

Date: 14 December 2009

Our ref: 09296/002/rp

**A REPORT OF MONITORING OF
AIRCRAFT NOISE FROM STANSTED AIRPORT
AT REED (near ROYSTON), ESSEX
BETWEEN JUNE AND SEPTEMBER 2008**

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Summary

A mobile Noise Monitoring Terminal (NMT) was deployed by Stansted Airport between 5th June to 18th September 2008. The site is approximately 14 miles NW of Stansted airport, at Reed (near Royston), Essex.

The aim of this report is to present the results of this three month noise monitoring exercise and to interpret the results in a way that places the contribution of the noise from aircraft using Stansted in the context of the overall noise climate from all other sources.

The NMT records noise data relating to all noise events which exceed a selected threshold noise level for a selected minimum period of time. These selected conditions were 56 dBA for 10 seconds.

These noise events are then compared by the airport's ANOMS (Airport Noise and Operations Monitoring System) noise and track keeping computer system with radar tracks of aircraft arriving at or departing from Stansted Airport. Only those noise events which are matched with Stansted aircraft tracks are called aircraft noise events, and those that are not matched are designated as residual noise events. The remainder of the noise at the site, i.e. noise not captured as events, (because it fails to meet the capture conditions of being above 56 dBA for 10 seconds) is also classified as 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 Stansted airport. Any noise arising from aircraft travelling to or from any other airport (i.e. overflights) will be included as residual noise.

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

A total of 2504 aircraft noise events occurred during the 105 days in the three month survey period. The number of aircraft noise events per day ranged from 1 to 56, with an average of 24 events per day. There were 2368 noise events due to departing

aircraft (1968 from runway 23 and 400 from runway 05), and 132 were due to arrivals (121 from runway 23 and 11 from runway 05), with 4 events due to overflights.

The numbers of aircraft noise events did not show any obvious correlation with day of the week or weekends. The highest numbers of aircraft noise events per hour occurred in the morning between 08.00 and 09.00 hours (local time).

The maximum level of aircraft noise events (L_{ASmax}) over the three month period ranged between 56 dBA and 75 dBA. The average maximum noise level of events per day ranged between 57 dBA and 61 dBA with an overall average value of 60 dBA.

The average noise level (L_{Aeq} value) of aircraft noise events, which have an average duration of about 22 seconds, is 57 dBA.

The total noise climate at the site may be characterised by average hourly values of various noise percentile levels, and by the average (or equivalent) noise level (L_{Aeq}). These values were fairly constant during the daytime, between 07.00 and 19.00 hours (with average values of L_{AS10} of 49 dBA, L_{AS90} of 40 dBA and L_{Aeq} of 49 dBA), but falling to lower levels in the late evening, night-time and early morning periods. The average value over the night-time period from 23.00 to 07.00 hours (L_{Aeq} values) was 42 dBA, and for the evening period from 19.00 to 23.000 hours was 46 dBA.

It is possible to convert the hourly 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 three months period, an L_{den} value of 51dBA.

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 5 dBA bands. As an example the L_{den} value for this site places it in the lowest noise exposure band, occupied by 33% of dwellings in the UK.

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

The daily average (L_{Aeq}) level of the total noise at the site is a combination of that due to aircraft noise events and that due to residual noise. The residual noise provides the major component, generally within 1 dBA of the total noise level, with the average level due to aircraft noise events usually being more than 10 dBA below the average (L_{Aeq}) level of total noise at the site

Therefore although each individual aircraft noise event is likely to be clearly audible and distinguishable, aircraft noise events in total make only a relatively minor contribution to the average (L_{Aeq}) level of total noise at the site.

The average maximum noise level (L_{ASmax}) during aircraft noise events does not vary significantly with aircraft type for the aircraft types which make up most of the aircraft noise events.

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.

1.0 Introduction

- 1.1 A mobile Noise Monitoring Terminal (NMT) was deployed by Stansted Airport for a three-month period from 5th June to 18th September 2008, a total of 105 vdays.
- 1.2 The site is approximately 14 miles North West of Stansted airport, at Reed near Royston in Essex, and close to routes for departures from both East and West directions i.e. from both runways 23 (mostly) and runway 05 when to the east. The A10 trunk road is to the west of the site and traffic noise from the A10 can be heard when the wind is from the west. Otherwise there is noise from occasional road traffic and farm vehicles along the minor roads nearby.
- 1.3 A map showing the location is presented in Appendix 1, together with example of flight paths passing close to the site.
- 1.4 The aims of this report are:
- to present the results of the three month noise monitoring survey, and
 - to interpret the results in a way that places the contribution of the noise from passing aircraft using Stansted 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.
- 1.4 A glossary of technical terms used in this report is given in the Appendix 2.

2.0 Data from the Noise Monitoring Terminal

- 2.1 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 56 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 Stansted Airport will occasionally cause noise events to be captured.

- 2.2 To determine which of all those events are due to aircraft using Stansted Airport their ANOMS (Aircraft Noise Management System) 'noise to track' matching software compares all captured noise events with all Stansted 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 56 dBA for 10 seconds), and is called residual noise.
- 2.3 Therefore wherever reference is made to aircraft noise events within this document it should be understood that these relate only to aircraft using Stansted airport. Any noise arising from aircraft travelling to or from any other airport (i.e. overflights) will be included as residual noise.
- 2.4 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
- 2.5 The following information is recorded for each noise event: date, time, duration, L_{ASmax} and SEL values, and, in addition, for aircraft noise events, event type (arrival/ departure), departure route, runway used, and aircraft type.
- 2.6 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.
- 2.7 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.

3.0 Analysis of Noise Monitoring Survey Results

3.1 The numbers of aircraft noise events

3.1.1 A total of 2504 aircraft noise events occurred during the 105 days in the three month survey period. There were 2368 noise events due to departing aircraft (1968 from runway 23 and 400 from runway 05), and 132 were due to arrivals (121 from runway 23 and 11 from runway 05), with 4 events due to overflights.

3.1.2 Figure 1 shows the total number of aircraft noise events occurring each day during the 3 months survey period from June to September 2008. The number of aircraft noise events per day ranged from 1 to 56, with an average of 24 events per day. There was no obvious correlation between the number of aircraft noise events and the day of the week or weekend.

3.1.3 Figure 2 indicates the average distribution of numbers of aircraft noise events throughout the day, showing that the highest numbers events per hour occurred in the morning between 08.00 and 09.00 hours (local time).

3.2 Maximum noise levels of aircraft noise events

3.2.1 The NMT recorded the maximum noise level (measured using the 'A' frequency weighting and the Slow (S) time weighting) produced by each aircraft noise event, (L_{ASmax}). These values ranged from 56 dBA to 75. Figure 3 indicates the average L_{ASmax} value of aircraft noise events recorded each day during the three month monitoring period. It can be seen that average maximum level per day ranges between 57 dBA and 61dBA with an overall average value of 60 dBA.

3.2.2 Figure 4 shows the variation of average hourly value of L_{ASmax} value for the three month period. This was generally between 58 dBA and 61 dBA except for the two early morning hours between 03.00 and 05.00 hours, although, as shown by Figure 2, these values arose from only two events, one in each of these two hourly periods.

3.2.3 Figure 5 shows the statistical distribution and cumulative frequency distribution of L_{ASmax} values for the three month period. It can be seen that the most commonly occurring

L_{ASmax} value (the mode of the distribution) is 59 dBA and that more than 90% of the values lay between 60 to 70 dBA, and more than 50% between 56 and 63 dBA.

3.3 Durations and average noise levels of aircraft noise events

3.3.1 The duration of 90% of the aircraft noise events was between 10 seconds and 34 seconds, with an average value of 22 seconds.

3.3.2 In addition to L_{ASmax} values the NMT also recorded the Single Event Noise Level (SEL) for each aircraft noise event. This parameter relates to the amount of sound energy in each event, and may be used to calculate the average noise level, or L_{Aeq} value, over the event duration. These L_{Aeq} values range from 54 to 60 dBA with an average value of 57 dBA.

3.3.3 Thus a typical aircraft noise event represents an average noise level of about 57 dBA for about 22 seconds.

3.4 The Total noise climate at the site

3.4.1 The NMT also recorded the total noise level (i.e. from all sources, including aircraft and residual noise events) each hour, measured in terms of the hourly values of L_{Aeq} (representing the average noise level over the hour) and the following statistical percentile levels: L_{AS1} , L_{AS10} , L_{AS50} , L_{AS90} and L_{AS99} , where, for example L_{AS10} is the noise level (measured using the 'A' frequency weighting (i.e. in dBA) and the Slow (S) time weighting) exceeded for 10% of the 1 hour measurement time interval. Figure 6 shows these values averaged over the three month noise survey period for each hour of the day.

3.4.2 It can be seen that the value of each index is fairly constant from about 07.00 hours to 19.00 hours (with average values of L_{AS10} of 49 dBA, L_{AS90} of 40 dBA and L_{Aeq} of 49 dBA) but then falls off outside these times i.e. in the late evening, night-time and early morning periods.

3.4.3 Since the noise levels at the site do not vary much from hour to hour in the daytime they are unlikely to vary much within each hour, and so the data shown in Figure 6, and particularly the L_{Aeq} values could be used as a good indication of 30 minute L_{Aeq} values,

required in Building Bulletin 93 for the assessment of noise climates near to schools in the vicinity.

3.4.4 For a period of one hour the value of the L_{AS10} noise index is the noise level exceeded for 6 minutes in that hour, and value of the L_{AS90} noise index is the noise level exceeded for 54 minutes in the hour, so that noise levels at or below the L_{AS90} value occur for 6 minutes in the hour. Thus Figure 6 shows that for a typical hour in the daytime (07.00 to 19.00 hours) the average total noise level at this site would be 49 dBA, and would exceed 49 dBA for 6 minutes, and would be below 40 dBA for 6 minutes, and would therefore be between 40 and 49 dBA for 48 minutes of the hour.

3.4.5 It is possible to convert the hourly L_{Aeq} values into the 24 hour L_{den} noise index (day evening night level) used by Defra for noise mapping purposes, giving an L_{den} value of 51 dBA.

3.5 Putting the noise climate at the site into a wider UK context

3.5.1 The National Noise Incidence survey of noise levels in the UK in 2000 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 living in dwellings exposed to daytime noise levels ($L_{Aeq, 16\text{ hour}}$) in 5 dB bands, in 2000 National Noise Incidence survey	
5 dB noise exposure level bands	Proportion in band
Less than 50 dBA	30%
50 dBA < L < 55 dBA	37%
55 dBA < L < 60 dBA	18%
Greater than 60 dBA	15%

3.5.2 From the data used to compile Figure 6 the 16 hour L_{Aeq} value for this site is 48.8 dBA, and this puts the site in the lowest noise exposure band, occupied by 30 % of dwellings in the UK.

3.5.3 A similar breakdown is given for the L_{den} index:

Proportion of UK population living in dwellings exposed to noise levels in 5 dB bands, according to the L_{den} noise index, in 2000 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%

3.5.4 Since the 16 hour L_{den} value for this site is 51 dBA (from paragraph 3.4.4) this puts the site in the lowest noise exposure band, occupied by 33% of dwellings in the UK.

World Health Organisation and PPG 24 Guidance on Community Noise

3.5.5 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."

3.5.6 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 $L_{Aeq, 8h}$.

3.5.7 The noise exposure levels at this site based on the data collected during the 3 month noise survey period (an L_{Aeq} of 48.8 dBA in the daytime and 42 dBA at night-time) are below the WHO Guidelines of 55 dBA in the daytime, and also below the night-time Guideline value of 45 dBA.

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

3.6.1 By using the Single Event Noise Level (SEL) for each aircraft noise event it is possible to calculate the average, or equivalent aircraft noise level (L_{Aeq}) due to aircraft noise events over a period of time (hour, day or month). Although this average noise level bears little relationship to the aircraft noise as heard, which occurs in short bursts of

noise at higher levels rather than as a lower continuous average level, it is, nevertheless, a useful parameter for comparative purposes.

- 3.6.2 Since the NMT also records hourly L_{Aeq} values of the total noise from the site it is possible, by subtracting the aircraft noise level from the total noise level (using the decibel (or logarithmic) subtraction process which is appropriate in this case) to calculate the remaining component of the total noise, i.e. the residual noise.
- 3.6.3 The residual noise is a combination of the noise from residual noise events (i.e. those captured noise events which did not match with aircraft movements) and from other residual noise, not captured as noise events, i.e. all other noise recorded by the monitor that did not exceed the trigger level for the required minimum time period.
- 3.6.4 Figure 7 shows a comparison between the average hourly L_{Aeq} values of the total noise, aircraft noise and residual noise by hour of day throughout the three month period.
- 3.6.5 It can be seen that for the daytime period from 07.00 hours to 23.00 hours, when most of the aircraft noise events occur, the total noise level varies between 45 dBA and 54 dBA, with an average of about 49 dBA. The major contribution to the total noise at the site arose from residual noise; residual noise levels throughout the 24 hour period were generally within 1 dBA of the total noise level. The level due to aircraft noise events was, on average more than 10 dBA lower than the total noise and residual noise, with a daytime average value of 36 dBA.
- 3.6.6 Figure 7 shows that when the noise from aircraft noise events is cumulatively averaged over an extended period of time (of hours days or weeks) they make only a relatively minor contribution to the average level of total noise at the site. However each individual aircraft noise event is likely to be clearly audible and distinguishable because, in addition to a change in character, it results in an increase in the level of the background noise by 10 dBA or more for a period of about 22 seconds

3.7 The contribution of different aircraft types to aircraft noise at the site

- 3.7.1 Forty nine different aircraft types contributed to the total number of 2504 aircraft noise events which occurred during the three month period. Figure 8 shows the numbers of

events from the different types of aircraft. Each aircraft type shown in Figure 8 is described by a 3 character source code. A list of these codes is given in Appendix 3.

3.7.2 Although 49 different aircraft were involved in total, one aircraft type accounted for more than 50% of the events, and more than 75% arose from only two types of aircraft: Boeing 737-800: 1733 events, Airbus A319: 236 events.

3.7.3 Figure 9 shows the average L_{ASmax} value for each aircraft type, and it can be seen that there is very little variation among the most commonly occurring aircraft types. Although there are a few aircraft types which produce significantly higher values of L_{ASmax} there are only very small numbers of these types of events.

4.0 Summary and Conclusions

4.1 A total of 2504 aircraft noise events occurred during the 105 days in the three month survey period. The number of aircraft noise events per day ranged from 1 to 56, with an average of 24 events per day. There were 2368 noise events due to departing aircraft (1968 from runway 23 and 400 from runway 05), and 132 were due to arrivals (121 from runway 23 and 11 from runway 05), with 4 events due to overflights.

4.2 The numbers of aircraft noise events did not show any obvious correlation with day of the week or weekends. The highest numbers of aircraft noise events per hour occurred in the morning between 08.00 and 09.00 hours (local time).

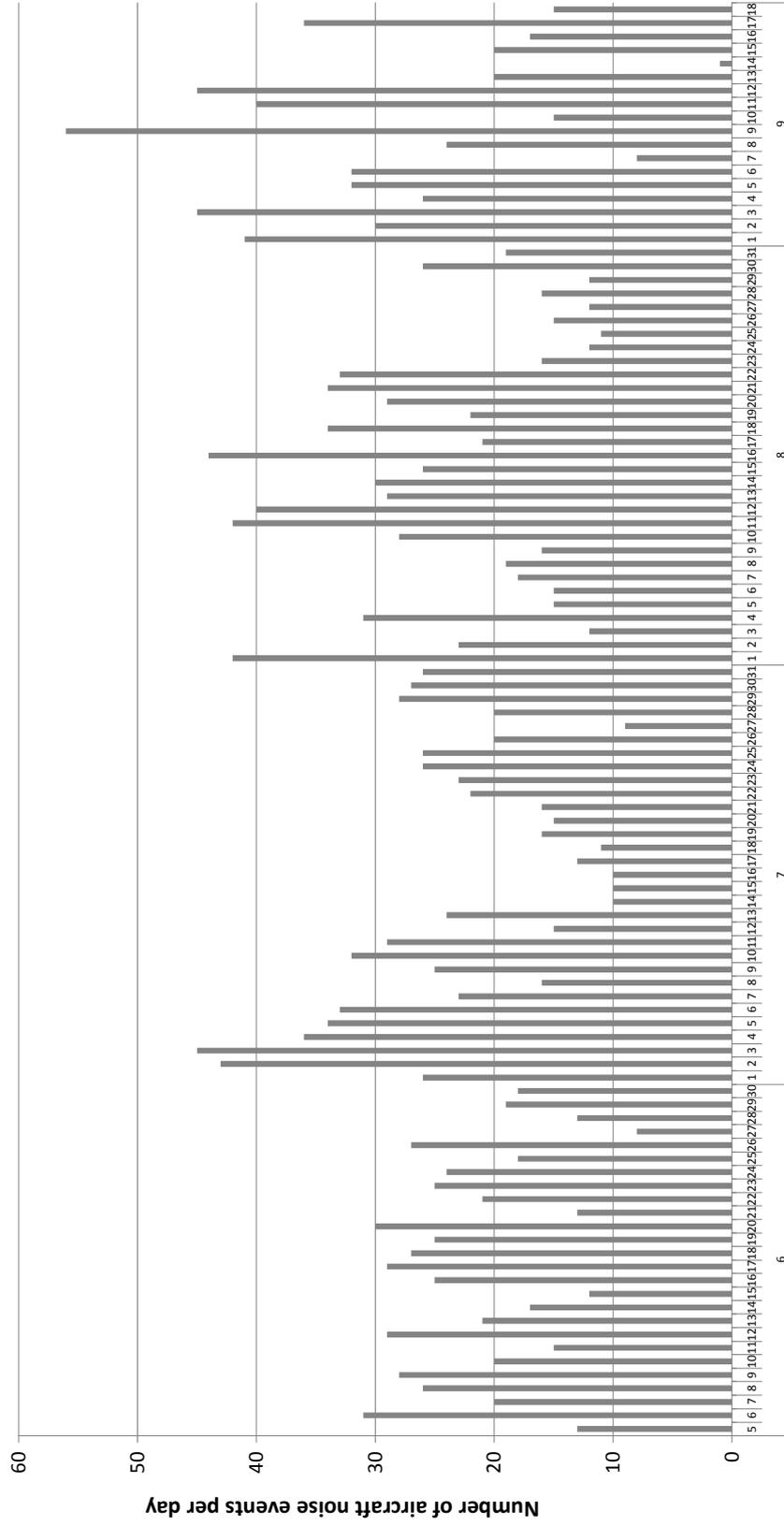
4.3 The maximum level of aircraft noise events ranged between 56 dBA and 75 dBA. The average maximum noise level (L_{ASmax}) of events per day ranged between 57 dBA and 61 dBA with an overall average value of 60 dBA.

4.4 The average noise level (L_{Aeq} value) during aircraft noise events, which have an average duration of about 22 seconds, is 57 dBA.

4.5 The total noise climate at the site may be characterised by average hourly values of various noise percentile levels, and by the average (or equivalent) noise level (L_{Aeq}). These values were fairly constant during the daytime, between 07.00 and 19.00 hours (with average values of L_{AS10} of 49 dBA, L_{AS90} of 40 dBA and L_{Aeq} of 49 dBA), but falling to lower levels in the late evening, night-time and early morning periods. The average

- value over the night-time period from 23.00 to 07.00 hours (L_{Aeq} values) was 42 dBA, and for the evening period from 19.00 to 23.000 hours was 46 dBA.
- 4.6 It is possible to convert the hourly 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 three months period, an L_{den} value of 51dBA.
- 4.7 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 5 dBA bands. As an example the L_{den} value for this site places it in the lowest noise exposure band, occupied by 33% of dwellings in the UK.
- 4.8 Levels of noise exposure (L_{Aeq}) at this site are below the World Health Organisation Guidelines of 55 dBA in the daytime, and 45 dBA at night-time.
- 4.9 The daily average (L_{Aeq}) level of the total noise at the site is a combination of that due to aircraft noise events and that due to residual noise. The residual noise provides the major component, generally within 1 dBA of the total noise level, with the average level due to aircraft noise events usually being more than 10 dBA below the average (L_{Aeq}) level of total noise at the site
- 4.10 Therefore although each individual aircraft noise event is likely to be clearly audible and distinguishable, aircraft noise events in total make only a relatively minor contribution to the average (L_{Aeq}) level of total noise at the site.
- 4.11 The average maximum noise level (L_{ASmax}) during aircraft noise events does not vary significantly with aircraft type for the aircraft types which make up most of the aircraft noise events.
- 4.12 The information presented in this report will serve as a baseline for comparison with any future noise level surveys at this location.

Figure 1: Number of aircraft noise events per day at Reed (near Royston) from 5 June to 18 September 2008



Day of the month (from 5 June to 18 September)

Figure 2: Number of aircraft noise events by hour of day at Reed (near Royston) , 5 June to 18 September 2008

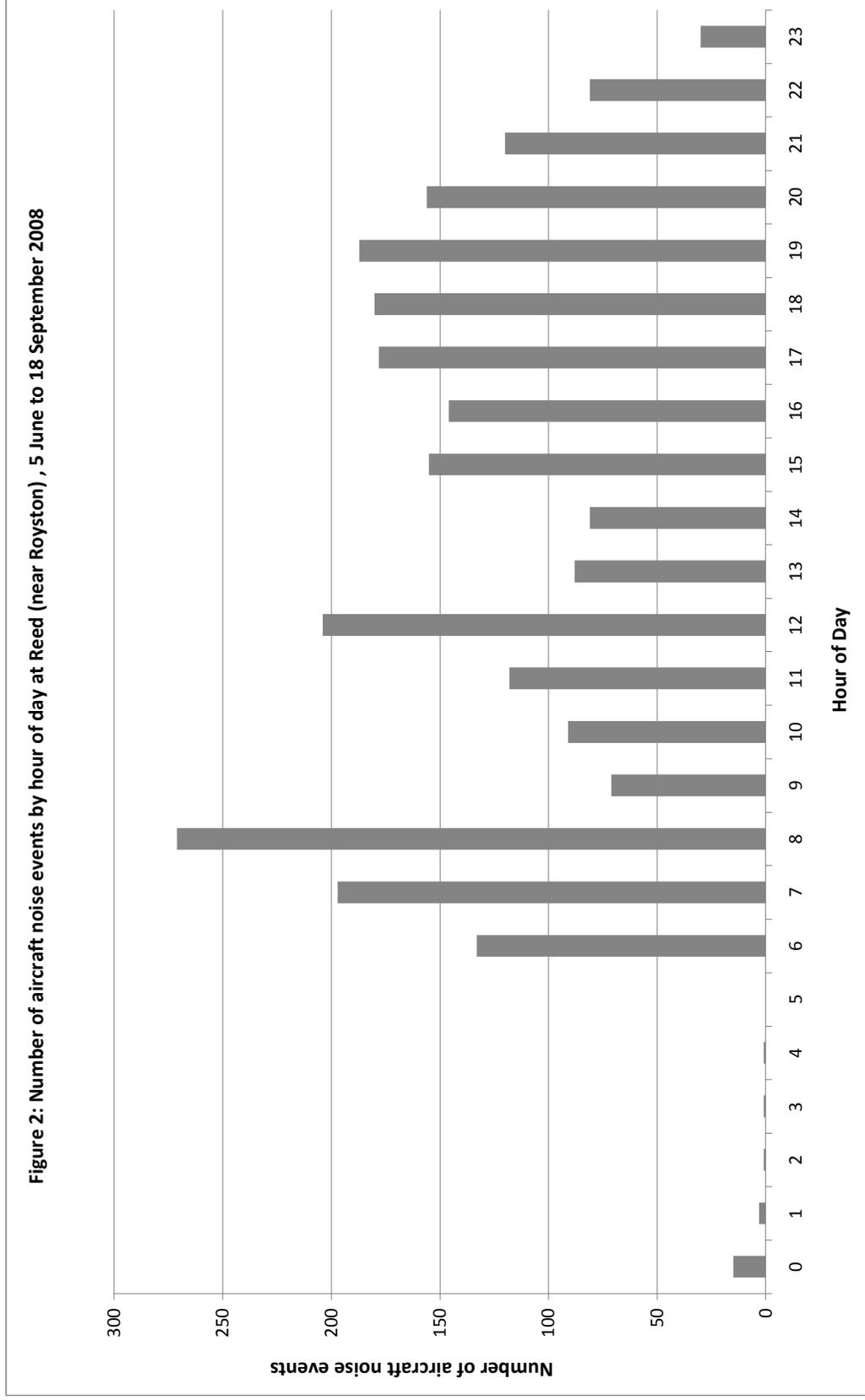


Figure 3: Daily average maximum level of aircraft noise events at Reed (near Royston), 5th June to 18th September 2008

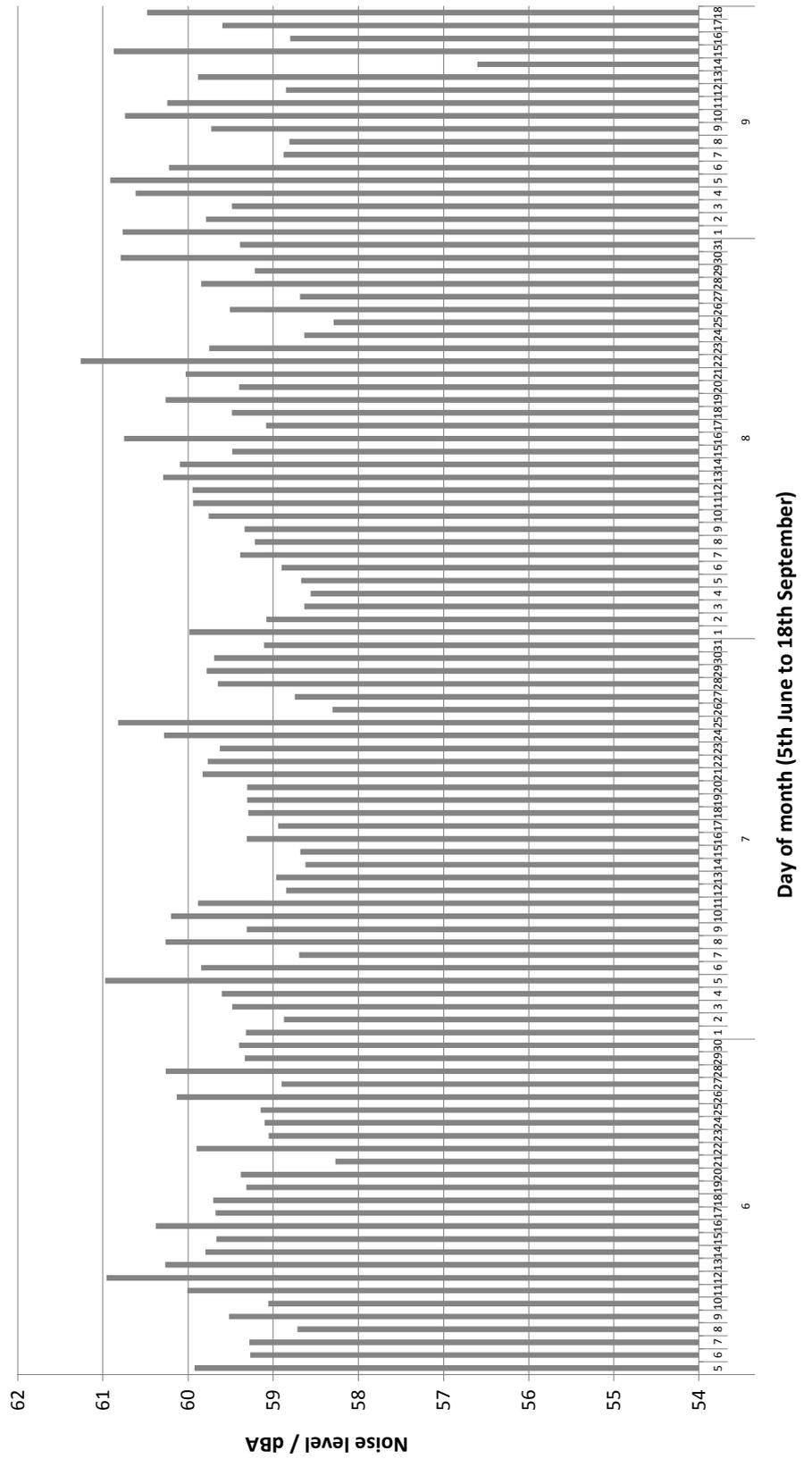
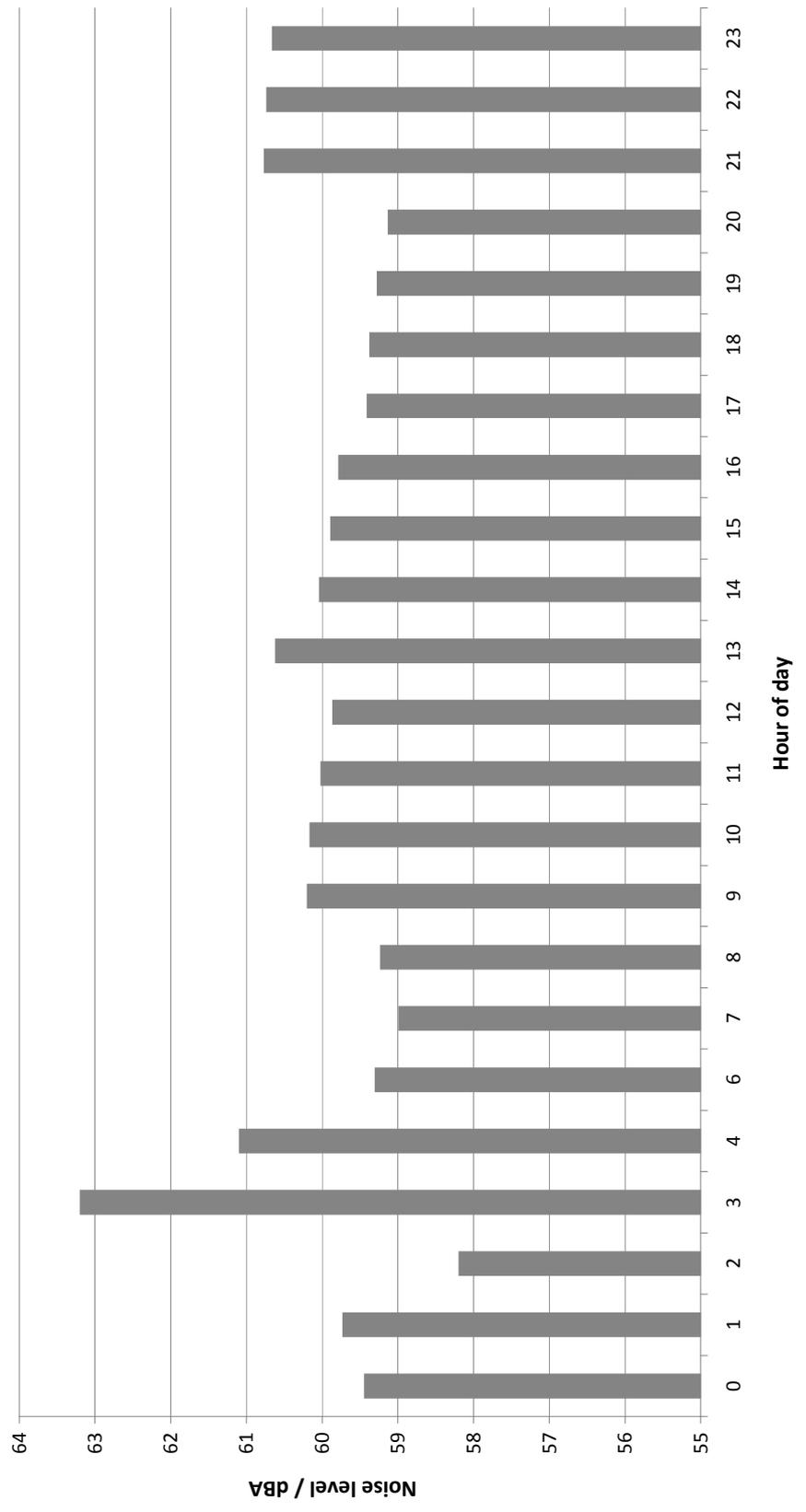


Figure 4: Average of maximum aircraft noise event levels by hour of day at Reed (near Royston) 5 June to 18 September 2008



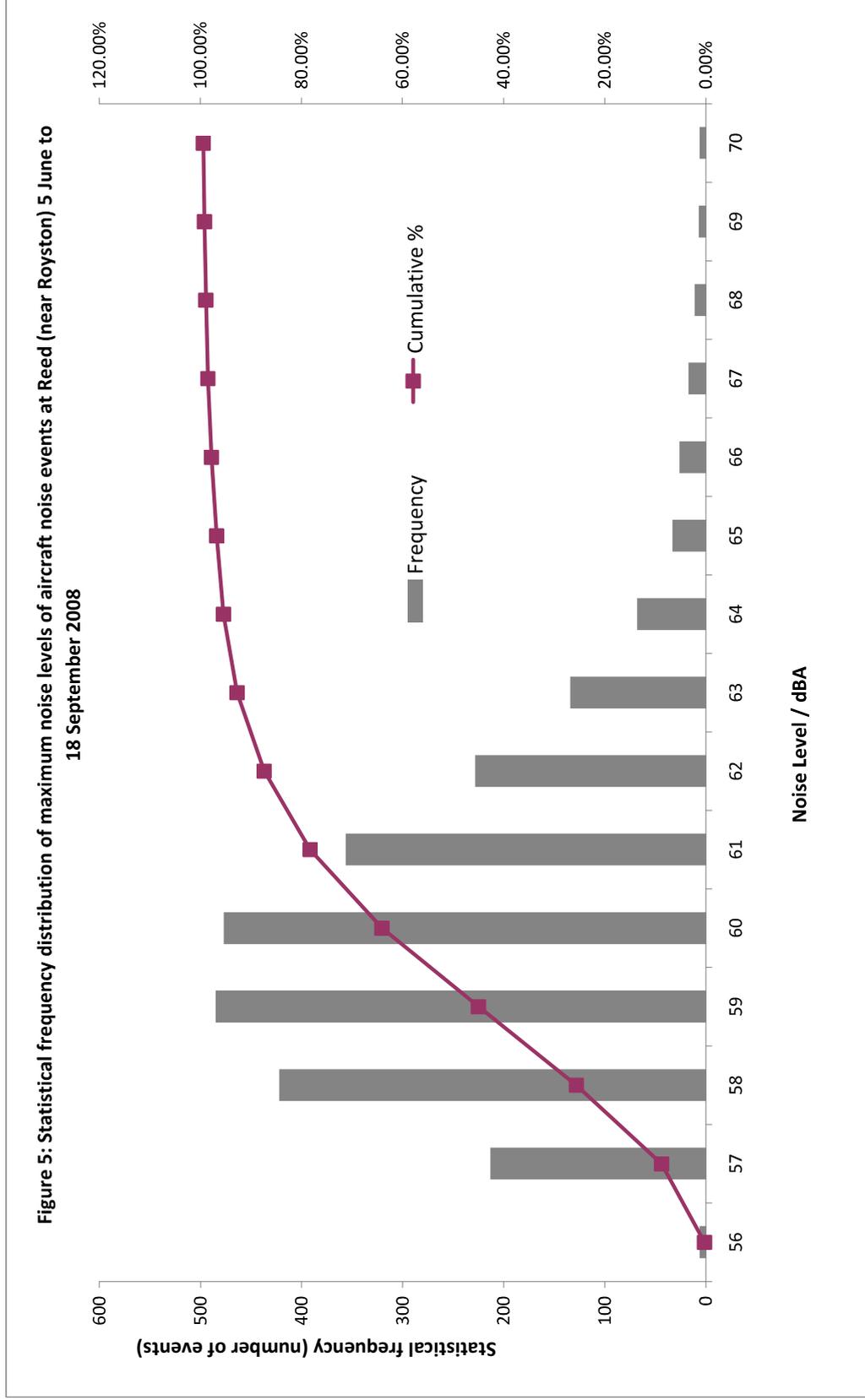


Figure 6: Total noise climate (Average and statistical percentage levels), by hour of day at Reed (near Royston) from 5 June to 18 September 2008

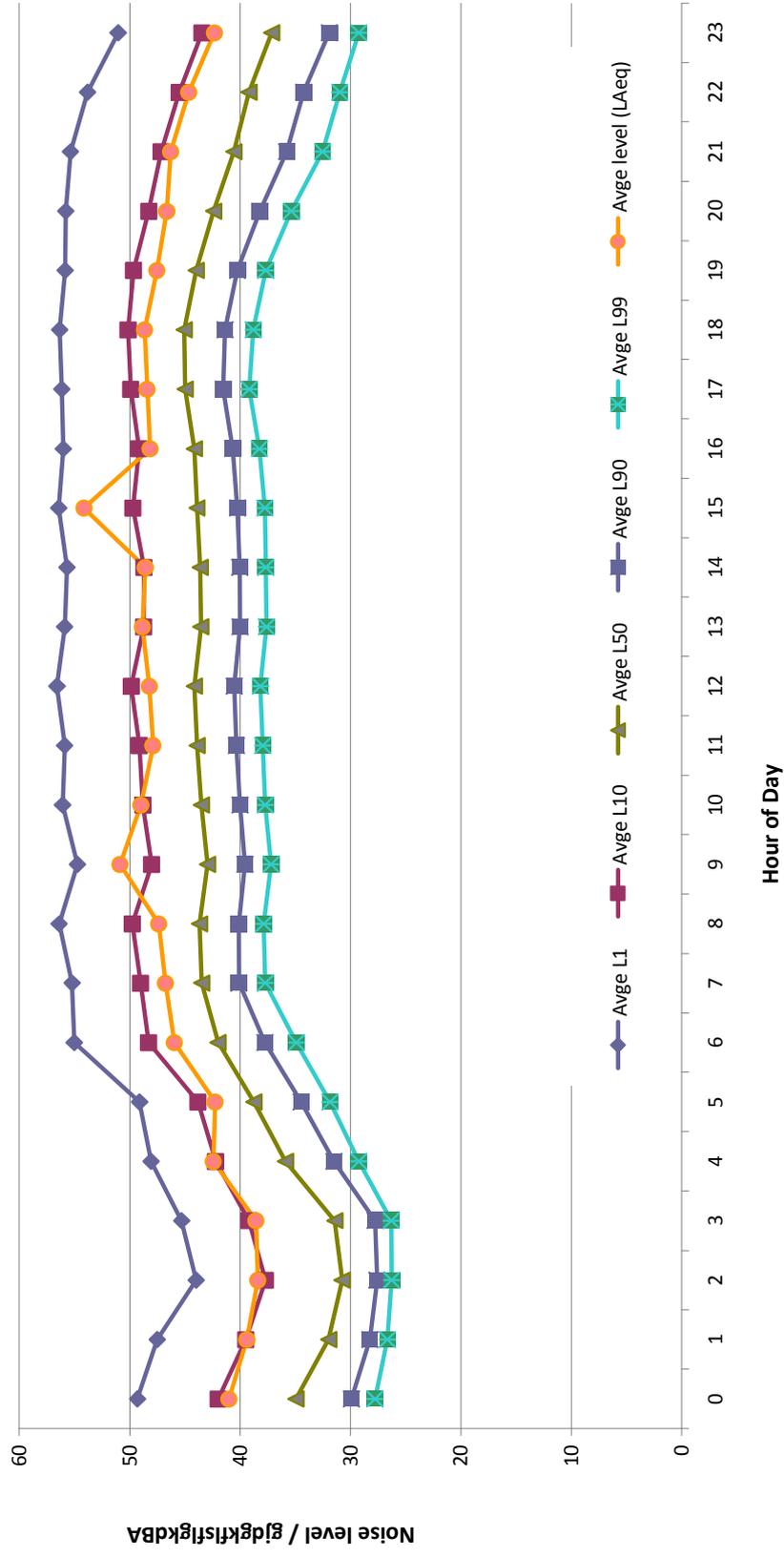


Figure 7: Contribution of aircraft noise (LAeq values) to the total noise, by hour of day, at Reed (near Royston) 5 June to 18 September 2008

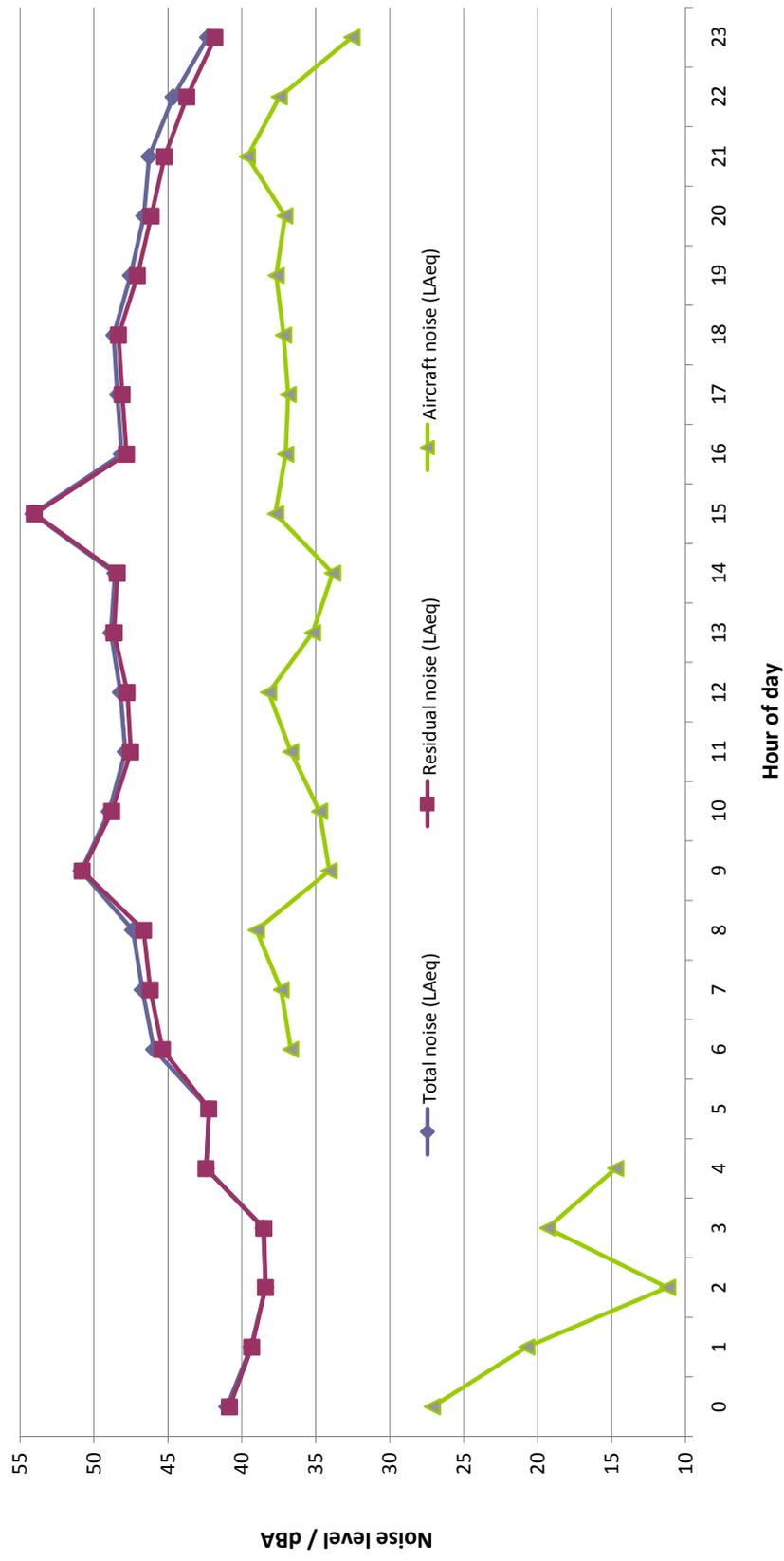


Figure 8: Numbers of aircraft noise events from different aircraft types at Reed (near Royston), June 5 to 18 September 2008

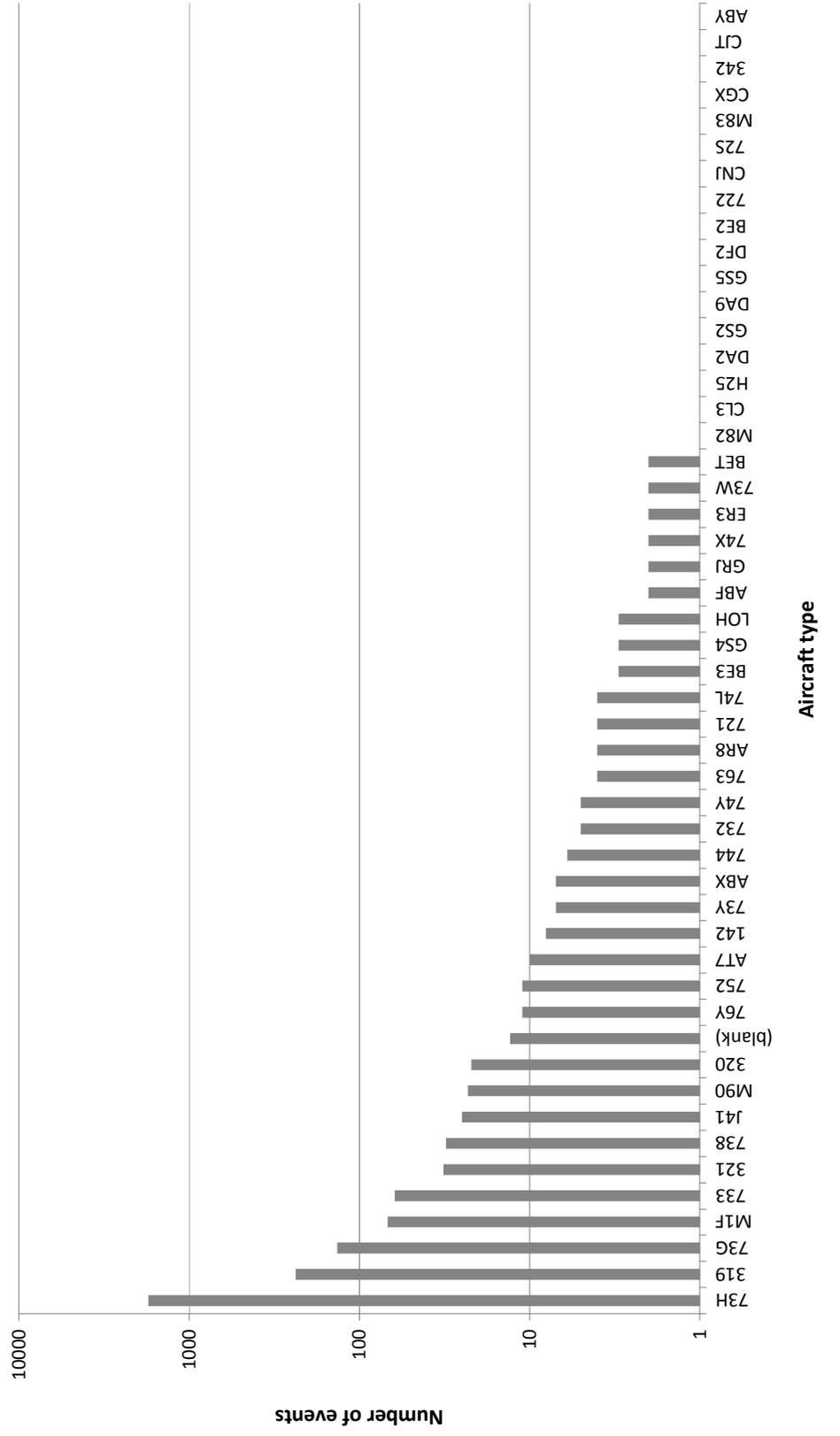
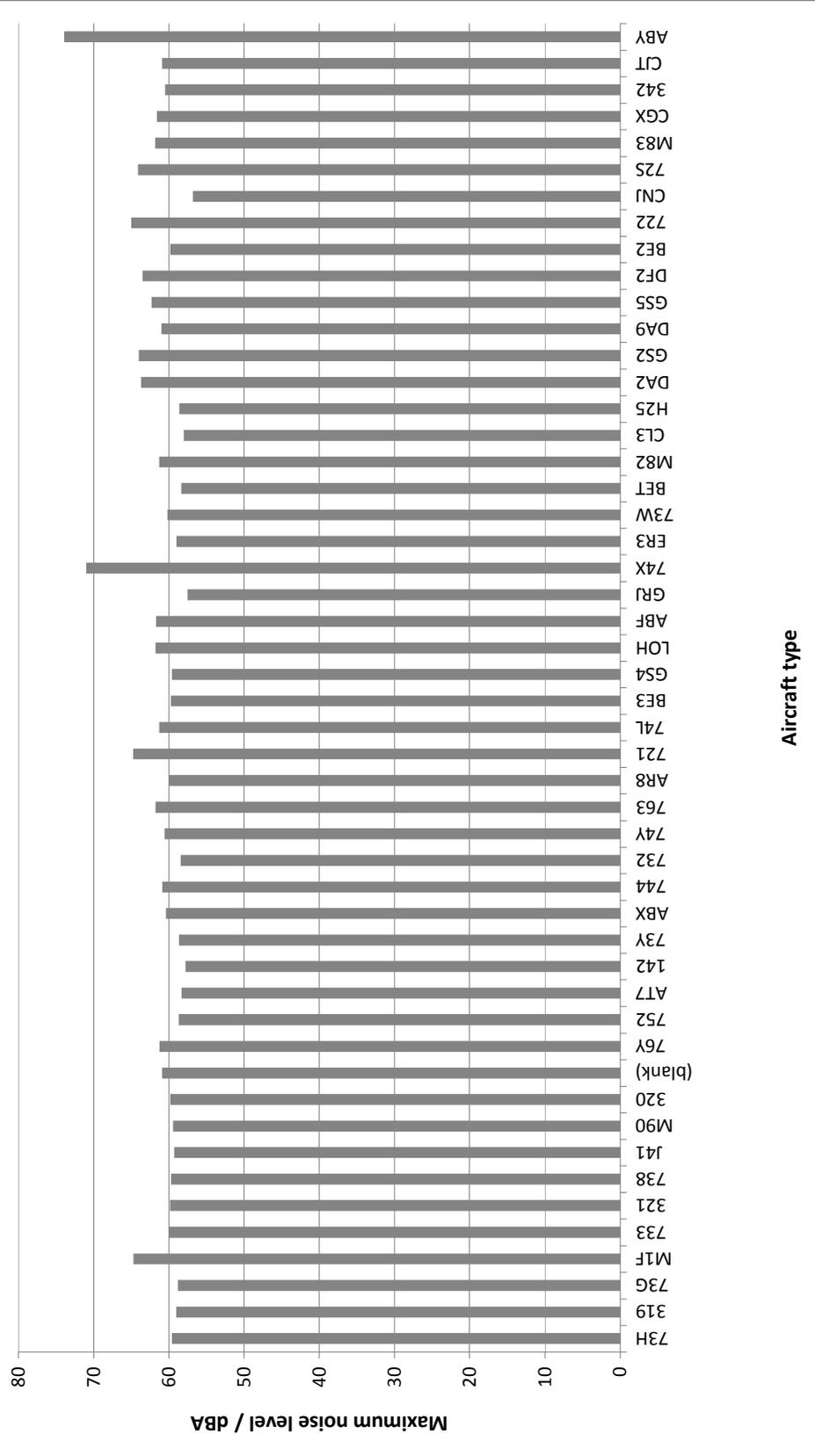


Figure 9: Maximum noise levels of aircraft noise events from different aircraft types at Reed (near Royston), 5 June to 18 September 2008



Aircraft type

APPENDIX 1

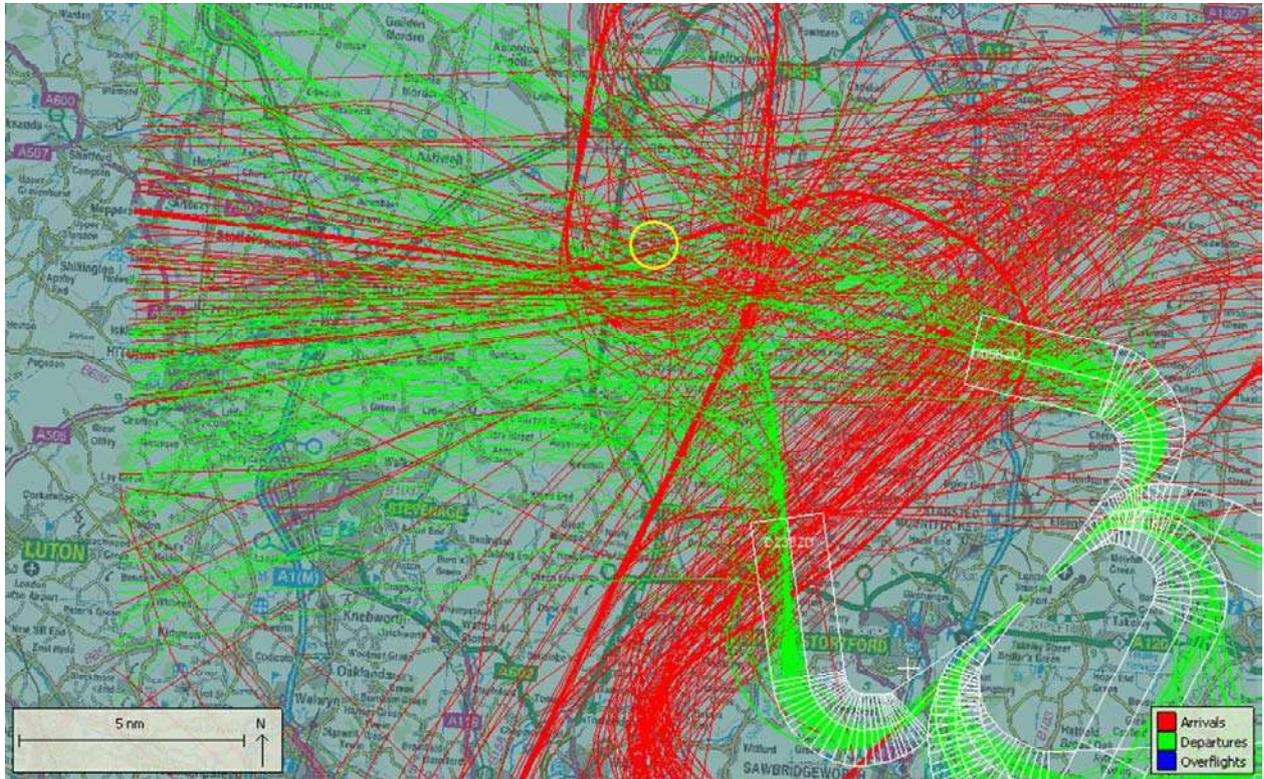
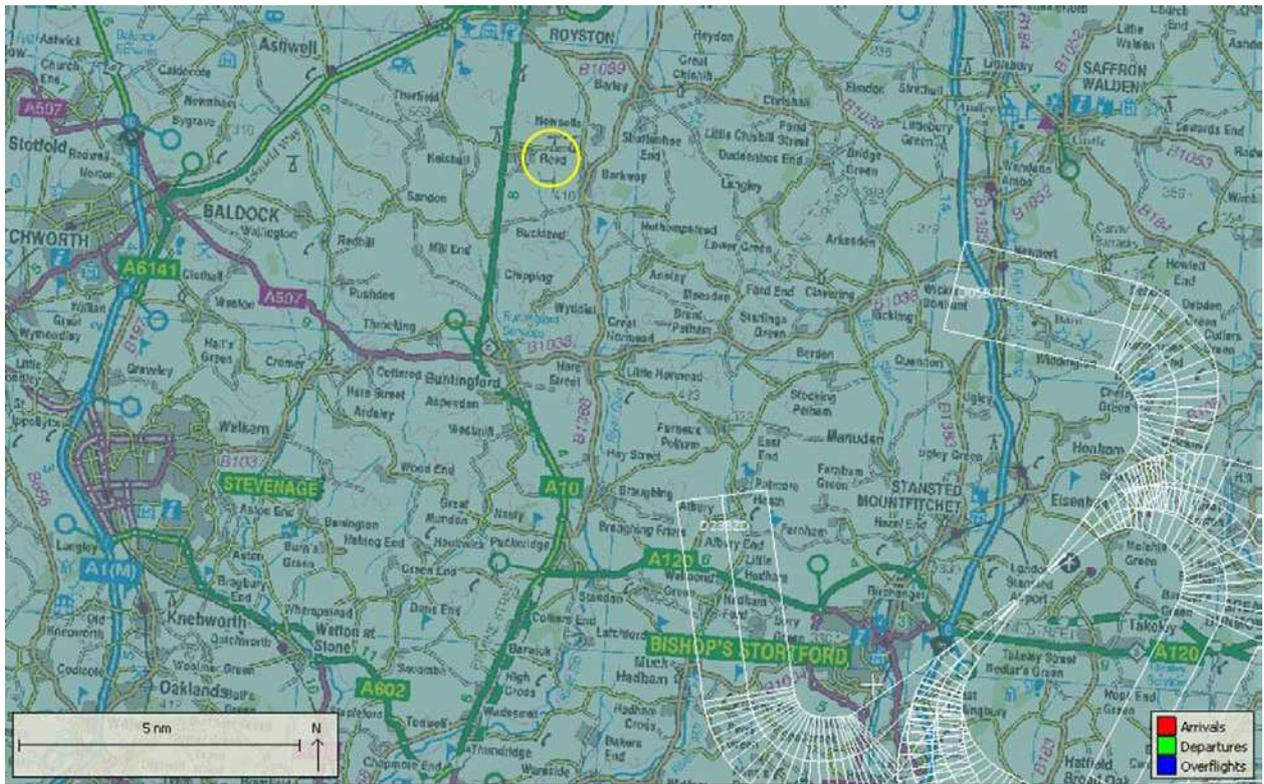
MAPS OF SITE WITH EXAMPLES OF DEPARTURE AND ARRIVAL FLIGHTPATHS



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Maps of site showing examples of departure and arrival flight paths



Stansted Airport Ltd
Aircraft Noise levels at Reed (near Royston), Essex, June to September 2008



AAD

applied
acoustic
design

APPENDIX 2

GLOSSARY OF ACOUSTIC TERMS



THE GREEN BUSINESS CENTRE
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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 Stansted 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 BAA 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, 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 60 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 Stansted 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 90th 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.

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

Noise

Unwanted sound

Octave band spectra

In order to 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, it is the Slow (S) time weighting that has been used, hence reference is made to L_{ASmax} and to L_{AS90} .

APPENDIX 3

LIST OF AIRCRAFT IDENTIFICATION SOURCE CODES



THE GREEN BUSINESS CENTRE
THE CAUSEWAY
STAINES
MIDDLESEX
TW18 3AL

TELEPHONE: 01784 464404
FACSIMILE: 01784 465447

List of Aircraft Identification Codes

100	Fokker 100
142	BAe 146-200
143	BAe 146-300
313	Airbus A310-300
319	Airbus A319
320	Airbus A320
321	Airbus A321
332	Airbus A330-200
342	Airbus A340-200
346	Airbus A340-600
721	Boeing 727-100
722	Boeing 727-200
72S	Boeing 727-200
732	Boeing 737-200
733	Boeing 737-300
734	Boeing 737-400
735	Boeing 737-500
736	Boeing 737-600
738	Boeing 737-800
73G	Boeing 737-700
73H	Boeing 737-800 (winglets)
73W	Boeing 737-700 (winglets)
73Y	Boeing 737-300 Freighter
744	Boeing 747-400
74L	Boeing 747SP
74X	Boeing 747-200 Freighter
74Y	Boeing 747-400 Freighter
752	Boeing 757-200
762	Boeing 767-200
763	Boeing 767-300
76Y	Boeing 767-300 Freighter
ABF	Airbus A300/C4/F4
ABX	Airbus A300 Freighter
ABY	Airbus A300-600

ANF	Antonov AN-12 Freighter
AR1	Avro RJ-100
AR8	Avro RJ-85
AT4	ATR-42
AT7	ATR-72
ATP	BAe ATP
BE2	Beech B200
BE3	Beech light twin turboprop
BET	Beech light twin turboprop
CCJ	Bombardier Challenger
CCX	Bombardier Global Express
CGX	Unknown
CJT	Unknown
CL3	Unknown
CNJ	Cessna Citation
CR2	Bombardier CRJ-200
CR9	Bombardier CRJ-900
D38	Dornier 328
DA2	Unknown
DA9	Unknown
DF2	Dassault Falcon 10/20/100/200
DF3	Dassault Falcon 50/900
EM2	Embraer Brasillia
ER3	Embraer RJ-135
F50	Fokker 50
FRJ	Dornier 328 Jet
GRJ	Gulfstream II/III/IV/V
GS2	Gulfstream II
GS4	Gulfstream IV
GS5	Gulfstream V
H25	Hawker HS-125
J31	BAe Jetstream 31
J41	Bae Jetstream 41
LOH	Locheed C130 Hercules
LRJ	Bombardier Learjet 23/24/25/31/35/40/45/55/60
M1F	Boeing (McDonnell Douglas) MD11 Freighter

Stansted Airport Ltd

Aircraft Noise levels at Reed (near Royston), Essex, June to September 2008

M82	Boeing (McDonnell Douglas) MD82
M83	Boeing (McDonnell Douglas) MD83
M87	Boeing (McDonnell Douglas) MD87
M90	Boeing (McDonnell Douglas) MD90
PA2	Piper
S20	Saab 2000
TU5	Tupolev TU-154