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**A REPORT OF MONITORING OF  
AIRCRAFT NOISE FROM GATWICK AIRPORT  
AT RUSPER, WEST SUSSEX,  
BETWEEN JANUARY AND DECEMBER 2009**

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## Summary

A mobile Noise Monitoring Terminal (NMT) has been deployed at Rusper in West Sussex by Gatwick Airport since 1998. The site is approximately 5 km south west of the airport.

The aim of this report is to present the results of the noise monitoring exercise over the twelve month period from January to December 2009, to compare these data with the predictions of published aircraft noise contours, and to interpret the results in a way that places the contribution of the noise from aircraft using Gatwick in the context of the overall noise climate from all other sources.

The site is overflown by both departing aircraft, when take off is to the west, and also by arriving aircraft, when take off is in the easterly direction. A total of about 124,500 aircraft noise events were recorded by the noise monitor in 2009, which corresponds, on average, to about 18 events per hour during the daytime and evening hours (07.00 to 23.00 hours). On average over the year 68% of these events were due to departures, and 32% were due to arrivals.

The variation in numbers of such events has been examined: month by month throughout the year, day to day throughout each month and hour by hour throughout the day. The highest numbers of events occurred during the summer months, July August and September, the busiest hours of the day were between 07.00 and 09.00 in the morning and between 18.00 and 19.00 in the afternoon, and there was no recognizable pattern of day to day variation in daily numbers of events during the months of the year.

The maximum noise level produced by each aircraft over-flight has been recorded by the monitor. These values ranged between 56 dBA and over 80 dBA, but over 90% of values lie between 61 and 74 dBA, and the average of these values over the year is 65 dBA for arrival events and 70 dBA for departures, and 68 dBA overall. A statistical distribution of the values has been displayed in the report.

Each aircraft noise event may also be characterised by its duration (the time for which the aircraft noise exceeds the trigger level value of 55 dBA) and the average noise levels during this period. The average event duration is 36 seconds and the average noise level during events is 63 dBA.

The noise level from each aircraft noise event at the site may be combined to produce average aircraft noise levels for each month ( $L_{Aeq,T}$  value). The average aircraft noise level during the daytime was 58 dBA and 50 dBA at night-time.

The average levels of total noise and aircraft noise are very close (within 1 dBA) indicating that aircraft noise is the dominant influence on the noise climate at this site, with the remaining component of the noise at the site, the residual noise, being several decibels lower.

It is possible to convert the hourly aircraft noise  $L_{Aeq}$  values into the 24 hour  $L_{den}$  noise index (day evening night level) used by Defra for noise mapping purposes, giving, on the basis of the data collected at this site over the twelve months period, an  $L_{den}$  value of 59 dBA.

The daytime (16 hour) and night-time (8 hour) average noise levels, and the day-evening-night level at the site have been compared with the 2008 (daytime), and 2006 ( $L_{den}$  and night-time) aircraft noise contours for Gatwick Airport. The comparison shows that these contours are in good agreement with the noise levels obtained from the noise monitor at the site.

In order to place the noise climate at the site in a wider UK context it is compared with the results of the National Noise Index survey of noise levels in the UK in 2000, carried out by the Building Research Establishment for Defra. This gave a breakdown of the proportion of UK residents exposed to various noise levels, in four 5 dBA bands. As an example the  $L_{den}$  value for this site places it in the 55 to 60 dBA noise exposure band, occupied by 38% of dwellings in the UK.

Levels of noise exposure ( $L_{Aeq}$ ) at this site are above the World Health Organisation Guidelines of 55 dBA in the daytime, and 45 dBA at night-time.

The information presented in this report will serve as a baseline for comparison with any future noise level surveys in this format that may be undertaken at this location.

A summary of the main noise related parameters (yearly average for 2009) for the site are shown in the Table below:

Number of aircraft noise events	124,500
% Arrivals and Departures	68% Departures; 32% Arrivals
Average maximum noise level of events	70 dBA Departures; 65 dBA Arrivals; 68 dBA overall
Average total noise level	58 dBA Day (16h); 51 dBA Night
Average aircraft noise level	58 dBA Day (16h); 50 dBA Night
Average residual noise level	50 dBA Day (16h); 46 dBA Night
Daytime level (12 hours)	58 dBA
Evening level (4 hours)	55 dBA
Day-evening night level	59 dBA
Background noise ( $L_{AS90}$ )	39 dBA Day (16h); 31 dBA Night

## 1.0 Introduction

- 1.1 A mobile Noise Monitoring Terminal (NMT) has been deployed by Gatwick Airport at a site in Rusper in West Sussex since 1998.
- 1.2 The site is approximately 5 km south west of the airport, at Rusper in West Sussex. The noise monitor is located in a paddock next to a detached house, and the microphone was located about 1 metre from an outbuilding (garage). A minor road runs past the property. The dominant source of noise audible at the site is that from aircraft arriving at or departing from Gatwick. Both arriving and departing aircraft can be seen and heard from the site. The proximity of the site to overflights can be seen from typical aircraft tracks for both easterly and westerly take-offs shown in Appendix 1. The distance from the NMT at Rusper to the extended runway centre-line is approximately 825m. In between bursts of aircraft noise the site is quiet with occasional noise from traffic on the minor road, from birdsong, and from domestic activity.
- 1.3 The aims of this report are:
  - to present the results of the twelve month noise monitoring survey, and
  - to compare the survey results with published aircraft noise contours
  - to interpret the results in a way that places the contribution of the noise from passing aircraft using Gatwick airport in the context of the overall noise climate from all other sources, and
  - To provide a baseline for comparison with any future noise surveys in this format that may be undertaken at this location.

## 2.0 Data from the Noise Monitoring Terminal

- 2.1 The Noise monitoring Terminal (NMT) gathers data about the number and level of aircraft noise events, and also data about the total level of noise at the site, on an hourly basis. The hourly values of total noise are a combination of the noise from the aircraft noise events and from all other noise sources, called residual noise.
- 2.2 Further details about the way the NMT gathers and processes noise data is given in Appendix 2.

### 3.0 Analysis of Noise Monitoring Survey Results

#### 3.1 The numbers of aircraft noise events

- 3.1.1 Aircraft noise events are bursts of noise which exceed a threshold condition (of 55 dBA for at least 10 seconds for this monitor) and which have been correlated with radar tracks of aircraft arriving at or departing from Gatwick. (Appendix 2 gives more details).
- 3.1.2 A total of 123,590 such events were recorded at the noise monitor at Rusper in 2009, which corresponds, on average, to 339 events per day.
- 3.1.3 The average daily number of events does, however, vary throughout the year. Figure 1 shows the month by month variation in average numbers of aircraft noise events per day throughout 2009. It can be seen that the highest numbers of events per day occurred in July, August and September with the lowest numbers in January, November and December.
- 3.1.4 On average over the year 68% of these events were due to departures, and 32% were due to arrivals. The month by month variation is shown in Figure 2. It can be seen that more than 90% of events were due to departures in July and August and that more than 50% of events were due to arrivals in April.
- 3.1.5 The number of aircraft noise events varies, hour by hour, throughout each day. Figure 3 shows this variation. It can be seen that there is a rapid rise in numbers of events from 6.00 hours and a rapid fall after 21.00 hours, with the highest numbers occurring between 07.00 and 9.00 hours.
- 3.1.6 The number of events also varies from day to day. Figure 4 shows the number of events which occurred each day in October with similar variations for other months. The relatively low number of events shown for 22 October cannot be explained without further detailed investigation and the possibility that the data for this particular day is faulty cannot be ruled out.

### 3.2 Maximum noise levels of aircraft noise events

3.2.1 Figure 5 shows the monthly average of maximum noise levels ( $L_{ASmax}$ ) of aircraft noise events throughout 2009, for daytime and night-time arrival and departure events. It can be seen (i) that there is no significant variation from month to month. (ii) that for the same type of movement, whether arrival or departure, there is no significant difference between daytime and night-time values, and (iii) maximum noise levels of departure events are on average between 4 and 5 dB higher than those from arrivals.

3.2.2 The maximum noise level produced by each aircraft movement ranged between 55 dBA and over 80 dBA, but over 90% of values lie between 61 and 74 dBA, and the average of these values over the year is 65 dBA for arrival events and 70 dBA for departures, and 68 dBA overall. Figure 6 shows a statistical analysis of the maximum noise levels of departure and arrival events, which shows the spread of the values, and a difference in the peak of the distributions of between 4 and 5 dB between arrivals and departures.

### 3.3 The Total noise climate at the site

3.3.1 Figure 7 shows the month by month average noise levels of aircraft noise, residual noise and total noise at the site throughout 2009. Also shown are the corresponding average values of maximum noise levels (as discussed earlier in paragraphs 3.2.1) of aircraft noise events, and of background noise ( $L_{AS90}$  values). Figure 8 shows similar data for night-time

3.3.2 The most noticeable feature of these graphs is a slight increase in the residual noise and background noise during November, which is not present in the aircraft noise level; otherwise the monthly average levels do not vary by more than 3 or 4 dB throughout the 12 month period. The average levels over the 12 month period are:

	Total noise	Aircraft noise	Residual noise	Average Maximum noise	Background noise ( $L_{AS90}$ )
Day	58.2 dBA	57.6 dBA	49.6 dBA	67.9 dBA	38.9 dBA
Night	51.2 dBA	49.6 dBA	46.1 dBA	67.0 dBA	30.8 dBA



The values of aircraft noise shown in Figures 7 and 8 include contributions from both arrivals and departures. Figure 9 shows the contributions from noise from arrivals and departures separately, for both daytime and night-time. It can be seen that the highest noise levels are from daytime departures and the lowest from night-time arrivals.

#### *Day evening night level ( $L_{den}$ )*

3.3.3 It is possible to use the hourly aircraft  $L_{Aeq}$  values to calculate average ( $L_{Aeq}$ ) values for the daytime (07.00 to 19.00), evening (19.00 to 23.00) and night-time (23.00 to 07.00) periods used in the determination of the 24 hour  $L_{den}$  (the day evening night level) noise index used by Defra for noise mapping purposes (see Appendix 4). Figure 10 shows the monthly variation in day, evening, and night levels, and in the  $L_{den}$  levels throughout 2009, with a overall values over the 12 months shown below.

$L_D$	$L_E$	$L_N$	$L_{DEN}$
58	55	49.6	59

#### 3.4 The contribution of aircraft noise events to the total noise climate at the site

It can be seen from the above Table that the average noise levels of Total noise and aircraft noise are very close (within 1 dBA) indicating that aircraft noise is the dominant influence on the noise climate at this site, with the remaining component of the noise at the site, the residual noise, being several decibels lower..

#### 3.5 Comparison with Contours

The table below shows a comparison of aircraft noise levels from the noise monitor at the site compared with the noise contours from Appendix 3.

	Value from Contour	Value from noise monitor
$L_{Aeq,16h}$ Day (2008)	Just below 60	58
$L_{Aeq,8h}$ Night (2006)	Just on 50 contour	49.6
$L_{den}$ (2006)	Just on 60 contour	59

It can be seen that the contours are in good agreement with the noise levels obtained from the noise monitor at the site.

### 3.6 Putting the noise climate at the site into a wider UK context

3.6.1 The National Noise Incidence survey of noise levels in England and Wales in 2001 carried out by the Building Research Establishment for Defra gave a breakdown of the proportion of UK residents exposed to noise, as follows:

Proportion of UK population of living in dwellings exposed to daytime noise levels ( $L_{Aeq, 16 \text{ hour}}$ ) in 5 dB bands, in the 2001 National Noise Incidence survey	
5 dB noise exposure level bands*	Proportion in band
Less than 50 dBA	10%
50 dBA < L < 55 dBA	36%
55 dBA < L < 60 dBA	31%
60 dBA < L < 65 dBA	14%
Greater than 65 dBA	9 %

\* noise levels were measured at 1 metre from building facades, which makes them directly comparable with those from the NMT because the microphone was located about 1 metre from an outbuilding (garage).

3.6.2 Since the 16 hour  $L_{Aeq}$  value for this site is 58 dBA (from the Table in paragraph 3.3.2) this puts the site in the 55 to 60 dBA noise exposure band, occupied by 31 % of dwellings in the UK. In the absence of aircraft noise the noise level at the site would be 49.6 dBA, i.e. the residual noise level (from the Table in paragraph 3.3.2) which would put the site in the lowest, i.e. quietest, category (less than 50 dBA).

3.6.3 The National Noise Incidence survey also gave a similar breakdown for the  $L_{den}$  index, as shown below

Proportion of UK population living in dwellings exposed to noise levels in 5 dB bands, according to the $L_{den}$ noise index, in 2001 National Noise Incidence survey	
5 dB noise exposure level bands*	Proportion in band
Less than 55 dBA	33%
55 dBA < L < 60 dBA	38%
60 dBA < L < 65 dBA	16%
Greater than 65 dBA	13%

\* noise levels were measured at 1 metre from building facades, which makes them directly comparable with those from the NMT because the microphone was located about 1 metre from an outbuilding (garage).

- 3.6.4 Since the  $L_{den}$  value for this site is 59 dBA (from paragraph 3.3.3) this puts the site in the 55 to 60 dBA noise exposure band, occupied by 38% of dwellings in the UK.

#### *World Health Organisation and PPG 24 Guidance on Community Noise*

- 3.6.5 In 2000 the World Health Organisation issued 'Guidelines for Community Noise', which are reflected in the UK Planning Policy Guidance Note 24 (Annex 2, paragraph 4): that "general daytime outdoor noise levels of less than 55 dBA are desirable to prevent significant community annoyance" and that "at night, sound pressure levels at the outside façades of living spaces should not exceed 45 dB ( $L_{Aeq}$ ) so that people may sleep with bedroom windows open."
- 3.6.6 The National Noise Incidence Study 2000 has estimated that 55% of the population of England and Wales live in dwellings exposed to day-time noise levels above the WHO level of 55 dB  $L_{Aeq,16h}$ , and that 68% are exposed to night-time levels above the WHO level of 45  $L_{Aeq,8h}$ .
- 3.6.7 The noise exposure levels at this site (see Table in paragraph 3.4.3) are above both the WHO Guidelines of 55 dBA in the daytime, and also the night-time Guideline value of 45 dBA.

## 4.0 Summary and Conclusions

- 4.1 A total of about 124,500 aircraft noise events were recorded by the noise monitor in 2009, which corresponds, on average, to about 18 events per hour during the daytime and evening hours (07.00 to 23.00 hours). On average over the year 68% of these events were due to departures, and 32% were due to arrivals.
- 4.2 The highest numbers of events occurred during the summer months, July August and September, the busiest hours of the day were between 07.00 and 09.00 in the morning and between 18.00 and 19.00 in the afternoon, and there was no recognizable pattern of day to day variation in daily numbers of events during the months of the year.
- 4.3 The maximum noise level produced by each aircraft over-flight has been recorded by the monitor. These values ranged between 55 dBA and over 80 dBA, but over 90% of values lie between 61 and 74 dBA, and the average of these values over the year is 65 dBA for arrival events and 70 dBA for departures, and 68 dBA overall. A statistical distribution of the values has been displayed in the report,
- 4.4 Each aircraft noise event may also be characterised by its duration (the time for which the aircraft noise exceeds the trigger level value of 56 dBA) and the average noise levels during this period. The average event duration is 36 seconds and the average noise level during events is 63 dBA.
- 4.5 The noise level from each aircraft noise event at the site may be combined to produce average aircraft noise levels for each month ( $L_{Aeq,T}$  value). The average aircraft noise level during the daytime was 58 dBA and 50 dBA at night-time.
- 4.6 The average levels of total noise and aircraft noise are very close (within 1 dBA) indicating that aircraft noise is the dominant influence on the noise climate at this site, with the remaining component of the noise at the site, the residual noise, being several decibels lower.
- 4.7 It is possible to convert the hourly aircraft noise  $L_{Aeq}$  values into the 24 hour  $L_{den}$  noise index (day evening night level) used by Defra for noise mapping purposes, giving, on

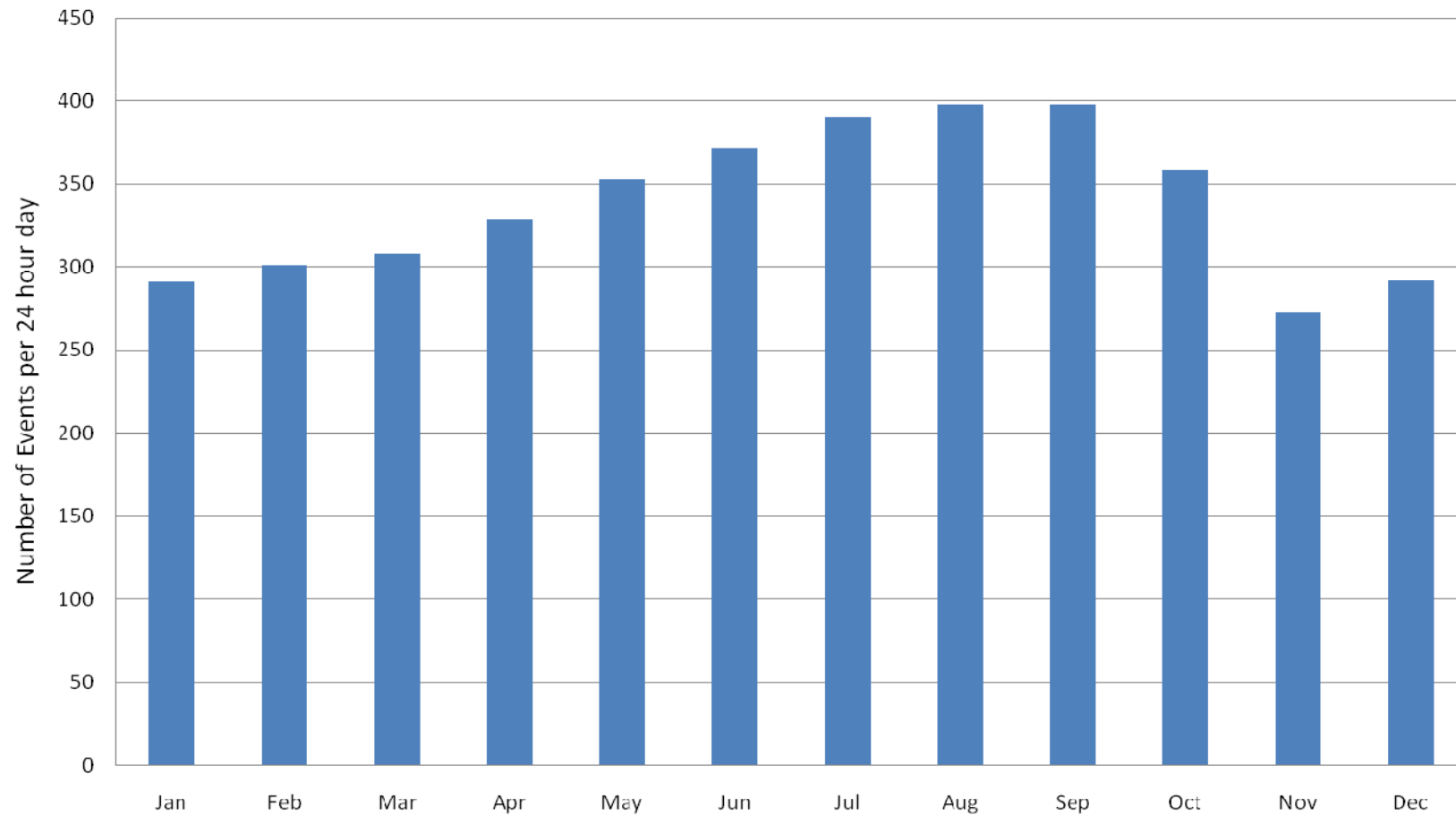
the basis of the data collected at this site over the twelve months period, an  $L_{den}$  value of 59 dBA.

- 4.8 The daytime (16 hour) and night-time (8 hour) average noise levels, and the day-evening-night level at the site have been compared with the 2008 (daytime), and 2006 ( $L_{den}$  and night-time) aircraft noise contours for Gatwick Airport. The comparison shows that these contours are in good agreement with the noise levels obtained from the noise monitor at the site.
- 4.9 In order to place the noise climate at the site in a wider UK context it is compared with the results of the National Noise Index survey of noise levels in the UK in 2000, carried out by the Building Research Establishment for Defra. This gave a breakdown of the proportion of UK residents exposed to various noise levels, in four 5 dBA bands. As an example the  $L_{den}$  value for this site places it in the 55 to 60 dBA noise exposure band, occupied by 38% of dwellings in the UK.
- 4.10 Levels of noise exposure ( $L_{Aeq}$ ) at this site are above the World Health Organisation Guidelines of 55 dBA in the daytime, and 45 dBA at night-time.
- 4.11 A summary of the main noise related parameters (yearly average for 2009) for the site are shown in the Table below:

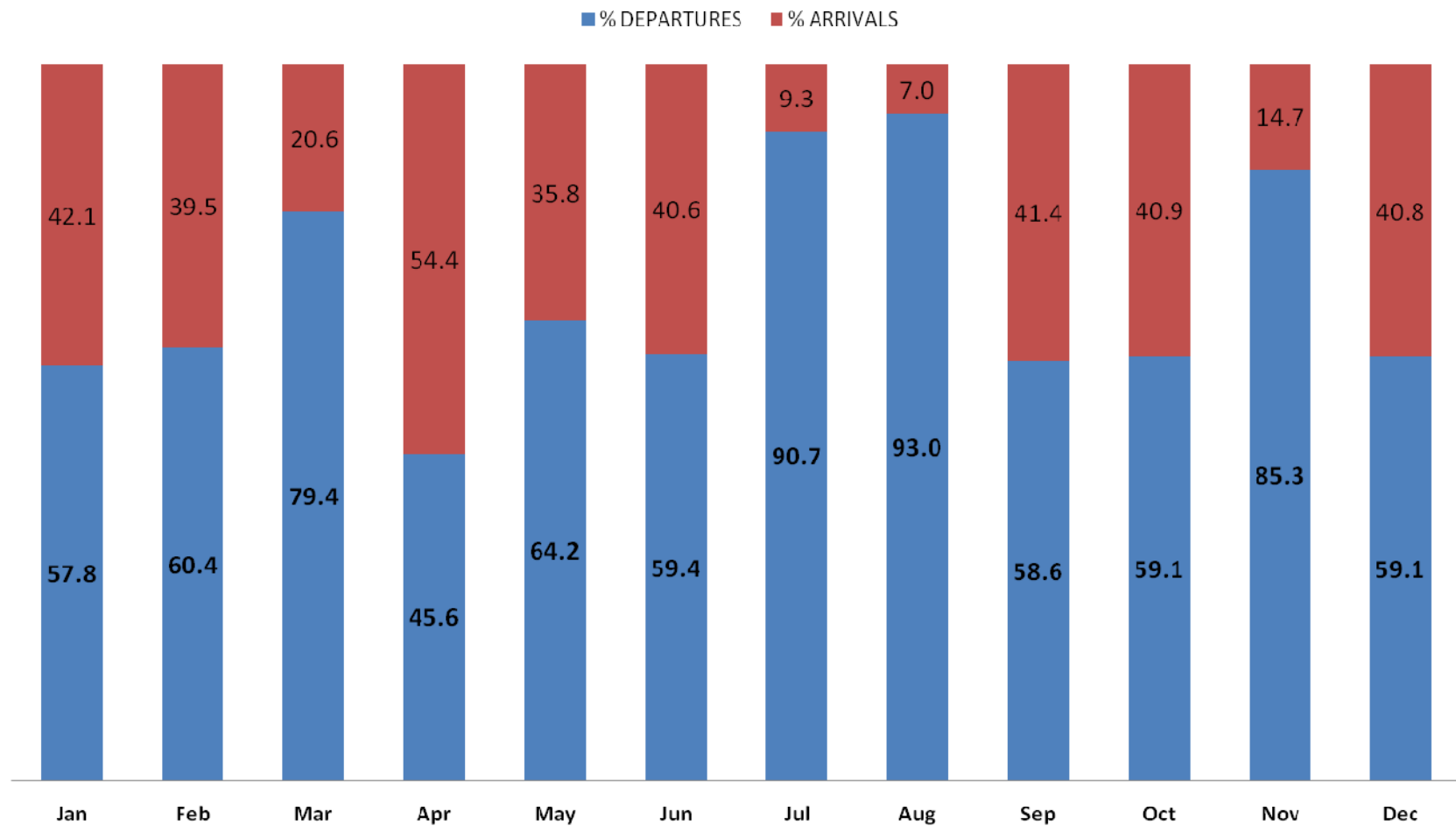
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% Arrivals and Departures	68% Departures; 32% Arrivals
Average maximum noise level of events	70 dBA Departures; 65 dBA Arrivals; 68 dBA overall
Average total noise level	58 dBA Day (16h); 51 dBA Night
Average aircraft noise level	58 dBA Day (16h); 50 dBA Night
Average residual noise level	50 dBA Day (16h); 46 dBA Night
Daytime level (12 hours)	58 dBA
Evening level (4 hours)	55 dBA
Day-evening night level	59 dBA
Background noise ( $L_{AS90}$ )	39 dBA Day (16h); 31 dBA Night

- 4.12 The information presented in this report will serve as a baseline for comparison with any future noise level surveys in this format that may be undertaken at this location.

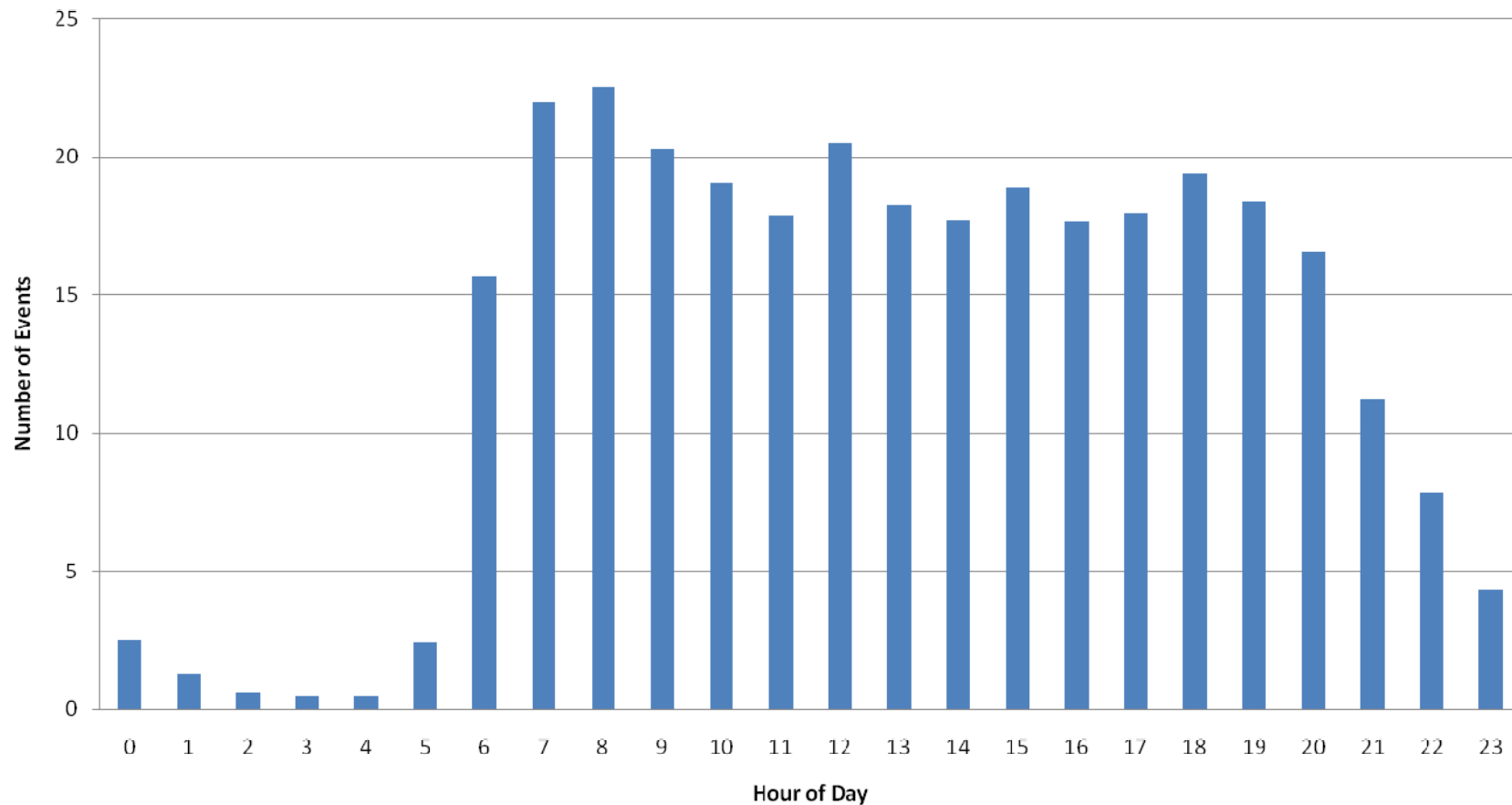
**Figure 1 Monthly Variation in Average Numbers of Aircraft Noise events per day recorded at Rusper in 2009**



**Figure 2 Monthly % of Departure and Arrivals Aircraft Noise Events at Rusper in 2009**

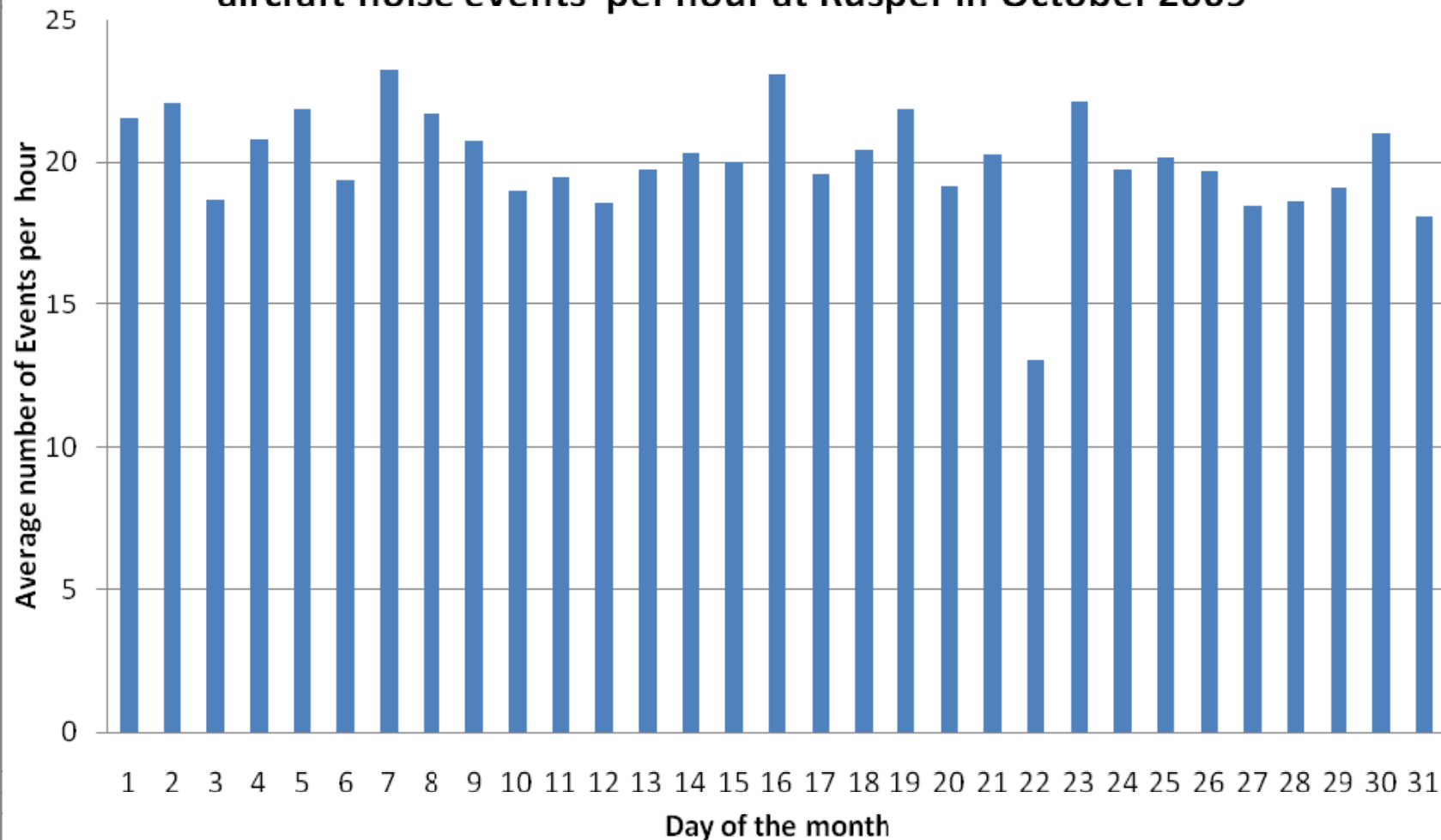


**Figure 3 Average Number of aircraft noise events per hour at Rusper, by hour of day, in 2009**

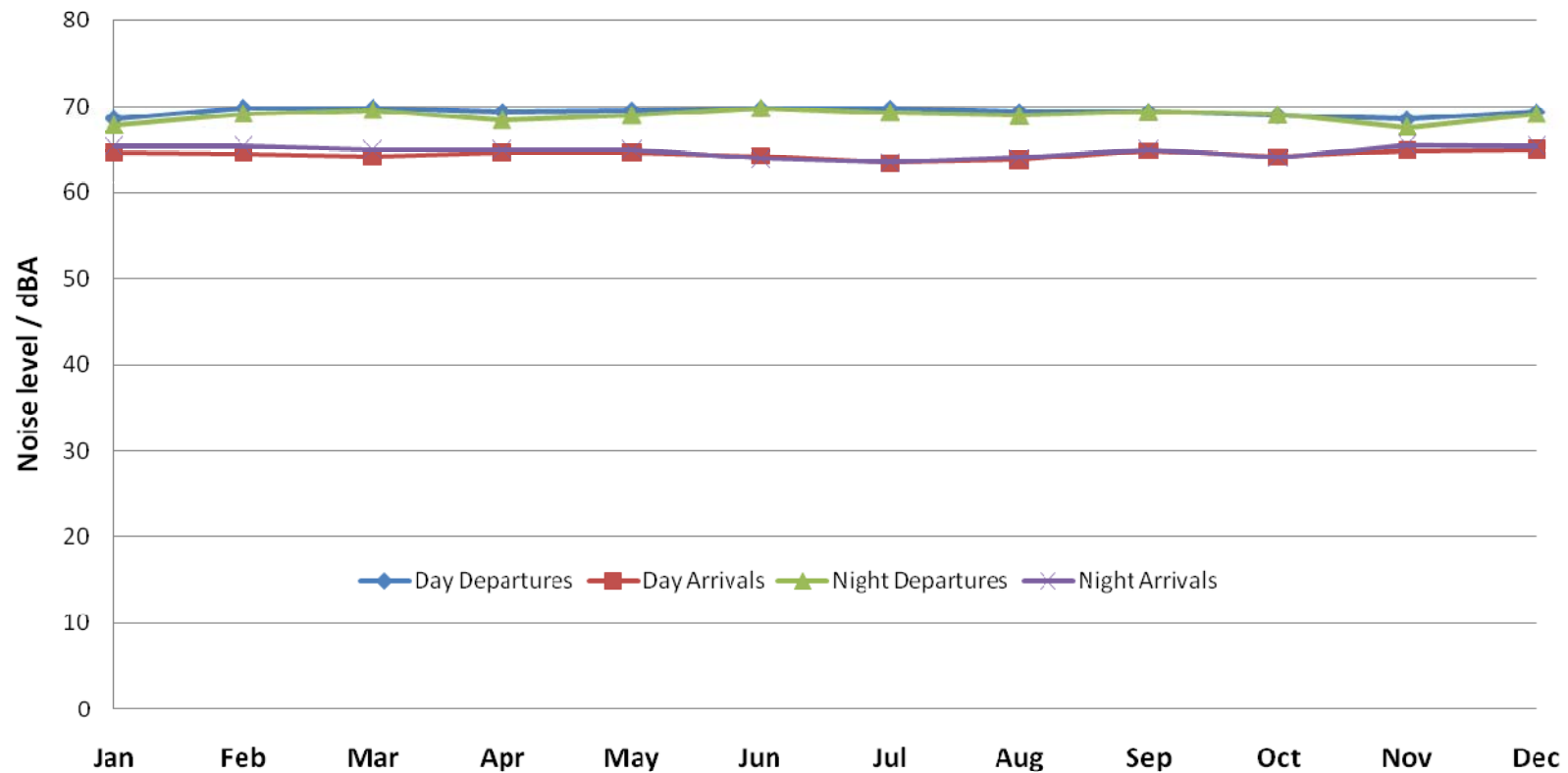




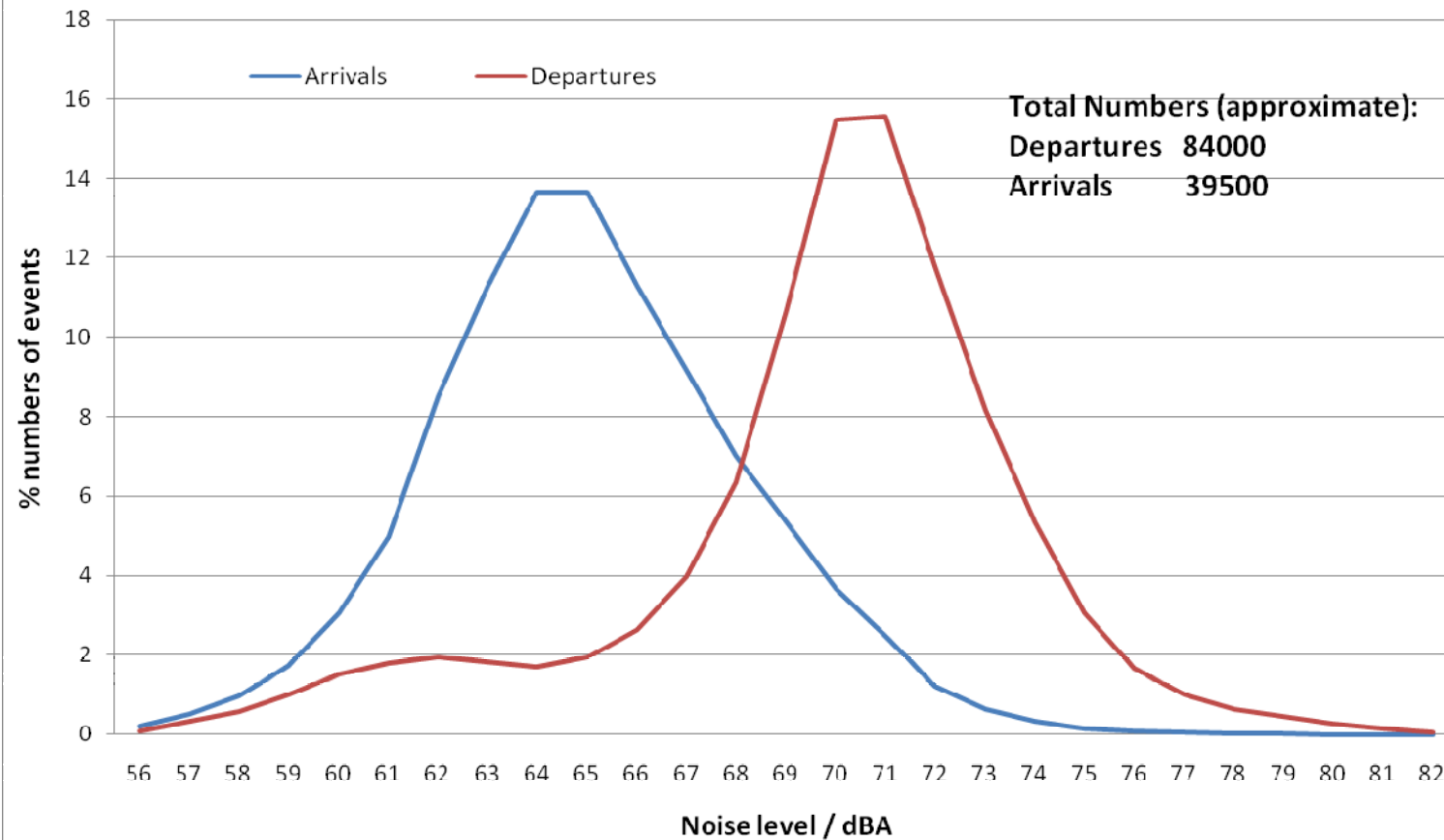
**Figure 4: Typical day to day variation of numbers of daytime aircraft noise events per hour at Rusper in October 2009**



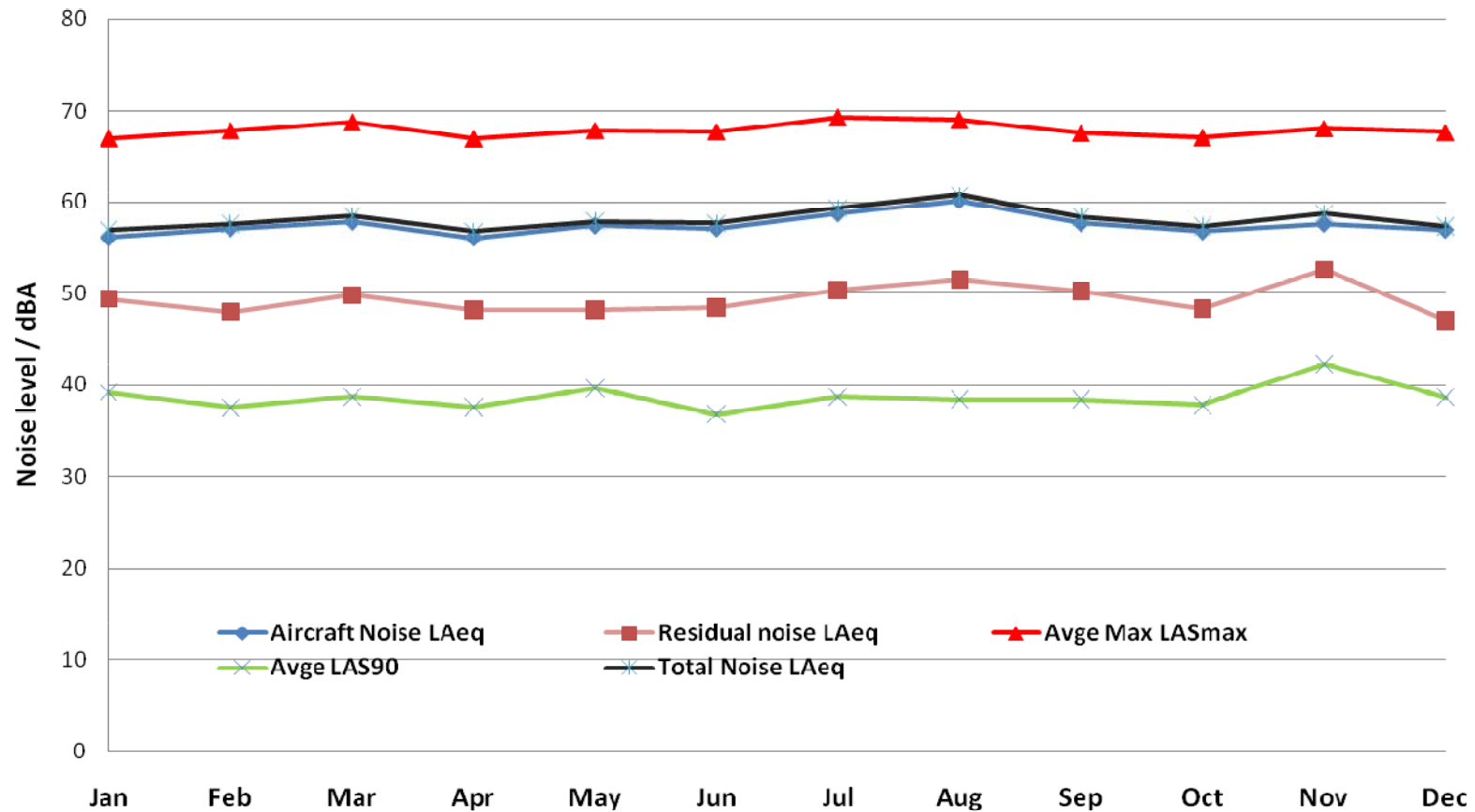
**Figure 5 Monthly average maximum values of aircraft noise events values at Rusper in 2009**

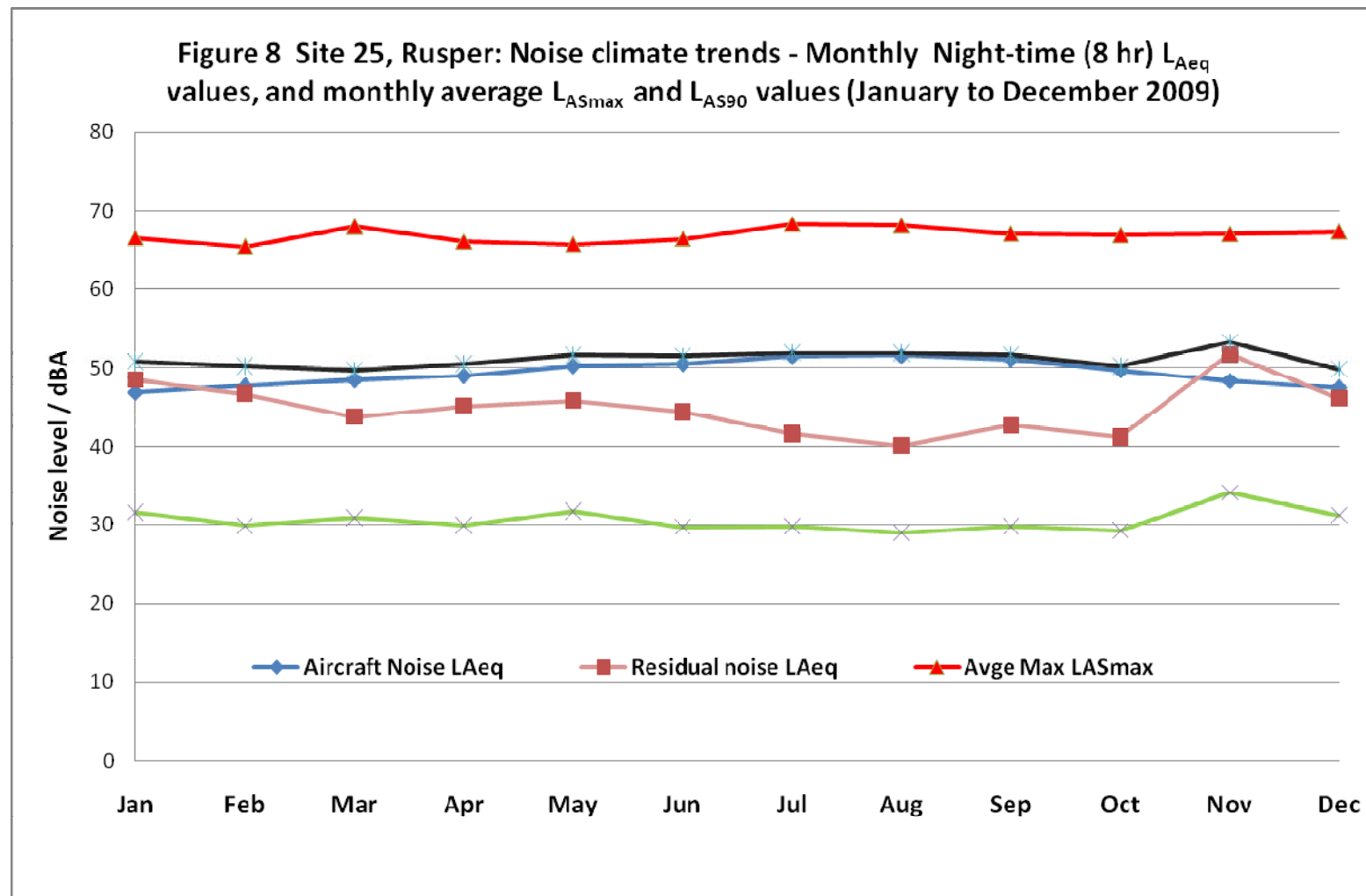


**Figure 6 Statistical distribution of maximum values of aircraft noise events at Rusper in 2009**

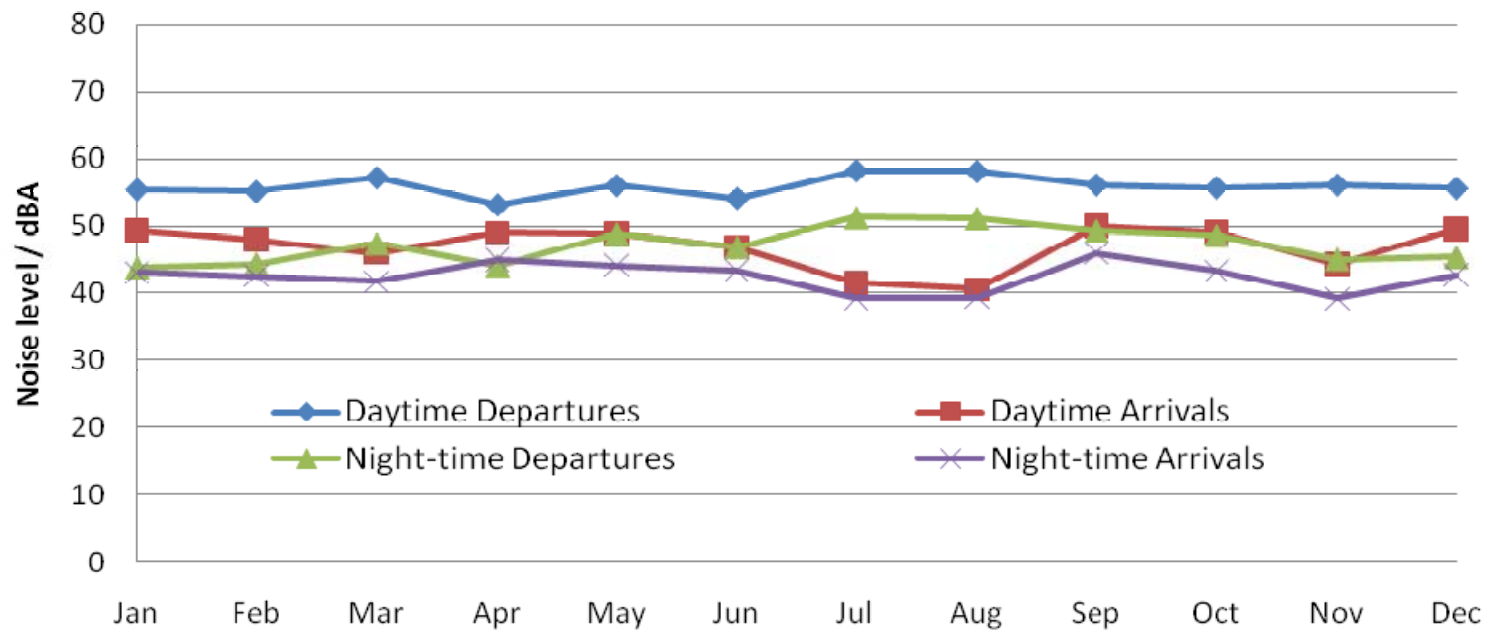


**Figure 7 Site 25, Rusper: Noise climate trends - Monthly Daytime (16 hr)  $L_{Aeq}$  values, and monthly average  $L_{ASmax}$  and  $L_{AS90}$  values (January to December 2009)**

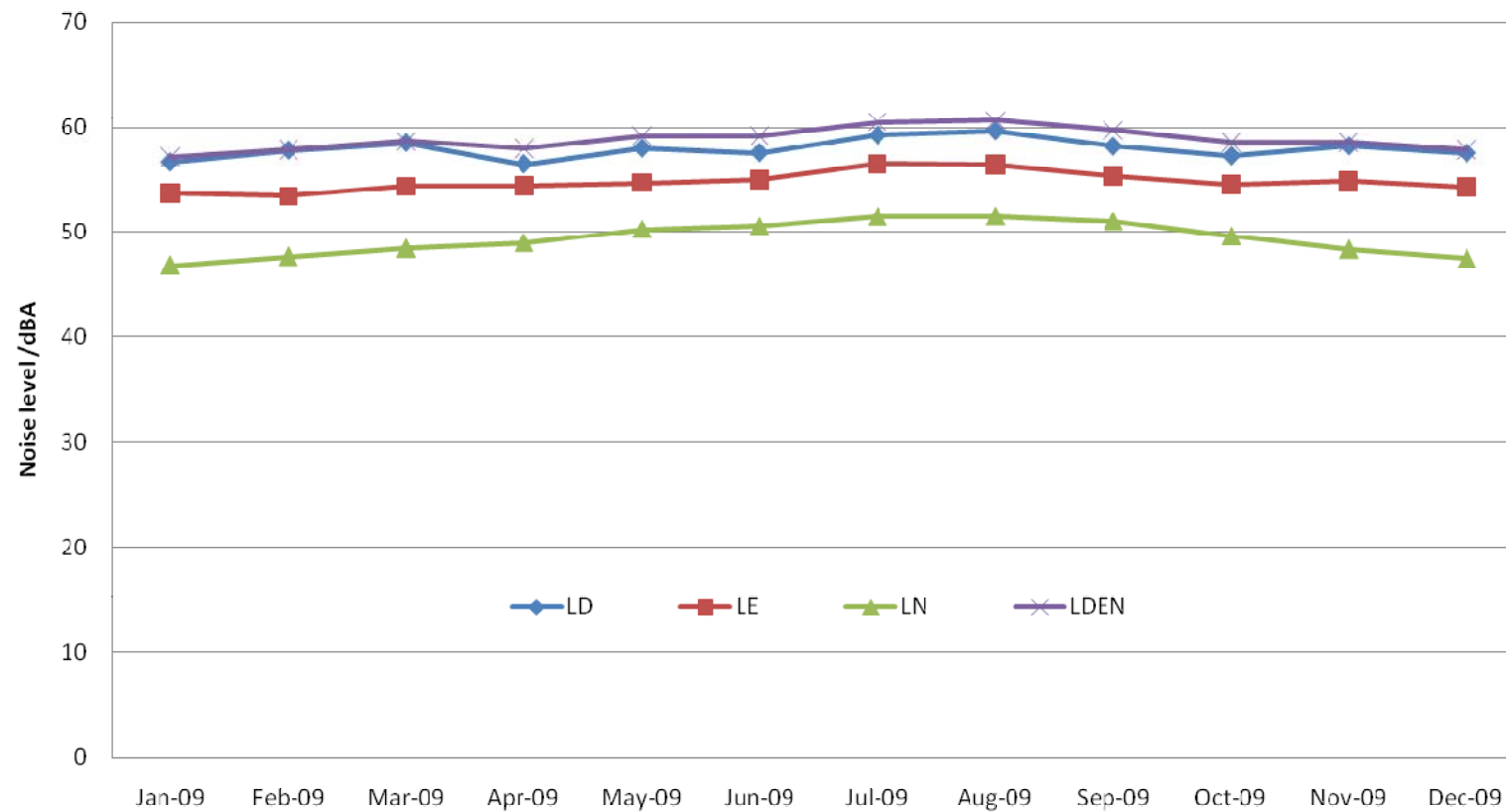




**Figure 9 Aircraft noise: Monthly LAeq values at site 25 (Rusper) January 2007 to December 2009**



**Figure 10 Variation of monthly average day, evening, night-time and Lden aircraft noise levels at Rusper from January to December 2009**



## APPENDIX 1

### ARRIVAL AND DEPARTURE TRACKS

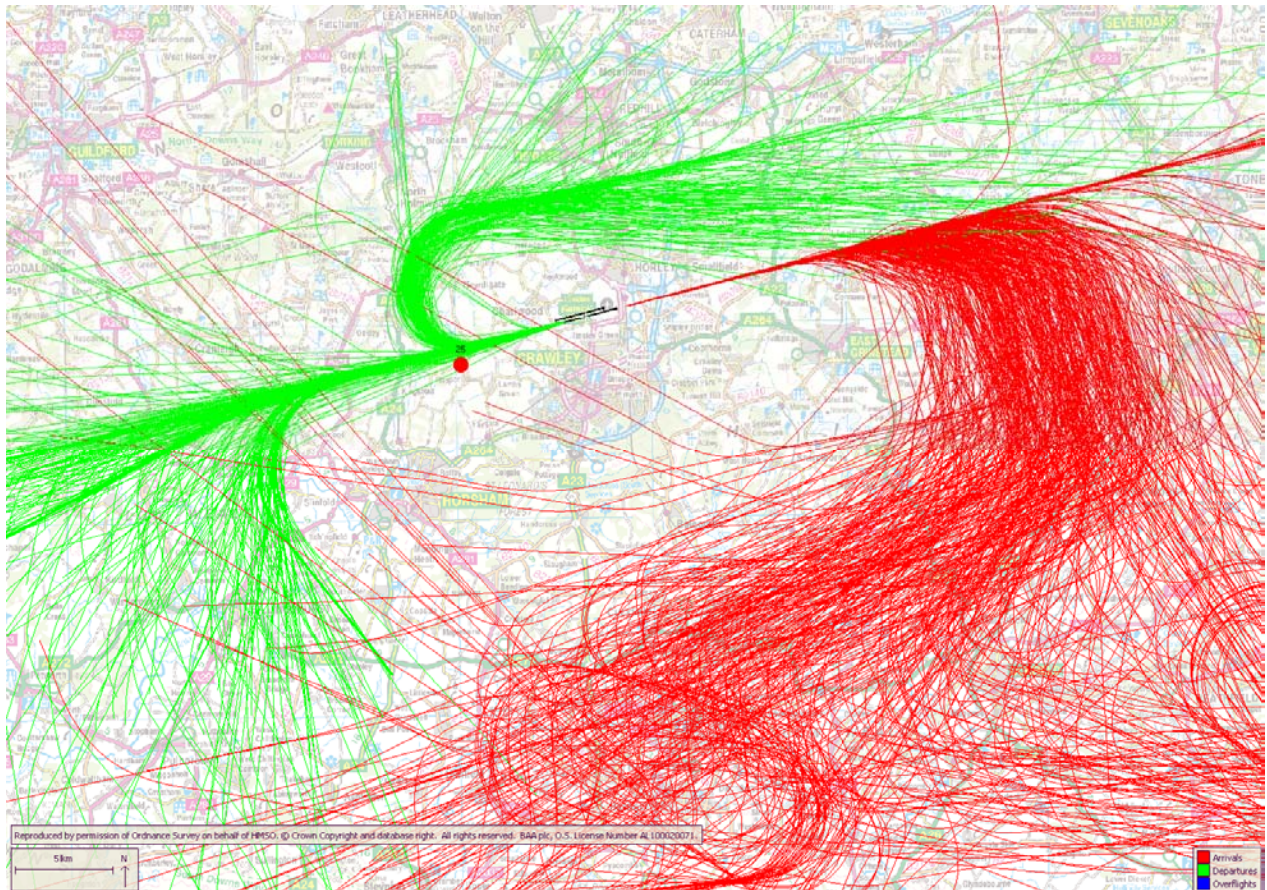


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Flight paths for a typical day of departures to the West (Arrivals are shown in Red and Departures in Green). The red dot shows the location of the noise monitor at Rusper.





Flight paths for a typical day of departures to the East (Arrivals are shown in Red and Departures in Green). The red dot shows the location of the noise monitor at Rusper



# AAD

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acoustic  
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## APPENDIX 2

### DATA FROM THE NOISE MONITORING TERMINAL



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## Appendix 2

### Data from the Noise Monitoring Terminal

The NMT always records all noise from all sources. It has, however, the facility to capture and show separately all noise events that meet particular pre-set conditions. This facility is used to capture noise events likely to arise from aircraft flying near to the monitor. The pre-set condition used for this study is that the noise must exceed a level of 55 dBA for a minimum duration of 10 seconds. This is arrived at following preliminary noise measurements at the site, and is broadly similar to conditions set for other such studies. It is of course likely that noise arising from activities other than aircraft using Gatwick Airport will occasionally cause noise events to be captured.

To determine which of all those events are due to aircraft using Gatwick Airport their ANOMS (Aircraft Noise Management System) 'noise to track' matching software compares all captured noise events with all Gatwick Airport's air traffic radar tracks. Noise events that are matched to aircraft are combined to provide a measure of 'aircraft noise' and noise events that are not matched to aircraft are included with 'all other noise' (i.e. that noise which is not captured as noise events, because it fails to meet the capture conditions of being above 55 dBA for 10 seconds), and is called residual noise.

Therefore wherever reference is made to aircraft noise events within this document it should be understood that these relate only to aircraft using Gatwick airport. Any noise arising from aircraft travelling to or from any other airport will be included as residual noise.

The selection of the threshold conditions (noise level and time period) which trigger the capture of a noise event is a compromise judgement designed to include as much of the noise from passing aircraft as possible whilst at the same time excluding, as far as possible, noise from other sources. For this survey a threshold trigger level 55 dBA for a duration of at least 10 seconds was used.

The following information is recorded for each noise event: date, time, duration, maximum noise level ( $L_{A_{Smax}}$ ) and SEL values, and, in addition, for aircraft noise events, event type (arrival/ departure), departure route, runway used, and aircraft type.

In addition to gathering data about noise events the NMT also collects and stores information on an hourly basis about the total level of noise at the site from all sources (including that from aircraft movements), including individual noise events.

Because the noise level is usually not constant, but varies continuously throughout each hour it is necessary to describe the total noise level statistically in terms of a measure of the average noise level throughout the hour (and called the hourly continuous equivalent noise level,  $L_{Aeq}$ ) and also in terms of a series of hourly percentile levels. The most important of these is the  $L_{AS90}$ , which is the noise level exceeded for 90% of each hour. This level of noise is conventionally taken to be a measure of the background noise level for each hour, and is the more or less constant level of noise which underlies the variations caused by various transient sources including aircraft.

## APPENDIX 3

### AIRCRAFT NOISE CONTOURS

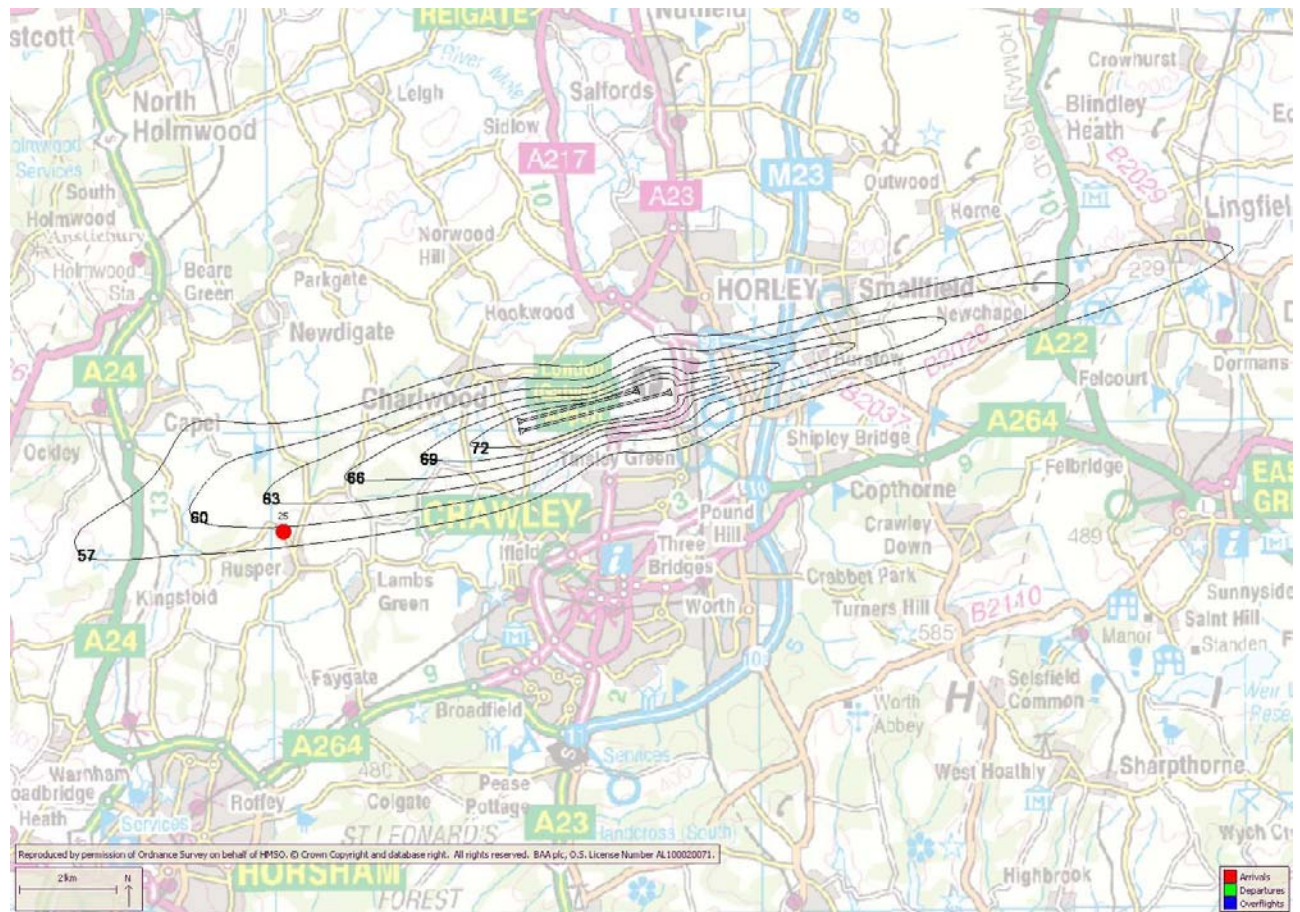


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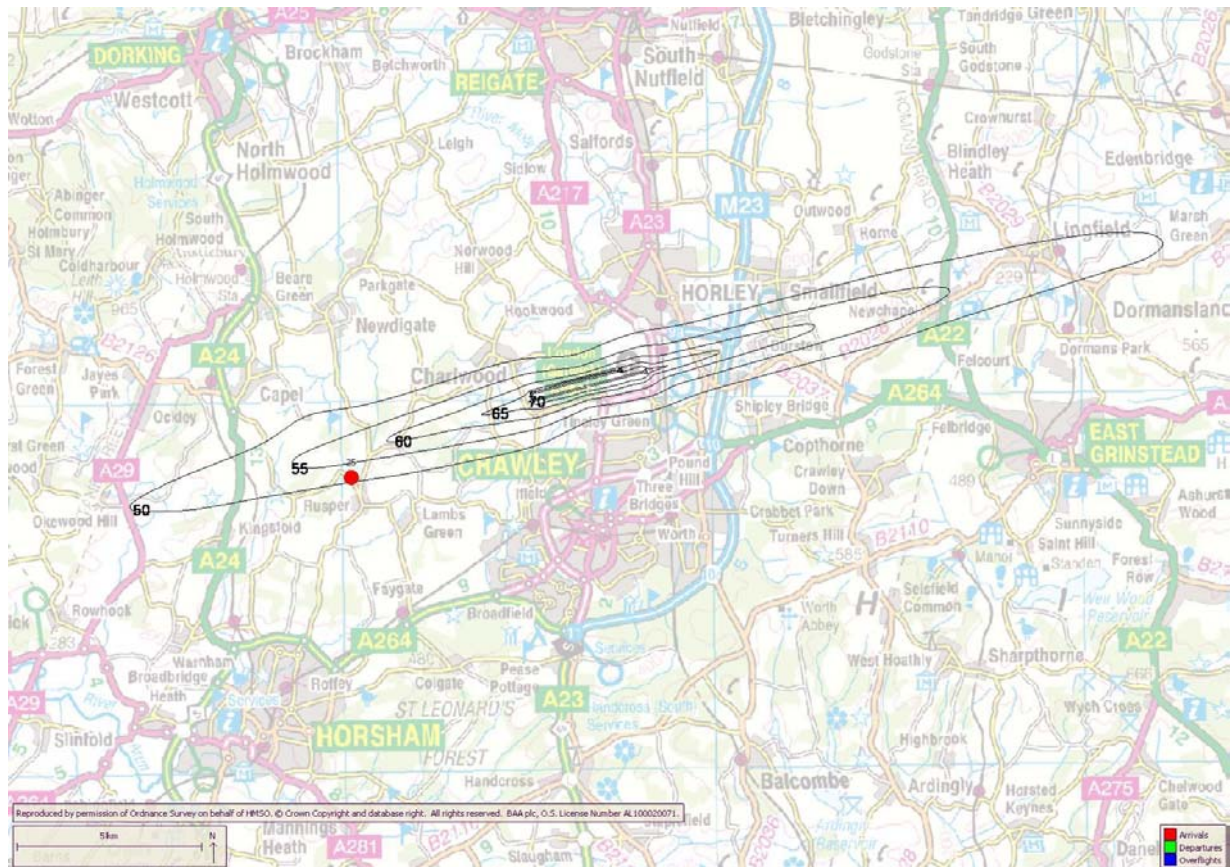
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LAeq contours for 2008 (location of noise monitor at Rusper shown as red dot)

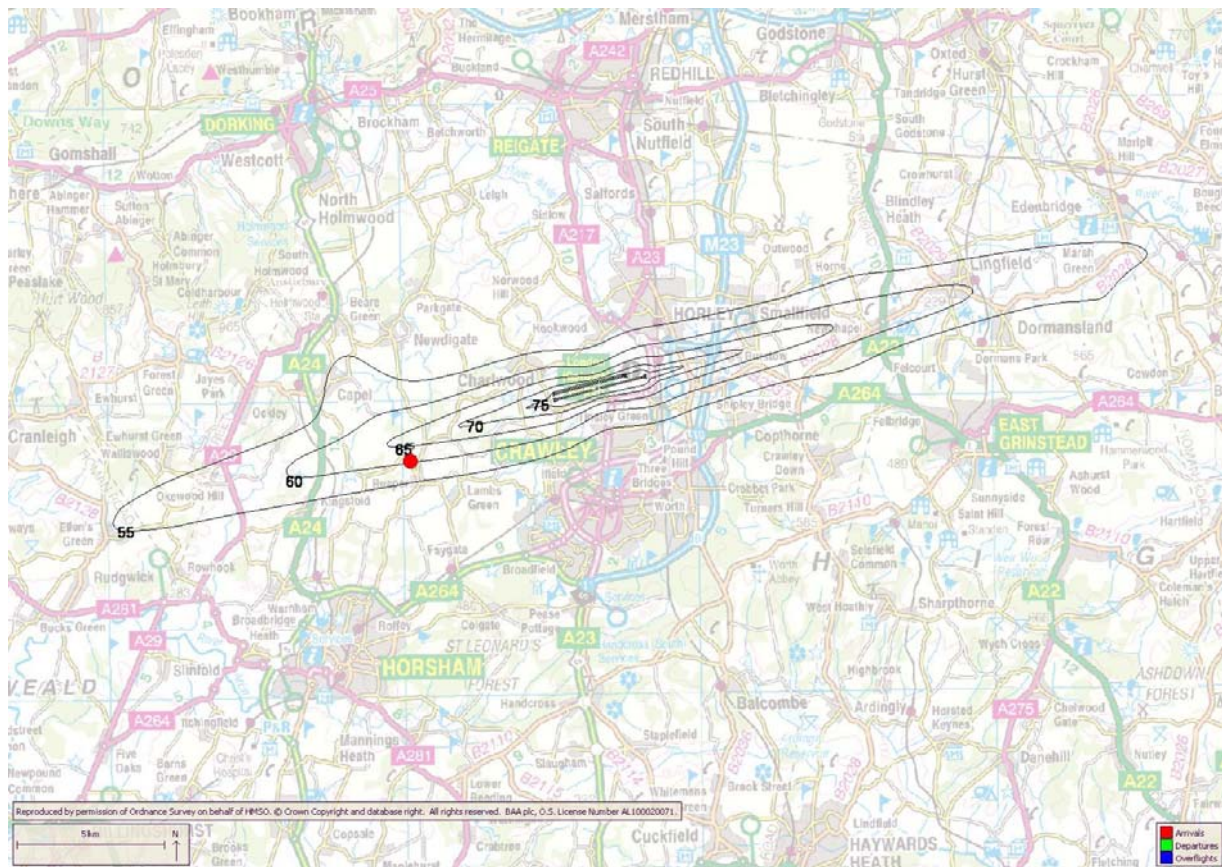


Lnight contours for 2006 (location of noise monitor at Rusper shown as red dot)





Lden contours for 2006 (location of noise monitor at Rusper shown as red dot)



## APPENDIX 4

### GLOSSARY OF ACOUSTIC TERMS



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## GLOSSARY OF TERMS

This glossary is presented in two parts. The first part contains definitions relating specifically to the context of this report, followed, in the second part, by a more general glossary of acoustic terms.

### Definitions relating specifically to the context of this Report:

**Aircraft Noise events** Noise events which have been matched by the GEMS noise and track keeping system to radar tracks in the vicinity of the NMT from aircraft arriving at or departing from Gatwick airport.

**Aircraft noise level** The average noise level derived from aircraft noise events, aggregated into hourly, daily or monthly average (LAeq) values.

**ANOMS** Airport Noise and Operations Monitoring System.  
  
The software data analysis system currently in use at the airport (incorporating the NTK system).

### Applied Acoustic Design (AAD)

Acoustic consultants retained by FEU

**Average  $L_{ASmax}$  level** The arithmetic average of the  $L_{ASmax}$  values of all the events (of a particular type i.e. either aircraft noise or community noise) which occur over a particular period of time (eg hour, day or month).

### Building Research Establishment

A former government organisation, now privately owned, which conducts research on noise. Carried out the National Noise Incidence Study for Defra in 2000.

**Defra** UK government Department for Environment Food and Rural Affairs, which has responsibility for aspects of policy relating to environmental noise

### Flight Evaluation Unit (FEU)

The unit within Gatwick Airport Limited which monitors all aircraft movements to ensure compliance with Department for Transport noise regulations relating to track keeping, noise abatement and night flights, and which also provides a means of investigating and responding to complaints and enquiries from the public.

### National Noise Incidence Study 2000

A study carried out by the Building Research Establishment for Defra based on a survey of noise levels outside 1020 dwellings in England and Wales in 2000, and extended to the rest of the UK in 2001, giving

proportions of the population exposed to various levels of environmental noise.

**Noise event** A burst of noise at a high level which satisfies the noise event capture conditions for a particular NMT, i.e. which exceeds the pre-set trigger noise level (in this report 55 dBA) for a pre-set time interval (in this report 10 seconds).

Noise events are detected, captured and stored by the NMT, and following subsequent processing by the NTK system are classified in this report as either aircraft noise events or community noise events

#### Noise Monitoring Terminal (NMT)

The noise measurement and analysis system installed at each site consisting of a precision grade sound level meter (Larson Davis type 870) inside a weather proof and tamper proof metal cabinet connected to an outdoor microphone located at a height of approximately 3.5 m above ground level.

**NTK system** Noise and Track Keeping system.

A software system able to match noise events recorded by the NMTs with aircraft tracks.

**PPG24** Planning Policy Guidance Note 24: Planning and Noise, a document issued by the UK government Department for the Environment in 1994 which gives guidance to local authorities and others on noise and planning.

**Residual noise** All noise arriving at the NMT microphone apart from aircraft noise events, i.e. comprising residual noise events and all other noise which does not satisfy the trigger conditions for capture as a noise event.

#### Residual Noise events

Those noise events which have not been matched by the NTK system to aircraft tracks using Gatwick Airport in the vicinity of the NMT.

#### Statistical frequency Analysis (of $L_{ASmax}$ noise levels)

An analysis of a group of  $L_{ASmax}$  values giving the numbers of events (or percentages of total numbers) at different dBA levels

**Total noise** All noise arriving at the NMT microphone, i.e. not only including all noise events (both aircraft and residual) but also all other noise which does not satisfy the trigger conditions for capture as a noise event.

**Total noise level** The average or continuous equivalent level ( $L_{Aeq}$ ) of the total noise at the site, recorded each hour by the NMT, which may also be aggregated into daily or monthly values.

**Total noise climate**      The level of the total noise at the NMT microphone varies with time. Over a particular period of time e.g. one hour, this variation may be described in terms of a number of different noise indices including the average or equivalent noise level, maximum and minimum noise level values and various percentile levels.

Such a description constitutes the noise climate at the site over that period of time.

The NMT records the following total noise indices every hour:

$L_{Aeq}$ ,  $L_{ASmax}$ ,  $L_{AS10}$ ,  $L_{AS50}$ ,  $L_{AS90}$  and  $L_{AS99}$ .

World Health Organisation

Issued 'Guidelines for Community Noise' in 2000

#### A general Glossary of acoustic Terms:

**A-weighting**      A method of producing a single figure measure of a broad band noise (as opposed to the 8 or 9 figures which make up an octave band spectrum) which takes into account, in an approximate way at least, the frequency response of the human hearing system. The idea is that sound levels measured in this way should give an indication of the loudness of the sound.

**A-weighted sound pressure level (dBA).**

The value of the sound pressure level, in decibels, measured using an A-weighting electronic circuit built into the sound level meter. The vast majority of noise measurements are carried out in this way.

**Day, evening, night level,  $L_{den}$**

An index of environmental noise based on average noise levels ( $L_{Aeq}$ ) throughout the 24 hour period, but with a weighting factor of 5 dBA added to evening noise levels (19.00 to 23.00 hours), and a weighting of 10 dB added to night-time noise levels (23.00 to 07.00 hours). It is the noise index used in the UK Noise mapping exercise commissioned by Defra in response to the European Union Directive on Environmental Noise in 2002.

**Decibel scale**      The decibel scale is the scale on which sound pressure levels are commonly measured. It is a logarithmic scale and is used for convenience to compress the audible range of sound pressures into a manageable range, from 0 dB to 140 dB. The zero of the scale, 0 dB, corresponds to the notional threshold of hearing, 0.00002 Pa, and the upper limit, 140 dB, corresponds to 20 Pa, which would cause immediate damage to the ear.



Equivalent continuous sound level ( $L_{Aeq,T}$ ), also called the Average noise level.

The  $L_{Aeq,T}$  represents a measure of the 'average' sound level over the measurement period. It corresponds to the steady continuous level of sound which, over the same period of time,  $T$ , would contain the same amount of (A-weighted) sound energy as the time varying noise.

This is the most common method of measuring time varying noise, and within certain limits gives the best correlation with human response to noise, for example with annoyance.

Frequency

The frequency of a musical note is what gives it its pitch. It is the number of cycles of the fluctuating sound pressure which occur each second, and is measured in cycles per second, Hertz (Hz). The human ear can detect frequencies in the range 20 to 20000 Hz.

Most noises are a mixture of all frequencies, called broad-band noise.

$L_{AS90,T}$

This is the most commonly used of many possible statistical measures of a time varying noise. It is the 90<sup>th</sup> percentile of the statistical noise level distribution, or, more simply, the noise level that is exceeded for 90% of the measurement time ( $T$ ). Thus over one hour for example it represents the noise level which is exceeded for all but (the quietest) six minutes of that hour.

It is commonly used as a measure of the background noise in any given situation, against which the level of any new, potentially intrusive source of noise is often compared. Background noise itself often varies with time and so the  $L_{A90,T}$  is almost universally used as the best measure of the 'more or less always present' noise level which underlies short term variations from other sources of noise.

Although it is more usual to measure LA90 using the F weighting, the Slow weighting has been used for the data in this report, i.e. LAS90. It is not considered that the use of the S weighting will make any significant difference to the LA90 values in this case. (See under Time Weighting, Fast(F) and Slow(S)) below.

Maximum sound pressure level ( $L_{ASmax,T}$ )

This is the highest value of the time weighted sound pressure level, (measured using the A frequency weighting and the Slow time weighting) which occurred during the measurement period,  $T$ . It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a

very small fraction of a second, may not have any effect on the  $L_{Aeq,T}$  value.

In the context of this report the  $L_{ASmax}$  value for each aircraft noise event and community noise event is monitored

In this report, in line with standard practice for aircraft noise measurement, the Slow (S) time weighting has been used for measurement of maximum levels of aircraft noise, hence reference is made to  $L_{ASmax}$ . (See under Time Weighting, Fast(F) and Slow(S)) below.

Noise Unwanted sound

Octave band spectra In order investigate the frequency content of broad band sounds, called its frequency spectrum, measurements of sound pressure are carried out over a range of frequency bands. The most common method is to split the audio frequency range into 8 or 9 octave bands. An octave is a frequency range from one particular frequency to double that frequency.

Octave band measurements are not referred to in this report.

Percentile noise level, ( $L_{ASN}$ , where N is a number between 0 and 100)

The noise level which is exceeded for N% of the measurement period. For example, a value of  $L_{A10,1hour}$  of 57 dBA means that in that hour the noise level was at or above 57 dBA for 6 minutes (i.e. 10% of an hour), or alternatively, was at or below 57 dBA for 54 minutes.

Sound exposure level (SEL)

This is a measure of the A-weighted sound energy used to describe single noise events such as the passing of a train or aircraft; it is the A-weighted sound pressure level which, if occurring over a period of one second, would contain the same amount of A-weighted sound energy as the event.

SEL values for events may be used to calculate the average noise level over a period of time (hour, day or month)

Sound pressure sound is a disturbance or fluctuation in air pressure, and sound pressure, measured in Pascals (Pa), is used as a measure of the magnitude of the sound. The human ear can detect sound pressures in the range from 0.00002 Pa to 20 Pa. This is an enormously wide range and so for convenience sound pressures are commonly measured on a decibel (dB) scale.

Time varying noise When the level of noise varies with time, as is often the case, for example with noise from road traffic, various measures or noise indices as they are called are used to give a single figure description of the

noise over a given period of time. The three most commonly used noise indices are the  $L_{Aeq,T}$ , the  $L_{A90,T}$  and the  $L_{Amax,T}$  values.

In all three cases the 'L' stands for the level of the sound in decibels, the 'A' for the fact that it is the A- weighted value, and the 'T' for the time period over which the noise is measured, for example 5min, 1 hour, 24 hour etc.

#### Time weighting (Fast (F) and Slow (S))

An exponential function of time, of a specified time constant, that weights the square of the instantaneous sound pressure. (Defined in BS EN 61672 – 1:2003).

There are two time constants defined in BS EN 61672 – 1:2003, designated Fast (F) and Slow (S), and noise indices such as the maximum, or percentile noise levels which are based on instantaneous time-weighted sound pressure should indicate which time weighting has been used in the measurement.

In this report, in line with standard practice for aircraft noise measurement, the Slow (S) time weighting has been used for measurement of maximum levels of aircraft noise, hence reference is made to  $L_{ASmax}$ . Because the sound level meter cannot measure using both Fast and Slow weightings simultaneously this necessarily means that the 90th percentile values have also been measured using the S weighting, hence reference is made to  $L_{AS90}$ . Although it is more usual to measure  $LA90$  using the F weighting, it is not considered that the use of the S weighting will make any significant difference to the  $LA90$  values in this case.