



Reading Metropolitan

Noise Impact Assessment

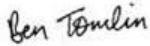
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Revision History

Revision	Date	Revision Details	Author	Checked
R01	13/12/2018	Original Issue	 Susan Witterick BSc MA MBA MIOA	 Ben Tomlin BSc MIOA

Introduction

This report details the noise survey and subsequent noise impact assessment carried out to support the planning application associated with the proposed mixed use development on land to the north of Reading Station, formerly a Royal Mail depot. The site comprises a number of blocks, containing retail units, office accommodation, and approximately 650 residential dwellings.

The site is bounded by Caversham Road to the west and Vastern Road to the north, along which residential properties are located. Reading station and its' associated rail lines run along the southern boundary, with commercial units to the east. There is currently a supermarket to the noise of the site.

The intention of this assessment is to report upon the noise survey and comment on the design requirements which will need to be considered in order to ensure that the development is not acoustically detrimental to residential amenity when considered against the noise levels detailed in BS 8233:2014 *'Guidance on sound insulation and noise reduction for buildings'* (BS8233) and the assessment methodology detailed in BS 4142:2014 *'Methods for Rating and Assessing Industrial and Commercial Sound'*.

A glossary detailing all units of acoustic terms used is appended to this report.

Guidance and Assessment Criteria

The following guidance and assessment criteria are referred to within this report:

Local Authority Requirements

We have consulted with Ms Rebecca Moon of Reading Borough Council. We understand from this conversation that Reading Borough Council's requirements with regard to new development are as follows;

Internal ambient noise levels within residential units are to be in accordance with BS 8233:2014.

Noise emissions to achieve a rating level under BS 4142:2014 of no more than the existing background sound level, with a specific sound level for plant of 10 dB below background.

BS 8233: 2014 Sound Insulation and Noise Reduction for Buildings

BS 8233 gives guidance for noise levels within residential properties. It discusses appropriate noise criteria for reasonable rest and sleep conditions, and details noise level limits which are considered to provide appropriate conditions, in accordance with World Health Organisation (WHO) guidelines.

Table 4 from BS8233 is reproduced as Figure 1, below:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

Figure 1: BS 8233 Indoor Ambient Noise Levels for Dwellings

It should be noted that these levels represent the average noise level over the 16-hour day or 8-hour night period. This potentially means that higher noise levels may be experienced internally over a shorter period of time (e.g. individual passing trains). These equivalent noise levels over a period of time are the best representation of the average noise level, and are generally the main focus when it comes to evaluating noise exposure.

Under the updates to BS 8233 in 2014, for both day and night time cases, a relaxation of up to 5 dB can be considered to provide “reasonable internal conditions” where development is considered necessary or desirable.

BS 4142:2014 ‘Methods for Rating and Assessing Industrial and Commercial Sound’

This standard provides a methodology for rating and assessing sound of an industrial or commercial nature, including sound from industrial and manufacturing processes, fixed plant installations, loading and unloading of goods, and sound from mobile plant.

The standard can be used both to assess sound from proposed new industrial and commercial sources, and sound from these sources affecting proposed new dwellings, as well as to investigate complaints. It does not, however, provide guidance sufficient to determine whether noise amounts to a nuisance.

The standard leads to derivation of a ‘rating level’ for the industrial sound which is weighted for acoustically significant characteristics including tonality, impulsivity and intermittency. This is compared against the background noise level in the absence of the specific noise (the noise source arising from the industrial/commercial use), the difference between the two being used to give an indication of impact.

Typically, the greater the difference, the greater the magnitude of the impact:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific noise source will have an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

It should be noted that not all adverse impacts will lead to complaints, and not every complaint is proof of an adverse impact.

BS 6472:2008 “Guide to evaluation of human exposure to vibration in buildings”

This document provides guideline limits for ground-borne vibration affecting people in buildings.

The threshold of perception depends on the frequency. The human body is most sensitive to vibration in the frequency range 1-80 Hz. The threshold of perception is typically taken to be 0.15 mms⁻¹ and 0.3 mms⁻¹ peak particle velocity at frequencies between 8 Hz and 80 Hz.

BS6472:1992 contains guidance relating to human exposure to vibration. A methodology is presented for assessing the human response to vibration in terms of either the vibration dose value (VDV).

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

BS 7385: Part 2:1993: “Evaluation and Measurement for Vibration in Buildings - guide to damage levels from ground-borne vibration”

For building damage criteria, Table 1 of BS 7385: Part 2:1993: “Evaluation and Measurement for Vibration in Buildings - guide to damage levels from ground-borne vibration”, sets out limits for primarily transient vibration above which cosmetic damage could occur.

ISO 9613-2:1993 “Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation”

This document provides a calculation methodology for predicting external noise levels.

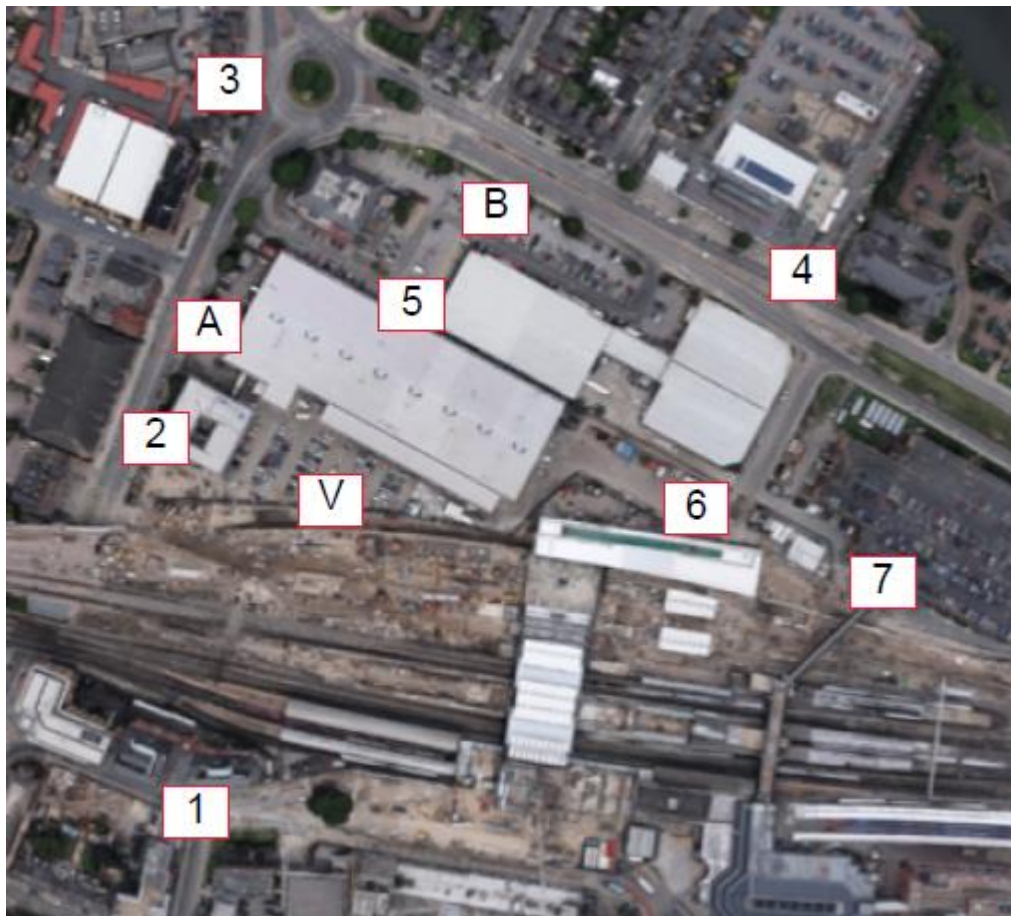
Noise Survey

To assess the noise environment at the site, a noise and vibration surveys were carried out on 8th-10th December 2017 and 27th November 2018, and Thursday 25th October 2018 and Sunday 11th November 2018.

Measurements were made at eight locations representative of the facades of the proposed development, and at the nearest noise sensitive receptors to the site, as shown in Figure 2 below.

The vibration monitoring equipment was left at a location representative of the nearest potentially affected façade of the proposed development, and monitored over more than 24 hours.

Figure 2 – Noise Monitoring Locations



Measurement Results

Noise

The results of the noise survey are provided in Appendix B.

Vibration

The results of the vibration survey are shown in Table 1, below.

Table 1: Measured Vibration Levels

Date	Period	VDV, $\text{mms}^{-1.75}$	PPV, mms^{-1}
26th November 2018	15:20h-23:00h	0.051	0.275
26th-27th November 2018	23:00h-07:00h	0.045	0.300
27th November 2018	07:00h-16:00h	0.051	0.275

Assessment and Mitigation

Noise Impact

Based on the anticipated development form, the future traffic flow predictions, and the calibrated baseline noise model, noise impact upon the facades of the future development has been predicted using the SoundPlan 8.1 acoustic modelling software.

The full development noise maps for both the day and night time scenarios are shown below.

Figure 2: Daytime Baseline Noise Map



Figure 3: Night time baseline noise map



The noise levels incident upon each façade can be broadly broken down into three façade Types – Facades A, B and C, whereby noise levels within around 5dB of each other have been considered the same, as indicated on Figure 4, and as summarised in Table 2, below.

Figure 4: Façade Noise Levels



Table 2: Predicted façade noise levels post-development

Façade Type	Period	Typical Ambient Noise Level, dBL_{Aeq,T}	Typical Maximum Noise Level, dBL_{Amax}
A	Day	66	-
A	Night	58	75
B	Day	71	-
B	Night	62	84
C	Day	76	-
C	Night	69	87

The worst case (i.e. highest) percentage glazing to each room type has been used in all calculations. However, a review of the difference between the lowest and highest percentage glazing has been determined to be 2dB or less, which is not significant;

All calculations have been based on achieving the requirements of BS8233, as detailed above. For bedrooms at night, both ambient (dBL_{Aeq}) and maximum (dBL_{Amax}) parameters have been considered.

The assessment is therefore considered worst case and robust. There may be scope to undertake a more detailed assessment and value engineering exercise of the facades and ventilation at a later date, but this is outside of the scope of this report, the purpose of which is to demonstrate that the requirements of Reading Borough Council can be met.

The mitigation measures required to achieve all relevant acoustic design targets in all noise sensitive rooms are as shown in Table 2, below.

Table 3: Sound Insulation Performance Requirements for Glazing and Ventilators

Façade	Room Type	Minimum Glazing Sound Insulation Performance, dBR_w	Example Glazing Construction, mm	Minimum Ventilator Sound Insulation Performance, $dBD_{n,e,w}$
A	Living rooms	33	6/12/6	44
	Bedrooms	34	6/12/6.4 pvb	48/MV
	Office	31	4/12/4	MV
	Retail	31	4/12/4	MV
B	Living rooms	42	10/12/8.8	38
	Bedrooms	47	10/12/6.5 acoustic	46/MV
	Office	31	4/12/4	MV
	Retail	31	4/12/4	MV
C	Living rooms	47	10/12/6.5 acoustic	44
	Bedrooms	47	10/12/6.5 acoustic	48/MV
	Office	36	10/12/4	MV
	Retail	31	4/12/4	MV

The ventilators could be replaced with mechanical ventilation in all rooms if desirable.

Windows can be openable so long as they are well sealed when closed. The frames and seals should not downgrade the performance of the glazing.

There are many alternative glazing specifications which would also meet the required sound insulation performances, which can be developed at the design stage.

Vibration

BS6472:1992 contains guidance relating to human exposure to vibration. A methodology is presented for assessing the human response to vibration in terms of the vibration dose value (VDV).

Table 1 of this standard, which details the likely levels of Vibration Dose Value (VDV) which might result in various probabilities of adverse impact in residential buildings, is reproduced as Table 4, below.

Table 4 – Table 1 of BS6472

Place and Time	VDV Values which might result in various probabilities of adverse comment within residential buildings, $\text{mm}^{\text{s}^{-1.75}}$		
	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential Buildings, 16 h day	0.2-0.4	0.4-0.8	0.8-1.6
Residential Buildings, 8 h night	0.1-0.2	0.2-0.4	0.4-0.8

For building damage criteria, Table 1 of BS 7385: Part 2:1993: “*Evaluation and Measurement for Vibration in Buildings - guide to damage levels from ground-borne vibration*”, sets out limits for primarily transient vibration above which cosmetic damage could occur. This is reproduced in Table 5, below.

Table 5 - Vibration levels above which cosmetic damage could occur.

Building Type	Peak Particle Velocity (mm/s)	
Reinforced or framed structures. Industrial and heavy commercial buildings.	50mm/s at 4Hz and above	
Unreinforced or light framed structures. Residential or light commercial type buildings.	4Hz to 15Hz	15Hz and above
	15mm/s at 4Hz, increasing to 20mm/s at 15Hz	20mm/s at 15Hz, increasing to 50mm/s at 40Hz and above

It can be seen that the measured vibration levels shown in Table 1 are significantly lower than the criteria detailed in Table 4 and 5, above, when measured at the most potentially affected location, and hence baseline vibration levels are negligible for the entire site.

Plant Noise Emission Limits

To meet Reading Borough Council's requirements, plant noise should be controlled to a specific noise level 10dB lower than the background sound level.

On this basis, and based on the background sound levels measured, the cumulative, specific plant noise level should be controlled to meet the limits detailed in Table 6, below.

Table 6: Plant Noise Limits – Specific Noise Level Limits

Location	Daytime Limit, dBL _{Aeq,16hour}	Night time Limit, dBL _{Aeq,8hour}
Dwellings on Caversham Road	53	37
Dwellings on Vastern Road	54	42
Commercial on Caversham Road	53	n/a
Commercial on Vastern Road	54	n/a

These limits are not particularly onerous, and can be readily achieved with appropriate selection of plant, and/or noise control measures such as attenuators for air movement plant, acoustic screens, acoustic louvres and enclosures. This will be developed as the design progresses.

Construction Noise

Construction activities are a potential, albeit temporary, source of noise and vibration. British Standard BS 5228 "Code of practice for noise and vibration control on construction and demolition sites" provides methodologies for the assessment and control of noise and vibration from construction operations. The Standard contains detailed information on noise reduction measures and promotes the 'best practicable means' (BPM) approach to control noise and minimise the impact on local residents and construction workers.

The magnitude and significance of effects due to construction noise is based on "Example Method 2 '5dB change'" as described in BS5228-1. This method states that noise levels generated by construction activities are deemed to be significant if the 'total noise' (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,period}$ from construction noise alone, for the daytime (07:00-19:00), evening (19:00-23:00) and night-time (23:00-07:00) periods, respectively.

There is no recognised guidance to determine if any predicted significant adverse effects are of 'minor', 'moderate' or 'major' significance, however the approach shown in Table 7, below, could be considered where there is a +5dB change or greater:

Table 7: Construction Noise Magnitude of Impact

Total Noise Arising from Construction	Significance
65-70 dBA	Low
70-75 dBA	Medium
>75 dBA	High

It is also suggested that, depending on if the effect is for a short or long duration, the reported effects can move to adjacent significance bands. For example, piling noise may be >75dB, but may only occur over a 1-week duration and therefore would be considered as of 'moderate' significance.

For construction noise and vibration, it is not possible at the planning application stage to predict detailed noise effects given the uncertainty as to construction methods, processes and plant. However, indicative noise levels have been calculated at the closest noise sensitive receivers for assumed plant and processes. These calculations have been undertaken on the following basis:

- All buildings on current existing site are to be demolished and site cleared at one time (not phased);
- Earthworks for all phases undertaken;
- Piling undertaken (assumed CFA piling);
- Phases 1-3 to be constructed in sequence;

The distance calculations have been based the lowest distance from the centre of each phase (as an average) to the nearest residential property (Vastern Road for Phases 1 and 2, at around 140m, and Vastern Road, at around 110m, for Phase 3). Properties at a greater distance will be subject to similar or lower noise levels;

The impact of the construction of Phase 2 has also been considered on the Phase 1 building (assumed average distance of 20m), and the impact of the construction of Phase 3 has been considered on the Phase 2 building (assumed average distance of 50m).

Full calculations are available on request, but in summary, typical noise levels anticipated at the nearest noise sensitive locations are detailed in Table 8, below.

Table 8: Predicted Construction Stage Noise Levels and Significance

Phase	Nearest Affected Location	Typical Daytime Noise Level, dBL _{Aeq,T}	Significance
Demolition	Buildings on Caversham Road	70	Minor
Earthworks P1/P2	Buildings on Vastern Road	67	Minor
Earthworks P3	Buildings on Caversham Road	65	Negligible
Phase 1 Piling	Buildings on Vastern Road	56	Negligible
Phase 1 Concreting	Buildings on Vastern Road	72	Moderate*
Phase 1 Main Build	Buildings on Vastern Road	73	Moderate*
Phase 2 Piling	P1 building	71	Moderate*
Phase 2 Concreting	P1 building	87	Major
Phase 2 Main Build	P1 building	87	Major
Phase 3 Piling	P2 building	63	Minor
Phase 3 Concreting	P2 building	79	Major
Phase 3 Main Build	P2 building	79	Major

* Although when considered in isolation the significance is considered 'moderate', with typical existing daytime ambient noise levels of around 73dBL_{Aeq,T}, this is below the Example Method 2 '5dB change' as described in BS5228-1.

All construction activities are therefore likely to be of minor or moderate significance, except the impact on Phase 1 of the construction of Phase 2, and on Phase 2 by the construction of Phase 3. In both cases this is due to the proximity of the construction site to the earlier phases of the scheme. This could be mitigated by building all three phases simultaneously, if feasible. Noise sensitive dwellings outside of the development site are unlikely to be significantly affected by such a change.

Furthermore, it should be noted that the noise data provided in BS5228 is representative of older machinery. Based on the implementation of best practical means with the contractors CEMP, the above noise levels are likely to reduce by somewhere in the order of 5-10dB.

All properties outside of the main development site are likely to benefit from acoustic screening provided by the site boundary fence (assuming solid construction not wire mesh) during periods when construction takes place at ground level e.g. piling, earthworks etc. This would reduce noise levels at the houses on Vastern Road and Caversham Road by a further 5-10dB.

If evening, night-time and/or Sunday working is to be required, then this would need to be agreed with the Local Authority under the Control of Pollution Act (CoPA). A noise and vibration management plan and possibly a prior, CoPA Section 60 agreement with the Local Authority, could also be considered.

Conclusion

This report details the noise survey and subsequent noise impact assessment carried out to support the planning application associated with the proposed mixed use development on land to the north of Reading Station, formerly a Royal Mail depot.

The site is bounded by Caversham Road to the west and Vastern Road to the north, both of which have some residential properties. The station and rail lines run along the southern boundary, with commercial units to the east.

Noise and vibration surveys were carried out in December 2017 and November 2018.

Measured vibration levels were significantly lower than the limits detailed in BS 6472:2008 *“Guide to evaluation of human exposure to vibration in buildings”* and BS 7385: Part 2:1993: *“Evaluation and Measurement for Vibration in Buildings - guide to damage levels from ground-borne vibration”*. Therefore vibration is not considered to be an issue.

Based on the measured noise levels a noise model of the site and the surrounding area has been created, and used to determine the acoustic requirements of the glazing and ventilation. In all areas, the requirements of the local authority can be achieved.

On this basis, noise and vibration should not be a limiting factor in any planning application.

Appendix A: Glossary of Acoustic Terminology

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is $2 \times 10^{-5} \text{ N/m}^2$. The sound pressure level existing when microphone measured pressure is $2 \times 10^{-5} \text{ N/m}^2$ is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of L_p actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during time, T.
$L_{Amax,T}$	The instantaneous maximum A weighted sound pressure level which occurred during time, T.

Appendix B: Noise Survey

Date & Time of Survey:	8th December 2017 to 10th December 2017 & 27th November 2018					
Personnel:	Chris Clayden (dBx Acoustics)					
Equipment Used:	Casella CEL 63-X Serial no 1711050 Norsonic NOR 140 serial no 1405619, Vibrocock V9001 Serial No 2177					
Calibration:	Measurements were undertaken in accordance with BS 7445-1:2003 <i>Description and Measurement of Environmental Noise</i>. Weather conditions throughout the survey were in accordance with good measurement practice. On site calibration checks were performed on the meter before and after the measurements and were found to be within the permitted tolerance of BS EN 61672-1:2013. All equipment had a valid calibration certificate at the time of the survey and all microphones were fitted with a windshield to prevent wind noise from affecting the measurements.					
Weather Conditions:	Day	Period	Wet/Dry	Temp°C	Wind Speed & Direction	Cloud Cover
	Friday	Day	Dry	3°C	9 mph W	25%
	Saturday	Night	Dry	-2°C	5 mph SW	0%
	Saturday	Day	Dry	2°C	6 mph S	50%
	Sunday	Night	Dry	0°C	11 mph ESE	50%
Measurement Locations:	Measurements were undertaken at 7 locations around the development site. These are identified on the site plan and are described below. MP1 – 2m from Station Hill Road MP2 – 2m from Caversham Road west of site by existing network rail building MP3 – 3m from roundabout on Caversham Road and Vastern Road Junction MP4 – 3m from Vastern Road North of site, in line with the Aldi on the other side of the road MP5 – Corner of Car Park next to Mothercare MP6 – 5m from Bagnall way taxi rank MP7 – 4th floor of Multistorey car park overlooking Reading train station and railway next to Bagnall Way. Additional measurements were made on-site at A and B on Vastern Road. Vibration measurements made on southern site boundary adjacent to railway, marked V on site map.					

Measurement Details:	Measurements were undertaken over various periods in terms of and L_{eq} , L_{90} , L_{max} .
Façade / Free-Field:	All measurements free-field
	Full results for the attended measurements are provided below
Measured Data:	Full octave band frequency data was obtained for all measurements.

Measured Noise Levels

Daytime

Location	Date	Period, h	Noise Level, dB			
			L_{Aeq}	L_{A10}	L_{A90}	$L_{Amax, F}$
1	8 th December 2017	1130 – 1145	62	65	57	74
		1702 – 1717	67	69	59	85
		1921 – 1936	65	67	61	75
	9 th December 2017	1414 – 1429	60	63	55	74
		1940 - 1955	63	65	60	82
	27 November 2018	13:11-13:26	76	77	69	98
		14:25-14:40	74	77	66	87
		15:43-15:58	74	76	69	81
2	8 th December 2017	1152 – 0015	77	80	69	91
		1753 -1808	71	75	63	87
		1945 – 2000	77	81	67	88
	9 th December 2017	1433 - 1448	77	81	69	86
		1959 – 2014	76	80	65	89
	27 November 2018	13:52-14:07	72	75	64	81
		14:53-15:08	74	77	67	80
		16:06-16:21	74	78	67	82
3	8 th December 2017	1210 – 1225	76	77	68	104
		1741 – 1756	69	71	65	94

	9 th December 2017	2004 – 2019	73	76	67	83
		1451 – 1506	74	76	69	90
		2017 – 2032	73	76	64	91
4	8 th December 2017	1232 – 1247	73	77	63	88
		1832 – 1847	73	77	65	88
		2042 -2057	73	77	63	86
	9 th December 2017	1526 – 1541	74	77	65	87
		2053 - 2108	71	75	59	83
5	8 th December 2017	1333 – 1348	59	61	58	70
		1803 – 1818	58	60	55	71
		2025 – 2040	58	59	55	67
	9 th December 2017	1509 – 1524	56	58	54	71
		2026 – 2041	57	58	52	77
6	8 th December 2017	1252 – 1307	62	65	57	78
		1840 – 1855	64	66	61	74
		2101 – 2116	64	66	62	71
	9 th December 2017	1544 – 1559	62	63	59	77
		2111 – 2126	61	63	59	70
7	8 th December 2017	1312 – 1327	66	68	63	79
		1900 – 1915	69	71	66	78
		2119 – 2134	71	72	70	75
	9 th December 2017	1601 - 1616	68	69	66	88
		2128 - 2143	65	67	63	78

Night Time

Location	Date	Period, h	Noise Level, dB		
			L _{Aeq}	L _{A90}	L _{Amax, F}
1	9 th December 2017	0415 – 0420	46	44	54
		0420 - 0425	53	45	68
		0425 - 0430	53	44	69

	10 th December 2017	0057 – 0102	59	51	70
		0102 - 0107	58	49	68
2	9 th December 2017	0435 – 0440	73	47	85
		0440 – 0445	69	50	84
		0445 - 0450	73	51	92
	10 th December 2017	0114 -0119	74	60	87
		0119 - 0124	73	53	86
3	9 th December 2017	0455 - 0500	67	52	79
		0500 – 0505	69	55	84
		0505 – 0510	67	53	81
	10 th December 2017	0126 - 0131	69	61	81
		0131 - 0136	69	59	80
4	9 th December 2017	0530 – 0535	67	51	83
		0535 - 0540	68	50	83
		0540 - 0545	66	48	81
	10 th December 2017	0158 - 0203	68	50	86
		0203 - 0208	67	49	82
5	9 th December 2017	0513 – 0518	52	43	62
		0518 – 0523	52	46	61
		0523 - 0528	51	46	62
	10 th December 2017	0142 - 0147	58	56	65
		0147 - 0152	57	54	63
6	9 th December 2017	0548 – 0553	59	51	70
		0553 – 0558	60	60	70
		0558 – 0603	60	60	70
	10 th December 2017	0217 - 0222	60	51	80
		0222 - 0227	55	51	67
7	9 th December 2017	0605 – 0610	57	51	71
		0610 – 0615	62	61	73
		0615 – 0620	64	61	74
	10 th December 2017	0233 – 0238	57	50	71
		0238 - 0243	55	50	63