South Industrial Zone

Environmental Statement
July 2020

Volume 2

Chapter E - Noise and Vibration

Contents

E1.0 Introduction

E1.1 This Chapter of the Environmental Statement (ES) has been prepared by Arup on behalf of the applicant, South Tees Development Corporation (STDC). It assesses the proposed development described in Chapter B and it considers the effects of the proposed development on noise and vibration in the surrounding area

E1.2 The baseline situation is considered before the likely environmental effects of the development are identified, both during construction and operational phases of the development. Mitigation measures to reduce any negative environmental effects are identified as appropriate, before the residual environmental effects are assessed.

E1.3 This Chapter is supported by the following technical appendix:

1 Appendix E1: Consultation correspondence.

About the Author

E1.4 The author is an Acoustics Consultant at Arup. He has five and a half years of experience in acoustics consultancy and is an Associate Member of Institute of Acoustics. The author holds a BSc (Hons) Acoustics obtained from Salford University.

E1.5 The author has extensive experience in acoustics survey, impact assessment, and providing mitigation strategies across a range of projects, from small-scale schemes to Nationally Significant Infrastructure Projects (NSIPs).

E1.6 This assessment has been reviewed by a Senior Acoustics Consultant at Arup who has 19 years of experience in noise assessment and who is a chartered engineer (CEng), Corporate Member of the Institute of Acoustics and holds an MSc Acoustics and Noise Control.

E1.7 This assessment has been approved by an Associate at Arup who has over 20 years of experience in noise assessment, and who is a Corporate Member of Institute of Acoustics and holds MSc Acoustics and Noise control.

E1.8 This assessment has been approved for the ES by an Associate at Arup who has over 20 years of experience in environmental assessment and is a CEnv.

E2.0 Policy Context

E2.1 The assessment approach reflects the requirements of the Government's noise policy and the Environmental Impact Assessment (EIA) Regulations [1]. The following summarises relevant legislation and planning policy:

National planning policy

National Planning Policy and Guidance

E2.2 The National Planning Policy Framework (NPPF) [2] took effect in 2012 to define the Government's planning policies for England and it was last updated in June 2019. Key to this assessment are paragraphs 170, 180, 204 and 205 of NPPF.

E2.3 Paragraph 170 of NPPF states that

"*Planning policies and decisions should contribute to and enhance the natural and local environment by…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of … noise pollution;*

E2.4 Paragraph 180 of NPPF states that "*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should*:

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

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

E2.5 Paragraph 204 of NPPF states that

"Planning policies should…when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction;

E2.6 Paragraph 205 of NPPF states that

"In considering proposals for mineral extraction, minerals planning authorities should…ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties;

E2.7 The NPPF planning objectives reflect and are linked to the policies and objectives set out in the Noise Policy Statement for England (NPSE) [3].

E2.8 The NPSE uses the key phrases 'significant adverse' and 'adverse' and extends concepts established by the World Health Organization (WHO) to describe effect levels.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse health effects on health and quality of life occur.

E2.9 The NPSE notes that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is for a project to identify relevant SOAELs taking account of the different sources of exposure and different receptors.

E2.10 Any receptor forecast to experience an overall exposure from the proposed development that exceeds the relevant SOAEL is identified as being subject to significant adverse impact on health and quality of life (under Government noise policy) and hence identified as a likely significant adverse effect.

E2.11 Where the noise level from the proposed development is between LOAEL and SOAEL, the NPSE states:

"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

E2.12 The magnitude of noise change can result in impacts between LOAEL and SOAEL being reported as likely significant effects in EIA terms. The EIA process requires that likely significant effects are identified along with the envisaged mitigation to avoid or reduce these significant effects.

Guidance and standards

E2.13 The noise assessment has taken account of the following relevant guidance and standards:

- Guideline for community noise (World Health Organization, 1999) [4]
- Night noise guidelines for Europe (World Health Organisation Europe,1999) [5]
- BS8233 Guidance on sound insulation and noise reduction for buildings (British Standards Institution, 2014) [6]
- BS4142: 2014 + A1 2019 - Methods for rating and assessing industrial and commercial sound (British Standards Institution, 2014) [7]
- BS 5228-1 + A1 2014 Code of practice for noise and vibration control on construction and open sites – noise (British Standards Institution, 2014) [8]
- BS 5228-2 + A1 2014 Code of practice for noise and vibration control on construction and open sites – vibration (British Standards Institution, 2014) [9]
- ISO9613 Acoustics – Attenuation of Sound during Propagation Outdoors: Part 2: General Method of Calculation (1996) [10]
- Calculation of road traffic noise (CRTN) (Welsh Office, 1988) [11]
- Calculation of rail noise (CRN) (1995) [12]
- The Design Manual for Roads and Bridges (DMRB) LA111, Revision 2 (Highways Agency and Welsh Office, 2020) [13]

Primary legislation

E2.14 Relevant legislation includes the Control of Pollution Act 1974 [14]. The construction noise and vibration assessment and envisaged mitigation are informed by this legislation. Specific references are made to sections of legislation as necessary. For example, 'best practicable means'

is defined in Section 72 of the Control of Pollution Act; and prior consent for the construction method and steps to minimise noise can be sought from local authorities under Section 61 of the Control of Pollution Act.

E3.0 Assessment Methodology & Significance Criteria

Assessment Methodology

E3.1 The following describes the assessment methods applied, including the means by which noise levels have been predicted. Significance of the predicted noise impacts has then been assessed by reference to criteria developed for each type of impact. The assessment considers impacts and effects at the nearest dwellings surrounding the proposed development.

Demolition and construction activity noise

E3.2 For some of the sources of noise that will arise from demolition of any existing structures and construction of the proposed development it is not possible, at this outline planning stage, to quantify levels of noise that will arise. Indicative calculations have been carried out based on the assumptions set out below.

E3.3 The distances between the proposed development and the nearest noise sensitive receptors reduce the likelihood of significant effects from construction noise activities. To confirm this, noise from construction activities has been calculated using the approach presented in BS5228-1. The assessment is based on noise arising from impact piling as a worst-case scenario. BS5228-1 prediction method is valid to a distance of 300m, due to increasing importance of meteorological effects. All sensitive receptors within the study area are located further than 300m and, as such, assessment is considered to be valid despite small prediction uncertainty.

E3.4 The predicted noise levels at identified sensitive receptors have been calculated by considering the individual source noise levels of hydraulic hammer (impact piling), taken from BS5228-1, the number of plant and proportion of time for which the piling is expected to operate, the distance to the receptors and any intervening screening.

E3.5 The assessment is based on the assumption that works will be undertaken using best practicable means (BPM) including the approaches described in BS5228-1. The assessment assumes construction work will be carried out 24 hours a day, 7 days a week, as is understood to be the case on nearby sites in the area, such as PD Ports (directly to the north of the site).

Demolition and construction traffic noise

E3.6 As this is an outline planning application, the end users of the development site, and therefore specifics of construction, including traffic, are not known at the time of writing. As such, construction traffic has not been included in the assessment. Further explanation can be found in the Chapter C (Transport).

Demolition and construction vibration

E3.7 No vibration effects are likely to occur, as groundborne vibrations diminish strongly with distance and the distances to all the existing residential receptors from the proposed works are greater than 100m (that falls out of vibration prediction range calculation method described in BS5228-2), the level of vibration is predicted to be well below levels at which there is a risk of causing building damage or disturbance to residents. Therefore, the construction vibration assessment is scoped out.

E3.8 This has been assessed assuming a worst case of impact piling being carried out around the perimeter of the site. Therefore, no significant effect is identified at dwellings.

Operational building services and industrial activity noise

E3.9 As this is an outline application, the design has not yet progressed to the level where detailed information regarding the end usage is known. Therefore, design of the mechanical services plant or type of industrial noise cannot be assessed with any certainty. Accordingly, it is anticipated that noise from building services and plant will be assessed at detailed planning or controlled through the specification of noise emission limits and acoustic design requirements.

E3.10 The proposed development will consist of General Industrial (B2), Storage or Distribution (B8) and Office (B1) usages. Therefore, indicative predictions and assessment of noise associated with heavy goods vehicle (HGV) deliveries and loading, car movements, air handling units and the breakout noise is included in the assessment.

E3.11 Traffic noise has been calculated using CRTN, break out noise and any associated plant noise has been calculated using ISO9613, using SoundPLAN acoustic prediction software.

E3.12 Noise arising from HGV and light vehicle movements has been assessed using predicted traffic flows detailed in the Transport Assessment (see Chapter C).

E3.13 General industrial mixed noise sources are assumed, therefore, there is no particular reason to assume tonality or impulsivity.

Road traffic noise

E3.14 Operational road traffic noise has been predicted using CRTN to calculate noise changes from changes in traffic flows. Changes in traffic flows have been provided by the Arup transport team (see Chapter C). Noise change has been quantified by calculating noise levels using SoundPLAN acoustic prediction software, for the do minimum (without the proposed development) and do something (with the proposed development) scenarios for the future assessment year (2028).

E3.15 The impact associated with change in traffic noise level is evaluated using DMRB.

Rail noise and vibration

E3.16 The proposed development is located near an existing rail line. Rail traffic noise levels have been calculated using CRN, using SoundPLAN acoustic prediction software. Railway noise levels are used only to assist in establishing the baseline sound levels and it assumed that no change in rail operations will occur due to the proposed development. Therefore, rail noise and vibration assessment is scoped out of further consideration.

Cumulative effects

E3.17 Noise and vibration effects from other developments expected to coincide with the proposed development have been considered.

E3.18 All residential committed developments are located at a greater separation distance than the proposed development to the currently identified noise sensitive receptors, therefore, they are scoped out from consideration.

E3.19 Industrial committed development (R.2019.0767.OM – Proposed Energy Recovery Centre, which is likely to be subject to permitted development) that may operate at the same time as the proposed development is located in the order of 700m from sensitive receptors. The potential for cumulative effects are assessed in Chapter O.

E3.20 Committed developments are included in the traffic growth factor accounted for in the Future Baseline (see Chapter C) and, therefore, cumulative effects have been accounted for in the road traffic noise assessment.

Significance Criteria

Derivation of significance criteria

E3.21 The noise and vibration assessment takes account of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 [15] and has been undertaken according to the national government's planning and noise policy as defined in:

- The NPSE;
- The NPPF; and
- Planning Practice Guidance – Noise (PPG-N).

E3.22 The assessment of noise and vibration considers the likely significant effects arising from the construction and operation of the proposed development. It is important to differentiate between impacts and effects. The following definitions are adopted for this assessment:

- Impact - the introduction of new noise or vibration into an existing environment.
- Effect - the noise effect on the receptor/community subject to an impact. The noise effect is therefore linked to the level of the impact, the sensitivity of the receptor and other key matters such as the existing acoustic environment.

E3.23 Therefore, it follows that:

- An impact is a change in the environment;
- An effect is what results from an impact on a receptor and is dependent on the receptor and its sensitivity; and
- As an impact increases in level, the effect increases either in terms of magnitude (e.g. noise change) to a point where either the level of exposure or the number of receptors exposed reach a point where the assessment needs to report the outcome as a likely significant effect consistent with the EIA Regulations.

Demolition and construction noise

E3.24 Direct, temporary effects of noise are associated with demolition and construction. Impact thresholds for construction noise have been established by reference to the 'ABC method' described in Annex E of BS5228-1. The ABC method defines the thresholds at building facades on the basis of existing noise levels as set out in Table E3.1.

Table E3.1: Thresholds of potential significant effects of demolition and construction noise at residential buildings (from BS 5228-1)

Period	**Threshold value in decibels, dBLAeq,T**		
	Category A (LOAEL)*	Category B (LOAEL)*	Category C (SOAEL)
Weekday Daytime (07:00-19:00) Saturday (07:00-13:00)	65	70	75
Weekdays (19:00-23:00) Saturday (13:00-23:00) Sunday (07:00-23:00)	55	60	65
Night-time (23:00-07:00)	45	50	55
Notes: All noise levels are defined outdoors at the façade of the receptor Assessment Category A: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are less than these values; Assessment Category B: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are the same as category A values; and Assessment Category C: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are higher than category A values. * dependent on existing ambient noise levels			

E3.25 Where the forecast construction noise exceeds the relevant threshold this is an indicator of a potential significant effect, as noted in BS5228-1, i.e. where the level of impact is sufficient that it may lead to a likely significant effect once other aspects are considered.

E3.26 For daytime, the widely used threshold of 75dBL_{Aeq} (category C in Table E3.1) has been taken to be the SOAEL for construction noise. Typically, a duration for the impact is also considered, such as being exceeded for one month or more. In the absence of a developed construction programme, in this case it has been cautiously taken than any exceedance of this threshold level is assessed as significant. The threshold was originally set to avoid interference with normal speech indoors, with windows closed [16]. Windows and their sound insulation properties have improved substantially since the Wilson Report; the 75dBL_{Aeq} SOAEL is therefore likely to be precautionary for modern properties.

E3.27 The daytime SOAEL assumed for construction reflects that construction noise is temporary and that higher levels of noise generally only occur for part of the construction programme.

E3.28 For night-time, the Night Noise Guidelines for Europe [5] introduced an interim target of 55dB$L_{Aeq,8hr}$ measured outdoors as an annual average. Exceeding this noise threshold (category 'C' of the ABC impact criteria at night as shown in Table E3.1), for one month or longer has been adopted as the SOAEL for night-time construction noise. The Night Noise Guidelines for Europe is based on evidence gathered for long term exposure to primarily road and aircraft noise. There is no evidence of short-term construction noise leading to significant health effects. The WHO's interim target of 55dBL_{Aeq} is, therefore, applied to construction on a precautionary basis.

E3.29 For the evening, the SOAEL is set 10dB lower than the daytime SOAEL, consistent with the 'ABC criteria' and the accepted criteria that date back to the Advisory Leaflet 72 - Noise Control on Building Sites [17].

E3.30 Noise exposure between LOAEL and SOAEL is, in Government policy terms, an adverse observed effect, but not a significant observed adverse effect. Such adverse effects relate to people's response to changes in local acoustic character particularly outdoors and to a lesser

extent indoors. Adverse observed effects are identified where categories A or B from Table E3.1 apply and the forecast construction noise exceeds the relevant category but is below category C. This provides a simplified method for considering adverse effects from noise increases caused by construction. Such observed adverse effects under policy may be reported as likely significant effects in the EIA following the consideration of the other significance criteria set out in this chapter.

E3.31 In summary, the following factors are considered when identifying the significance:

- Construction noise level relative to the ambient noise level
- Exceedance of the ABC threshold level
- Absolute construction noise level
- Duration of the impact

Operational building services and industrial activity noise

E3.32 The assessment of mechanical services and industrial noise is based on the intrusive noise within noise sensitive receptors compared to recommended background levels.

E3.33 Industrial noise is often assessed using BS4142, which relies upon knowledge of the background (L_{A90}) sound level at receptors. Due to the absence of a site-specific sound level survey, due to the Covid-19 pandemic, establishment of the background sound level climate is not possible. BS4142 recommends that the absolute level of sound should also be taken into consideration when assessing potential impact from industrial sound sources. The absolute noise levels are predicted for daytime and night-time periods and compared with external and internal noise criteria where appropriate. Absolute noise levels are predicted without BS4142 corrections applied (i.e. penalties to account for noise sources of distinctive character, i.e. tonal, intermittent or impulsive) and assessed against WHO/BS8233 noise criteria.

E3.34 For dwellings, thresholds of significance are taken from chapter 7 of BS8233. This standard proposes background levels inside bedrooms. For residential properties the BS8233 provides threshold of 35dBL_{Aeq} and 30dBL_{Aeq} for daytime and night-time respectively.

E3.35 A typical opened window would provide a sound reduction of at least 15dB, meaning that the external daytime and night noise levels arising from the proposed development should, in total, be no greater than 50dBL_{Aeq} and 45dBL_{Aeq} respectively to meet this condition.

E3.36 To determine significance the following has been considered:

- Predicted baseline noise levels;
- Difference between the 'predicted baseline noise levels' with and without the industrial noise, at the receiver location;
- Absolute level of industrial noise;
- Character of the new industrial noise compared to the character of the existing residual or ambient noise; and
- Sensitivity of the receptor.

Road traffic noise

E3.37 The operational noise impacts and effects are related to both the noise level and the change in noise level caused by the proposed development. The Government's noise policy provides the basis for evaluating the magnitude of the effect as discussed earlier. In this assessment,

residential receptors (dwellings) are forecast to experience a likely significant adverse noise effect from operation of the scheme if noise outside dwellings from the scheme only is:

- 68dB$L_{A10,18hr}$ (equivalent to 63dB$LA_{eq,16hr\ free\text{-}field}$) or greater during the day; or
- 55dB$L_{Aeq,8hr}$ (i.e. 23:00-07:00) or greater during the night.

E3.38 The rationale for this is as follows.

E3.39 During the daytime the level of 68dB$L_{A10,18hr}$ is considered a SOAEL (equivalent to 63dB$L_{Aeq,16hr\ free\text{-}field}$). This is consistent with the daytime trigger level in the Noise Insulation (Amendment) Regulations 1988. Aligning the SOAEL with noise insulation trigger thresholds is consistent with the advice in PPG-N that notes as an example of the consequence of noise exposure above the SOAEL is that people start *"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"*.

E3.40 The WHO Night Noise Guidelines for Europe sets an interim target of 55dB$L_{Aeq,8hr}$ outdoors. This has been taken to be a SOAEL for night-time traffic noise.

E3.41 In this assessment residential receptors (dwellings) are forecast to experience an adverse effect in policy terms where noise from the operation of the scheme outside dwellings is:

- 50dB$L_{Aeq,16hr}$ or greater during the day; and
- 40dB$L_{Aeq,8hr}$ or greater at night.

E3.42 These are the LOAELs adopted for operational noise in this assessment.

E3.43 For the daytime LOAEL the WHO Guidelines for Community Noise identifies that 50 to 55dBL_{Aeq} (outdoor noise level), represents: *"day-time levels below which a majority of the adult population will be protected from becoming moderately or seriously annoyed, respectively."*

E3.44 In the Night Noise Guidelines for Europe, the night noise guideline of 40dBL_{night}, outside is set explicitly as a LOAEL. This is an annual average level measured over the 8hr night-time period from 2300 to 0700.

E3.45 The thresholds of 50dB$L_{Aeq,16hr}$ and 40dB$L_{Aeq,8hr}$ therefore represent the onset of the lowest observed community noise effects during the day (annoyance) and night (potential for some reported sleep disturbance) consistent with the Night Noise Guidelines for Europe Guidelines for Community Noise and PPG–N). No adverse effects are therefore generally likely below these absolute levels of sound exposure.

E3.46 Forecast operational sound levels from the scheme of between 50dBL_{Aeq} and 68dB$L_{A10,18hr}$ (equivalent to 63dB$L_{Aeq,16hr\ free\text{-}field}$), or 40dB$L_{Aeq,8hr}$ and 55dB$L_{Aeq,8hr}$ night-time (i.e. between the respective LOAELs and SOAELs) are adverse effects with regard to noise policy.

E3.47 LOAEL and SOAEL summary for road traffic noise for this assessment are given in Table E3.2.

Table E3.2: Adverse effect levels from road traffic noise

Effect level	Period	Noise level
LOAEL	Day	50dBLAeq,16hr
	Night	40dBLAeq,8hr
SOAEL	Day	63dBLAeq,16hr
	Night	55dBLAeq,8hr

E3.48 DMRB, LA111 provides a basis for evaluating the magnitude of the impact and effect caused by noise change both in the short-term and long-term. This is also consistent with DMRB, LA111, which notes:

3dB change is the impact taken as the initial assessment of a potential significant effect – other factors relating to the context are also considered.

E3.49 Where the overall noise level with the scheme in operation is between the LOAEL and the SOAEL, the magnitude of the impact and effect caused can be indicated by the change in noise levels attributable to the scheme. The DMRB method for evaluating the magnitude of impact from such changes in the long term is shown in Table E3.3.

Table E3.3: Classification of magnitude of traffic noise impact on dwellings in the long-term under DMRB

Magnitude of impact in the long term	Long term noise change (dB LA10,18hr or Lnight)
Negligible	Less than 3.0
Minor	3.0 to 4.9
Moderate	5.0 to 9.9
Major	Greater than or equal to 10.0

E3.50 Where the overall exposure is greater than the relevant SOAEL, then there is the increasing risk of likely health effects associated with long term (permanent) exposure.

E3.51 For areas already exposed to relatively high baseline noise levels, it is appropriate to give greater weight to noise change where the existing baseline noise level is in excess of the SOAEL. This is to reflect the consideration of likely health effects. In these situations, the magnitude of the impact caused by change in noise levels attributable to the scheme is shown in Table E3.4.

Table E3.4: Classification of magnitude of traffic noise impact on dwellings in the short-term under DMRB

Magnitude of impact in the short term	Short term noise change (dB LA10,18hr or Lnight)
Negligible	Less than 1.0
Minor	1.0 to 2.9
Moderate	3.0 to 4.9
Major	Greater than or equal to 5.0

E3.52 In summary, following factors are considered when identifying the significance:

- Noise level change
- Impact magnitude comparison between long term and short term
- Absolute noise levels with reference to LOAEL and SOAEL
- Acoustics context sensitivity of rooms on the facade exposed to noise change

Consultation

E3.53 Consultations were undertaken with the Redcar and Cleveland Borough Council (RCBC) Environmental Health Officer (EHO) to confirm their approval of the scope, approach to baseline, and assumptions used for the noise and vibration assessment (Appendix E1). Through discussion with the council, it was confirmed that the proposed approach was accepted.

Assumptions and Limitations

E3.54 As the scheme is currently at outline stage, assumptions have been made about the types of plant and equipment which are likely to be used during construction and operation.

E3.55 It is worth noting that the assumptions that have been used to inform the assessment of the construction and operational noise impacts can only be considered to be indicative at this stage in the development of the project. However, the assumptions are considered representative of a reasonably foreseeable worst case. Any uncertainty associated with the construction and operational assumptions are unlikely to have any influence on the outcome of the assessment given the relatively large separation distances involved.

E3.56 The assessment has been undertaken during the global Covid-19 pandemic, therefore, it has not been possible to undertake a baseline sound level survey to quantify the noise climate under what would be considered normal conditions. The baseline sound level climate has, therefore, been informed by noise prediction modelling and professional judgement.

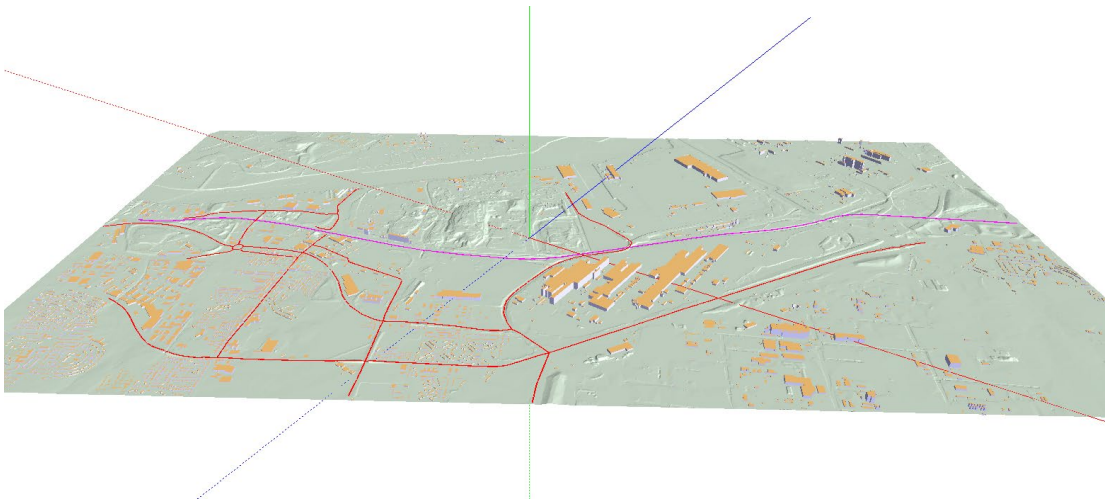
E3.57 Existing baseline sound levels include only rail and road noise sources. Other sound sources in the area, for example, industrial are not included. It is considered, therefore, that the predicted baseline is conservative.

E4.0 Baseline Conditions

E4.1 The assessment has been undertaken during the Covid-19 pandemic and, as such, it has not been possible to undertake a baseline sound level survey to quantify the noise climate under usual conditions. The baseline sound level climate has, therefore, been informed by noise prediction modelling and professional judgement.

E4.2 A three-dimensional SoundPLAN noise prediction model of rail and road traffic has been created (Figure E4.1). The model has been used to calculate baseline and 'do minimum' (i.e. without proposed development) noise levels.

Figure E4.1: Computer model used for predicting baseline noise levels (looking north).



Rail

E4.3 Baseline rail traffic movement data has been derived from RealTimeTrains [18]. For the 'do minimum' scenario no additional services (passenger or freight) have been assumed. Rail traffic noise has been modelled using CRN.

Road

E4.4 Baseline 2020 and proposed full occupation of 2028 road traffic flow data have been provided by the Arup transport team (See Chapter C). Road traffic noise has been modelled using CRTN.

Noise sensitive receptors

E4.5 For the closest noise sensitive receptors to the site boundary, the noise climate is considered to be dominated by noise arising from road traffic on the A66 road.

E4.6 The chosen receptors are considered to be representative of their surrounding location.

E4.7 Some sensitive receptors that the RCBC EHO noted were not included in the assessment, as they are located more than 2.5 km away from the site boundary and, as such, considered unlikely to be affected by either construction or operation of the proposed development.

E4.8 Figure E4.2 and Table E4.1 represent the representative closest sensitive receptor locations and their spatial relation to the site boundary.

Table E4.1: Receptor location description

Receptor	Address/ Description	Approximate distance to the site boundary, metres
1	King George's Terrace (Mobile Homes), TS6 6AZ	750
2	41 Salisbury Terrace, South Bank, Middlesbrough, TS6 6EX	760
3	1 Salisbury Terrace, South Bank, Middlesbrough, TS6 6EX	640
4	19 Jones Road, South Bank, Middlesbrough, TS6 6QQ	550
5	Elgin Avenue, South Bank, Middlesbrough, TS6 6TP	1020
6	8 St. James Court, Grangetown, Middlesbrough, TS6 7SX	990
7	72 Bolckow Road, Grangetown, Middlesbrough, TS6 7EG	980
8	26 Corncroft Mews, Middlesbrough, TS6 7HJ	1020

Figure E4.2: Noise sensitive receptors location and site boundary

Existing Conditions

E4.9 The predicted existing baseline sound levels at each sensitive receptor are summarised in Table E4.2 for daytime and night-time, respectively.

Table E4.2: Predicted existing baseline sound levels at the noise sensitive receptors.

Receptor (See Table E4.1)	dBLAeq, 07:00-23:00hrs daytime	dBLAeq, 23:00-07:00hrs night-time
1	56	51
2	61	53
3	62	54
4	69	60
5	68	60
6	62	54
7	66	58
8	64	56

Future Baseline

E4.10 It can be reasonably expected that the predicted existing baseline is sufficiently representative of the future baseline noise situation because future changes in traffic flow are incremental and associated with changes to the surrounding road network, of which none are currently proposed.

E4.11 As mentioned in paragraph E3.20, committed developments have been accounted for in the traffic future baseline.

E4.12 The future baseline sound levels at each sensitive receptor are summarised in Table E4.3 for daytime and night-time, respectively.

Table E4.3: Predicted future (do minimum) baseline sound levels at the noise sensitive receptors.

Receptor (See Table E4.1)	dBLAeq, 07:00-23:00hrs daytime	dBLAeq, 23:00-07:00hrs night-time
1	57	51
2	61	54
3	62	54
4	69	61
5	68	60
6	62	54
7	66	58
8	64	56

E5.0 Potential Effects

Embedded Mitigation

E5.1 It is assumed that existing landscape and buildings outside of the site's red line boundary act as natural barriers and provide embedded mitigation that was considered during the assessment.

During Demolition and Construction

Demolition and Construction noise

E5.2 For some of the sources of noise that will arise from construction of the proposed development it is not possible, at this outline planning stage, to quantify levels of noise that will arise. Indicative calculations have been carried out based on the assumptions set out below.

E5.3 The distances between the proposed development and the nearest noise sensitive receptors reduce the likelihood of significant effects from construction noise activities. To confirm this, noise from construction activities has been calculated using the approach presented in BS5228-1. The assessment is based on noise arising from impact piling as a worst-case scenario. BS5228-1 prediction method is valid to a distance of 300m, due to increasing importance of meteorological effects. All sensitive receptors, within the study area, are located further than 300m and as such, assessment is considered to be valid despite small prediction uncertainty.

E5.4 The predicted noise levels at surrounding dwellings have been calculated by considering the individual source noise levels of Hydraulic hammer (Impact piling) (Table E5.1), taken from BS5228-1, the number and proportion of time for which the piling is expected to operate, the distance to the receptors and any intervening screening.

E5.5 The assumed sound source levels are shown in Table E5.1. The calculation assumes a piling rig operating at each proposed building at the same time (identified in Figure E5.1) and these sources have been assumed at the closest possible distance to each receptor, operating for 100% of the time. The sound source height is assumed to be 4m above local ground level.

Figure E5.1: Proposed buildings plan

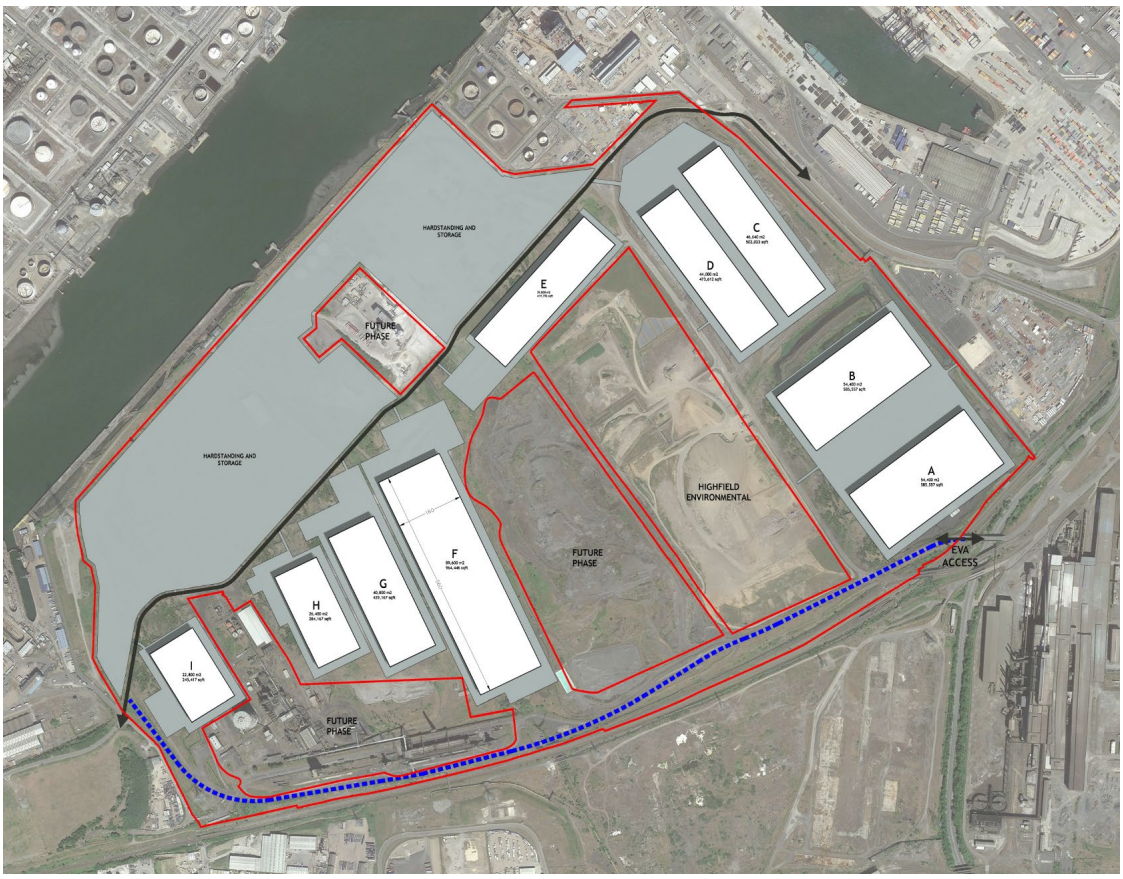


Table E5.1: Noise level data used for Hydraulic hammer (Impact piling) prediction (BS5228-1 Table C.3-3)

Equipment	Number of items	Equipment size	dBLAeq,T at 10m (single item of plant)
Hydraulic hammer (Impact piling)	9	240 mm diameter	88

E5.6 The assessment is based on the assumption that works will be undertaken using BPM including the approaches described in BS5228-1. The assessment assumes construction work will be carried out over 24 hours a day, 7 days a week, as is understood to the case on nearby sites in the area (such as PD Ports directly to the north of the site).

E5.7 The thresholds for determining potentially significant construction noise effects have been determined using the 'ABC method' described in Annex E of BS5228-1 and the predicted baseline noise levels (see Table E5.2). Full details of the predicted baseline noise levels can be found in Section E4.0. Predicted free field noise levels have been converted to façade levels by adding 3dB, as specified in BS5228-1.

E5.8 Only a night-time assessment was undertaken as this represents the worst potential impacts if working 24 hours a day.

Table E5.2: Summary of ambient noise levels and construction noise criteria (façade levels) according the BS 5228-1 'ABC Method' for night-time.

Receptor (See Table E4.1)	Assessment Period (T)	Lowest predicted ambient noise level, dBLAeq, T	Threshold category and (decibel value (dB))	Highest predicted construction noise level, dBLAeq,T (façade)	Level above ABC threshold, dB	Potential significant effect
1	Night-time (23:00-07:00)	54	C (55)	45	-10e	None
2		56	C (55)	44	-11	None
3		57	C (55)	41	-14	None
4		63	C (55)	53	-2	None
5		63	C (55)	50	-5	None
6		57	C (55)	49	-6	None
7		61	C (55)	50	-5	None
8		59	C (55)	49	-6	None

E5.9 The construction noise prediction resulted in highest construction noise level of 53dB$L_{Aeq,8hr}$ at the closest sensitive receiver.

E5.10 The predicted highest construction noise level of 53dB$L_{Aeq,8hr}$ is 2dB below the construction noise threshold of 55dB for the night-time and, established for residential receptors. The effects at sensitive receptors surrounding the proposed development during the works would be not significant, although receptors are located >300m, any small uncertainty would not change the assessment result.

E5.11 It follows that there would be no adverse impacts from construction noise, in policy and EIA terms the construction noise exposure level at any sensitive receptors surrounding the construction works would be below the SOAEL threshold as defined, hence this is not significant in policy and EIA terms.

During Operation

Road traffic noise

E5.12 For road traffic noise, the predicted noise levels for the 'Do something' scenario have been compared to the predicted 'Do minimum' scenario noise levels.

E5.13 Table E5.3 and Table E5.4 show the predicted "Do minimum" and "Do something" road noise levels at the nearest sensitive receptors and the change in road traffic noise levels.

E5.14 In reference to the significance criteria, the operation of the proposed development will result in a negligible increase in road traffic noise levels within the local area, therefore no significant effects have been identified.

Table E5.3: Road traffic noise change (daytime)

Receptor (See Table E4.1)	Daytime noise levels, free field (dBLAeq,16h)		
	'Do minimum' road traffic noise, 2028	'Do something' road traffic noise, 2028	Change in road traffic noise*
1	56	58	+2
2	61	62	+1
3	62	63	+1
4	69	69	0
5	68	69	+1
6	62	62	0
7	66	67	+1
8	64	64	0

Table E5.4: Road traffic noise change (night-time)

Receptor (See Table E4.1)	Night-time noise levels, free field (dBLAeq,8h)		
	'Do minimum' road traffic noise, 2028	'Do something' road traffic noise, 2028	Change in road traffic noise*
1	50	51	+1
2	54	54	0
3	54	55	+1
4	61	61	0
5	60	60	0
6	54	55	+1
7	58	59	+1
8	56	57	+1

Operational building services and industrial activity noise

E5.15 At this stage in the design, no specific operators have been identified for this site. Therefore, noise arising from specific industrial activities cannot be predicted with great accuracy. This assessment provides a high-level assessment, indicating worst reasonable case scenario.

E5.16 Operating hours are considered to be 24hrs a day, 7 days per week.

E5.17 It is assumed that each building has an associated industrial AHU unit/large extract fan unit on the south of the building positioned near the roof.

E5.18 It is assumed that each building will have an internal reverberant sound level of 85dBA, which is relevant to hearing protection zones in the working environment [19]. It is considered to be the extreme worst case to test the potential for the effects. It most unlikely that the internal reverberant level will reach 85dBA for the 24hrs a day, 7 days per week. Each building is assumed to be 35m high.

E5.19 Lining of the buildings is assumed to have a transmission loss as shown in Table E5.5.

Table E5.5: Sound reduction indices for a lightweight wall/roof panelling system

Material	Octave band sound pressure level, Hz					
	125	250	500	1k	2k	4k
Lightweight wall/roof panelling	17	20	23	23	23	41

E5.20 The breakout noise level at sensitive receptors was predicted using ISO9613 Acoustics – Attenuation of Sound during Propagation Outdoors: Part 2: General Method of Calculation [10].

E5.21 Road traffic movements on site, that is, car and HGV activity were also considered as part of the overall operational facilities noise emission.

E5.22 As mentioned in paragraph E3.33, BS4142 was not used to assess the operational impacts.

E5.23 Table E5.6 and Table E5.7 show the change in ambient noise levels at the receptor locations. Absolute levels of the predicted operational noise levels are very low and satisfy the BS8233 bedroom internal requirement with open windows at night-time. However, it should be noted that existing noise levels would exceed internal BS8233 requirements with windows opened at night. The differences between the existing ambient noise and predicted operational noise levels is at least 7dB at the identified receptors.

E5.24 There are unlikely to be adverse impacts from operational noise, in policy terms the operational noise exposure level at any sensitive receptors would be substantially below existing ambient noise and therefore is assessed as not significant in EIA terms.

Table E5.6: Ambient external noise change (daytime)

Receptor (See Table E4.1)	Predicted ambient noise level, dBLAeq,day	Predicted total operational external noise level, dBLAeq,day	Change in ambient noise level, dBLAeq,day
1	56	45	-11
2	61	36	-25
3	62	37	-25
4	69	41	-28
5	68	37	-31
6	62	37	-25
7	66	37	-29
8	64	37	-27

Table E5.7: Ambient external noise change (night-time)

Receptor (See Table E4.1)	Predicted ambient noise level dBLAeq,night	Predicted total operational external noise level, dBLAeq,night	Change in ambient noise level, dBLAeq,night
1	51	44	-7
2	53	35	-18
3	54	36	-18
4	60	40	-20
5	60	36	-24
6	54	37	-18
7	58	37	-22
8	56	37	-19

E6.0 Mitigation and Monitoring

During Construction

E6.1 Demolition and construction works will be undertaken using the principles of BPM as set out in paragraph E3.5. This will include, as necessary, selection of quiet plant, ensuring plant is well maintained, operating the plant with all covers in place and close and shutting down of plant when not in use.

E6.2 The development will implement a Demolition and Construction Environmental Management Plan to control and minimise potential disturbance to identified receptors.

During Operation

Operational building services and industrial activity noise

E6.3 Noise from building services plant will be controlled through design to achieve acceptable noise criteria based on the existing baseline noise levels at the closest noise sensitive receptors. This will depend on the specific use for each development plot and by considering the total combined noise level from all plots once operational. In addition, noise from building services plant will be controlled to provide a suitable environment within the site.

E6.4 The indicative assessment has shown that even assuming very high internal noise levels, noise levels would be substantially below existing noise levels. Noise from miscellaneous plant (specific to industrial usage) and industrial operation will be controlled through design to achieve acceptable noise criteria based on the existing predicted baseline noise levels at the closest noise sensitive receptors. Noise from industrial activity will be controlled to meet noise criteria for proposed office developments within the site. This will depend on the specific use of each plot and by considering the total combined noise level from all plots once operational.

E6.5 Good practice will be ensured through a management plan to ensure considerate working, particularly if it is necessary to work outside daytime hours. The management plan would include issues such as considerate driver behaviour, avoidance of idling engines and avoidance of queuing on public highways.

E6.6 The design and control measures that will be used to limit operational noise from the plant will prevent significant effects in both ES and policy terms. The design and control measures will also minimise any adverse effects, as far as it is reasonable to do so. Accordingly, the measures proposed to control operational industrial noise will meet the aims of national noise policy, typical measures that could be implemented include, but are not limited to, selection of quiet plant, provision of sound attenuators, location of noisy plant at greatest distance from noise sensitive receptors.

E6.7 Individual operators will have to submit detailed planning noise assessment to ensure operating levels do not exceed criteria.

Road traffic noise

E6.8 No significant effects have been identified from changes in road traffic flows in the local area, therefore no mitigation has been recommended.

E7.0 Residual Effects

During Construction

E7.1 No significant effects were identified in the assessment of potential effects and best practice mitigation measures have been identified to control noise during the construction phase of development. As such there will be no significant residual effects of noise or vibration.

During Operation

E7.2 As no significant effects are identified, no additional mitigation has been proposed and there will be no significant residual effects of noise or vibration.

E8.0 Summary & Conclusions

E8.1 The predicted highest construction noise levels are below the BS 5228-1 'ABC Method' noise threshold. The effects at sensitive receptors surrounding the proposed development during the construction works would be not significant.

E8.2 Whilst there is a small increase in road traffic noise due to increase in traffic movements, this is expected to be a negligible impact in the short term and a negligible impact in the long term.

E8.3 This assessment has identified no significant effects from operational or construction noise sources on the surrounding residential receptors. Table E8.1 represents the potential effect summary for each sensitive receptor assessed.

E8.4 The following steps are recommended to ensure established criteria are met:

- Use of BPM during the construction phase;
- Appropriate layout/orientation of service yards to provide screening of HGV movements and loading noise; and
- At the detailed planning stage, the design of building services plant and industrial noise sources would be designed in line with BS4142 and national policies. Assessments would be required to be submitted by individual operators intending to occupy the site. The assessments should demonstrate that noise from individual sites, in addition to the site as a whole, does not exceed the noise criteria.

Table E8.1: Potential effect summary for demolition, construction and operation

Receptor (See Table E4.1)	**Potential Effect**	**Mitigation Measure**	**Residual effect**
1	No Effect	Standard BPM	No Effect
2	No Effect	Standard BPM	No Effect
3	No Effect	Standard BPM	No Effect
4	No Effect	Standard BPM	No Effect
5	No Effect	Standard BPM	No Effect
6	No Effect	Standard BPM	No Effect
7	No Effect	Standard BPM	No Effect
8	No Effect	Standard BPM	No Effect

E9.0 Abbreviations & Definitions

1 **Decibel (dB)**

The ratio of sound pressures which we can hear is a ratio of 106:1 (one million:one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (L_p) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

2 **dB(A)**

The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

In some statistical descriptors the 'A' weighting forms part of a subscript, such as L_{A10}, L_{A90}, and L_{Aeq} for the 'A' weighted equivalent continuous noise level.

3 **Equivalent Continuous Sound Level**

An index for assessment for overall noise exposure is the equivalent continuous sound level, $L_{eq, T}$. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

4 **Frequency**

Frequency is the rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the hertz (Hz), which is identical to cycles per second. A 1000Hz is often denoted as 1kHz, e.g. 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.

5 **Statistical noise levels**

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10}, the level exceeded for 10% of the time period under consideration and can be used for the assessment of road traffic noise (note that L_{Aeq} is used in BS 8233 for assessing traffic noise). The L_{90}, the level exceeded for 90% of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for 1% of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, e.g. dBL_{A10}, 5min or $dBL_{A90, 8hr}$.

6 **Sound Power Level**

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.

7 **Sound Pressure Level**

The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

The sound pressure level (L_p) is ten times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x 10-5Pa (the threshold of hearing).

Thus L_p (dB) = 10 log (P1/Pref)2 where Pref, the lowest pressure detectable by the ear, is 0.00002 pascals (ie 2x10-5 Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dBLA and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

8 **Facade level**

A façade level refers to noise levels an assessment locationbetween 1 and 3.5m from the façade of a building or other reflective structure. The difference between the façade and free field noise level depends on the distance from the reflecting surface but is generally accepted to e 2.5 dB(A) at a distance of 1m.

9 **Free field level**

The term 'free field' is used to define noise levels that have been measured or predicted in the absence of any influence of reflections from nearby surfaces, other than the ground. In practice, a noise level is considered to be free field if it is at a distance greater than 3.5m from any reflecting surfaces, other than the ground.

10 **Typical Levels**

Some typical dB(A) noise levels are given below:

Noise Level, dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy lorries at 5m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber

11 Abbreviations

Term	Definition
NPPF	The National Planning Policy Framework
NPSE	National Policy Statement for England
NOEL	No observed effect level
LOAEL	Lowest observed adverse effect level
SOAEL	Significant observed adverse effect level
BPM	Best Practicable Means
WHO	World Health Organization
DMRB	Design Manual for Roads and Bridges
CRTN	Calculation of Road Traffic Noise
CRN	Calculation of rail noise
HGV	Heavy Goods Vehicles
PPG-N	Planning Practice Guidance – Noise
ES	Environmental Statement
STDC	South Tees Development Corporation
NSIPs	Nationally Significant Infrastructure Projects
EHO	Environmental Health Officer
RCBC	Redcar and Cleveland Borough Council

E10.0 References

1 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017

2 Department for Communities and Local Government (2019); National Planning Policy Framework; https://www.gov.uk/government/publications/national-planning-policy-framework--2; Accessed: *21 June 2020*

3 Department for Environment Food and Rural Affairs (2010); Noise Policy Statement for England 2010; https://www.gov.uk/government/publications/noise-policy-statement-for-england; Accessed: 21 June 2020

4 World Health Organization (1999); Guidelines for Community Noise; http://www.who.int/docstore/peh/noise/guidelines2.html; Accessed: 21 June 2020

5 World Health Organisation Europe; Night Noise Guidelines for Europe (2009); http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf; Accessed: 21 June 2020

6 British Standards Institute (2014). BS8233:2014 Guidance on sound insulation and noise reduction for buildings.

7 British Standards Institute (2014). BS4142:2014 Methods for rating and assessing industrial and commercial sound.

8 British Standards Institute (2014). BS5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Noise.

9 British Standards Institute (2014). BS5228-2:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Vibration.

10 International Organization for Standardization (1996). ISO9613 Acoustics – Attenuation of Sound during Propagation Outdoors: Part 2: General Method of Calculation

11 Department of Transport and Welsh Office (1988). Calculation of Road Traffic Noise

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13 Highways Agency and Welsh Office (2020). https://www.standardsforhighways.co.uk/dmrb/search/cc8cfcf7-c235-4052-8d32-d5398796b364 Accessed: 21 June 2020

14 Control of Pollution Act 1974 (1974 Chapter 40); http://www.legislation.gov.uk/ukpga/1974/40/contents; Accessed: 21 June 2020

15 Infrastructure Planning (Environmental Impact Assessment) Regulations 2009

16 Wilson Report on Noise 1963

17 Advisory Leaflet 72 - Noise Control on Building Sites. Department of the Environment, 1976

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19 The Control of Noise at Work Regulations 2005