DEWSBURY RIVERSIDE

NOISE AND VIBRATION IMPACT ASSESSMENT

VC-103588-EN-RP-0001
R00

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VANGUARDIA

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CONTENTS

1. INTRODUCTION

BACKGROUND

1.1. Vanguardia Ltd has been instructed to undertake a noise and vibration impact assessment for the proposed development of land, located approximately 2km to the south-west of the town centre of Dewsbury in West Yorkshire, for residential use.

1.2. The site extends to 29.5 ha and is formed mainly of agricultural land. Within the north-eastern extent of the site are the Ravensthorpe Road allotments. The plot forms part of the Dewsbury Riverside housing allocation with the adopted Local Plan for Kirklees Council (KC). The allocation aims to deliver 4,000 residential units with associated education and community facilities; the current application is for up to 350 residential dwellings.

1.3. The Proposed Development will be submitted as a hybrid application, whereby detailed matters for consideration are partially reserved.

1.4. The elements covered by the application comprise:

- Application for full planning permission for engineering works, drainage and utilities connection for the provision of site access from Forge Lane and Ravensthorpe Road and associated works; and,

- Application for outline planning permission for the erection of up to 350 dwellings and mixed use development (including community facilities) with associated works including the provision of internal estate roads and parking, landscape works (including provision of public open space, tree clearance/replacement/woodland management and ecological management) and sustainable urban drainage works drainage principles.

1.5. The development site parameters plan is shown in Figure 1.

Figure 1 Parameters plan of the proposed development

SCOPE OF ASSESSMENT

1.6. This assessment considers the potential noise effects of the Proposed Development from the construction and completed development phases on nearby noise sensitive receptors. Vibration effects associated with construction phase have also been assessed.

1.7. The completed development is not expected to introduce any significant sources of vibration; vibration effects associated with the completed development have therefore been scoped out of this assessment.

1.8. The suitability of the site for residential development, in terms of the noise environment, has been assessed and is presented in Appendix B

2. POLICY CONTEXT

NATIONAL POLICY

National Planning Policy Framework

2.1. The National Planning Policy Framework (NPPF), last amended in July 2021 sets out the Government Planning Policy for England. It aims to devolve planning decision making to local planning authorities, asserting the primacy of local development plans and sustainable development. It encourages local planning authorities to set their own standards (although not as fixed thresholds) and adopt a more holistic approach to sustainable development.

2.2. The relevant paragraphs concerning noise in the NPPF are:

- Paragraph 174e: Specifies that new and existing development should be prevented from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution and, wherever possible, should help to improve local environmental conditions.

- Paragraph 185(a): “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:

  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;”

2.3. The NPPF makes direct reference to the Noise Policy Statement for England for advice on the achievement of these policy aims and particularly for the explanation of “adverse impacts”.

Noise Policy Statement for England

2.4. The overarching Government policy on noise is set out in the Noise Policy Statement for England (NPSE). It seeks to clarify the underlying principles and aims in past and existing policy documents, legislation and guidance in relation to all forms of noise including environmental noise, neighbour noise and neighbourhood noise (but not noise in the workplace).

2.5. It uses the established concepts of No Observed Effect Level (NOEL) and Lowest Observed Adverse Effect Level (LOAEL). The NPSE extends these by introducing Significant Observed Adverse Effect Level (SOAEL). This is the level above which significant adverse effects on health and quality of life occur. However, the explanatory note to the NPSE states that it is not possible to identify a single objective value to define SOAEL for noise that is applicable to all sources of noise in all situations. It is likely to be different for different noise sources, for different receptors and at different times.

2.6. The NPSE's vision is 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.

This long-term vision is supported by the following aims:

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

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

2.7. The second aim of the NPSE refers to noise impacts that lie somewhere between LOAEL and SOAEL. The NPSE asserts that, while this means that all reasonable steps should be taken to mitigate and minimise adverse effects, this does not mean that such adverse effects cannot occur[1].

2.8. In a decision letter associated with the Thames Tideway Tunnel project, the Government clarified the meaning of the phrase 'sustainable development' as follows:

2.9. The National Planning Policy Framework, the National Planning Practice Guidance on noise and the Noise Policy Statement for England are all clear that noise management should be determined in the context of sustainable development including the environmental, economic and social benefits of the proposal.

[1] Ibid, paragraph 2.24

Planning Practice Guidance: Noise (PPG:N)

2.10. Further government guidance on the consideration of noise for planning has been published as the Planning Practice Guidance for Noise (PPG:N), last revised in July 2021. The PPG:N supports the NPPF by providing a range of advice and includes a noise exposure hierarchy table, and again makes reference to the NPSE.

2.11. The hierarchy table (reproduced in Table 1 below), provides descriptive (i.e. non-numerical) guidance on the potential effects of noise exposure at levels corresponding to the NOAEL, LOAEL and SOAEL as described in the NPSE, and confirms that adverse effects (between LOAEL and SOAEL) should be mitigated and reduced to a minimum, and significant adverse effects (above SOAEL) should be avoided, taking account of the economic and social benefit of the activity causing or affected by the noise.

Table 1 PPG:N Noise Exposure Hierarchy

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and	Significant Observed Adverse Effect	Avoid

Response	Examples of outcomes	Increasing effect level	Action
	difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.		
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

LOCAL PLANNING POLICY

2.12. KC adopted their Local Plan in February 2019. Noise is identified within the plan as one of the issues facing Kirklees, stating:

"Noise in particular can be an issue for Kirklees residents as noise from traffic and nearby industry can be a problem. Again policies are in place to protect residents from elevated noise levels."

2.13. The following Policies from the Local plan are relevant to the mitigation of environmental noise impact, and to the proposed Dewsbury Riverside development:

- **LP15 - Residential use in town centres** - Proposals for residential uses (including student accommodation) within the defined town centres as set out on the Policies Map will be supported subject to: … the protection of the amenity of existing residents and future occupiers of the proposed residential use in accordance with amenity and design policies within the plan, and will in particular consider matters such as privacy, noise and air quality;

- **LP21 - Highways and access** - All proposals shall: … be accompanied by a supporting Transport Assessment or Transport Statement where the development would generate significant trip generation, providing detail as to the impact on highway safety, air quality, noise and light restrictions;

- **LP52 - Protection and improvement of environmental quality** - Proposals which have the potential to increase pollution from noise, vibration, light, dust, odour, shadow flicker, chemicals and other forms of pollution … must be accompanied by evidence to show that the impacts have been evaluated and measures have been incorporated to prevent or reduce the pollution, so as to ensure it does not reduce the quality of life and well-being of people to an unacceptable level or have unacceptable impacts on the environment.

GUIDANCE DOCUMENTS

2.14. Additionally, the following guidance documents have been referenced in the course of the assessment.

- Planning Practice Guidance on Noise (2021)
- IEMA Guidelines for Environmental Noise Impact Assessment (2014)
- BS 5228-1:2009+A1 (2014)
- BS 5228-2:2009+A1 (2014)
- Manual for Roads and Bridges (DMRB) - LA 111 Noise and Vibration – Revision 1 (2020)
- Calculation of Road Traffic Noise (CRTN), 1988
- ProPG: Planning & Noise – New Residential Development (2017)

3. CONSULTATION

3.1. As part of the consultation carried out for this assessment, KC issued the following comments:

"The construction of the new dwellings and associated infrastructure would involve the arrival and departure of Heavy Goods Vehicles (HGVs). It is also considered that it would involve the use of heavy machinery including mechanical excavators and dump trucks etc. Noise would therefore be generated by the vehicles themselves and when heavy vehicles are loaded and unloaded. There may also be vibration impacts arising from work on site.

There are residential properties within the area to the north and east in particular. The closest of these, on Ravensthorpe Road and Ouzelwell Lane, are located immediately adjacent to the boundary. However, any noise and vibration generated during the construction phase would be temporary and localised and not atypical of a construction site. It could also be managed through the submission of a Construction Environmental Management Plan (CEMP), which could be secured by condition. Furthermore, it is anticipated that a detailed Noise and Vibration Impact Assessment would be submitted with the application and once the site is occupied, noise levels in particular would reduce to those normally associated with a residential area."

3.2. Vanguardia also provided a briefing note to KC (Vanguardia Report Reference: 103588-PN-0001-00) outlining the proposed approach to obtaining baseline noise levels, who confirmed acceptance of the approach via email.

4. ASSESSMENT METHODOLOGY

STUDY AREA AND RECEPTORS

4.1. With regard to the likely noise and vibration effects of the Proposed Development, the extent of the study area includes the site and the surrounding sensitive receptors in proximity to the site boundary. Generally, for construction noise, consideration is given to the nearest receptors to the site boundary, on the assumption that these represent the worst affected receptors and the impact at all other receptor locations will be no worse and most likely lower than those included in the assessment.

4.2. The receptors which have been used in the assessment of the likely effects of noise are listed in Table 2 and shown in Figure 2, and are considered to represent the nearest noise sensitive receptors to the Proposed Development. The receptor heights that have been used in the assessment are presented in the Table. A height of 1.5 m represents typical ground floor windows and a height of 4.5 m represents typical first floor windows.

4.3. For assessment of noise associated with the completed development, ground floor heights are considered for daytime and first floor for night-time activities. Since construction activities will be limited to the daytime period, only ground floor heights are considered appropriate. Receptor R6 has been selected primarily to assess the effect of the proposed demolition works at the neighbouring Bakr Mosque and Lees Hall Playgroup building. Receptor R7 is located on the corner of Forge Lane and Lees Hall Road, and has been selected, as the only residential receptor on Forge Lane, to assess the effect of road traffic noise on that road link.

Table 2 Noise sensitive receptors

Receptor Number	Noise Receptor Type*	Receptor Height m	Description
R1	C, T	1.5, 4.5	Dwellings on Ravensthorpe Road
R2	C, T	1.5	Ravenshall School
R3	C, T	1.5, 4.5	Dwellings on Ouzewell Lane
R4	C, T	1.5, 4.5	Isolated Farm House south of site
R5	C	1.5,4.5	'Five Arches' on Sands Lane
R6	C	1.5,4.5	410 Lees Hall Road
R7	T	1.5, 4.5	535 Lees Hall Road
* C – Construction; T – Traffic			

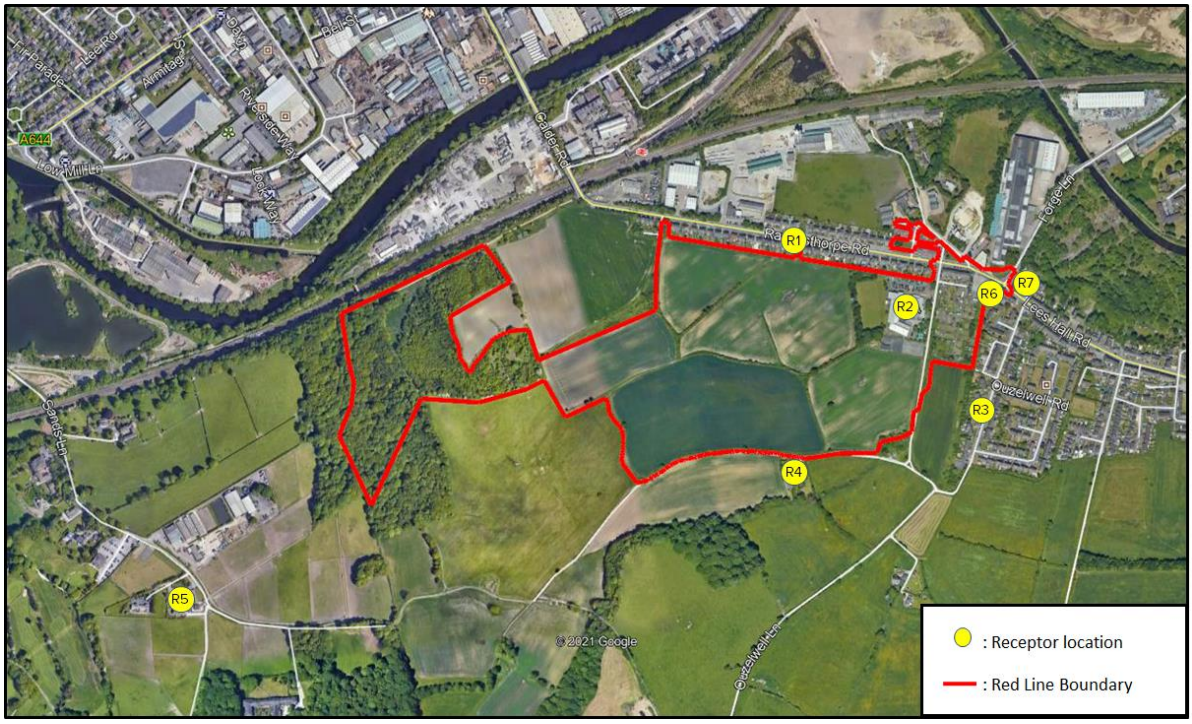

Figure 2 Noise sensitive receptor locations

CONSTRUCTION NOISE ASSESSMENT METHOD

4.4. Noise associated with the construction phase has been assessed using the guidance given in BS 5228-1[2], which provides methods for predicting and assessing noise from construction sites.

4.5. A construction contractor has not yet been assigned to the Project, and therefore no detailed information regarding the construction works associated with the Proposed Development is available.

4.6. Reasonable worst-case assumptions, based on a development of a similar type and scale, have therefore been made regarding the main construction activities scheduled to take place, the expected phasing and duration for each, and the type and usage of the associated construction equipment. In order to maintain a consistency of approach across other impact assessments being carried out in relation to the Proposed Development, the assumed construction details have been taken from the same development used to inform the basis for the traffic and air quality assessments, as supplied by Buro Happold3.

[2] BS 5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites – Part 1: Noise
[3] Buro Happold, Sandymoor South Phase 2 and Wharford Farm, 2021

4.7. Noise data for the various items of equipment associated with the construction phase were obtained from Annex C of BS 5228-1, which provides sound pressure data at a 10 m distance for a variety of plant items engaged in a various, typical construction activities. The sound pressure levels were converted into a sound power level and corrected for the assumed number of equipment items, and % on-times.

4.8. A noise model has been produced for the Proposed Development in the IMMI noise modelling software package. The corrected sound power levels were then entered into the noise model developed and used to predict the resultant level at the various noise sensitive receptor locations.

4.9. The assumed type and number of plant items, the % on-time assumed within the assessment, and the noise data associated with each plant item is included in Appendix C.

4.10. The main construction activities associated with the Proposed Development are: The main construction activities associated with the Proposed Development are:

- Demolition
- Site preparation
- Piling
- Foundations and concreting
- General building activities

4.11. There is only a small amount of demolition work required for the removal of the Masjid Abu Bakr Mosque and Lees Hall Playgroup building, located in the north-east corner of the site.

4.12. There is expected to be a significant amount of earth works involved in the preparation of the site, largely concentrated in the areas set aside for residential development and new roads.

4.13. While it is expected that the majority of the dwellings will be constructed on traditional strip footings, it is noted that some plots may require alternative piled foundations following earthworks regrade, where this results in fill depths greater than c. 2.5m. It has been assumed that, where it found that this is required, it would be achieved through rotary / CFA piling methods.

4.14. In order to provide a robust, worst-case assessment, it has been assumed that all equipment items associated with each phase could, at some point, be operating simultaneously at the closest point to a given receptor.

4.15. For demolition, the closest point will be the nearest façade of the to the Mosque and Playgroup building. Equipment for all other phases has been located at the closest point within the site area assigned to road and/or residential use, with the exception of site preparation which has been assumed will take place at any point within the red line boundary, and therefore equipment items have been placed at the closest point on the boundary to the respective receptor.

4.16. The location of construction equipment haul roads within the site have not yet been defined, it has therefore been assumed that the main haul route will follow the route of the Forge Lane access road to access the site, before turning into the central area of the site set aside for residential development and new roads.

4.17. The method of calculation for noise from construction vehicles using this route is the method for mobile plant using a regular well-defined route as described in Annex F of BS 5228-1:2009+A1:2014, which uses the following information:

- Sound power level of source (assumed as 108 dB(A) based on data for a 4-axle lorry, taken from the BS 5228-1 database);
- Number of vehicles per hour (assumed as 6 based on the construction traffic data supplied by the Project's traffic consultant);
- Average speed (assumed as a constant 16 km/hr, equivalent to 10 mph – note that the calculation methodology assumes that noise level increases as speed decreases, so this is considered a worst-case assumption); and
- Distance from the proposed construction vehicle route to the receptor identified for assessment.

CONSTRUCTION VIBRATION ASSESSMENT METHOD

4.18. Prediction of ground-borne vibration associated with the construction phase of the Proposed Development has been undertaken using the methodologies given in BS 5228-2[4].

4.19. Annex E of BS 5228-2 provides empirical formulae for predicting vibration levels at known distances from sources of vibration for various construction activities.

4.20. The need piling activities has not been confirmed, and if required it is expected that rotary / CFA piling method would be used, which is not anticipated to result in significant levels of

4 BS 5228-2:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration

vibration. The primary source of vibration associated with the construction phase is therefore expected to be use of vibratory rollers for ground compaction. Annex E of BS 5228-2 provides a method for calculating vibration levels from vibratory compaction based on the following:

- Maximum amplitude of drum vibration;
- Number of vibrating drums;
- Width of vibrating drum; and
- Distance to receptor measured along the ground.

4.21. The standard provides acceptable ranges for each of the source specific parameters listed. Since information regarding the specific compactors to be used is not yet available, an assessment has been undertaken using the upper (or lower) bound of each of the parameter ranges, as appropriate, to assess the worst case.

COMPLETED DEVELOPMENT NOISE ASSESSMENT METHOD

4.22. Noise effects associated with the completed development are expected to be limited to the noise produced by changes in traffic flow on the local road network as a result of the new houses and roads being proposed.

4.23. The community aspect of the development forms part of the outline application and no detailed designs have been proposed. For the purposes of this assessment it has been assumed the community facilities comprise the same scale and type of development as the Mosque and playgroup buildings being removed. . In that instance, it is considered that the net effect on noise would be negligible. Where alternative proposals are put forward for that area, further assessment would be required; this is discussed in more detail later in this report.

4.24. Noise from any potential changes in road traffic has been predicted using the methodology described within the CRTN memorandum[5], the standard method of traffic noise prediction used in the UK.

4.25. CRTN calculates road traffic noise levels in terms of the LA10,18hr index. In order to compare these results to the noise exposure thresholds described in later in this Chapter, the predicted free-field LA10,18hr values from the model have been corrected for façade effects by adding 2.5 dB and converted to LAeq,16hr by subtracting 2 dB.

[5] Calculation of Road Traffic Noise, Department of Transport (1988)

4.26. The information required for the prediction of road traffic noise using CRTN, including the Annual Average Weekday Traffic (AAWT) traffic flow values, the percentage of heavy vehicles and the average speed, have been provided by the traffic consultant for Proposed Development.

4.27. The traffic data was entered into the acoustic model, configured to implement the CRTN calculation method directly, to predict the resulting noise levels at the receptor locations.

4.28. Noise levels associated with traffic changes from both the construction and operational phases of the Proposed Development have been assessed.

4.29. Construction Road traffic noise levels have been predicted for the following traffic scenarios:

- Do Minimum[6] peak construction year (2023); and
- Do Something[7] peak construction year (2023);

4.30. Operational Road traffic noise levels have been predicted for the following traffic scenarios:

- Do Minimum 'opening year' (2023);
- Do Something 'opening year' (2023);
- Do Minimum future year (2030); and
- Do something future year (2030).

LIMITATIONS AND ASSUMPTIONS

4.31. All acoustic assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices made in setting-up the model, choosing the input data, and selecting the baseline data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

4.32. In order to take a robust approach to this assessment, reasonable worst-case, rather than central-estimate, assumptions have been used wherever possible.

4.33. Detailed information is not yet available regarding the type, numbers, and % on-time of construction equipment that will be employed for each activity. The assessment has been

[6] Without the implementation of the Proposed Development
[7] With the implementation of the Proposed Development

based on assumptions of the likely plant and equipment and their expected typical use over a working day.

5. SIGNFINCANCE OF EFFECTS

GENERAL APPROACH

5.1. The overarching approach to the identification and assessment of adverse noise effects is based on the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE), and the associated Planning Practice Guidance on Noise (PPG:N).

5.2. Fundamental to this approach are the aims that potentially adverse effects on health and quality of life resulting from noise from new developments should be mitigated and minimised and that significant adverse effects should be avoided.

5.3. Key to the identification of adverse, and significant adverse effects are the concepts of the Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL), introduced in the NPSE in 2010.

5.4. The LOAEL represents the threshold of noise exposure at and above which adverse effects may be expected. The SOAEL represents the threshold of noise exposure at and above which significant adverse effects may be expected. In the region between the LOAEL and the SOAEL, while adverse effects may be expected, these would not be considered significant. Furthermore, as stated in the NPSE, while reasonable steps should be taken to mitigate and minimise adverse effects, it does not mean that such adverse effects cannot occur Below the LOAEL threshold, no adverse effects would be expected, however the sound may still be heard and could, at levels close to the LOAEL threshold, cause some changes in behaviour and could affect the acoustic character of the area such that there is a small actual or perceived change in quality of life.

5.5. Current government policy does not include specific, quantified definitions of the LOAEL or SOAEL. The NPSE does note that the SOAEL is likely to be different for different sources of noise, for different receptors and at different times. Typically, thresholds to represent the LOAEL and SOAEL are taken from recognised guidance such as relevant British Standards, Regulations or research and guidance produced by the World Health Organisation, as well as accepted thresholds previously defined for other, similar, schemes.

5.6. This is described for the various sources of noise being assessed in the following sections.

CONSTRUCTION NOISE

5.7. The presence of a significant adverse effect associated with construction noise has been assessed using the thresholds set out in Table 3.

5.8. The threshold values are based on the guidance given within Annex E of BS 5228-1:2009+A1:2014 which provides criteria for assessing the potential significance of noise effects from construction on those exposed to it, and are expressed in terms of current Government Policy.

Table 3 Summary of LOAEL and SOAEL for Construction Noise

Effect	**Time Period**	**Threshold Values***
Lowest Observed Effect Level (LOAEL)	Day (07:00 – 19:00)	65
	Evening (19:00 –23:00)	55
	Night (23:00 – 07:00)	45
Significant Adverse Effect Level (SOAEL)	Day (07:00 – 19:00)	75
	Evening (19:00 –23:00)	65
	Night (23:00 – 07:00)	55
* These effects are expected to occur if the programme of works indicates that the relevant threshold values are likely to be exceeded over a period of at least one month		

5.9. As indicated by the note in the Table, there is a need to take account of the length of time for which the threshold values are exceeded in order to properly assess significance of any adverse effect from construction noise. Adverse effects are only considered to be significant where the predicted noise level exceeds the SOAEL, for a period of at least one month.

CONSTRUCTION TRAFFIC

5.10. The significance of construction traffic noise effects has been determined using the thresholds set out in Table 4; these values are based on the guidance in Table 3.17 of DMRB LA111.

Table 4 Descriptors of magnitude of construction traffic noise change

Semantic Descriptor of Magnitude of Adverse Impact	**Increase in $L_{A10,T}$ or $L_{Aeq,T}$ noise level dB(A)**
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0

Negligible	Less than 1.0
Note: Construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding: a) 10 or more days or nights in any 15 consecutive days or nights b) A total number of days exceeding 40 in any 6 consecutive months.	

CONSTRUCTION VIBRATION

5.11. Although the concepts regarding LOAEL and SOAEL in Government policy only specifically refer to noise exposure, it is helpful to adopt the same principles when assessing vibration impact and effect.

5.12. Table 5 sets out the construction vibration exposure thresholds based on the guidance within Annex B of BS 5228-2:2009+A1:2014.

Table 5 LOAEL and SOAEL thresholds for construction vibration

Effect	Threshold Value (PPV, mm/s)[a]
LOAEL	0.5
SOAEL	1.0[b]
Notes: a This is the level at a residential receptor b Guidance in BS 5228:2009+A1:2014 States that this level of exposure can be tolerated by those affected if prior warning and explanation has been given. It goes on to state that a level of 10 mm/s is unlikely to be tolerable in most buildings for any more than a very brief exposure.	

COMPLETED DEVELOPMENT NOISE

5.13. As discussed, it is expected that noise effects associated with the completed development will be limited to noise associated with increased road traffic flows, assuming the community use allocation in the north-east corner of the site is set aside for a development of the same type and scale as the existing Mosque and playgroup buildings.

5.14. In line with guidance given in the DMRB LA111[8], the significance of adverse road traffic noise effects associated with the operation of the site has been based on the change in noise exposure between the Do Minimum and the Do Something traffic scenarios.

[8] Design Manual for Roads and Bridges (DMRB) - LA 111 Noise and Vibration – Revision 1 (2020)

5.15. The noise exposure thresholds are set out in Table 6. These have been derived from the effect that road traffic noise can have on those affected[9] and are expressed in terms of Government policy.

Table 6 LOAEL and SOAEL for operational traffic noise

Effect	Time period	Threshold Values ($L_{Aeq,T}$)[a,b]
Lowest Observed Effect Level (LOAEL)	Day (07:00-23:00)	50
	Night (23.00-07.00)	40
Significant Adverse Effect Level (SOAEL)	Day (07:00-23:00)	65
	Night (23.00-07.00)	55

Notes:
[a] This is the average daily value at a position one metre from a residential building façade containing a window, ignoring the effect of an acoustic reflection from that façade.
[b] For the night-time period of 23.00 – 07.00, the relevant noise indicator is L_{night}.

5.16. If the LOAEL threshold is exceeded, the data in Table 7 sets out how the magnitude of the impact is described, taking account of the change in daytime noise exposure at the receptor and the resulting 'do something' exposure level.

Table 7 Descriptors of magnitude of daytime road traffic noise change

Magnitude of Impact	Change in Exposure	
	If resulting exposure at receptor between SOAEL and LOAEL	If resulting exposure at receptor is at SOAEL or Greater
No Change	0	0
Negligible	Up to 2.9 dB	Up to 0.9 dB
Minor	3.0 – 4.9 dB	**1.0 – 2.9 dB**
Moderate	5.0 – 9.9 dB	**3.0 – 4.9 dB**
Major	10.0 dB and over	**5.0 dB and over**

5.17. Whether or not a significant adverse effect is expected to occur in terms of daytime road traffic noise is determined by comparing the predicted 'Do Something' noise level (with the Proposed Development) with the LOAEL and SOAEL values shown in Table 6, and also considering the increase in noise due to the Proposed Development. If the result for any receptor falls in the categories shown by the shaded boxes (with text in bold) in Table 7,

[9] Guidelines for Community Noise, WHO (1999), Night Noise Guidelines for Europe, WHO (2009), Noise Insulation Regulations 1975 (as amended) and best practice from other projects such as the A14 Developmental Consent Order Application.

that indicates that the property is regarded as experiencing a significant adverse effect with respect to Government policy due to an increase in road traffic noise.

5.18. If the night-time LOAEL threshold is exceeded, the data in Table 8 sets out how the magnitude of the impact is described taking account of the change in night-time noise exposure and the resulting exposure.

Table 8 Descriptors of magnitude of night-time road traffic noise change

Magnitude of Impact	**Change in Exposure**	
	If resulting exposure at receptor between SOAEL and LOAEL	**If resulting exposure at receptor is at SOAEL or Greater**
No Change	0	0
Negligible	Up to 0.9 dB(A)	Up to 0.9 dB(A)
Minor	1 – 2.9 dB(A)	**1.0 – 2.9 dB(A)**
Moderate	3.0 – 4.9 dB(A)	**3.0 – 4.9 dB(A)**
Major	5.0 dB(A) and over	**5.0 dB(A) and over**

5.19. Whether or not a significant adverse effect is expected to occur is determined in the same way previously described for the day time period, referencing the descriptors in Table 8.

6. BASELINE CONDITIONS

EXISTING BASELINE

6.1. The existing noise environment at the receptor locations has been characterised by way of a baseline noise survey. The survey was undertaken between 31st August and 2nd September, and comprised a combination of long-term unattended measurements and short term attended samples.

6.2. The primary purpose of the survey was to determine existing levels of road traffic noise affecting the local receptors. As such the survey was carried out in line with the principles of the CRTN measurement method. Specifically, the 'comparative measurement' procedure described in section 3 of the CRTN memorandum was used whereby the $L_{A10,\ 18\ hour}$ is measured directly at a control point via long-term monitoring. Shorter term sample measurements are then taken at other 'satellite' locations and used to correct the control point noise level to derive an $L_{A10,\ 18\ hour}$ level at each of the satellite locations.

6.3. When undertaking a noise survey, in general it is not practicable to undertake baseline monitoring at every noise sensitive receptor. Therefore, monitoring locations are selected which are considered to be representative of the affected receptor locations. It is common, therefore, for a monitoring location to relate to more than one receptor location. Figure 3 shows the measurement locations used for the baseline survey.

6.4. Note that position L2 was used to characterise the baseline noise environment at Ravenshall School and at the rear gardens of the properties along Ravenshall Road, and as the control point used to derive the $L_{A10,\ 18\ hour}$ at position L3.

6.5. Table 9 presents the measured $L_{A10,\ 18\ hour}$ levels along with derived the $L_{Aeq,\ 16\ hour}$ levels used in the completed development impact assessment detailed later in this report. Note the

6.6. Note that position L6 was used to determine existing noise levels in the vicinity of the new dwellings proposed as part of the Dewsbury Riverside development, in order to assess the suitability of the site for residential development (the results of that assessment are included in Appendix B).

Table 9 Baseline survey data used in the assessment

Measurement Location	L10, 18hour	LAeq, 16 hr
ST1	72	72.8
LT2	47	47.7
ST3	42	42.9
LT4	45	45.5
ST5	46	46.5
ST7	65	65.9

Figure 3 Baseline monitoring locations

FUTURE BASELINE

6.7. In the absence of the Proposed Development, the evolution of noise within and around the proposed Dewsbury Riverside development site, is very likely to continue to be governed by changes in the current dominant sources of noise i.e. road traffic.

6.8. The evolution of the baseline road traffic noise has been determined through calculation based on the prediction methodology given in CRTN, and on road traffic forecasts for future baseline assessment years provided by the Project's traffic consultant.

7. CONSTRUCTION ASSESSMENT

ON-SITE WORKS

7.1. As a precautionary approach, unmitigated noise predictions have been undertaken and unmitigated noise effects have been identified for each task. It has been assumed that all equipment items associated with each respective activity are in operation at the closest realistic point to each receptor.

7.2. Table 10 presents the results of the construction noise assessment for each of the tasks individually and Table 11 presents the levels from each task cumulatively with the haul road noise; each table provides an indication as to whether the predicted noise levels exceed the respective LOAEL or SOEAL.

7.3. It is expected that construction activities will take place within the following time periods:

- Monday – Friday: 8 am – 6 pm; and
- Saturday: 9 am – 1 pm.

7.4. The potential for a significant adverse effect has therefore been assessed against the daytime threshold values given in Table 3.

Table 10 Summary of construction noise assessment, individual tasks

Receptor	Resulting Exposure at Receptor, dBA					
	Demolition	**Site Prep**	**Piling**	**Concreting**	**General Build**	**Haul Road**
R1	54 (<LOAEL)	85 (>SOAEL)	70 (>LOAEL &< SOAEL)	68 (>LOAEL &< SOAEL)	71 (>LOAEL &< SOAEL)	51 (<LOAEL)
R2	44 (<LOAEL)	64 (<LOAEL)	62 (<LOAEL)	59 (<LOAEL)	62 (<LOAEL)	53 (<LOAEL)
R3	46 (<LOAEL)	66 (>LOAEL &< SOAEL)	58 (<LOAEL)	55 (<LOAEL)	58 (<LOAEL)	51 (<LOAEL)
R4	53 (<LOAEL)	65 (>LOAEL &< SOAEL)	66 (>LOAEL &< SOAEL)	63 (<LOAEL)	67 (>LOAEL &< SOAEL)	48 (<LOAEL)
R5	37 (<LOAEL)	40 (<LOAEL)	40 (<LOAEL)	38 (<LOAEL)	40 (<LOAEL)	44 (<LOAEL)
R6	86 (>SOAEL)	63 (<LOAEL)	51 (<LOAEL)	48 (<LOAEL)	51 (<LOAEL)	52 (<LOAEL)

Table 11 Summary of effects during construction, cumulative with haul roads

Receptor	Resulting Exposure at Receptor, dBA				
	Demolition + Haul Road	**Site Prep + Haul Road**	**Piling + Haul Road**	**Concreting + Haul Road**	**General Build + Haul Road**
R1	56 (<LOAEL)	85 (>SOAEL)	70 (>LOAEL &< SOAEL)	68 (>LOAEL &< SOAEL)	71 (>LOAEL &< SOAEL)
R2	54 (<LOAEL)	64 (<LOAEL)	63 (<LOAEL)	60 (<LOAEL)	63 (<LOAEL)
R3	52 (<LOAEL)	66 (>LOAEL &< SOAEL)	59 (<LOAEL)	56 (<LOAEL)	59 (<LOAEL)
R4	54 (<LOAEL)	65 (>LOAEL &< SOAEL)	66 (>LOAEL &< SOAEL)	63 (<LOAEL)	67 (>LOAEL &< SOAEL)
R5	45 (<LOAEL)	45 (<LOAEL)	45 (<LOAEL)	45 (<LOAEL)	45 (<LOAEL)
R6	86 (>SOAEL)	63 (<LOAEL)	55 (<LOAEL)	53 (<LOAEL)	56 (<LOAEL)

7.5. The majority of construction activities produce noise levels below LOAEL at all receptor locations.

7.6. Site preparation works at the Ravensthorpe Road receptors that back on to the site boundary, and demolition works at the property neighbouring the Masjid Abu Bakr Mosque and Lees Hall Playgroup building being demolished are predicted to have the potential to produce noise levels that are in excess of the SOAEL. This is due to the proximity of the site boundary to the rear gardens of those properties.

7.7. Only a limited amount of demolition works are required to remove the Masjid Abu Bakr Mosque and Lees Hall Playgroup building. While a demolition programme is not available at this stage, it is anticipated that the bulk of the works are likely to take place over the course of a few days.

7.8. The highest noise levels associated with site preparation works at the Ravensthorpe Road receptors occur when the works are taking place immediately adjacent to the rear gardens of those properties. While some earth works may take place at that location, in reality, the bulk of the site preparation works will be concentrated around the areas set aside for residential development. When the works are at that location, noise levels are at least 12 dB lower at the Ravensthorpe Road properties than the figures shown in Table 10, and below the SOAEL.

7.9. It should be further noted that the noise levels given in Table 10 are based on all the equipment associated with the respective activity operating simultaneously at the closest

point to the receptors. Therefore, the period for which these levels would actually be experienced is extremely limited, if they occur at all.

7.10. The guidance in BS 5228-1 indicates that a significant adverse effect is likely to be experienced if the threshold is exceeded for a period of one month or more. It is therefore considered likely that, while noise levels may, in the absolute worst case, exceed the SOAEL for a short period, it would not result in a significant adverse effect.

7.11. As indicated in Table 10, there are a number of instances where there is potential for noise levels, in a worst-case, exceed the LOAEL (but not the SOAEL).

7.12. The Planning Practice Guidance on Noise (PPG:N) which accompanies the NPSE provides guidance on the potential effects of noise exposure at levels corresponding to the LOAEL and SOAEL as described in the NPSE. The guidance confirms that adverse effects between LOAEL and SOAEL should be mitigated and reduced to a minimum. It is anticipated that any adverse effects in these cases can be suitably mitigated through application of general good practice; this is discussed further later in this report.

7.13. The cumulative effect of noise from heavy vehicles using the site access haul road is not predicted to be significant and does not result in a change in significance of effect for any scenario.

CONSTRUCTION TRAFFIC NOISE

7.14. DMRB LA111 sets out scoping criteria for determining the need for carrying out a specific assessment of noise levels associated with changes to traffic flow due to construction.

7.15. The guidance document states that a specific assessment is required if either:

- The construction traffic noise generated by the project has the potential to adversely affect any noise sensitive receptors; or
- There any are noise receptors where there would be a reasonable stakeholder expectation that a construction [traffic] noise assessment would be undertaken.

7.16. It is considered that there is potential for an adverse effect at a noise sensitive receptor that warrants detailed assessment where there is a reasonable expectation of an increase in noise levels in excess of 1 dB.

7.17. An initial screening exercise was carried out using the traffic data supplied by the Project's traffic consultant. From the screening exercise, it was found that on all road links assessed, the % increase in HGV composition is expected to be much less than 1% and is therefore

not expected to produce an increase in noise level in excess of 1 dB. It is therefore considered that any adverse effects associated with construction traffic noise will be negligible at all receptors.

CONSTRUCTION VIBRATION EFFECTS

7.18. The most significant source of vibration being introduced to the environment during construction will be vibratory rollers used for ground compaction. An assessment of vibration levels arising from ground compaction has been undertaken using the following worst case assumptions:

- Dual drum vibratory roller;
- 0.75 m drum width
- 1.72 mm maximum amplitude of drum vibration

7.19. Based on these worst-case assumptions, according the prediction methodologies given in BS 5528-2 vibratory compaction does not produce levels of vibration at or above a level likely to cause significant adverse effects beyond a distance of approximately 70 m from the vibratory roller, with a 95% probability.

7.20. The majority of receptors are significantly further than 70 m away from the areas of the Proposed Development site in which vibratory compaction is likely to occur. The exception to this are the receptors on Ravensthorpe Road.

7.21. Ground compaction by vibratory roller may take place as close as 55 m to the Ravensthorpe Road receptors during the works to construct the site access roads.

7.22. An assessment of the vibration levels likely to be produced by vibratory rollers at R1 has been undertaken using the method described in Annex E of BS 5228-2; the results are presented in Table 12. The calculation method is derived from empirical data and includes a scaling factor based on the probability of the predicted vibration level being exceeded, at set intervals of 5%, 33% and 50%.

Table 12 Summary of construction vibration assessment

	Resulting Vibration Level at Receptor, PPV ms^{-1}, at given probability of the level being exceeded		
Receptor	**5%**	**33%**	**50%**
R1	2.12	1.10	0.57

7.23. From the assessment, there is a 50% probability of the SOAEL not being exceeded at all. There is, however, at least a 33% probability that SOAEL will be exceeded.

7.24. It should be noted that, while the levels of vibration indicated in the Table that exceed the SOAEL are likely to be perceptible, they are significantly below the level at which there is any potential for damage to buildings.

7.25. Furthermore, the levels in the table are based on the worst-case assumptions previously discussed and only apply to the point at which the vibratory roller is closest to the receptor. Therefore, the period of time for which there is any chance of the SOAEL being exceeded is extremely limited, if those levels of vibration occur at all.

8. COMPLETED DEVELOPMENT ASSESSMENT

NOISE EFFECTS ASSOCIATED WITH THE COMMUNITY USE ALLOCATION

8.1. It has been assumed that, at this stage, the community use allocation will be used for a development of the same type and scale as the existing Mosque and Playgroup facilities. In this instance, it is considered that the impact on noise effects will be negligible.

8.2. Where any future application for community facilities in that area include proposals that constitute a significant change in the design, scale, nature, or location of the existing use, then they should be accompanied by a specific noise impact assessment to assess and appropriately mitigate any associated adverse effects.

COMPLETED DEVELOPMENT TRAFFIC EFFECTS

8.3. With respect to operational assessment, DMRB LA111 sets out scoping criteria for determining the need for carrying out a specific assessment of noise levels associated with changes to traffic flow. Regarding the Proposed Development, the most pertinent of these criteria states that a specific assessment would be required where “the project likely to cause a change in the BNL of 1dB LA10,18hr in the do-minimum opening year (DMOY) compared to the do-something opening year (DSOY)”.

8.4. Note: the BNL refers to the Basic Noise Level, and essentially refers to the noise produced by a given road scheme. Previous iterations of the DMRB guidance further defined the traffic flow conditions likely to produce a minimum 1 dB change in the BNL, as any roads where a greater than 25% increase in traffic flow is expected.

8.5. An initial screening exercise was carried out based on this criterion using the traffic data supplied by the Project’s traffic consultant. From the screening exercise, it was found that only 1 of the links included in the traffic assessment (Forge Lane) was subject to changes in traffic flow likely to produce an increase in noise levels in excess of 1 dB. A detailed assessment of the noise levels associated with changes to traffic flows along this road link was therefore carried out to assess the likely impact at the property on the corner of Forge Lane and Lees Hall Road (R7).

8.6. For new roads being introduced as part of the Proposed Development, since there are no existing traffic flows on which to base the assessment, the Basic Noise Level (BNL), as defined in CRTN, was calculated, and compared with the threshold values given in Table 6.

8.7. It should be noted that no traffic data was supplied for the proposed road egressing the development site to the south-west. Therefore, calculations have been based on the data pertaining to the road leading off Forge Lane, since this is considered likely to be the busiest road associated with the development and as such provides a worst-case assessment,.

8.8. Tables 13 - 16 present the results of the completed development traffic assessment for changes in traffic flow on existing roads.

8.9. Tables 17 – 18 present the result relating to the new roads being introduced as part of the Proposed Development. On these roads, the night time traffic flows are significantly below lower limit of the CRTN calculation method, and therefore specific noise levels have not been calculated. Similarly, the forecast daytime traffic flow on the new development road that will run behind the Ravensthorpe Road receptors is also significantly below lower limit of the CRTN calculation method. In these cases, due to the low traffic flows involved, it is considered that the resulting effect from noise will be negligible.

Table 13 Summary of operational traffic noise assessment – daytime, opening year, existing road links

Receptor	Do Minimum Opening Year Noise Level, dB $L_{A10,16hr}$	Do Something Opening Year Noise Level, dB $L_{Aeq,\ 16hr}$	Difference, dB	Magnitude of impact
R7	58.6	59.4 (>LOAEL & <SOAEL)	0.8	Negligible

Table 14 Summary of operational traffic noise assessment – night-time, opening year, existing road links

Receptor	Do Minimum Opening Year Noise Level, dB $L_{A10,16hr}$	Do Something Opening Year Noise Level, dB $L_{Aeq,\ 16hr}$	Difference, dB	Magnitude of impact
R7	46.8	47.9 (>LOAEL & <SOAEL)	1.1	Minor

Table 15 Summary of operational traffic noise assessment – daytime, future year, existing road links

Receptor	Do Minimum Opening Year Noise Level, dB $L_{A10,16hr}$	Do Something Opening Year Noise Level, $L_{Aeq,\ 16hr}$	Difference, dB	Magnitude of impact
R7	59.2	60.0 (>LOAEL & <SOAEL)	0.8	Negligible

Table 16 Summary of operational traffic noise assessment – night-time, future year, existing road links

Receptor	Do Minimum Opening Year Noise Level, dB $L_{A10,16hr}$	Do Something Opening Year Noise Level, dB $L_{Aeq,\ 16hr}$	Difference, dB	Magnitude of impact
R7	48.7	48.4 (>LOAEL & <SOAEL)	0.7	Negligible

Table 17 Summary of operational traffic noise assessment – daytime, opening year, Proposed Development road links

Receptor	Do Something Opening Year Noise Level, dB $L_{A10,16hr}$	Existing baseline noise level, dB $L_{Aeq,\ 16hr}$	Difference, dB	Magnitude of impact
R2	52.4 (>LOAEL & <SOAEL)	47.7	4.7	Minor
R3	49.1 (<LOAEL)	42.9	N/A	Negligible
R4	51.0 (>LOAEL & <SOAEL)	45.5	5.5	Moderate
* Based on traffic flows significantly below the lower bound of the CRTN calculation method				

Table 18 Summary of operational traffic noise assessment – daytime, future year, Proposed Development road links

Receptor	Do Something Future Year Noise Level, dB $L_{A10,16hr}$	Existing baseline noise level, dB $L_{A10,16hr}$	Difference, dB	Magnitude of impact
R2	51.3 (>LOAEL & <SOAEL)	47.7	3.6	Minor
R3	48.0 (<LOAEL)	42.9	N/A	Negligible
R4	50.0 (>LOAEL & <SOAEL)	45.5	4.5	Minor
* Based on traffic flows significantly below the lower bound of the CRTN calculation method				

8.10. The predicted daytime impacts show that at all residential receptors, the increased road traffic noise on existing roads due to the Proposed Development will have a negligible impact for both opening year and future year scenarios.

8.11. The night-time assessment indicates that, at all residential receptors, the Proposed Development will have a minor impact for opening year, and a negligible impact for the future year scenario.

8.12. Noise levels on new roads being introduced as part of the Proposed Development are not expected to exceed the SOAEL at any receptor. Noise levels may marginally exceed the LOAEL at receptors R2 and R4 for both the opening year and future year scenarios. However, in the case of the opening year scenario, and the future year scenario at receptor R2, given the excess above the existing baseline is relatively small (< 5 dB), only a minor impact is expected.

8.13. For the opening scenario at receptor R4 (the Isolated Farm House to south of the development site) the excess above the existing baseline is marginally over the 5 dB threshold, indicating a moderate impact may occur.

8.14. This is based on road traffic flow on the proposed road egressing the development site to the south-west. As previously noted, no specific traffic data was supplied for this road and

the assessment has been based on the worst-case assumption that all the traffic leading off Forge Lane will continue onto south-west egress road. In reality, some of that traffic will likely go into the development itself, and so the traffic flow and associated noise levels will likely be lower than stated in the Table. Furthermore, it is noted that the moderate effect is only temporary in nature with the traffic data indicating the effect will reduce to a minor adverse under the 'future do something' scenario.

8.15. Therefore taking account of the fact that, as a worst case, the assessment predicts only a 1 dB excess above the LOAEL at a single isolated property, it is considered that the existence of a temporary moderate adverse effect should not be a barrier to the development in this case, and further mitigation is not required.

9. MITIGATION

CONSTRUCTION NOISE

9.1. Under the assumed absolute worst-case assessment presented previously in this document, the potential for a significant adverse effect due to construction noise has been identified from site preparation activities at the Ravensthorpe Road receptors, and therefore some form of mitigation to reduce potential impacts at receptor locations may be required.

9.2. It should be emphasised that the potential for a significant adverse effect assumes an absolute worst-case scenario of all plant associated with site preparation operating simultaneously at the closest point to the Ravensthorpe Road receptors.

9.3. As the construction method is not finalised at this outline stage, detailed mitigation measures that follow the principles discussed in this report will be provided as part of reserved matters. However, as an example of what may be achieved, erection of close board hoarding around the site perimeter would reduce the noise levels up to 10 dB below those levels indicated in Table 10 (assuming it would be possible to block line of sight between the sources of noise and the receptors) which would be enough to reduce the effect below the SOAEL.

9.4. In order to identify where specific mitigation is required, a Construction Environmental Management Plan (CEMP) will be issued to KC and will define the measures necessary to control various potential adverse effects during the construction programme.

9.5. The CEMP will further refine the assessment of likely adverse effects based on specific detailed information from the construction method statement, and would include:

- A description of the works and site layout plan;
- A works programme;
- Details of the demolition and construction methods to be used;
- The proposed hours of working;
- Details of the equipment expected to be used for the works;
- Predictions of the expected levels of construction noise at sensitive receptors based on the principles of the methodology contained within Annex F of BS 5228-1:2009+A1:2014[10];

[10] BS 5228-1:2009+A1:2014 – Code of Practice for noise and vibration control on construction and open sites, Part 1: Noise

- Details of the measures that will be employed to manage construction noise so that any predicted significant adverse effects are avoided, and any adverse effects are mitigated and minimised as required by Government policy. The measures will be based on the application of best practicable means (BPM); and
- Details of the any noise and vibration monitoring regime required for the works.

9.6. Regarding any monitoring regime that may be required to manage noise levels generated during the works, typically noise and vibration monitoring stations are installed in locations representative of the nearest noise sensitive receptors that are likely to experience significant adverse impacts (i.e. a review of the works activities would be under taken in advance to identify key noise generating activities relative to sensitive receptors). These monitoring stations have the ability to send alerts to site managers if noise levels are likely to exceed a pre-agreed noise limit based on current activity. If an alert is received the site manager would review the activities taking place on site and where appropriate stop all working and identify whether quieter working methods can be adopted or other mitigation employed to assist in the reduction of noise or vibration emissions.

9.7. In general, construction noise and vibration would be managed using best practicable means (BPM), i.e. the use of all reasonable measures to minimise construction noise and vibration. This would follow the principles of the guidance within BS 5228-1 and may include the following where appropriate:

- Each item of equipment used for the works complies with the noise limits quoted in the relevant European Commission Directive 2005/88/EC and regulation (EC) 219/2009/ United Kingdom Statutory (SI) 2005/3525. The Noise Emission in the Environmental by Equipment for Use Outdoors Regulations (as amended).
- Plant and equipment liable to create noise whilst in operation is, as far as reasonably practicable, located away from sensitive receptors. The use of barriers to absorb and/or deflect noise away from noise sensitive areas are employed where required and reasonably practicable. For maximum benefit any screening should be located close to the source of noise or to the noise sensitive receptor.
- All plant, equipment and noise control measures applied are maintained in good and efficient working order and operated such that noise emissions are minimised as far as reasonably practicable. Any plant, equipment or items fitted with noise control equipment found to be defective will not be operated until repaired.

- Where reasonably practicable, fixed items of construction equipment will be electrically powered in preference to being diesel or petrol driven.
- Vehicles and mechanical equipment utilised on site for any activity associated with the construction are fitted with effective exhaust silencers and are maintained in good working order with sustained efficient performance and operated in a manner such that noise emissions are controlled and limited as far as reasonably practicable.
- Machines in intermittent use are shut down or throttled down to a minimum during periods when not in use. Static noise-emitting equipment operating continuously are housed within a suitable acoustic enclosure where appropriate.
- Site personnel instructed on BPM to reduce noise and vibration as part of their induction training and as required prior to specific work activities;
- The Hours of working should be planned, and account should be taken of the effects of noise upon persons in areas surrounding site operations and upon persons working on site.
- Use rubber linings in for example chutes and dumpers to reduce impact noise
- Materials should be lowered wherever practical and should not be dropped
- Start-up plant subsequently rather than all together
- Liaison with residents in advance of works commencing to provide information regarding the programme

9.8. It is expected that, by use of BPM, the noise from construction activities is likely to be attenuated so that the predicted construction noise levels would be below the SOAEL and so not result in a significant adverse effect in all instances, including any out of hours works.

CONSTRUCITON VIBRATION

9.9. The construction vibration assessment has indicated the potential for an exceedance of the SOAEL for a limited period, at the Ravenshall Road receptors. This is based on worst case assumptions. The CEMP will further refine the construction vibration assessment once the construction methodology has been defined.

9.10. It is noted that the while highest predicted levels of vibration are significantly below the level at which building damage is a concern, they will likely be perceptible. BS 5228-2 notes that higher levels of vibration are more likely to be considered acceptable, if prior warning and explanation is given.

9.11. Where the potential for exceedance of the SOAEL is confirmed, a programme of community liaison will be undertaken to inform affected residents of the details and duration of the works and vibration monitoring will be undertaken to ensure the highest predicted levels of vibration are not exceeded.

COMPLETED DEVELOPMENT

9.12. Since no receptor is expected to experience more than a minor adverse effect due to operation of the Completed Development, no mitigation is expected to be required.

9.13. As previously discussed, where any proposals for the community facilities allocation in the north-east corner of the site include a significant change in the design, scale, nature, or location of the existing use, then they should be accompanied by a specific noise impact assessment to assess and appropriately mitigate any associated adverse effects.

10. CONCLUSIONS

10.1. Vanguardia Ltd has been instructed to undertake a noise and vibration impact assessment for the proposed development of land, located approximately 2km to the south-west of the town centre of Dewsbury in West Yorkshire, for residential use.

10.2. The completed development is not expected to introduce any significant sources of vibration; vibration effects associated with the completed development were therefore scoped out of the assessment.

10.3. This impact assessment has identified the relevant national and local policy, guidance and standards to assess the potential noise impacts of the Proposed Development during both the construction and operational phases. The overall approach is in line with national policy on noise, as set out in the UK Department for the Environment, Food and Rural Affair's 'Noise Policy Statement for England' and the accompanying Planning Practice Guidance on Noise.

10.4. Baseline conditions at the site were determined by way of a baseline noise survey to determine existing levels of road traffic noise.

10.5. The construction phase may give rise to a significant adverse noise effect at the Ravensthorpe receptors during site preparation, and at the dwelling immediately adjacent to Bakr Mosque and Lees Hall Playgroup building (410 Lees Hall Road) during demolition of those buildings. However, it has been noted that this is based on the absolute worst-case assumption of all equipment items being in operation at the closest point to the receptor. Furthermore, it is likely that the highest noise levels associated with this activity will only be present for a few days. Where this is confirmed, in accordance with the guidance in BS 5228-1, this would not constitute a significant adverse effect, due its very temporary nature

10.6. Following application of appropriate mitigation, it is considered that no significant adverse effect will occur during the construction phase.

10.7. The assessment concluded that, based on the assessment of operational road traffic noise levels, the completed development is unlikely to give rise to any significant adverse noise effects. This assumes that the community use allocation in the north-east corner of the site will be set aside for a development of similar type and scale as the existing Mosque and playgroup buildings.

10.8. Where alternative proposals are put forward for that allocation, which constitute a significant change in the design, scale, nature, or location of the existing use, then they should be

accompanied by a specific noise impact assessment to assess and appropriately mitigate any associated adverse effects.

APPENDIX A - ACOUSTIC TERMS GLOSSARY

DECIBELS DB

Noise is commonly defined as unwanted sound. The range of audible sound is from 0 dB to 140 dB, which is taken to be the threshold of pain. The sound pressure detected by the human ear covers an extremely wide range. The decibel (dB) is used to condense this range into a manageable scale by taking the logarithm of the ratio of the sound pressure and a reference sound pressure.

'A' WEIGHTED DECIBELS DB(A)

1.1. The frequency response of the ear is usually taken to be about 18Hz (number of oscillations per second) to 18,000Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than at the lower and higher frequencies, and because of this, the low and high frequency component of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most used and which correlates best with the subjective response to noise, including that of music, is the dB(A) weighting. This electronic filter matches the variation in the frequency sensitivity of the meter to that of the human ear. This is an internationally accepted standard for noise measurements.

EQUIVALENT CONTINUOUS SOUND LEVEL LAEQ

The subjective response to a noise is dependent not only upon the sound pressure level and its frequency, but also its intermittency. Various indices have been developed to try and correlate annoyances with the noise level and its fluctuations. The parameter used for this measure is the Equivalent Continuous Sound Pressure Level (L_{Aeq}). The A-weighted sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound under investigation. In essence, the L_{Aeq} provides a single value to express the average sound energy over the measurement period and is the most widely used indicator for environmental noise.

The decibel scale is logarithmic and therefore when two noise sources are present together, they have to be combined logarithmically. Therefore, when two sound sources of the same sound pressure level are combined the resultant level is 3 dB(A) higher than the single source. However, in subjective terms the ear can distinguish a difference in 'loudness' between two simple noises sources when there is a 3 dB(A) difference between

them. Loudness, not a measure of annoyance. Again for simple sources, when two sounds differ by 10 dB(A) one is said to be twice as loud as the other.

OTHER NOISE UNITS:

$L_{A10,T}$: This is the 'A' weighted noise level exceeded for 10% of the measurement period,T. Typically used to describe traffic noise.

$L_{A90,T}$: This is the 'A' weighted noise level exceeded for 90% of the measurement period,T. This is normally used to describe the background noise.

Façade Level: The sound level at a position 1 m in front of a reflecting façade of a building. The façade noise level is assumed to be 3 dB(A) higher than the level measured or predicted at an equivalent position away from the noise reflected from the building façade i.e. in the free-field.

Free-field Level: The sound level in an open area well away from any buildings or other sound reflecting surfaces other than the ground. Generally the minimum distance from building facades for free-field measurements is taken to be 3.5 m.

BS414:2014 TERMINOLOGY

Background Noise Level: The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval. Expressed as LA90,T and generally considered to be the average minimum noise level.

Ambient Noise Level: Totally encompassing sound in a given situation at any given time interval and usually composed of sound from many sources near and far. Usually expressed in terms of LAeq,T

Residual Noise Level: The ambient noise remaining at a given position in a given situation where the specific noise source is suppressed to such a degree that it does not contribute to the ambient noise. Expressed in terms of LAeq,T

Specific Noise Level: The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source (source being assessed) over a given reference time interval (LAeq,Tr)

Rating Noise Level: The specific noise level plus any adjustment for the characteristic features of the noise. Expressed in terms of LAr,Tr. The standard indicates that a

correction should be added to the noise if it was tonal, impulsive or irregular enough to attract attention.

OBSERVED EFFECTS

The Noise Policy Statement for England (2010) defines several key terms in relation to the observed effects of noise. The three key terms are defined below;

No Observed Effect Level (NOEL): 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.

No Observed Effect Level (NOAEL): This is the level below which no adverse effect can be detected. Noise can be heard, but does not cause any change in behaviour.

Lowest Observed Adverse Effect Level (LOAEL): This is the level above which adverse effects on health and quality of life can be detected.

Significant Observed Adverse Effect Level (SOAEL): This is the level above which significant adverse effects on health and quality of life occur.

APPENDIX B IMPACT OF BASELINE NOISE ENVIRONMENT ON PROPOSED NEW RESIDENTIAL DWELLINGS – SITE SUITABILITY

INTRODUCTION

This appendix provides an assessment of the noise levels that would be experienced at the residential dwellings proposed as part of the Dewsbury Riverside development. Figure B1 displays the proposed indicative land uses for the development.

The residential buildings proposed for the central area of the site are considered sensitive with respect to noise.

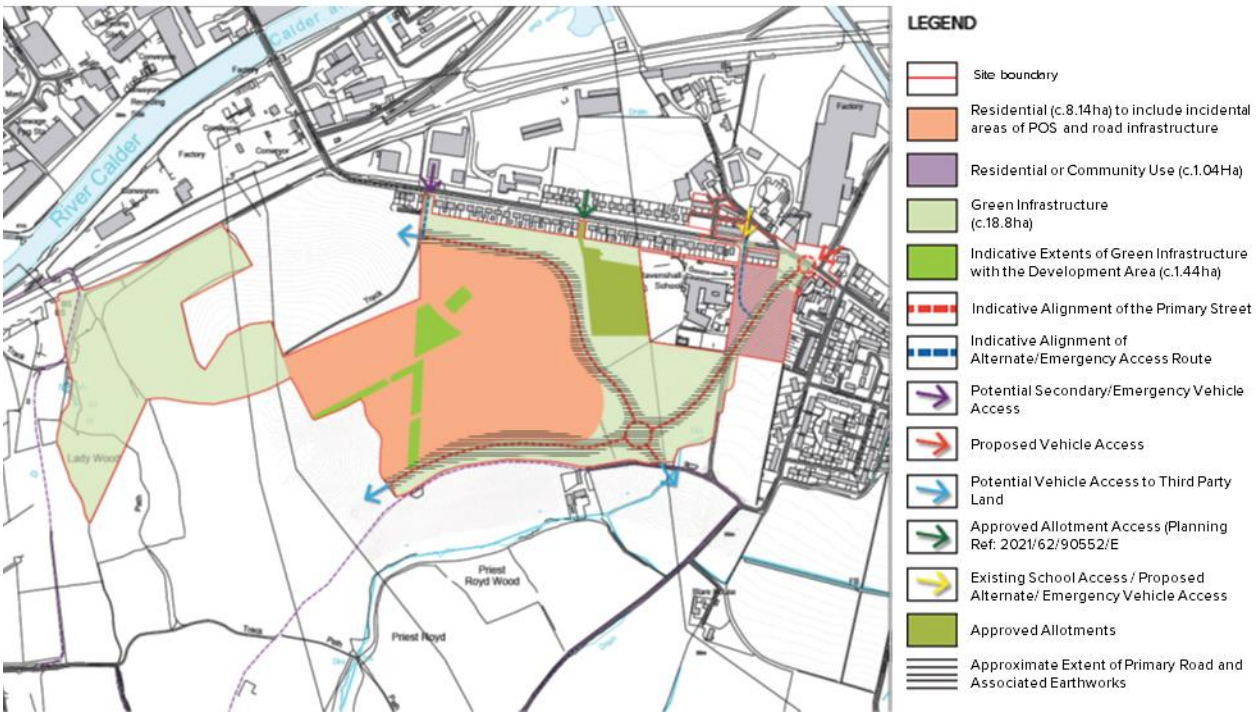

Figure B1 – Proposed land uses for proposed development

POLICY AND GUIDANCE

ProPG; Planning & Noise – New Residential Development

The ProPG provides a recommended approach to the management of noise within the planning system in England for new residential development. The approach consists of two stages:

- Stage 1 provides an initial noise risk assessment of the proposed development site based on the existing levels of noise;
- Stage 2 is the consideration of four elements, including the demonstration of a good acoustic design

process, observation of internal noise level guidelines and external amenity noise levels. It makes reference to the guideline noise levels given BS 8233 and the WHO Guidelines for Community Noise, both discussed further below.

BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

BS 8233:2014 Guidance on sound insulation and noise reduction for buildings provides information on the design of buildings in order that the internal acoustic environment is appropriate to the required function(s) of the space. Section 7 of the document contains the following guidance regarding desirable internal ambient noise levels for dwellings:

Table B1 – BS 8233:2014 desirable indoor ambient noise levels for dwellings

Activity	Location	07:00-23:00	23:00-07:00
Resting	Living Room	35 dB LAeq,16hr	-
Dining	Dining Room/area	40 dB LAeq,16hr	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq,16hr	30 dB LAeq,8hr

The table is appended with several notes. Most relevant are the following:

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,F, depending on the character and number of events per night. Sporadic noise events could require separate values.

It should be noted that the consideration of night-time internal noise levels based on external LAmax noise levels, which represent short noise "events", is typically the primary factor in the specification of suitable façade constructions or glazing types, rather than the LAeq,8hr night-time value given in Table 1 above, which can be considered more similar to an average noise level over the full night-time period.

NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

Ventilation typically refers to whole dwelling ventilation for the supply of fresh air to habitable rooms as defined in the Building Regulations guidance document Approved Document F. It is not intended to provide mitigation of overheating, for which alternative means should be considered to enhance the comfort of any future occupants.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

The ProPG reflects the guidance given in Note 7 of BS 8233 by stating that if internal noise levels exceed the desirable indoor ambient noise levels in Table 1 by more than 5 dB, they may be considered "unreasonable".

Section 7 also contains the following regarding design criteria for external noise:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB LAeq,T or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.

As stated above, the ProPG refers to BS 8233:2014 both in terms of internal and external noise criteria.

WHO: Guidelines for Community Noise11

The WHO Guidelines present various guideline values for community in specific environments. Regarding LAmax noise levels, as described in Paragraph 4.10 above, the guidelines state that, for good sleep, indoor sound pressure levels should not exceed around 45 dB LAmax more than 10–15 times during the 8 hour night-time period. This is equated to a level at the outside façade of 60 dB LAmax with a partially open window.

ANC: Acoustics Ventilation and Overheating - Residential Design Guide[12]
The guidance provides useful information regarding the potential assessment of overheating, which has become increasingly important in recent years where it has been identified that guideline internal noise level criteria may only be achieved by keeping windows closed.

BASELINE CONDITIONS

The sound levels recorded at survey location L6 (monitoring location detailed in section 6 of the main report) are presented in the table below for the day (07:00 - 23:00) and night-time periods (23:00 - 07:00).

Table B2 – Measured ambient noise levels for day and night-time periods

Day/Date	$L_{Aeq,\ 16\ hour}$ (dB)	$L_{Aeq,\ 8\ hour}$ (dB)
01/09/2021	48	44

With regard to the LAmax noise levels, these are the maximum noise levels measured over the interval period. This means they could be caused by one off events occurring only once during the baseline survey period. As such the LAmax noise levels used in this assessment of suitability for residential development are the 95th percentile of the LAmax, 15 minute measurements undertaken during the night time period (23:00 - 07:00). The 95th percentile of the LAmax is 70 dB.

PREDICTED INTERNAL NOISE LEVELS

When considering noise break in from outside, there are two main elements to consider:

- The internal ambient noise level requirements for the day and night-time period in accordance with the guidance in BS 8233:2014; and
- The maximum (LAmax) noise levels at night (23:00 – 07:00) and what effect these might have on sleep in accordance with the World Health Organisation Guidelines for Community Noise.

[11] Guidelines for Community Noise. World Health Organisation (1999)
[12] Acoustics Ventilation and Overheating - Residential Design Guide, Association of Noise Consultants (2020)

While details of the proposed site building layout and internal dwelling layouts are not available at this stage, initial calculations of internal noise levels have been carried out, based on the following assumptions:

- a bedroom with dimensions of 3m(w) x 4m(l) x 2.4m(h) ,
- with an average mid-frequency reverberation time of 0.5 seconds,
- standard brick and blockwork façade construction.

Given the proposed site layout is not finalised, the following advice constitutes a "worst-case", with an assumption that all proposed dwellings will be directly exposed to the noise sources. In reality, when the buildings are constructed , a number of the façades will be screened from the primary sources of noise.

Based on the measured LAeq noise levels, the recommended internal ambient noise levels set out in BS 8233 can be achieved with open windows.

However, based on the measured LAmax levels, bedroom windows would have to remain closed to achieve a maximum internal LAmax level of 45 dBA, as recommended in the WHO's Guidelines for Community Noise and therefore alternative means of ventilation would need to be supplied. As stated within BS 8233:2014, where closed windows are relied on to meet the internal guideline values, there should be an appropriate alternative means of ventilation and measures taken to mitigate overheating. This should be confirmed by the relevant consultant. Furthermore, whilst it is advised that whilst bedrooms on the most exposed facades require windows to be closed to achieve the maximum noise level criteria, windows should remain openable to allow for purge ventilation. Purge ventilation is defined as the rapid removal of odours, pollutants or water vapour from a property for a short period of time.

The table below presents the requirements for glazing and ventilator performance for the proposed development bedrooms , the performance figures presented are achievable through standard double glazing units and readily available acoustic 'trickle' ventilation systems. Therefore, this is considered a suitable site for residential development

It should be noted that these are guidelines figures, based on assumed building layouts and room dimensions. They are intended to demonstrate that the site can achieve suitable acoustic conditions for residential development, rather than site specific design advice. The acoustic performance requirements of the dwellings should be reviewed as the design of the residential development progresses.

Table B3 – Glazing and Ventilation Performance Requirement

Room	Glazing Performance Requirement		Ventilator Performance Requirements		Number of Vents	Driven By
	Rw	Ctr	Dn,e,w	Ctr		
Bedroom	31	-4	38	-2	2	LAmax

External Amenity Areas

Based on the measurements for the 16-hour daytime period, the external noise levels are below the BS 8233 desirable guideline value of 50 dB LAeq,T. It is therefore considered that the acoustic environment at the site is conducive to provide suitable levels of amenity in outdoor spaces (private gardens) without the need for further mitigation.

APPENDIX C – CONSTRUCTION ASSESSMENT ASSUMPTIONS

Demolition

Equipment	BS 5228-1 Table Ref.	BS 5228-1 Description	Lp @ 10 m dB(A)	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Excavator	C2.14	Tracked Excavator, 226 kW - 40t	79	107	70%	3	5	-2	110
Dozer	C2.1	Dozer*, 142 kW - 20t	75	103	70%	3	5	-2	106
Wheeled loader	C2.9	wheeled backhoe loader (idling), 62 kW - 8t	55	83	75%	2	3	-1	85
Dump truck (tipping fill)	C2.30	Dump truck (tipping fill), 306 kW - 29t	79	107	30%	2	3	-5	105
Dump truck (empty)	C2.31	Dump truck (empty)*, 306 kW - 29t	87	115	30%	2	3	-5	113
Lorry	C2.34	Lorry*, - 4-axle wagon	80	108	75%	2	3	-1	110
Dozer (tower roller)	C2.36	Dozer (towing roller), 142 kW - 20t	81	109	70%	2	3	-2	110
Cable percussion drilling rig	C2.43	Cable percussion drilling rig, 18 kW - 2t / 150mm diameter / 75m depth	74	102	50%	1	0	-3	99
Directional drill (generator)	C2.44	Directional drill (generator), 106 kW	77	105	60%	2	3	-2	106
Water pump	C2.46	Water pump, - 4in	62	90	60%	2	3	-2	91
								Total	**118**

Site Preparation

Equipment	BS 5228-1 Table Ref.	BS 5228-1 Description	Lp @ 10 m dB(A)	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Excavator	C2.14	Tracked Excavator, 226 kW - 40t	79	107	70%	3	5	-2	110
Dozer	C2.1	Dozer*, 142 kW - 20t	75	103	70%	3	5	-2	106
Wheeled loader	C2.9	wheeled backhoe loader (idling), 62 kW - 8t	55	83	75%	2	3	-1	85
Dump truck (tipping fill)	C2.30	Dump truck (tipping fill), 306 kW - 29t	79	107	30%	2	3	-5	105
Dump truck (empty)	C2.31	Dump truck (empty)*, 306 kW - 29t	87	115	30%	2	3	-5	113
Lorry	C2.34	Lorry*, - 4-axle wagon	80	108	75%	2	3	-1	110
Dozer (tower roller)	C2.36	Dozer (towing roller), 142 kW - 20t	81	109	70%	2	3	-2	110
Cable percussion drilling rig	C2.43	Cable percussion drilling rig, 18 kW - 2t / 150mm diameter / 75m depth	74	102	50%	1	0	-3	99
Directional drill (generator)	C2.44	Directional drill (generator), 106 kW	77	105	60%	2	3	-2	106
Water pump	C2.46	Water pump, - 4in	62	90	60%	2	3	-2	91
								Total	**118**

Piling

Equipment	BS 5228-1 Table Ref.	BS 5228-1 Description	Lp @ 10 m dB(A)	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Air Compressors	C3.19	Compressor for mini piling, 45 kW - 1t	75	103	50%	2	3	-3	103
Delivery Trucks	C6.19	Road lorry (empty)* 320 kW - 39t	76	104	50%	2	3	-3	104
Dumpers	C2.31	Dump truck (empty)*, 306 kW - 29t	94	122	30%	2	3	-5	120
Mobile Craneage / Tower Cranes	C3.28	Tracked mobile crane, 184 kW - 110t	67	95	75%	2	3	-1	97
Piling Rigs (Rotary)	C3.17	Mini piling rig, 29 kW - 5.4t / auger 10m deep x 450mm diameter piles		28	75%	2	3	-1	30
Skips and Skip Trucks	C8.21	Skip wagon*,	78	106	75%	2	3	-1	108
Tracked / Wheeled 360 degree Excavators	C3.23	Tracked excavator,	68	96	75%	2	3	-1	98
								Total	**120**

Concreting Works

Equipment	BS 5228-1 Table Ref.	BS 5228-1 Description	Lp @ 10 m dB(A)	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Air Compressors	C3.19	Compressor for mini piling, 45 kW - 1t	75	103	60%	2	3	-2	104
Delivery Trucks	C6.19	Road lorry (empty)* 320 kW - 39t	76	104	75%	1	0	-1	103
Dumpers	C2.31	Dump truck (empty)*, 306 kW - 29t	94	122	30%	1	0	-5	117
Eight-wheeler Trucks	C4.18	Cement mixer truck (discharging),	75	103	75%	1	0	-1	102
Mobile Craneage / Tower Cranes	C3.28	Tracked mobile crane, 184 kW - 110t	67	95	50%	1	0	-3	92
Skips and Skip Trucks	C8.21	Skip wagon*,	78	106	50%	2	3	-3	106
Tracked / Wheeled 360 degree Excavators	C3.23	Tracked excavator,	68	96	75%	2	3	-1	98
								Total	**118**

General Build

Equipment	BS 5228-1 Table Ref.	BS 5228-1 Description	Lp @ 10 m dB(A)	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Air Compressors	C3.19	Compressor for mini piling, 45 kW - 1t	75	103	50%	2	3	-3	103
Delivery Trucks	C6.19	Road lorry (empty)* 320 kW - 39t	76	104	50%	2	3	-3	104
Diamond Cutting Tools/Saws	C4.72	Hand-held circular saw (petrol cutting concrete blocks), 3 - 9kg / 300mm diameter	79	107	20%	1	0	-7	100
Dumpers	C2.31	Dump truck (empty)*, 306 kW - 29t	87	115	30%	2	3	-5	113
Eight-wheeler Trucks	C4.18	Cement mixer truck (discharging),	75	103	50%	2	3	-3	103
Excavator Mounted Hydraulic Breakers	C5.2	Mini excavator with hydraulic breaker, - (1.5t) 44mm diameter / 115 bar / 120kg	83	111	50%	2	3	-3	111
Forklift Trucks	C4.55	Telescopic handler, 75 kW - 3.7t	70	98	30%	2	3	-5	96
Hand Held Tools including breakers (pneumatic and hydraulic)	C5.3	Road breaker (hand-held pneumatic),	82	110	30%	1	0	-5	105
Mobile Craneage / Tower Cranes	C3.28	Tracked mobile crane, 184 kW - 110t	67	95	30%	2	3	-5	93
Skips and Skip Trucks	C8.21	Skip wagon*,	78	106	50%	1	0	-3	103
Tracked / Wheeled 360 degree Excavators	C3.23	Tracked excavator,	68	96	75%	2	3	-1	98
								Total	**117**