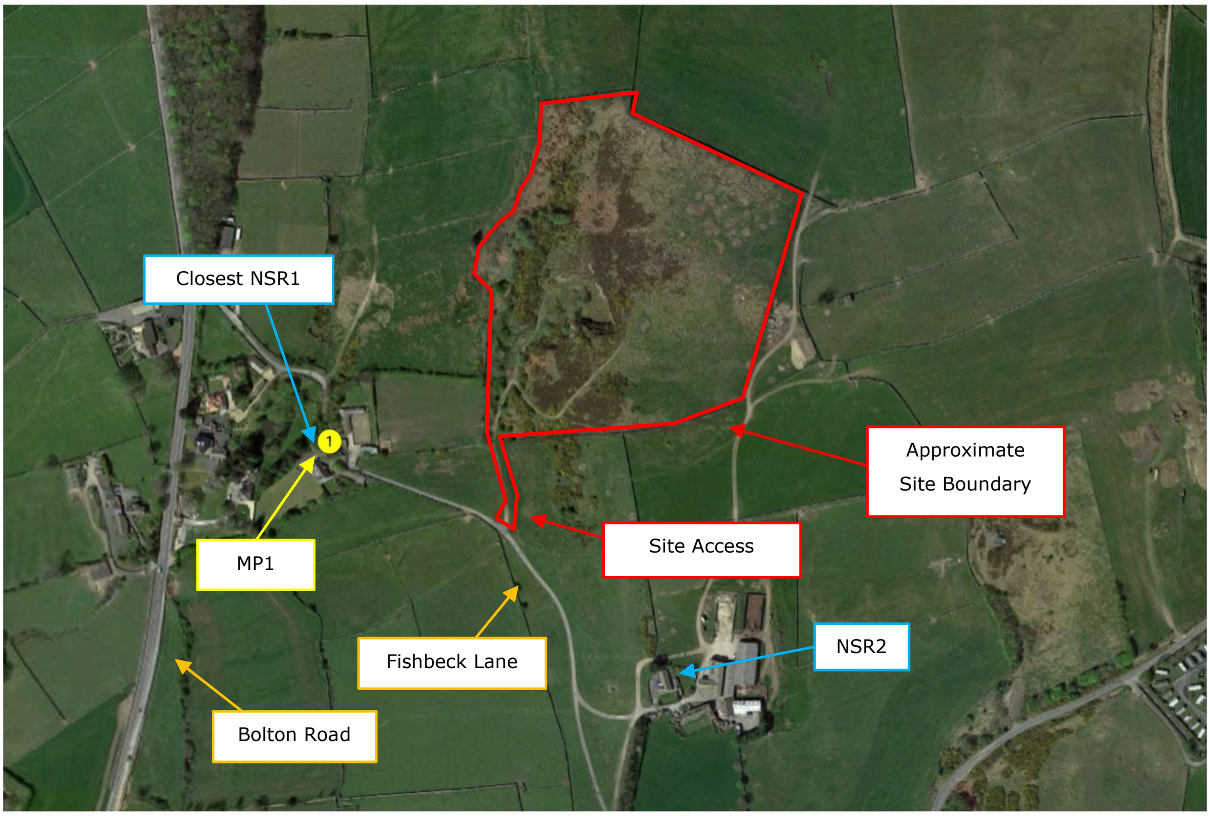


Figure 1.0 – Indicative Site Layout

Context & Subjective Impression

The area surrounding the site is primarily pastoral farmland with a minority of residential properties. The noise profile at the NSR is dominated by road traffic noise from Bolton Road and Brown Bank Lane as well as noise from farm animals however these were secondary in nature.

Environmental Noise Survey Results

The proposed quarry will operate 07:30 to 18:00, Monday to Friday, and 08:00 to 13:00 on Saturdays. The table below outlines the lowest ambient sound levels measured during the operational period of the quarry that will be used as the baseline for the noise assessment. Further summary results for the entire measurement period can be found in Appendix D.

Measurement Position MP1				
Measurement Time Period (‘t’)	**$L_{Aeq,t}$**	**$L_{Amax,t}$**	**$L_{A90,t}$**	**$L_{A10,t}$**
Day 1 - 19/03/21 – 08:30 - 18:00	52.0	79.0	49.0	54.0

Table 1.0 – Environmental Survey Summary Results

3. BS5228:2009 Noise Assessment

3.1 On-Site Activities

The activities that are proposed to be undertaken on site are as follows:

- Ripping of rock from quarry faces.
- Splitting of blocks with secondary blasting methods (nonex).
- Loading of blocks onto flatbed trucks.
- HGVs entering and exiting the site to transport materials.
- Stripping of soils to enter next phase (very temporary activity, only occurs for a few weeks per year)
- Landscaping and restoration during the final phase.

The processing of block takes place off-site at an external processing yard.

3.2 Specific Sound Level

The table below shows the noise levels of the equipment which is to be used for the Proposed Development. It is noted that it is unlikely that all plant machinery will be operational simultaneously, and as such, the following assessment is deemed to be a worst-case scenario. The noise data is taken from manufacturers datasheets which can be found in Appendix E.

Description	Sound Pressure Level at 10m (L_{Aeq}, dB)	Sound Power Level (L_{WA}, dB)
Volvo EC480EL Excavator	--	106.0
Volvo L220H Wheel Loader	--	109.0
JCB JS130 with Drill Attachment	--	107.0
McCloskey R155 Screener*	82.0	110.0

Table 2.0 – Plant Equipment Noise Data

**Data taken from McCloskey S130 screener datasheet. The two screeners are assumed to be similar noise levels. The client has stated that the screen will only be used at the start of the development for tasks such as preparing an entrance and turning area. It is estimated that it will be used for a maximum of 6 months.*

HGV Movements

The table below shows the noise levels for an HGV entering and leaving the site, taken from BS5228:2009.

Description	L_{WA} (dB)
Lorry Pulling Up	98.0

Table 3.0 – HGV Movement Noise Level

The noise level of the HGVs being loaded/unloaded has also been taken from BS5228:2009. The following table shows the noise level with a time correction applied to account for the loading/unloading process taking approximately 20 minutes per hour.

BS5228:2009 Process Description	L_{wA} (dB)	Total On-Time (mins/hour)	Time Corrected L_{wA} (dB)
Lorry Unloading	112.0	20	107.0

Table 4.0 – HGV loading/Unloading Noise Levels

The specific sound levels at the NSRs have been calculated using SoundPlan 8.2, which undertakes its calculations in accordance with the guidance given in IS09613 – 1:1993 and ISO9613 – 2:1996.

The following assumptions have been made within the calculation software:

- To accurately model the land surrounding the development the topographical data has been taken from Google Maps, it is assumed this has an accuracy within the last 3 years. Topographical data for the quarry itself has been provided by the client, this is also included in the model.
- The ground between the source and receiver is a mix of 'soft' and 'hard' surfaces.
- The sound levels presented above have been inputted into the software.
- The HGV movement noise emissions have been modelled as a line source at a height of 1.5m (approximate engine height).
- All operations have been placed in the most exposed areas in relation to the NSRs. This again is considered a worst-case scenario.
- The grid height of the noise map is set to 1.5m.

The sound map showing the specific sound level emissions from the Proposed Development can be seen below in the figure below.

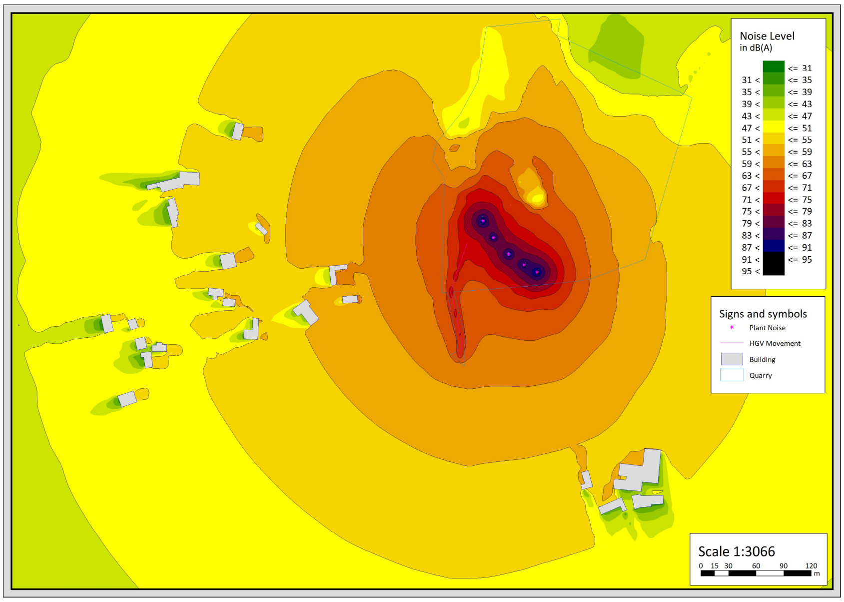


Figure 2.0 – Specific Sound Level Map – 1.5m Grid Height

A summary of the specific sound levels at the NSRs based on the sound map shown in Figure 3.0, can be seen in the following table.

NSR	Specific Sound Level (dBA)
1	58.0
2	54.0

Table 5.0 – Specific Sound Level at NSR Summary

3.3 BS5228:2009-1 Construction Noise Assessment

Based on the measured noise levels shown in Section 2.0, the appropriate threshold values have been determined for the NSRs using the BS5228-1:2009 ABC method. As can be seen in the table below, the lowest L_{Aeq} ambient noise level measured during the weekday operational period was 52.0 dB, and as such, when rounding up to the nearest 5.0 dB the site is considered 'Category A'. This means that a threshold of 65.0 dB is the recommended noise limit level.

The table below shows the predicted noise levels at the most affected NSRs added to the existing ambient noise levels. This is then compared with the threshold level.

ABC Method: Noise Impact Assessment			
Location	**Predicted Sound Level (dBA)**	**Day Time Threshold Level (dB $L_{Aeq,12hour}$)**	**Significance**
NSR1	58.0	65.0	Not Significant
NSR2	54.0	65.0	Not Significant

Table 6.0 – ABC Method: Noise Impact Assessment

Discussion

As can be seen in the assessment above, considering the predicted sound emissions from the proposed activities, no significant impact is expected at the most affected NSRs.

3.4 Recommendations and Mitigation

To reduce the potential impact of noise levels generated by the quarry activities it is recommended mitigation measures be put in place.

In addition, best working practice should be implemented during each phase of the quarry works and close attention should be paid to work within the immediate vicinity of NSRs. The works will follow the guidelines in BS5228-1:2009 and the guidance in BRE Controlling particles, vapour and noise pollution from construction sites, Parts 1 to 5 2003.

The following mitigation measures should be implemented to minimise noise emissions:

- Stationary plant such as generators should be located as far as possible away from the nearest sensitive receptors and engines should be turned off whilst idling.

- Plant should be used in accordance with the manufacturers' recommendations.
- Plant which may be used intermittently should be shut down between work periods or throttled down to a minimum.
- Appropriate screens or enclosures should be provided where practicable.
- All plant and machinery should be regularly maintained to control noise emissions, with emphasis on lubrication of bearings and integrity of silencers.
- Use quiet reversing alarms/methods.
- Site staff should be aware that they are working adjacent to residential properties and avoid all unnecessary noise due to misuse of tools and equipment, shouting and radios.
- Adherence to any restrictions of operating hours or activities imposed by the Local Authority.

If at any time it is necessary to undertake temporary actions that are likely to cause elevated levels of noise, the TCM (or designated responsible person) will contact Environment Health and any other interested parties before such actions are taken to inform them of the operations being undertaken and that the elevated levels of noise will be of a temporary nature. Where practicable, such actions will only proceed when the prevailing wind direction is away from sensitive receptors.

As discussed in the Pre-application advice it may be prudent to undertake noise and vibration monitoring during the mineral extraction phase to ensure the noise and vibration level are not exceeding the relative criteria. Ideally, these noise and vibration monitors would be located in proximity to the closest NSRs. The limit levels that should be adhered to are outlined below.

- Noise 65 dBA as per Category A BS5228-1
- Vibration 0.14 – 0.3 $mm.s^{-1}$ PPV as per BS5228-2

3.5 Increase in Ambient Noise Level Assessment

The following section analyses the expected increase in ambient noise levels in the surrounding area due to the Proposed Development. The specific sound levels associated with the Proposed Development are logarithmically added to the lowest measured residual sound level. The higher the increase in noise levels the higher the impact.

Increase in Ambient Noise Level Assessment		
Description	**NSR1 (dBA)**	**NSR2 (dBA)**
Lowest Measured Ambient Noise Level	52.0	52.0
Specific Noise Level	58.0	54.0
Resulting Noise Level	59.0	56.1
Increase in Noise Level	+7.0	+4.1
Expected Impact	Substantial	Slight/Moderate

Table 7.0 – Increase in Ambient Noise Level Assessment

Discussion

The results show that the ambient noise levels are predicted to increase by approximately 7.0 dB and 4.1 dB for NSRs 1 and 2 respectively. This is classed as a 'Substantial' impact at NSR1 and 'Slight/Moderate' at NSR2. Whilst this level of impact is high at NSR1, due to the temporary nature of the activities, it is deemed to be acceptable in accordance with BS5228:2009. It should also be noted that the assessment has been undertaken assuming all machinery at the site is operating continuously and simultaneously which is not likely the case. Given this, the impact is likely lower than stated in the IANL Assessment above.

Appendix A – Acoustic Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10-6 Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided. The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source. A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}.

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound. To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS4142:2014 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125ms

Appendix B – Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

B.1 – National Planning Policy Framework (2019)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2019. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 170e, it states:

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. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 180 states:

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 impact 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; and*
c) *Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 180 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

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

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life;*
- *Where possible, contribute to the improvement of health and quality of life.*

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that "significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development".

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: "all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: "where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – British Standard BS5228 – 1:2009 'Code of practice for noise and vibration control on construction and open sites'

Guidance on the prediction and assessment of noise from development sites is given in BS 5228 – 1:2009 "Code of practice for noise and vibration control on construction and open sites – Part 1 :Noise".

Construction noise can have disturbing effects on the surrounding neighborhood. The effects are varied and are complicated further by the ever changing locations of the site works throughout the construction process. The duration of site operations is also an important consideration. Higher noise levels may be acceptable if it is known that the levels will occur for a limited period. BS5228 -1 provides guidance on significance criteria for assessing the potential noise impact associated with the construction phase of large projects, which would be applicable to construction activities. For the purpose of this noise assessment, the noise likely to be generated during the construction phase have been assessed against the significance criteria established using the BS5228 -1 ABC method.

The ABC method for determining significance criteria requires the ambient noise levels at existing sensitive receptors to be determined. The ambient noise levels at each existing receptor location are then rounded to the nearest 5dB(A) to determine the appropriate threshold value in accordance with the category value, A B or C, as detailed in Table 1.0 below.

Table 1: Thresholds of significant impact from construction noise at residential receptors in accordance with the ABC method of BS5228-1

Assessment category and threshold value period (LAeq)	Threshold value, in decibels (dB)		
	Category A*[1]	Category B*[2]	Category C*[3]
Daytime (0700 to 1900 hours) and Saturdays (0700 to 1300 hours)	65	70	75
Evening and weekends	55	60	56

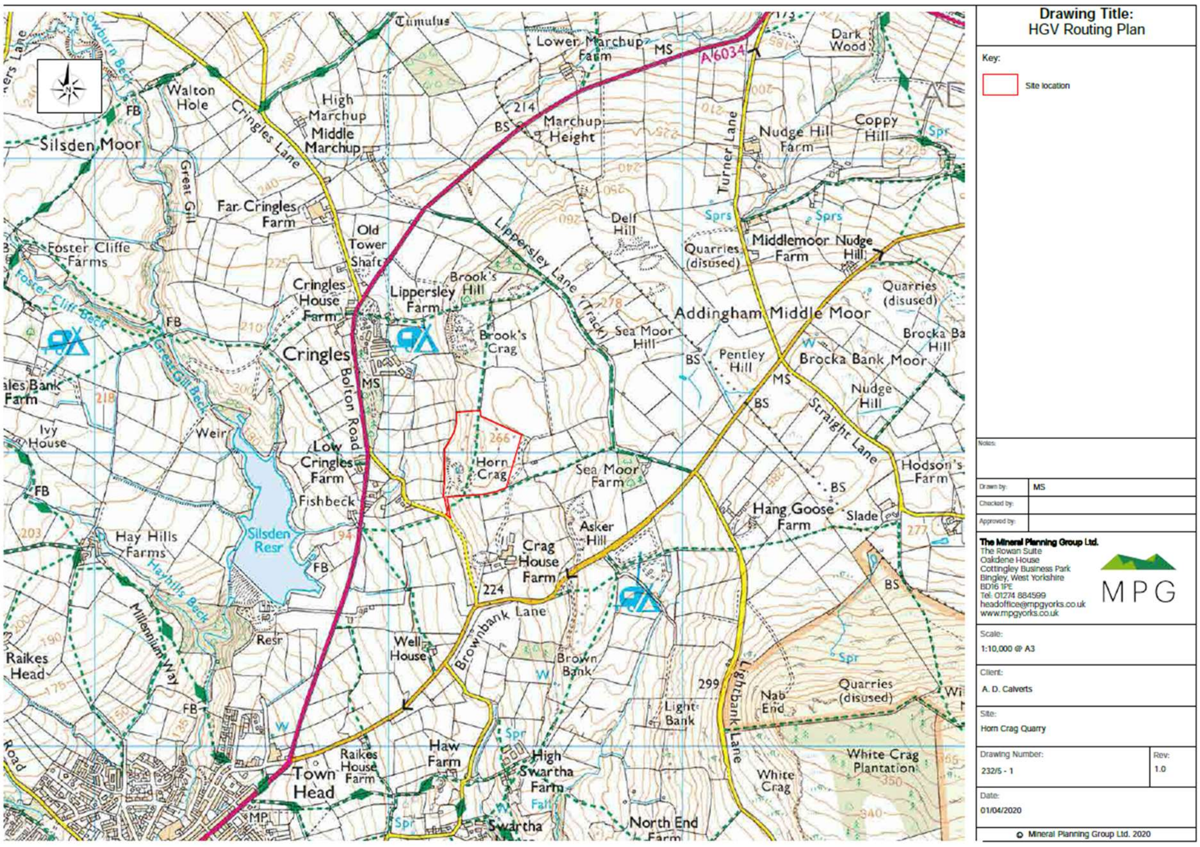
*[1] Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than this value.

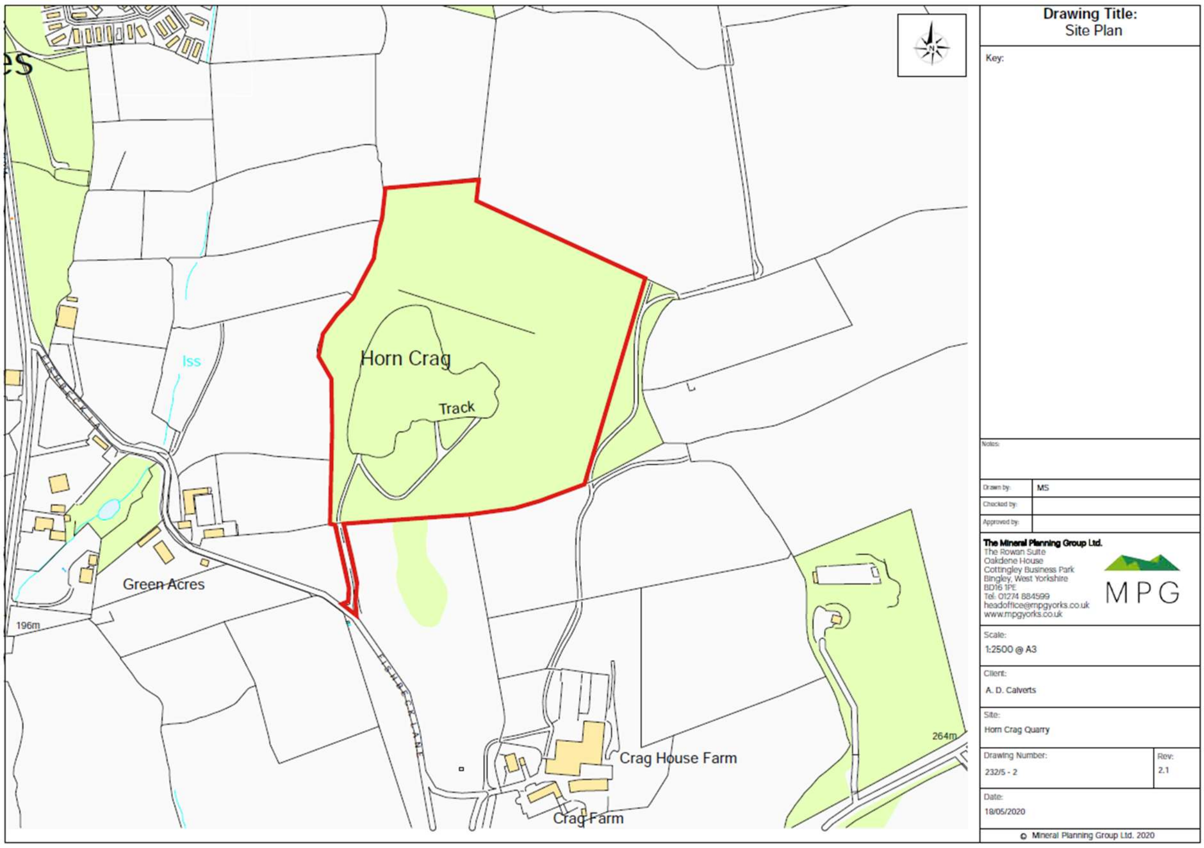
*[2] Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.

*[3] Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.

The predicted noise level likely to be generated at the receptor during the construction phase, i.e. the ambient noise level plus construction noise, is then compared to the appropriate category value. If the noise level is greater than the appropriate category value, a significant noise impact may be registered.

Appendix C – Site Plans





Appendix D – Environmental Survey

D.1 – Tabulated Summary Noise Data

Measurement Position MP1 – Full Measurement Summary				
Measurement Time Period ('t')	**$L_{Aeq,t}$**	**$L_{Amax,t}$**	**$L_{A90,t}$**	**$L_{A10,t}$**
Friday – 19/03/21 – 08:30 – 23:00	51.0	79.0	43.0	53.0
Friday – 19/03/21 – 23:00 – 07:00	43.0	72.0	35.0	49.0
Saturday – 20/03/21 – 07:00 – 23:00	54.0	79.0	44.0	56.0
Saturday – 20/03/21 – 23:00 – 07:00	44.0	80.0	34.0	47.0
Sunday – 21/03/21 – 07:00 – 23:00	54.0	91.0	43.0	57.0
Sunday – 21/03/21 – 23:00 – 07:00	47.0	78.0	36.0	52.0
Monday – 22/03/21 – 07:00 – 10:10	56.0	77.0	54.0	58.0
Measurement Position MP1 – Operational Hours Summary				
Measurement Time Period ('t')	**$L_{Aeq,t}$**	**$L_{Amax,t}$**	**$L_{A90,t}$**	**$L_{A10,t}$**
Friday – 19/03/21 – 08:30 – 18:00	52.0	79.0	49.0	54.0
Saturday – 20/03/21 – 08:00 – 13:00	55.0	78.0	52.0	57.0
Monday – 22/03/21 – 08:00 – 10:10	57.0	77.0	54.0	58.0

Noise Survey Time History

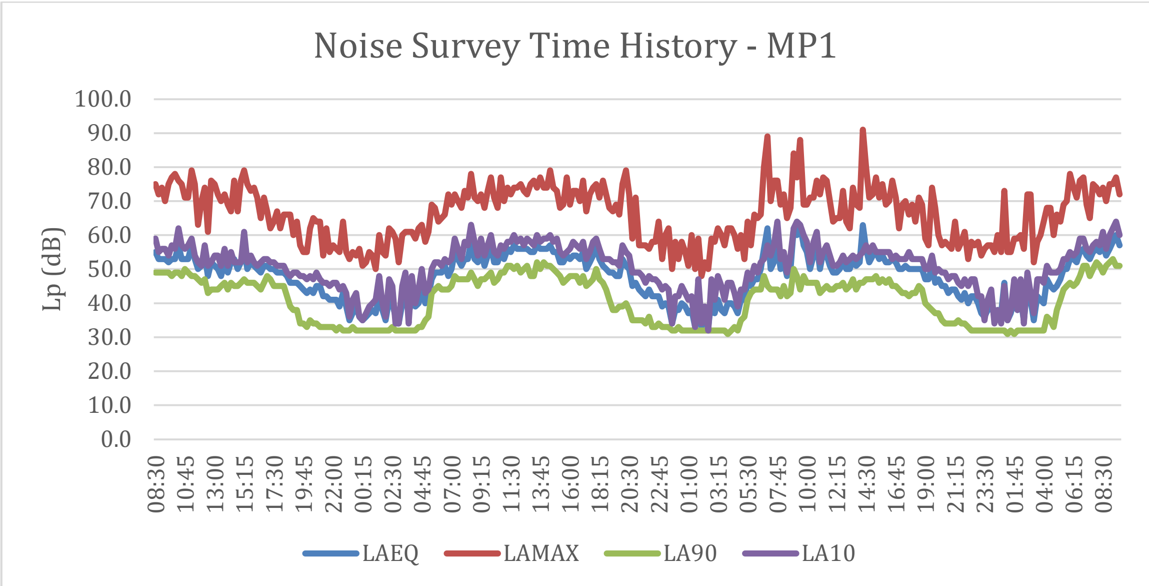


Table 8.0 – Sound Survey Summary Results

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound Level Meter	T246452	≤0.5
CESVA CB006 Class 1 Calibrator	901997	

Table 9.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.5 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

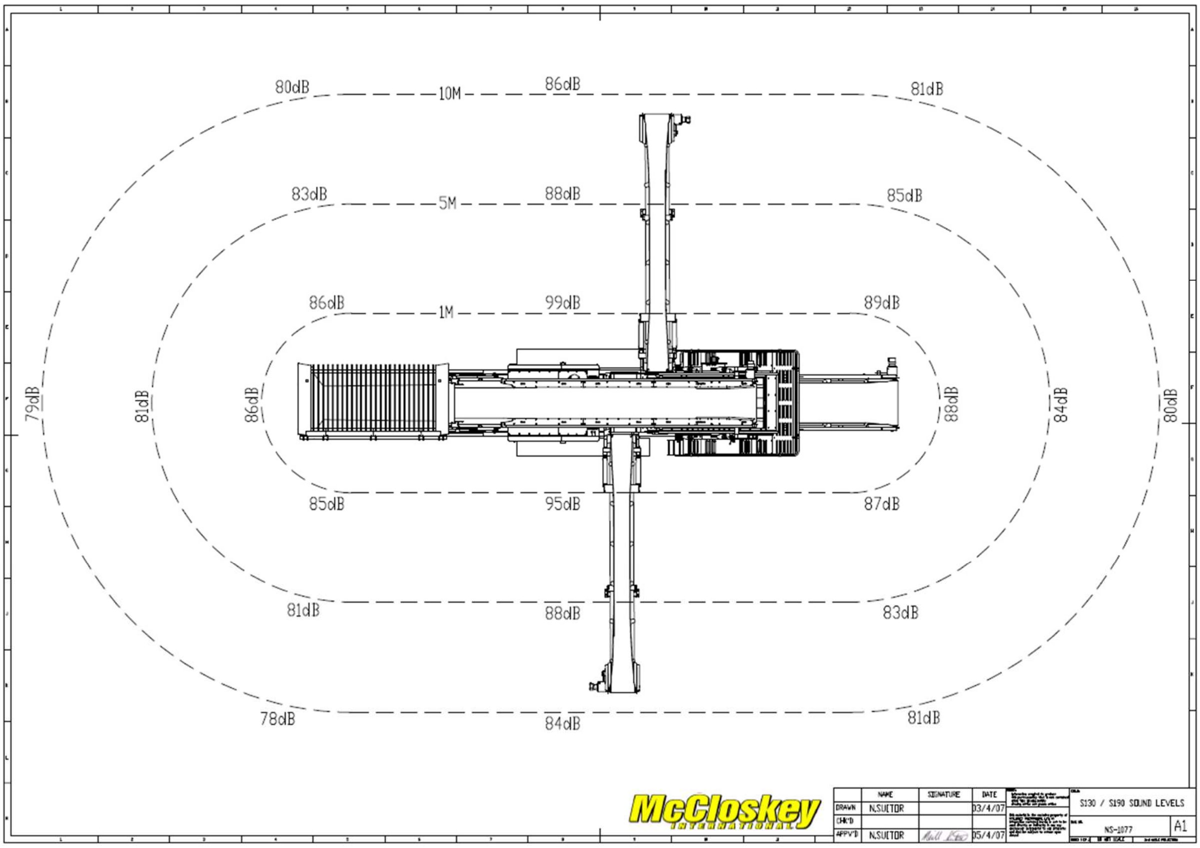
D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localized records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Riddlesden – 4km South-East of Site				
Time Period	Air Temp (^{0}C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
19/03/21 – 00:00 – 23:59	5.9 – 9.9	0.0	ESE	0.0 – 3.9
20/03/21 – 00:00 – 23:59	5.9 – 10.5	0.0	W	0.0 – 5.7
21/03/21 – 00:00 – 23:59	4.2 – 10.7	0.0	SW	0.0 – 2.6
22/03/21 – 00:00 – 23:59	4.1 – 9.9	0.0	W	0.9 – 6.1

Table 10.0 – Weather Summary

Appendix E – Manufacturers Datasheets



Volvo L150H, L180H, L220H in detail

Hydraulic system

System supply: Two load-sensing axial piston pumps with variable displacement. The steering function always has priority.
Valves: Double-acting 2-spool valve. The main valve is electro operated.
Lift function: The valve has four positions; raise, hold, lower and floating position. Inductive/magnetic automatic boom kickout can be switched on and off and is adjustable to any position between maximum reach and full lifting height.
Tilt function: The valve has three functions including rollback, hold and dump. Inductive/magnetic automatic tilt can be adjusted to the desired bucket angle.
Cylinders: Double-acting cylinders for all functions.
Filter: Full flow filtration through 10 micron (absolute) filter cartridge.

		L150H	L180H	L220H
Working pressure maximum, pump 1 for working hydraulic system	MPa	29	29	29
Flow	l/min	180	217	252
at	MPa	10	10	10
engine speed	r/min	1 900	1 900	1 900
Working pressure maximum, pump 2 for steering-, brake-, pilot- and working hydraulic system	MPa	31	31	31
Flow	l/min	202	202	202
at	MPa	10	10	10
engine speed	r/min	1 900	1 900	1 900
Working pressure maximum, pump 3 for brake- and cooling fan system	MPa	25	25	25
Flow	l/min	83	83	83
at	MPa	10	10	10
engine speed	r/min	1 900	1 900	1 900
Pilot system, working pressure	MPa	3.5	3.5	3.5
Cycle times				
Lift	s	5.9	6.4	6.8
Tilt	s	2	1.8	1.6
Lower, empty	s	3.7	3.3	3.2
Total cycle time	s	11.6	11.5	11.6

Steering System

Steering system: Load-sensing hydrostatic articulated steering.
System supply: The steering system has priority feed from a loadsensing axial piston pump with variable displacement.
Steering cylinders: Two double-acting cylinders.

		L150H	L180H	L220H
Steering cylinders		2	2	2
Cylinder bore	mm	100	100	100
Rod diameter	mm	60	60	60
Stroke	mm	390	525	525
Working pressure	MPa	21	21	21
Maximum flow	l/min	202	202	202
Maximum articulation	± °	37	37	37

Service Refill

Service accessibility: Large, easy-to-open hood covering whole engine department, electrically operated. Fluid filters and component breather air filters promote long service intervals. A quick-fit adapter on the hydraulic tank provides faster hydraulic oil fill. Possibility to monitor, log and analyze data to facilitate troubleshooting.

		L150H	L180H	L220H
Fuel tank	l	366	366	366
DEF/AdBlue® tank	l	31	31	31
Engine coolant	l	55	55	55
Hydraulic oil tank	l	156	156	226
Transmission oil	l	48	48	48
Engine oil	l	50	50	50
Axle oil front	l	46	46	77
Axle oil rear	l	55	55	71

Sound Level

		L150H	L180H	L220H
Sound pressure level in cab according to ISO 6396				
L_{pA}	dB	69	70	70
External sound level according to ISO 6395 and EU Noise Directive 2000/14/EC				
L_{WA}	dB	108	108	109

Volvo EC480E in detail

Engine

The latest generation, Volvo engine Stage V emissions certified diesel engine fully meets the demands of the latest, emissions regulations. Featuring Volvo Advanced Combustion Technology (V-ACT), it is designed to deliver superior performance and fuel efficiency. The engine uses precise, highpressure fuel injectors, turbo charger and air-to-air intercooler, and electronic engine controls to optimize machine performance.
Air Filter: 3-stage with precleaner.
Automatic Idling System: Reduces engine speed to idle when the levers and pedals are not activated resulting in less fuel consumption and low cab noise levels.

Engine	Volvo	D13J
Max power at	r/min	1 800
Net, ISO 9249/SAE J1349	kW	283
	hp	385
Gross, ISO 14396/SAE J1995	kW	284
	hp	386
Max torque	Nm	1 928
at engine speed	r/min	1 350
No. of cylinders		6
Displacement	l	12.8
Bore	mm	131
Stroke	mm	158

Electrical system

High-capacity electrical system that is well protected. Waterproof double-lock harness plugs are used to secure corrosion-free connections. The main relays and solenoid valves are shielded to prevent damage. The master switch is standard. Contronics provides advanced monitoring of machine functions and important diagnostic information.

Voltage	V	24
Batteries	V	2 x 12
Battery capacity	Ah	200
Alternator	V/A	28/80

Swing system

The swing system uses an axial piston motors, driving a planetary gearbox for maximum torque. An automatic holding brake and antirebound valve are standard.

Max. slew speed	r/min	9.3
Max. slew torque	kNm	166.3

Travel System

Each track is powered by an automatic two-speed shift travel motor. The track brakes are multi-disc, spring-applied and hydraulic released. The travel motor, brake and planetary gears are well protected within the track frame.

Max. drawbar pull	kN	333.4
Max. travel speed (low)	km/h	3.2
Max. travel speed (high)	km/h	5.2
Gradeability	°	35

Undercarriage

The undercarriage has a robust X-shaped frame. Greased and sealed track chains are standard.

Track shoes		2 x 52
Link pitch	mm	215.9
Shoe width, triple grouser	mm	600/ 600HD*/ 700 / 800 / 900
Shoe width, double grouser	mm	600
Bottom rollers		2 x 9
Top rollers		2 x 2
Top rollers (retractable)		2 x 3

* Not HD shoe but HD track link

Sound Level

Sound pressure level in cab according to ISO 6396		
L_{pA}	dB	71
External sound level according to ISO 6395 and EU Noise Directive 2000/14/EC		
L_{WA}	dB	106

Hydraulic system

The new electro-hydraulic system and new MCV (main control valve) use intelligent technology to control on-demand flow for highproductivity, high-digging capacity and excellent fuel consumption.
The following important functions are included in the system for optimum performance:
Summation system: Combines the flow of both hydraulic pumps to ensure quick cycle times and high productivity.
Boom priority: Gives priority to the boom operation for faster raising when loading or performing deep excavations.
Arm priority: Gives priority to the arm operation for faster cycle times in leveling and for increased bucket filling when digging.
Swing priority: Gives priority to swing functions for faster simultaneous operations.
Regeneration system: Prevents cavitation and provides flow to other movements during simultaneous operations for maximum productivity.
Power boost: All digging and lifting forces are increased.
Holding valves: Boom and arm holding valves prevent the digging equipment from creeping.

Main pump, Type 2 x variable displacement axial piston pumps		
Maximum flow	l/min	2 x 376
Pilot pump, Type Gear pump		
Maximum flow	l/min	32
Relief value setting pressure		
Implement	MPa	32.4/35.3
Travel circuit	MPa	32.4
Slew circuit	MPa	25.8
Pilot circuit	MPa	3.9

Hydraulic Motors

Travel: Variable displacement axial piston motor with mechanical brake.
Slew: Fixed displacement axial piston motor with mechanical brake

Hydraulic Cylinders

Mono boom		2
Bore x Stroke	ø x mm	165 x 1 590
Arm		1
Bore x Stroke	ø x mm	190 x 1 850
Bucket		1
Bore x Stroke	ø x mm	165 x 1 335
ME Bucket		1
Bore x Stroke	ø x mm	175 x 1 335

Service Refill

Fuel tank	l	680
DEF/AdBlue® tank	l	62.5
Hydraulic system, total	l	525
Hydraulic tank	l	270
Engine oil	l	42
Engine coolant	l	60
Slew reduction unit	l	2 x 6
Travel reduction unit	l	2 x 7.5

Cab

The operator's cab has easy access via a wide door opening. The cab is supported on hydraulic dampening mounts to reduce shock and vibration levels. These along with sound absorbing lining provide low noise levels. The cab has excellent all-round visibility. The front windshield can easily slide up into the ceiling, and the lower front glass can be removed and stored in the side door.
Integrated airconditioning and heating system: The pressurized and filtered cab air is supplied by an automaticallycontrolled fan. The air is distributed throughout the cab from 14 vents.
Ergonomic operator's seat: The adjustable seat and joystick console move independently to accommodate the operator. The seat has nine different adjustments plus a seat belt for the operator's comfort and safety.
Refrigerant of the type R134a is used when this machine is equipped with air conditioning. Contains fluorinated greenhouse gas R134a, Global Warming Potential 1430 CO2-eq.

A COMFORTABLE FAVOURITE

The working environment.

4 The JS130/145 creates a quieter working environment inside and out. Because we've reduced noise levels to 72dB(A) inside and 99dB(A) outside, you can use the machine at any location, any time.

JCB cabs use 6 viscous rubber mounts to minimise noise and vibration.

The positive pressure cab keeps out dirt and dust.

5 JCB's climate control option offers a precisely controlled cab temperature with fresh or recirculated air. Demisting/defrosting functions keep a JS130/145's front window clear.

6 There's a spacious luggage tray behind the operator's seat.

7 A large floor area with large high grip pedals gives easy and precise tracking.

The JS130/145's cab and controls are independently adjustable so that it's easy to find the perfect operating position.

We offer air suspension, heated and ventilated seating options to suit many different applications.

JS130/145 LC/HD TRACKED EXCAVATOR 7