The London Resort Development Consent Order

BC080001

Environmental Statement
Volume 2: Appendices

Appendix 15.3 – Construction noise and vibration assessment

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Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
Regulation 5(2)(a)
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
Regulation 12(1)

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Appendix 15.3 Construction Noise and Vibration Assessment

INTRODUCTION

15.3.1 This section presents the construction noise assessment for the London Resort Environmental Statement. Predicted noise levels from construction have been used to assess the significance of effect from construction noise, from different phases of construction, at each identified Noise Sensitive Receptor (NSR).

CONSTRUCTION NOISE ASSESSMENT CRITERIA

15.3.2 The criteria for the significance of effect due to construction noise upon noise sensitive receptors are derived from Annex E of BS 5228-1:2009+A1:2014. These criteria are based on the total construction noise level, which is the combination of the pre-existing ambient noise level plus construction noise. The threshold of significant effect on dwellings criteria is included in Table 15.3.1.

15.3.3 The significance of construction noise can be determined using the ABC method from BS 5228:2009+A1:2014 which sets an appropriate "Assessment Category" that is derived from the pre-existing ambient noise level. If the total construction noise level exceeds the Assessment Category value, then a significant effect is deemed to occur.

15.3.4 The magnitude of impact from noise can be summarised as shown in Table 15.3.1.

Table 15.3.1: Threshold of significant effect on dwellings (BS 5228:2009+A1:2014)

Evaluation period	Assessment category (LAeq,T dB)		
	A	B	C
Night-time (23:00-07:00)	45	50	55
Evening and Weekends*	55	60	65
Daytime (07:00-19:00)	65	70	75

**19:00 - 23:00 weekdays, 13:00 - 23:00 Saturdays and 07:00 - 23:00 Sundays.*

Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Cat A.

Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Cat A.

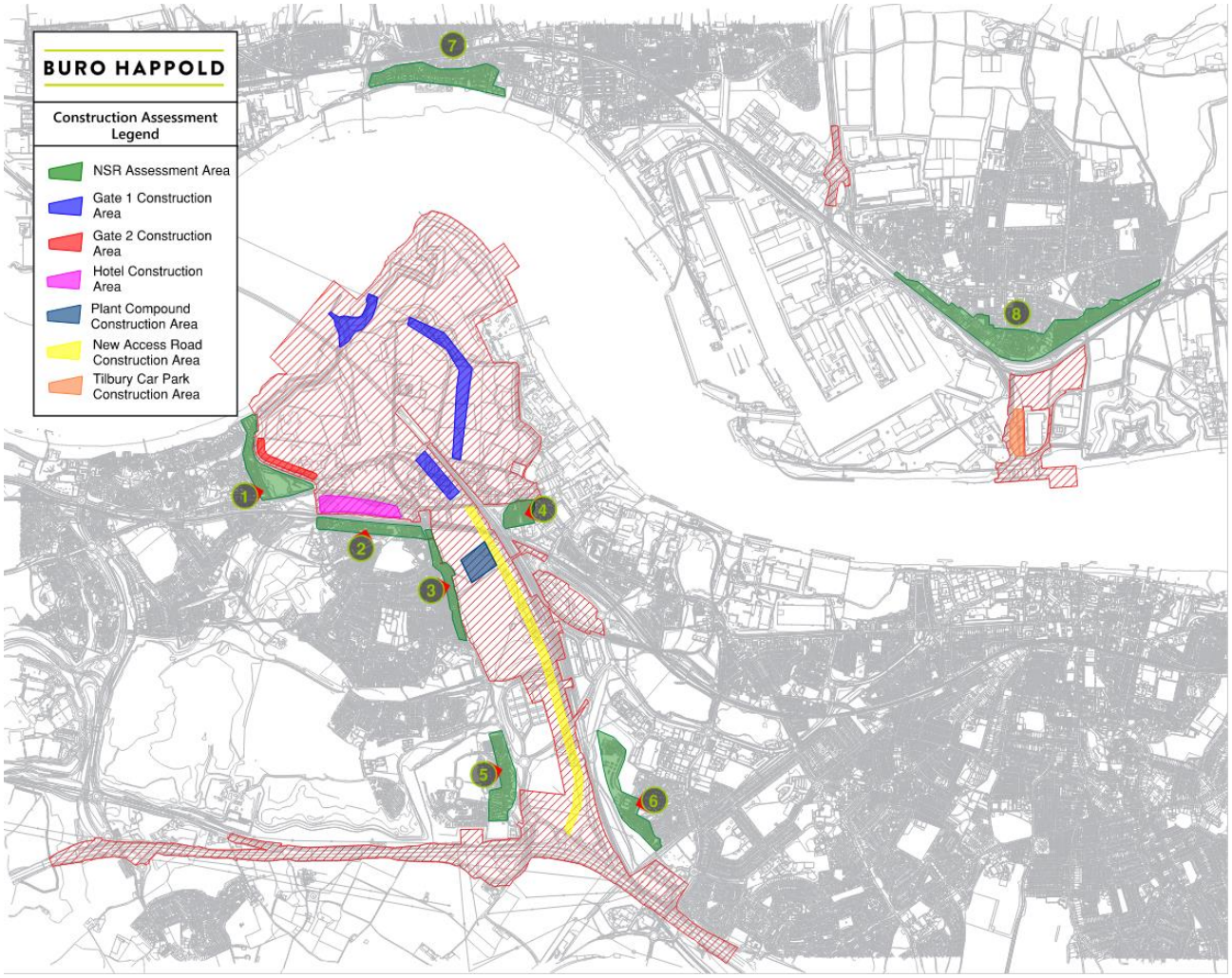
The Category (A, B or C) is to be determined separately for each time period and the lowest noise category is then used throughout the 24-hour cycle, e.g. a site which is Category A by day and Category B or C in the evening and night will be treated as Category A for day, evening and night.

Table 15.3.2: Magnitude of impact from construction noise

Magnitude of impact	Total construction noise level
Negligible	0 to 3 dB > Assessment Category
Small	3 to 5 dB > Assessment Category
Medium	5 to 10 dB > Assessment Category
Large	+10 dB > Assessment Category

15.3.5 The construction phases and NSRs are shown in Diagram 15.3.1. There is, in addition, the potential for impact on marine life due to construction vibration created on land transmitting to underwater noise. Therefore, the river Thames is an NSR itself.

Diagram 15.3.1: Construction noise assessment areas and NSRs



PLANT AND EQUIPMENT

15.3.6 The tables in the present section identify the sound pressure level of construction plant and equipment at the 10 metres threshold as presented in BS 5228-1:2009+A1:2014 and at distances representative of the nearest noise sensitive receptors from the noise source.

Table 15.3.3: Indicative plant type and equipment during construction activities.

Plant	Stage of Construction				Lw dB(A)	BS 5228-1 reference
	Earthworks	Piling	Paving	General construction		
Air Compressors	x	x	x	x	93	Table C.5, Item 5
Concrete Crushing Plant	x	-	-	-	110	Table C.1, Item 14
Delivery Trucks	x	x	x	x	106	Table C.8, Item 21
Diamond Cutting Tools/Saws	-	-	-	x	119	Table C.4, Item 70
Dumpers	x	x	x	x	107	Table C.2, Item 30-31
Eight-wheeler Trucks	x	-	x	x	113	Table C.10, Item 16
Excavator Mounted Hydraulic Breakers	x	-	-	x	118	Table C.1, Item 9
Forklift Trucks	-	-	-	x	116	Table D.7, Item 94
Hand Held Tools including breakers (pneumatic and hydraulic)	x	-	x	x	111	Table C.1, Item 6
Hand/Power Tools	x	-	x	x	93	-
Mobile Access Platforms	-	-	x	x	95	Table C.4, Item 57
Mobile Craneage / Tower Cranes	x	x	x	x	104	Table C.4, Item 48

Plant	Stage of Construction				Lw dB(A)	BS 5228-1 reference
	Earthworks	Piling	Paving	General construction		
Piling Rigs (Rotary)	-	x	-	-	111	Table C.3, Item 14
Power Tools including percussion drills, cutting disks, pipe -threaders	x	x	-	x	106	Table D.6, Item 52
Pulveriser Mounted on Excavator	-	-	-	-	104	Table C.1, Item 4
Scaffold	x	-	-	x	108	Table D.7, Item 1
Skips and Skip Trucks	x	x	x	x	106	Table C.8, Item 21
Tracked / Wheeled 360 degree Excavators	x	x	x	x	105	Table C.2, Item 2
Total Lw dB(A) per stage	**121**	**115**	**117**	**124**		

15.3.7 This list of plant (referenced from BS 5228-1:2009+A1:2014) has been used to derive the total sound power output level for each construction activity. A full list of plant associated with each construction phase is represented below.

Table 15.3.4: Earthworks

Earthworks	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Air Compressors	93	0.6	1	0	-2	91
Concrete Crushing Plant	110	0.3	2	3	-5	108
Delivery Trucks	106	0.5	2	3	-3	106
Diamond Cutting Tools/Saws	119	-	-	-	-	-
Dumpers	107	0.3	2	3	-5	105
Eight-wheeler Trucks	113	0.75	3	5	-1	117
Excavator Mounted Hydraulic Breakers	118	0.5	2	3	-3	118
Forklift Trucks	116	-	-	-	-	-

Earthworks	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Hand Held Tools including breakers (pneumatic and hydraulic)	111	0.3	1	0	-5	106
Hand/Power Tools	93	0.3	2	3	-5	91
Mobile Access Platforms	95	-	-	-	-	-
Mobile Craneage / Tower Cranes	104	0.5	1	0	-3	101
Piling Rigs (Rotary)	111	-	-	-	-	-
Power Tools including percussion drills, cutting disks, pipe -threaders	106	0.3	2	3	-5	104
Pulveriser Mounted on Excavator	104	-	-	-	-	-
Scaffold	108	0.75	3	5	-1	112
Skips and Skip Trucks	106	0.75	2	3	-1	108
Tracked / Wheeled 360 degree Excavators	105	0.75	2	3	-1	107
					Total	**122**

Table 15.3.5: Piling

Piling	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Air Compressors	93	0.5	2	3	-3	93
Concrete Crushing Plant	110	-	-	-	-	-
Delivery Trucks	106	0.5	2	3	-3	106
Diamond Cutting Tools/Saws	119	-	-	-	-	-
Dumpers	107	0.3	2	3	-5	105
Eight-wheeler Trucks	113	-	-	-	-	-
Excavator Mounted Hydraulic Breakers	118	-	-	-	-	-
Forklift Trucks	116	-	-	-	-	-
Hand Held Tools including breakers (pneumatic and hydraulic)	111	-	-	-	-	-
Hand/Power Tools	93	-	-	-	-	-
Mobile Access Platforms	95	-	-	-	-	-

Piling	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Mobile Craneage / Tower Cranes	104	0.75	2	3	-1	106
Piling Rigs (Rotary)	111	0.75	2	3	-1	113
Power Tools including percussion drills, cutting disks, pipe -threaders	106	0.3	2	3	-5	104
Pulveriser Mounted on Excavator	104	-	-	-	-	-
Scaffold	108	-	-	-	-	-
Skips and Skip Trucks	106	0.75	2	3	-1	108
Tracked / Wheeled 360 degree Excavators	105	0.75	2	3	-1	107
					Total	**116**

Table 15.3.6: Paving

Concrete operations	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Air Compressors	93	0.6	2	3	-2	94
Concrete Crushing Plant	110	-	-	-	-	-
Delivery Trucks	106	0.75	1	0	-1	105
Diamond Cutting Tools/Saws	119	-	-	-	-	-
Dumpers	107	0.3	1	0	-5	102
Eight-wheeler Trucks	113	0.75	1	0	-1	112
Excavator Mounted Hydraulic Breakers	118	-	-	-	-	-
Forklift Trucks	116	-	-	-	-	-
Hand Held Tools including breakers (pneumatic and hydraulic)	111	0.3	1	0	-5	106
Hand/Power Tools	93	0.3	2	3	-5	91
Mobile Access Platforms	95	0.5	1	0	-3	92
Mobile Craneage / Tower Cranes	104	0.5	1	0	-3	101
Piling Rigs (Rotary)	111	-	-	-	-	-
Power Tools including percussion drills, cutting disks, pipe -threaders	106	-	-	-	-	-

Pulveriser Mounted on Excavator	104	-	-	-	-	-
Scaffold	108	-	-	-	-	-
Skips and Skip Trucks	106	0.5	2	3	-3	106
Tracked / Wheeled 360 degree Excavators	105	0.75	2	3	-1	107
					Total	**115**

Table 15.3.7: General construction

General site activities	Lw dB(A)	Time 'on'	Number of plant	Corrected for number of plant	Corrected for time 'on'	Corrected Lw dB(A)
Air Compressors	93	0.5	2	3	-3	93
Concrete Crushing Plant	110	-	-	-	-	-
Delivery Trucks	106	0.5	2	3	-3	106
Diamond Cutting Tools/Saws	119	0.2	1	0	-7	112
Dumpers	107	0.3	2	3	-5	105
Eight-wheeler Trucks	113	0.5	2	3	-3	113
Excavator Mounted Hydraulic Breakers	118	0.5	2	3	-3	118
Forklift Trucks	116	0.3	2	3	-5	114
Hand Held Tools including breakers (pneumatic and hydraulic)	111	0.3	1	0	-5	106
Hand/Power Tools	93	0.5	2	3	-3	93
Mobile Access Platforms	95	0.3	2	3	-5	93
Mobile Craneage / Tower Cranes	104	0.3	2	3	-5	102
Piling Rigs (Rotary)	111	-	-	-	-	-
Power Tools including percussion drills, cutting disks, pipe -threaders	106	0.5	2	3	-3	106
Pulveriser Mounted on Excavator	104	-	-	-	-	-
Scaffold	108	0.5	2	3	-3	108
Skips and Skip Trucks	106	0.5	1	0	-3	103
Tracked / Wheeled 360 degree Excavators	105	0.75	2	3	-1	107
					Total	**122**

15.3.8 The magnitude of impact and significance of effect due to construction noise has been calculated based on the levels generated by either earthworks (Table 15.3.4) and general construction activities (Table 15.3.7) given that these are demonstrated in their respective tables to be the construction phases which have the potential to generate the highest construction noise levels.

15.3.9 The magnitude of impact and significance of effect due to construction works in the Kent Project Site has been assessed for NSRs 1 to 7. The impact of construction works in the Essex Project Site has been assessed at NSR 8.

15.3.10 For the purpose of this assessment, the baseline ambient LAeq noise level at NSR 7 is being assumed to be below LAeq 65 dB during the daytime due to their close proximity to the river and the fact that no major sources of noise are expected to impact their local sound climate. As such, they have been assigned to the Assessment Category A.

CONSTRUCTION NOISE ASSESSMENT

15.3.11 A construction noise assessment is provided in this section for the construction of the Gate 1, Gate 2 (Kent Project Site) and Essex Project Site elements of the Proposed Development. This is organised as per Paragraph 15.3.8 to highlight the activities in the construction sequence predicted to cause the greatest construction noise. The year applicable to each noise assessment is provided as a guide based on the assumption that peak construction activity on both Kent and Essex Project Sites will be in 2023 with Gate One opening in 2024 and Gate Two opening in 2029.

Table 15.3.8: Construction noise assessment – Gate 1 (Kent Project Site) – Earthworks (year 2022)

NSR #	Baseline ambient $L_{Aeq,T}$ noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	61	Negligible	Negligible
2	65	A	65	65	Negligible	Negligible
3	67	B	70	67	Negligible	Negligible
4	61	A	65	61	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	58	Negligible	Negligible
7	-	A	65	40	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

Table 15.3.9: Construction noise assessment – Gate 1 (Kent Project Site) – General construction (year 2023)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	61	Negligible	Negligible
2	65	A	65	65	Negligible	Negligible
3	67	B	70	67	Negligible	Negligible
4	61	A	65	61	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	58	Negligible	Negligible
7	-	A	65	43	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

Table 15.3.10: Construction noise assessment – Gate 2 (Kent Project Site) – Earthworks (year 2025)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	69	Small	Minor adverse
2	65	A	65	65	Negligible	Negligible
3	67	B	70	67	Negligible	Negligible
4	61	A	65	61	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	58	Negligible	Negligible
7	-	A	65	19	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

Table 15.3.11: Construction noise assessment – Gate 2 (Kent Project Site) – General construction (year 2028)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	71	Medium	Major adverse
2	65	A	65	65	Negligible	Negligible
3	67	B	70	67	Negligible	Negligible
4	61	A	65	61	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	58	Negligible	Negligible
7	-	A	65	19	Negligible	Negligible

*Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level

Table 15.3.12: Construction noise assessment – Access Road (Kent Project Site) – Earthworks (year 2022)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	61	Negligible	Negligible
2	65	A	65	65	Negligible	Negligible
3	67	B	70	67	Negligible	Negligible
4	61	A	65	61	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	59	Negligible	Negligible
7	-	A	65	19	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

Table 15.3.13: Construction noise assessment – Access Road (Kent Project Site) – General construction (year 2023)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	61	Negligible	Negligible
2	65	A	65	65	Negligible	Negligible
3	67	B	70	67	Negligible	Negligible
4	61	A	65	62	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	59	Negligible	Negligible
7	-	A	65	19	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

Table 15.3.14: Construction noise assessment – Hotel (Kent Project Site) – Earthworks (year 2022)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	61	Negligible	Negligible
2	65	A	65	66	Negligible	Negligible
3	67	B	70	67	Negligible	Negligible
4	61	A	65	61	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	58	Negligible	Negligible
7	-	A	65	19	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

Table 15.3.15: Construction noise assessment – Hotel (Kent Project Site) – General construction (year 2023)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	61	Negligible	Negligible
2	65	A	65	68	Small	Minor adverse
3	67	B	70	67	Negligible	Negligible
4	61	A	65	61	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	58	Negligible	Negligible
7	-	A	65	19	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

Table 15.3.16: Construction noise assessment – Plant compound (Kent Project Site) – Paving (year 2023)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
1	61	A	65	61	Negligible	Negligible
2	65	A	65	65	Negligible	Negligible
3	67	B	70	67	Negligible	Negligible
4	61	A	65	61	Negligible	Negligible
5	64	A	65	64	Negligible	Negligible
6	58	A	65	58	Negligible	Negligible
7	-	A	65	19	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

Table 15.3.17: Construction noise assessment – Tilbury car park (Essex Project Site) – Earthworks (year 2022)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
8	61	A	65	62	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

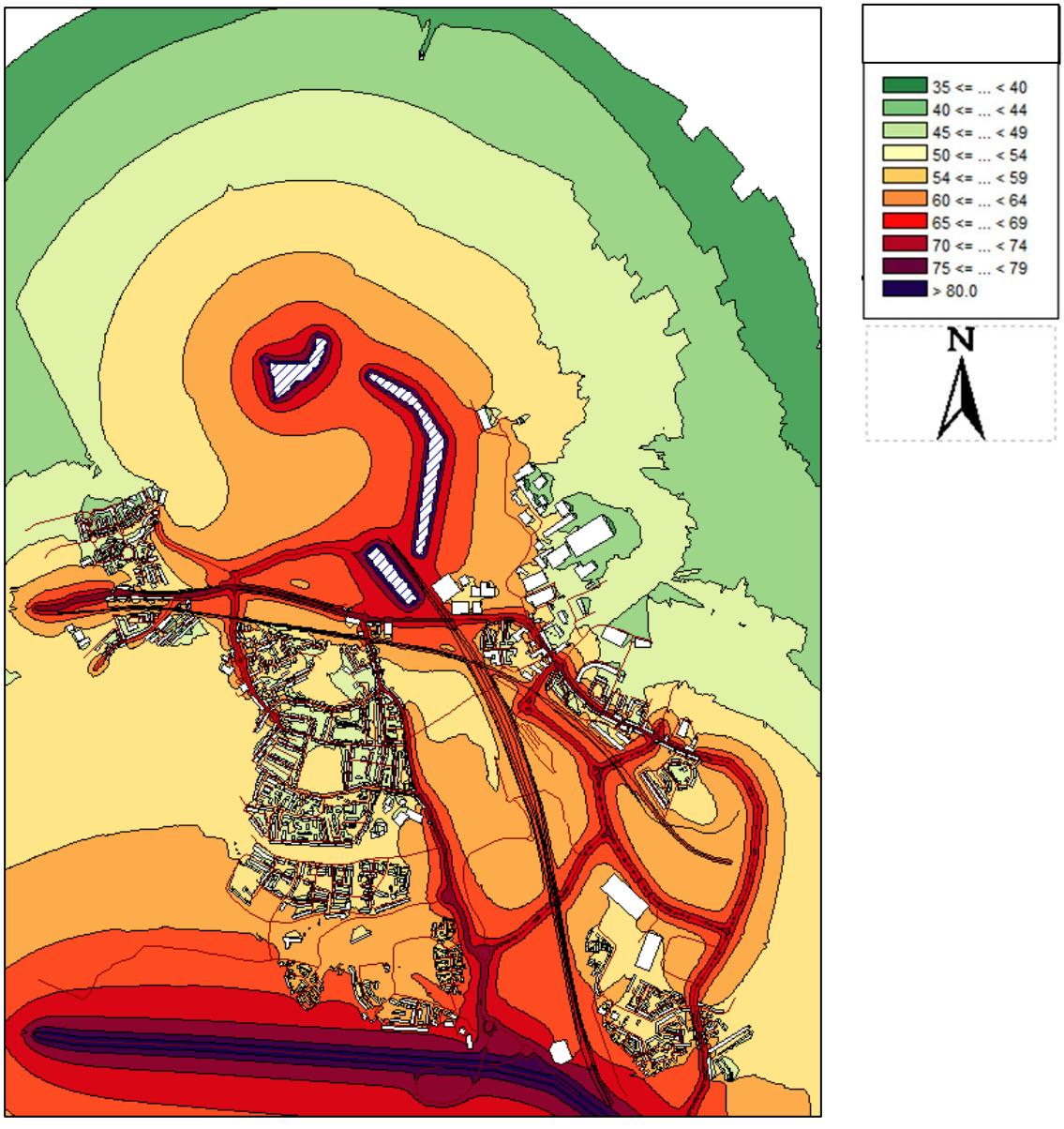
Table 15.3.18: Construction noise assessment – Tilbury car park (Essex Project Site) – General construction (year 2023)

NSR #	Baseline ambient LAeq noise level – dB(A)	Assessment category	Daytime noise threshold level – dB(A)	Total LAeq noise level* – dB(A)	Magnitude of impact	Significance of effect
8	61	A	65	62	Negligible	Negligible

**Total $L_{Aeq,T}$ noise level is baseline ambient noise level + construction noise level*

15.3.12 Diagram 15.3.2 displays an example noise map due to existing environmental noise sources, together with construction activities in Gate 1 (Kent Project Site).

Diagram 15.3.2: $L_{Aeq,T}$ noise map showing Gate 1 General Construction



Effect of Wind on Propagation of Construction Noise

15.3.13 The effect of winds on the noise impact of construction noise for the NSRs to the North across the Thames in Essex has been assessed.

15.3.14 Construction activity for Gate 1 is the furthest to the north of the Kent Project Site and has the likelihood to have the most significance of effect on NSR 7. Therefore, General construction activities have been modelled with, and without, the effects of winds, including both southerly and northerly winds.

Table 15.3.19: Construction noise assessment – Gate 1 (Kent Project Site) – General construction (year 2023)

NSR #	Ambient LAeq noise level due to construction noise– dB(A)			Magnitude of impact	Significance of effect
	No wind	Prevailing Southernly winds	Occasional Northernly winds		
7	46	46	38	Negligible	Negligible

15.3.15 Table 15.3.19 shows that southerly winds do not increase the estimated construction noise at NSR 7, and that northerly winds decrease noise levels due to construction.

CONSTRUCTION VIBRATION ASSESSMENT CRITERIA

15.3.16 The predictions of ground-borne vibrations are based on the methodologies set out in BS 5228-2:2009+A1:2014. The standard provides Peak Particle Velocity (PPV,$mm.s^{-1}$) levels based on different soil conditions for typical plant items and equipment used for construction.

15.3.17 Vibration levels of typical plant and equipment have been extrapolated from BS 5228-2:2009+A1:2014 and CALTRAN Standard Plans 2013. Using empirical prediction formulas contained in BS 5228-2:2009+A1:2014, the vibration level can be predicted at the nearest affected vibration sensitive receptor.

Vibration effects on humans

15.3.18 Guidance on the human response to vibration is presented in Annex B, Table B.1 of BS 5228-2:2009+A1:2014. These levels have been reproduced in Table 15.3.20 along with the significance of effect.

Table 15.3.20: Criteria for determining the magnitude of impact of vibration levels (BS 5228:2009+A1:2014)

Magnitude	Peak particle velocity (PPV) level	Effect
Large	10 mm·s^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level
Medium	1.0 mm·s^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
Small	0.3 mm·s^{-1}	Vibration might be just perceptible in residential environments
Negligible	0.14 mm·s^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration

Vibration effects on buildings

15.3.19 Guidance on vibration effects on buildings can be found in Annex B, Table B.2 of BS 5228-2:2009+A1:2014. These levels have been reproduced in Table 15.3.21 and 15.3.22.

Table 15.3.21: Transient vibration guide values for cosmetic damage (Source: BS 5228-2:2009+A1:2014)

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Table 15.3.22: Criteria for determining magnitude of impact vibration levels on buildings (derived from BS 5228-2: 2009+A1:2014)

Type of building	Magnitude	Criteria
Reinforced or framed structures Industrial and heavy commercial buildings	Large	Greater than 200 mm/s at 4 Hz and above
	Medium	Greater than 100 mm/s at 4 Hz and above
	Small	Greater than 50 mm/s at 4 Hz and above
	Negligible	Lower than 50 mm/s at 4 Hz and above

Type of building	Magnitude	Criteria	
Unreinforced or light framed structures Residential or light commercial buildings	Large	Greater than: 60 mm/s at 4 Hz increasing to 80 mm/s at 15 Hz	Greater than: 80 mm/s at 15 Hz increasing to 200 mm/s at 40 Hz and above
	Medium	Greater than: 30 mm/s at 4 Hz increasing to 40 mm/s at 15 Hz	Greater than : 40 mm/s at 15 Hz increasing to 100 mm/s at 40 Hz and above
	Small	Greater than: 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	Greater than: 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
	Negligible	Lower than: 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	Lower than: 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Vibration effects on marine life

15.3.20 There is the potential for construction vibration caused on land to be transmitted to the underwater environment in the form of underwater noise. However, the likelihood of this is only significant for percussive piling and the requirements of the Proposed Development do not include percussive piling. Therefore, whilst acknowledged, the vibration effects on marine life are not included in this assessment.

CONSTRUCTION VIBRATION ASSESSMENT

15.3.21 The tables below identify the reference PPV for each type of equipment that produces ground-borne vibration that is of significance along with the predicted PPV level at the different NSRs. The magnitude of impact from construction vibration at the closest NSRs are summarised in the final two columns the tables.

15.3.22 The soil material has been assumed to be of the “competent soil” type, consisting typically of clay.

15.3.23 As a worst-case scenario, the minimum approximate distance from the each NSR to the closest construction Project Site boundary has been taken to estimate the construction vibration impact.

15.3.24 NSRs at distances greater than 95 m from the closest construction Project Site boundary (NSRs 3, 4, 5, 6, 7 and 8) have been grouped given the consistent negligible magnitude of impact for exposure to humans.

Table 15.3.23: Reference and estimated PPV–Significance of effect from construction vibration exposure at 25 m from Kent site boundary (NSR 1)

Construction activity	Equipment	Reference PPV at 7.6 m -mm/s	Estimated PPV at 25 m from site boundary - mm/s	Magnitude of impact for exposure to humans	Magnitude of impact on buildings
Site preparation and excavation	Vibratory roller	5.33	1.14	Medium	Negligible
	Large bulldozer	2.26	0.48	Small	Negligible
	Hydraulic breakers	6.10	1.30	Medium	Negligible
	Jackhammer	0.89	0.19	Negligible	Negligible
Piling	Rotary bored piling	BS5228-2:2009 (ref 104)	0.02	No change	Negligible
Other	Loaded trucks	1.93	0.41	Small	Negligible

Table 15.3.24: Reference and estimated PPV–Significance of effect from construction vibration exposure at 40 m from Kent site boundary (NSR 2)

Construction activity	Equipment	Reference PPV at 7.6 m -mm/s	Estimated PPV at 25 m from site boundary - mm/s	Magnitude of impact for exposure to humans	Magnitude of impact on buildings
Site preparation and excavation	Vibratory roller	5.33	0.62	Small	Negligible
	Large bulldozer	2.26	0.26	Negligible	Negligible
	Hydraulic breakers	6.10	0.71	Small	Negligible
	Jackhammer	0.89	0.10	No change	Negligible
Piling	Rotary bored piling	BS5228-2:2009 (ref 104)	0.02	No change	Negligible
Other	Loaded trucks	1.93	0.22	Negligible	Negligible

Table 15.3.25: Reference and estimated PPV–Significance of effect from construction vibration exposure at distances greater than 95 m from Kent and Essex site boundaries (NSR 3, 4, 5, 6, 7 and 8)

Construction activity	Equipment	Reference PPV at 7.6 m -mm/s	Estimated PPV at 25 m from site boundary - mm/s	Magnitude of impact for exposure to humans	Magnitude of impact on buildings
Site preparation and excavation	Vibratory roller	5.33	0.20	Negligible	Negligible
	Large bulldozer	2.26	0.09	No change	Negligible
	Hydraulic breakers	6.10	0.23	Negligible	Negligible
	Jackhammer	0.89	0.03	No change	Negligible
Piling	Rotary bored piling	BS5228-2:2009 (ref 104)	0.02	No change	Negligible
Other	Loaded trucks	1.93	0.07	No change	Negligible

15.3.25 The significance of effect of vibration exposure to humans and on buildings at the identified NSRs are presented in Table 15.3.26 and Table 15.3.27, respectively.

Table 15.3.26: Significance of effect – Vibration exposure to humans

NSR	Receptor sensitivity	Distance to site boundary	Construction phase	Magnitude of impact	Significance of effect
NSR 1	High	25 m	Site preparation and excavation	Medium	Minor adverse
			Piling	Negligible	Negligible
			Other	Small	Minor adverse
NSR 2	High	40 m	Site preparation and excavation	Small	Minor adverse
			Piling	Negligible	Negligible
			Other	Negligible	Negligible
NSR 3 - 8	High	>95 m	Site preparation and excavation	Negligible	Negligible
			Piling	Negligible	Negligible
			Other	Negligible	Negligible

Table 15.3.27: Significance of effect - vibration on buildings

NSR	Receptor sensitivity	Magnitude of impact	Effect significance
NSR 1	High	Negligible	Negligible
NSR 2	High	Negligible	Negligible
NSR 3 - 8	High	Negligible	Negligible

CONSTRUCTION TRAFFIC ASSESSMENT

15.3.26 Annual average weekday traffic (AAWT) flow counts have been undertaken on the links marked in Diagram 15.3.4. Observed and construction traffic flows have been used to assess the magnitude of impact on the NSRs due to construction traffic during key construction years prior to and during the construction of the specific Resort access roads (2023 and 2024).

15.3.27 Transport predictions for future flows during 2023 and 2024 have been assessed as these are considered to represent the worst-case construction years during the development of Gate 1 facilities, the London Resort future access road and the opening of Gate 1 respectively. It is expected that the Resort access road will provide a route for construction vehicles away from the local roads after these slice years, consequently reducing construction traffic impacts.

15.3.28 Table 15.3.28 and 15.3.29 show the magnitude of impact on local roads, which are to be used by both construction vehicles and local residents.

Diagram 15.3.3: Project transport consultant traffic flow links

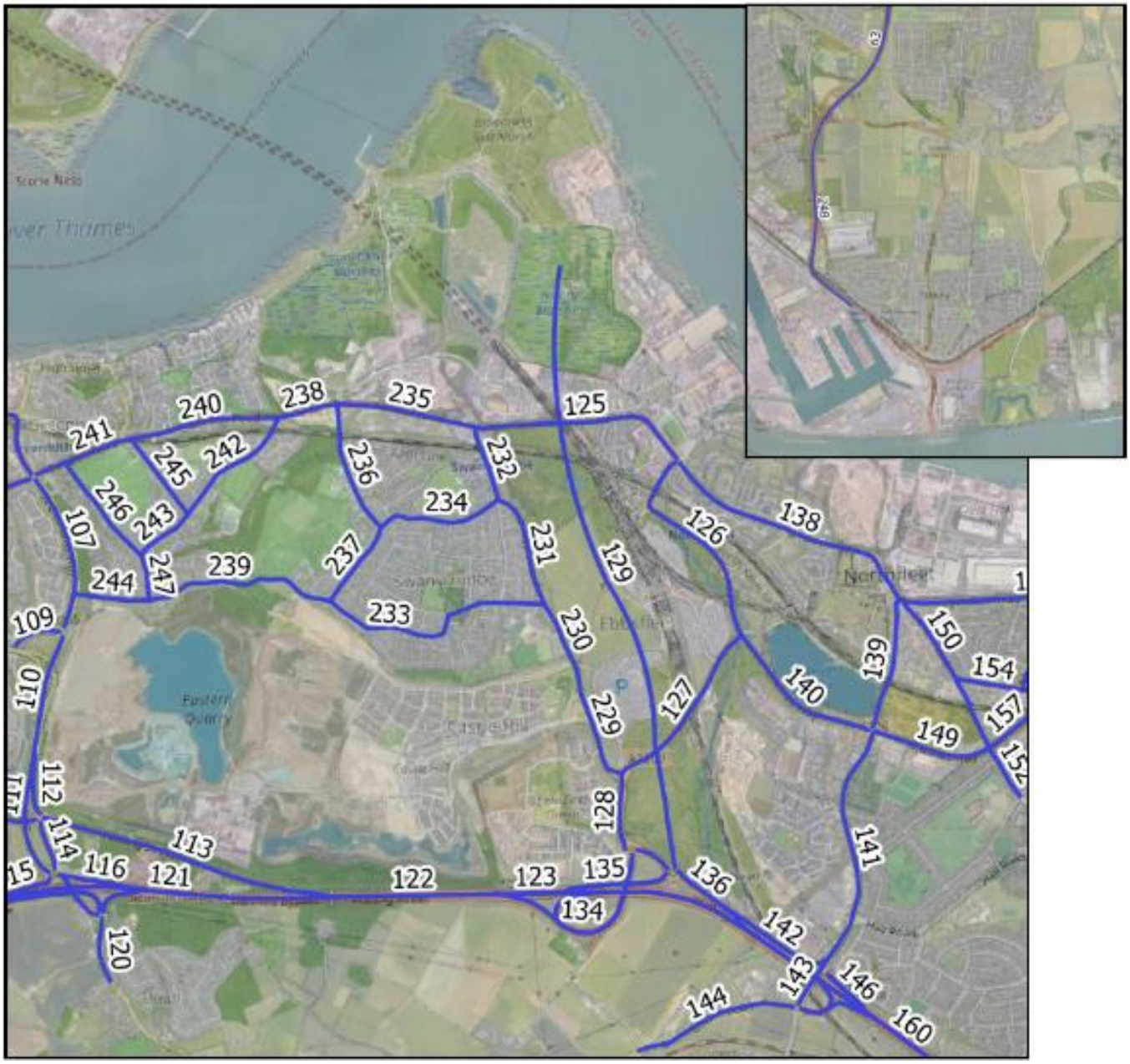


Table 15.3.28 Magnitude of impact due to construction traffic – 2023 assessment

APT Link	Road Names	APT 2018 baseline traffic flow data		APT 2023 future traffic data		Predicted change in traffic noise level - dB	Magnitude of impact
		Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
121	A2(T)	132254	8.06	140379	7.43	0.0	No change
122	A2(T)	143444	7.87	149977	7.32	0.1	Negligible
125	A226	9654	4.78	12032	3.88	0.8	Negligible
126	A226 & Thames Way	4937	8.43	5724	5.63	-0.2	No change
127	A2260	8340	6.37	10594	3.97	0.4	Negligible
128	A2260	19466	6.76	25066	4.24	0.3	Negligible
129	London Resort Future Access Road	0	0.00	0	0.00	0.0	No change
130	A2260	9386	7.29	12307	3.09	1.2	Small
132	A2(T)	135015	8.36	136854	8.08	0.0	No change
133	A2(T) Slip road	5054	5.86	6680	5.03	1.1	Small
134	A2(T) Slip road	5883	6.17	9070	3.44	1.4	Small
135	A2(T) Slip road	13223	4.09	17481	2.55	0.9	Negligible
136	A2(T) Slip road	14451	4.14	17123	2.50	0.3	Negligible
138	B2175 High Street	8103	4.06	11178	3.17	1.2	Small
139	Springhead Road	9118	2.73	9247	2.76	0.1	Negligible
140	Thames Way	8047	2.85	8410	2.49	0.1	Negligible
141	Springhead Road	12718	2.62	14524	2.62	0.6	Negligible
142	A2(T) Slip road	9319	3.01	11186	2.35	0.5	Negligible
144	Station Road	8093	2.12	8966	2.56	0.6	Negligible
146	A2(T) Slip road	8971	3.32	10731	3.27	0.8	Negligible
188	Lower Thames Crossing	0	0.00	0	0.00	0.0	No change
229	B259	12516	4.81	15111	3.01	0.8	Negligible
230	Stanhope Road	11434	5.27	13250	3.70	0.2	Negligible
231	Stanhope Road	3648	12.22	4608	7.66	0.1	Negligible
232	Swanscombe High Street	2644	16.13	3408	10.08	-0.4	No change
233	Swanscombe Street	728	0.00	23	1.56	-14.2	No change

APT Link	Road Names	APT 2018 baseline traffic flow data		APT 2023 future traffic data		Predicted change in traffic noise level - dB	Magnitude of impact
		Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
234	Milton Road	1486	1.86	1949	2.32	1.2	Small
235	London Road	10636	7.92	13103	5.64	0.1	Negligible
236	Craylands Lane	4687	9.23	4746	10.46	0.3	Negligible
237	Milton Street	1692	0.83	2523	0.55	1.5	Small
238	London Road	14174	8.86	16373	7.38	0.1	Negligible
239	Alkerden Lane	2198	3.31	2542	0.56	-0.8	No change
240	London Road	12699	8.02	14576	7.00	0.3	Negligible
241	London Road	13073	7.84	15032	6.82	0.3	Negligible
242	Knockhall Road	1476	18.31	1799	13.10	-0.1	No change
245	Mounts Road	352	0.00	456	0.78	1.8	Small
68	A1089 - Essex Project Site	23956	10.39	26842	9.99	-3.7	No change
248		26844	10.39	30070	9.99	-1.8	No change

15.3.29 The greatest significance of effect will occur by roads identified to have a 'small' magnitude of noise impact. In Table 15.3.28 a minor adverse significance is predicted in the following locations:

- A2260;
- A2(T) slip road;
- Milton Road;
- Milton Street; and
- Mounts road

15.3.30 The impact due to construction traffic in 2023 at these locations is still considered to below the SOAEL rating and therefore not a significant noise issue.

Table 15.3.29 Magnitude of impact due to construction traffic - 2024

APT Link	Road Names	APT 2018 baseline traffic flow data		APT 2024 future traffic data		Predicted change in traffic noise level - dB	Magnitude of impact
		Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
121	A2(T)	132254	8.06	142261	7.34	0.1	Negligible
122	A2(T)	143444	7.87	151988	7.23	0.0	No change
125	A226	9654	4.78	12193	3.85	0.3	Negligible
126	A226 & Thames Way	4937	8.43	5801	5.59	-0.2	No change
127	A2260	8340	6.37	10735	3.94	0.1	Negligible
128	A2260	19466	6.76	25402	4.21	0.2	Negligible
129	London Resort Future Access Road	0	0.00	0	0.00	0.0	No change
130	A2260	9386	7.29	12472	3.07	1.7	Small
132	A2(T)	135015	8.36	138690	7.99	0.1	Negligible
133	A2(T) Slip road	5054	5.86	6769	4.99	-0.2	No change
134	A2(T) Slip road	5883	6.17	9191	3.42	1.8	Small
135	A2(T) Slip road	13223	4.09	17716	2.53	2.0	Small
136	A2(T) Slip road	14451	4.14	17353	2.48	-0.6	No change
138	B2175 High Street	8103	4.06	11328	3.12	1.1	Small
139	Springhead Road	9118	2.73	9370	2.71	0.2	Negligible
140	Thames Way	8047	2.85	8522	2.47	0.0	No change
141	Springhead Road	12718	2.62	14718	2.58	0.6	Negligible
142	A2(T) Slip road	9319	3.01	11336	2.33	0.6	Negligible
144	Station Road	8093	2.12	9086	2.52	0.7	Negligible
146	A2(T) Slip road	8971	3.32	10876	3.24	0.8	Negligible
188	Lower Thames Crossing	0	0.00	0	0.00	0.0	No change
229	B259	12516	4.81	15314	2.96	-0.1	No change
230	Stanhope Road	11434	5.27	13427	3.64	-0.1	No change
231	Stanhope Road	3648	12.22	4670	7.54	-0.2	No change
232	Swanscombe High Street	2644	16.13	3454	9.91	-0.3	No change
233	Swanscombe Street	728	0.00	23	1.55	-17.7	No change

APT Link	Road Names	APT 2018 baseline traffic flow data		APT 2024 future traffic data		Predicted change in traffic noise level - dB	Magnitude of impact
		Total traffic flow 18h	% HGV	Total traffic flow 18h	% HGV		
234	Milton Road	1486	1.86	1976	2.28	1.6	Small
235	London Road	10636	7.92	13278	5.60	0.2	Negligible
236	Craylands Lane	4687	9.23	4810	10.28	0.6	Negligible
237	Milton Street	1692	0.83	2557	0.54	1.6	Small
238	London Road	14174	8.86	16592	7.33	0.7	Negligible
239	Alkerden Lane	2198	3.31	2576	0.55	-1.7	No change
240	London Road	12699	8.02	14770	6.95	0.4	Negligible
241	London Road	13073	7.84	15233	6.77	0.4	Negligible
242	Knockhall Road	1476	18.31	1823	12.88	0.0	No change
245	Mounts Road	352	0.00	462	0.77	0.8	Negligible
68	A1089 - Essex Project Site	23956	10.39	26842	10.39	0.7	Negligible
248		26844	10.39	30070	10.39	0.6	Negligible

15.3.31 The greatest significance of effect will occur by roads identified to have a 'small' magnitude of noise impact. In Table 15.3.29 a minor adverse significance is predicted in the following locations:

- A2260;
- A2(T) slip road;
- B2175 High Street;
- Milton Road; and
- Milton Street;

15.3.32 The impact due to construction traffic in 2024 at these locations is still considered to below the SOAEL rating and therefore not a significant noise issue.