The Great Grid Upgrade

North Humber to High Marnham

Preliminary Environmental Information Report

Volume 3: Appendix 16.1 Construction Noise and Vibration Data

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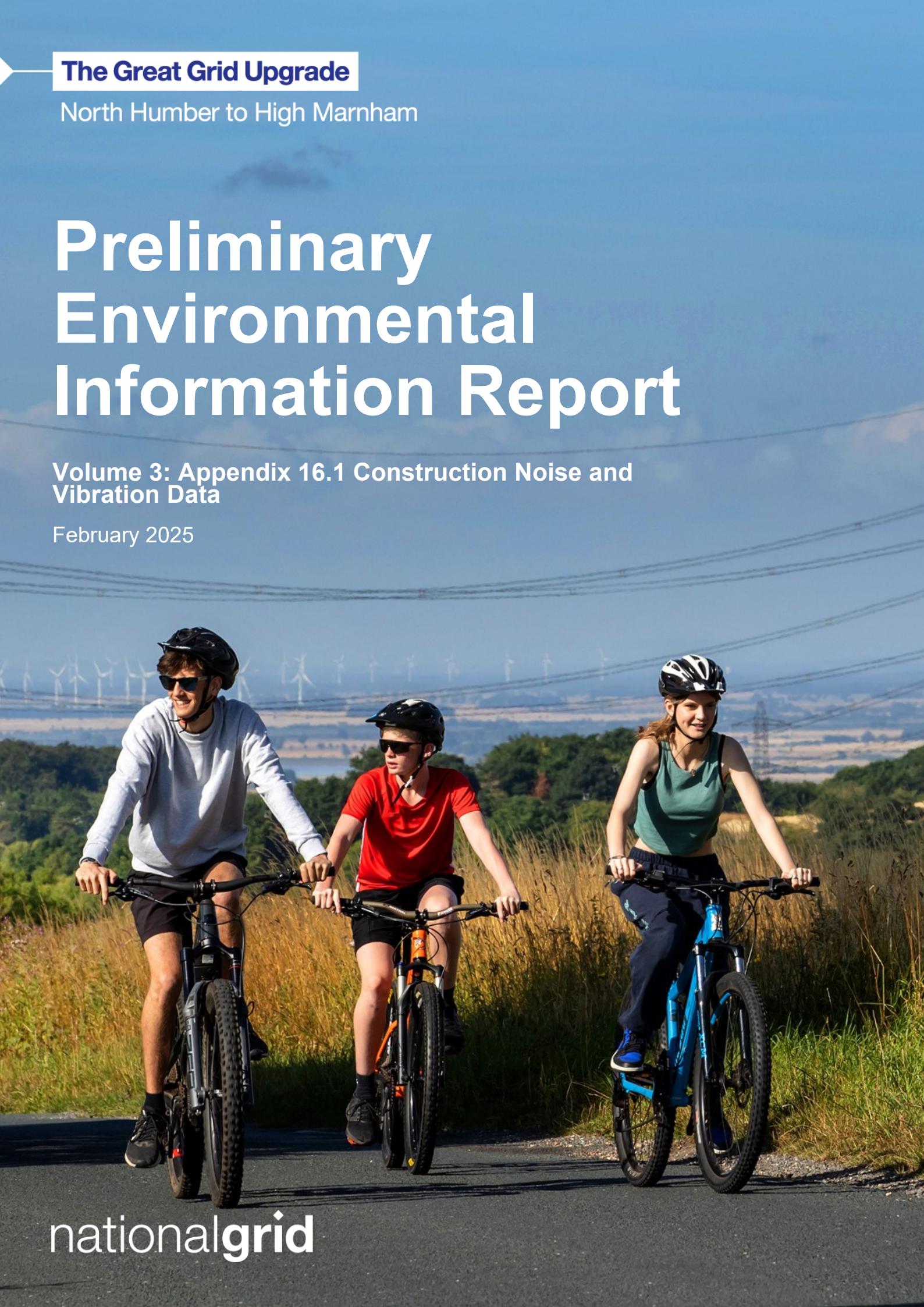

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Contents

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1. Introduction

1.1.1. This appendix has been produced to support **Chapter 14 Noise and Vibration** in Volume 2 of the Preliminary Environmental Information Report (PEIR). It sets out the information and data used within the assessment of noise and vibration effects from construction activities at noise sensitive receptors (NSR).

2. Construction Noise

2.1. Introduction

2.1.1. The construction noise assessment has been undertaken with reference to the methods and empirical data outlined in British Standard (BS) 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (Ref 16.1).

2.2. Construction Plant Data

2.2.1. Indicative construction plant and data associated with each proposed construction activity is provided in Table 2.1. The table provides the average expected sound power level for each activity. For the purposes of the assessment, attenuation from mitigation measures is not included, such that noise 'hot-spots' can be identified and specific mitigation measures can be identified.

2.3. Construction Noise Levels Over Distance

2.3.1. Table 2.2 provides indicative construction noise levels over a range of distances and shows how noise levels reduce with distance.

2.4. Construction Noise Effect Levels

2.4.1. Indicative distances within which Significant Observed Adverse Effect Levels (SOAEL) may be exceeded during daytime, evenings and weekends, and night-time periods are provided Table 2.3.

Table 2.1 - Construction activity plant and noise data

Activity	Plant item	Number of plant items	BS 5228-1 [1]	% On-time	A-weighted Sound Pressure Level at 10 m, dBA	Assumed attenuation due to embedded best practice measures, dB	Average activity Sound Power Level, dBA
General Works							
Site preparation	Tracked excavator	2	C2.7	70	70	0	107
	Dozer	3	C2.1	70	75	0	
Topsoil strip	Tracked excavator	2	C2.7	70	70	0	107
	Dozer	3	C2.1	70	75	0	
Temporary access routes	Wheeled backhoe loader	1	C2.8	70	68	0	107
	Dumper	2	C4.4	70	76	0	
	Vibratory roller	1	C2.40	70	73	0	
Temporary Construction Compounds							
Site preparation	Tracked excavator	2	C2.7	70	70	0	107
	Dozer	3	C2.1	70	75	0	
Road construction	Dumper	3	C4.4	70	76	0	110
	Road Roller	1	C5.19	70	80	0	
Compound buildings	Telehandler	2	C4.55	50	70	0	98
	Generator	2	C3.33	100	57	10	
	Lorry	1	C2.34	25	80	0	104

[1] This column presents the table and equipment referenced in BS 5228-1 (Ref 16.1). For example, C2.7 means the seventh equipment in Table C2 of BS 5228-1.

Activity	Plant item	Number of plant items	BS 5228-1 [1]	% On-time	A-weighted Sound Pressure Level at 10 m, dBA	Assumed attenuation due to embedded best practice measures, dB	Average activity Sound Power Level, dBA
Compound operation	Telehandler	2	C4.55	50	70	0	
	Generator	2	C3.33	100	57	10	
Overhead Line Removal							
Site preparation	Tracked excavator	1	C2.7	90	70	0	98
Breaking up concrete	Excavator mounted pulveriser	2	C1.5	50	72	0	100
Dumping brick rubble	Tracked excavator	1	C1.10	10	85	0	103
Breaking up/ cutting steel	Tracked excavator	1	C1.16	25	82	0	104
Overhead Line Construction							
Pylon construction	Tracked excavator	1	C2.7	70	70	0	111
	Steel tube piling rig	1	C3.8	25	88	0	
	Concrete pump	1	C3.26	50	75	0	
Pylon Assembly	Telehandler	1	C4.55	50	70	0	95
Pylon installation	Crane	1	C4.46	10	67	0	85
Conductor Installation	Puller/Tensioner	1	Suppliers' data	60	77	0	106
	Rear Winder	1	Suppliers' data	60	77	0	

Table 2.2 - Construction activity noise levels over distance

Activity	Average activity Sound Power Level, dBA	Sound Pressure Level, dBA, at distance, meters					
		10	25	50	100	200	300
General Works							
Site preparation	107	82	74	68	62	56	53
Topsoil strip	107	82	74	68	62	56	53
Temporary access routes	107	82	74	68	62	56	52
Temporary Construction Compounds							
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	103	78	70	64	58	52	49
Overhead Line Removal							
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
Overhead Line Construction							
Pylon 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

Table 2.3 - Construction activity noise SOAEL distances

Activity	Average Activity Sound Power Level, dBA	Daytime (65 dBA)	Evenings and weekends (55 dBA)	Night time (45 dBA)
General works				
Site preparation	107	71	225	712
Topsoil strip	107	71	225	712
Temporary access routes	107	68	216	684
Temporary Construction Compounds				
Site preparation	107	71	225	712
Road construction	110	98	311	984
Compound buildings	98	25	80	252
Compound operation	103	47	149	471
Overhead Line Removal				
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
Overhead Line Construction				
Pylon construction	111	107	338	1067
Pylon assembly	95	18	56	178
Pylon installation	85	6	18	56
Conductor installation	106	62	195	616

3. Construction Vibration

3.1. Introduction

3.1.1. 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 (Ref 16.2).

3.1.2. 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:

- Ground compaction with vibratory roller:
  - setup of site compounds;
  - site preparation; and
  - temporary access route construction.
- Piling:
  - pylon foundations.

3.2. Prediction of Construction Vibration

3.2.1. 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 (Ref 16.2). 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

3.2.2. 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 2.13m width and maximum amplitude of 1.1mm.
- Percussive piling assumptions:
  - Typical value of nominal hammer energy of 25kJ; and
  - Scaling factor of 1.5 representative of typical soil conditions.

Vibration Prediction Results

3.2.3. 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 3.1 are used in the preliminary assessment to identify areas where NSR are potentially affected by construction vibration.

Table 3.1 - 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

4. References

Ref 16.1 British Standards Institute (2014). BS 5228-1:2009+A1:2014. Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. [Online]. Available at: https://www.landingpage.bsigroup.com/LandingPage/Standard?UPI=000000000030258086 [Accessed: November 2024].

Ref 16.2 British Standards Institute (2014). BS 5228-2:2009+A1:2014. Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration. [Online]. Available at: https://www.landingpage.bsigroup.com/LandingPage/Standard?UPI=000000000030258089 [Accessed: November 2024].

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