APPENDIX 11-1

GLOSSARY OF ACOUSTIC TERMINOLOGY

APPENDIX 11.1: GLOSSARY OF ACOUSTIC TERMINOLOGY

NOISE

Noise is defined as unwanted sound. Human hearing is able to respond to sound in the frequency range 20 Hz (low frequency/deep bass) to 20,000 Hz (high frequency/high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used, which reduces the importance of lower and higher frequencies in a similar manner to human hearing.

The weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

The subjective response to a noise is dependent not only upon the sound pressure level and its frequency, but also its intermittency. Various indices have been developed to try and correlate annoyances with the noise level and its fluctuations.

- Sound Pressure: Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
- Sound Pressure Level (Sound Level): The sound level is the sound pressure relative to a standard reference pressure of 20 Pa ($20x10^{-6}$ Pascals) on a decibel scale.
- Sound Power: The sound energy radiated per unit time by a sound source. Measured in Watts (W).
- Sound Power Level, L_W: Sound power measured on a decibel scale, relative to a reference value of 10^{-12} W.
- Decibel (dB): A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 $\log_{10}$ (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 Pa.
- A-weighting, dB(A): The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
- Noise Level Indices: Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
- $L_{eq,T}$: A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
- $L_{max,T}$: A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

- $L_{90,T}$: A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
- $L_{10,T}$: A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
- L_{AE} (or SEL): A noise level index. Equivalent to the $L_{Aeq,T}$ condensed into a one second period. Typically used when dealing with noise events where the activity duration is not necessary the same as under the conditions the source data was obtained.
- Free-Field: Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres away.
- Façade: At a distance of 1 metre in front of a large sound reflecting object such as a building façade.
- Slow and Fast Time Weightings: Averaging times used in sound level meters.

VIBRATION

Vibration is defined as a repetitive oscillatory motion. Groundborne vibration can be transmitted to the human body through the supporting surfaces; the feet of a standing person, the buttocks, back and feet of a seated person or the supporting area of a recumbent person. In most situations, entry into the human body will be through the supporting ground or through the supporting floors of a building. Vibration from road traffic can also be airborne. Such airborne vibration is transmitted as a low-frequency sound wave and is often perceived when the sound wave causes windows or other objects to rattle.

Vibration is often complex, containing many frequencies, occurring in many directions and changing over time. There are many factors that influence human response to vibration. Physical factors include vibration magnitude, vibration frequency, vibration axis, duration, point of entry into the human body and posture of the human body. Other factors include the exposed persons experience, expectation, arousal and activity.

Experience shows that disturbance or annoyance from vibration in residential situations is likely to arise when the magnitude of vibration is only slightly in excess of the threshold of perception.

The threshold of perception depends on the frequency of vibration. The human body is most sensitive to vibration in the frequency range 1 to 80 Hz and especially sensitive to vibration in the range 4 to 8 Hz. As with noise, a frequency weighting mechanism is used to quantify vibration in a way that best corresponds to the frequency response of the human body. In general, vibration is only perceptible in residential situations when the building is close to a railway, construction site or very close to a road that carries large and heavy vehicles.

- Displacement, Acceleration and Velocity; Root Mean Square (r.m.s.) and Peak Values; and Peak Particle Velocity (PPV): Vibration is an oscillatory motion. The magnitude of vibration can be defined in terms of displacement (how far from the equilibrium position that something moves), velocity (how fast something moves), or acceleration (the rate of change of velocity). When describing vibration, one must specify whether peak values are used (i.e. the maximum displacement or maximum velocity) or r.m.s. / r.m.q. values (effectively an average value) are used. Standards for the assessment of building damage are usually given in terms of peak velocity (usually referred to as Peak Particle Velocity, or PPV), whilst human response to vibration is often described in terms of r.m.s. or r.m.q. acceleration.
- Root Mean Square (r.m.s.): The r.m.s. value of a set of numbers is the square root of the average of the squares of the numbers. For a sound or vibration waveform, the r.m.s. value over a given time period is the square root of the average value of the square of the waveform over that time period.

- Root Mean Quad (r.m.q.): The r.m.q. value of a set of numbers is the fourth root of the average of the fourth powers of the numbers. For a vibration waveform, the r.m.q. value over a given time period is the fourth root of the average value of the fourth power of the waveform over that time period.
- Attenuation: A general term used to indicate the reduction of noise or vibration, or the amount (in decibels) by which it is reduced.
- Vibration Dose Value (VDV): This is a measure of the amount of vibration that is experienced over a specified period, and has been defined so as to quantify the human response to vibration in terms of comfort and annoyance. The Vibration Dose Value is used to assess the likely levels of adverse comment about vibration, and is defined mathematically as the fourth root of the time integral of the fourth power of the acceleration, after it has been frequency weighted to take into account the frequency response of the human body to a vibration stimulus. Measured in units of m $s^{-1.75}$.

APPENDIX 11-2

TRAFFIC NOISE NUISANCE ASSESSMENT METHODOLOGY

APPENDIX 11-2: NOISE AND AIRBORNE VIBRATION NUISANCE ASSESSMENT

TRAFFIC NOISE NUISANCE ASSESSMENT METHODOLOGY

The DMRB HD 213/11 notes that the nuisance caused by road traffic noise mainly affects people in their homes. Nuisance is measured in terms of the percentage of the population as a whole that is bothered “very much” or “quite a lot” by virtue of a specific traffic related noise level. The correlation between specific levels and the percentage population bothered for the purposes of the assessment has been developed from studies that focused on reported nuisance where traffic related noise has changed over a relatively long period of time.

In line with the DMRB HD 213/11, the noise nuisance assessment considers:

- The degree of bother based on a ‘steady state’ or ‘before noise change’ level (DMRB HD 213/11 Figure A6.1)
- The abrupt change in bother that arises from a change in noise level (DMRB HD 213/11 Figure A6.2).

The noise nuisance assessment considers both the do-minimum and do-something long-term comparisons, with the noise nuisance level changes being directly calculated from the predicted noise level changes.

For the long-term do-minimum assessment, the following approach has been adopted in accordance with DMRB HD 213/11:

- Determine the percentage bothered in the do-minimum opening year using the steady state Figure A6.1 and the predicted noise level in the do-minimum opening year
- Determine the percentage bothered in the do-minimum future year using the steady state Figure A6.1 and the predicted noise level in the do-minimum future year
- Determine the change in percentage bothered by subtracting the do-minimum bothered in the opening year from the do-minimum bothered in the future year and report this value.

For the long-term do-something assessment the following approach has been adopted in accordance with DMRB HD 213/11:

- Determine the percentage bothered in the do-minimum opening year using the steady state Figure A6.1 and the predicted noise level in the do-minimum opening year
- Determine the percentage change in bother from the predicted change in noise between do-minimum opening year and do-something opening year using the abrupt change Figure A6.2 and add this to do-minimum percentage bothered to derive the total percentage bothered in the do-something opening year
- Determine the percentage bothered in the do-something future year using the steady state Figure A6.1 and the predicted noise level in the do-something future year
- Select the highest level of bother from steps two and three and report the change arising relative to the percentage bothered in the do-minimum opening year.

TRAFFIC AIRBORNE VIBRATION NUISANCE ASSESSMENT METHODOLOGY

As required by DMRB HD 213/11, the predicted residential receptor noise levels have also been used as the basis for an appraisal of the change in airborne vibration nuisance that would arise as a result of the Proposed Scheme. This assessment has been undertaken for all residential

receptors within 40 metres of the Proposed Scheme and any other, affected routes within the 1 km boundary.

The assessment has been undertaken applying the DMRB HD 213/11 guidance which states that the percentage of people bothered by airborne vibration is 10% lower than for noise, with, on average, traffic induced vibration nuisance tending to zero at a noise level of 58 dB $L_{A10,18h}$.

TRAFFIC NOISE NUISANCE ASSESSMENT RESULTS

Table C11-1 presents the traffic noise nuisance changes for all receptors within the calculation area for the Proposed Scheme with the inclusion of mitigation.

Table C11-1 - TRAFFIC NOISE NUISANCE

CHANGE IN NUISANCE LEVEL		NUMBER OF DWELLINGS	
		DO-MINIMUM	DO-SOMETHING
INCREASE IN NUISANCE LEVEL	< 10%	1865	1356
	10 < 20%	0	750
	20 < 30%	0	3
	30 < 40%	0	0
	> 40%	0	0
NO CHANGE	0%	485	156
DECREASE IN NUISANCE LEVEL	< 10%	55	140
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

TRAFFIC AIRBORNE VIBRATION ASSESSMENT RESULTS

Table C11-2 presents the traffic noise nuisance changes for all receptors within the calculation area for the scheme with the inclusion of mitigation.

Table C11-2 - TRAFFIC AIRBORNE VIBRATION NUISANCE

CHANGE IN NUISANCE LEVEL		NUMBER OF DWELLINGS	
		DO-MINIMUM	DO-SOMETHING
INCREASE IN NUISANCE LEVEL	< 10%	61	54
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0
NO CHANGE	0%	61	69
DECREASE IN NUISANCE LEVEL	< 10%	1	0
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

APPENDIX 11-3

SOURCE INFORMATION AND ASSUMPTIONS FOR CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

APPENDIX 11-3: SOURCE INFORMATION AND ASSUMPTIONS FOR CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

TABLE C11-3 – SOURCE INFORMATION AND ASSUMPTIONS FOR CONSTRUCTION NOISE AND VIBRATION ASSESSMENT.

ACTIVITY	EQUIPMENT	L_{AEQ} AT 10M	SOUND POWER LEVEL (SWL)	SOURCE BS5228-1	NUMBER OF ITEMS	WORST CASE ON-TIME, %H
SITE CLEARANCE AND VERGE DEMOLITION	Dozer	82	110	C.5-13	1	20%
	Wheeled excavator	73	101	C.5-11	1	20%
	Hand-held circular saw (petrol)	87	115	C.5-36	1	5%
	Lorry	80	108	C.2-34	1	15%
	Wheeled loader	79	107	C.2-26	1	20%
EARTHWORKS	Dozer	75	103	C.2-1	2	60%
	Tracked excavator	77	105	C.2-2	2	60%
	Lorry	80	108	C.2-34	2	20%
DRAINAGE WORKS	Tracked excavator	80	108	C.5-18	2	50%
	Wheeled mobile crane	70	98	C.3-30	1	50%
REMOVAL OF ROAD SURFACE	Road planer	82	110	C.5-7	2	60%
	Wheeled excavator	73	101	C.5-11	4	20%
	Hand-held circular saw (petrol)	87	115	C.5-36	2	15%
	Lorry	80	108	C.2-34	4	10%
LAYING ROAD SURFACE	Road roller	80	108	C.5-19	2	10%
	Vibratory compacter	82	110	C.5-29	1	10%
	Asphalt paver (and tipper lorry)	75	103	C.5-33	2	60%
ROAD MARKING WORKS	Lorry	80	108	C.2-34	2	20%
SIGNAGE WORKS	Hydraulic hammer rig	89	117	C.3-1	1	10%
	Wheeled mobile crane	70	98	C.3-30	1	50%
	Gas cutter (cutting top of pile)	68	96	C.3-34	1	20%
	Lorry	80	108	C.2-34	2	20%
	Dozer	75	103	C.2-1	2	30%
	Tracked excavator	77	105	C.2-2	2	30%

TABLE C11-3 – SOURCE INFORMATION AND ASSUMPTIONS FOR CONSTRUCTION NOISE AND VIBRATION ASSESSMENT.

ACTIVITY	EQUIPMENT	L_{AEQ} AT 10M	SOUND POWER LEVEL (SWL)	SOURCE BS5228-1	NUMBER OF ITEMS	WORST CASE ON-TIME, %H
COMPOUND SITE CLEARANCE	Wheeled loader	79	107	C.2-26	4	30%
	Articulated dump truck (tipping fill)	74	102	C.2-32	2	30%
COMPOUND CONSTRUCTION	Tracked crusher	84	112	C.1-15	1	40%
	Dozer	81	109	C.2-12	1	40%
	Vibratory roller	74	102	C.2-39	1	40%
	Lorry	80	108	C.2-34	1	50%
COMPOUND OPERATION	Generator	61	89	C.4-76	1	100%
NMU CONSTRUCTION	Tracked crusher	84	112	C.1-15	1	40%
	Vibratory compacter	82	110	C.5-29	1	10%
	Asphalt paver (and tipper lorry)	75	103	C.5-33	1	60%
	400T wheeled mobile crane	78	106	C.4-38	1	10%
BRIDGE WIDENING	Breaker mounted on wheeled backhoe	92	120	C.1-1	1	25%
	Scabbling concrete	83	111	D.6-45	1	10%
	Concrete saw	91	119	C.4-70	1	5%
	Drilling concrete	90	118	D.7-64	1	5%
	Sheet steel piling - vibratory	88	116	C.3-1	1	30%
	Gas cutter (cutting top of pile)	68	96	C.3-34	1	10%
	Tracked excavator (loading dump truck)	85	113	C.1-10	2	50%
	Articulated dump truck (dumping rubble)	80	108	C.1-11	1	25%
	400T wheeled mobile crane	78	106	C.4-38	1	50%
	Concrete mixer truck and truck mounted concrete pump and boom arm	78	106	C.4-32	1	5%

The above plant assumptions were used to calculate the SOAEL zones for both daytime and night-time.

It is common practice on Highways England schemes for contractors to work 10 out of 12 hours in the daytime and six out of eight hours in the night-time. As such, the above percentage on-time have been further corrected for these hours.

APPENDIX 11-4

NOISE MODELLING

APPENDIX 11-4: NOISE MODELLING

TABLE C11-4 - NOISE MODELLING ASSUMPTIONS AND SETTINGS

[1] NOISE PREDICTION METHODOLOGY	→ The Calculation of Road Traffic Noise (CRTN) memorandum (1988), published by the Department of Transport and Welsh Office. → Additional advice detailed within Annex 4: Additional advice to CRTN procedures of the DMRB Volume 11 Section 3 Part 7, HD 213/11 – Revision 1 Noise and vibration.
[2] NOISE MODELLING SOFTWARE	→ Version 2018 (64 bit) of the CadnaA, PC based, noise modelling suite.
[3] BASE MAPPING	→ Ordnance Survey (OS) MasterMap Topography Layer has been incorporated within the noise model to provide base-mapping for the area.
[4] TERRAIN DATA	→ For the the study area, Lidar data (0.5 metre grid spacing) were downloaded from the .GOV website and imported into CadnaA, with 0.25 metre height contours subsequently generated by the noise modelling software. → As there is no significant change in topography between do-minimum and the do-something scenario with the Proposed Scheme (i.e. no change in height greater than 0.5m), the same topography has been used in both scenarios.
[5] ROAD TRAFFIC SOURCE	→ All roads that are unaltered by the Proposed Scheme, have been spatially aligned using the OS MasterMap Topography Layer. → All new, altered and relieved roads comprising the A27 improvements, have been spatially aligned using the engineering drawings provided by WSP. → Road heights and gradients have been determined automatically from the terrain data as created (see [4] above). → The traffic data (flow, speed and proportion of heavy vehicles) have been provided by WSP for all relevant scenarios: ▪ do-minimum, year of opening (2022) ▪ do-something, design year (2037) ▪ do-minimum, year of opening (2022) ▪ do-something, design year (2037) → Roads with 18-hour flows of less than 1,000 have been excluded. Where a road link has a traffic flow less than 1,000 in one scenario, the same road link has been removed from all scenarios. Where flows fall between 1,000 and 4,000 in the 18-hour period, a low-flow correction has been applied. → Speed bands, as provided by WSP, have been used; all roads have been assigned one of the following speeds, as specified in IAN185/15 for non-motorway roads: 97, 63, 55, 33 and 20 kph. → All roads with a standard hot rolled asphalt surface have been assigned a correction of -1.0 dB where speeds are below 75 kph and -0.5 dB for speeds at or above 75 kph (equivalent to a road surface texture depth of 1.5 mm). All new roads with a low noise road surface have been assigned a correction of -3.5 dB, all existing roads with a low noise road surface have been assigned a correction of -2.5 dB, but only where speeds are at or above 75 kph, otherwise a correction of -1.0 dB has been applied.
[6] BRIDGES	→ Bridges have been incorporated manually into the noise model and spatially aligned based on the OS MasterMap Topography Layer and the terrain data as created (see [4] above). Where any road passes over a bridge, care has been taken to ensure the road sits appropriately on the bridge, rather than following the local terrain.
[7] BUILDINGS	→ Building outlines have been incorporated into the noise model based on the OS MasterMap Topography Layer. A height of 6 metres has been assigned universally to all buildings.

	→ All buildings have been set to be reflective (absorption coefficient of 0), which means that these buildings potentially might reflect noise if they lie close to, and on the opposite side of the highway (i.e. opposite reflections using CRTN terminology).
[8] GROUND COVER	→ A default ground absorption coefficient of 1 has been adopted (i.e. acoustically absorbent ground cover). However, roads and buildings have been set to be acoustically reflecting.
[9] NOISE LEVELS	→ Unless stated otherwise, all noise levels presented in this report are in terms of $L_{A10,18h}$ in the free-field at a height of 4 metres.

APPENDIX 11-5

WEATHER CONDITIONS DURING THE NOISE SURVEY

APPENDIX 11-5: WEATHER CONDITIONS DURING THE NOISE SURVEY

Weather Conditions

Meteorological measurement data for the survey period have been obtained from www.wunderground.com for weather station IEASTBOU25, which is located on the western fringe of Eastbourne, close to Polegate and approximately 3km south of the scheme. These data have been analysed and the wind speed, wind direction and notable events are presented in tabular form below.

TABLE 1 – METEOROLOGICAL CONDITIONS

DAY	DATE	PERIOD	WIND SPEED ($m \cdot s^{-1}$)			WIND DIRECTION		NOTABLE EVENTS
			MIN	AVE	MAX	RANGE	DOMINANT	
TUE	01-May-18	Day	0.0	1.8	4.5	E-W	ESE	-
		Night	1.3	3.3	5.4	E-SE	ESE	-
WED	02-May-18	Day	0.0	3.1	6.3	ENE-WNW	ESE	[1]
		Night	0.4	1.7	3.1	WSW-WNW	W	-
THU	03-May-18	Day	0.0	1.9	4.0	ENE-WNW	WSW	-
		Night	0.0	0.3	2.2	S-W	calm	-
FRI	04-May-18	Day	0.0	0.9	4.0	ENE-WSW	E	-
		Night	0.0	0.8	2.2	VARIABLE	SSE	-
SAT	05-May-18	Day	0.0	1.2	4.0	ENE-NW	E	-
		Night	0.0	0.7	2.2	SW-W	WSW	-
SUN	06-May-18	Day	0.0	1.1	2.7	ENE-WSW	E	-
		Night	0.0	0.9	1.3	S-SW	SSW	-

Notes:

Meteorological data (5 and 10-minute observations) taken from www.wunderground.com for IEASTBOU25, located on the western edge of Eastbourne, close to Polegate, circa 3 km south of the Proposed Scheme.

Notable Meteorological events:

[1] Rain between 08:20 and 14:10 hours

It can be seen from Table 1 that wind speeds remained below 5 m·s-1 for the vast majority of the survey period (the only exception being short periods on the Wednesday 02 May 2018), whilst there was only one period of rain during the morning and early afternoon on 02 May 2018.

In general, weather conditions were calm and warm and remained conducive to accurate environmental noise measurement over the course of the baseline noise survey.

APPENDIX 11-6

NOISE MONITORING EQUIPMENT

APPENDIX 11-6: NOISE MONITORING EQUIPMENT

Table C11-5 - DETAILS OF NOISE MONITORING EQUIPMENT

INTERNAL REFERENCE	EQUIPMENT	MAKE / MODEL	SERIAL NUMBER
SOLO 11	Sound level meter	01dB-METRAVIB Solo Master	60845
	Pre-amplifier	01dB-Stell PRE 21 S	13164
	Microphone	Microtech Gefell GmbH MCE212	182024
	Calibrator	01dB-Stell Cal 21	51031216
SOLO 13	Sound level meter	01dB-METRAVIB Solo Master	65303
	Pre-amplifier	01dB-Stell PRE 21 S	15976
	Microphone	Microtech Gefell GmbH MCE212	142812
	Calibrator	01dB-Stell Cal 21	34213780
SOLO 14	Sound level meter	01dB-METRAVIB Solo Master	65469
	Pre-amplifier	01dB-Stell PRE 21 S	15983
	Microphone	Microtech Gefell GmbH MCE212	271264
	Calibrator	01dB-Metravib Cal 21	35113822
SOLO 17	Sound level meter	01DB-METRAVIB SOLO MASTER	65773
	Pre-amplifier	01DB-STELL PRE 21 S	16554
	Microphone	MICROTECH GEFELL GMBH MCE212	181879
	Calibrator	01DB-METRAVIB CAL 21	34134165

APPENDIX 11-7

DETAILED NOISE MONITORING RESULTS

APPENDIX 11-7: DETAILED NOISE MONITORING RESULTS

TABLE C11-6 - HOURLY MONITORING RESULTS FOR LOCATION A (WILMINGTON JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
01/05/2018 14:00	69.6	60.4	72.6	83.4
01/05/2018 15:00	69.4	62.4	72.1	85.4
01/05/2018 16:00	70.3	63.8	72.8	86.7
01/05/2018 17:00	68.3	60.3	70.8	90.8
01/05/2018 18:00	69.5	59.6	71.6	99.2
01/05/2018 19:00	68.7	52.1	72.7	81.8
01/05/2018 20:00	67.2	49.1	71.9	80.2
01/05/2018 21:00	65.9	45.2	70.6	86
01/05/2018 22:00	65.1	41.5	70.1	80.9
01/05/2018 23:00	63.6	38.8	68	80.5
02/05/2018 00:00	61.9	39.1	64.2	80.8
02/05/2018 01:00	60	36.9	59.8	81.8
02/05/2018 02:00	60.3	41.1	61.6	80.4
02/05/2018 03:00	61.2	39	63.9	81
02/05/2018 04:00	63.6	43.6	67.9	81
02/05/2018 05:00	67.4	51.8	71.2	82.3
02/05/2018 06:00	69.7	62.9	72.7	81.9
02/05/2018 07:00	70.5	64.3	73.3	82
02/05/2018 08:00	70.6	63.6	73.6	86.8
02/05/2018 09:00	71.4	64.8	74.2	95
02/05/2018 10:00	72	64.5	75	83.1
02/05/2018 11:00	72.8	64.5	75.9	84.5
02/05/2018 12:00	73.8	64.7	76.8	84.9
02/05/2018 13:00	73.8	66.3	76.6	86.1
02/05/2018 14:00	73.4	66.1	75.8	94.6
02/05/2018 15:00	72.2	63.9	75	94.5
02/05/2018 16:00	71.9	65.8	74.5	83.3
02/05/2018 17:00	71.5	64.9	74.2	81.5
02/05/2018 18:00	70.8	60.6	73.8	94.2
02/05/2018 19:00	69.4	56.2	73.3	86.7

TABLE C11-6 - HOURLY MONITORING RESULTS FOR LOCATION A (WILMINGTON JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
02/05/2018 20:00	68.2	52.4	72.8	80.6
02/05/2018 21:00	67	50.5	71.7	82
02/05/2018 22:00	66.5	48.7	71.2	82.9
02/05/2018 23:00	65	40.7	69.4	84.1
03/05/2018 00:00	63.4	32.3	66	81.3
03/05/2018 01:00	62	29.3	62.1	83.9
03/05/2018 02:00	61.9	30.9	64.3	82.9
03/05/2018 03:00	62.3	31.4	65.7	83.6
03/05/2018 04:00	64.7	41.3	69	82.3
03/05/2018 05:00	68.1	51.4	71.9	83
03/05/2018 06:00	70	58.6	73.1	81.4
03/05/2018 07:00	71.8	57.1	72.8	101.3
03/05/2018 08:00	70.6	61.4	73.8	90.7
03/05/2018 09:00	69.8	61.6	73	81.7
03/05/2018 10:00	69.9	59.5	72.8	95
03/05/2018 11:00	69.3	59.9	72.6	84.9
03/05/2018 12:00	69.3	59.1	72.5	91.1
03/05/2018 13:00	70	60.5	72.6	95.8
03/05/2018 14:00	69.7	59.5	72.7	91.7
03/05/2018 15:00	69.5	61.2	72.4	81.7
03/05/2018 16:00	68.3	61.3	71.3	83
03/05/2018 17:00	67.7	58.7	70.8	79.8
03/05/2018 18:00	69.3	59.6	72.4	89.2
03/05/2018 19:00	69.2	55.2	72.8	89.9
03/05/2018 20:00	67.5	50.2	72	81.4
03/05/2018 21:00	66.5	46.6	71	82.2
03/05/2018 22:00	66	45.9	70.9	81.6
03/05/2018 23:00	64.6	40.1	68.9	81.6
04/05/2018 00:00	62.8	34	65.4	81.3
04/05/2018 01:00	60.3	25.4	59.9	82.2
04/05/2018 02:00	61.5	27.5	63.1	81.7

TABLE C11-6 - HOURLY MONITORING RESULTS FOR LOCATION A (WILMINGTON JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
04/05/2018 03:00	61.8	34.9	64.3	81.9
04/05/2018 04:00	63.6	42.5	67.6	83.5
04/05/2018 05:00	67.1	50.4	71.3	83.4
04/05/2018 06:00	69.9	59.4	73	87.2
04/05/2018 07:00	70.5	62.4	73.6	88.1
04/05/2018 08:00	69.8	60.3	73	85.6
04/05/2018 09:00	69.1	60.9	72.3	82.6
04/05/2018 10:00	69.1	59.5	72.2	88.7
04/05/2018 11:00	69.3	59.9	72	91.1
04/05/2018 12:00	68.1	58.6	71	87.3
04/05/2018 13:00	68.9	60.5	71.9	86
04/05/2018 14:00	69	60.7	71.7	91.3
04/05/2018 15:00	68.9	61	71.8	84.3
04/05/2018 16:00	68.3	59.6	71.1	81.7
04/05/2018 17:00	66.8	57.8	69.8	85.3
04/05/2018 18:00	67.4	56.6	71.1	81.6
04/05/2018 19:00	68.3	52.2	72	86.6
04/05/2018 20:00	67.7	50.1	72	83.9
04/05/2018 21:00	66.6	50.1	70.9	85.5
04/05/2018 22:00	66.8	50.5	71.5	83.5
04/05/2018 23:00	66.7	47.6	71.7	79.3
05/05/2018 00:00	64.5	43.5	69.7	83
05/05/2018 01:00	61.9	35.2	63.7	82.4
05/05/2018 02:00	61.3	33	62.6	80.2
05/05/2018 03:00	62.2	35.3	65.5	84
05/05/2018 04:00	63	40.2	66.3	82.2
05/05/2018 05:00	65.4	47.6	69.7	83.3
05/05/2018 06:00	67.4	50.5	71.1	86.1
05/05/2018 07:00	68.5	51.4	72.5	89.5
05/05/2018 08:00	68.9	54.2	72.6	84.4
05/05/2018 09:00	68.4	56.3	72	88.1

TABLE C11-6 - HOURLY MONITORING RESULTS FOR LOCATION A (WILMINGTON JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
05/05/2018 10:00	68.4	58.2	71.6	87.2
05/05/2018 11:00	67.8	58	71	83.6
05/05/2018 12:00	67.7	57.8	70.7	86.3
05/05/2018 13:00	67.8	55.9	70.7	92.4
05/05/2018 14:00	67.8	57.4	70.6	93.7
05/05/2018 15:00	67.2	55.6	70.3	85.7
05/05/2018 16:00	67.5	56.5	70.5	89.9
05/05/2018 17:00	67.8	57.2	70.9	87.2
05/05/2018 18:00	68.1	55.1	71.3	92.5
05/05/2018 19:00	67.1	52.4	71.2	80.9
05/05/2018 20:00	66.4	49.8	71	83.1
05/05/2018 21:00	65.3	44.7	70	85.4
05/05/2018 22:00	65.5	47.4	70.5	82
05/05/2018 23:00	64.4	43.7	69.5	77.5
06/05/2018 00:00	62.9	38.2	67.1	83.8
06/05/2018 01:00	61.9	31.8	63.7	87
06/05/2018 02:00	61	33.3	62.6	81.1
06/05/2018 03:00	60.7	32.9	62.7	81
06/05/2018 04:00	61.6	37.7	64.3	79.9
06/05/2018 05:00	64.2	47.1	68.9	82.4
06/05/2018 06:00	65.5	48.8	70.2	81.9
06/05/2018 07:00	67	49.7	71.3	87.7
06/05/2018 08:00	67.5	52.2	71.6	87
06/05/2018 09:00	67.9	55.5	71.6	85
06/05/2018 10:00	67.8	58.5	71.1	88.5
06/05/2018 11:00	67.4	57.7	70.2	89.5
06/05/2018 12:00	67.5	57.2	69.9	97
06/05/2018 13:00	67.3	56.3	69.9	88.6
06/05/2018 14:00	67.1	55.6	70	88
06/05/2018 15:00	66.9	56	70.1	87.5
06/05/2018 16:00	67.1	57	69.9	86

TABLE C11-6 - HOURLY MONITORING RESULTS FOR LOCATION A (WILMINGTON JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
06/05/2018 17:00	67.3	55.8	70.6	81.6
06/05/2018 18:00	66.9	53.7	70.5	79.2
06/05/2018 19:00	67.1	53.9	70.9	88.5
06/05/2018 20:00	66.8	51.8	71	81.9
06/05/2018 21:00	65.4	46.5	70	80.4
06/05/2018 22:00	65.4	43.9	70.2	88.8
06/05/2018 23:00	63.7	39.4	68.7	80.4
07/05/2018 00:00	62.3	38	65.6	79.3
07/05/2018 01:00	59.6	32.3	61	78.7
07/05/2018 02:00	60.4	32.4	61.6	82.9
07/05/2018 03:00	58.4	28.1	59.9	79.7
07/05/2018 04:00	61	35.8	64.6	81.6
07/05/2018 05:00	64.6	47.8	68.9	81.5
07/05/2018 06:00	65.7	49.2	70.2	80.6
07/05/2018 07:00	66.5	49	71	85.7
07/05/2018 08:00	68.3	50.6	72	90.5
07/05/2018 09:00	69.6	56.9	72.1	92
07/05/2018 10:00	69.9	57	71.2	99.4
07/05/2018 11:00	67.4	57.8	69.9	88.1
07/05/2018 12:00	70.2	60.4	71	99.9

TABLE C11-7 - HOURLY MONITORING RESULTS FOR LOCATION B (ROADSIDE)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
01/05/2018 14:00	73.7	62.7	77	86.7
01/05/2018 15:00	73.8	65.7	77	87.8
01/05/2018 16:00	74	65.7	77.3	84.6
01/05/2018 17:00	74	64.1	77	98.7
01/05/2018 18:00	73.6	60.4	77.4	87.5
01/05/2018 19:00	72.7	51.2	76.6	85.6
01/05/2018 20:00	71.7	51.6	75.9	93.5
01/05/2018 21:00	70	47.4	74.6	84.9
01/05/2018 22:00	69	41	73.9	86.4
01/05/2018 23:00	67.1	39	72	85.1
02/05/2018 00:00	64.6	36.4	68.4	83.1
02/05/2018 01:00	62.5	34.3	63.8	83
02/05/2018 02:00	63.2	38.4	63.8	84.4
02/05/2018 03:00	65.1	39.2	66.7	86
02/05/2018 04:00	67.7	56	71.2	83.9
02/05/2018 05:00	71.7	49.2	77	86
02/05/2018 06:00	74.1	61.6	77.3	86.6
02/05/2018 07:00	73.6	66.2	76.4	84.5
02/05/2018 08:00	74.8	65.8	77.3	99.9
02/05/2018 09:00	75	65	77.6	96.8
02/05/2018 10:00	74.6	64.8	77.7	85.6
02/05/2018 11:00	75.4	65.6	78.4	88
02/05/2018 12:00	76.2	66	79.1	86.6
02/05/2018 13:00	76.5	67.7	79.5	87.7
02/05/2018 14:00	76.2	67.4	79.2	94.1
02/05/2018 15:00	75.8	67.5	78.9	87.8
02/05/2018 16:00	76.2	70.5	79.1	86.1
02/05/2018 17:00	76.1	70	79.1	88.1
02/05/2018 18:00	75.5	63.8	78.8	90.1
02/05/2018 19:00	74.1	57.4	78	92.5
02/05/2018 20:00	73.1	56.4	77.1	87.4

TABLE C11-7 - HOURLY MONITORING RESULTS FOR LOCATION B (ROADSIDE)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
02/05/2018 21:00	71.7	53.7	75.8	90.6
02/05/2018 22:00	70.8	52.1	75.4	86.5
02/05/2018 23:00	68.9	42	73.7	84.9
03/05/2018 00:00	66.8	36.5	70.9	84.7
03/05/2018 01:00	65.6	31.5	67.9	89.4
03/05/2018 02:00	65.3	31.3	67.1	84.9
03/05/2018 03:00	67	34	69.2	86.7
03/05/2018 04:00	69.6	41.2	73.7	89.5
03/05/2018 05:00	73.5	54.7	78.7	86.5
03/05/2018 06:00	76.3	65.8	79.5	87.7
03/05/2018 07:00	74.8	61.9	77.9	91.8
03/05/2018 08:00	75.8	66.7	78.8	89.6
03/05/2018 09:00	75.3	66.5	78.2	86.3
03/05/2018 10:00	74.8	63.7	77.9	95.6
03/05/2018 11:00	74.4	62.1	77.6	92.2
03/05/2018 12:00	74	60.7	77	98.1
03/05/2018 13:00	74.4	62.7	77.7	90.1
03/05/2018 14:00	74.1	62.1	77.2	93.9
03/05/2018 15:00	74.2	63.7	77.3	89.1
03/05/2018 16:00	74	65.1	77.1	84.8
03/05/2018 17:00	73.9	64.2	77.4	86.6
03/05/2018 18:00	74.4	62	77.7	95.1
03/05/2018 19:00	73.8	55.5	77.3	100
03/05/2018 20:00	71.7	49.8	76.1	90.8
03/05/2018 21:00	70.7	47.3	74.9	92.3
03/05/2018 22:00	70.1	48.4	74.3	91.5
03/05/2018 23:00	67.7	40.9	72.7	84.5
04/05/2018 00:00	65.8	34	69.8	82.5
04/05/2018 01:00	63.7	27	65	83.8
04/05/2018 02:00	65.1	30.3	66.6	87.9
04/05/2018 03:00	66.1	32.9	67.7	84.3

TABLE C11-7 - HOURLY MONITORING RESULTS FOR LOCATION B (ROADSIDE)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
04/05/2018 04:00	68.2	41.3	71.7	85.8
04/05/2018 05:00	72.6	51.5	77.9	88.6
04/05/2018 06:00	75.8	63.1	78.9	94.4
04/05/2018 07:00	75.7	67.5	78.7	89.1
04/05/2018 08:00	74	61.4	77.3	85.6
04/05/2018 09:00	74.5	64.3	77.5	89.6
04/05/2018 10:00	74	62.6	77.2	92.9
04/05/2018 11:00	74.1	61.6	77.1	99.2
04/05/2018 12:00	72.5	59.5	75.9	92.5
04/05/2018 13:00	73.5	61.5	76.9	85.3
04/05/2018 14:00	72.6	61.2	76.2	89
04/05/2018 15:00	74	63.7	77.1	91.6
04/05/2018 16:00	73.9	65.5	77	85
04/05/2018 17:00	72.5	58.7	75.9	86.9
04/05/2018 18:00	73.8	61.8	77.2	85.5
04/05/2018 19:00	73.4	58.8	76.9	94
04/05/2018 20:00	72.3	53.9	76.3	91
04/05/2018 21:00	71.8	53.7	75.5	92.7
04/05/2018 22:00	71.4	53.1	75.1	93.9
04/05/2018 23:00	70.9	48.2	75.2	85.2
05/05/2018 00:00	68.2	45.4	73.1	85.1
05/05/2018 01:00	65.2	35	68.3	83.5
05/05/2018 02:00	65.3	33.9	67.7	85.4
05/05/2018 03:00	67	39.2	69.6	86.8
05/05/2018 04:00	67.3	40.1	70.7	85.1
05/05/2018 05:00	70.5	47.3	75.2	87.2
05/05/2018 06:00	72.2	52.6	77.1	88
05/05/2018 07:00	73.2	54.5	77.5	91.9
05/05/2018 08:00	73.9	57.3	77.6	95.7
05/05/2018 09:00	73.8	62	77.1	88.1
05/05/2018 10:00	73.8	65.4	76.7	91.1

TABLE C11-7 - HOURLY MONITORING RESULTS FOR LOCATION B (ROADSIDE)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
05/05/2018 11:00	73.8	64.9	76.9	90.1
05/05/2018 12:00	73.6	64.4	76.6	92.6
05/05/2018 13:00	73.3	63.3	76.3	96.9
05/05/2018 14:00	72.9	61.9	76.1	88.8
05/05/2018 15:00	72.8	62.2	76.1	91.1
05/05/2018 16:00	72.9	61.7	76	91.6
05/05/2018 17:00	73.2	63.4	76.5	90.5
05/05/2018 18:00	73.2	59.4	76.5	94
05/05/2018 19:00	72.1	55.3	76.1	85.3
05/05/2018 20:00	70.9	54.5	75.2	88.7
05/05/2018 21:00	70.2	49.9	74.5	83.3
05/05/2018 22:00	69.6	50.7	74.3	86.8
05/05/2018 23:00	68.8	46.2	73.6	83.5
06/05/2018 00:00	66.9	36	71.7	82.4
06/05/2018 01:00	64.3	31.3	67.4	83
06/05/2018 02:00	64.4	32.7	67.1	83.5
06/05/2018 03:00	64.8	31.8	66.9	85.1
06/05/2018 04:00	65.9	35.4	68.9	85.4
06/05/2018 05:00	69.8	46.9	73.6	97.9
06/05/2018 06:00	70.4	49	75.4	90
06/05/2018 07:00	71.5	50.8	76.2	88.7
06/05/2018 08:00	72.6	55.5	76.7	95.1
06/05/2018 09:00	73.7	61.2	76.8	100.2
06/05/2018 10:00	72.3	60.7	75.6	89.9
06/05/2018 11:00	72.1	59.5	73.4	99.8
06/05/2018 12:00	70	58.1	73.6	91.3
06/05/2018 13:00	72.4	62.9	75.5	89.8
06/05/2018 14:00	72.6	62	75.6	91.5
06/05/2018 15:00	72.5	62.3	75.8	84.6
06/05/2018 16:00	72.7	63.2	75.6	93.8
06/05/2018 17:00	72.8	62.8	75.8	89.3

TABLE C11-7 - HOURLY MONITORING RESULTS FOR LOCATION B (ROADSIDE)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
06/05/2018 18:00	72.1	58.2	75.7	83.8
06/05/2018 19:00	73.1	58.3	75.8	102.4
06/05/2018 20:00	71.7	55.8	75.5	87.6
06/05/2018 21:00	70.3	52.1	74.6	84.2
06/05/2018 22:00	69.4	49.1	73.8	90.9
06/05/2018 23:00	67.4	46.2	72.3	83.5
07/05/2018 00:00	65.6	37.5	70	83.6
07/05/2018 01:00	63.6	30.8	65.7	84.5
07/05/2018 02:00	63.8	32.7	66.1	82.9
07/05/2018 03:00	62.4	31	62.7	83.6
07/05/2018 04:00	65.8	40.1	68.8	82.9
07/05/2018 05:00	68.8	47.7	73.4	87.3
07/05/2018 06:00	70.3	49.5	75.4	87.2
07/05/2018 07:00	71.4	49.6	75.6	96.4
07/05/2018 08:00	72.7	55.3	76.2	95.8

TABLE C11-8 - HOURLY MONITORING RESULTS FOR LOCATION C (POLEGATE JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
01/05/2018 14:00	68.7	58.6	71.5	83.5
01/05/2018 15:00	68.4	59.6	71.1	82.7
01/05/2018 16:00	67.9	59.2	70.8	80.3
01/05/2018 17:00	68	58.1	70.2	93.8
01/05/2018 18:00	69.2	57.8	70.8	97.9
01/05/2018 19:00	68.3	51	71.3	87.6
01/05/2018 20:00	66.4	46.9	70.8	80.4
01/05/2018 21:00	64.8	43.9	69.3	88.2
01/05/2018 22:00	64	42.5	69.1	84.9
01/05/2018 23:00	62.1	39.9	67.2	79.6
02/05/2018 00:00	59.4	35.2	63.7	81.2
02/05/2018 01:00	57.5	31.8	59.4	76.8
02/05/2018 02:00	58.3	36.4	59.3	78.4
02/05/2018 03:00	59.3	36.6	62.5	78.4
02/05/2018 04:00	62.6	40.2	67.3	82.4
02/05/2018 05:00	66.6	49.5	71	81.7
02/05/2018 06:00	68.2	56	71.3	80.1
02/05/2018 07:00	68.2	59.4	71.1	85.9
02/05/2018 08:00	71.2	61.1	71.6	103
02/05/2018 09:00	71.4	62.6	72.7	101
02/05/2018 10:00	70.5	62	73.1	82
02/05/2018 11:00	71.7	62.4	74.6	82.1
02/05/2018 12:00	72.8	62	75.5	85.5
02/05/2018 13:00	73.1	62.4	76	83.9
02/05/2018 14:00	72.6	62.3	74.8	96.4
02/05/2018 15:00	71.1	60.8	73.7	82.3
02/05/2018 16:00	70.7	64.1	73.3	86.1
02/05/2018 17:00	70.1	61.9	72.7	85.5
02/05/2018 18:00	70.1	60.1	73	86.5
02/05/2018 19:00	69.1	55.2	72.7	84.1
02/05/2018 20:00	67.7	53.3	71.8	79.3

TABLE C11-8 - HOURLY MONITORING RESULTS FOR LOCATION C (POLEGATE JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
02/05/2018 21:00	66	51.2	70.4	79.6
02/05/2018 22:00	65.6	51	70.2	87.7
02/05/2018 23:00	63.5	45.2	68.8	82.7
03/05/2018 00:00	61	38	65.3	79.7
03/05/2018 01:00	60.5	35.4	62.6	84.1
03/05/2018 02:00	59.8	36.4	62.2	79.9
03/05/2018 03:00	61.8	38	65.1	79.7
03/05/2018 04:00	64.1	44.2	69.2	80.3
03/05/2018 05:00	68.1	54.3	72.9	81.5
03/05/2018 06:00	70.4	60.6	73.4	84.6
03/05/2018 07:00	68	58.6	71	91.3
03/05/2018 08:00	70.3	61.2	72.4	94.7
03/05/2018 09:00	69.8	60.7	72.5	80.4
03/05/2018 10:00	70.4	58.6	72.9	93.5
03/05/2018 11:00	69.6	58.5	72.4	86.3
03/05/2018 12:00	70.5	58.6	72.2	98.7
03/05/2018 13:00	69.8	58.5	72.3	93
03/05/2018 14:00	69.6	58.3	71.9	94.4
03/05/2018 15:00	68.9	60.5	71.7	82.1
03/05/2018 16:00	68.3	58.9	71.1	90.6
03/05/2018 17:00	68.5	59	71.2	90.4
03/05/2018 18:00	68.9	59.9	71.6	85.8
03/05/2018 19:00	68.4	52.2	71.7	85.5
03/05/2018 20:00	67	48.1	71	87.8
03/05/2018 21:00	65.8	47.4	70.1	81.6
03/05/2018 22:00	64.7	45.7	69.2	81.5
03/05/2018 23:00	63	42	68.3	85.3
04/05/2018 00:00	61.6	38.4	65.3	92.1
04/05/2018 01:00	58.3	34.7	60	76.8
04/05/2018 02:00	60	34.3	62.4	79.1
04/05/2018 03:00	60.6	36.5	64	77.7

TABLE C11-8 - HOURLY MONITORING RESULTS FOR LOCATION C (POLEGATE JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
04/05/2018 04:00	63.3	45.4	68.1	81.3
04/05/2018 05:00	67.2	51.9	72	85.1
04/05/2018 06:00	70.6	58.2	73.3	87.9
04/05/2018 07:00	70.6	61.1	73.1	89.8
04/05/2018 08:00	70.3	59.2	72.7	94.6
04/05/2018 09:00	70.1	60.8	72.3	94.7
04/05/2018 10:00	69.7	59.4	72.2	92.8
04/05/2018 11:00	70.5	60.9	71.9	100.1
04/05/2018 12:00	69.7	58.9	72.1	93.7
04/05/2018 13:00	68.7	58.9	71.3	83.6
04/05/2018 14:00	68.9	60.5	71.6	84
04/05/2018 15:00	68.3	59.8	70.8	86.7
04/05/2018 16:00	67.9	58.9	70.5	79.1
04/05/2018 17:00	67.5	57.3	70.1	88.6
04/05/2018 18:00	68.2	58.8	71.2	87.7
04/05/2018 19:00	68.1	51.9	71.3	89
04/05/2018 20:00	67.5	51.1	70.8	89.9
04/05/2018 21:00	65.9	49.9	69.9	83.8
04/05/2018 22:00	66.1	50.8	69.6	90.6
04/05/2018 23:00	65.4	49.7	69.6	79.3
05/05/2018 00:00	63	46.5	68.3	81
05/05/2018 01:00	59.7	40.1	63.1	80.2
05/05/2018 02:00	59.8	40.1	62.7	78.9
05/05/2018 03:00	61.2	41.7	64.8	84.9
05/05/2018 04:00	62	46.6	66.4	82.9
05/05/2018 05:00	64.7	49.6	70.2	84.3
05/05/2018 06:00	66.9	51.7	71.6	82.1
05/05/2018 07:00	68.8	53.5	72.4	91.8
05/05/2018 08:00	69.4	55.9	72.2	94.6
05/05/2018 09:00	69.2	57.7	72	91.4
05/05/2018 10:00	69	59.6	71.5	85.8

TABLE C11-8 - HOURLY MONITORING RESULTS FOR LOCATION C (POLEGATE JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
05/05/2018 11:00	68.3	60.2	70.9	85.6
05/05/2018 12:00	68.9	59.6	71.1	93.3
05/05/2018 13:00	68.1	57.3	70.9	85.6
05/05/2018 14:00	68.4	57.9	71	85
05/05/2018 15:00	68.5	56.5	71.1	89.6
05/05/2018 16:00	68.7	57.1	71.1	88.5
05/05/2018 17:00	69.1	58.2	71.4	90.5
05/05/2018 18:00	68.7	54.5	71.3	91.7
05/05/2018 19:00	67.6	54.3	71	88.9
05/05/2018 20:00	67	52.3	70	97.6
05/05/2018 21:00	65.1	50.4	69.4	81.4
05/05/2018 22:00	65.1	50.2	69	94.4
05/05/2018 23:00	63.8	49.1	68.7	81.2
06/05/2018 00:00	60.8	45.5	65.9	76
06/05/2018 01:00	59.9	41.1	64	78.7
06/05/2018 02:00	58.9	39.5	61.6	79.3
06/05/2018 03:00	59.2	40	62.6	77.8
06/05/2018 04:00	60.7	46.4	64.4	79.7
06/05/2018 05:00	64.5	48.5	69.1	87.8
06/05/2018 06:00	65.4	50.6	70.3	82.6
06/05/2018 07:00	67.6	52.8	71.4	90.1
06/05/2018 08:00	68	52.8	71.5	85.6
06/05/2018 09:00	69.2	56.2	70.6	100.8
06/05/2018 10:00	68.4	58.6	70.9	86.8
06/05/2018 11:00	70.9	59.2	70.8	101
06/05/2018 12:00	68.5	58.7	70.6	95
06/05/2018 13:00	68.2	54.8	70.7	90.9
06/05/2018 14:00	68.6	58.6	70.8	92.9
06/05/2018 15:00	68.2	58.4	70.9	87.3
06/05/2018 16:00	68.8	59	70.9	92.8
06/05/2018 17:00	68.3	57.4	70.9	89.1

TABLE C11-8 - HOURLY MONITORING RESULTS FOR LOCATION C (POLEGATE JUNCTION)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
06/05/2018 18:00	67.8	54.4	70.9	83.6
06/05/2018 19:00	67.8	52.7	70.9	88.9
06/05/2018 20:00	66.7	51.8	70.4	85.3
06/05/2018 21:00	64.9	49.2	69.2	79.1
06/05/2018 22:00	64.9	49.1	68.7	91.9
06/05/2018 23:00	62.4	46.4	67.3	84
07/05/2018 00:00	60.2	42.7	64.9	79.8
07/05/2018 01:00	57.9	37.1	60.2	77.1
07/05/2018 02:00	58.4	35.8	60.6	79.7
07/05/2018 03:00	56.6	35.3	57.6	76.8
07/05/2018 04:00	61.2	45.9	64.7	84.5
07/05/2018 05:00	63.8	49.2	68.7	81.2
07/05/2018 06:00	65.6	50.5	70.5	78.5
07/05/2018 07:00	66.6	53	70.9	82.8
07/05/2018 08:00	67.9	53.3	71.4	86
07/05/2018 09:00	69.4	57.4	71.6	96.4
07/05/2018 10:00	70.9	58.6	71.3	98.6
07/05/2018 11:00	69.5	59	71.3	98.5
07/05/2018 12:00	68.5	57.9	70.9	88.1

TABLE C11-9 - HOURLY MONITORING RESULTS FOR LOCATION D (DRUSILLAS ROUNDABOUT)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
01/05/2018 14:00	61.3	56.3	63.3	92.2
01/05/2018 15:00	61	57	63.3	73.3
01/05/2018 16:00	61.2	56.1	63.1	87.8
01/05/2018 17:00	63.7	54.8	62.7	90.6
01/05/2018 18:00	62.9	53.5	62.1	92.3
01/05/2018 19:00	57.4	49.3	60.5	74.9
01/05/2018 20:00	56.6	47.3	59	82.5
01/05/2018 21:00	56.4	44	58.2	83.8
01/05/2018 22:00	52.9	40.1	56.3	72.4
01/05/2018 23:00	51	37.1	54.5	74.2
02/05/2018 00:00	48.7	36.6	51.9	66.2
02/05/2018 01:00	46.5	34.6	50.1	65.1
02/05/2018 02:00	48.6	38	51.9	65.1
02/05/2018 03:00	48.8	37.6	52.3	68.7
02/05/2018 04:00	52.1	40.3	55.4	70.5
02/05/2018 05:00	55.8	46.6	59	70.5
02/05/2018 06:00	58.8	54	61.3	78.4
02/05/2018 07:00	60.8	56.3	63.2	80.3
02/05/2018 08:00	67.1	56.6	64.1	98.1
02/05/2018 09:00	64.7	57.5	65.2	93.7
02/05/2018 10:00	62.3	57.2	65.1	74.2
02/05/2018 11:00	63.7	58.2	66.4	80.1
02/05/2018 12:00	64.5	59.6	67.2	76.5
02/05/2018 13:00	64.2	59.4	66.8	75.9
02/05/2018 14:00	64.9	59.7	66.8	87.6
02/05/2018 15:00	62.7	57.7	64.7	86.9
02/05/2018 16:00	62.1	58.5	64.3	76.3
02/05/2018 17:00	62.1	57.5	63.6	89.9
02/05/2018 18:00	61.9	55.7	63	89.6
02/05/2018 19:00	58.5	52.6	61.1	74.4
02/05/2018 20:00	57.9	49.1	60.8	77.7

TABLE C11-9 - HOURLY MONITORING RESULTS FOR LOCATION D (DRUSILLAS ROUNDABOUT)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
02/05/2018 21:00	56.9	49.3	59.7	80.9
02/05/2018 22:00	57.4	48.2	59.6	81.6
02/05/2018 23:00	53.6	42.4	57	71.3
03/05/2018 00:00	52.5	37.9	55.4	72.6
03/05/2018 01:00	52	29.1	55.3	77.2
03/05/2018 02:00	49.8	30.3	53.2	68
03/05/2018 03:00	51.4	35.7	54.6	74.4
03/05/2018 04:00	57.8	44.6	58.3	81.7
03/05/2018 05:00	57.9	51.4	60.9	74.8
03/05/2018 06:00	60.8	57.1	63	76.6
03/05/2018 07:00	62.6	56.8	64.4	89.3
03/05/2018 08:00	62.8	57.6	64.6	89.4
03/05/2018 09:00	61.8	56.3	64.1	83.4
03/05/2018 10:00	60.9	54.3	62.8	86.8
03/05/2018 11:00	59.8	53.6	62.7	81.3
03/05/2018 12:00	62.8	53	63.6	87.8
03/05/2018 13:00	60.3	54.8	63.1	77.5
03/05/2018 14:00	64.4	54.8	66.1	89.8
03/05/2018 15:00	59.3	54.4	61.8	76
03/05/2018 16:00	60.6	55.4	62.6	85.5
03/05/2018 17:00	61.2	55.2	62.5	89.5
03/05/2018 18:00	59.6	53.8	62.1	80.7
03/05/2018 19:00	58.8	49.7	60.2	85.8
03/05/2018 20:00	57.4	45.8	59.3	87.4
03/05/2018 21:00	58.4	42.5	57.9	89.9
03/05/2018 22:00	55.2	43.5	58	81.9
03/05/2018 23:00	52	37.7	55.6	70.3
04/05/2018 00:00	49.8	31.7	53.5	71.2
04/05/2018 01:00	47	25.8	50.2	68.1
04/05/2018 02:00	49.8	29.3	52.8	74.5
04/05/2018 03:00	50.2	33.3	53.9	67.3

TABLE C11-9 - HOURLY MONITORING RESULTS FOR LOCATION D (DRUSILLAS ROUNDABOUT)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
04/05/2018 04:00	58.1	37.6	58.8	83.3
04/05/2018 05:00	57.2	48.3	60.2	79.6
04/05/2018 06:00	60.6	55	62.9	78.3
04/05/2018 07:00	61.7	56.5	63.8	83.6
04/05/2018 08:00	61.8	55.9	64.1	87.6
04/05/2018 09:00	60.5	54.5	62.8	83
04/05/2018 10:00	60.1	53.7	62.7	78.6
04/05/2018 11:00	64.2	53.2	62.4	94.9
04/05/2018 12:00	61	52.2	62.6	86
04/05/2018 13:00	59.8	53.1	62.3	80.6
04/05/2018 14:00	60	53	62.1	86
04/05/2018 15:00	60.5	53.6	62.3	84.2
04/05/2018 16:00	60	53.8	62	84.7
04/05/2018 17:00	58.7	52.5	61.4	81
04/05/2018 18:00	59.4	52.7	61.4	81.8
04/05/2018 19:00	62.5	50.6	60.6	91
04/05/2018 20:00	57.8	48.7	59.5	86.6
04/05/2018 21:00	58.4	47.8	59.1	89.3
04/05/2018 22:00	57.3	49.9	59.2	79.9
04/05/2018 23:00	55.8	47.7	58.4	79.1
05/05/2018 00:00	52.7	43.9	56	68.9
05/05/2018 01:00	50.9	34.1	54.1	76.6
05/05/2018 02:00	49.9	35.8	53.2	65.7
05/05/2018 03:00	51.6	36	55	74.1
05/05/2018 04:00	57.8	42.6	57.4	80.5
05/05/2018 05:00	55.8	47.6	58.9	77.9
05/05/2018 06:00	57.6	50	60.2	74.2
05/05/2018 07:00	59.4	50.1	62.1	80.6
05/05/2018 08:00	59.2	51.1	61.6	79.4
05/05/2018 09:00	61.7	53.4	62.2	88.5
05/05/2018 10:00	60.4	55.1	62.4	81.2

TABLE C11-9 - HOURLY MONITORING RESULTS FOR LOCATION D (DRUSILLAS ROUNDABOUT)

PERIOD START	$L_{Aeq,1h}$	$L_{A90,1h}$	$L_{A10,1h}$	L_{AFmax}
05/05/2018 11:00	60.8	54.6	62.1	90.8
05/05/2018 12:00	59.6	53.6	61.6	80
05/05/2018 13:00	60	52.8	61.1	84.3
05/05/2018 14:00	58.8	52.3	60.8	82
05/05/2018 15:00	59.4	54.3	61.1	78
05/05/2018 16:00	60	53.3	60.8	86.3
05/05/2018 17:00	61.1	53.3	61.3	88.8
05/05/2018 18:00	60.1	52.1	60.5	94.4
05/05/2018 19:00	58.7	51.1	60.5	84.7
05/05/2018 20:00	61.3	49.2	58.9	95.3
05/05/2018 21:00	55.5	48.1	58.3	73.4
05/05/2018 22:00	55.4	47.4	58	75.1
05/05/2018 23:00	53.5	43	56.9	70.4
06/05/2018 00:00	51.6	38.8	55.2	67.5
06/05/2018 01:00	51.7	33.4	54.5	77.1
06/05/2018 02:00	50	29.4	53.7	70.7
06/05/2018 03:00	50.3	28.8	54.1	77.3
06/05/2018 04:00	55.6	36.1	56.4	79.3
06/05/2018 05:00	55.4	47.3	58.3	71.4
06/05/2018 06:00	56.3	48.2	59.3	73
06/05/2018 07:00	57.8	49.6	60.1	79.5
06/05/2018 08:00	59	50.6	61	84.4
06/05/2018 09:00	61.3	52.8	62	85.3
06/05/2018 10:00	61.1	54.4	62.3	81.9
06/05/2018 11:00	64.6	53.8	61.7	94.1
06/05/2018 12:00	60	53.1	61.3	84.1
06/05/2018 13:00	59.8	52.9	61.4	82.4
06/05/2018 14:00	62.2	52.6	61.6	88.9
06/05/2018 15:00	58.2	53	60.6	77.8
06/05/2018 16:00	59.6	53.6	61.1	78.5
06/05/2018 17:00	63.9	53.5	60.8	93.6

APPENDIX 11-8

CONSTRUCTION NOISE AND VIBRATION MITIGATION CLAUSES

APPENDIX 11-8: CONSTRUCTION NOSIE AND VIBRATION MITIGATION CLAUSES

LEVEL 1 MITIGATION CLAUSES

- The contractor will assess, consider and implement best practicable means ("BPM") at all times throughout the construction of the Proposed Scheme in order to control noise and vibration resulting from the construction works. S72 of Control of Pollution Act (CoPA) 1974, BS 5228-2 and BS 5228-1 will be adopted. The Contractor will develop and submit a noise and vibration management plan (NVMP) including method statements and any monitoring and reporting protocols that demonstrate to Highways England that no significant impact will result from their construction works. The method statements shall specify how immediate neighbours will be kept informed of the measures taken to achieve this requirement. The contractor will provide the method of working with at least 14 days' notice. No work shall commence without written acceptance from Highways England.
- The contractor will undertake and report noise and vibration monitoring as is necessary to ensure and demonstrate compliance with all noise and vibration commitments and any s61 consent(s). Noise monitoring requirements should also be agreed with the local authority.
- Regular onsite observation monitoring and checks/audits will be undertaken to ensure that BPM are being employed at all times. The site reviews will be logged and any remedial actions recorded. Such checks will include:
  - hours of working;
  - presence of mitigation measures, equipment (i.e. engines doors closed, airlines not leaking, etc.) and screening (i.e. location and condition of local screening, etc.);
  - number and type of plant;
  - construction method; and
  - where applicable, any specific s61 consent conditions.
- The number of instances of a particular diversion route being used should be limited to:
  - less than 10 days/nights in any 15 consecutive days, and
  - less than 40 days/nights in any consecutive 6 month period.
- Where a diversion route is to be used the pavement will be checked to ensure it is in good condition, and the signalling of traffic lights adjusted to avoid the stop-start of traffic within 50m of receptors in discussions with the Local Highway Authority.
- Where construction activities are undertaken in the same area concurrently, the cumulative effects of both (or more) needs to be considered such that the SOAEL is not exceeded outside of the predicted SOAEL zone for any of the individual activities.

LEVEL 2 MITIGATION CLAUSES

- Works should be limited to no more than 10 working days/nights in any 15 consecutive days and must not exceed 40 days/nights in any 6 consecutive months.
- If the above working durations are exceeded temporary re-housing should be offered to residents for the duration of the works in this area.
- The contractor will implement a hierarchy of mitigation where the use of diversion routes is required to construct the Proposed Scheme. The following will be implemented by the contractor, in the following order:
  - Where an alternative diversion route cannot be accommodated, and use of a route is likely to exceed more than 10 days/nights in any 15 consecutive days, or 40 days/nights in any 6 consecutive months, alternative mitigation may be offered to properties within 50m of the diversion route such as secondary insulation of the windows of affected habitable rooms or

temporary re-housing in line with the example thresholds in BS 5228-1 Annex E.4 will be provided as a minimum.

- If required, production and submission of an application under Section 61 (s61) of Part III of The Control of Pollution Act 1974 for submission to the Local Authority Environmental Health Department in whose area the works are to take place - once approved, any conditions applied to the approval shall be complied with.
- The consent applications will be discussed with the relevant local authority, or authorities, both prior to construction work and throughout the construction period.
- Liaison with relevant local Environmental Health Officers, affected residents and commercial operations will be undertaken to ensure that noise and vibration during construction are effectively managed.
- Keep all receptors within 300m of the Proposed Scheme informed of the progress of the works, including the nature and timing of the works, including compound locations and traffic controls, via such means as newsletters and public meetings.
- The contractor will appoint a responsible person to liaise with the public and have a representative available on site during daytime working hours to answer queries or address any concerns expressed.
- The contractor will treat complaints fairly and expeditiously.
- Careful selection of equipment, for example any compressors brought to site will be super-silenced or sound reduced models fitted with acoustic enclosures or any pneumatic tools will be fitted with silencers or mufflers wherever practicable to achieve required acoustic performance. Generators, pumps and lights required for 24-hour operation will be super-silenced (enclosed) and /or screened. All relevant plant will comply with permissible noise levels set out in the relevant European Directives.
- The contractor will develop and submit method statements, monitoring and reporting protocols that demonstrate to Highways England that all plant and equipment will be properly maintained and operated in accordance with manufacturers' recommendations. Plant will be inspected on arrival to site.
- The contractor will develop and submit method statements, monitoring and reporting protocols that demonstrate to Highways England that machines in intermittent use will be shut down in intervening periods of non-use or, where this is impracticable, they will be throttled down to a minimum.
- Where it is identified that static items of plant are likely to generate relatively high noise levels, portable noise screens will be sourced and introduced to provide additional noise attenuation when working close to residential properties.
- Plant will be fitted with broadband reversing alarms.
- Careful consideration will be made of the site layout in order that any noise impact at nearby sensitive properties is minimised. Static plant will be located so as to optimise screening and/or distance attenuation in relation to occupied residential properties and fitted with suitable enclosures where practicable.
- The contractor will develop and submit method statements and monitoring and reporting protocols that demonstrate to Highways England that no vehicles will wait or queue on public highways or in the vicinity of site compounds with engines running for periods in excess of ten minutes.