The Great Grid Upgrade

Sea Link

Preliminary Environmental Information Report

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Part 3 Kent Onshore Scheme

Appendix 3.10.B Kent Construction Noise and Vibration Data

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3.10.B Construction Noise and Vibration Data

3.10.B.1 Introduction

3.10.B.1.1 This appendix presents the data used in the assessment of construction noise and vibration at noise and vibration sensitive receptors (NSR).

3.10.B.1.2 This appendix is presented in three sections:

- construction noise;
- construction vibration;
- construction traffic noise; and
- construction traffic vibration.

3.10.B.2 Construction Noise Data

Introduction

3.10.B.2.1 This section details the approach to the assessment of construction noise impacts from the Proposed Project.

Assessment Methodology

2.10.B.2.2 Indicative construction plant and data associated with each proposed construction activity is provided in **Appendix 1.4.E Construction Plant Schedule**. The appendix also provides the average expected sound levels for each activity. For the purposes of this assessment, activities have been grouped into their respective construction areas, as follows:

- substation and converter station construction;
- cable construction;
- overhead line construction;
- overhead line dismantling;
- haul roads and compound construction; and
- trenchless crossings.

2.10.B.2.3 The worst-case activity within each area is considered.

3.10.B.2.4 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) (Ref 3.10.B.1).

3.10.B.2.5 Although best practicable means (BPM) will be implemented to reduce levels of construction noise affecting NSR, this initial assessment does not take account of specific mitigation measures, such as screening. This is so that potential construction noise 'hot-spots' can be identified. Specific mitigation measures can be specified and put in place, secured by a requirement in the Development Consent Order (DCO), at those locations, where required. The exception to the exclusion of screening within this initial assessment is specific plant and activities where screening would be expected as standard. This includes fixed plant items (generators and compressors), and jackhammering activity. All other sources are unscreened for the purposes of this assessment.

3.10.B.2.6 Although the assessment assumes no specific mitigation measures, where screening is applied as part of BPM, noise levels would be expected to be reduced by between 5 and 10 decibel (dB). Other BPM measures may reduce noise levels further.

Construction Noise Threshold Distances

3.10.B.2.7 Indicative distances within which SOAEL may be exceeded during daytime, evenings and weekends, and night-time periods are provided in Table 3.10.B.1.

3.10.B.2.8 The majority of works would be conducted during standard weekday daytime periods and Saturdays, as defined in **Volume 1, Part 1, Chapter 4: Description of the Proposed Project**. This includes:

- Monday – Friday: 07:00-1900.
- Saturday – 0700-1700.
- Sundays/Bank Holidays – non working.

3.10.B.2.9 Exceptions to the above include but not limited to:

- Continuous periods of operation such as concrete pouring, dewatering, cable pulling, cable jointing and drilling during the operation of a trenchless technique (e.g. Horizontal Directional Drill (HDD)), installation and removal of conductors, pilot wires and associated protective netting above and across highways or public footpaths.
- Internal fitting out works within buildings associated with the Minster Substation and Minster Converter Station.
- Delivery to the transmission works of abnormal loads that may cause congestion on the local road network (e.g. transformer delivery vehicles, cable drum delivery) or any other highway works requested by the relevant Highway Authority to be undertaken on a Saturday, Sunday or Bank Holiday outside of core working hours.
- Testing or commissioning.
- Completion of construction activities commenced during the approved working hours which cannot safely be stopped.
- Activities necessary in the instance of an emergency where there is a risk to persons, delivery of electricity or property.
- Marine works (all works below the mean high water springs (MHWS) line).
- Survey works.

3.10.B.2.10 These would in most cases be relatively quiet works, or isolated occurrences and would not typically be significant due to the temporal criteria for significance not being exceeded.

3.10.B.2.11 One particular exception, where extended periods of evening, weekend, or night-time working may be required, is during the operation of a trenchless technique (e.g. HDD). Potential night-time works are therefore assessed for this activity.

Table 3.10.B.1 Construction activity noise SOAEL distances without mitigation

Activity	Worst-case activity sound power level, dBA	Distance within which SOAEL may be exceeded		
		Daytime (65 dBA)	Evening and weekends (55 dBA)	Night-time (45 dBA)
Converter station and substation construction	119	126	320	800
Cable construction	114	83	210	525
Overhead line construction	119	126	320	800
Overhead line dismantling	110	60	150	380
Haul roads and compound construction	105	36	90	230
Trenchless technique	102	27	70	175

3.10.B.3 Construction Vibration Data

Introduction

3.10.B.3.1 The construction vibration assessment has been undertaken with reference to the methods and empirical data outlined in BS 5228:2009+A1:2014 Part 2 (BS 5228-2) (Ref 3.10.B.2).

3.10.B.3.2 The main significant sources of vibration during construction activities are expected to be ground compaction. These processes may be required during the following activities:

- Ground compaction with vibratory roller:
  - setup of site compounds;
  - site preparation;
  - haul road construction; and
  - cable laying.

- Piling:
  - pylon foundations; and
  - substation foundations.

Prediction of Construction Vibration

3.10.B.3.3 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 3.10.B.2). The formulae are shown below.

Vibratory roller

Calculation

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

Where:

V_{res} = Resultant PPV, in millimetres per second (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)

L_d = vibrating roller drum width, in metres (m)

Assumptions

Scaling factor of 75, representative of average conditions.

Vibratory roller data based on Bomag BW 213, 1 drum of 2.13 m width and maximum amplitude of 1.1 mm.

Percussive pilling

Calculation

$$v_{res} = k_s\sqrt{n_d}\left[\frac{A}{x+L_d}\right]^{1.5}$$ (Equation 2)

Where:

V_{res} = Resultant PPV, in millimetres per second (mm/s)

K_p = Scaling factor (depending on soil conditions)

W = Nominal hammer energy, in joules (J)

r = Slope distance from the pile toe, in metres (m)

Assumptions

Typical value of nominal hammer energy of 25kJ.

Scaling factor of 1.5 representative of typical soil conditions

Vibration Prediction Threshold Distances

3.10.B.3.4 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 3.10.B.2 are used in the preliminary assessment to identify areas where NSR are potentially affected by construction vibration.

Table 3.10.B.2 Indicative construction vibration threshold distances

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

3.10.B.4 Construction Traffic Noise

Introduction

3.10.B.4.1 This section describes the assessment of construction traffic noise on the public highways. The assessment of construction traffic noise has been conducted following the guidance detailed in Design Manual for Roads and Bridges LA 111 (DMRB LA111) (Ref 3.10.B.3) and the Calculation of Road Traffic Noise (CRTN) (Ref 3.10.B.4).This provides guidance for the assessment and noise and vibration impacts from road projects, however, the guidance is widely used in the assessment of construction noise and vibration impacts from other types of project, particularly with regards to construction traffic noise in lieu of other guidance.

Assessment Methodology

3.10.B.4.2 Noise from construction traffic on the public highway has been calculated in accordance with the (CRTN) (Ref 3.10.B.4) and assessed against the criteria detailed in DMRB LA 111 (Ref 3.10.B.3). The basic noise level (BNL) from public roads used as construction traffic routes has been calculated in accordance with CRTN for the do-minimum and do-something scenarios in the construction period. The calculated BNL values were compared to determine the magnitude of the impact.

3.10.B.4.3 The BNL is standardised metric for determining the noise level from a road and is defined as the noise level exceeded for 10% of the time at a reference of 10m away from the nearside carriageway edge obtained from traffic flow, speed, composition road gradient and road surface, and is calculated in line with the methodology described in CRTN.

3.10.B.4.4 The study area is defined following the guidance detailed in DMRB LA 111 which states that the construction traffic study areas shall be defined to include a 50m width from the kerb line of public roads with the potential for an increase in BNL of 1 dB or more as a result of the additional construction traffic to existing traffic levels.

3.10.B.4.5 The calculation methodology described in CRTN utilises the Annual Average Weekday Traffic over the 18 hour period between 06:00 and 00:00 (AAWT,18h). However, the 18 hour traffic data is not available at the time of writing. The assessment is therefore based on 12 hour data. In principle, this is slightly worst case as the construction traffic would be the same over a 12 hour period, whereas the baseline traffic flows would be lower. The relative addition of the construction traffic to the baseline is therefore slightly greater. For simplicity, the following methodology references 18 hour data.

3.10.B.4.6 The standard CRTN BNL calculation is applicable where traffic flows are greater than 4000 vehicles per 18-hour day. Where flows are between 1000 and 4000 vehicles per day, a 'low flow' correction can be applied which is a function of the distance from the carriageway. For the purposes of the initial assessment, a typical worst-case distance of 10m has been assumed (the correction reduces with increased distance, with no correction applied beyond 30m). Where flows are less than 1000 vehicles per day, the BNL has been calculated and compared but it results should be treated with caution as CRTN states that calculations of traffic flows below 1000 vehicles per 18 hour day are unreliable. However, where traffic flows are low, absolute noise levels would be expected to be low and would not likely lead to significant adverse effects. Additional discussion is provided in these cases, where applicable.

3.10.B.4.7 Where there are potential changes in the BNL on roads greater than or equal to 1dB(A) a subsequent assessment of the impacts on NSR within 50m of routes where there are potential significant effects has been conducted. NSR include dwellings (including listed buildings), healthcare facilities, education facilities or other buildings where noise or vibration can cause disturbance to people using the buildings.

3.10.B.4.8 Exceedance of the change in traffic noise by greater than or equal to 3.0dB and less than 5dB is considered medium magnitude impact, while a change in traffic noise level of Greater than or equal to 5dB is considered a large magnitude impact. Construction traffic noise effects are considered to be significant where there are medium or large magnitude impacts for a duration of ten or more days in any 15 consecutive days or for a total number of days exceeding 40 in any six consecutive months.

Assessment Results

3.10.B.4.9 The results of the construction traffic noise assessment are provided in Table 3.10.B.3. It is assumed that there is no change in average speed between the do-minimum and do something scenarios.

3.10.B.4.10 The results indicate that there is a small magnitude impact on one route; namely Ebbsfleet Lane. The impact of all other routes is negligible magnitude. Within 50m of Ebbsfleet Lane there are residential receptors and medium sensitivity non-residential receptors. The effect of construction traffic is therefore likely **not significant**.

Table 3.10.B.3 Construction traffic noise assessment – public highway

Road name/location	Baseline data		Baseline data plus construction traffic		BNL, dB $L_{A10,18h}$		Change, dB	Outcome
	Total daily vehicles	%HGV	Total daily vehicles	%HGV	Baseline	Baseline plus construction traffic		
A299 (West)	23406	5.2	23991	5.8	76.1	76.3	+0.2	Negligible magnitude
A299 (East)	33123	3.4	33225	3.5	77.2	77.3	+0.1	Negligible magnitude
A256 (South)	26857	6.1	26998	6.2	76.8	76.9	+0.1	Negligible magnitude
Sandwich Road	24489	6.2	24755	6.5	72.3	72.4	+0.1	Negligible magnitude
A256 (K-BM02)	26857	6.1	28101	7.2	76.0	76.4	+0.4	Negligible magnitude
A299/A256 Roundabout)	41218	4.7	41977	5.2	77.6	77.8	+0.2	Negligible magnitude
A256/Sandwich Road Roundabout	38711	6.2	39197	6.5	76.9	77.0	+0.1	Negligible magnitude
Ebbsfleet Lane (K-BM01)	2449	6.2	2716	8.7	61.9	63.1	+1.2	Small magnitude
Jutes Lane (K-BM03)	1343	6.1	1449	6.3	57.9	58.5	+0.6	Negligible magnitude

3.10.B.5 Construction Traffic Vibration

Introduction

3.10.B.5.1 This section details the assessment of construction traffic vibration on the existing public highway. However, the outcomes are equally applicable to construction traffic on haul roads and access tracks.

Assessment Methodology

3.10.B.5.2 As described in DMRB LA 111 (Ref 3.10.B.3), construction traffic vibration on the public highway is caused by irregularities in the road surface (e.g. potholes). Where the road surface is free of irregularities, significant levels of vibration from road traffic would not be expected. Determination of road surface defects along proposed construction traffic routes is outside the scope of this assessment, but indicative road traffic vibration levels have been calculated for various defect depth, various vehicle speeds, and at various distances from the defect, based on the methodology described in Transport and Road Research Laboratory Research Report 246 Traffic induced vibration in buildings (Ref 3.10.B.5). The formula is shown below.

Road traffic vibration formula

$PPV_{max} = 0.028 \cdot a \cdot (v/48) \cdot t \cdot p \cdot (r/6)^x$ (Equation 1)

Where:

a = maximum height or depth of the surface defect in mm

v = maximum expected speed of HGVs in km/h

t = ground scaling factor

p = wheel path correction

r =distance of the foundation from the defect

x = power factor

Road traffic vibration assumptions

3.10.B.5.3 The following assumptions have been made:

a = various (10 and 30 mm)

v = various (10 to 50 km/h)

t = 0.94 (standard sand/gravel ground)

p = 0.75 (assumes single wheel path, e.g. pothole)

r = various (1 to 20m)

x = -0.74 (standard sand/gravel ground)

Criteria

3.10.B.5.4 There are no specific criteria for construction vibration effects from road traffic. However, based on guidance from DMRB LA 111 (Ref 3.10.B.3) and BS 5228-2 (Ref 3.10.B.2), the lowest observed adverse effect level (LOAEL) can be considered to be a vibration level of 0.3 mm/s, and the SOAEL can be considered to be a vibration level of 1.0 mm/s.

Road Traffic Vibration Threshold Distances

3.10.B.5.5 Equation 1 has been used to predict vibration levels from construction road traffic. The predictions are shown in for various defect depths, vehicle speeds, and distances from the defect.

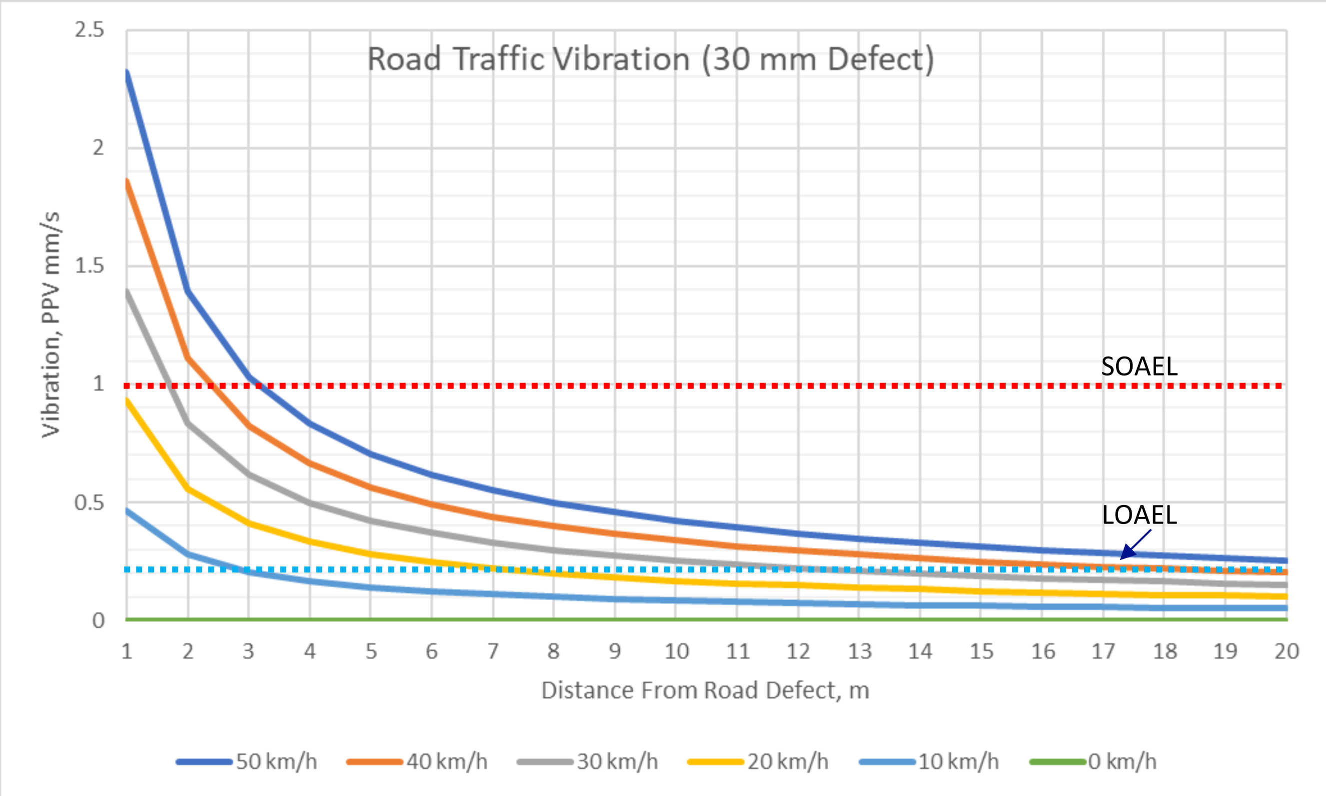

Image 3.10.B.1 Predicted road traffic vibration levels – 30 mm defect depth

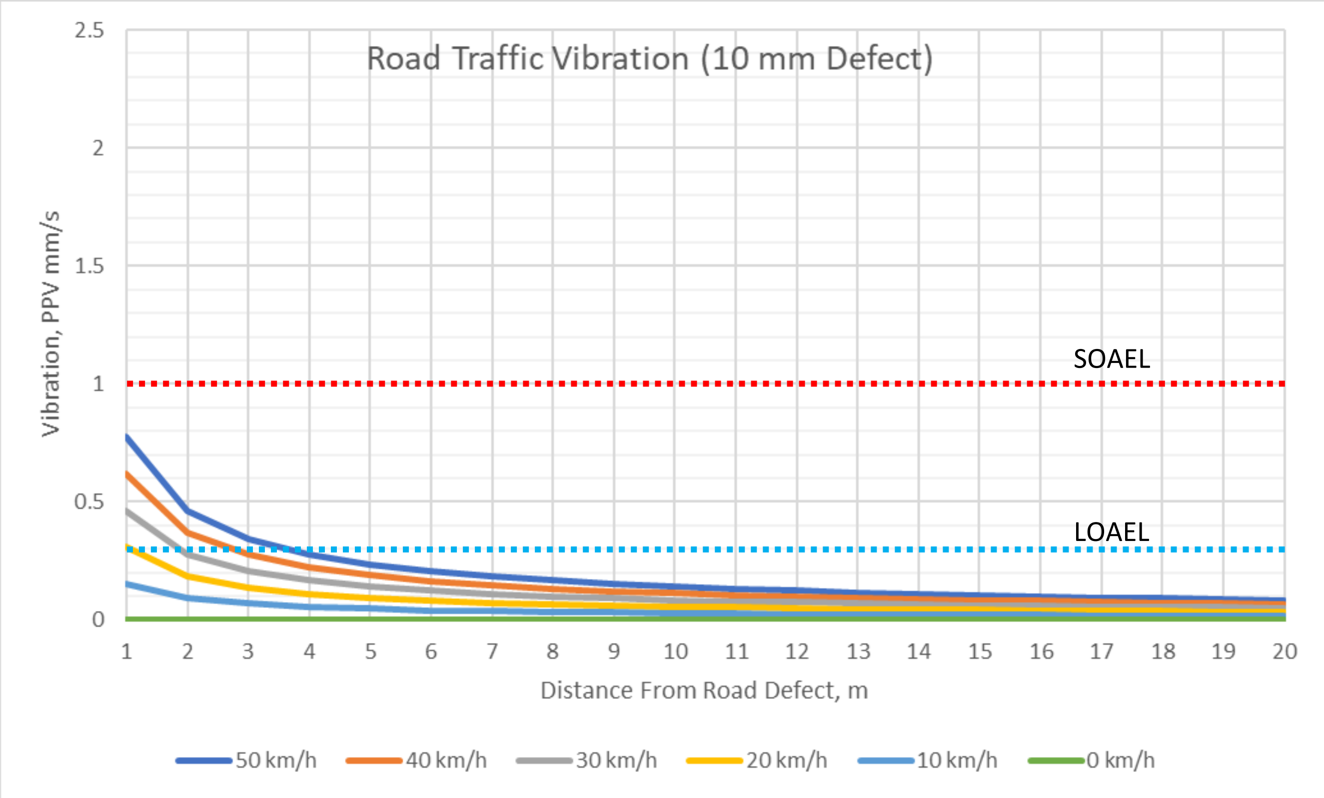

Image 3.10.B.2 Predicted road traffic vibration levels – 10 mm defect depth

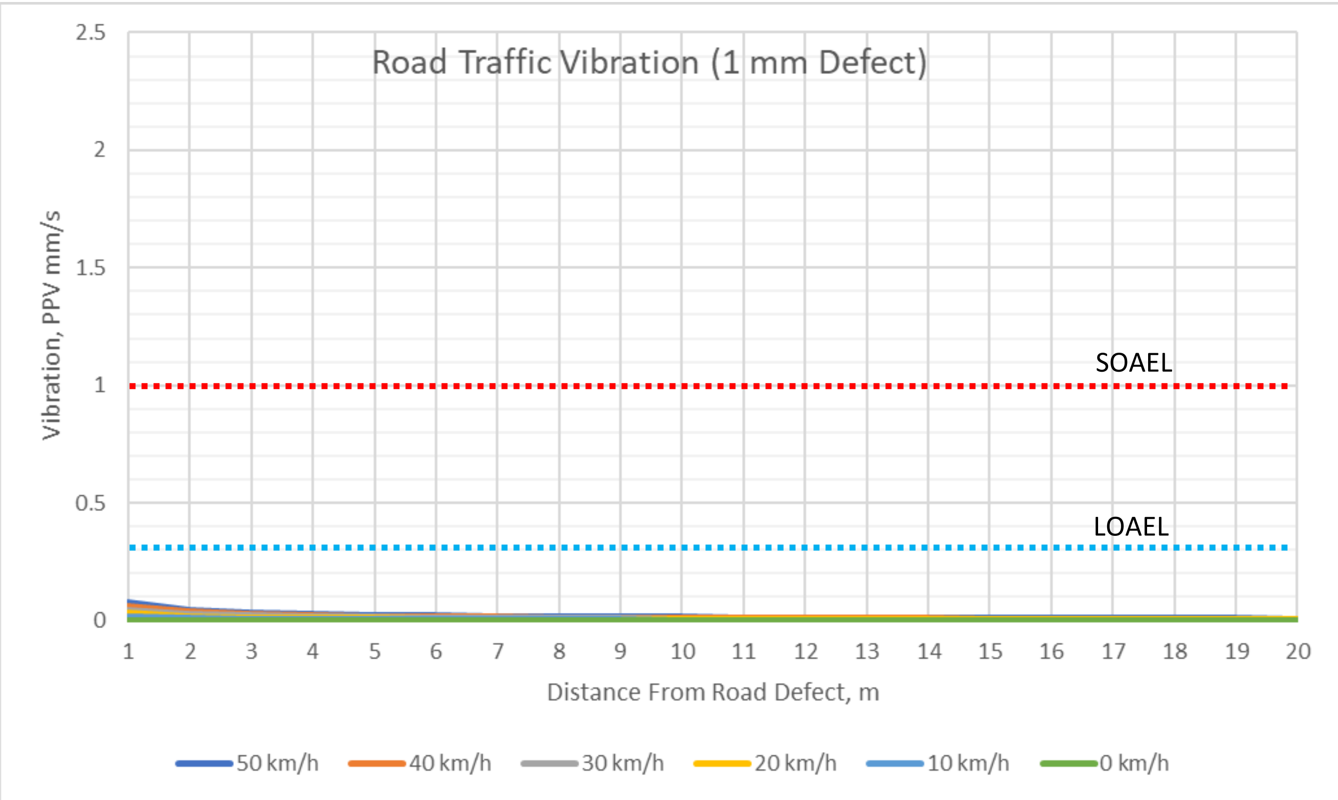

Image 3.10.B.3 Predicted road traffic vibration levels – 1 mm defect depth

Discussion

3.10.B.5.6 The results indicate that the vibration LOAEL of 0.3 mm/s or SOAEL of 1 mm/s PPV are not likely to be exceeded where roads are free from defects, traffic speeds are low, or where the distance from the defect is beyond a few metres, depending on the various factors.

3.10.B.5.7 As the defect size reduces and tends towards 0mm, the vibration level tends towards 0 mm/s PPV.

3.10.B.5.8 Construction traffic vibration is not expected to be significant where the public highway, access tracks, and haul roads are appropriately maintained. Additionally, appropriate measures, such as the control of construction traffic speeds and selection of appropriate access routes, will be implemented to reduce potential vibration impacts at NSR. These will be detailed in a Construction Traffic Management Plan (CTMP) which will be produced prior to construction.. An outline CTMP is provided in Volume 2, Part 1, Appendix 1.4.C.

3.10.B.6 References

Ref 3.10.B.1 British Standard Institution. (2014). British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.

Ref 3.10.B.2 British Standard Institution. (2014). British Standard 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

Ref 3.10.B.3 Highways England et al. (2020).Design Manual for Roads and Bridges LA 111 Noise and vibration.

Ref 3.10.B.4 Department of Transport. (1988). Calculation of Road Traffic Noise.

Ref 3.10.B.5 Department of Transport, Transport and Road Research Laboratory (1990). Research Report 246, Traffic induced vibration in buildings.

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