Gatwick Airport Northern Runway Project

Environmental Statement
Appendix 14.9.3: Ground Noise Modelling

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1 Introduction

1.1 General

1.1.1 This document forms Appendix 14.9.3 of the Environmental Statement (ES) prepared on behalf of Gatwick Airport Limited (GAL) for the proposal to make best use of Gatwick Airport's existing runways and infrastructure (referred to within this report as 'the Project').

1.1.2 This document provides details of the ground noise modelling for the Project, the results and assessment of which are reported in **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).

2 Baseline Study

2.1 Baseline Receptor Noise Survey

2.1.1 For the assessment of ground noise, around the perimeter of the airport, long term average L_{Aeq} noise levels over the day (07:00-23:00) and night (23:00-07:00) periods have been calculated with reference to the results of a 2-week baseline noise survey in 2016. The full baseline noise survey report is provided in **ES Appendix 14.9.6: Ground Noise Baseline Report** (Doc Ref. 5.3). The sites surveyed are shown in Figure 14.4.1 of the ES, where it should be noted that an additional thirteenth location has been added since the PEIR was produced. The location numbering used in the 2016 baseline noise monitoring report has also been used here. The thirteenth location is Hoots cottage which was labelled as location 15 within the baseline measurement report, included as **ES Appendix 14.9.6: Ground Noise Baseline Report** (Doc Ref. 5.3).

2.1.2 The overall average daytime and night-time measured L_{Aeq} sound levels, including all noise sources, are shown at Table 2.1.1. The pattern of ground operations on the airfield is different between the two runway modes of operation (26 and 08) so the survey results for the two runway modes are reported separately.

Table 2.1.1: Summary of Average 2016 Baseline Measurements

Descriptor	Location ($L_{Aeq, T}$ dB)												
	1	2	3	4	5	6	7	8	9	10	11	12	15
26 Daytime	56	60	61	58	51	55	60	60	67	60	56	61	56
26 Night	50	54	55	50	44	52	56	56	61	54	51	56	52
08 Daytime	53	56	57	56	48	57	60	61	66	60	59	68	60
08 Night	52	54	55	53	47	54	55	56	61	56	54	61	55

2.1.3 It should be noted that the long-term average results of the 2016 baseline survey are generally representative of neutral weather conditions (typically characterised by low wind speeds) which have relatively little effect on the propagation of noise.

2.1.4 The 2016 baseline ground noise has been predicted at the same receptor locations that were used for the measurements. The results are presented at Table 5.2.1 below following the ground noise prediction method described in section 2, 3 and 4.

2.1.5 The predicted 2016 baseline noise levels are, in some cases, higher than the average measured 2016 baseline noise levels. For locations where ground noise is dominating the ambient noise environment, this is not unexpected since although the predictions represent, and have been corrected for, average wind conditions, this is a conservative correction and can still be considered to represent a realistic worst-case scenario. The noise propagation methodology used in the ground noise modelling is carried out according to ISO9613-2 and within the scope of this standard it states:

'The method predicts the equivalent continuous A-weighted sound pressure level (as described in parts 1 to 3 of IS0 1996) under meteorological conditions favourable to propagation from sources of known sound emission. These conditions are for downwind propagation, as specified in 5.4.3.3 of IS0 1996-21987…'

2.1.6 Since the current version of ISO9613 was published in 1996, the other standard referred to (ISO1996) has been updated and the latest version published in 2017 includes details about expected propagation under downwind conditions at Annex G. Annex G discusses an example of traffic noise predicted at 200 m from a road providing a figure which demonstrates 7-10 dB increase between neutral weather conditions and 'very favourable' downwind weather conditions. In order to consider downwind propagation of ground noise at Gatwick, the results of the 2016 baseline survey have been analysed to find the maximum measured $L_{Aeq, 1\text{-hour}}$ levels at each location (for day and night periods separately). The long-term average levels have then been subtracted from the maximum 1-hour averages to show the maximum upward variance in measured noise levels as shown at Table 2.1.2 below.

Table 2.1.2: Summary of Maximum Variance in measured 2016 Baseline Levels above the mean (dB L_{Aeq})

Descriptor	Location ($L_{Aeq, T}$ dB)												
	1	2	3	4	5	6	7	8	9	10	11	12	15
26 Daytime	7	7	5	6	10	8	4	5	3	6	6	4	5
26 Night	8	8	8	7	8	7	6	5	8	9	9	4	8
08 Daytime	10	7	7	5	14	15	12	6	4	5	4	2	5
08 Night	11	11	12	9	9	6	5	7	10	9	9	7	8

2.1.7 It can be seen that the variation in the measured 2016 baseline noise, in terms of the maximum variance above the long-term average, generally shows some 1-hour periods over the baseline survey where favourable downwind conditions occurred resulting in a 7-10 dB increase in ground noise. It should be noted that where variations are in excess of 10 dB, this is an indication that other sources of noise (other than ground noise) may be starting to significantly affect the baseline measurements which include all sources of noise.

2.1.8 Allowing for this variation in the baseline noise measurements, and expected increase due to favourable downwind conditions, the 2016 predicted ground noise levels (presented at Table 5.2.1) are within the expected range.

2.2 Model Review

2.2.1 Hayes McKenzie has developed an equivalent point source noise model for predicting airport ground noise, and this has previously been used for ground noise assessment at Gatwick Airport. Whilst the acoustic propagation within this model is based on methodology within ISO9613-2, the parameters which are used for defining the equivalent point sources have been developed

over a number of years by Hayes McKenzie. A review of the existing ground noise model parameters was carried out and it was identified that source noise data for aircraft were quite out of date and required updating if possible. A study carried out at Madrid Airport (Ansensio *et al*., 2007) provided some useful source noise data for comparison with the data used in previous ground noise modelling exercises (most recently for the 2019 Master Plan). A brief review of the derived source noise data from the Madrid Airport study confirmed that data used in previous ground noise modelling carried out for Gatwick were appropriate, if slightly conservative by comparison. However, the data are now more than 10 years old and do not include next generation aircraft such as the Airbus A320 Neo. The methodology used in the Madrid Airport study provides a useful measurement protocol for estimating the sound power of taxiing aircraft and this was used as a basis for a survey of taxiing aircraft noise at Gatwick carried out in March/April 2019 (see Section 2.3).

2.2.2 More recently, some work sponsored by the Federal Aviation Administration (FAA) was published by the National Academy of Science as a web-based document (National Academies of Sciences, Engineering, and Medicine, 2013) and this builds on the work carried out at Madrid Airport. This National Academy of Science document presents measurements carried out by Wyle Laboratories at Washington (Dulles) Airport and provides comparison with the data from Madrid Airport. The data in this document are more difficult to interpret in relation to the data used in previous Gatwick modelling as they are not provided in a comparable format. The document was written with the view to developing the FAA's noise modelling software for use in ground noise modelling and noise levels are represented in dB Sound Exposure Levels (SELs) for standard distances from aircraft as defined and used in the FAA models. Whilst the presented noise levels are not directly comparable, the results do provide more confidence in the results of the Madrid Airport aircraft taxi noise measurements. In addition, the measurement protocol used by the Wyle Laboratories is very similar to that used in the Madrid Airport study.

Wind Speed and Direction

2.2.3 Another aspect of the noise model that has been reviewed is the inherent effect of wind speed and direction on predicted noise levels. Since the wind direction determines whether the airport operates in runway 08 or runway 26 mode, it would seem appropriate to allow for wind conditions in the noise model. As discussed at paragraph 2.1.5, the ISO 9613-2 methodology results in an absolute worst-case "downwind" predicted noise level and although there is some discussion about a meteorological correction, there is no detailed methodology for implementing this and the standard does not provide clear guidance on how to correct predicted noise levels for average wind conditions.

2.2.4 In order to make an allowance for the average wind conditions experienced during the typical 92-day summer period, various methodologies were considered. A potentially suitable meteorological correction was found within a road traffic noise model published by the Acoustical Society of Japan (ASJ RTN 2018), and this was investigated further to understand the relevance to airport ground noise. Section 3.6 on the road traffic noise model is relatively brief and provides a simple formula for correcting overall A-weighted L_{Aeq} levels to account for meteorological effects. The model is based around determining predicted noise levels for neutral wind conditions over relatively short distances so the correction can be positive or negative depending on whether the conditions are favourable (downwind) or unfavourable (upwind).

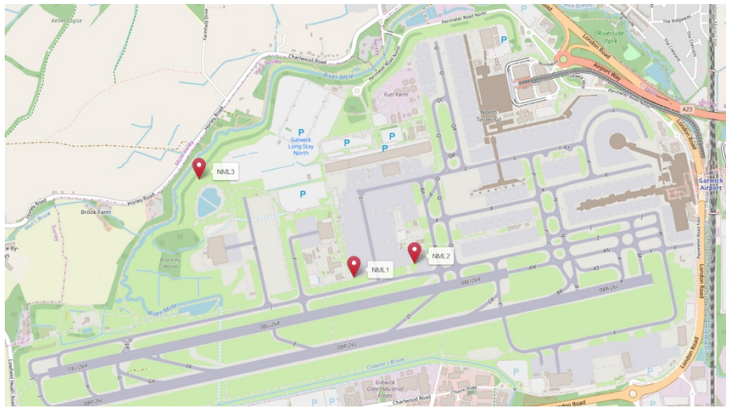
2.2.5 The origin of the meteorological correction in the road traffic noise model is referenced to a study published in 1983 and written by H. Tachibana, (*Study on the practical prediction of the effect of wind on noise propagation*) which describes the setup of a scale model experiment carried out in a wind tunnel that accurately reflects the results of field measurements presented in another study. The field measurements used for comparison were carried out by P. H. Parkin and W. E. Scholes and published in the Journal of Sound and vibration in 1965 (The Horizontal Propagation of Sound from a Jet Engine Close to The Ground, at Hatfield). These comprehensive measurements carried out by Parkin and Scholes are of particular relevance since they were carried out to measure propagation of noise from an aircraft jet engine under a range of wind conditions measured over long distances with the furthest measurement positions being in excess of 1 km from the noise source (jet engine).

2.2.6 Whilst the meteorological correction is presented within a road traffic noise model that corrects a prediction for neutral wind conditions (rather than correcting a worst-case downwind prediction), it is still considered to be relevant to the airport ground noise model. The fact that the research carried out to derive the meteorological correction has been verified through comparison with measurements of jet engine noise over long distances, gives confidence that the correction will provide a reasonable estimate of the effect of average wind conditions on long term average ground noise predictions.

2.3 Source Noise Survey

2.3.1 In order to provide more current data for Gatwick Airport, unattended sound level measurements were conducted over a period of 32 days between 21 March and 22 April 2019. Equipment was installed at three noise monitoring locations (NMLs) considered to be appropriate for measuring noise from aircraft taxi movements. The measurement locations are labelled NML 1, NML 2 and NML 3 and are shown at Diagram 2.3.1.

Diagram 2.3.1: NML Location Plan



2.3.2 At each NML, a Rion NL-52 Sound Level Meter fitted with a ½ inch microphone complying with the Class 1 standard in IEC 61672-1 (IEC, 2013) was installed, mounted on a tripod, at approximately 1.2 metres height, as shown at Diagram 2.3.2 to Diagram 2.3.4. At each NML, the microphone was located within a double-skinned windshield consisting of a 45 mm foam ball surrounded by a 125 mm radius secondary windshield of 40 mm thickness. The equipment was set up to measure the L_{Aeq} and L_{A90} noise level in 10-minute intervals along with 1-second L_{eq} data in ⅓-octave bands and audio recording to allow further analysis of the measurements as necessary.

2.3.3 Calibration was carried out on all meters using a B&K type 4231 Acoustic Calibrator (s/n 2699280) with a level of 94.06 dB at the start of the survey and checked at the end with the same field calibrator. A drift of no more than 0.3 dB in the calibration was observed in any of the meters which is within normal tolerances and no correction was therefore required (or made) to the

measured levels. All equipment was within its relevant laboratory calibration period.

2.3.4 Meteorological data including rainfall and wind speeds in 10-minute intervals were collected from the on-site runway midpoint meteorological station. Obtaining this weather data enabled periods of rainfall and high wind speeds to be considered and excluded from the derivation of the representative sound levels as necessary. These factors are less significant for aircraft pass-by at NML 1 and NML 2 but could potentially increase the measured background sound levels at NML 3.

NML 1

2.3.5 At NML 1, the monitoring equipment was installed on an area of grass beside an access road near to some disused maintenance hangers at the end of Larkins Road. The sound level meter was positioned at approximately 3 metres from the edge of the access road, 40 metres from the edge of Taxiway Juliet and 123 metres from the edge of the northern runway. The noise environment at NML 1 was dominated by taxiing aircraft passing on Taxiway Juliet and take-offs on the main runway. Aircraft landing on the main runway, more distant taxiing aircraft and occasional vehicles on the access road could also be heard.

Diagram 2.3.2: Photographs of NML 1

NML 2

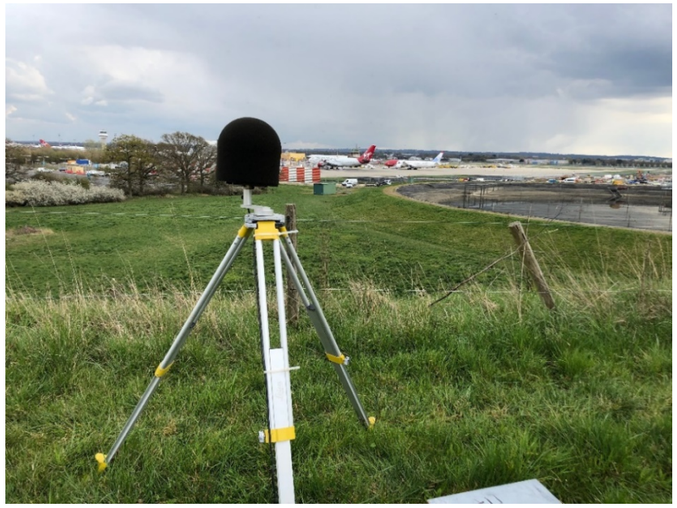
2.3.6 At NML 2, the monitoring equipment was installed on an area of grass in front of the operations building. The sound level meter was positioned at approximately 44 metres from the edge of Taxiway Juliet and 127 metres from the edge of the northern runway. The noise environment at NML 2 was dominated by taxiing aircraft passing on Taxiway Juliet and take-offs on the main runway. Aircraft landing on the main runway, more distant taxiing aircraft and occasional vehicle movements related to the operations building could also be heard.

Diagram 2.3.3: Photographs of NML 2

NML 3

2.3.7 At NML 3, the monitoring equipment was installed on top of the north bund near to a holding pond behind the Boeing hangar development site. The sound level meter was positioned at the following latitude/longitude coordinates: 51.156737, -0.200590. The noise environment at NML 3 included take-offs and landings on the main runway, distant taxiing aircraft and reversing beepers/other sporadic noises from the Boeing hangar construction site (under construction at the time of survey).

Diagram 2.3.4: Photographs of NML 3



Aircraft Logging

2.3.8 In addition to the noise data, it was also necessary to keep a log of aircraft passing the microphones at NML 1 and NML 2 in order to allow detailed analysis of noise levels generated by particular types of taxiing aircraft.

2.3.9 Initially, when the equipment was installed in March (2019), a manned survey of the aircraft was carried out over 2-3 hours from the observation room in the operations building using GPS time and binoculars to note down aircraft registration and times. During this manned survey, the surveyors (Hayes McKenzie) were also provided access to the Gatwick situational awareness tool which provides live (and historical) radar data showing the exact location of aircraft taking off, landing and taxiing around the airport. The manned survey log sheets correlated perfectly with information obtained from the situational awareness tool and it was decided that all further information required for the aircraft log sheets could be obtained remotely through access to the situational awareness tool.

2.3.10 For the purposes of calculating source noise data used in the model for this assessment, approximately two weeks of aircraft log data was processed representing a large dataset of recorded aircraft pass-by.

Results

2.3.11 The survey results were filtered to only include measurements where no take-offs or landings were happening whilst taxing aircraft travelled along the section of Taxiway Juliet that was used in the measurements. Results were also filtered to ensure that no measurements were included where a taxiing aircraft passing a microphone was within one minute of another aircraft passing the same microphone. Based on the two weeks of aircraft log data, a total of 1460, 98, 36, and 130 samples were obtained for the A320, A320 Neo, B747 and B787 aircraft respectively. Following the filtering described above the total numbers reduce to 484, 35, 9 and 49 for the A320, A320 Neo, B747 and B787 aircraft respectively. It was also decided that since the A320N and the A321N both use the same GE engine, results of these two aircraft types would be combined in order to provide a greater dataset for the sound power level assumed to be representative of the majority of small (Category C) next generation aircraft. Combining the two datasets provided a total of 58 samples from A320N and A321N aircraft after filtering. Some manual filtering was also made where it was considered that particular recordings appeared to be outliers based on the recorded noise profile not fitting with the expected trend.

3 Updated Source Terms

3.1 Sound Power Levels

3.1.1 Detailed analysis of the results of the source noise survey revealed overall A-weighted maximum sound power levels (varies significantly with directivity) of 133 dBA, 130 dBA, 142 dBA and 137 dBA for the A320, A320 Neo, B747 and B787 aircraft respectively. This indicates that the next generation aircraft are 3 – 5 dB quieter than older aircraft (at source) when taxiing and this has been taken into account within the noise model.

3.1.2 The calculated sound power levels for each aircraft type are presented in octave bands at Table 3.1.1 below. It should be noted that due to difficulties with accurately measuring in the 31.5 Hz octave band, calculated levels in the 63 Hz band have been assumed to be representative of levels in the 31.5 Hz band.

Table 3.1.1: Calculated Sound Power Levels

Aircraft Type	Octave Band Sound Power dB L_{wA}									Overall L_{wA}
	31.5	63	125	250	500	1k	2k	4k	8k	
B747	125	125	130	135	133	135	133	136	128	142.2
B787	126	126	132	132	127	120	120	120	119	137.0
A320	124	124	128	125	123	123	122	121	117	133.2
A320 Neo	118	118	121	123	123	121	118	120	117	129.9

4 Prediction Model

4.1 Approach

4.1.1 Aircraft ground noise is assessed by carrying out predictions of noise levels arising from the proposed change in taxi routes and number and type of aircraft using the taxi routes. The accuracy of the ground noise predictions depends on the quality of the input noise data and the assumptions used in the prediction model.

4.1.2 Predictions of aircraft ground noise have been carried out in the noise modelling software CadnaA. Modelling has been carried out for the existing baseline situation comprising actual traffic

data covering the 92-day summer period (as used for air noise). This modelling was initially carried out as part of the 2019 Gatwick Master Plan, but the model has been used as a basis for future baseline predictions and it is considered that the key assumptions relating to aircraft taxi routes are also valid for this purpose. It should also be noted that the predicted ground noise levels provided for the 2019 Master Plan have been updated based on the revised sound power data calculated as part of the survey discussed above within section 2.

4.2 Baseline Noise Model

4.2.1 For the 2019 Master Plan modelling, the total numbers of arrivals and departures for the relevant taxiways were derived from recorded movements supplied by GAL. Actual taxiways that were used have not been recorded in the recorded traffic data but the stand location is provided, and the taxiway on which a stand is located has been used to define the assumed taxi route for each individual movement (for the purposes of the model a single movement is considered to encompass both the arrival and departure of an aircraft). Movements were summed and averaged over the 92 day period to provide typical movements for the 16 hour day (07.00 to 23.00), and 8 hour night (23.00 to 07.00). The process of creating this model for the 2019 masterplan also provided information on the proportions of different aircraft using each of the defined taxiways for the daytime and night-time periods. These proportions of aircraft types on each of the defined taxiways have then been taken as representative of the current airport operation and used for interpretation of the predicted traffic data across all of the future baseline noise modelling.

4.2.2 Taxiing routes between the ‘defined taxiways’ which are marked on the airport plan (Quebec, Romeo, Sierra etc), and the runway have been interpreted from analysis carried out by London City Airport Consulting. The analysis shows the normal routes taken for aircraft arriving and departing under easterly and westerly operations separately. Based on routing diagrams provided by London City Airport Consulting, the most efficient routes between taxiways have been selected for inclusion in the baseline noise model.

4.3 Project Model

4.3.1 Modelling of the ‘with Project’ scenario has been based on specific arrival and departure routes around the airport supplied by GAL. The taxi routes are defined for Category C and Category E aircraft (small and large) travelling to six individual areas of the airport apron that are separated equally into three associated with the North Terminal and three associated with the South Terminal. These taxi routes are defined for day and night, separated into easterly and westerly operations. This results in 74 individual arrival and departure routes for daytime operation and 60 individual arrival and departure routes for night-time operation that are included within each run of the noise model.

4.4 Generic Aircraft Types

4.4.1 For the purposes of the 2019 Master Plan aircraft ground noise model, the many different aircraft types recorded were classed as either ‘large’ or ‘small’ generic types using the International Civil Aviation Organization (ICAO) wake category. The ‘heavy’ wake category has been used to indicate the first generic type (large), which is representative of the 'jumbo' size aircraft taxiing sound levels as first measured for the Heathrow Terminal 5 Public Inquiry. The ‘medium’ and ‘light’ wake categories have been used to indicate the second generic type which is representative of the majority of small standard size category twin-jet aircraft currently operating at Gatwick.

4.5 Source Noise Levels

4.5.1 Historically, source noise levels for the ‘jumbo’ size aircraft measured for Heathrow Terminal 5 Public Inquiry have been used to model large aircraft and measurements of an Airbus A319 aircraft carried out at Stansted Airport on 29 January 2007 have been used to model small aircraft. The small and large aircraft sizes correspond to GAL categories C and E respectively.

4.5.2 The taxiing noise source sound power levels used, in the pre-existing model (pre-2019 survey), for both large and small generic types were measured at 150 metre radius for both idle and breakaway thrust settings which were assumed to be typical for normal taxiing. There is sufficient residual thrust even at idle power settings to maintain forward motion during normal taxiing, but pilots can choose to use higher breakaway thrust settings for a few seconds to assist the aircraft to accelerate rapidly from rest or to negotiate a particularly sharp bend. Sound levels are not directly affected by the speed of taxiing but only by the thrust setting needed to maintain that speed.

4.5.3 The extent to which newer aircraft types may be quieter than those previously measured and used for the ground noise calculation model generated a significant uncertainty within the model. Since the fleet of aircraft at Gatwick will be changing over the coming years in terms of the number of next generation aircraft, it was deemed necessary to gather up-to-date source noise measurements that could be used to take this into account. As set out in Section 2.2, a survey was therefore conducted based on the principles set out in the research carried out at Madrid Airport (Ansensio *et al.,* 2007).

4.5.4 Historically (pre-2019 survey) the calculation model required an average sound power level to be calculated for taxiing operations based on the proportion of small and large aircraft types. The majority of air traffic at Gatwick falls into the small category and a statistical analysis of the supplied 2016 traffic data indicated that the lowest proportion of small aircraft using any of the defined taxiways for both easterly and westerly operation was 80.1% on Taxiway Lima. However, in order to further improve the accuracy of the modelling, each aircraft type included in the modelling for EIA purposes has now been modelled separately. The four aircraft types measured in the survey have been used to represent older small and large aircraft and next generation small and large aircraft accordingly. Forecast traffic numbers falling into each of these four categories of aircraft have been used to model noise from each aircraft category individually, producing a more accurate overall prediction of airport ground noise.

4.5.5 The ground noise model uses the Central Case air traffic forecast which is most likely as opposed to the slower transition case fleet, as discussed in the air noise assessment which uses both fleets to predict a range of air noise impacts. The numbers of aircraft in both forecasts are the same, as is the split between large and small used to distinguish taxiing noise levels. For ground noise it was not considered necessary to model the slower transition fleet case as well for the following reasons. The slower transition fleet case would give the same L_{max} levels, and L_{eq} noise levels only 1-2 dB higher in both the baseline and Project cases. This would not result in noise impacts in significantly larger areas because compared to air noise ground noise attenuates more rapidly as it propagates close to the ground and is attenuated by buildings and structures. The assessment of engine run noise and APU noise would not change. Also ground noise is assessed in the context of other forms of ambient noise, such as road traffic, that are not affected by the rate of aircraft fleet transition. Finally, as discussed in Section 14.9 of the main ES, if concerns are raised over increased ground noise impacts after opening of the Project, monitoring will be carried out and if significant effects are found the Noise Insulation Scheme will be used to offer mitigation.

4.6 Directivity

4.6.1 Historical directivity patterns of small and large aircraft were determined by direct measurements at ten-degree increments around each of the two aircraft measured, with constant operating conditions throughout each measurement whilst the aircraft were stationary. The measurements of taxiing aircraft have been used to estimate the directivity pattern of each aircraft type following methodology used the research at Madrid Airport (Ansensio *et al.,* 2007). Frequency dependent directivity corrections have been applied within the model in 15-degree increments, based on the results of the measurements.

4.7 Calculation Method

4.7.1 The acoustic propagation model implemented within the CadnaA software is as set out in ISO 9613 Part 1 (ISO, 1993) and Part 2 (ISO, 1996), with point noise sources for taxiing noise assumed along a string of potential source locations covering the length of each of the baseline taxi routes and each of the 74 daytime and 60 night-time taxi routes for the development case scenarios. Ground absorption is assumed to be 0 for 'hard ground' over the airport apron and a coefficient of 0.6 has been used for all other ground absorption within the model.

4.7.2 The historical source sound power levels only offered overall A-weighted levels which was another factor affecting the accuracy and therefore the uncertainty of the previous model. Since updated source sound power levels have been obtained through measurements of taxiing aircraft in March and April 2019 it has been possible to derive octave band sound power levels which are considered to provide greater accuracy and lower overall uncertainty in the calculation. Remaining uncertainties that cannot be removed relate to environmental conditions and the effect these have on noise propagation. Air turbulence caused by cross winds or upwind obstructions can have a much bigger effect on A-weighted front end fan sound levels than any increases associated with breakaway thrust. It should be noted that ISO 9613 states that the methodology provides a nominal accuracy of ± 3 dB and the predicted noise levels can therefore be expected to vary this much due to the accuracy of the acoustic propagation model. In light of these known uncertainties in the modelling of environmental noise propagation it is best practice to conservatively allow for this to ensure that impacts are not underestimated. The inputs that are used for the modelling have been developed over a number of years (specifically in relation to ground noise at Gatwick) to ensure that results provide a conservative prediction. It should therefore be noted that the model is more likely to over-predict ground noise than under-predict it.

4.8 Wind Direction Correction

4.8.1 Whilst there should be some caution exercised to ensure that the noise model does not underpredict ground noise, it is also considered that assuming worst-case downwind conditions at all receivers for both easterly and westerly operations is simply too conservative. Following the review of the noise model (discussed at section 2.2 above), it is considered that a conservative estimate of the effects due to typical or average wind conditions can be obtained by using a meteorological correction outlined in a Japanese road traffic noise model (see paragraphs 2.2.3 - 2.2.6). The Japanese meteorological correction is derived so as to be applied to a prediction of noise under neutral wind conditions rather than a correction to be applied to a downwind noise prediction. The formula gives a correction ($\Delta L_{m,line}$) to overall A-weighted levels that is directly proportional to both wind speed and distance from the source and can be both positive or negative depending on wind direction as follows:

$$\Delta L_{\mathrm{m,line}} = \begin{cases} 0.88 \lg\left(\frac{l}{15}\right) \cdot U_{\mathrm{vec}} & l > 15 \\ 0 & l \leq 15 \end{cases},$$

Where l is the distance from the source in meters;

U_{Vec} = U.Cos(θ)

where U is the wind speed in m/s and

θ is the angle between the wind direction and the line perpendicular to the road through the prediction point.

4.8.2 In order to apply this meteorological correction to the worst-case downwind ground noise predictions, it is first necessary to convert from a worst-case downwind condition to something closer to neutral wind conditions. This has been conservatively estimated by calculating the correction for a downwind condition and subtracting this prior to applying the correction. This approach means that if a receiver is actually downwind of a noise source, then the downwind correction would then be added back on and there would be no change to the predicted noise level.

4.8.3 It is also necessary to obtain representative values for typical wind conditions during easterly and westerly operations and for this purpose hourly meteorological observations from a centrally located weather station on the airfield were obtained for the 92-day summer period in 2018. The wind speeds have been arithmetically averaged and the wind directions have been arithmetically averaged for day and night under easterly and westerly conditions separately. The averaged 2018 wind conditions used for the calculation of the meteorological correction (in all years) are summarised in the table below:

Table 4.8.1: Summary of 2018 92-day summer period typical wind conditions

Description	Ave wind speed	Ave wind direction
East Day	2.7	69.5
East Night	2.0	65.4
West Day	2.9	243.1
West Night	2.0	239.3

4.9 Taxiing Assumptions

4.9.1 All taxiing noise sources have been assumed to be at a height of 3 metres above ground level; this is based on the average centreline height of the jet engines on larger aircraft types. The taxiways have then been split into a series of segments represented by point sources and the locations of these taxiing noise sources have been agreed with GAL.

4.9.2 The model was set up with each straight length of taxiway divided into a series of short segments of around 100 metres. All bends in the main taxiways are represented by multiple short straight-line segments, which are assumed to be traversed at lower speed than for straight lengths of taxiway to represent typical queuing which occurs at sharp bends and at the pre-departure runway thresholds. Depending upon the time of day, the total numbers of aircraft along a given route can then be multiplied by the time spent on each separate segment represented by a point source. This provides an 'on time' which is dependent on the assumed speed at which each aircraft taxis across each taxiway segment and the assumed length of that segment.

4.9.3 Each aircraft travelling across each segment of taxiway is assumed to be positioned on the centre of each segment for as long as it would take to traverse that segment at the assumed standard taxiing speeds of 10 m/s for normal taxiing and 3 m/s when negotiating bends. At receiver locations outside the airport

boundary this achieves exactly the same results as assuming continuous progression through each segment. Observations in the research at Madrid Airport and also the observations from the 2019 Gatwick Airport survey of taxi noise along Taxiway Juliet indicate that 10 m/s is a suitable assumption for constant speed along a straight section of taxiway.

4.9.4 Taxiway alignments were modelled from the Project design drawings and in most cases were well defined. The exact position of two Rapid Exit taxiways was shown +/- 100m as described in ES Chapter 5, and the central location was assumed for the model. If the western RET is built 100m west of the central position it would increase taxiing noise levels in the Charlwood area by 1-2dB in comparison with that modelled. However, the assessment shows that noise levels when this RET is not in use, i.e. during easterly operations, are significantly higher and determine the noise impact, and so if noise levels were increased by the RET moving 100m west, this would not increase the highest noise levels experienced at NSRs and would not affect the assessment. If this RET is built east of the modelled location noise levels in Charlwood would be lower. If the eastern RET is moved from the central location as modelled it would not change the modelled noise levels significantly.

4.10 Noise Barriers

4.10.1 Only those physical structures which make a significant contribution to screening in different directions within and around the airport are included in the model. For the baseline modelling, these are:

- the existing noise wall to the northeast of the airport north of North Terminal Pier 4 and South Terminal Pier 3;
- the earth bunds around the end of the runway and North Terminal long stay car park;
- the existing terminal buildings and cargo sheds;
- the existing piers at the North and South Terminals; and
- the closest buildings outside the airport boundary.

4.10.2 For the Project case this is slightly different as follows:

- the existing earth bund at the end of the runway needs to be removed to allow for the development to take place; and
- an additional barrier would be built into the Project design to replace the functionality of the earth bund as much as possible as described within Section 14.8 of the **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1).

5 Primary Metric ($L_{Aeq\ 16\ hour\ Day}$ and $L_{eq\ 8\ hr\ night}$) Results

5.1 Assessment locations

5.1.1 The 13 baseline locations listed in Chapter 14 are shown in Figure 14.4.1 (Doc Ref. 5.2). Also shown in Figure 14.4.1 are 12 Noise Sensitive Receptor Areas encompassing the locations which are considered to be represented by these baseline measurement locations. It should be noted that there are only 12 assessment areas because two of the baseline locations are within the same area (Charlwood Road). The reason for this disparity is due to the fact that Bear and Bunny Nursery was deemed to be a noise sensitive commercial premises and for this reason it is included within the area but assessed separately. Due to varying degrees of shielding between the airport and different parts of these representative areas, the baseline measurement locations are not always the worst-affected locations within the representative areas.

5.1.2 For the purposes of the ground noise assessment, it is necessary to consider the locations with the highest predicted noise levels in order to assess the worst-case impacts. Therefore, for each receptor area, a number of representative assessment locations have been selected so that the worst affected locations can be chosen for the assessment. There are 12 receptor areas and a total of 43 assessment locations, details of these locations are provided in the following table.

Table 5.1.1: Assessment Areas and Locations

Assessment Area	Baseline Location number	Assessment Location	Easting	Northing
Charlwood (1)	1	3 Charlwood Road (A1)	524621	140931
	1	2 Frys Cottages (A2)	524869	140987
	1	Westfield Place (A3)	524814	140387
Outer Charlwood (2)	2	Blue Cedars (A4)	524569	141233
	2	Chapel Farm (A5)	524647	141208
	2	12 Willow Corner (A6)	524826	141079
Charlwood Road (3)	2	The Seasons (A7)	524039	140090
	3	Brook Farm (A8)	525313	141029
	3	Farmfield Cottages (A9)	525841	141371
	3	Charlwood Aquatics (A10)	525705	141101
	3	Warwick Cottage (A11)	526662	141906
	4	Bear and Bunny Nursery (A12)	526051	141564
Farmfield (4)	5	April Cottage (A13)	525764	142366
	5	Larkfield (A14)	525904	142242
	5	Suvla (A15)	526569	141992
Povey Cross (5)	6	Oakfield Cottage (A16)	526887	141974
	6	Gatwick Park Hospital (A17)	527111	142489
	6	Travel Lodge (A18)	527429	142265
Longbridge Road, Horley (6)	7	103 Cheyne Walk (A19)	527873	142246
	7	17 Woodroyd Gardens (A20)	527931	142198
	7	Moat House Hotel (A21)	527500	142396
Riverside, Horley (7)	8	82 The Crescent (A22)	528517	141795
	8	45 Riverside (A23)	528244	142079
Bonnetts Lane (8)	9	Hyders Farm House (24)	525296	139381
	9	Amberley Fields Campsite (A25)	525809	139614
	9	Westfield House (A26)	525333	139548

Assessment Area	Baseline Location number	Assessment Location	Easting	Northing
	9	Little Park Farm (A27)	524081	139540
Lowfield Heath (9)	10	Myrtle Cottage (A28)	526401	139753
	10	Tinsley House (A29)	527602	140112
	10	St Michael & All Angels (A30)	527418	140113
	10	Hawthorn Farm (A31)	527306	139886
	10	Charlwood House (A32)	526312	139857
	10	Lowfield Farm (A33)	525953	139764
Rowley Farm (10)	11	Rowley Farmhouse (A34)	527964	139632
	11	Rowley Cottages (A35)	527791	139990
Balcombe Road (11)	12	Trent House (A36)	529815	140633
	12	Meadowcroft House (A37)	529148	141846
	12	Hunters Lodge (A38)	529527	141307
	12	Four Winds (A39)	529693	140816
	12	Mynthurst (A40)	529716	140012
Tinsley Green (12)	15	Hoots Cottage (A41)	529554	139832
	15	Oldlands Farmhouse (A42)	528999	139668
	15	Brookside (A43)	529218	139778

5.2 Baseline

First Full Year of Opening: 2029

5.2.1 The predicted ground noise baseline levels are presented for each of the receptor areas (showing only the results from the worst affected location) in Table 5.2.1.

Table 5.2.1: Summary of Ground Noise 2029 Future Baseline Predicted Levels (dB L_{Aeq})

Descriptor	Receptor Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2029 - 26 Daytime	48	49	53	52	54	56	59	55	63	59	55	50
2029 - 26 Night	47	49	52	50	52	52	55	54	59	57	50	46
2029 - 08 Daytime	55	61	58	54	55	51	50	62	64	61	44	46
2029 - 08 Night	52	56	54	50	52	48	49	58	62	58	42	43

Interim Year: 2032

5.2.2 The 2032 predicted ground noise baseline is given in Table 14.6.8 of Chapter 14.

Design Year: 2038

5.2.3 The 2038 predicted ground noise baseline levels are presented for each of the receptor areas (showing only the results from the worst affected location) in Table 5.2.2.

Table 5.2.2: Summary of Ground Noise 2038 Future Baseline Predicted Levels (dB L_{Aeq})

Descriptor	Receptor Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Daytime	46	47	51	50	52	54	57	53	61	57	53	48
2038 - 26 Night	46	47	49	48	50	51	53	52	58	56	49	45
2038 - 08 Daytime	53	60	55	52	54	50	49	60	62	59	43	44
2038 - 08 Night	48	54	51	49	51	47	47	57	60	56	41	42

Design Year: 2047

5.2.4 The 2047 predicted ground noise baseline levels are presented for each of the assessment areas (showing only the results from the worst affected location) in Table 5.2.3.

Table 5.2.3: Summary of Ground Noise 2047 Future Baseline Predicted Levels (dB L_{Aeq})

Descriptor	Assessment Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Daytime	46	47	51	49	51	53	56	53	61	57	52	47
2038 - 26 Night	46	47	48	47	50	50	53	52	58	55	49	45
2038 - 08 Daytime	53	59	55	52	54	49	49	60	62	58	43	44
2038 - 08 Night	47	54	51	48	50	47	47	57	60	56	41	41

5.3 With Project Scenario

First Full Year of Opening: 2029

5.3.1 As part of the Project, mitigation in the form of noise barriers has been proposed and has been included in the results presented in Table 5.3.1, with the difference between the predicted levels and the 2029 baseline shown in Table 5.3.2. It should be noted that results are presented for the same worst affected location (within each receptor area) identified for the baseline.

Table 5.3.1: Summary of Ground Noise 2029 Predicted Level (dB L_{Aeq})

Descriptor	Receptor Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2029 - 26 Daytime	48	50	59	53	55	56	59	60	65	59	55	50
2029 - 26 Night	46	48	54	53	55	54	55	55	60	60	51	49
2029 - 08 Daytime	55	64	59	54	56	51	50	61	64	62	44	46
2029 - 08 Night	49	58	52	49	51	47	47	56	61	60	42	43

Table 5.3.2: Summary of Ground Noise 2029 Predicted Project Level versus 2029 Baseline, Differences (dB L_{Aeq})

Descriptor	Receptor Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2029 - 26 Daytime	0	0	6	2	1	1	0	5	2	0	0	0
2029 - 26 Night	-1	0	2	3	2	2	1	1	1	3	1	2
2029 - 08 Daytime	0	3	0	1	0	0	0	-1	0	1	0	0
2029 - 08 Night	-2	3	-2	-1	-1	-1	-1	-2	0	2	0	0

Design Year: 2038

5.3.2 As part of the Project, mitigation in the form of noise barriers has been proposed and has been included in the results presented below in Table 5.3.3 with the difference between the predicted levels and the 2038 baseline shown in Table 5.3.4.

5.3.3 The predicted level differences in Table 5.3.4 show some slightly larger differences (of the order of up to 1 dB greater) than for the interim assessment year (2032) presented at Chapter 14: Noise and Vibration. However, these predicted changes are in the context of an overall lower predicted noise levels with the Project in 2038 due to a larger proportion of next generation aircraft in the fleet.

Table 5.3.3: Summary of Ground Noise 2038 Predicted Level (dB L_{Aeq})

Descriptor	Receptor Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Daytime	47	49	57	52	54	55	58	59	64	58	54	49
2038 - 26 Night	46	47	54	53	55	54	55	53	60	60	51	49
2038 - 08 Daytime	54	63	57	53	55	50	50	59	64	61	44	45
2038 - 08 Night	48	57	51	48	50	46	46	55	61	59	41	42

Table 5.3.4: Summary of Ground Noise 2038 Predicted Project Level versus 2038 Baseline, Differences (dB L_{Aeq})

Descriptor	Receptor Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Daytime	1	2	6	3	2	1	1	6	3	1	1	1
2038 - 26 Night	-1	0	5	5	4	4	1	1	2	5	2	4
2038 - 08 Daytime	1	4	2	1	1	1	1	-1	1	3	1	1
2038 - 08 Night	0	3	-1	0	-1	-1	-1	-3	1	3	0	1

Design Year: 2047

5.3.4 As part of the Project, mitigation in the form of noise barriers has been proposed and has been included in the results presented below in Table 5.3.5 with the difference between the predicted levels and the 2038 baseline shown in Table 5.3.6.

5.3.5 The predicted level differences in Table 5.3.6 show some slightly larger differences again when compared to the interim assessment year (2032) presented at Chapter 14: Noise and Vibration. These differences are generally still of the order of 1 dB but up to 3 dB at one location (receptor area 1 under easterly operation at night changes from -2 up to +1 dB difference). However, these predicted changes are in the context of an overall lower predicted noise levels with the Project in 2047 due to a larger proportion of next generation aircraft in the fleet.

Table 5.3.5: Summary of Ground Noise 2047 Predicted Level (dB L_{Aeq})

Descriptor	Receptor Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Daytime	47	49	57	52	54	55	58	59	64	58	54	49
2038 - 26 Night	46	47	54	53	55	54	55	53	60	60	51	48
2038 - 08 Daytime	54	63	57	53	55	50	50	59	64	61	44	45
2038 - 08 Night	48	57	51	48	50	46	46	55	61	59	41	43

Table 5.3.6: Summary of Ground Noise 2047 Predicted Project Level versus 2047 Baseline, Differences (dB L_{Aeq})

Descriptor	Receptor Area ($L_{Aeq,T}$ dB)											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Daytime	1	2	7	4	3	2	2	6	3	1	2	2
2038 - 26 Night	-1	1	6	5	5	4	2	1	2	5	2	4
2038 - 08 Daytime	2	4	2	2	1	1	1	-1	2	3	1	1
2038 - 08 Night	1	3	0	0	0	0	-1	-3	1	3	0	1

5.4 Complete Results for all assessment locations

5.4.1 The predicted ground noise baseline and with project levels for the 2029 assessment year are presented for each of the receptor areas (including all assessment locations) at

Table 5.4.1.

Table 5.4.1: Ground Noise 2029 Predictions at All Locations (dB L_{Aeq})

Receptor Area	Assessment Location	Baseline				Project			
		2029 - 26 Daytime	2029 - 26 Night	2029 - 08 Daytime	2029 - 08 Night	2029 - 26 Daytime	2029 - 26 Night	2029 - 08 Daytime	2029 - 08 Night
Charlwood 1	3 Charlwood Road	46	46	57	52	47	47	57	51
	2 Frys Cottages	49	49	58	53	50	48	58	51
	Westfield Place	44	43	61	56	47	47	64	58
Outer Charlwood 2	Blue Cedars	48	47	56	51	46	45	55	49
	Chapel Farm	48	48	56	52	47	46	55	49
	12 Willow Corner	48	47	55	50	48	46	55	48
	The Seasons	38	38	55	49	41	41	55	49

Receptor Area	Assessment Location	Baseline				Project			
		2029 - 26 Daytime	2029 - 26 Night	2029 - 08 Daytime	2029 - 08 Night	2029 - 26 Daytime	2029 - 26 Night	2029 - 08 Daytime	2029 - 08 Night
Charlwood Road 3	Brook Farm	52	51	58	54	57	52	59	52
	Farmfield Cottages	51	49	55	51	56	53	57	50
	Charlwood Aquatics	53	52	58	53	59	54	58	52
	Warwick Cottage	53	51	55	51	54	54	56	51
	Bear and Bunny Nursery	51	49	55	50	54	53	56	50
Farmfield 4	April Cottage	46	44	49	45	49	47	50	45
	Larkfield	47	45	50	46	50	48	51	46
	Suvla	52	50	54	50	53	53	54	49
Povey Cross 5	Oakfield Cottage	54	52	55	52	55	55	56	51
	Gatwick Park Hospital	51	49	50	47	52	51	50	46
	Travel Lodge	55	52	51	49	55	53	52	48
Longbridge Road, Horley	103 Cheyne Walk	55	52	51	48	56	54	51	47
	17 Woodroyd Gardens	56	52	51	48	56	54	51	47
	Moat House Hotel	54	51	50	48	54	52	51	47
Riverside, Horley 7	82 The Crescent	59	55	51	49	59	55	50	47
	45 Riverside	57	53	50	48	57	55	50	47
Bonnetts Lane 8	Hyders Farmhouse	50	49	60	57	53	50	59	54
	Amberley Fields Campsite	55	54	61	57	60	55	59	55
	Westfield House	51	51	62	58	55	52	61	56
	Little Park Farm	44	44	57	52	44	44	57	51
Lowfield Heath 9	Myrtle Cottage	61	59	62	58	62	57	62	57
	Tinsley House	55	53	57	54	55	55	59	57
	St Michael & All Angels	62	59	64	62	60	60	64	61
	Hawthorn Farm	57	55	62	59	55	56	63	60
Rowley Farm 10	Charlwood House	63	61	64	60	65	59	62	58
	Lowfield Farm	58	57	62	58	63	58	60	56
	Rowley Farmhouse	57	55	58	55	58	58	59	56
	Rowley Cottages	59	57	61	58	59	60	62	60
Balcombe Road 11	Trent House	51	47	42	40	51	48	42	40
	Meadowcroft House	55	50	44	42	55	51	44	42
	Hunters Lodge	53	49	43	41	53	50	43	41
	Four Winds	52	47	43	41	52	49	43	41
	Mynthurst	49	46	43	40	49	47	43	40
Tinsley Green 12	Hoots Cottage	50	47	45	42	50	48	45	43
	Oldlands Farmhouse	49	46	46	43	50	49	46	43
	Brookside	50	46	45	42	50	48	45	43

The predicted ground noise baseline and with project levels for the 2032 assessment year are presented for each of the receptor areas (including all assessment locations) at Table 5.4.2.**Table 5.4.2: Ground Noise 2032 Predictions at All Locations (dB LAeq)**

Receptor Area	Assessment Location	Baseline				Project			
		2032 - 26 Daytime	2032 - 26 Night	2032 - 08 Daytime	2032 - 08 Night	2032 - 26 Daytime	2032 - 26 Night	2032 - 08 Daytime	2032 - 08 Night
Charlwood 1	3 Charlwood Road	45	45	56	51	47	47	57	51
	2 Frys Cottages	48	48	57	52	50	48	57	51
	Westfield Place	43	42	60	55	48	46	64	58
Outer Charlwood 2	Blue Cedars	47	47	55	50	46	45	54	49
	Chapel Farm	47	47	55	51	47	46	55	49
	12 Willow Corner	47	46	54	49	48	46	55	48
	The Seasons	38	38	54	48	41	40	55	49
Charlwood Road 3	Brook Farm	51	50	57	52	56	51	58	52
	Farmfield Cottages	50	48	54	50	56	53	56	50
	Charlwood Aquatics	52	51	57	52	58	53	58	51
	Warwick Cottage	52	50	54	50	54	54	55	50
	Bear and Bunny Nursery	50	48	54	49	54	53	55	49
Farmfield 4	April Cottage	45	43	49	45	48	47	50	45
	Larkfield	46	44	49	46	49	48	51	46
	Suvla	51	49	53	49	53	53	54	49
Povey Cross 5	Oakfield Cottage	53	51	55	51	55	55	55	51
	Gatwick Park Hospital	51	48	49	46	52	51	50	46
	Travel Lodge	54	51	51	48	54	53	52	48
Longbridge Road, Horley	103 Cheyne Walk	54	51	50	47	55	54	51	47
	17 Woodroyd Gardens	55	51	50	48	56	54	51	47
	Moat House Hotel	53	50	50	47	54	53	50	46
Riverside, Horley 7	82 The Crescent	58	54	50	48	59	55	50	47
	45 Riverside	56	52	50	47	57	55	50	47
Bonnetts Lane 8	Hyders Farmhouse	49	49	59	56	53	50	58	54
	Amberley Fields Campsite	54	53	60	56	60	54	58	54
	Westfield House	50	50	61	58	55	51	60	56

Receptor Area	Assessment Location	Baseline				Project			
		2032 - 26 Daytime	2032 - 26 Night	2032 - 08 Daytime	2032 - 08 Night	2032 - 26 Daytime	2032 - 26 Night	2032 - 08 Daytime	2032 - 08 Night
Lowfield Heath 9	Little Park Farm	43	43	56	51	44	44	56	51
	Myrtle Cottage	60	58	61	57	62	56	61	57
	Tinsley House	55	52	57	53	54	56	59	57
	St Michael & All Angels	61	59	63	61	60	60	64	61
	Hawthorn Farm	56	54	61	58	55	57	63	60
	Charlwood House	62	60	63	60	65	58	62	58
	Lowfield Farm	57	56	61	57	63	57	59	56
Rowley Farm 10	Rowley Farmhouse	56	54	57	54	57	58	59	56
	Rowley Cottages	58	56	60	57	59	60	62	60
Balcombe Road 11	Trent House	50	46	41	39	50	48	42	40
	Meadowcroft House	54	50	44	41	54	51	44	41
	Hunters Lodge	52	48	42	40	53	50	43	41
	Four Winds	51	47	42	40	51	49	43	40
	Mynthurst	48	45	42	40	49	47	43	40
Tinsley Green 12	Hoots Cottage	49	46	44	41	49	48	45	42
	Oldlands Farmhouse	48	46	45	42	49	49	46	43
	Brookside	49	46	44	42	49	48	45	42

5.4.2 The predicted ground noise baseline and with project levels for the 2038 assessment year are presented for each of the receptor areas (including all assessment locations) at Table 5.4.3.

Table 5.4.3: Ground Noise 2038 Predictions at All Locations (dB L_{Aeq})

Receptor Area	Assessment Location	Baseline				Project			
		2038 - 26 Daytime	2038 - 26 Night	2038 - 08 Daytime	2038 - 08 Night	2038 - 26 Daytime	2038 - 26 Night	2038 - 08 Daytime	2038 - 08 Night
Charlwood 1	3 Charlwood Road	44	44	54	50	46	46	56	50
	2 Frys Cottages	47	47	55	51	49	47	56	50
	Westfield Place	42	42	60	54	47	45	63	57
Outer Charlwood 2	Blue Cedars	46	46	53	49	46	45	53	48
	Chapel Farm	46	46	53	50	46	46	54	48
	12 Willow Corner	46	45	53	48	47	45	54	47
	The Seasons	37	37	53	48	40	40	54	48
	Brook Farm	50	49	56	51	55	50	57	51
Charlwood Road	Farmfield Cottages	49	47	53	49	55	52	56	49
	Charlwood Aquatics	51	50	55	51	57	52	57	50
	Warwick Cottage	51	49	54	50	53	54	55	49
	Bear and Bunny Nursery	49	47	53	49	53	52	55	49
Farmfield 4	April Cottage	44	43	48	44	47	47	49	44
	Larkfield	45	44	49	45	48	48	50	45
	Suvla	50	48	52	49	52	53	53	48
Povey Cross 5	Oakfield Cottage	52	50	54	51	54	55	55	50
	Gatwick Park Hospital	50	48	48	46	51	51	49	45
	Travel Lodge	53	51	50	47	54	53	51	47
Longbridge Road, Horley 6	103 Cheyne Walk	54	50	49	47	55	54	50	46
	17 Woodroyd Gardens	54	51	50	47	55	54	50	46
	Moat House Hotel	52	49	49	46	53	52	50	46
Riverside, Horley 7	82 The Crescent	57	53	50	47	58	55	50	46
	45 Riverside	56	52	49	47	57	55	50	46
Bonnetts Lane 8	Hyders Farmhouse	48	48	58	56	52	48	57	53
	Amberley Fields Campsite	53	52	58	55	59	53	57	53
	Westfield House	49	49	60	57	54	50	59	55
	Little Park Farm	42	42	55	50	43	43	55	50
	Myrtle Cottage	59	57	60	57	62	56	60	56
	Tinsley House	54	51	56	53	53	56	59	56
Lowfield Heath 9	St Michael & All Angels	60	58	62	60	58	60	64	61
	Hawthorn Farm	56	53	60	58	54	57	62	59
	Charlwood House	61	59	62	59	64	58	61	57
	Lowfield Farm	56	55	60	56	63	55	58	54
Rowley Farm 10	Rowley Farmhouse	54	53	55	53	56	58	58	55
	Rowley Cottages	57	56	59	56	58	60	61	59
	Trent House	49	45	41	38	49	48	42	39
Balcombe Road 11	Meadowcroft House	53	49	43	41	54	51	44	41
	Hunters Lodge	52	47	42	39	52	50	42	40
	Four Winds	50	46	41	39	51	49	42	40
	Mynthurst	47	44	41	39	48	47	42	40
Tinsley Green 12	Hoots Cottage	48	45	43	41	48	48	44	41
	Oldlands Farmhouse	47	45	44	42	48	49	45	42
	Brookside	48	45	43	41	49	48	44	42

5.4.3 The predicted ground noise baseline and with project levels for the 2047 assessment year are presented for each of the receptor areas (including all assessment locations) at Table 5.4.4.

Table 5.4.4: Ground Noise 2047 Predictions at All Locations (dB L_{Aeq})

Receptor Area	Assessment Location	Baseline				Project			
		2038 - 26 Daytime	2038 - 26 Night	2038 - 08 Daytime	2038 - 08 Night	2038 - 26 Daytime	2038 - 26 Night	2038 - 08 Daytime	2038 - 08 Night
Charlwood 1	3 Charlwood Road	44	44	54	50	46	46	56	50
	2 Frys Cottages	47	47	55	51	49	47	56	50
	Westfield Place	42	42	59	54	47	45	63	57
Outer Charlwood 2	Blue Cedars	46	46	53	49	46	45	53	48
	Chapel Farm	46	46	53	49	46	46	54	48
	12 Willow Corner	46	45	52	48	47	45	54	47
	The Seasons	36	37	53	47	40	40	54	48
Charlwood Road 3	Brook Farm	50	49	55	51	55	50	57	51
	Farmfield Cottages	48	47	53	49	55	52	56	49
	Charlwood Aquatics	51	50	55	51	57	52	57	50
	Warwick Cottage	50	48	53	49	53	54	55	49
	Bear and Bunny Nursery	48	47	52	48	53	52	55	49
Farmfield 4	April Cottage	43	42	47	43	47	47	49	44
	Larkfield	44	43	48	44	48	48	50	45
	Suvla	49	47	52	48	52	53	53	48
Povey Cross 5	Oakfield Cottage	51	50	54	50	54	55	55	50
	Gatwick Park Hospital	48	47	48	45	51	51	50	45
	Travel Lodge	52	50	50	47	54	53	51	47
Longbridge Road, Horley	103 Cheyne Walk	52	50	49	47	55	54	50	46
	17 Woodroyd Gardens	53	50	49	47	55	54	50	46
	Moat House Hotel	51	49	48	46	53	52	50	46
Riverside, Horley 7	82 The Crescent	56	53	49	47	58	55	50	46
	45 Riverside	54	51	49	47	57	55	50	46
Bonnetts Lane 8	Hyders Farmhouse	48	48	57	55	52	48	57	53
	Amberley Fields Campsite	53	52	58	55	59	53	57	53
	Westfield House	49	49	60	57	54	50	59	55
	Little Park Farm	41	42	54	50	43	43	55	50
Lowfield Heath 9	Myrtle Cottage	59	57	60	56	62	56	60	56
	Tinsley House	53	51	55	52	53	56	59	56
	St Michael & All Angels	60	58	62	60	58	60	64	61
	Hawthorn Farm	55	53	60	57	54	57	62	59
	Charlwood House	61	59	62	59	64	58	61	57
	Lowfield Farm	56	55	60	56	63	56	58	54
Rowley Farm 10	Rowley Farmhouse	54	53	55	52	56	58	58	55
	Rowley Cottages	57	55	58	56	58	60	61	59
Balcombe Road 11	Trent House	48	45	40	38	49	48	42	39
	Meadowcroft House	52	49	43	41	54	51	44	41
	Hunters Lodge	50	47	41	39	52	50	42	40
	Four Winds	49	46	41	39	51	49	42	40
	Mynthurst	46	44	41	39	48	47	42	40
Tinsley Green 12	Hoots Cottage	47	45	43	40	48	48	44	41
	Oldlands Farmhouse	46	45	44	41	48	48	45	43
	Brookside	47	45	43	40	49	48	44	42

6 Secondary Metric (L_{Amax}) Results

6.1 Baseline

6.1.1 The number of maximum noise level events exceeding the day and night criteria, for the 2029 and 2038 future baseline scenarios (not presented in the main chapter), are summarised below. Numbers are reported for the same worst-affected locations in each receptor area as those identified by the L_{Aeq} assessment.

Table 6.1.1: Summary of 2029 Future Baseline Aircraft Taxiing Events exceeding L_{Amax} Criteria

Descriptor	Total number of L_{Amax} events at Worst-case Location Within Receptor Area											
	1	2	3	4	5	6	7	8	9	10	11	12
2029 - 26 Daytime (>65 dB)	0	0	3	0	0	0	8	3	154	19	0	0
2029 - 08 Daytime (>65 dB)	0	59	0	0	26	0	0	77	303	47	0	0
2029 - 26 Night (>60 dB)	1	5	9	0	13	3	11	41	184	84	0	0
2029 - 08 Night (>60 dB)	0	49	33	13	14	1	1	83	165	106	0	0

Table 6.1.2: Summary of 2038 Future Baseline Aircraft Taxiing Events exceeding L_{Amax} Criteria

Descriptor	Total number of L_{Amax} events at Worst-case Locations Within Receptor Area											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Daytime (>65 dB)	0	0	0	0	0	0	8	0	102	1	0	0
2038 - 08 Daytime (>65 dB)	0	66	0	0	23	0	0	24	142	10	0	0

Descriptor	Total number of L_{Amax} events at Worst-case Locations Within Receptor Area											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Night (>60 dB)	0	4	6	0	8	0	2	39	154	71	0	0
2038 - 08 Night (>60 dB)	0	6	26	9	9	0	0	70	143	62	0	0

6.2 With Project Scenario

Taxiing Noise

6.2.1 The number of maximum noise level events exceeding the day and night criteria, for the 2029 and 2038 northern runway scenarios (not presented in the main chapter), are summarised below. Numbers are reported for the same worst-case locations in each receptor area as those identified by the L_{Aeq} assessment.

Table 6.2.1: Summary of 2029 Northern Runway Aircraft Taxiing Events exceeding L_{Amax} Criteria

Descriptor	Total number of L_{Amax} events at Worst-case Locations Within Receptor Area											
	1	2	3	4	5	6	7	8	9	10	11	12
2029 - 26 Daytime (>65 dB)	0	0	17	0	0	0	22	47	246	8	0	0
2029 - 08 Daytime (>65 dB)	0	204	38	0	23	0	0	21	392	76	0	0
2029 - 26 Night (>60 dB)	0	0	24	5	25	18	26	64	297	178	0	0
2029 - 08 Night (>60 dB)	0	53	3	8	11	3	0	57	246	121	0	0

Table 6.2.2: Summary of 2038 Northern Runway Aircraft Taxiing Events exceeding L_{Amax} Criteria

Descriptor	Total number of L_{Amax} events at Worst-case Locations Within Receptor Area											
	1	2	3	4	5	6	7	8	9	10	11	12
2038 - 26 Daytime (>65 dB)	0	0	1	0	0	0	20	63	128	0	0	0
2038 - 08 Daytime (>65 dB)	0	84	50	0	24	0	0	1	213	104	0	0
2038 - 26 Night (>60 dB)	0	0	28	8	28	15	19	27	294	188	0	0
2038 - 08 Night (>60 dB)	0	54	2	7	8	3	0	23	154	59	0	0

APU, EGR and EAT Maximum Noise Levels

6.2.2 Maximum noise levels produced by auxiliary power units (APU) noise and engine ground running (EGR) noise are independent of runway operation and do not differ for day or night as the stands and EGR areas are fixed locations. The end around taxiway (EAT) usage has been modelled independently of other taxi movements and since there are only two EATs proposed for the Project, this is only dependent on 08 or 26 runway operation.

6.2.3 There are essentially four EGR locations that have been modelled but the central one of these is split into two slightly different positions for aircraft facing either east or west depending on the operational mode of the airport (Juliet Tango and Juliet Sierra). Maximum noise levels due to EGR operations at each of these locations has been predicted at all assessment locations and the results (along with an overall maximum) are provided at Table 6.2.3.

Table 6.2.3: Predicted EGR L_{Amax} Noise Levels

Receptor Area	Assessment Location	Juliet 4	Yankee	Alpha 2	Juliet Tango	Juliet Sierra	Maximum
Charlwood 1	3 Charlwood Road	67	50	45	57	43	67
	2 Frys Cottages	65	54	46	59	44	65
	Westfield Place	79	51	-	58	43	79
Outer Charlwood 2	Blue Cedars	62	56	37	60	43	62
	Chapel Farm	62	51	38	61	43	62
	12 Willow Corner	64	54	38	62	44	64
	The Seasons	66	47	36	52	40	66
Charlwood Road 3	Brook Farm	67	54	40	63	47	67
	Farmfield Cottages	60	56	42	65	54	65
	Charlwood Aquatics	63	56	42	67	50	67
	Warwick Cottage	51	57	51	60	63	63
	Bear and Bunny Nursery	57	57	44	63	58	63
Farmfield 4	April Cottage	55	52	45	55	55	55
	Larkfield	56	53	46	56	56	56
	Suvla	52	57	50	58	62	62
Povey Cross 5	Oakfield Cottage	49	57	53	61	60	61
	Gatwick Park Hospital	48	53	56	57	55	57
	Travel Lodge	46	55	60	58	57	60
Longbridge Road, Horley 6	103 Cheyne Walk	43	56	60	54	57	60
	17 Woodroyd Gardens	43	57	61	53	57	61
	Moat House Hotel	45	54	59	57	56	59
Riverside, Horley 7	82 The Crescent	40	58	62	47	57	62
	45 Riverside	42	58	59	50	57	59
Bonnetts Lane 8	Hyders Farm House	68	53	42	63	51	68
	Amberley Fields Campsite	60	57	45	68	56	68
	Westfield House	70	54	44	65	51	70
	Little Park Farm	64	48	44	56	49	64
Lowfield Heath 9	Myrtle Cottage	51	63	49	67	66	67
	Tinsley House	-	79	64	54	70	79
	St Michael & All Angels	-	80	61	59	72	80
	Hawthorn Farm	44	73	59	64	69	73
	Charlwood House	54	63	48	71	64	71
	Lowfield Farm	56	59	45	68	57	68
Rowley Farm 10	Rowley Farmhouse	43	72	67	56	66	72
	Rowley Cottages	-	82	68	59	67	82
Balcombe Road 11	Trent House	34	43	59	39	50	59
	Meadowcroft House	37	51	61	43	53	61

Receptor Area	Assessment Location	Juliet 4	Yankee	Alpha 2	Juliet Tango	Juliet Sierra	Maximum
	Hunters Lodge	35	47	62	39	51	62
	Four Winds	34	44	60	39	51	60
	Mynthurst	34	44	59	39	50	59
Tinsley Green 12	Hoots Cottage	35	45	59	39	51	59
	Oldlands Farmhouse	36	51	61	43	54	61
	Brookside	36	48	62	41	53	62

6.2.4 Maximum noise levels due to APU and EAT usage have been predicted at all assessment locations and the results are provided at Table 6.2.4.

Table 6.2.4: Predicted APU and EAT L_{Amax} Noise Levels

Receptor Area	Assessment Location	APU	EAT 26	EAT 08
Charlwood 1	3 Charlwood Road	39	63	51
	2 Frys Cottages	41	57	52
	Westfield Place	35	71	43
Outer Charlwood 2	Blue Cedars	34	60	51
	Chapel Farm	35	60	51
	12 Willow Corner	37	56	43
	The Seasons	29	54	50
Charlwood Road 3	Brook Farm	42	63	53
	Farmfield Cottages	46	64	47
	Charlwood Aquatics	46	66	46
	Warwick Cottage	47	53	48
	Bear and Bunny Nursery	45	56	48
Farmfield 4	April Cottage	35	52	44
	Larkfield	36	52	45
	Suvla	45	53	47
Povey Cross 5	Oakfield Cottage	50	53	49
	Gatwick Park Hospital	43	51	47
	Travel Lodge	47	51	48
Longbridge road, Horley 6	103 Cheyne Walk	43	49	45
	17 Woodroyd Gardens	43	49	45
	Moat House Hotel	46	51	47
Riverside, Horley 7	82 The Crescent	47	47	49
	45 Riverside	45	48	47
Bonnetts Lane 8	Hyders Farm House	36	68	53
	Amberley Fields Campsite	40	73	47
	Westfield House	37	72	54
	Little Park Farm	33	58	50
Lowfield Heath 9	Myrtle Cottage	42	71	59
	Tinsley House	48	59	69
	St Michael & All Angels	48	64	63
	Hawthorn Farm	45	57	60
	Charlwood House	45	73	59
	Lowfield Farm	40	73	49
Rowley Farm 10	Rowley Farmhouse	42	60	62
	Rowley Cottages	47	61	67
Balcombe Road 11	Trent House	35	45	50
	Meadowcroft House	39	45	46
	Hunters Lodge	38	44	47
	Four Winds	37	45	49
	Mynthurst	33	46	53
Tinsley Green 12	Hoots Cottage	33	47	52
	Oldlands Farmhouse	34	48	50
	Brookside	37	48	52

7 Fixed Plant Noise

7.1 Noise Design Standards

7.1.1 The 2016 baseline data has been re-analysed to find the most representative background sound levels, in terms of L_{A90}, following the methodology required by BS4142) during the day and night periods for each of the assessment areas. The full baseline noise survey report is provided in **ES Appendix 14.9.6: Ground Noise Baseline Report** (Doc Ref. 5.3).

7.1.2 Planning Noise Advice Document: Sussex states that:

'The rating level of the industrial or commercial sound source should, where practicable, achieve a level no greater than the representative background sound, when measured in accordance with BS 4142:2014 + A1: 2019. There may be instances, for specific sites, where a rating level below background is deemed appropriate. This can be determined through discussion with the Local Planning Authority (LPA). A rating level below background may be required if there are concerns for potential noise creep, for example in a High Street setting. It is considered that meeting this criterion would avoid adverse noise impacts, in the interests of ensuring a good standard of amenity and protecting human health. Where these criteria are not attainable, the noise report should explain why, and how best practicable means will be implemented to control noise in order to satisfy the LPA that the development is acceptable. At all times the reports shall have regard to the context.'

7.1.3 Following consultation with local authorities and review of the measured background sound levels, there is nothing to indicate that any of the assessment areas around the airport would require special consideration of noise limits below the background sound level. Therefore, the representative background sound levels (L_{A90}) are assumed to be appropriate noise limits applicable to any fixed plant. These limits have been derived and are shown in Table 7.1.1. Charts showing L_{A90} frequency distribution plots for the 12 assessment areas are provided at LA90 frequency analysis. These charts in the Annex were used to derive the representative background sound levels at Table 7.1.1.

Table 7.1.1: Derived L_{A90} Noise Limits for Assessment Areas

Descriptor	Assessment Area Representative Background Sound Level (L_{A90} dB)											
	1 Blue Cedars	2 3 Charlwood Road	3 Brook Cottage	4 Bear and Bunny Nursery	5 April Cottage	6 Oakfield Cottage	7 Cheyne Walk	8 82 The Crescent	9 Hyders Farm	10 Myrtle Cottage	11 Rowley Farm	12 Trent House
L_{A90} Night	28	36	34	30	45	49	54	29	45	46	47	45
L_{A90} Day	41	47	47	39	49	56	56	49	47	50	55	50

7.1.4 The fixed plant noise sources have been reviewed and 31 individual fixed plant locations have been identified, these are detailed in Table 7.1.2 below.

7.1.5 Although there is no specific noise data relating to plant items available at this stage, the type of plant likely to be installed has been reviewed. The new CARE facility (S10) has been highlighted as a possible source of low frequency noise. The facility includes an incinerator for obtaining energy from waste and this includes a 50 m chimney flue which has the potential to generate low frequency noise, particularly if the exhaust system includes large fans. It can be difficult to mitigate low frequency noise from chimney flues but given the size of the Biomass boiler (450 kW) and the minimum separation distance (just under 450 m to nearest assessment location) it is unlikely that this will present a significant problem. No other sources of low frequency noise or plant items with noticeable tonal or impulsive characteristics have been identified at this stage but this will be under review as and when information becomes available.

Table 7.1.2: Fixed Plant Locations

Description	Source ID	Easting	Northing
Purple Parking	S1	525111	139725
Pier 6 Western Extension	S2	527310	141179
Car Park (MSCP7)	S3	527541	142089
Robotic Car Parking	S4	529153	140752
Substation BK	S5	526153	140617
Substation J	S6	525399	140504
Glendale (Grounds Maintenance Contractor)	S7	528331	140302
Rendezvous Point (RVP) North	S8	526168	141214
MT facilities	S9	526087	141326
CARE Facility	S10	526722	141466
Hangar 7 Facilities	S11	526597	140847
Pump Station 2A (PS02A)	S12	527153	140832
De-icing storage tanks	S13	527011	141001
Substation A	S14	526518	140802
Satellite airport fire service	S15	527487	140299
Water treatment facility (from De-icer polution storage)	S16	529211	140170
Pier 7 Building	S17	526251	141212
Autonomous vehicle maintenance building	S18	527436	141837
Autonomous vehicle statio	S19	528451	141392
New Code C Stand	S20	526658	141060
Pump Station 7a (PS7a)	S21	527146	141489
Pump Station East (PS EoR)	S22	528773	141120
Multi Storey Car Park J (MSCP J)	S23	527789	141626
Multi Storey Car Park Y (MSCP Y)	S24	527658	142187
Multi Storey Car Park H1 (MSCP H1)	S25	529008	141457
Multi Storey Car Park H2 (MSCP H2)	S26	529121	141436
Multi Storey Car Park H3 (MSCP H3)	S27	529143	141372
North Terminal Deck (MSCP)	S28	526371	141656
MSCP (DECK MA01)	S29	528081	140239
Destinations Place Hotel	S30	528606	141236
New Code E Hanger	S31	526102	141178

7.1.6 The 43 assessment locations listed at Table 5.1.1 have been cross referenced with the fixed plant locations listed at Table 6.2.2 above and a distance matrix has been produced to find the separation distance between each fixed plant location and each assessment location. The separation distances have been processed to identify the closest assessment location to each fixed plant location and the derived noise limits for the relevant assessment area have been identified. A summary of the closest assessment location, the separation distance and the relevant noise limits has been provided at Table 7.1.3 for each plant location.

Table 7.1.3: Closest Assessment Locations and Source Noise Limits

Source ID	Minimum distance (km)	Assessment Location	Representative Background Location	L_{A90} Night	L_{A90} Day
S1	0.284	A26	Hyders Farmhouse	29	49
S2	0.901	A16	Oakfield Cottage	45	49
S3	0.209	A18	Oakfield Cottage	45	49
S4	0.544	A39	Trent House	47	55
S5	0.660	A10	Blue Cedars	28	41
S6	0.532	A8	Hoots Cottage	45	50
S7	0.623	A35	Rowley Farmhouse	46	50
S8	0.363	A9	Hoots Cottage	45	50
S9	0.241	A12	Bear and Bunny Nursery	34	51
S10	0.444	A11	Brook Farm	34	47
S11	0.901	A12	Bear and Bunny Nursery	34	51
S12	0.766	A30	Myrtle Cottage	45	47
S13	0.970	A11	Brook Farm	34	47
S14	0.866	A10	Blue Cedars	28	41
S15	0.198	A30	Myrtle Cottage	45	47
S16	0.392	A43	Hoots Cottage	45	50
S17	0.405	A12	Bear and Bunny Nursery	34	51
S18	0.428	A18	Oakfield Cottage	45	49
S19	0.408	A22	82 The Crescent	54	56
S20	0.789	A12	Bear and Bunny Nursery	34	51
S21	0.550	A16	Oakfield Cottage	45	49
S22	0.722	A22	82 The Crescent	54	56
S23	0.589	A20	103 Cheyne Walk	49	56
S24	0.223	A19	103 Cheyne Walk	49	56
S25	0.413	A37	Trent House	47	55
S26	0.411	A37	Trent House	47	55
S27	0.389	A38	Trent House	47	55
S28	0.333	A12	Bear and Bunny Nursery	34	51
S29	0.382	A35	Rowley Farmhouse	46	50
S30	0.566	A22	82 The Crescent	54	56
S31	0.325	A9	Hoots Cottage	45	50

8 Detailed Taxiing Noise Assessment by Area 2032

8.1 Outer Charlwood

Night-time

8.1.1 At assessment location 1 (see Figure 14.4.1) in the Outer Charlwood assessment area, predicted night-time noise levels are up to 1 dB above the night LOAEL of 45 dB $L_{Aeq,}$ during westerly operations and 4 dB above the night-time LOAEL during easterly operations. Predicted night-time noise levels are at least 6 dB below the night SOAEL of 55 dB L_{eq}. The magnitude of the night-time change is -1 dB and -2 dB for westerly and easterly operations respectively (see assessment criteria in main ES noise chapter), which is considered to result in a **negligible** effect based on the absolute predicted noise levels and maximum noise levels. This represents a beneficial change from the effects predicted in the PEIR and it is due to the updated mitigation which includes changes to the location of the proposed noise barrier along with additional bunding in the Museum Field. The proposed mitigation is predicted to be particularly effective in this area.

8.1.2 The Outer Charlwood assessment area covers the outer part Charlwood village that excludes properties within around 75 – 100 m of the main through roads (see Figure 14.4.2. The area includes a total of 281 residential noise sensitive receptors and there are approximately 123 and 186 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 46 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 169 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 49 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 116 properties in the area that already receive road traffic noise at or above this level.

Daytime

8.1.3 During the daytime, the 51 dB L_{Aeq} LOAEL is predicted to be exceeded by a maximum of 4 dB, which is 8 dB below the SOAEL of 63 dB L_{Aeq}. The daytime exceedance of 4 dB above the LOAEL should be taken in context with a low increase in noise of 1 dB during the day on easterly operations. Under westerly operations during the daytime the predicted noise is 5 dB below the LOAEL and there is a negligible increase in noise. In the context of the margin below the SOAEL and the maximum noise levels it is considered to be a low impact resulting in a **negligible adverse** effect. This also represents a beneficial change for the same reasons stated above for operation during the night.

8.1.4 There are approximately 2 and 191 locations (under westerly and easterly conditions respectively) within the Outer Charlwood area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 46 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are 279 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 49 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are 90 properties in the area that already receive road traffic noise at or above this level.

Overall

8.1.5 The Outer Charlwood assessment area is representative of the quieter parts of Charlwood (including the primary school) which are more distant from the main road through the village. As mentioned above, this area contains 281 properties, and as a worst-case the impacts described above could be considered to apply to somewhere in the region of 20-60 of the residential properties in this area where road traffic noise is lower than the predicted levels of ground noise. The resultant effects at these properties is negligible and therefore the effects are considered to be negligible and **not significant** at all 281 properties.

8.2 Charlwood

Night-time

8.2.1 Within the Charlwood assessment area, the worst affected locations are Frys Cottages under westerly operation and Westfield Place under easterly. The predicted worst-case nighttime noise level of 58 dB $L_{Aeq,}$ exceeds the night LOAEL of 45 dB $L_{Aeq,}$ by a maximum of 13 dB at Westfield Place, and this is in the context of a worst-case predicted increase in night-time ground noise of 4 dB resulting in a medium magnitude of impact. Predicted night-time noise levels are up to 3 dB above the night-time SOAEL of 55 dB L_{Aeq} at the worst-case property. It should be noted that the worst affected locations in the Charlwood area are at the eastern and southern most points at the boundary of the village; the rest of the village receives lower predicted noise levels. Also, the highest predicted night-time noise for this area is under easterly operations which occur less frequently than westerly operations. The predicted night-time noise is considerably higher for this area than it is for Outer Charlwood under easterly operations and in the context of the SOAEL, this is considered to be a medium impact resulting in a **major adverse significant** effect. The predicted exceedance of the SOAEL is only under Easterly operation and relates to Westfield Place which is located circa 380m northwest of the end of the western end of the northern runway. The next nearest domestic property is 100m further to the north of Westfield Place and has predicted noise levels 3 dB quieter; all other properties in Charlwood have predicted noise levels at least 7 dB lower than Westfield Place (not exceeding the SOAEL by some margin).

8.2.2 The Charlwood assessment area covers the central part of Charlwood village, including properties within around 75 – 100 m of the main through roads (see Figure 14.4.1). The area includes a total of 219 residential noise sensitive receptors and there are approximately 6 and 1 of these locations (under westerly and easterly conditions respectively) where predicted night-time ground noise levels are within 1 dB of the worst-case predicted levels discussed above. It should be noted that the majority of properties in this area are subject to much lower predicted levels of ground noise, particularly under easterly conditions where all but one of the noise sensitive receptors have predicted ground noise levels at least 14 dB below that predicted at the worst-case assessment location. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- Under westerly conditions, ground noise is predicted to be 48 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 179 properties in the area that already receive road traffic noise at or above this level.
- Under easterly conditions, ground noise is predicted to be 58 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 17 properties in the area that already receive road traffic noise at or above this level.

8.2.3 Taking into account the variation in noise levels across the assessment area and the level of road traffic noise, it is considered that the during the night hours there is a potential for **minor adverse** effects at 40 properties and **major adverse significant** effects at 2 properties.

Daytime

8.2.4 At assessment location 2 in the Charlwood assessment area (see Figure 14.4.1) the 51 dB L_{eq} LOAEL is predicted to be exceeded by a maximum of 13 dB under easterly operations, which is 1 dB above the SOAEL of 63 dB L_{eq}. The Project would result in a change of up to 4 dB in the daytime noise levels, resulting in a medium magnitude of impact. Given the level is above SOAEL and considering the change in the frequency of significant maximum noise levels, the daytime noise impact is considered to result in a **major adverse significant** effect. It should be noted that, as with the effect during the night, the exceedance of the SOAEL is only for Easterly operation and relates to Westfield Place. This is only for Westfield Place and all other locations in the Charlwood area are below the SOAEL during the day.

8.2.5 There are approximately 15 and 1 of these locations - under westerly and easterly conditions respectively - where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. It should be noted that, as with the nighttime period, the majority of properties in this area are subject to much lower predicted levels of ground noise, particularly under easterly conditions where all but one of the noise sensitive receptors have predicted ground noise levels at least 13 dB below that predicted at the worst-case assessment location. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 50 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and all 219 properties in the area already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 64 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are 10 properties in the area that already receive road traffic noise at or above this level. However, it should be noted (as stated above) that the worst-case predicted noise level only applies to one property (Westfield Place) and that all other properties in this area have predicted ground noise at least 13 dB lower. For the other 218 properties in the area road traffic noise is already at or above the predicted level of ground noise.

8.2.6 Taking into account the variation in noise levels across the assessment area and the level of road traffic noise, it is considered that the during the day there is a potential for **minor adverse** effects at 1 property. At all remaining properties there is considered to be a negligible effect since ground noise is at a similar level to road traffic noise.

Overall

8.2.7 The Charlwood assessment area is representative of the busier area of Charlwood, close to the main road through the village. The area contains 219 properties. However, as already identified, the assessment is a worst-case and the conclusions about major adverse effects only apply to two properties during the night and one during the day - predominantly under easterly operation. For the remaining 217 properties in this area, the SOAEL is not exceeded, all of these receptors have road traffic noise at or above the predicted level of ground noise during the day and the effect is considered to be **not significant**.

8.3 Charlwood Road

Night-time

8.3.1 Within the Charlwood Road assessment area, predicted night-time noise levels exceed the night LOAEL of 45 dB L_{eq} by a maximum of 10 dB, which is at the SOAEL of 55 dB L_{eq}. The worst affected property (Warwick Cottage) would experience a predicted increase in night-time ground noise of up to 5 dB (medium magnitude of impact) along with up to 29 night-time L_{max} events exceeding the 60 dB criterion. Assessed overall, the night-time noise effect is therefore considered to be a **major adverse significant** effect.

8.3.2 The Charlwood Road assessment area covers the road between Charlwood village and Povey Cross, including properties within around 150 m of, and with clear line of site to, the road (see Figure 14.4.1). The area includes a total of 41 residential noise

sensitive receptors and there are approximately 26 and 5 of these locations (under westerly and easterly conditions respectively) where predicted night-time ground noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under Westerly conditions, ground noise is predicted to be 55 dB $L_{Aeq, 8\ hr}$ at the worst-affected location and there are 29 properties in the area that already receive road traffic noise at or above this level.
- under Easterly conditions, ground noise is predicted to be 52 dB $L_{Aeq, 8\ hr}$ at the worst-affected location and there are 33 properties in the area that already receive road traffic noise at or above this level.

Daytime

8.3.3 During the daytime the 51 dB L_{eq} LOAEL is predicted to be exceeded by a maximum of 6 dB, and predicted levels are at least 5 dB below the SOAEL of 63 dB L_{eq}. There are predicted changes in ground noise level of 5 and 6 dB during the day resulting in a medium and high magnitude of impact. During the daytime there would be a maximum of 47 events above the daytime 65 dB L_{max} criterion at the worst affected location (Charlwood Aquatics) and this is in the context of a single event above the criterion for the baseline scenario. It is therefore considered that due to the predicted change in L_{eq} and L_{max} ground noise levels with the Project, the daytime noise impact would result in a **moderate adverse significant** effect.

8.3.4 There are approximately 1 and 5 of these locations (under westerly and easterly conditions respectively) where predicted daytime ground noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under both easterly and westerly conditions, ground noise is predicted to be 58 dB $L_{Aeq, 16\ hr}$ at the worst-affected location and there are 31 properties in the area that already receive road traffic noise at or above this level.

Overall

8.3.5 This area represents 41 properties along Charlwood Road to the northwest of the airport, but the identified moderate adverse effects do not apply to all residential properties in this area as some receive greater benefits from the noise bund resulting in lower predicted noise levels and all are subject to similar levels of road traffic noise as ground noise. There are only 8 receptors on the south side of Charlwood Road where residential gardens are shielded from road traffic noise but facing towards the airport where the **major significant adverse effects** during the night hours discussed in paragraphs above apply. During the day it is considered that the number of properties where a **moderate adverse significant effect** occurs at reduces from 8 (during the night) to 5. Impacts and resulting effects are considered to be **not significant** at the remaining properties (33 at night and 36 during the day) in this area where ground noise is at a similar level to, or below road traffic noise.

8.3.6 Predicted noise levels for the five worst-affected locations in the Charlwood Road assessment area (all to the south of Charlwood Road) are provided in Section 5 where it can be seen that the worst affected location during the day under easterly operation is Charlwood Aquatics. The predicted noise at this location is 1 dB higher than Brook Farm under these conditions and at least 3 dB higher than the other 3 locations in the immediate vicinity within this assessment area.

8.4 Farmfield

Night-time

8.4.1 Within the Farmfield assessment area, predicted night-time noise levels are up to 8 dB above the night LOAEL of 45 dB $L_{Aeq,}$ and below SOAEL, and properties would experience up to 4 dB change in the predicted noise level on westerly operations only resulting in a medium magnitude of impact. This affects a low number of properties. The night noise impact is therefore considered to result in a **minor adverse** effect.

8.4.2 The Farmfield assessment area covers an area to the north of Charlwood Road, including properties within an additional 800m band of the Charlwood Road assessment area (see Figure 14.4.1). The area includes a total of 11 residential noise sensitive receptors and none of the additional 10 locations have predicted night-time ground noise levels within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under Westerly conditions, ground noise is predicted to be 53 dB $L_{Aeq, 8\ hr}$ at the worst-affected location and road traffic noise is below this level at all receptors.
- under Easterly conditions, ground noise is predicted to be 49 dB $L_{Aeq, 8\ hr}$ at the worst-affected location and road traffic noise is below this level at all receptors.

Daytime

8.4.3 During the daytime the 51 dB L_{eq} LOAEL is predicted to be exceeded by up to 3 dB and there is a potential increase in ground noise of up to 2 dB resulting in a low magnitude of impact. Since this affects only a small number of properties, the daytime noise impact is considered to result in a **negligible** effect.

8.4.4 There are no additional locations within the Farmfield assessment area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 53 dB $L_{Aeq, 16\ hr}$ at the worst-affected location and there is 1 property in the area that already receives road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 54 dB $L_{Aeq, 16\ hr}$ at the worst-affected location and there are no properties in the area that already receive road traffic noise at or above this level.

Overall

8.4.5 This location is representative of properties further to the north of Charlwood Road that experience a quieter noise environment than those represented by the Charlwood Road assessment area. The area contains 11 properties, and the identified minor adverse effects during the night are very much worst-case since 10 of the 11 properties are considerably further from the airport than Suvla which is the worst-affected location. Predicted noise levels for the three worst-affected locations in the Farmfield assessment area are provided in Section 5 where it can be seen that the predicted noise levels at Suvla are at least 4 dB higher than either of the other two locations.

8.4.6 There is a **minor adverse significant effect** during the night at 1 receptor in this area and the effects at all other receptors during the night is considered to be negligible adverse which is **not significant**. During the day there is a **negligible effect** at all receptors in this area, which is **not significant**.

8.5 Povey Cross

Night-time

8.5.1 Within the Povey Cross assessment area, predicted night-time noise levels exceed the night LOAEL of 45 dB L_{eq} by a maximum of 10 dB for westerly operations and the worst-affected locations would experience a change of up to 4 dB in ground noise levels resulting in a medium magnitude of impact. However, this change of up to 4 dB only occurs for approximately 10 properties in the vicinity of Oakfield Cottage and for the remaining properties in the area the change is less than 3 dB. The noise levels do not exceed SOAEL for the 10 properties where there is a change of 4 dB and night noise impact is considered to potentially result in a **moderate** effect.

8.5.2 The Povey Cross assessment area covers a residential area immediately north of the north terminal buildings and apron (see Figure 14.4.1). The area includes a total of 279 residential noise sensitive receptors and there are approximately 12 and 13 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 55 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are at least 41 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 51 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 110 properties in the area that already receive road traffic noise at or above this level.

Daytime

8.5.3 During the daytime, the 51 dB L_{eq} LOAEL is predicted to be exceeded by up to 4 dB which is 8 dB below the SOAEL of 63 dB L_{eq}. A change in ground noise of up to 2 dB is expected, resulting in a Low magnitude of impact. However, this change of up to 2 dB only occurs for approximately 10 properties in the vicinity of Oakfield Cottage and for the remaining properties in the area the change is less than 1 dB. The ground noise impact is therefore considered to potentially result in a **minor adverse** effect at these 10 properties.

8.5.4 There are approximately 12 and 14 locations (under westerly and easterly conditions respectively) within the Povey Cross area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under both easterly and westerly conditions, ground noise is predicted to be 55 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are at last 129 properties in the area that already receive road traffic noise at or above this level.

Overall

8.5.5 This area is representative of 279 properties, and as a worst-case assessment the identified **moderate adverse significant effects** during the night are considered to apply to approximately 10 of these properties with the greatest impacts under westerly conditions. During the day, **minor adverse effects** are identified which are considered to affect the same 10 properties in the area which is **not significant**. Effects at the remaining 269 properties in the assessment area are considered to be **not significant**.

8.6 Longbridge Road, Horley

Night-time

8.6.1 Within the Longbridge Road assessment area, predicted night-time noise levels are up to 9 dB above the night LOAEL of 45 dB $L_{eq,}$ and there is a predicted change in night ground noise of 3 dB on westerly operations, zero on easterly operations, resulting in a Medium magnitude of impact. Predicted levels are close to SOAEL and affect a large population but there are high levels of existing noise due to road traffic on the A23 which indicate that predicted noise levels would be at a similar level to or below existing noise from other sources most of the time. The night noise impact is considered to result in a **minor adverse** effect which is not significant.

8.6.2 The Longbridge Road assessment area covers a residential area to the northeast of the airport close to Longbridge Road (see Figure 14.4.1). The area includes a total of 591 residential noise sensitive receptors and there are approximately 66 and 61 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- Under westerly conditions, ground noise is predicted to be 54 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 149 properties in the area that already receive road traffic noise at or above this level.
- Under easterly conditions, ground noise is predicted to be 47 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 585 properties in the area that already receive road traffic noise at or above this level.

Daytime

8.6.3 During the daytime, the 51 dB L_{eq} LOAEL is predicted to be exceeded by up to 5 dB. There is a predicted increase in ground noise level of up to 1 dB resulting in a Low magnitude of impact. The ground noise impact is therefore considered to result in a **minor adverse** effect.

8.6.4 There are 28 and 149 receptors (under easterly and westerly conditions respectively) within the Longbridge Road assessment area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 56 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are 293 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 51 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are 587 properties in the area that already receive road traffic noise at or above this level.

Overall

8.6.5 This location is representative of properties in the Horley area that are affected by ambient noise from the main roads. This area contains 591 properties, and the greatest impacts (resulting in **minor adverse effects**) are observed under westerly conditions particularly at night, but the worst-case predicted noise levels are only relevant for a limited number of properties (around 66) in Cheyne Walk and Woodroyd Gardens and is **not significant**. For the remaining properties, predicted noise levels are 1 – 4 dB lower than at the worst-affected properties. The effects at these remaining properties reduce in relation to the existing road traffic noise and become a **negligible effect** during both the day and night which is **not significant**.

8.7 Riverside, Horley

Night-time

8.7.1 Within the Riverside assessment area, predicted night-time noise levels exceed the night LOAEL of 45 dB L_{eq} by a maximum of 10 dB, and the worst-affected location would experience a predicted decrease in night ground noise of 1 dB under easterly operations, resulting in a Low magnitude of impact. Under westerly operation there is a predicted increase in night ground noise of 1 dB, resulting in a Low magnitude of impact. Predicted night-time noise levels are at or below the night SOAEL of 55 dB L_{Aeq}. The night noise impact is considered to result in a **minor adverse** effect.

8.7.2 The Riverside assessment area covers a residential area to the east of the airport between Longbridge Road and Horley (see Figure 14.4.1). The area includes a total of 843 residential noise sensitive receptors and there are approximately 220 and 321 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 55 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are approximately 41 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 47 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 741 properties in the area that already receive road traffic noise at or above this level.

Daytime

8.7.3 During the daytime the 51 dB L_{eq} LOAEL is predicted to be exceeded by a maximum of 8 dB and would be at least 4 dB below the SOAEL of 63 dB L_{Aeq}. Predicted ground noise levels would increase by less than 1 dB with the Project resulting in a negligible magnitude of impact. Although there are some increases in the number of maximum noise events above the daytime and nighttime L_{max} criteria, it is unlikely that these would be perceived since predicted 2032 noise levels are at least 1-2 dB below the overall baseline noise levels due to high levels of road traffic noise. The ground noise impact is considered to result in a **negligible** effect.

8.7.4 There are 184 and 333 receptors (under easterly and westerly conditions respectively) within the Longbridge Road assessment area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 59 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are 79 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 50 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and all 843 properties in the area already receive road traffic noise at or above this level.

Overall

8.7.5 This assessment area is representative of 843 properties, and as a worst-case the identified minor adverse effects are considered to apply to 220 residential properties in the vicinity of the worst-affected locations. The worst-case predicted noise levels have the biggest impact during the night under westerly conditions (resulting in a **minor adverse effect**) but during the day the impacts reduce and under easterly conditions predicted noise levels are 8-9 dB lower than under westerly conditions resulting in negligible effects. In practice, impacts and resultant effects would be lower at some of these 220 properties due to localised acoustic screening and increased distances. Due to the small magnitude of change in this area the effects are considered to be **not significant**.

8.8 Bonnetts Lane

Night-time

8.8.1 Within the Bonnetts Lane assessment area, predicted night-time noise levels are a maximum of 10 dB above the night LOAEL of 45 dB L_{eq}, and the worst affected location would experience a predicted change in night ground noise ranging from -2 to +1 dB, resulting in a Low positive and Negligible negative magnitude of impact respectively. Predicted night-time noise levels just exceed the night SOAEL of 55 dB L_{eq} by 1dB on easterly operations but there is a noise reduction under easterly operation. This area is representative of a small number of residential properties. Night-time L_{max} levels are above the 60 dB threshold resulting in up to 46 maximum noise events exceeding this nighttime criterion which is a reduction of 27 compared to the baseline. Ambient noise levels are also considered below. The night noise impact is therefore considered to result in a **minor adverse** effect which is not significant.

8.8.2 The Bonnetts Lane assessment area covers a residential area to the southwest of the airport (see Figure 14.4.1). The area includes a total of 66 residential noise sensitive receptors and there are approximately 1 and 3 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 54 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 10 properties in the area that already receive road traffic noise at or above this level. The majority of other properties in the area have predicted ground noise 9-10 dB lower than is predicted at the worst-affected location.
- under easterly conditions, ground noise is predicted to be 56 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 5 properties in the area that already receive road traffic noise at or above this level. Other properties in the area generally have predicted ground noise levels 3 – 4 dB lower than those predicted at the worst-case location.

Daytime

8.8.3 During the daytime the 51 dB L_{eq} LOAEL is predicted to be exceeded by a maximum of 9 dB and would be 3 dB below the SOAEL of 63 dB L_{eq}. Predicted ground noise levels change by up to 6 dB for westerly operations, resulting in a high magnitude of impact. The number of maximum noise events above the daytime L_{max} criterion decrease compared with the baseline and overall, and also considering road traffic noise levels (see below) the ground noise impact is therefore considered to result in a **minor adverse** effect.

8.8.4 There are 1 and 3 receptors (under easterly and westerly conditions respectively) within the Bonnett's Lane assessment area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under both easterly and westerly conditions, ground noise is predicted to be 60 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location

and there are 12 properties in the area that already receive road traffic noise at or above this level.

8.8.5 At all other properties (other than the 3 that have ground noise levels within 1 dB of worst-case), predicted ground noise is lower by 1 dB or more and the effects are reduced.

Overall

8.8.6 Bonnetts Lane is representative of an area to the southwest of the airport that contains 66 properties, and as a worst-case the **minor adverse** effect is considered to apply to 1 – 3 properties under easterly conditions and around 25 – 30 under westerly operation. The noise impacts are considered to result in a **minor adverse** effect at the affected properties. These effects are considered to be **not significant**.

8.9 Lowfield Heath

Night-time

8.9.1 Within the Lowfield Heath assessment area, predicted night-time noise levels are 16 dB above the night LOAEL of 45 dB $L_{eq,}$ and up to 6 dB over the night SOAEL of 55 dB L_{eq}. The worst-affected location would experience a change in night-time noise of up to 2 dB, resulting in a Low magnitude of impact. However, there is a change of 1 dB or more at only 10 of these properties in this area. The night-time noise impact is considered to potentially result in a **major adverse significant** effect at these 10 properties due to the predicted exceedance of the SOAEL

8.9.2 The Lowfield Heath assessment area covers a residential area to the southwest of the airport (see Figure 14.4.1). The area includes a total of 60 residential noise sensitive receptors and there are approximately 11 and 5 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. There are up to 12 assessment locations within this assessment area that exceed the SOAEL under westerly operation. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 60 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 2 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 61 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there are 2 properties in the area that already receive road traffic noise at or above this level.

Daytime

8.9.3 During the daytime the 51 dB L_{eq} LOAEL is predicted to be exceeded by a maximum of 14 dB, and to be 1 dB above the SOAEL of 63 dB L_{eq}. The predicted change in ground noise level is 3 dB on westerly operations and 1dB on easterly. However, as with the night, there is a change of 1 dB or more at only 10 of these properties in this area. There are also notable increases in the number of maximum noise events exceeding the daytime L_{max} criterion. The daytime noise impact is considered to potentially result in a **major adverse significant** effect at these 10 properties.

8.9.4 There are 5 and 17 receptors (under easterly and westerly conditions respectively) within the Lowfield Heath assessment area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. There are up to 10 assessment locations within this assessment area that exceed the SOAEL under westerly operation. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 65 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are 2 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 64 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and all 2 properties in the area already receive road traffic noise at or above this level.

Overall

8.9.5 The western part of this assessment area is representative of an area of buildings in the locality of Poles Lane which contains 60 properties, and the identified **major adverse significant effects** are considered likely to apply to up to 10 of the properties in this area. **Minor adverse effects** are expected to occur at 30 properties which are **not significant** and **negligible effects** are expected at the remaining 20 properties (also not significant).

8.10 Rowley Farm

Night-time

8.10.1 Within the Rowley Farm assessment area, predicted night noise levels exceed the night LOAEL of 45 dB L_{eq}, by up to 15 dB (up to 5 dB above the SOAEL) and the nearest property would experience a change in night ground noise of 4 dB, resulting in a Medium magnitude of impact. However, the worst-affected location (Rowley Cottage) is immediately adjacent to a dual carriageway experiencing a very high level of road traffic noise and other properties in this area have predicted ground noise levels 2 – 4 dB lower. Due to the small number of properties affected, the night-time noise impact is considered to result in a **moderate adverse significant** effect.

8.10.2 The Rowley Farm assessment area covers a residential area to the southwest of the airport (see Figure 14.4.1). The area includes a total of 9 residential noise sensitive receptors and there are approximately 2 and 1 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 60 dB $L_{Aeq,\ 8\ hr}$ at the worst-affected location and there is only 1 property in the area that already receives road traffic noise at or above this level.

Daytime

8.10.3 During the daytime the 51 dB L_{eq} LOAEL is predicted to be exceeded by up to 9 dB with a change of 2 dB generating a Low magnitude of impact. The ground noise impact is therefore considered to result in a **minor adverse** effect.

8.10.4 There are 2 and 1 receptors (under easterly and westerly conditions respectively) within the Rowley Farm assessment area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 59 dB $L_{Aeq,\ 16\ hr}$ at the worst-affected location and there are 2 properties in the area that already receive road traffic noise at or above this level.

- Under easterly conditions, ground noise is predicted to be 62 dB $L_{Aeq, 16\ hr}$ at the worst-affected location and 1 property in the area already receive road traffic noise at or above this level.

Overall

8.10.5 This location is representative of an area on a hill to the south of the airport that contains 9 properties, and the identified **moderate adverse significant effect** (during the night) applies to 7 of these properties. The minor adverse effects (during the day) are likely to apply to 7 of the properties in this area and are considered to be **not significant**.

8.11 Balcolme Road

Night-time

8.11.1 Within the Balcombe Road assessment area, predicted night-time noise levels are 6 dB above the night LOAEL of 45 dB $L_{eq,}$ and there would be up to 2 dB of change in night-time ground noise levels resulting in a Low magnitude of impact. The night-time noise impact is therefore considered to result in a **minor adverse** effect.

8.11.2 The Balcombe Road assessment area covers a residential area to the east of the airport (see Figure 14.4.1). The area includes a total of 382 residential noise sensitive receptors and there are approximately 145 and 131 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 51 dB $L_{Aeq, 8\ hr}$ at the worst-affected location and there are 216 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 41 dB $L_{Aeq, 8\ hr}$ at the worst-affected location and all 382 properties in the area already receive road traffic noise at or above this level.

Daytime

8.11.3 During the daytime the 51 dB L_{Aeq} LOAEL would be exceeded by up to 3 dB and noise change is predicted to be less than 1 dB resulting in a negligible magnitude of impact. The ground noise impact is therefore considered to result in a **negligible** effect.

8.11.4 There are 132 and 113 receptors (under easterly and westerly conditions respectively) within the Balcombe Road assessment area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 54 dB $L_{Aeq, 16\ hr}$ at the worst-affected location and there are 311 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 44 dB $L_{Aeq, 16\ hr}$ at the worst-affected location and all 382 properties in the area already receive road traffic noise at or above this level.

Overall

8.11.5 This location is representative of an area of Balcombe Road that contains 382 properties, and as a worst-case, the **minor adverse effect** identified for westerly operation during the night is considered likely to apply to somewhere in the region of 70 properties in this area. For the remaining 312 properties the effect is considered to be negligible. Also, under easterly operation at night and for easterly and westerly operation during the day, the impact is lower resulting in a negligible effect. In practice, impacts and resultant effects would be lower at some of these properties due to localised acoustic screening. The effects at all properties in this area are considered to be **not significant**.

8.12 Tinsley Green

Night-time

8.12.1 Within the Tinsley Green assessment area, predicted night-time noise levels are 4 dB above the night LOAEL of 45 dB $L_{eq,}$ and there would be up to 3 dB of increase in night-time ground noise levels on westerly operations and a 1dB increase on easterly operations, resulting in a Low magnitude of impact. The night-time noise impact is therefore considered to result in a **minor adverse** effect.

8.12.2 The Tinsley Green assessment area covers a residential area to the southeast of the airport (see Figure 14.4.1). The area includes a total of 494 residential noise sensitive receptors and there are approximately 380 and 293 of these locations (under westerly and easterly conditions respectively) where predicted night-time noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.34) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 49 dB $L_{Aeq, 8\ hr}$ at the worst-affected location and there are 204 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 43 dB $L_{Aeq, 8\ hr}$ at the worst-affected location and all 494 properties in the area already receive road traffic noise at or above this level.

Daytime

8.12.3 During the daytime the 51 dB L_{eq} LOAEL would not be exceeded and noise change is predicted to be less than 1 dB resulting in a negligible magnitude of impact. The ground noise impact is therefore considered to result in a **negligible** effect.

8.12.4 There are 43 and 282 receptors (under easterly and westerly conditions respectively) within the Tinsley Green assessment area where predicted daytime noise levels are within 1 dB of the worst-case predicted levels discussed above. Comparing ground noise with existing levels of road traffic noise in the area (see Figure 14.6.33) the following observations can be made:

- under westerly conditions, ground noise is predicted to be 54 dB $L_{Aeq, 16\ hr}$ at the worst-affected location and there are 311 properties in the area that already receive road traffic noise at or above this level.
- under easterly conditions, ground noise is predicted to be 44 dB $L_{Aeq, 16\ hr}$ at the worst-affected location and all 382 properties in the area already receive road traffic noise at or above this level.

Overall

8.12.5 This location is representative of an area of Tinsley Green that contains 494 properties, and as a worst-case, the **minor adverse effects** identified in relation to nighttime westerly operation are considered likely to apply to a maximum of 290 of the properties in this area. For all remaining properties this identified impact is lower and is considered to be negligible. During the night under easterly operations and during the day (for both easterly and westerly operations) there is a **negligible effect**. In practice, impacts and resultant effects would be lower at some of the

properties in this area due to localised acoustic screening and increased distance. The effects at all properties in this area are considered to be **not significant.**

9 References

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Annex 1

L_{A90} requency analysis

Figure 1: Site 1 L_{A90} distribution Day

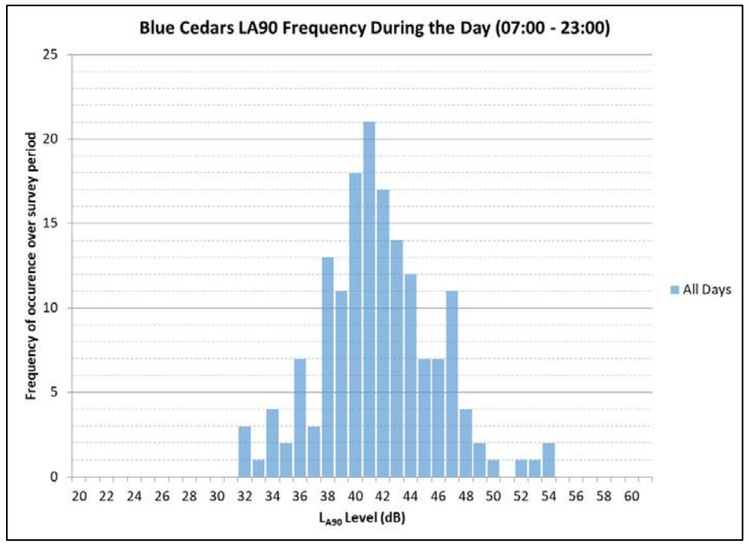

Figure 2: Site 1 L_{A90} distribution Night

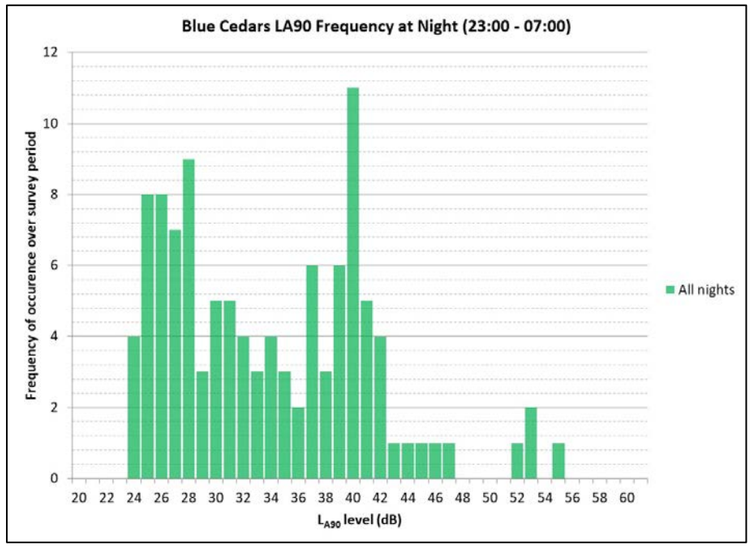

Figure 3: Site 2 L_{A90} distribution Day

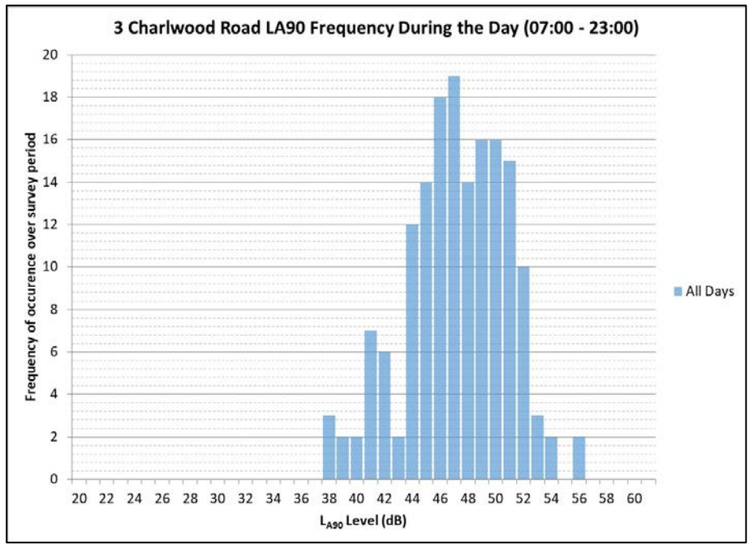

Figure 4: Site 2 L_{A90} distribution Night

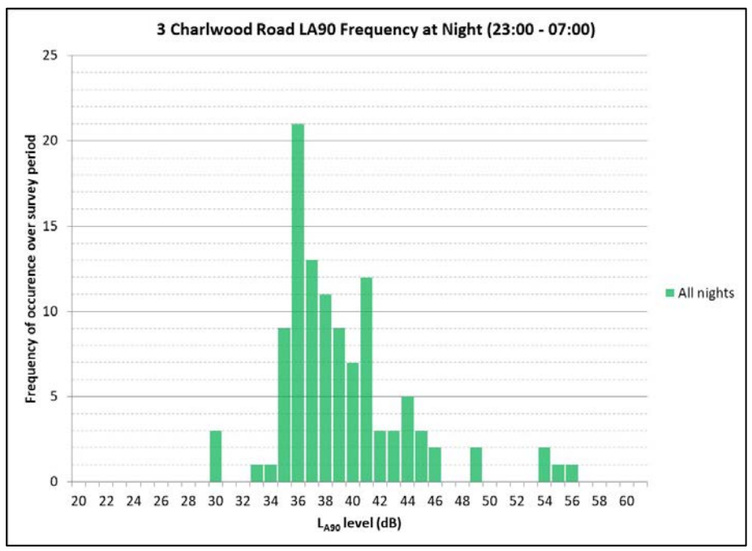

Figure 5: Site 3 L_{A90} distribution Day

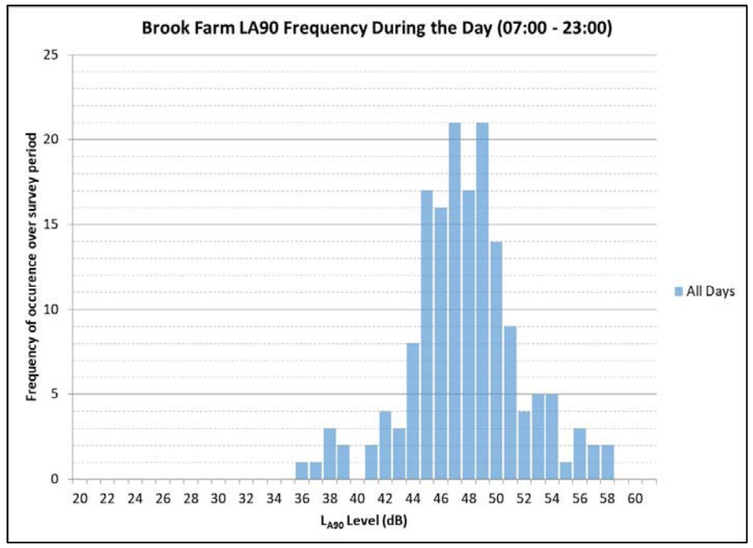

Figure 6: Site 3 L_{A90} distribution Night

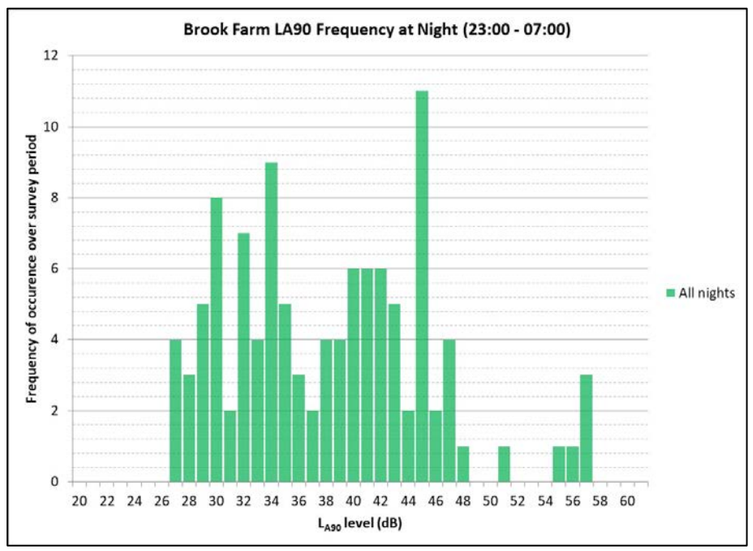

Figure 7: Site 4 L_{A90} distribution Day

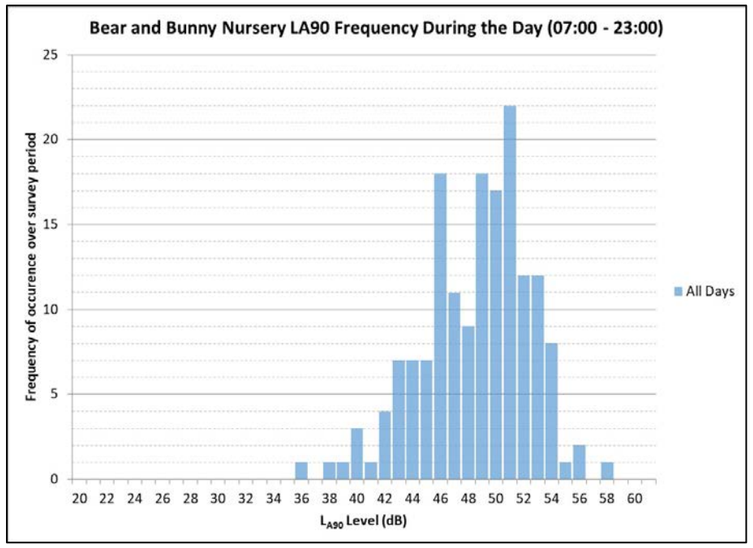

Figure 8: Site 4 L_{A90} distribution Night

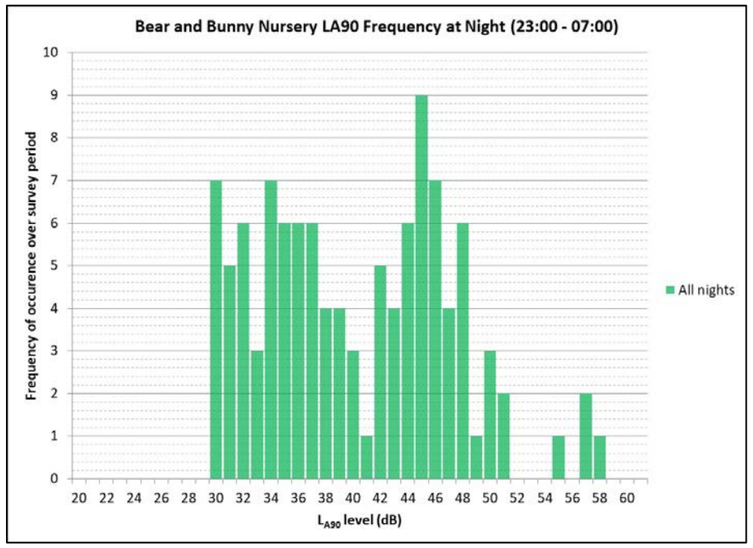

Figure 9: Site 5 L_{A90} distribution Day

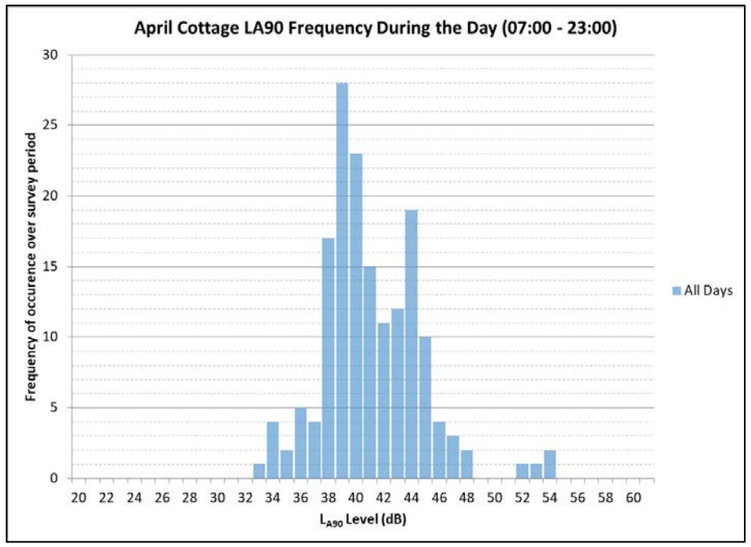

Figure 10: Site 5 L_{A90} distribution Night

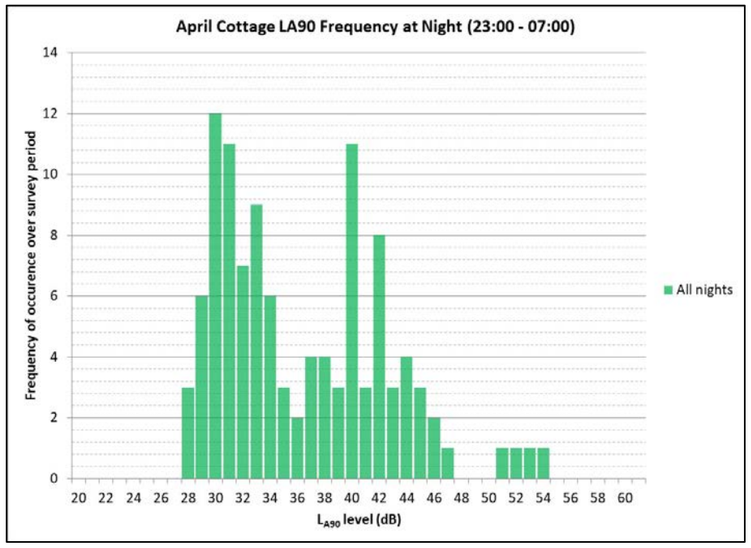

Figure 11: Site 6 L_{A90} distribution Day

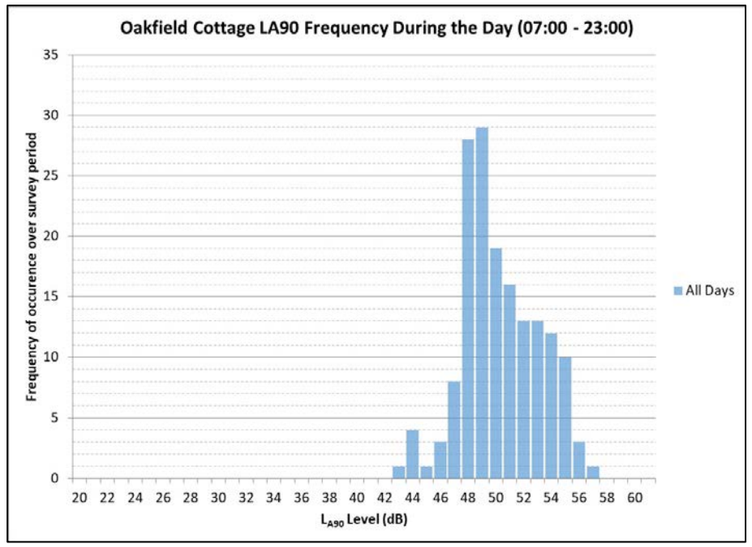

Figure 12: Site 6 L_{A90} distribution Night

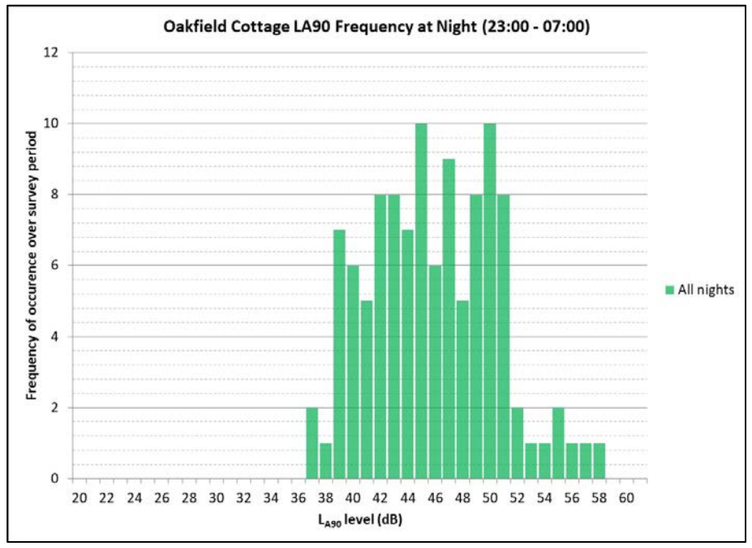

Figure 13: Site 7 L_{A90} distribution Day

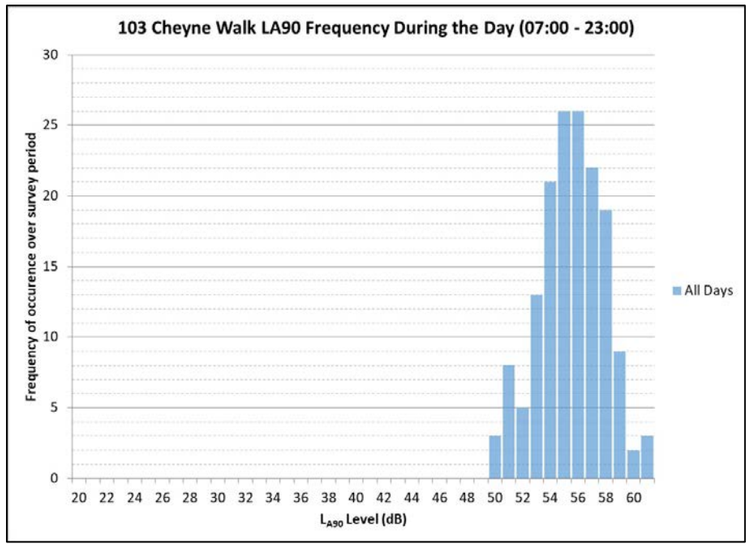

Figure 14: Site 7 L_{A90} distribution Night

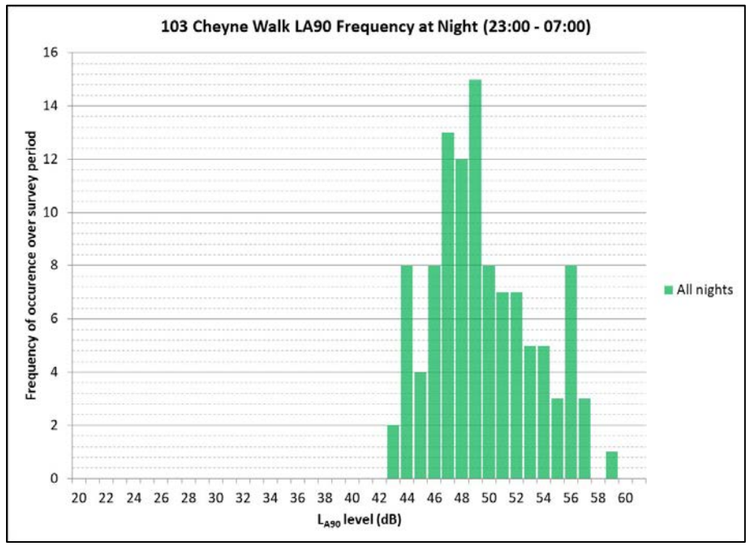

Figure 15: Site 8 L_{A90} distribution Day

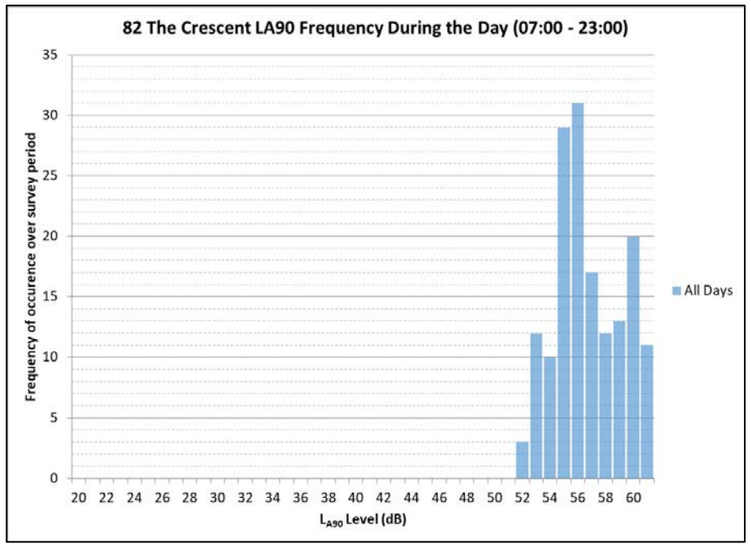

Figure 16: Site 8 L_{A90} distribution Night

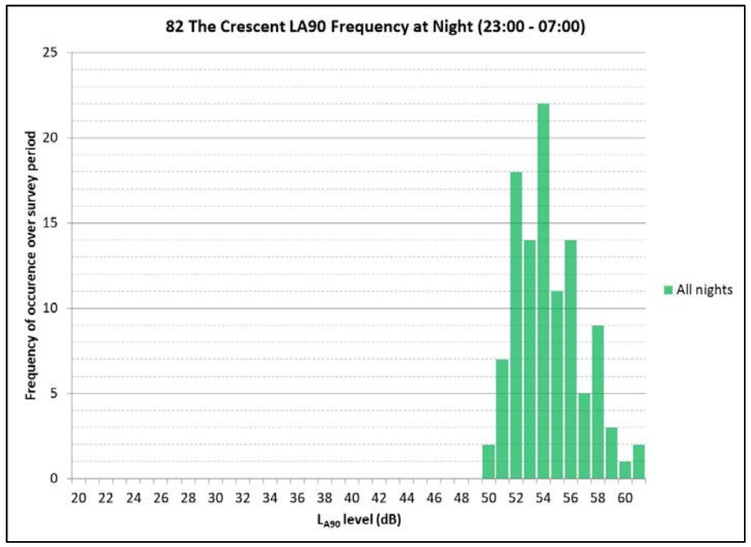

Figure 17: Site 9 L_{A90} distribution Day

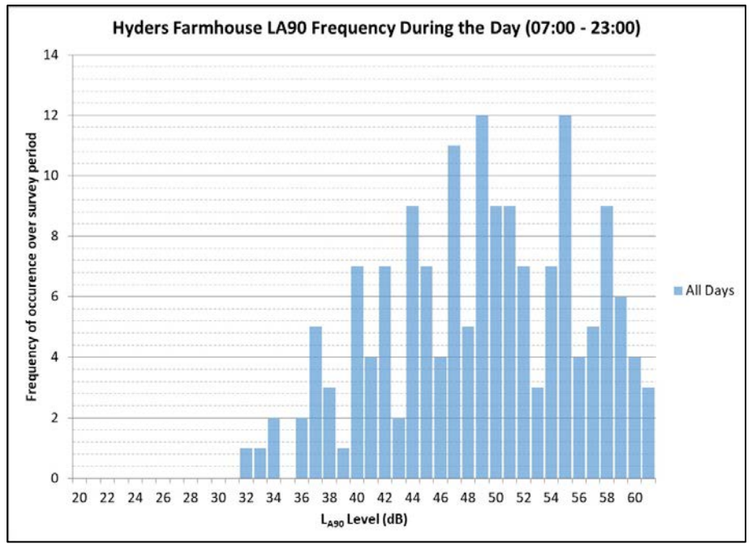

Figure 18: Site 9 L_{A90} distribution Night

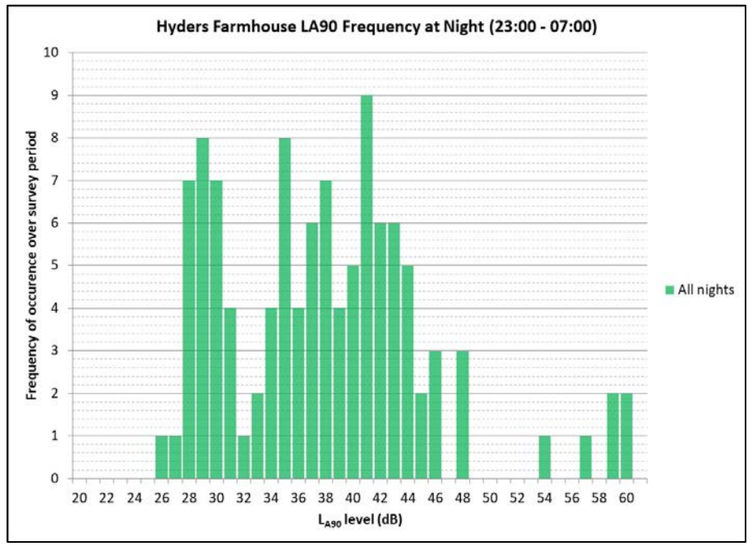

Figure 19: Site 10 L_{A90} distribution Day

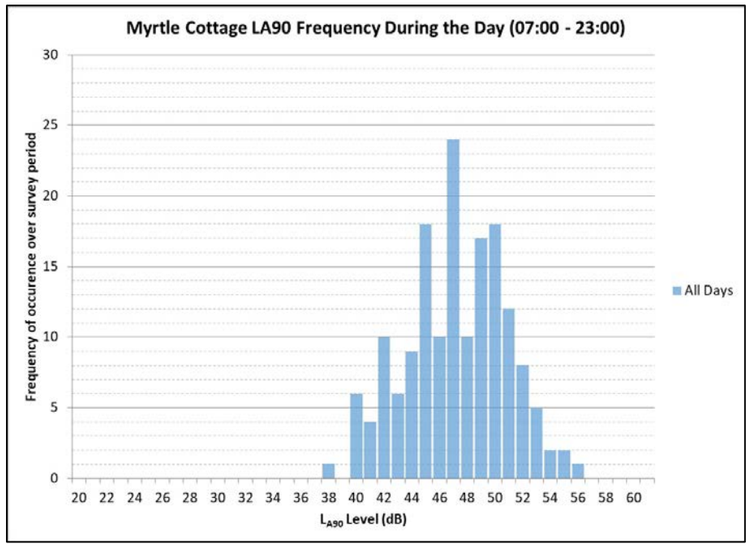

Figure 20: Site 10 L_{A90} distribution Night

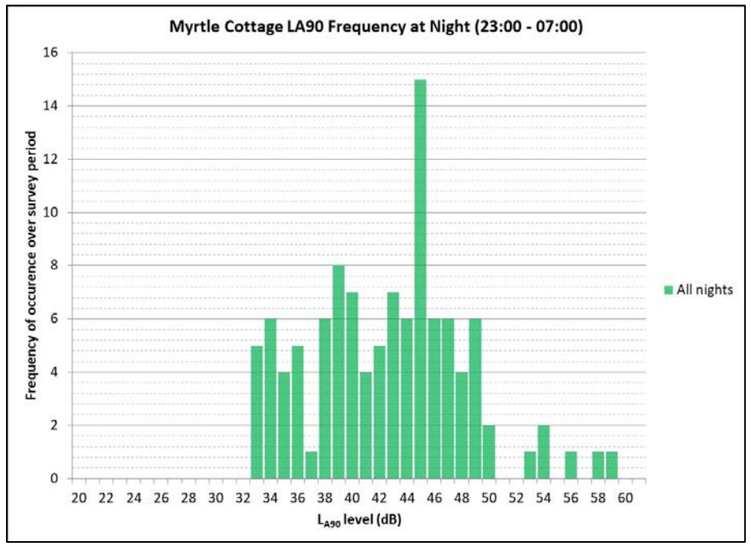

Figure 21: Site 11 L_{A90} distribution Day

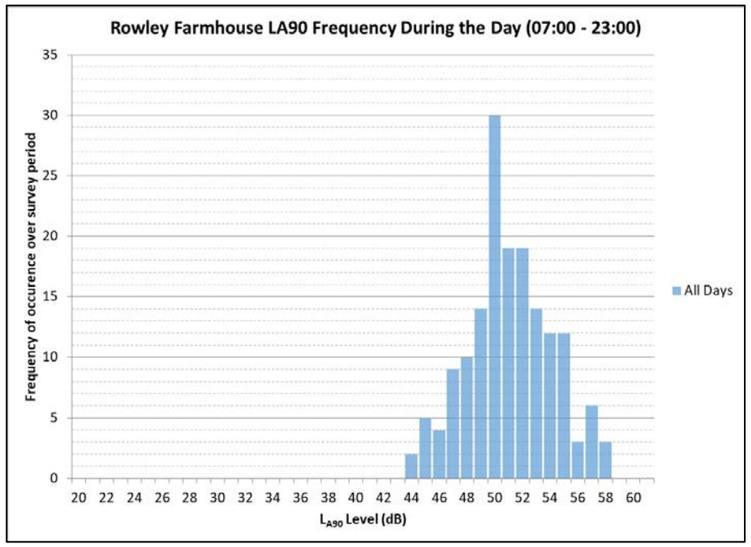

Figure 22: Site 11 L_{A90} distribution Night

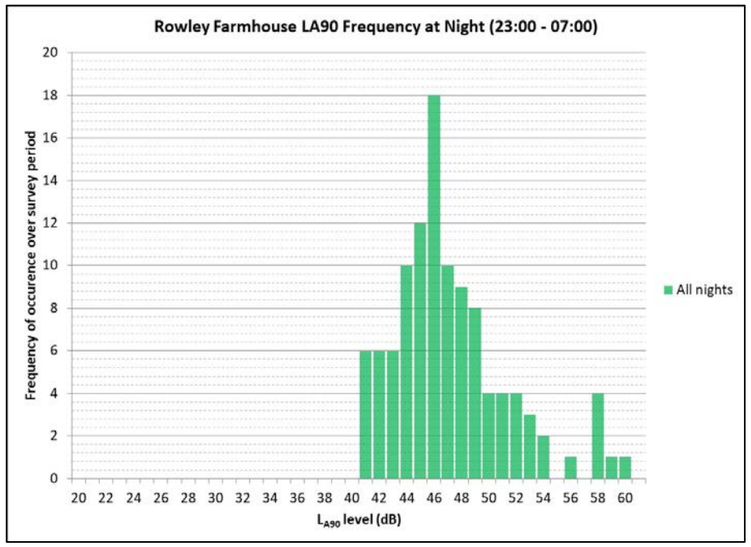

Figure 23: Site 12 L_{A90} distribution Day

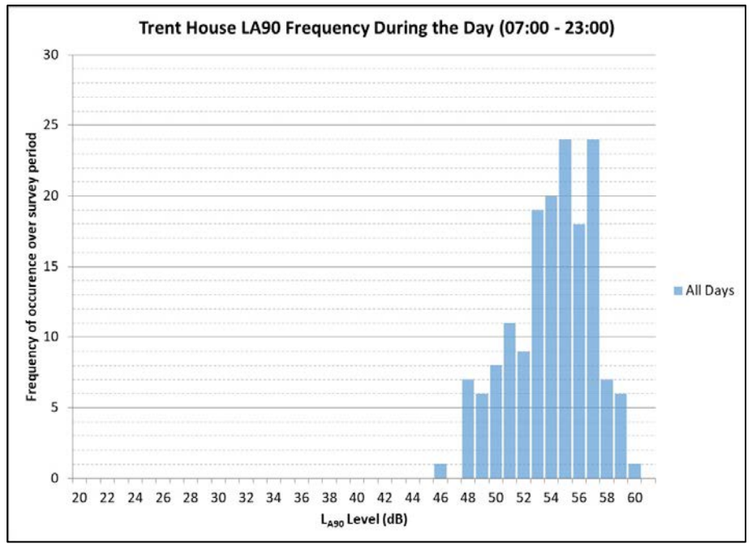

Figure 24: Site 12 L_{A90} distribution Night

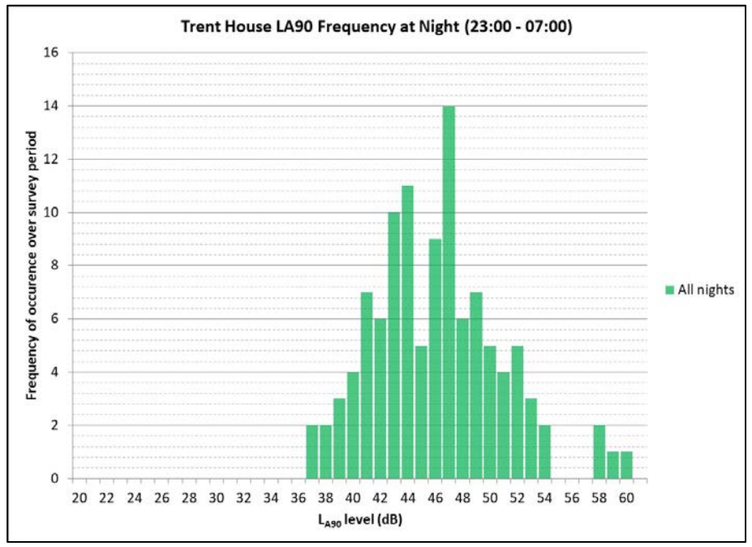

Figure 25: Site 13 L_{A90} distribution Day

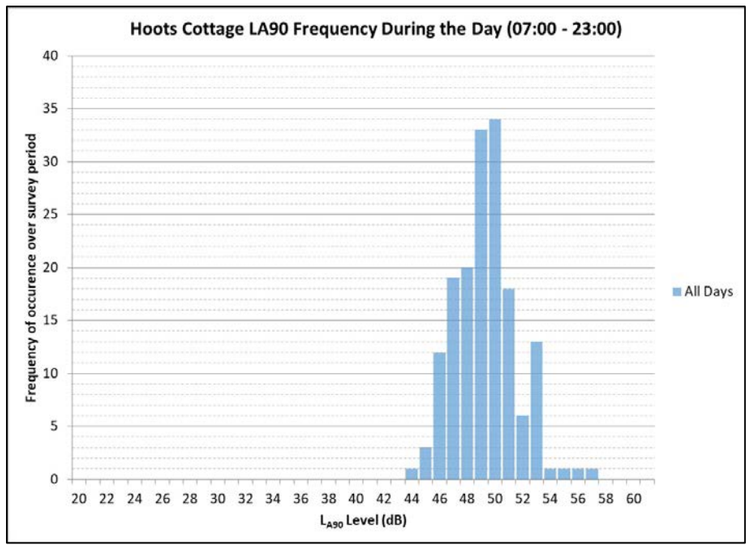

Figure 26: Site 13 L_{A90} distribution Night