The Great Grid Upgrade

North Humber to High Marnham

NHHM-AEC-CNS-REP-0111

North Humber to High Marnham

Volume 6: Environmental Statement

Document 6.16.A3 Environmental Statement Appendix 16.3 - Construction Noise and Vibration Data

Final Issue A

October 2026

Planning Inspectorate Reference: EN020034

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5(2)(a)

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1. Construction Noise and Vibration Data

1.1 Introduction

1.1.1 This appendix to **Application Document 6.16 Chapter 16 Noise and Vibration** presents the data used in the assessment of construction noise and vibration at noise and vibration sensitive receptors (NSRs).

1.1.2 This appendix is presented in two sections:

- construction noise; and
- construction vibration.

1.2 Construction Noise Data

Introduction

1.2.1 This section details the approach to the assessment of construction noise impacts from the Project.

1.3 Assessment Methodology

1.3.1 For the purposes of the noise and vibration assessment, activities have been grouped into their respective construction areas, as follows:

- construction access tracks and access construction;
- temporary construction compound construction;
- compound operation during construction;
- overhead line construction; and
- overhead line dismantling.

1.3.2 The worst-case activity within each area is considered.

1.3.3 Indicative distances within which Significant Observed Adverse Effect Levels (SOAEL) may be exceeded during daytime, evenings and weekends, and night-time periods, have been calculated based on the calculation methodology described in British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (BS 5228-1) (BSI, 2014a).

1.3.4 Although best practicable means (BPM) will be implemented to reduce levels of construction noise affecting NSRs, this assessment does not take account of specific mitigation measures, such as screening. This is so that potential construction noise 'hot-spots' can be identified. Where required, specific mitigation measures will be specified by the Main Works Contractor(s) and put in place, secured by commitments NV01 and NV02 of **Application Document 7.3 Register of Environmental Actions and Commitments**. The exception to the exclusion of screening within this initial assessment is specific plant and activities where screening would be expected as

standard, such as fixed plant items (generators and compressors), and jackhammering activity. All other sources are unscreened for the purposes of this assessment.

1.4 Construction Noise Levels

Construction Plant Data

1.4.1 Indicative construction plant and data associated with each proposed construction activity is provided in Table 1.1. The table provides the average expected sound power level for each activity. For the purposes of the assessment, attenuation from mitigation measures (such as screening) is not included, such that noise 'hot-spots' can be identified and specific mitigation measures can be identified. The data presented in Table 1.1 has been used to inform the assessment of construction noise, as presented in section 9 of **Application Document 6.16 Chapter 16 Noise and Vibration**.

Construction Noise Levels Over Distance

1.4.2 Table 1.2 provides indicative construction noise levels over a range of distances and shows how noise levels reduce with distance.

Construction Noise Effect Levels

1.4.3 Indicative distances within which the SOAEL may be exceeded during daytime, evenings and weekends, and night-time periods are provided Table 1.3.

Table 1.1 – Construction activity plant and noise data (without mitigation)

Activity	Plant Item	Number of Plant Items	BS 5228-1 Ref	% On-time	A-weighted Sound Pressure Level at 10m, dBA	Average Activity Sound Power Level, dBA
Construction Access Tracks and Access Construction						
Site preparation	Tracked excavator	2	C2.7	70	70	107
	Dozer	3	C2.1	70	75	
Topsoil strip	Tracked excavator	2	C2.7	70	70	107
	Dozer	3	C2.1	70	75	
Construction access tracks	Wheeled backhoe loader	1	C2.8	70	68	107
	Dumper	2	C4.4	70	76	
	Articulated dump truck (tipping fill)	1	C.2.32	5	74	
	Vibratory roller	1	C2.40	70	73	
Temporary Construction Compound Construction						
Site preparation	Tracked excavator	2	C2.7	70	70	107
	Dozer	3	C2.1	70	75	
Road construction	Dumper	3	C4.4	70	76	110
	Road Roller	1	C5.19	70	80	
Compound buildings	Telehandler	2	C4.55	50	70	98
	Generator	2	C3.33	100	57	

Activity	Plant Item	Number of Plant Items	BS 5228-1 Ref	% On-time	A-weighted Sound Pressure Level at 10m, dBA	Average Activity Sound Power Level, dBA
Compound Operation During Construction						
Compound operation	Lorry	1	C2.34	25	80	104
	Telehandler	2	C4.55	50	70	
	Generator	2	C3.33	100	57	
Overhead Line Construction						
Pylon Foundation Construction	Tracked excavator	1	C3.7	70	70	111
	Stell tube piling rig	1	C3.8	25	88	
	Concrete pump	1	C3.26	50	75	
Pylon Assembly	Telehandler	1	C4.55	50	70	95
Pylon installation	Crane lifting pylon	1	C4.46	10	67	85
Cable tensioning	Winder	1	Suppliers' data	60	77	106
	Rear Winder	1	Suppliers' data	60	77	
Overhead Line Dismantling						
Site preparation	Tracked excavator	1	C2.7	90	70	98
Breaking up concrete	Excavator mounted pulveriser	2	C1.5	50	72	100
Dumping brick rubble	Tracked excavator	1	C1.10	10	85	103
Breaking up/cutting steel	Tracked excavator	1	C1.16	25	82	104

Table 1.2 – Construction activity noise levels over distance (without mitigation)

Activity	Average activity Sound Power Level, dBA	Sound Pressure Level, dBA, at distance, meters					
		10	25	50	100	200	300
Construction Access Tracks and Access Construction							
Site preparation	107	82	74	68	62	56	53
Topsoil strip	107	82	74	68	62	56	53
Construction access tracks	107	82	74	68	62	56	52
Temporary Construction Compound Construction							
Site preparation	107	82	74	68	62	56	53
Road construction	110	85	77	71	65	59	55
Compound buildings	98	73	65	59	53	47	43
Compound Operation During Construction							
Compound operation	103	78	70	64	58	52	49
Overhead Line Construction							
Pylon foundation construction	111	86	78	72	66	60	56
Pylon assembly	95	70	62	56	50	44	40
Pylon installation	85	60	52	46	40	34	30
Conductor installation	106	81	73	67	61	55	51

Activity	Average activity Sound Power Level, dBA	Sound Pressure Level, dBA, at distance, meters					
		10	25	50	100	200	300
Overhead Line Dismantling							
Site preparation	98	73	65	59	53	47	43
Breaking up concrete	100	75	67	61	55	49	45
Dumping brick rubble	103	78	70	64	58	52	48
Breaking up/cutting steel	104	79	71	65	59	53	49

Table 1.3 – Construction activity SOAEL threshold distances (without mitigation)

Activity	Average Activity Sound Power Level, dBA	Daytime (65 dBA)	Evenings and weekends (55 dBA)	Nighttime (45 dBA)
Construction Access Tracks and Access Construction				
Site preparation	107	71	225	712
Topsoil strip	107	71	225	712
Construction access tracks	107	68	216	684
Temporary Construction Compound Construction				
Site preparation	107	71	225	712
Road construction	110	98	311	984
Compound buildings	98	25	80	252

Activity	Average Activity Sound Power Level, dBA	Daytime (65 dBA)	Evenings and weekends (55 dBA)	Nighttime (45 dBA)
Compound Operation During Construction				
Compound operation	103	47	149	471
Overhead Line Construction				
Pylon foundation construction	111	107	338	1067
Pylon assembly	95	18	56	178
Pylon installation	85	6	18	56
Conductor installation	106	62	195	616
Overhead Line Dismantling				
Site preparation	98	24	75	238
Breaking up concrete	100	32	100	316
Dumping brick rubble	103	45	141	447
Breaking up/cutting steel	104	50	158	500

1.5 Construction Vibration

Introduction

1.5.1 The construction vibration assessment has been undertaken with reference to the methods and empirical data outlined in BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BSI, 2014b).

1.5.2 The main significant sources of vibration during construction activities are expected to be ground compaction, and percussive or vibratory piling. These processes may be required during the following activities:

1.5.3 Ground compaction with vibratory roller:

- Temporary construction compound construction;
- site preparation; and
- construction of access tracks.

1.5.4 Piling:

- pylon foundations.

Prediction of Construction Vibration

1.5.5 Peak particle velocity (PPV) vibration levels in millimetres per second (mm/s) generated by ground compaction and piling activities can be predicted using the guidance and empirical formulae in Table E1 of BS 5228-2 (BSI, 2014b). The formulae are shown below.

Vibratory Roller Calculation Formula

$$v_{res} = k_s \sqrt{n_d} \left[\frac{A}{x+l_d}\right]^{1.5} \quad \text{(Equation 1)}$$

Where:

- V_{res} = resultant PPV in mm/s;
- k_s = scaling factor (and probability of predicted value being exceeded);
- n_d = number of vibrating drums;
- A = Maximum amplitude of drum vibration, in millimetres (mm);
- x = Distance measured along the ground surface, in metres (m); and
- L_d = vibrating roller drum width, in m.

Percussive Piling Calculation Formula

$$v_{res} \leq k_p [\frac{\sqrt{w}}{r^{1.3}}] \quad \text{(Equation 2)}$$

Where:

- V_{res} = Resultant PPV, in mm/s;

- K_p = Scaling factor (depending on soil conditions);
- W = Nominal hammer energy, in joules (J); and
- r = Slope distance from the pile toe, in m.

Assumptions

1.5.6 The following conservative assumptions have been made to predict vibration levels to assess a reasonable worst-case:

- Vibratory Roller assumptions:
  - Scaling factor of 75, representative of average conditions; and
  - Vibratory roller data based on worst case Bomag BW 213, 1 drum of 2.13 m width and maximum amplitude of 1.1 mm.
- Percussive piling assumptions:
  - Typical value of nominal hammer energy of 25kJ; and
  - Scaling factor of 1.5 representative of stick cohesive soils.

Vibration Prediction Results

1.5.7 Equations 1 and 2 have been used to predict the minimum distances within which the vibration threshold values human comfort impacts from vibration in terms of SOAEL and potential cosmetic building damage may be exceeded (1.0 mm/s, and 12.5 mm/s PPV respectively). The calculated distances in Table 1.4 are used in the assessment presented in Section 9 of **Application Document 6.16 Chapter 16 Noise and Vibration** to identify areas where NSRs are potentially affected by construction vibration.

Table 1.4 – Indicative construction vibration threshold distances

Activity	Distance within which SOAEL may be exceeded (m)	Distance within which cosmetic building damage may occur (m)
Ground compaction	18	<2
Percussive piling	70	<10

References

BSI. (2014a). BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise. London: BSI.

BSI. (2014b). BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration. London: BSI.

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