UK Civil Aviation Authority

Survey of Noise Attitudes 2014: Aircraft Noise and Annoyance, Second Edition

CAP 1506

Published by the Civil Aviation Authority, 2021
Civil Aviation Authority,
Aviation House,
Beehive Ringroad,
Crawley
West Sussex,
RH6 0YR.

First published 2017

The work reported herein was carried out under a Letter of Agreement placed on 27 April 2016 by the Department for Transport. Any views expressed are not necessarily those of the Secretary of State for Transport.

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The latest version of this document is available in electronic format at www.caa.co.uk/CAP1506

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Preface

1. This revision of the SoNA 2014 report (CAP 1506) has been produced to address two issues which have been identified in the noise modelling that was used in the SoNA 2014 study, following the initial publication of the report in February 2017.

2. The first issue concerns the L_{ASmax} values calculated by ANCON that was discovered as part of a study[1] commissioned by Heathrow Airport Ltd (HAL) to validate their noise and track keeping system. That study incorporated a review of the noise data calculated by ANCON, which included the L_{ASmax} values. The HAL study was undertaken after the modelling had been completed for SoNA 2014 and whilst the analysis and reporting were in progress.

3. The HAL study found that ANCON underestimated L_{ASmax} noise levels for several important aircraft types, the most prominent of which was the Airbus A320 family. The HAL study also examined the L_{eq} and L_{den} values generated by ANCON and found that they were robust. Regarding the results of SoNA 2014, the L_{eq} and L_{den} can be relied upon and the underestimation of L_{ASmax} would only affect the N65 and N70 results.

4. The Environmental Research and Consultancy Department (ERCD) of the CAA thoroughly examined the data from the HAL study to understand the implications for SoNA 2014. Consequently, the data used by ANCON to calculate L_{ASmax} for each aircraft type were adjusted for the seven airports for which ANCON was used to produce the aircraft noise data[2]. The relevant N65 and N70 values that were used in the SoNA 2014 report were recalculated.

5. In the process of making this update, a second issue was identified. This concerned the calculation of the average N65 and N70 values. It was discovered that logarithmic averaging had been inadvertently used instead of arithmetic averaging when accounting for the runway modal split. This meant that the stated average values of N65 and N70 were higher than they should have been.

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1 Verification of Heathrow Noise and Track Keeping Systems (NLR-CR-2016-089), NLR (Netherlands Aerospace Centre), for Community Noise Forum commissioned by Heathrow Airport Ltd. July 2016 https://www.heathrow.com/content/dam/heathrow/web/common/documents/company/local-community/noise/reports-and-statistics/reports/other-reports/NLR_CR_2016_089.pdf

2 This did not affect the results for East Midlands Airport and Luton Airport that were provided by Bickerdike Allen Partners.

6. It would be expected that although the average L_{ASmax} values would rise (due to updated model validation), the average N65 and N70 values would fall (due to the correction to arithmetic averaging). The consequence of this is a net reduction in the average N65 and N70 values, except at low values of N65 and N70, (N65 at fewer than 50 events and N70 at fewer than 25 events), where the effect of updating the modelled L_{ASmax} data is greater than the effect of correcting the averaging, and leads to increases in N65 and N70 values.

7. Neither of these issues have affected the results for L_{eq} or L_{den}, nor the relationships between those indicators and percentage highly annoyed (in particular the results in Table 25 remain unaffected). However, where there are changes to the data, these can be seen in the following tables and any associated figures:

   - Table 10: Respondents categorised by 2014 summer average number of events ≥70 dB L_{ASmax} (N70)
   - Table 11: Respondents categorised by 2014 summer average number of events ≥65 dB L_{ASmax} (N65)
   - Table 15: Mean annoyance scores in SoNA 2014 survey as a function of average summer day, 16-hour N70 noise exposure
   - Table 16: Mean annoyance scores in SoNA 2014 survey as a function of average summer day, 16-hour N65 noise exposure
   - Table 17: Coefficients of determination between different noise indicators and mean annoyance score
   - Table 21: Percentage of respondents indicating high annoyance for all airport locations except Luton by average summer day 16-hour N70
   - Table 23: Percentage of respondents indicating high annoyance for Heathrow, Gatwick and Stansted by average summer day 16-hour N65

8. This revised report uses the updated N65 and N70 values as presented in the results and analysis in Chapter 5. Revised associations between N65, N70 and $L_{Aeq,16h}$ are presented in Appendix B. The revised associations between N65, N70 and noise attitudes are shown in Table 17 in Chapter 5. Although the updated results show a stronger association between N65, N70 and noise attitudes than previously stated, the association still remains weaker than that between $L_{Aeq,16h}$, L_{den} and noise attitudes. Therefore, the overall conclusions of the SoNA 2014 study remain unchanged.

Chapter 1

Introduction

1.1 Airports aim to satisfy the demands of travellers and provide jobs: but they can cause adverse effects on the environment and people living nearby. A major form of adverse effect is that from aircraft noise. Airport planning and development planning must take account of the aircraft noise exposure to residents; airport operators and interested government departments have to view aircraft operations in the context of the related airport noise. These assessments are usually carried out in the UK, and in most countries of the world, by using noise exposure indices.

1.2 This report describes a research study to obtain new and updated evidence on attitudes to aviation noise around airports in England, and how they relate to the UK aircraft noise exposure indices. The study was commissioned by the Department for Transport, and builds on earlier noise attitude surveys commissioned by Defra.

1.3 The current UK civil aircraft noise exposure index, $L_{Aeq,16h}$ was adopted in 1990, based on an aircraft noise attitude survey undertaken in 1982 and reported as the UK Aircraft Noise Index Study (ANIS) in 1985[3]. Contours of equal noise exposure, rather like geographical height contours, are plotted around an airport, along with estimates of the area and population contained within the contours. The 57 dB $L_{Aeq,16h}$ contour was chosen as the threshold of community annoyance because it 'indicated a marked increase in some reported measures of disturbance'[4], with 63 and 69 dB $L_{Aeq,16h}$ representing medium and high annoyance and subsequently incorporated into planning policy guidance.

[3] Brooker et al 1985. Brooker P, Critchley J B, Monkman D J & Richmond C. DR Report 8402: United Kingdom Aircraft Noise Study: Main Report, January 1985.

[4] Critchley et al 1990. Critchley J B & Ollerhead J B. DORA Report 9023: The use of L_{eq} as an Aircraft Noise Index, Civil Aviation Authority, September 1990.

1.4 $L_{Aeq,16h}$ was established as the relevant indicator by means of social surveys and noise measurements. The ANIS social survey measured annoyance from aircraft noise expressed by a sample of people living at different places around five English and one Scottish airport. Noise data were then matched to reported attitudes so that physical noise variables could be used to estimate annoyance.

1.5 Critics of $L_{Aeq,16h}$ argue that:

- it is difficult to comprehend, being on a logarithmic scale,
- an equivalent continuous level is not consistent with people's perception of aircraft noise as a number of discrete, noticeable events, and
- it is out of date, 57 dB $L_{Aeq,16h}$ no longer represents the approximate onset of significant community annoyance.

1.6 The overall aims of the Survey of Noise Attitudes (SoNA) 2014 were to:

- Obtain new and updated evidence on attitudes to aviation noise around airports in England, including the effects of aviation noise on annoyance (Chapter 5), wellbeing and health (Chapter 6).
- Obtain new and updated evidence on what influences attitudes to aviation noise (Chapter 5 & 7), and how attitudes vary, particularly how attitudes vary with L_{Aeq}, but also other non-acoustic factors that may influence attitudes, such as location and time of day, and socio-economic group of respondents.
- Examine whether the currently used measure of annoyance, L_{Aeq}, is the appropriate measure of annoyance for measuring the impact on people living around major airports.
- Consider the appropriateness of the policy threshold for significant community annoyance from aviation noise.
- Provide baseline results that can be used for a programme of regular surveys of attitudes to aviation noise.

1.7 The report is structured as follows:

- Background

- Methodology
- Social Survey Results SoNA 2014 in the context of SoNA 2013
- Noise exposure and annoyance
- Health and wellbeing
- Non-acoustic factors
- Summary

1.8 Appendix A provides glossary to the report which gives definitions of the more commonly used technical terms concerning aircraft and airport operations used here. Appendix B gives more detailed information on noise indices. The questionnaire is reproduced in Appendix C. The airport noise contours are presented in Appendix D and details of airport developments, consultations and trials during 2014 are given in Appendix E.

Chapter 2

Background

Noise indices

2.1 Noise indices must be reliable; thus they must not only correlate adequately with impact, but also be relatively simple to understand, readily definable by measurement or prediction, robust (which means that they are insensitive to unavoidable or unpredictable uncertainties), and realistic by accounting for factors that common sense tells people are important. As a rule, the major impact around airports is from air noise[5] which, for the most part, is a clearly identifiable part of the total noise climate. Thus aircraft noise indices are expected to be sensitive to factors such as the numbers of aircraft heard and their noise levels and differences between day and night activity.

2.2 A large number of noise indices has been proposed to describe aircraft noise, developed, tested and implemented in different countries over the last half-century or so. The existence of different approaches is not surprising, given the complexity of how aircraft noise varies. The situation has now changed. Thanks to progress in the field of research, and with better communications and international collaboration between researchers, as well as continuing efforts by the standardisation bodies, there is a reasonable level of agreement on many of the fundamental aspects of the approach to the situation, especially regarding the definition of noise exposures. Appendix B provides an overview of the various noise indicators that are in common use.

2.3 Despite this progress, aircraft noise assessments remain complicated and there will always be demands for more and better information about the impacts of noise as well as identifying the means for mitigating them.

[5] By convention, air noise is the noise generated by aircraft during landing and take-off, including the noise generated whilst accelerating to take off and decelerating after landing. Noise generated during taxi from and to the runway and whilst parked is considered ground noise.

There is also a natural caution towards changing noise indices upon which past policies and plans have been based.

UK Aircraft Noise Index

2.4 This section summarises the history of the $L_{Aeq,16h}$ noise index and the need for review.

2.5 $L_{Aeq,16h}$ was adopted in 1990 on the basis of the 1982 Aircraft Noise Index Study, ANIS[3]. The reference time period is an average summer day, from June 16th to September 15th inclusive and from 7am to 11pm. The summer day period dates back to the recommendations in the 1963 Wilson Committee report on aircraft noise, which recommended measuring noise exposure during the summer months because people were more likely to have windows open, be outdoors, and aviation activity is at its most intense. In addition to these reasons, warmer summer temperatures adversely affect aircraft performance and lead to increased noise exposure compared to other times of the year. The time period of 7am to 11pm, recognises that daytime and night-time noise exposure can lead to quite different reactions in people (principally daytime annoyance and night-time sleep disturbance) and thus it is better to define day and night noise exposure separately.

2.6 At the time $L_{Aeq,16h}$ was adopted in 1990, the UK government defined three threshold levels for policy consideration: 57, 63 and 69 dB $L_{Aeq,16h}$ representing, low, moderate and high annoyance. In the 2003 Air Transport White Paper, 57 dB $L_{Aeq,16h}$ was defined as marking the approximate onset of significant community annoyance, and this was re-affirmed in the Government's 2013 Aviation Policy Framework[6].

2.7 Critics argue that attitudes have changed since the 1982 survey. This could be because of general shifts in attitudes to annoyance, changes in

6 2013 Aviation Policy Framework, Cm 8584, ISBN 9780101858427, Department for Transport, March 2013.

the pattern of aircraft noise experienced, and/or because of changes to lifestyle that are affected by aircraft noise.

2.8 Secondly, a number of alternative noise indices have been developed and come into use since $L_{Aeq,16h}$ was adopted. These include the EU Environmental Noise Directive's 24-hour weighted noise index (L_{den} see Appendix B for more details). In Australia, although the noise index for planning continues to be the ANEF[7], N70 has come to prominence as a supplementary indicator (see Appendix B for more details). N70 is often considered to be easier to understand as it is a linear index.

ANASE

2.9 The Attitudes to Noise from Aviation Sources in England (ANASE) study was commissioned by the DfT in 2001 and was published in 2007[8]. The aims of the study were to re-assess attitudes to aircraft noise in England, re-assess their correlation with the $L_{Aeq,16h}$ noise index and examine willingness to pay in respect of annoyance from such noise, in relation to other elements, on the basis of stated preference survey evidence.

2.10 In addition to interview questions, respondents at some of the study sites were played audio recordings of aircraft noise and were also asked to rate their *"willingness to pay"* to avoid aircraft noise. The study concluded that *"levels of annoyance were higher than expected from previous surveys and that the relationship between L_{Aeq} and annoyance was not stable over time:*

- *the proportion of respondents who are at least very annoyed is less than 10% for areas with L_{Aeq} less than 43 dB;*
- *the proportion of respondents at least very annoyed generally increases with L_{Aeq} for values of L_{Aeq} over 43 dB, although there is a relatively large spread in percentages for most L_{Aeq} values; and*

7 Australian Noise Exposure Forecast.

8 Attitudes to Noise from Aviation Sources in England, November 2007.

- *at least 40% of respondents were at least very annoyed for all except one of the areas with L_{Aeq} greater than 57 dB."*[8]

2.11 Although the researchers concluded there was no clear threshold between 43 and 57 dB $L_{Aeq,16h}$, the study suggested that for the same proportion of highly annoyed people as found in ANIS at 57 dB $L_{Aeq,16h}$ (10%), the corresponding $L_{Aeq,16h}$ level would be approximately 10-13 dB lower.

2.12 The independent peer review by Havelock (CAA) and Turner (Bureau Veritas)[9] raised concerns over the use of and calibration of noise playback equipment prior to the social survey being undertaken. Restricted sites, where no noise playback equipment was used appeared to show differences in attitudes to those from the main study, where noise playback equipment was used. There were also concerns over the estimation of aircraft noise at survey sites. Consequently the peer review concluded that "there were sufficient technical and methodological uncertainties still remaining with the study… [that] the reviewers would counsel against using the results and conclusions in the development of government policy".

Noise indices in scope

2.13 The high level of aims of SoNA 2014, set out in Chapter 1, make it clear that one of the aims of the study was to check whether L_{Aeq} is the appropriate measure of annoyance for measuring the impact of aircraft noise on people living around major airports. The aim, however, was not to create new noise indices. Thus, with reference to Appendix B, the noise indices in scope were:

- average summer day $L_{Aeq,16h}$
- average annual L_{den} (24-hour)
- average summer day N70 (16-hour)

9 ANASE Non-SP Peer Review, November 2007.

- average summer day N65 (16-hour)

Chapter 3

Methodology

NNAS and SoNA

3.1 In 2012 Defra conducted the National Noise Attitudes Survey (NNAS 2012)[10], which provided the Government with a good estimate of current attitudes to various aspects of 'environmental, neighbour and neighbourhood noise' from face-to-face interviews (including the percentage of the population affected). In addition, it was intended that this information would allow the Government to detect any substantive changes in attitudes to noise in the UK since the 2000 survey. The sample size of NNAS 2012 was over 2,700 respondents.

3.2 The NNAS 2012 found that 72% of respondents reported general satisfaction with their noise environment, however, 48% felt their home life was spoilt to some extent by noise. Between 2000 and 2012 there was an increase of between 11% and 17% (depending on the noise source) in the proportion of people surveyed who felt that they were to some extent bothered, annoyed or disturbed by the four of the most commonly heard sources of noise ('road traffic', 'neighbours and/or other people nearby', 'aircraft, airports and airfields' and 'building, construction, demolition, renovation and road works'). The only statistically significant increase in the proportion of people that considered themselves very or extremely bothered, annoyed or disturbed between 2000 and 2012 was for aircraft noise (from 2% to 4%).

3.3 In 2013 Defra ran the first Survey of Noise Attitudes (SoNA 2013)[11], a face-to-face survey within England to establish current attitudes to noise, in particular attitudes from road traffic and neighbour noise sources and a

10 National Noise Attitude Survey (2012) Department for Environment, Food and Rural Affairs (Defra).

11 Survey of Noise Attitudes (2013) Department for Environment, Food and Rural Affairs (Defra).

section that could focus on different areas of interest without impacting on the backwards compatibility of the rest of the questionnaire. In 2013, that section concentrated on entertainment noise. SoNA 2013 found that just over two-thirds of respondents reported hearing aircraft, airport or airfield noise, with 3% giving very or extreme ratings for being bothered, annoyed or disturbed.

3.4 SoNA 2014 is a continuation of SoNA 2013. In this instance, it was decided that the variable section in the 2014 survey should consider civil aircraft noise in order to obtain up-to-date and detailed information regarding attitudes to aircraft noise. The Civil Aircraft Noise (CAN) section was introduced in 2014 alongside the other sections on road and neighbourhood noise and replaced the previous entertainment noise section. It was not made explicit to respondents at the start of the survey that the focus of the study was aircraft noise in order to minimise potential bias.

SoNA 2014

3.5 Unlike NNAS 2012 and SoNA 2013, the SoNA 2014 responses needed relating to noise exposure. To do so, however, meant that the sample for SoNA 2014 could not be nationally representative as sampled residents had to live within different noise contour bands near airports.

3.6 Face-to-face interviews from a representative sample of approximately 2,000 adults aged 18 and over were collected from those living in residential dwellings in proximity to nine of the largest airports in England (as defined by aircraft movements), and where noise from aircraft is estimated to be more than 51 dB $L_{Aeq,16h}$ during an average summer day.

3.7 The sampling was designed such that one-third of the interviews were carried out in the 51-54 dB $L_{Aeq,16h}$ band, and two-thirds for noise exposure in the >54 dB $L_{Aeq,16h}$ band (stratification based on estimated population numbers falling within these bands). This was done to increase

statistical power at higher noise exposure levels, where populations decrease as noise exposure levels increase.

3.8 This chapter briefly summarises the questionnaire design process, the survey design, the sample selection and the noise indicators considered.

Questionnaire design

3.9 The questionnaire built on that developed by Defra for its 2013 Survey of Noise Attitudes (SoNA 2013), which itself was developed from the 2012 National Noise Attitude Survey (NNAS 2012).

3.10 The questionnaire, as provided in Appendix C, comprised of five sections:

1) A general section
2) An optional Road Traffic Noise section[12]
3) An optional Neighbourhood Noise section[12]
4) A Civil Aircraft Noise section
5) A health section

3.11 The Civil Aircraft Noise section included two questions on noise annoyance that sought responses on a 5-point scale and an 11-point scale, recommended by ICBEN[13] and ISO[14] respectively, which allow direct comparison with the 2007 ANASE study[9]. Such questions explicitly sought views on annoyance due to aircraft noise. The survey also asked residents early in the interview *'Is there anything you particularly dislike about this neighbourhood?'* and specifically looked (without prompting) for responses mentioning aircraft or aircraft noise.

3.12 The SoNA 2014 questionnaire design was both peer-reviewed and underwent cognitive testing to confirm people's understanding of the

[12] The road traffic and neighbourhood noise sections were only asked if the respondent responded to a question in the general section (A) that the relevant source bothered them 'at least slightly'.

[13] Fields et al (2001). Fields JM, De Jong JM, Gjestland T, Flindell IH, Job RFS, Kurra S, Lercher P, Vallet M, Yano T, Guski R, Felscher-Suhr U, Schumer R (2001). Standardized general-purpose noise reaction questions for community noise surveys: research and a recommendation. J Sound Vibr 242: 641-679.

[14] International Standards Organization (2003). Acoustics - Assessment of noise annoyance by means of social and socio-acoustic surveys, ISO/TS 15666:2003.

questions asked, and to identify any need for questionnaire improvement and simplification.

Survey design

3.13 The questionnaire, the selection and sampling process are reported and covered separately in Ipsos MORI's 2014 Survey of Noise Attitudes (SoNA) technical report[15], which provides more detailed information on the sample strategy agreed, response rates, demographics of participants, questionnaire including show cards and diagrams showing areas sampled.

3.14 The survey was conducted via face-to-face in-home interviews with residents aged 18 and over who live in the vicinity of nine airports in England and took approximately 35 minutes to complete. The survey employed a random probability methodology, and was conducted with adults randomly chosen within their household.

3.15 Fieldwork was conducted between 5 October 2014 and 8 February 2015. The survey selected respondents at random, according to the populations around the sample airports. All eligible households were located within the pre-defined noise exposure areas, with a minimum noise threshold being set at 51 dB $L_{Aeq,16h}$, in order to ensure that estimated noise exposure information remained reliable[16]. Noise contour information was provided to allow Ipsos MORI's in-house sampling unit to draw up the appropriate sample in each of the nine areas around the following airports:

- Birmingham (BHX)
- East Midlands (EMA)
- Gatwick (LGW)
- Heathrow (LHR)
- London City (LCY)
- Luton (LTN)

15 The 2014 Survey of Noise Attitudes (SoNA) Technical Report, Ipsos MORI, 22 June 2015.

16 White et al (2010). White S, Beaton D, McMahon J & Rhodes D P, 'Measurement and modelling of aircraft noise at low levels', ERCD Report 1006, Civil Aviation Authority, October 2010.

- Manchester (MAN)
- Newcastle (NCL)
- Stansted (STN)

3.16 The population exposed to specific levels of aircraft noise was estimated by the CAA (for Birmingham, Gatwick, Heathrow, Manchester, Newcastle and Stansted airports) and by Bickerdike Allan and Partners (for East Midlands, London City, Luton, and Newcastle). This was based on available data (2013, except for East Midlands, London City and Newcastle airports, which was 2012 data) and is shown in Table 1.

Table 1: Estimated population exposure in the vicinity of the nine largest airports in England (based on annual movements and ordered alphabetically)

Summer average noise exposure $L_{Aeq,16h}$ (dB)								
Airport	**51-53.9**	**54-56.9**	**57-59.9**	**60-62.9**	**63-65.9**	**66-68.9**	**69-71.9**	**>72**
Birmingham	13,100	9,100	4,550	2,050	750	50		
East Midlands	600	550	200	200	100			
Gatwick	5,650	2,450	1,000	350	50	100	<50	
Heathrow	228,400	145,750	57,700	24,550	11,700	3,650	900	100
London City	12,600	10,950	4,450	3,050	350	<50		
Luton	2,200	2,100	1,750	750	350	<50		
Manchester	30,200	14,100	9,600	2,600	750	350	<50	
Newcastle	1,600	1,200	300	<50				
Stansted	2,200	1,350	350	100	50			
Total	**296,500**	**187,550**	**79,900**	**33,700**	**14,100**	**4,200**	**900**	**100**

Populations rounded to the nearest 50.

3.17 The original commissioned design was an unclustered sample of private dwellings in proximity to ten of the largest airports (the above airports listed and Bristol[17]). Ipsos MORI originally proposed an unclustered sample because unclustered samples are more statistically efficient than clustered ones, as they maximise precision for any given sample size[18]. This was subsequently adapted to a clustered sample for noise levels less

17 Bristol was omitted because the CAA did not have adequate data on aircraft noise to enable robust sampling, and consequently there was an opportunity to improve the sample size at the other nine airports.

18 Section 2.1, p.10 of The 2014 Survey of Noise Attitudes (SoNA) Technical Report, Ipsos MORI, 22 June 2015.

than 54 dB $L_{Aeq,16h}$, but remained unclustered for noise levels greater than 54 dB $L_{Aeq,16h}$.

3.18 The sample was allocated in proportion to the population exposed at each airport (based on Table 1), thus the sampling initially defined was mainly comprised of people living around London Heathrow, since the majority of people exposed to aircraft noise in England live around Heathrow airport. In addition, the sample was modified to undertake disproportionate sampling by noise level, with two-thirds of the sample allocated to noise levels above 54 dB $L_{Aeq,16h}$ and one third in the band 51-54 dB $L_{Aeq,16h}$. Without this adjustment the 51-54 dB $L_{Aeq,16h}$ band would have accounted for almost 50 percent of the survey, substantially affecting coverage at higher noise exposure levels. Additionally, it was agreed to disproportionately sample by airports, driven by the need to increase the sample size at Gatwick Airport for subset analysis purposes, and the desire to keep the proportion of addresses in the sample around airports other than Heathrow and Gatwick as near to their true proportions as possible.

3.19 The Civil Aircraft Noise section was preceded by a question checking that respondents were resident during summer 2014. As 122 interviewees were not resident during summer 2014, they were excluded. The remaining sample across all airports was 1,877 interviews. A combination of population density and size of airport meant that the majority of respondents live around Heathrow airport (two-thirds of respondents, three-quarters of weighted responses).

Noise modelling

3.20 The main reference time period for the noise exposure was the 2014 average summer day (16th June to 15th September inclusive). Although, interviews took place from early October 2014 through to February 2015, respondents were asked their views on noise during summer 2014.

Previous studies[19] have shown that noise attitudes may be more highly correlated with noise exposure just prior to interview. To test for this hypothesis, each noise indicator was also estimated based on the runways used during the 7 days and 30 days immediately preceding interview. This is discussed in more detail in paragraph 3.29

3.21 To enable questionnaire responses to be correlated with noise exposure information, noise exposure was estimated for the following indicators:

- $L_{Aeq,16h}$
- L_{den}
- N70
- N65

3.22 N65 and N70 represent the number of aircraft events that exceed 65 dB L_{ASmax} and 70 dB L_{ASmax} respectively for an average summer day. The average L_{ASmax} for each aircraft type and flight path combination at each SoNA resident's postcode location is estimated by the noise model and the corresponding number of events aggregated where those exceed 65 and 70 dB L_{ASmax} respectively. When validating the ANCON[20] model against measurements, the modelled L_{ASmax} is compared with the measured logarithmic average $L_{ASmax.}$ Using a logarithmic average places a greater weight on the noisiest events in the measurement sample. For typical measured L_{ASmax} with a measured standard deviation of around 2 dB, a logarithmic average is approximately 0.5 dB higher than the arithmetic average.

3.23 To enable different runway modal splits to be assessed (see paragraph 3.29), N65 and N70 results were generated for each runway operating direction and then arithemitically averaged according to runway modal split, since the number of events for each runway direction is an arithmetic quantity.

[19] Brooker etal (1985). Brooker P, Critchley J B, Monkman D J & Richmond C. 'United Kingdom Aircraft Noise Index Study: main report', DR Report 8402, Civil Aviation Authority, January 1985.

3.24 For Birmingham, Gatwick, Heathrow, Manchester, Newcastle and Stansted airports, noise exposure was estimated using the CAA's ANCON model[20]. For East Midlands, London City and Luton airports, noise exposure was estimated using the US Federal Aviation Administration's Integrated Noise Model (INM)[21] by Bickerdike Allan and Partners on behalf of the respective airport. Although noise exposure information was estimated using two different noise models, the approach used is consistent since both models accord with international best practice by ECAC[22], and are adjusted to reflect measurements obtained around each airport in question.

3.25 $L_{Aeq,16h}$ noise exposure information for Luton airport for 2014 was not available and thus data for 2013 was used instead. N70 information was available for all airports except Luton. L_{den} information was limited to Gatwick, Heathrow and Stansted airports. N65 data was limited to Heathrow Gatwick and Stansted airports. Summer average day $L_{Aeq,16h}$ noise exposure contours showing the areas sampled are presented in Appendix D.

3.26 Noise level information was calculated at postcode centroids representing the locations of the postcode of each of the respondents.

Effect of runway direction

3.27 Irrespective of the noise indicator, aircraft noise exposure is affected by the direction of use of the runway at an airport. All single runway airports have two operating directions or operating modes. The proportion of time in a westerly or easterly operating mode is typically referred to as the modal split.

20 Ollerhead et al (1999). Ollerhead J B, Rhodes D P, Vininikainen M S, Monkman D J and Woodley A C, 'The UK Civil Aircraft Noise Contour Model, ANCON: Improvements in version 2', R&D Report 9842, Civil Aviation Authority, June 1999.

21 See http://www.faa.gov/about/office_org/headquarters_offices/apl/research/models/inm_model/.

22 'Standard Method of Computing Noise Contours around Civil Airports', ECAC.CEAC Document 29, European Civil Aviation Conference, December 2005.

3.28 Heathrow airport with its two runways alternates the runway used for arrivals and departures during periods of westerly operations and thus it has three operating modes in total. However, because Heathrow's traffic is sufficiently constant throughout the day, over the course of a whole day, there is little difference in average daily noise exposure between the two westerly modes and thus for the purposes of this study, Heathrow can be treated as though it has two operating-modes, like the other airports.

3.29 Although respondents were asked their views on aircraft noise experienced during summer 2014, ANIS[23] found that respondents' attitudes are often better correlated with more recent noise exposure at the respondent's location, e.g. the past week or the past month. These shorter time periods could be associated with substantially different modal splits and thus different noise exposure. For all airports, except Luton (where data were not available), the following different temporal noise exposures were also estimated for each respondent's location, and for each available noise indicator:

- 100% westerly-mode
- 100% easterly-mode
- 7-day average-modal split prior to interview
- 30-day average-modal split prior to interview
- 92-day summer average-modal split
- The highest noise level from either the 100% westerly or 100% easterly modes

3.30 The last indicator simply uses the highest noise exposure that occurred from either the 100% westerly or 100% easterly operating modes. Note that, irrespective of the modal split applied, the number and types of aircraft operating are for a 16-hour average summer day for $L_{Aeq,16h}$, N70 and N65 respectively, and the 24-hour average annual day for L_{den}.

[23] Brooker et al 1985. Brooker P, Critchley J B, Monkman D J & Richmond C. DR Report 8402: United Kingdom Aircraft Noise Study: Main Report, January 1985.

Chapter 4

Social survey results

Introduction

4.1 This chapter presents an overview of the social survey results. It includes information on:

- Demographic, household and dwelling characteristics of the sample respondents
- Attitudes to noise (all sources)
- Noise sensitivity
- Attitudes to the environment

4.2 Throughout this chapter all results are presented on a weighted basis in order to enable comparison across airports and noise bands, even though the sampling technique which had to be used means they are not nationally representative.

Survey design, responses and weighting

4.3 Responses have been weighted to account for differing probabilities of selection by airport and noise band, dwelling and household selection probability (where there are multiple dwellings and households at a single address) and individual selection weight, where there are multiple adults aged 18 or over at each household selected. A weighting was applied to correct for oversampling higher noise bands and oversampling at Gatwick airport[24].

[24] The largest single component of the weighting relates to respondents living near Gatwick. These were over-sampled (n=202) to allow for subset analysis, but in the overall sample this is weighted down to 31 responses to reflect the appropriate percentage of the population, see table 3 and table 2.2 of the Ipsos MORI Survey report.

SoNA 2014 in the context of SoNA 2013

4.4 This section presents information on demographic, household and dwelling information of the SoNA 2014 sample. It includes a comparison of the SoNA 2014 sample against the SoNA 2013 sample and the Census 2011 for England. Comparing the SoNA 2014 sample with the SoNA 2013 sample, although there are some similarities, the SoNA 2014 sample are younger, with fewer retired respondents and with a greater proportion in rented accommodation. However, it must be remembered that the SoNA 2014 is not intended to represent a national sample, as respondents were required to live within the vicinity of a civil airport and be exposed to an average summer day noise exposure level of at least 51 dB $L_{Aeq,16h}$.

Demographic, household and dwelling Information for the SoNA 2014 sample

4.5 Table 2 presents demographic information for the SoNA 2014 sample compared with SoNA 2013.

Table 2: Demographic Information for SoNA 2014, compared with SoNA 2013

	SoNA 2014 N=1,847 % (N)	**SoNA 2013** N=2,383 % (N)
How long have you lived in this home? (Question A1)[25]		
Less than 6 months	2.4% (44)	6.1% (146)
6 months - 1 year	7.9% (146)	6.2% (147)
1 - 2 years	12.1% (223)	7.2% (172)
2 - 5 years	17% (314)	13.3% (317)
5 - 10 years	16.5% (304)	15.9% (378)
10 years or more	43.9% (812)	51.3% (1222)
Don't know	0.2% (3)	n/a
Home ownership (Question H3)		
Being bought on a mortgage	27.4% (507)	34.7% (826)
Owned outright by household	24.2% (447)	36.2% (863)
Rented from local authority	16% (295)	5.5% (130)

[25] Survey question ID.

Rented from housing association	10.5% (193)	5.9% (141)
Rented from private landlord	19.2% (354)	15.2% (363)
Shared ownership	0.6% (11)	0.5% (12)
Tied to employment	0.2% (4)	0.8% (18)
Other	1.1% (20)	0.7% (16)
Refused	0.9% (17)	0.6% (14)
How did you come to be living here (Question H4)		
My choice	42.5% (785)	32.6% (777)
Choice made with someone else in the household	39% (721)	49.6% (1183)
Choice made by someone else in the household	7.1% (130)	11.0% (261)
Choice made by landlord (e.g. Local Authority, housing association)	9.8% (181)	2.6% (63)
Choice made by someone else outside the household, e.g. employer	0.6% (11)	1.4% (34)
Born here	0.2% (4)	n/a
Convenient for family / work / school	0.1% (2)	n/a
Inherited the property	0.1% (3)	n/a
The property owner is my partner / I moved in	0% (0)	n/a
Other	0.2% (3)	2.6% (62)
Refused	0.3% (6)	0.2% (4)
Age of respondent (Question H5)		
16-17 years	n/a	2.6% (62)
18 – 19 years	2.3% (42)	1.8% (43)
20 – 24 years	6.0% (111)	6.7% (159)
25 – 34 years	20.7% (383)	15.3% (365)
35 – 44 years	22.0% (407)	15.7% (375)
45 – 54 years	17.4% (321)	17.4% (415)
55 – 64 years	14.2% (263)	15.7% (375)
65 – 74 years	10.7% (197)	15.2% (362)
75 years or older	6.3% (116)	9.5% (228)
Refused	0.4% (8)	n/a
Gender of respondent (Question H6)		
Male	49.1% (907)	49.5% (1181)
Female	50.9% (940)	50.5% (1202)
Any infants, children or teenagers in household (0-17 years) (Question H7a)		
No	55.3% (1021)	68.6% (1634)

Yes	44.7% (826)	31.4% (749)
Employment Status of respondent (Question H8)		
Working full time (30 hours a week or more)	52.1% (962)	40.5% (966)
Working part time	12% (221)	14.5% (345)
Unemployed and looking for work	4.2% (78)	3.8% (90)
Retired from paid work altogether	17.6% (324)	26.5% (630)
In full-time education	3.7% (68)	5.8% (138)
Looking after the home or family	6.8% (125)	6.3% (150)
Something else	3.3% (62)	2.4% (57)
Refused	0.3% (6)	0.3% (6)
Working at home (Question H9a)		
Sometimes work at home	19.6% (361)	17.3% (413)
How many days in a typical week do you work from home? (Question H9b) - % given for N = 361 who work at home		
Less than 3	59.2% (214)	53.9% (222)
3 to 4	11.5% (42)	9.7% (40)
5 to 7	15.7% (57)	16.1% (66)
Varies	12.5% (45)	20.4% (85)
Social grade of head of household (Question H13a)		
A/B	25.4% (470)	28.1% (671)
C1	36.2% (669)	30.3% (722)
C2	15.2% (281)	21.2% (504)
D	12.4% (229)	10.9% (260)
E	9.8% (180)	9.5% (226)
Don't know	0.9% (17)	n/a

NB: the question numbers in the table reflect the numbering in SoNA 2014, not SoNA 2013.

The N for each variable/question may add to ±1 of the expected sample totals due to weighting and rounding.

4.6 Just under one-quarter of the sample owned their home outright, compared with over one-third for SoNA 2013 (36%), with just over a further one-quarter purchasing their home with a mortgage, compared with over one-third for SoNA 2013 (35%). Almost half of the sample (46%) rented their home either from the local authority, a housing association, or from a private landlord, compared with one-quarter (27%) for SoNA 2013. Almost half of the sample had a household that included infants, children or teenagers (0-17 years of age) (45%), compared with one-third for

SoNA 2013 (31%). Half of the SoNA 2014 sample was female. The sample ranged in age from 18 years to over 75 years with a median age of 35-44 years, compared with a median age of 45-54 years for SoNA 2013. Just over half of the sample (52%) worked full-time, compared with 41% for SoNA 2013, and just under one-fifth (18%) were retired in SoNA 2014, compared with 27% for SoNA 2013.

4.7 Table 3 presents dwelling information for the SoNA 2014 sample and compares it with SoNA 2013.

Table 3: Dwelling Information for SoNA 2014 compared with SoNA 2013

	SoNA 2014 N=1,847 % (N)	**SoNA 2013** N=2,383 % (N)
Type of house (Question A2)		
Purpose built flat/maisonette	31.6% (584)	9.7% (232)
Converted flat/maisonette	8.9% (165)	3.1% (74)
Semi-detached/end of terrace house	20% (370)	34.7% (827)
Mid-terrace house	11.7% (216)	19.0% (454)
Detached house	8% (148)	20.9% (497)
Bungalow	18.3% (337)	12.0% (285)
Cluster home	0.6% (11)	n/a
Other	0.8% (15)	0.6% (14)
Access to garden or other private outdoor space (Question A3)		
No	29.6% (546)	6.9% (164)
Yes	70.4% (1300)	93.1% (2219)
Double glazing in the home (Question Dblglaze)		
Missing information	5.1% (95)	n/a
Yes	69.1% (1275)	n/a[26]
No	12.5% (231)	4.6% (111)
Don't know	13.3% (245)	n/a
Age of home (Question H2)		
Before 1919	16% (295)	17.6% (419)
1919 – 1940	16.3% (301)	17.4% (415)
1941 – 1960	14% (258)	14.0% (335)

[26] SoNA 2013 reported double-glazing on all or some rooms and thus the response cannot be compared to SoNA 2014.

1961 – 1990	17.2% (318)	31.3% (746)
1991 – 2000	5.8% (106)	5.4% (129)
2001 – 2010	4.8% (90)	6.4% (151)
2011 – 2014	0.7% (14)	1.6% (39)
Don't know	25.2% (465)	6.3% (150)

4.8 Just under one-quarter of the sample owned their home outright, compared with over one-third for SoNA 2013 (36%), with just over a further one-quarter purchasing their home with a mortgage, compared with over one-third for SoNA 2013 (35%). Almost half of the sample (46%) rented their home either from the local authority, a housing association, or from a private landlord, compared with one-quarter (27%) for SoNA 2013. Almost half of the sample had a household that included infants, children or teenagers (0-17 years of age) (45%), compared with one-third for SoNA 2013 (31%). Half of the SoNA 2014 sample was female. The sample ranged in age from 18 years to over 75 years with a median age of 35-44 years, compared with a median age of 45-54 years for SoNA 2013. Just over half of the sample (52%) worked full-time, compared with 41% for SoNA 2013, and just under one-fifth (18%) were retired in SoNA 2014, compared with 27% for SoNA 2013.

4.9 Table 4 presents dwelling information for the SoNA 2014 sample and compares it with SoNA 2013.

Table 4: Demographic distribution of SoNA 2014 data and the 2011 Census for England

	SoNA 2014	Census 2011 England
Age (Question H5)		
16 – 17 years	n/a	3.1%
18 – 19 years	2.3%	3.2%
20 – 24 years	6.0%	8.4%
25 – 34 years	20.7%	16.7%
35 – 44 years	22.0%	17.3%
45 – 54 years	17.4%	16.9%
55 – 64 years	14.2%	14.4%
64 – 74 years	10.7%	10.6%
75 years or older	6.3%	9.6%

Refused	0.4%	n/a
Respondent Gender (Question H6)		
Female	50.9%	50.8%
Which of these best describes your current situation? (Question H8)		
Working full time (30 hours a week or more)	52.1%	47.1%
Working part time	12.0%	17.2%
Unemployed and looking for work	4.2%	4.5%
Retired from paid work altogether	17.6%	14.2%
In full-time education	3.7%	3.6%
Looking after the home or family	6.8%	4.5%
Something else	3.3%	8.9%
Refused	0.3%	n/a
Social Grade based on Chief Income Earner (Question H13a)		
A/B	25.4%	23.0%
C1	36.2%	30.9%
C2	15.2%	20.6%
D/E	22.2%	25.5%
Don't know	0.9%	n/a

4.10 The SoNA 2014 is very similar in terms of gender and full-time employment. Compared with the 2011 Census, the SoNA 2014 sample is under represented in part-time workers and is slightly over-represented by retired people. The socio-demographic status is similar for social group A/B, however there is an over-representation of social group C1 and a corresponding under representation of social groups C2 and D/E. In terms of age groups, SoNA 2014 is over-represented by the 25-34 and 35-44 years age groups, but under-represented in the 18-19 and 20-24 years age groups.

Noise sensitivity

4.11 Question A7b sought views on how noise sensitive respondents reported themselves to be, the results of which are presented in Table 5 alongside the equivalent self-reported responses for SoNA 2013.

Table 5: Self-reported noise sensitivity

	SoNA 2014 % (N)	SoNA 2013 % (N)
1 Not at all sensitive	17.2% (410)	13.7% (252)
2	16.7% (397)	17.5% (322)
3	15.3% (364)	16.4% (303)
4	19.7% (470)	21.6% (399)
5	15.8% (377)	13.1% (242)
6	5.9% (141)	8.8% (162)
7 Highly sensitive	9.3% (222)	8.6% (160)

4.12 Noise sensitivity of respondents for SoNA 2014 is similar to that found for SoNA 2013, although the differences for a rating of 1, 5 and 6 are statistically significant ($p<0.05$).

Attitudes to key environmental problems

4.13 Table 6 presents information on attitudes to key environmental problems and asked respondents to select their top five. Traffic congestion, parking, speed or danger, was cited by just over half (53%) of the SoNA 2014 sample, compared with 43% for SoNA 2013. 34% of the SoNA 2014 cited noise, compared with 15% for SoNA 2013, and 23% cited air pollution from traffic or local industry/agriculture, compared with 7% for SoNA 2013.

Table 6: Attitudes to key environmental problems

	N=1,847 % (N)	N=2,383 % (N)
A6 SoNA 2014 Please look at this list of environmental problems. Which FIVE would you say you are personally most affected by?		
Traffic congestion, parking, speed or danger	52.6% (971)	43.1% (1027)
Litter and/or rubbish	35.6% (657)	32.0% (764)
Noise	33.8% (624)	15.2% (363)
Fouling by dogs	24.9% (460)	34.3% (816)
Air pollution from traffic or local industry/agriculture	23.5% (435)	7.4% (177)
Pests, including wild/feral animals, birds, insects or fouling by animals other than dogs	15% (277)	9.4% (223)
Dust and dirt	12.6% (233)	7.4% (175)
None of these	12.4% (228)	n/a

Smells	11% (202)	7.8% (186)
Loss of natural environment – gardens, green spaces or plant/animal life	8.5% (156)	8.9% (213)
Light pollution from streetlights, floodlights, security lights, shops, and other artificial light from outside the house	8.3% (154)	7.8% (187)
Extreme weather (e.g. flooding, drought, high winds, snow and ice)	6.5% (121)	10.4% (247)
Pollution of rivers, lakes, the sea, beaches, etc.	4.1% (76)	2.8% (67)

4.14 The SoNA 2014 survey, like previous surveys also sought views on noise disturbance from a variety of sources. In the 2014 survey 12% of respondents reported being very or extremely bothered, annoyed or disturbed by road traffic noise, whereas in the 2013 survey the proportion was 7%. In the 2014 survey 7% of respondents reported being very or extremely bothered, annoyed or disturbed by neighbours/people nearby, whereas in the 2013 survey the proportion was 11%. In the 2014 survey 8% of respondents reported being very or extremely bothered, annoyed or disturbed by construction noise, whereas in the 2013 survey the proportion was 4%.

4.15 It must be noted that these findings do not reflect any nationally representative year to year change as the sampling for the two surveys was very different.

Chapter 5

Noise exposure and annoyance

Introduction

5.1 This chapter focuses on the analysis undertaken to address three of the five survey aims which are:

- Obtain new and updated evidence on attitudes to aviation noise around airports in England, including the effects of aviation noise on annoyance, wellbeing and health.
- Obtain new and updated evidence on what influences attitudes to aviation noise, and how attitudes vary, particularly how attitudes vary with L_{Aeq}, but also other non-acoustic factors that may influence attitudes, such as location and time of day, and socio-economic group of respondents.
- Examine whether the currently used measure of annoyance, L_{Aeq}, is the appropriate measure of annoyance for measuring the impact on people living around major airports.

5.2 In particular it focuses on how attitudes and annoyance vary with noise exposure level, based on four different noise indicators and six different temporal definitions of each noise indicator. The effect of non-acoustic factors is covered in Chapter 7.

Number of respondents by noise exposure

5.3 Although respondents were selected based on 2013 average summer day noise exposure, their noise exposure was estimated for a 2014 average summer day using records of air traffic and distributions of flights by arrival and departure routes from summer 2014.

5.4 As explained in paragraphs 3.27-3.29, wind patterns can affect the direction of use of an airport's runway over a summer period and

consequently affect noise exposure levels. Table 7 compares the runway modal split between summer 2013 and summer 2014.

Table 7: Runway modal split by airport for summer 2013 and summer 2014

Airport	Summer 2013 modal split % west / % east	Summer 2014 modal split % west / % east
Birmingham	61% / 39%	62% / 38%
East Midlands	n/a	73% / 27%
Gatwick	69% / 31%	64% / 36%
Heathrow	74% / 26%	68% / 32%
London City	n/a	62% / 38%
Luton	n/a	n/a
Manchester	84% / 16%	76% / 24%
Newcastle	n/a	55% / 45%
Stansted	71% / 29%	54% / 46%

5.5 Tables 8 to 11 show the numbers of weighted responses obtained at nine airports for the four noise exposure variables used in this analysis.

Table 8: Respondents categorised by 2014 summer average mode $L_{Aeq,16h}$ (N=1,847)

Noise exposure variable average summer day $L_{Aeq,16h}$ (dB)	Airport									
	BHX	EMA	LGW	LHR	LCY	LTN	MAN	NCL	STN	Total*
48.0 – 50.9			1	74			2		2	79
51.0 – 53.9	28	1	15	644	3	7	86	3	5	792
54.0 – 56.9	34	2	9	360	63	5	36	3	3	515
57.0 – 59.9	20		3	178	16	6	34	2	2	261
60.0 – 62.9	8	1	1	103	6	1	8			129
≥ 63	1			61	5	2	1		1	71
Total*	**90**	**5**	**31**	**1,419**	**93**	**21**	**168**	**8**	**12**	**1,847**

* Totals do not always sum due to rounding

5.6 In Table 8, the 2014 average summer day noise exposure for 79 respondents was found to be less than 51 dB $L_{Aeq,16h}$, but greater than 49 dB $L_{Aeq,16h}$ so they were assigned to a 48-50.9 dB $L_{Aeq,16h}$ band. This occurred due to a combination of changes in traffic levels, changes in flight routings associated with airspace trials and changes in wind patterns

that affected some airports compared with 2013 values. These respondents were, nevertheless retained for analysis within the study.

Table 9: Respondents categorised by 2014 annual average mode 24-hour L_{den} (N=1,462)

Average annual 24-hour L_{den} (dB)	Gatwick	Heathrow	Stansted	Total*
50.0 – 52.9	5	194	0	199
53.0 – 55.9	13	579	6	598
56.0 – 58.9	8	333	3	344
59.0 – 61.9	3	165	2	170
62.0 – 64.9	1	89	0	91
≥ 65	1	59	1	60
Total*	**31**	**1,419**	**12**	1,462

* Totals do not always sum due to rounding

5.7 In Table 9, the average annual 24-hour L_{den} noise exposure is approximately 1.5 dB lower than $L_{Aeq,16h}$ and thus L_{den} lends itself to being in 3 dB bands, starting at 50 dB L_{den}.

Table 10: Respondents categorised by 2014 summer average number of events ≥70 dB L_{ASmax} (N70) (N=1,826)

Average summer day number of events ≥70dB L_{ASmax}	Airport								
	BHX	EMA	LGW	LHR	LCY	MAN	NCL	STN	Total*
<1			7	560		5			573
1 – 24	25		14	376		93	1	6	515
25 – 49	18	1	3	133	32	21	3	1	212
50 – 99	28	2	2	143	51	17	4	4	251
100 – 199	18	1	2	81	10	24		2	139
≥200*			2	127		8			137
Total*	**90**	**5**	**31**	**1,419**	**93**	**168**	**8**	**12**	**1,826**

* Totals do not always sum due to rounding

In Table 10, N70 refers to the number of events of ≥70 dB L_{ASmax} that respondents were estimated to have been exposed to during an average summer day in 2014. Bands were defined in intervals using a geometric scale (doubling of N) to provide consistency with the 3 dB wide bands used for

$L_{Aeq,16h}$, though it was necessary to separate out respondents exposed to less than 1 event; 573 weighted responses (31%) were found to have experienced no noise events of ≥70 dB L_{ASmax}, even though they experience $L_{Aeq,16h}$ levels between 48 and 53.9 dB. There were three respondents at Heathrow that were exposed to N70 ≥400, with the highest number of N70 events for a respondent being 411. Due to this small sample the three respondents have been included in the ≥200 category.

Table 11: Respondents categorised by 2014 summer average number of events ≥65 dB L_{ASmax} (N65) (N=1,462)[27]

Average summer day number of events of ≥65 dB L_{ASmax}	Airport			
	Gatwick	Heathrow	Stansted	Total*
<1		18		18
1 – 24	4	274	4	283
25 – 49	3	240		243
50 – 99	9	284	5	298
100 – 199	7	254	3	264
200 – 399	8	306		313
≥400		43		43
Total*	**31**	**1,419**	**12**	**1,462**

* Totals do not always sum due to rounding

5.8 In Table 11, due to the large number of respondents who were exposed to no events ≥70 dB L_{ASmax}, an additional noise indicator of the number of events ≥65 dB L_{ASmax} (N65) was also assessed for respondents surveyed around Heathrow, Gatwick and Stansted only (Table 11). The number of respondents experiencing less than one noise event ≥65 dB L_{ASmax} per average summer day was 18, compared with 573 respondents experiencing less than one noise event ≥70 dB L_{ASmax} per average summer day. The same banding of number of events was used as for N70.

[27] In revising this report, it was noticed there was a transcription issue in Table 11 which has now been corrected.

Noise annoyance

Sampling rationale

5.9 When looking at evidence on attitudes to noise, many surveys obtain a number of responses within a narrow geographical location that can be defined as a single noise exposure value and compare attitudes across different geographical locations that are exposed to different noise levels.

5.10 For SoNA 2014, a slightly different approach was taken. To maximise the number of locations considered it was necessary to group annoyance responses by noise exposure band. A 3 dB wide band was chosen to balance noise exposure variation and sample sizes. In practice, because locations were randomly sampled within each noise band, the average exposure within each band was close to the mid-band interval. For example, the average $L_{Aeq,16h}$ exposure for respondents in the 51-54 dB band was 52.5 dB.

Survey questions on annoyance

5.11 All respondents who had been resident at their current address during summer 2014 were asked questions on Civil Aircraft Noise. However, some questions were not asked if the respondent answered that they were not at all bothered by civil aircraft noise of any kind at any time, thus table totals may not always agree with the sample details given in Chapter 4.

5.12 The annoyance question used is that defined by ISO[28], and was applied using two scales also recommended by ISO, one with a five-point verbal rating scale (CAN1) and one with an 11-point numerical rating scale (CAN34). For both questions annoyance is characterised as 'being bothered, disturbed or annoyed', however throughout this document such responses are simply referred to as annoyance responses.

[28] ISO/TS 15666:2003, Assessment of noise annoyance by means of social and socio-acoustic surveys, Technical Specification, first edition, 1st February 2003.

5.13 CAN1 was presented as a matrix question, seeking views on overall annoyance from civil aircraft, but also views on noise associated with specific types of operation and specific times of day.

CAN1: So, thinking about this summer, when you were here at home, how much did each of these different types of noise from aeroplanes bother, disturb or annoy you?

		Not at all	Slightly	Moderately	Very	Extremely	Don' t know
i	Overall noise of all kinds, from aeroplanes	☐	☐	☐	☐	☐	☐
ii	Noise from aeroplanes on the ground at an airport (e.g. taxiing planes, engine testing)	☐	☐	☐	☐	☐	☐
iii	Noise from aeroplanes taking off and climbing	☐	☐	☐	☐	☐	☐
iv	Noise from aeroplanes descending and landing	☐	☐	☐	☐	☐	☐
v	Noise from aeroplanes in flight	☐	☐	☐	☐	☐	☐
vi	Noise from aeroplanes during the day (7 a.m. – 11 p.m.)	☐	☐	☐	☐	☐	☐
vii	Noise from aeroplanes during the night (11 p.m. – 7 a.m.)	☐	☐	☐	☐	☐	☐

5.14 Although annoyance has been long been considered a daytime noise effect in UK policy (as distinct from night time sleep disturbance), the study assessed responses to two questions, one on overall aeroplane noise (CAN1i) and noise from aeroplanes during the daytime (CAN1vi).

5.15 Question CAN34 used an 11-point numerical scale, but unlike CAN1, was presented as a single question with no time of day subdivision:

CAN34: Thinking about this summer, what number from 0 to 10 best shows how much you were bothered, disturbed or annoyed by noise from aeroplanes.

Not at all **Extremely**

0	1	2	3	4	5	6	7	8	9	10	Don't know
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

5.16 In addition to questions CAN1 and CAN34, an earlier question, A9a, was asked seeking general attitudes on aircraft, airport or airfield noise, using

the ISO recommended methodology and a 5-point verbal scale. This question was followed by similar questions on other sources of noise, including both transport and non-transport sources.

A9a. Thinking about the last 12 months or so, when you are here at home, how much does noise from aircraft, airports or airfields, bother, disturb or annoy you?

- ☐ Not at all
- ☐ Slightly
- ☐ Moderately
- ☐ Very
- ☐ Extremely
- ☐ Don't know
- ☐ Don't hear

Annoyance scores

5.17 Although some comparisons can be made across the different survey questions the use of different scales limits the extent to which direct comparisons can be made. It has therefore become standard practice to transform annoyance scales used in such surveys onto a 0 to 100 scale. This technique has been used by Miedema & Oudshoorn (2001)[29], van Kempen & van Kamp (2005)[30] and in the ANASE study (2007)[31]. Different scales are transformed onto a 0 to 100 scale assuming equal width categories such that:

$$Annoyance\ score_i = \frac{100(i - {}^1/_2)}{m}$$

5.18 This gives the relationships between the 5 and 11-point scales and annoyance scores shown in Table 12.

29 Miedema & Oudshoorn (2001). Miedema H M E & Oudshoorn C G M, "Annoyance from Transportation Noise: Relationships with Exposure Metrics DNL and DENL and Their Confidence Intervals", Environmental Health Perspectives, Volume 109, Number 4, April 2001.

30 van Kempen & van Kamp (2005). van Kempen E E M M & van Kamp I, "Annoyance from air traffic noise: Possible trends in exposure-response relationships", Report 01/2005, RIVM, 2005.

31 Attitudes to Noise from Aviation Sources in England, November 2007.

Table 12: Transformation of 5 and 11-point scales to a 0 to 100 scale

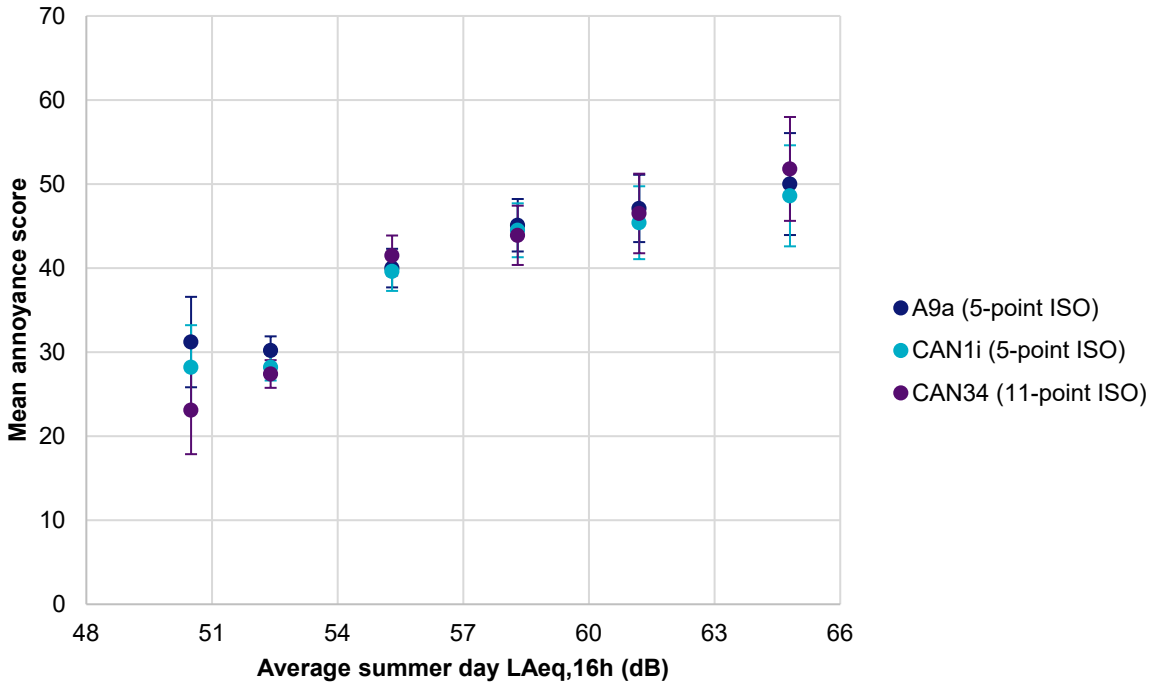
5-point verbal scale			11-point numerical scale		
Annoyance category	**Scale boundary**	**Scale mid-point**	**Annoyance category**	**Scale boundary**	**Scale mid-point**
Not at all	0.0 – 19.0	10	0	0.0 – 8.9	4.5
Slightly	20.0 – 39.9	30	1	9.0 – 17.9	13.6
Moderately	40.0 – 59.9	50	2	18.0 – 26.9	22.7
Very	60.0 – 79.9	70	3	27.0 – 35.9	31.8
Extremely	80.0 – 100.0	90	4	36.0 – 44.9	40.9
			5	45.0 – 54.9	50.0
			6	55.0 – 63.9	59.1
			7	64.0 – 72.9	68.2
			8	73.0 – 81.9	77.3
			9	92.0 – 90.9	86.4
			10	91.0 – 100.0	95.5

5.19 Having transformed responses onto common scales, annoyance scores to each question were compared in order to determine the integrity and consistency of the responses. Table 13 and Figure 1 shows the mean annoyance score for the three questions as a function of average summer day $L_{Aeq,16h}$ noise band. Figure 1 also includes 95% confidence intervals around the mean annoyance scores.

Table 13: Mean annoyance scores in SoNA 2014 survey as a function of average summer day $L_{Aeq,16h}$ noise exposure (N=1,844)

Average summer day $L_{Aeq,16h}$ (dB)	N	Mean annoyance score			95% confidence interval		
		A9a	CAN1i	CAN34	A9a	CAN1i	CAN34
48.0 – 50.9	79	31.2	28.2	23.1	±5.4	±5.0	±5.2
51.0 – 53.9	790	30.2	28.2	27.4	±1.7	±1.6	±1.6
54.0 – 56.9	515	40.0	39.6	41.5	±2.3	±2.3	±2.4
57.0 – 59.9	260	45.1	44.5	43.9	±3.1	±3.2	±3.5
60.0 – 62.9	129	47.1	45.4	46.5	±4.0	±4.3	±4.7
≥ 63	71	50.0	48.6	51.8	±6.1	±6.0	±6.2
Total	**1,844**	**-**	**-**	**-**			

Figure 1: Plot of mean annoyance scores in SoNA 2014 survey as a function of average summer day $L_{Aeq,16h}$ noise exposure



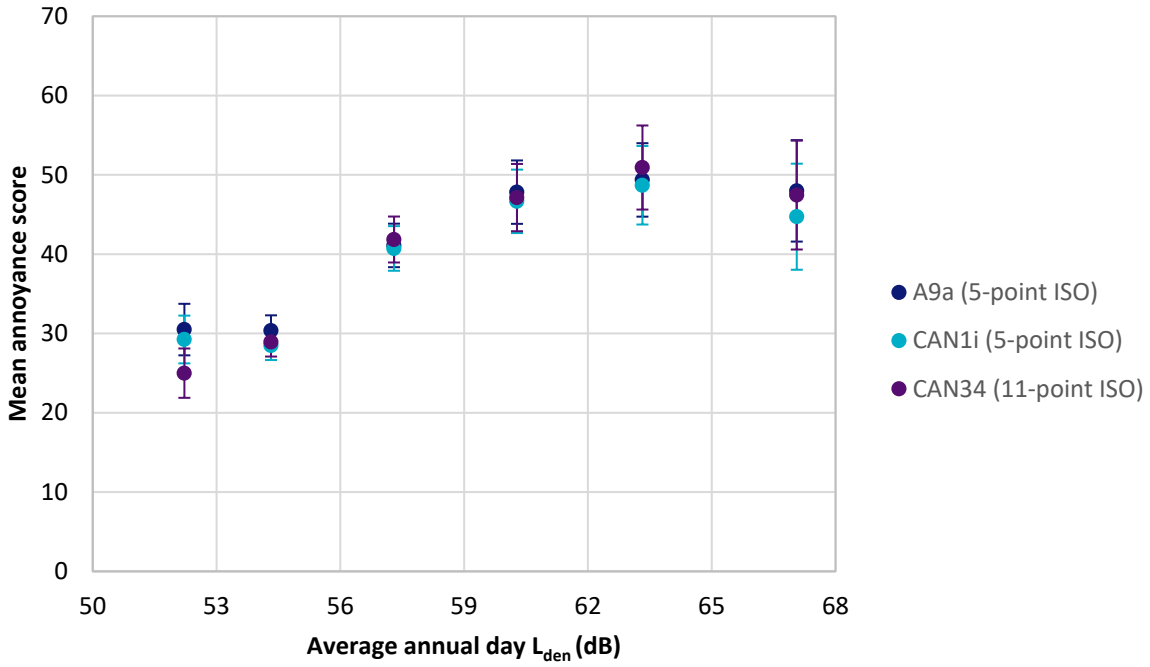
Error bars show 95% confidence intervals of the mean scores.

5.20 Mean annoyance scores were also calculated for the indicators L_{den}, N70 and N65, which are shown in Tables 14 to 16 and Figures 2 to 4 respectively.

Table 14: Mean annoyance scores in SoNA 2014 survey as a function of average annual day 24-hour L_{den} noise exposure (N=1,462)

Average annual day L_{den} (dB)	Average L_{den}	N	Mean annoyance score			95% confidence interval		
			A9a	CAN1i	CAN34	A9a	CAN1i	CAN34
50.0 – 52.9	52.2	199	30.5	29.2	25.0	±3.2	±3.0	±3.1
53.0 – 55.9	54.3	598	30.4	28.5	28.9	±1.9	±1.8	±1.8
56.0 – 58.9	57.3	344	41.1	40.7	41.8	±2.7	±2.8	±2.9
59.0 – 61.9	60.3	170	47.8	46.7	47.1	±4.0	±4.0	±4.2
62.0 – 64.9	63.3	91	49.4	48.7	50.9	±4.6	±5.0	±5.3
≥ 63	67.1	60	48.0	44.7	47.5	±6.4	±6.7	±6.9
Total	**-**	**1,462**	**-**	**-**	**-**	**-**	**-**	**-**

Figure 2: Plot of mean annoyance scores in SoNA 2014 survey as a function of average annual day 24-hour L_{den} noise exposure



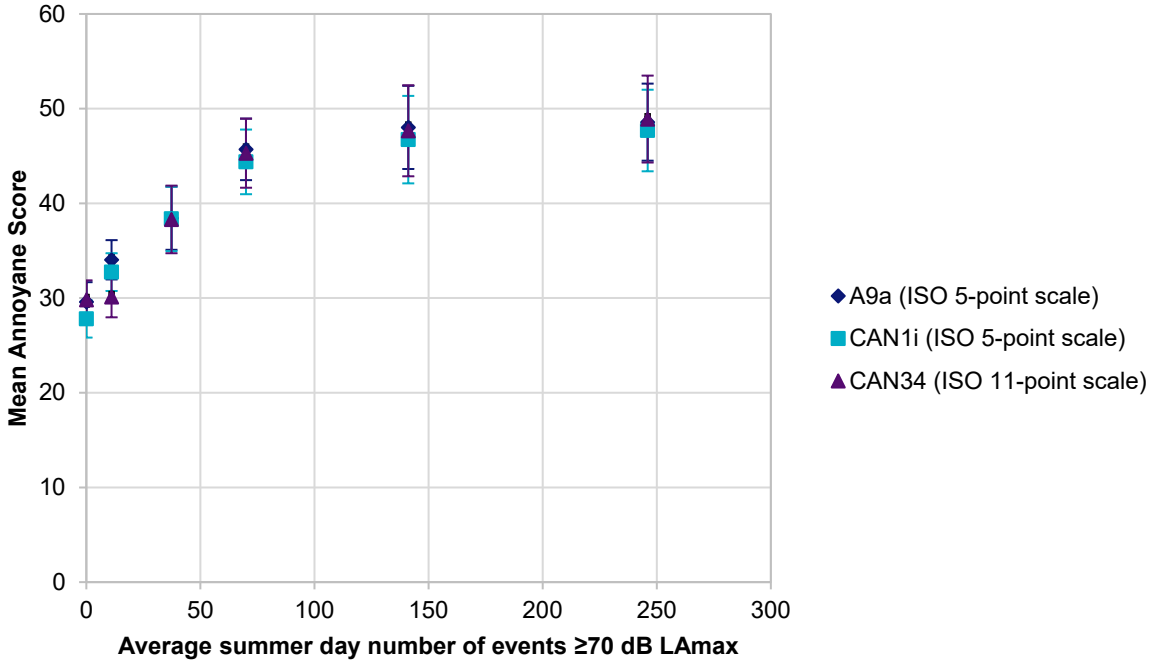
Error bars show 95% confidence intervals of the mean scores.

Table 15: Mean annoyance scores in SoNA 2014 survey as a function of average summer day, 16-hour N70 noise exposure (N=1,823)

Average summer day number of events ≥70 (dB L_{ASmax})	Average number of events ≥70 dB L_{ASmax} in band	N*	Mean annoyance score			95% confidence interval		
			A9a	CAN1i	CAN34	A9a	CAN1i	CAN34
<1	0	570	29.6	27.8	29.8	±2.1	±2.0	±2.1
1-24	11	515	34.0	32.7	30.1	±2.1	±2.0	±2.2
25-49	37	212	38.4	38.4	38.3	±3.3	±3.4	±3.6
50-99	70	251	45.7	44.4	45.3	±3.2	±3.4	±3.6
100-199	141	139	48.0	46.7	47.7	±4.4	±4.6	±4.8
>200	246	136	48.6	47.7	48.9	±4.1	±4.3	±4.6
Total	**-**	**1,823**	**-**	**-**	**-**	**-**	**-**	**-**

* Totals do not always sum due to rounding

Figure 3: Plot of mean annoyance scores in SoNA 2014 survey as a function of average summer day, 16-hour N70 noise exposure

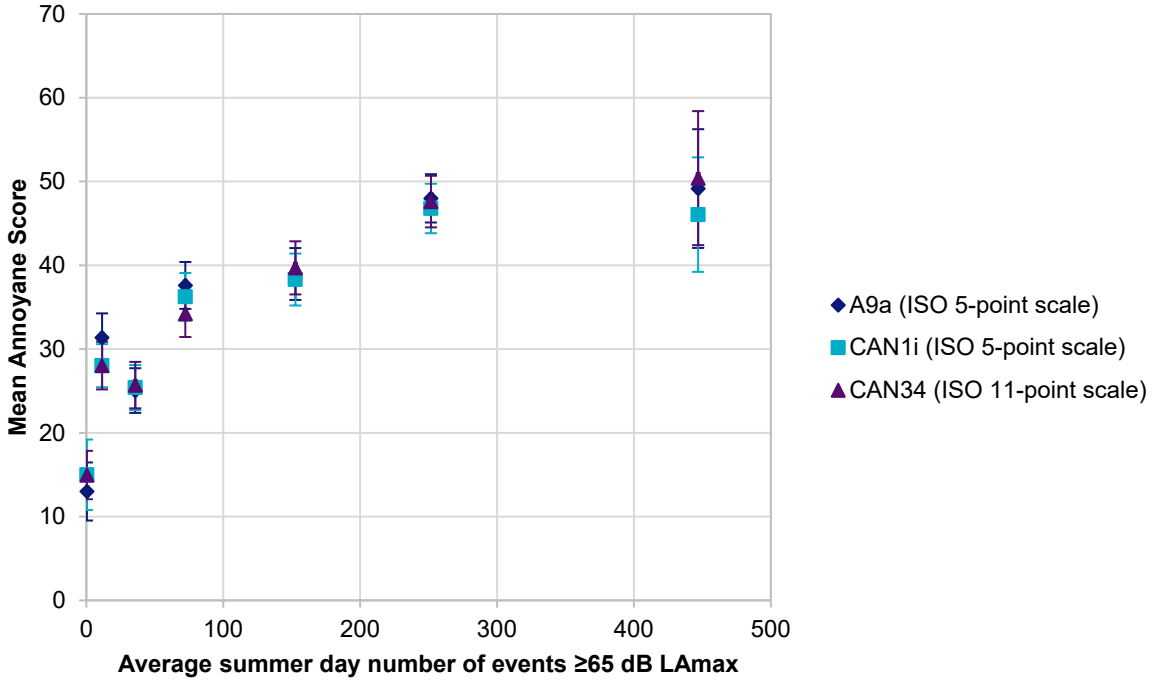


Error bars show 95% confidence intervals of the mean scores.

Table 16: Mean annoyance scores in SoNA 2014 survey as a function of average summer day, 16-hour N65 noise exposure (N=1,460)

Average summer day number of events ≥65 (dBA)	Average number of events ≥65 dB L_{ASmax} in band	N	Mean annoyance score			95% confidence interval		
			A9a	CAN1i	CAN34	A9a	CAN1i	CAN34
<1	0	18	13.0	15.0	15.0	±3.5	±4.2	±2.9
1-24	11	283	31.4	28.0	28.0	±2.9	±2.6	±2.8
25-49	36	243	25.0	25.4	25.7	±2.7	±2.7	±2.8
50-99	72	297	37.6	36.2	34.2	±2.8	±2.8	±2.8
100-199	153	263	39.0	38.3	39.7	±3.1	±3.1	±3.2
200-399	252	313	48.0	46.8	47.6	±2.9	±3.0	±3.1
≥400	447	43	49.2	46.1	50.4	±7.1	±6.8	±8.0
Total	-	**1,460**	-	-	-	-	-	-

Figure 4: Plot of mean annoyance scores in SoNA 2014 survey as a function of average summer day, 16-hour N65 noise exposure



Error bars show 95% confidence intervals of the mean scores.

Relationship between different noise indicators and mean annoyance score

5.21 In order to identify whether one noise indicator is more strongly associated with mean annoyance score, a logistic function was fitted through the mean annoyance scores plotted for each noise indicator. A logistic function[32] is preferred as it is naturally bounded between 0 and 100%, unlike other types of functions. The correlation of determination (r^2)[33] of a logistic function fitted using ordinary least-squares regression for each noise indicator is shown in Table 17.

[32] The data points are close to linear and correlation does not significantly change whether a linear, polynomial or logistic function is used. A logistic function, however, avoids the situation where a linear or polynomial function predicts zero or negative annoyance at low noise exposure.

[33] In statistics, the coefficient of determination, denoted r^2, is a number that indicates the proportion of the variance in the dependent variable that is predictable from the independent variable. r^2 varies between 0 and 1, with a higher number indicating that a greater proportion of the variance in the dependent variable is predicted from the independent variable.

Table 17: Coefficients of determination between different noise indicators and mean annoyance score

Noise indicator	Weighted responses	r^2
92-day $L_{Aeq,16h}$	1,460	0.874
Annual L_{den} 24-hour	1,460	0.707
92-day N70 16-hour	1,460	0.694
92-day N65 16-hour	1,460	0.659
92-day N65 16-hour*	1,442	0.728

* N65 analysis with 18 respondents experiencing less than 1 event of at least 65 dB L_{ASmax} excluded.

5.22 Whilst numerically the r^2 values show that $L_{Aeq,16h}$ correlates better with mean annoyance score, in practice, all the noise indicators show adequate correlation. There is, however, no evidence to suggest that any of the indicators assessed is better than $L_{Aeq,16h}$.

Effect of runway direction

5.23 As explained in Chapter 3, noise exposure levels at individual locations may be substantially affected by the direction of use of an airport's runway.

5.24 For safety reasons, aircraft are generally required to take-off or land into wind. In the UK, the predominant wind direction is a south-westerly wind and, as a result, most UK airports have runways aligned east-west or south-west-north-east. Most take-offs and landings operate in an east to west direction and are colloquially referred to as westerly-mode operations. Conversely, during periods of easterly winds, take-offs and landings operate in a west to east direction and are colloquially referred to as easterly-mode operations.

5.25 This is the case for the nine study airports, with the exception of Birmingham airport, whose runway is aligned north-west-south-east, in which case westerly-mode refers to the south-east-north-west mode and easterly-mode refers to north-west-south-east mode.

5.26 Because different flight paths are used depending on the runway direction, there can be substantial differences in noise exposure

experienced at some residential locations, in excess of 10 dB. Although respondents were asked to give their views 'about the summer', interviews took place over a five month period with large variations in the proportion of operating mode used at many of the study airports. ANIS found that annoyance responses correlated much better with shorter term definitions of noise exposure experienced prior to interview.

5.27 To examine the effects of changes in noise exposure in the time preceding interview, for each respondents dwelling location, noise exposure was re-estimated for six different temporal variations:

- 92-day summer average modal split
- 30-day summer average modal split prior to interview
- 7-day summer average modal split prior to interview
- Summer average westerly day
- Summer average easterly day
- Summer day highest noise level from either the 100% westerly or 100% easterly modes

5.28 A logistic function was fitted to mean annoyance score and $L_{Aeq,16h}$ noise exposure based on the six temporal variations defined in paragraph 3.29 and correlation of the logistic function for each temporal variation is presented in Table 18.

Table 18: Correlation between temporal variations of $L_{Aeq,16h}$ noise exposure and mean annoyance score

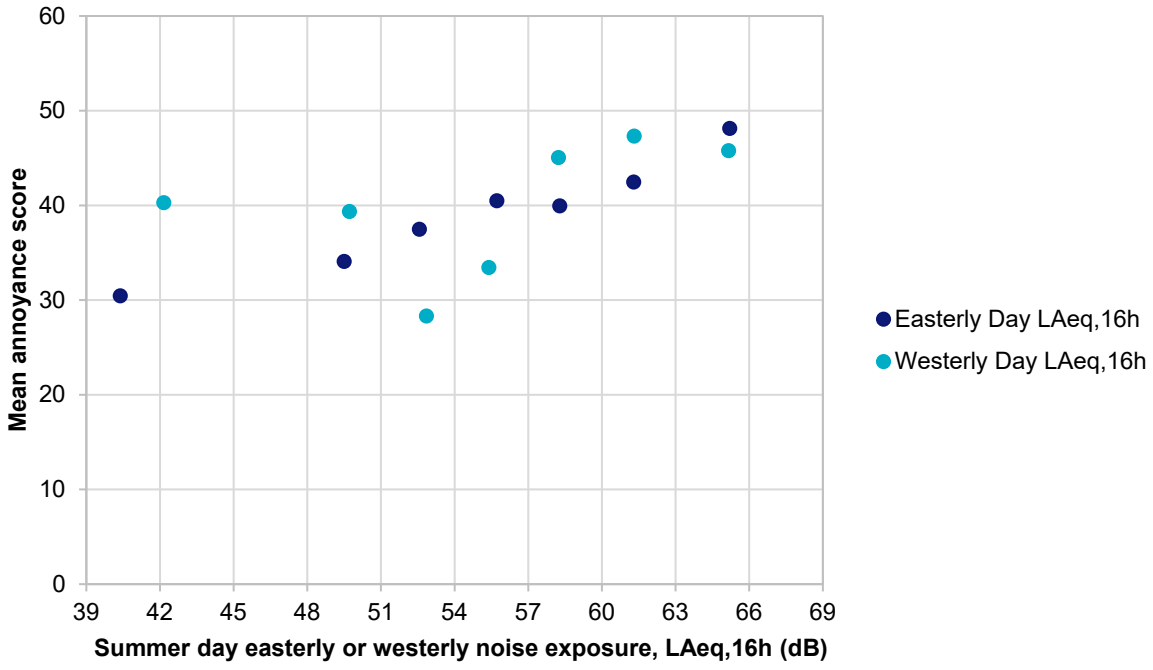
Noise indicator	N	r^2
92-day average mode	1,844	0.882
30-day average mode	1,844	0.828
7-day average mode	1,844	0.687
Westerly day	1,844	0.207
Easterly day	1,844	0.952
Highest noise level of either westerly or easterly mode	1,844	0.877

5.29 Of the average-modes, the 92-day average correlates with mean annoyance score better (higher r^2) than a 30-day or 7-day average. Somewhat surprisingly, easterly day noise exposure has the highest r^2 (0.95), whereas a westerly day has the lowest r^2 (0.21). Closer

examination shows that 70% of survey respondents were exposed to westerly noise, consistent with prevailing wind direction and noise exposure at English airports. The mean annoyance scores (Figure 5), however, show that attitudes to easterly or westerly noise differ markedly below 55 dB $L_{Aeq,16h}$. When, westerly day noise exposure falls below 51 dB $L_{Aeq,16h}$, indicating easterly noise dominates, annoyance scores remain constant, leading to poor correlation. In contrast annoyance scores continue to reduce with reducing easterly noise exposure, even for the majority exposed to predominantly westerly-mode noise. The higher annoyance associated with easterly, as oppose to westerly operations, may be due to the relatively infrequent use of easterly operations at UK airports.

5.30 In contrast easterly noise exposure, which occurs much less frequently than a westerly day due to westerly prevailing winds is highly correlated (r^2=0.95). The indicator based on highest noise exposure from either the easterly or westerly modes, correlates with annoyance as well as the 92-day summer average.

Figure 5: Mean annoyance score plotted as a function of easterly and westerly day $L_{Aeq,16h}$ noise exposure



Airport developments, consultations and trials during 2014

5.31 During 2014, several of the airports surveyed announced developments, undertook consultations and/or operated airspace trials that altered the noise exposure in their vicinity, leading to both increases and decreases in noise exposure at certain locations. Regardless of whether noise exposure differed during summer 2014 from previous years, these changes may have also affected expectations or heightened awareness of aircraft noise and may have had an impact on attitudes given in survey interviews. Details of relevant developments, consultations and trials are summarised in Appendix E.

Percentage highly annoyed

5.32 The preceding analysis used mean annoyance score. In aircraft noise assessment it has become common practice to focus on those individuals that are said to be highly annoyed. In their landmark works, both Shultz[34] and Miedema et al[35] defined high annoyance as a cut-off of 72 on a 100 point scale.

5.33 Using the 100 point scales in Table 12, the cut-offs for the 5 and 11-point scales are:

- 5-point scale: 'Extremely annoyed' (category 5) + 0.4 x 'Very annoyed' (category 4)
- 11-point scale: A score of 8, 9 or 10

5.34 A 2013 ANASE update study by Flindel et al[36] also used a cut-off of 72 and applied it as defined above to a 5-point scale.

5.35 Using these criteria, Table 19 presents the distribution of response to the CAN1i question and the corresponding percentage of respondents highly

[34] Schultz T J. (1978) 'Synthesis of social surveys on noise annoyance', Journal of Acoustical Society of America, 64, p. 377-405.

[35] Miedema H M E & Vos H. (1998) 'Exposure-response relationships for transportation noise', Journal of Acoustical Society of America, 104 (6), p. 3432-3445.

[36] Flindell et al (2013). "Understanding UK Community Annoyance with Aircraft Noise", ANASE update, Report for 2M Group, September 2013.

annoyed. Table 20 presents corresponding results using the CAN34 11-point scale question. As was the case for mean annoyance scores, the percentage of respondents highly annoyed is very consistent for both questions. Overall, 12% of responses to the CAN1i question (the 5-point scale) indicated high annoyance, whilst 11% of responses to the CAN34 question (the 11-point scale) indicated high annoyance.

Table 19: Distribution of annoyance responses to CAN1i question as function of $L_{Aeq,16h}$

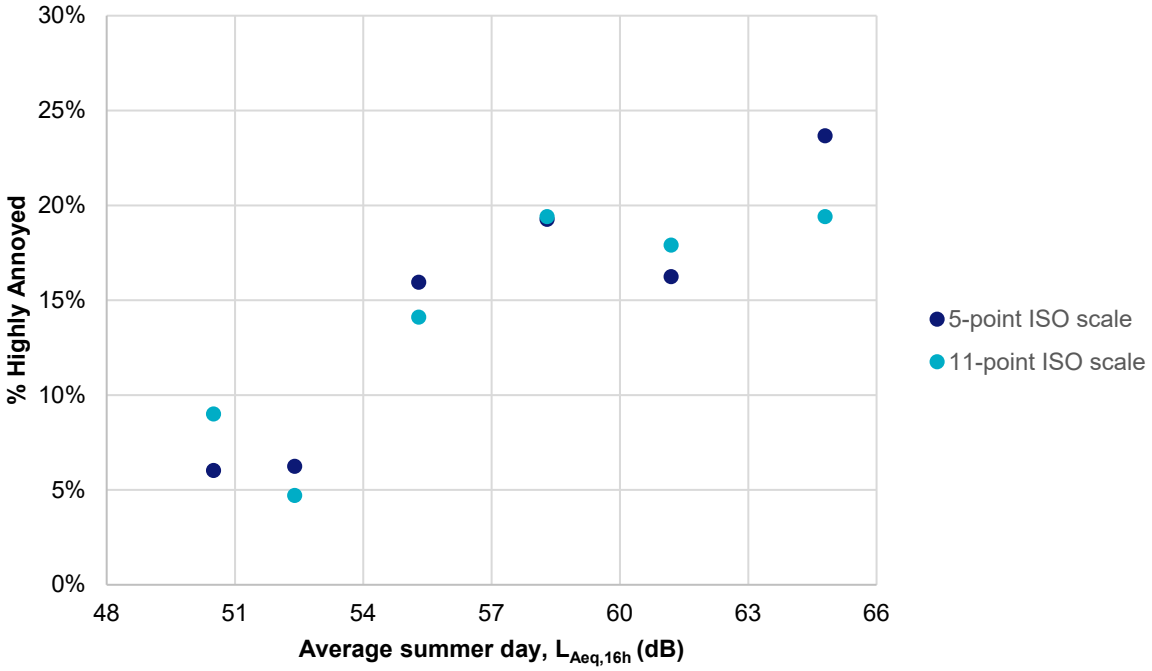
Average summer day $L_{Aeq,16h}$ (dB)	Not at all	Slightly	Moderately	Highly annoyed		% highly annoyed
				Very	Extremely	
48.0 – 50.9	50.0%	22.5%	16.3%	8.8%	2.5%	**6.0%**
51.0 – 53.9	49.1%	25.2%	14.6%	8.1%	3.0%	**6.2%**
54.0 – 56.9	28.4%	29.6%	18.5%	12.6%	10.9%	**15.9%**
57.0 – 59.9	18.8%	31.2%	21.5%	15.4%	13.1%	**19.3%**
60.0 – 62.9	19.4%	19.4%	38.0%	11.6%	11.6%	**16.2%**
≥ 63	16.9%	25.4%	19.7%	23.9%	14.1%	**23.7%**
Total	**35.8%**	**26.7%**	**18.5%**	**11.3%**	**7.6%**	**12.1%**

Table 20: Distribution of annoyance responses to CAN34 question as function of $L_{Aeq,16h}$ (%)

Average summer day $L_{Aeq,16h}$ (dB)	0 (%)	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	Highly annoyed (%)			% highly annoyed
									8	9	10	
48.0 – 50.9	28.2	33.3	10.3	12.8	1.3	1.3	1.3	2.6	6.4	0.0	2.6	**9.0**
51.0 – 53.9	23.9	23.9	15.0	8.9	5.3	6.7	5.7	5.9	1.9	1.3	1.5	**4.7**
54.0 – 56.9	13.3	10.9	12.5	13.3	7.0	9.4	8.8	10.9	5.5	3.3	5.3	**14.1**
57.0 – 59.9	12.6	10.3	13.4	11.5	6.9	8.4	5.0	12.6	7.6	5.7	6.1	**19.4**
60.0 – 62.9	11.6	3.9	12.4	10.9	7.0	14.0	10.1	12.4	7.0	4.7	6.2	**17.9**
≥ 63	9.7	4.2	6.9	8.3	5.6	13.9	15.3	16.7	6.9	5.6	6.9	**19.4**
Total	**18.1**	**16.6**	**13.4**	**10.8**	**6.0**	**8.2**	**6.9**	**9.0**	**4.4**	**2.8**	**3.8**	**11.0**

5.36 The percentage of respondents calculated as highly annoyed is also plotted in Figure 6.

Figure 6: Percentage of respondents calculated as highly annoyed



5.37 There is a sharp increase in responses between 51-54 and 54-57 dB $L_{Aeq,16h}$, as was also reflected in the earlier mean annoyance scores. Above 54-57 dB, the percentage highly annoyed broadly increases with increasing exposure level.

5.38 Tables 21-23 show similar data as a function of average summer day N70, average annual day 24-hour L_{den} and average summer day N65 respectively.

Table 21: Percentage of respondents indicating high annoyance for all airport locations except Luton by average summer day 16-hour N70 (total n=1,823)

Average summer day number of events of ≥70 dB L_{ASmax}	Weighted responses in noise band	CAN1i % highly annoyed	CAN34 % highly annoyed
0	573	7.9%	6.8%
1 – 24	515	7.9%	6.3%
25 – 49	212	13.0%	10.1%
50 – 99	251	20.3%	21.9%
100 – 199	139	22.5%	19.5%
>200	136	20.1%	19.2%
Total	1,823	12.2%	11.0%

5.39 Results for N70 (Table 21) show a similar sharp increase in the percentage of respondents highly annoyed between 1-24 and 25-49 events.

Table 22: Percentage of respondents for Heathrow, Gatwick and Stansted indicating high annoyance by average summer day L_{den} 24-hour (total n=1,462)

Average summer day L_{den} 24-hour (dB)	Weighted responses in noise band	CAN1i % highly annoyed	CAN34 % highly annoyed
50.0 – 52.9	199	5.8%	5.0%
53.0 – 55.9	600	6.4%	4.3%
56.0 – 58.9	343	16.3%	15.2%
59.0 – 61.9	169	21.3%	20.7%
62.0 – 64.9	90	19.1%	17.8%
≥ 65	62	19.0%	17.7%
Total	**1,462**	**11.7%**	**10.2%**

5.40 Results using the 24-hour L_{den} noise indicator (Table 22) follow a similar trend to $L_{Aeq,16h}$, with a sharp rise between 53-55.9 and 56-58.9 dB L_{den}.

Table 23: Percentage of respondents indicating high annoyance for Heathrow, Gatwick and Stansted by average summer day 16-hour N65 (total n=1,462)

Average summer day number of events of ≥65 dB L_{ASmax}	Weighted responses in noise band	CAN1i % highly annoyed	CAN34 % highly annoyed
<1	18	0.0%	0.0%
1 – 24	283	5.2%	6.0%
25 – 49	243	5.1%	3.2%
50 – 99	298	12.1%	7.6%
100 – 199	264	12.8%	11.5%
200 – 399	313	21.3%	20.1%
≥400	43	14.4%	20.8%
Total	1,462	11.6%	10.2%

5.41 Results for N65 (Table 23) show an increase in the percentage of respondents highly annoyed between 25-49 and 50-99 events for CAN1i, and between 50-99 and 100-199 events for CAN34. Previously, the step increase in percentage highly annoyed occurred between 50-99 and 100-199 events for both questions. The step increase seen here for CAN1i now occurs earlier than in the initial publication of the report. This is a

consequence of the updated and corrected N65 noise data, which has changed the distribution of respondents within the N65 noise bands.

Comparison with ANASE and ANIS

5.42 Table 24 compares the overall approaches taken by SoNA 2014, ANASE and ANIS studies. The SoNA 2014 and ANASE studies used the same ISO 5-point verbal scale annoyance question, used the same transformation to annoyance score and used the same cut-off to define high annoyance.

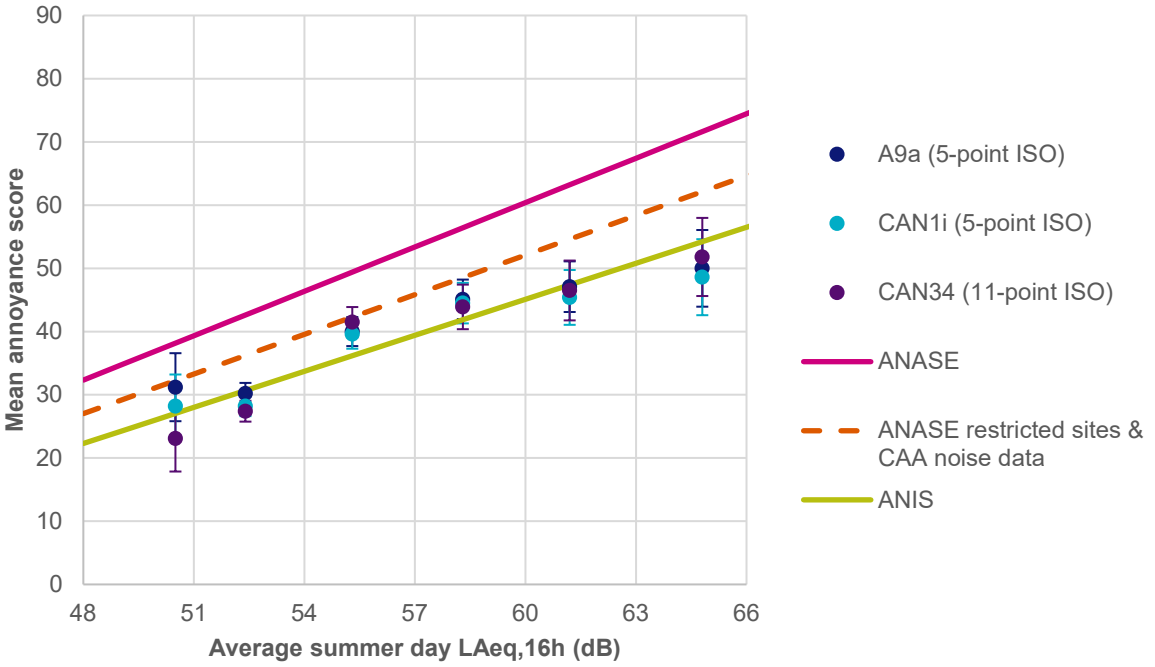
Table 24: Comparison of SoNA 2014, ANASE and ANIS studies

Parameter	SoNA 2014	ANASE	ANIS
Survey year	2014	Phase 1: 2003 Phase 2: 2005	1982
Site selection	Sites randomly selected, stratified by noise exposure level	Sites randomly selected, stratified by sound level and number of aircraft	Sites pre-selected based on sound level and number of aircraft
Coverage	Semi-clustered approach with noise exposure estimated for each respondent's location around 8 airports	56 sites around 16 airports	23 sites around 5 airports
Number of interviews	1,999	2,132	2,097
Noise exposure level range	$L_{Aeq,16h}$ range: 51 to 72 dB	$L_{Aeq,16h}$ range: 40 to 64 dB At least one event of 65 dB L_{ASmax} or more every four hours	L_{eq} range: 51 to 72 dB
Annoyance question	Main annoyance questions used five point and 11-point ISO scales	Main annoyance question used five-point ISO scale	Main annoyance question used four-point scale plus "not heard"
Annoyance scale transformation	Transformed to 0 to 100 scale using equally spaced categories	Transformed to 0 to 100 scale using equally spaced categories	No transformation used
High annoyance cut-off	72%	72%	Not defined but roughly equivalent to 75%

5.43 Mean annoyance scores calculated from the SoNA 2014 survey are plotted in Figure 7, alongside results from the full ANASE study and ANASE restricted sites (see paragraph 2.12), and those derived for ANIS by the ANASE researchers. SoNA 2014 is seen to produce similar mean annoyance scores as for ANIS, whilst ANASE calculated somewhat

higher values. This is not to say that the SoNA 2014 findings are the same as or similar to ANIS[37].

Figure 7: Comparison of mean annoyance scores for SoNA 2014, ANASE and ANIS



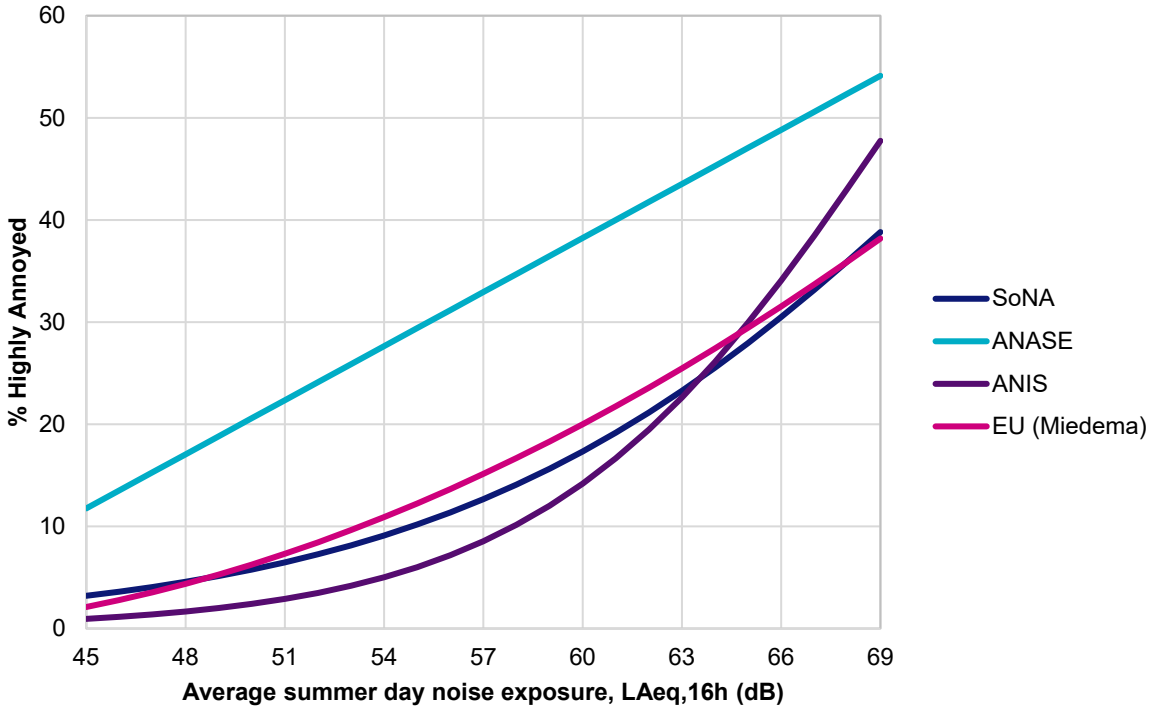
5.44 Figure 8 completes the comparison by comparing the percentage of respondents calculated as highly annoyed from the three surveys, with the ANASE results based on the update from 2013 as the original report did not calculate a percentage highly annoyed. It is apparent that for values below 60 dB $L_{Aeq,16h}$, the SoNA 2014 results lie between ANASE and ANIS. At levels above 63 dB $L_{Aeq,16h}$ the SoNA 2014 estimates lie below ANIS. This may be due to small sample sizes at higher exposure levels for SoNA 2014 not being representative – early charts showed mean responses with relatively large uncertainties due to small sample sizes.

5.45 The SoNA 2014 results are somewhat similar to the Miedema curve[37,38].

37 ANIS predates the concept of mean annoyance scores and thus these have been calculated retrospectively. Because the final output of ANIS that informed policy was the percentage highly annoyed it is premature to conclude that SoNA 2014 and ANIS are same based solely on mean annoyance score.

38 The Miedema dose-response function is based on the 24-hour L_{den} indicator. Although Miedema recommends converting L_{den} to $L_{Aeq,16h}$ using an adjustment of $L_{den} = L_{Aeq,16h} + 2$ dB, the study found the difference was 1.5 dB for SoNA 2014 respondents (see Appendix B) and this value was used in constructing Figure 8.

Figure 8: Comparison of % highly annoyed for SoNA 2014, ANASE, ANIS and Miedema



5.46 The results in Figure 8 have been used to update Table 3 of CAP 725 Appendix B, as shown in Table 25.

Table 25: Percentage highly annoyed as a function average summer day noise exposure, $L_{Aeq,16h}$

Average summer day noise exposure, $L_{Aeq,16h}$ (dB)	% highly annoyed	
	ANIS 1982	SoNA 2014
51	3%	7%
54	5%	9%
57	9%	13%
60	14%	17%
63	23%	23%
66	34%	31%
69	48%	39%

5.47 The same percentage of respondents said by ANIS to be highly annoyed at 57 dB $L_{Aeq,16h}$ now occurs at 54 dB. Comparing with the results in Table 25, the 'Miedema' dose response function[39], predicts 12% highly annoyed at 54 dB and 16% at 57 dB.

[39] Miedema & Oudshoorn (2001). Miedema H M E & Oudshoorn C G M, "Annoyance from Transportation Noise: Relationships with Exposure Metrics DNL and DENL and Their Confidence Intervals", Environmental Health Perspectives, Volume 109, Number 4, April 2001.

Chapter 6

Health and wellbeing

6.1 An objective of the SoNA 2014 survey was also to obtain evidence on the effects of noise on well-being and health. The scope of the well-being and health questions was, however, constrained by the need to limit the length of the questionnaire.

6.2 The questionnaire asked respondents a question about their general health at the time of interview and specific questions using a previously validated well-being scale. Question HL1 asked people to rate their health on a 5-point scale. Table 26 shows the association between self-reported health rating and annoyance score. Over half the respondents stated that their health rating was “very good” or “excellent”.

Table 26: Crosstabulation results for self-reported health rating and annoyance scores

		Overall annoyance score (5-point scale)						
		N	**10**	**30**	**50**	**70**	**90**	**Total**
Self-reported health rating	**Excellent**	374	7%	6%	4%	2%	2%	**20%**
	Very good	663	12%	11%	7%	4%	2%	**36%**
	Good	567	12%	7%	6%	4%	2%	**31%**
	Fair	166	4%	2%	1%	2%	1%	**9%**
	Poor	71	1%	1%	1%	0%	0%	**4%**
	Total	**1841**	**36%**	**27%**	**19%**	**11%**	**8%**	**100%**

6.3 A Chi-Square Test of Independence was performed to examine the relationship between self-reported health rating and annoyance score. The relationship between these variables was found to be significant ($X^2(16)=38.793$, $p=0.001$). This test suggests that there is a relationship between self-reported health rating and annoyance score.

6.4 Table 27 presents self-reported health rating and noise exposure.

Table 27: Crosstabulation results for self-reported health rating and average summer day $L_{Aeq,16h}$

		Average summer day $L_{Aeq,16h}$ (dB)							
		N	48 – 51	51 – 54	54 – 57	57 – 60	60 – 63	>63	Total
Self-reported health rating	Excellent	373	1%	9%	5%	3%	2%	1%	20%
	Very good	663	1%	16%	10%	5%	3%	1%	36%
	Good	567	1%	13%	9%	5%	2%	1%	31%
	Fair	166	1%	4%	2%	1%	1%	1%	9%
	Poor	71	0%	1%	2%	1%	0%	0%	4%
	Total	1,840	**4%**	**43%**	**28%**	**14%**	**7%**	**4%**	**100%**

6.5 A Chi-Square Test of Independence was performed to examine the relationship between self-reported health rating and aircraft noise exposure. The relationship between these variables was not significant ($X^2(20)=27.776$, $p=0.115$). This test suggests that there is no relationship between self-reported health rating and aircraft noise exposure level.

6.6 Question HL4 asked respondents to complete the Short Warwick-Edinburgh Mental Well-Being Scale (SWEMWBS)[40], which is comprised of seven questions:

[Shown on screen in random order]	A All of the time	B Often	C Some of the time	D Rarely	E None of the time	F Don't know / refused
I've been feeling optimistic about the future	☐	☐	☐	☐	☐	☐
I've been feeling useful	☐	☐	☐	☐	☐	☐
I've been feeling relaxed	☐	☐	☐	☐	☐	☐
I've been dealing with problems well	☐	☐	☐	☐	☐	☐
I've been thinking clearly	☐	☐	☐	☐	☐	☐
I've been feeling close to other people	☐	☐	☐	☐	☐	☐
I've been able to make up my own mind about things	☐	☐	☐	☐	☐	☐

Short Warwick–Edinburgh Mental Well-being Scale (SWEMWBS)

40 Short Warwick–Edinburgh Mental Well-being Scale (SWEMWBS) © NHS Health Scotland, University of Warwick and University of Edinburgh, 2006, all rights reserved.

6.7 Table 28 shows a crosstabulation table of the calculated SWEMWBS and annoyance scores (5-point scale). A Chi-Square Test of Independence was performed to examine the relationship between self-reported mental well-being and annoyance score. The relationship between these variables was found to be significant ($X^2(24)=50.239$, p=0.001). This test suggests that there is a relationship between self-reported well-being score and annoyance, mirroring the finding for self-reported health rating.

Table 28: Crosstabulation results for the Short Warwick-Edinburgh Mental Well-being Score (SWEMWBS) and annoyance score (5-point ISO scale)

SWEMWBS	Overall annoyance score (5-point score)						
	N	10	30	50	70	90	Total
<21	90	1.4%	1.5%	0.9%	0.4%	0.8%	5.0%
21 – 22	199	2.4%	1.6%	2.1%	1.2%	0.5%	7.7%
23 – 24	289	3.2%	3.0%	2.0%	1.8%	1.1%	11.1%
25 – 26	429	5.7%	4.3%	2.3%	2.0%	1.8%	16.1%
27 – 28	266	8.6%	6.3%	5.0%	2.3%	1.7%	23.9%
29 – 30	138	5.5%	4.2%	2.8%	1.3%	0.9%	14.8%
>30	386	9.0%	5.8%	3.6%	2.1%	1.1%	21.5%
Total	**1,797**	**35.8%**	**26.7%**	**18.6%**	**11.1%**	**7.8%**	**100.0%**

6.8 Table 29 shows a crosstabulation table of the calculated SWEMWBS and average summer day $L_{Aeq,16h}$. A Chi-Square Test of Independence was performed to examine the relationship between self-reported mental well-being and aircraft noise. The relationship between these variables was not significant (X2(30)=35.281, p=0.233). This test suggests that there is no relationship between self-reported well-being score and aircraft noise exposure level mirroring the finding for self-reported health rating.

Table 29: Crosstabulation results for the Short Warwick-Edinburgh Mental Well-being Score (SWEMWBS) and average summer day $L_{Aeq,16h}$

SWEMWBS	Average summer day $L_{Aeq,16h}$							
	N	48 – 51	51 – 54	54 – 57	57 – 16	60 – 63	>63	Total
<21	91	0.2%	2.1%	1.6%	0.6%	0.3%	0.3%	5.1%
21 – 22	138	0.7%	3.4%	1.4%	1.2%	0.6%	0.4%	7.7%
23 – 24	199	0.6%	4.8%	2.6%	2.0%	0.7%	0.4%	11.1%
25 – 26	289	0.5%	7.2%	5.0%	2.1%	0.8%	0.5%	16.1%
27 – 28	429	0.9%	9.0%	7.8%	3.2%	2.0%	0.9%	23.9%
29 – 30	263	0.8%	6.3%	3.8%	2.2%	0.9%	0.6%	14.7%
>30	386	0.6%	9.8%	5.6%	3.0%	1.8%	0.7%	21.5%
Total	1,795	**4.2%**	**42.6%**	**27.9%**	**14.3%**	**7.2%**	**3.8%**	**100%**

Chapter 7

Non-acoustic factors

Introduction

7.1 This chapter addresses the following study objective:

- Obtain new and updated evidence on what influences attitudes to aviation noise, and how attitudes vary, particularly how attitudes vary with L_{Aeq}, but also other non-acoustic factors that may influence attitudes, such as location and time of day, and socio-economic group of respondents.

7.2 Whilst the preceding chapter examined how annoyance varied with noise exposure level for a variety of different noise indicators, including L_{Aeq}, it did not consider other, non-acoustic factors. Past UK and international surveys have shown[41,42] that whilst there is a high correlation between noise exposure and mean annoyance or percentage highly annoyed, there is considerable variation in annoyance responses that is not associated with noise exposure.

7.3 The identification of and the relative contribution of non-acoustic factors may yield additional factors for consideration in noise management and in setting policy. Secondly, consideration of non-acoustic factors are important since they can obscure or confound the relationship between annoyance and noise exposure. By separating out and including the effects of other variables in our model for estimating the likelihood of annoyance it may be possible to reduce uncertainty and increase confidence in the relationship between noise exposure and annoyance.

41 Brooker et al 1985. Brooker P, Critchley J B, Monkman D J & Richmond C. DR Report 8402: United Kingdom Aircraft Noise Study: Main Report, January 1985.

42 Schultz T J. (1978) 'Synthesis of social surveys on noise annoyance', Journal of Acoustical Society of America, 64, p. 377-405.

Multivariate analysis

7.4 The analysis builds on that presented in Chapter 5 and that used for SoNA 2013, by introducing additional variables and estimating their association with annoyance. Because many of the non-acoustic factors are categorical, the statistical analysis lends itself to a logistic regression approach, which also requires the use of a categorical dependent variable. Thus, this analysis is based on being 'highly annoyed' (or not) as computed from question CAN34. CAN34 is used since the transformation of annoyance score to highly annoyed can be applied to each survey respondent and related to non-acoustic factors specific to that respondent.

7.5 The output from a logistic regression analysis is an odds-ratio. In statistics, the odds ratio is one of three main ways to quantify how strongly the presence or absence of property 'A' (highly annoyed or not) is associated with the presence or absence of property 'B' (the non-acoustic factor) in a given population. If the odds-ratio is greater than 1 then having property 'A' is considered to be associated with having property 'B' in the sense that the having 'B' raises the odds of having 'A'. Odds ratios and their associated significance level show only association and do not indicate causality, i.e. whether or not A causes B or B causes A.

7.6 Table 30 presents the results of a multivariate logistic regression analysis which considered the following non-acoustic factors in addition to average summer noise exposure, $L_{Aeq,16h}$.

- Length of residence
- Self-reported noise sensitivity rating
- Expectation of possibility of hearing noise from the airport prior to moving to their current home
- Expectations on experiencing more or less noise next summer
- Age
- Socio-economic status
- Presence of double-glazing
- 2011 Census Urban-Rural Classification

7.7 Each non-acoustic factor was considered in turn alongside noise exposure. This was done to ensure data samples were sufficiently large for analysis. In some cases multiple factors were considered together to check for any confounding effects on each other and this is discussed in a later section. For each non-acoustic factor, a reference condition (REF) was selected against which odds-ratios for the other values the non-acoustic factor can take are reported. For example for gender, female was selected as the reference condition and the odds-ratio reported is the odds of a man being highly-annoyed relative to a woman.

Table 30: Relationship of high annoyance to non-acoustic factors

		N	Odds ratio
Noise exposure	Average summer day $L_{Aeq,16h}$	1,847	1.121***
Length of residence	Less than 6 months	35	REF
	6 months – 1 year	139	0.364
	1 – 2 years	218	0.422*
	2 – 5 years	319	0.421**
	5 – 10 years	320	0.836
	10 years or more	841	0.934
Noise sensitivity	1 – Least sensitive	266	REF
	2	331	0.916
	3	304	1.495
	4	417	2.893***
	5	249	3.209***
	6	142	7.592***
	7 – Most sensitive	164	9.639***
Expectation of possibility of hearing noise from the airport prior to moving here	No, I was not aware of the possibility of hearing noise	575	2.826**
	Yes, but the noise was more than I expected	234	6.114***
	Yes, and the noise is roughly what I expected	682	0.705
	Yes, but the noise was less than I expected	116	0.301
	Yes, but the noise has got worse since I moved here	111	13.716***
Age	18 – 19 years	28	REF
	20 – 24 years	81	0.714
	25 – 34 years	342	0.876
	35 – 44 years	394	0.986
	45 – 54 years	343	1.409

	55 – 64 years	271	2.708*
	65 – 74 years	241	2.611*
	75 years or older	168	1.646
Gender	Male	900	0.910
	Female	977	REF
Approximated social grade	A	80	REF
	B	375	0.432**
	C1	648	0.444***
	C2	323	0.215***
	D	234	0.189***
	E	197	0.320***
Double-glazing	Yes	1341	REF
	No	165	1.848**
2011 census rural-urban classification	Urban	1646	REF
	Rural	231	2.007**
Expectation of noise next summer	1 – Expect it to be less	13	0.004
	2	16	0.055**
	3	45	0.205***
	4	774	0.097***
	5	180	0.136***
	6	124	0.421**
	7 – Expect it to be more	151	REF
Working from home	No	369	REF
	Yes	776	1.895***

*** p<0.05**
**** p<0.01**
***** p<0.001**

7.8 Employment at an airport or for an airline was considered separately and not found to have a statistically significant influence on annoyance. This may be because employment at an airport or with an airline represented a small proportion of the study respondents (2.6%).

7.9 Length of residence was found to be statistically significant for two categories 1-2 years ($p<0.05$) and 2-5 years ($p<0.01$), but not for other categories ($p=0.164$-0.740).

7.10 Being more noise sensitive was found to significantly increase the likelihood of high annoyance and was significant for all but the lowest two of the seven sensitivity categories (category 2 p=0.837 and category 3 p=0.314). For respondents in the most noise sensitive category, 7, OR=9.6 compared with reference category (p<0.001).

7.11 On the expectation of the possibility of hearing aircraft noise, prior to moving, the reference condition was defined as those respondents that had always lived there. For those that said they did not expect to hear aircraft noise OR=2.9 (p<0.05). Those that had moved and said they expected to hear noise, but that it was more than expected OR=6.1 (p<0.001) than residents that had always lived there. Results for the two groups that said noise was roughly what they expected or less than they expected after moving were not statistically significant (p=0.416 and p=0.156 respectively). Results for the group that thought the noise had got worse since moving there, OR=13.7, compared to the reference group. Overall, these findings indicated that expectation after moving was the strongest non-acoustic factor (largest statistically significant OR) affecting the likelihood of high annoyance.

7.12 On expectations of experiencing more or less noise next summer, the reference condition was taken as those likely to expect more noise next summer (this had a larger sample than those expecting less noise which aided analysis). Compared to those that thought noise next summer would be roughly the same (answer 4), to those expecting more noise (answer 7), OR=10.3 (p<0.001).

7.13 Although some variation was found between different age groups, the results were not found to be statistically significant for any age group (p=0.013-0.974). Gender was also not found to be statistically significant (p=0.530).

7.14 Approximated social grade was found to be statistically significant for all five categories (p<0.01). Respondents in grade A were found to be more likely to be highly annoyed than any other social grade. The odds of being

highly annoyed was found to decrease through grades A to E. For grades C2, D and E, OR=0.189 to 0.444.

7.15 Regarding double-glazing, it was found that for respondents from homes without double glazing OR=1.85 ($p<0.01$). As is discussed later, this finding did not remain when approximated social grade was added to the model in addition to double-glazing (see Confounding Factors).

7.16 Each respondent's dwelling was categorised according to the 2011 Census Rural-Urban Classification into five categories: three rural and two urban classifications. Results for none of the categories were statistically significant ($p=0.056$-0.875). The majority of respondents lived in urban locations. The 2011 Census Rural-Urban Classifications were re-grouped in order to reduce the number of classifications from five to two (all rural and all urban) which increased sample size. From this it was found that for respondents from locations classified as rural OR=2.0 ($p<0.05$). However, as with double-glazing, this finding did not remain once approximated-social grade was added to the model.

Confounding factors

7.17 Any factors identified as significantly correlated with high annoyance were then assessed together. Some were no longer found to have statistically significant associations with high annoyance. In particular when approximated social grade, presence of double-glazing and urban-rural classification were included together, only approximated social grade remained statistically significant, with double-glazing ($p=0.957$) and urban-rural classification ($p=0.276$) being not significant. This does not indicate there is not an association for urban/rural classification or double-glazing, but that one could not be identified from the survey most likely due to small sample sizes, especially in these sub-categories.

7.18 Having included additional contributory factors from Table 19, noise exposure continued to have a statistically significant association with

annoyance, its association with high annoyance strengthening to an odds ratio of 1.2 compared with 1.13 previously.

7.19 The inclusion of additional non-acoustic variables in the model, in particular noise sensitivity, expectations prior to moving and expectations next summer significantly improved the multivariate model predictive power, whilst reducing variance and uncertainty.

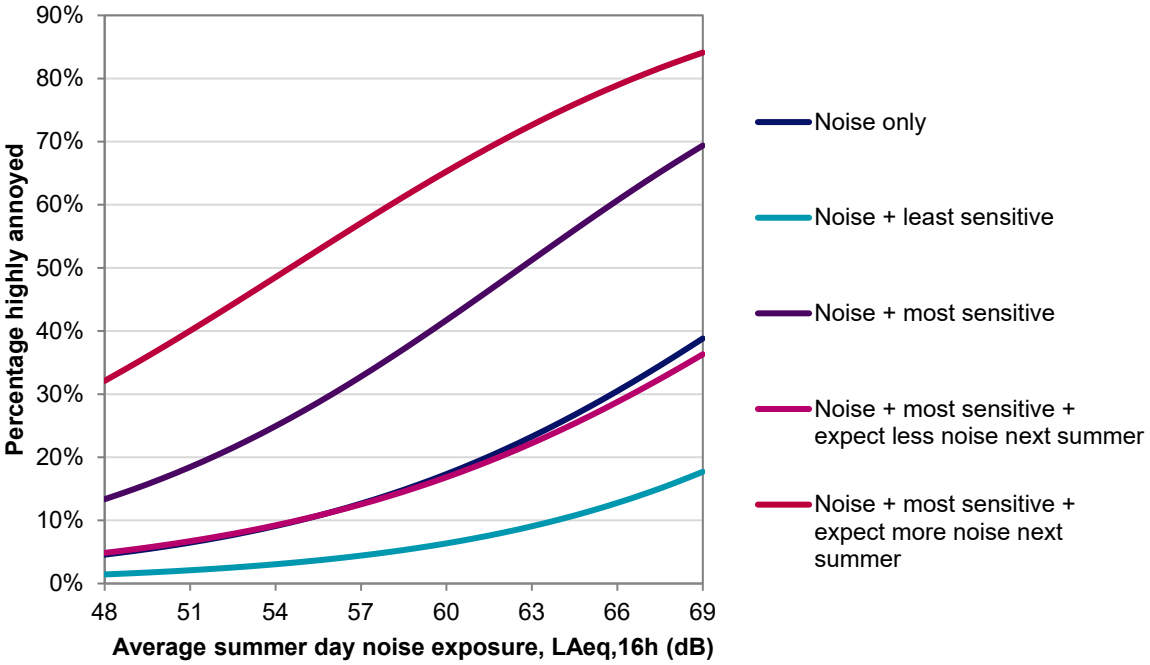
Dose response relationship

7.20 The logistic regression results may also be used as a statistical estimator of high annoyance. A model was developed using combinations of the two key non-acoustic factors: one with noise exposure alone (as presented in Chapter 5), noise exposure and noise sensitivity and, noise exposure, sensitivity and expectations next summer.

7.21 Figure 9 shows the dose response relationship, i.e. the proportion of respondents likely to be highly annoyed as a function of noise exposure along with four sensitivities around the baseline model based solely on noise exposure:

- Least sensitive respondents
- Most sensitive respondents
- Most sensitive respondents expecting less noise next summer
- Most sensitive respondents expecting more noise summer

Figure 9: Variation in dose response relationships for different logistic regression models



Chapter 8

Summary

Survey and analysis methodology

8.1 Respondents were selected using a random, partially-clustered approach from around nine airports in England, having been exposed to average $L_{Aeq,16h}$ noise levels of at least 51 dB in the summer of 2013.

8.2 1,999 participants completed a face-to-face survey on attitudes to civil aircraft noise. 122 were not resident during summer 2014, leaving a sample of 1,877 valid responses.

8.3 The survey used the ISO recommended 5-point verbal scale and 11-point numerical scale of reported annoyance from aircraft noise.

8.4 Data transformation to annoyance scores and the threshold for being defined as highly annoyed followed international best practice and the method used in recent UK and overseas studies. Annoyance scores calculated from the 5-point and 11-point scale questions were found to be consistent.

Study aims

8.5 The study aims as originally set out were:

- Obtain new and updated evidence on attitudes to aviation noise around airports in England, including the effects of aviation noise on annoyance, wellbeing and health.
- Obtain new and updated evidence on what influences attitudes to aviation noise, and how attitudes vary, particularly how attitudes vary with L_{Aeq}, but also other non-acoustic factors that may influence attitudes, such as location and time of day, and socio-economic group of respondents

- Examine whether the currently used measure of annoyance, L_{Aeq}, is the appropriate measure of annoyance for measuring the impact on people living around major airports.
- Consider the appropriateness of the policy threshold for significant community annoyance from aviation noise.
- Provide baseline results that can be used for a programme of regular surveys of attitudes to aviation noise.

8.6 It is helpful to recast these into a series of sequential questions, which have been used to frame the following sections.

Is $L_{Aeq,16h}$ still the most appropriate indicator to use to estimate the annoyance arising from aircraft noise?

8.7 The study compared reported mean annoyance scores against average summer-day noise exposure defined using four different noise indicators: $L_{Aeq,16h}$, L_{den}, N70 and N65.

8.8 Evidence was found that mean annoyance score correlated well with average summer day noise exposure, $L_{Aeq,16h}$ (r^2=0.87). There was no evidence found to suggest that any of the other indicators L_{den}, N70 or N65 (r^2=0.66-0.73) correlated better with annoyance than $L_{Aeq,16h}$.

8.9 Having said this, the study recognises that residents can struggle to understand the concept of a time-averaged metric such as $L_{Aeq,16h}$ and L_{den} and the fact that it is measured and reported on a logarithmic scale where a change of 3 dB representatives a doubling or halving of noise energy.

8.10 There is, therefore merit in considering greater use of 'Number Above' metrics as supplemental indicators to help portray noise exposure, but recognising that evidence-based decisions should continue to use $L_{Aeq,16h}$. In this context N65 is preferred over N70 as noise events in many areas are already beginning to occur at levels less than 70 dB L_{ASmax} and are forecast to reduce over time.

Is summer day, average mode, still the best time period to use as opposed to single-mode?

8.11 Whilst evidence was found indicating that easterly-mode noise exposure correlated best with mean annoyance score (r^2=0.95), westerly-mode noise exposure was found to have the poorest correlation (r^2=0.21). This occurs because respondents were found to be more annoyed by easterly-mode noise exposure compared to westerly-mode for a given noise level. Practically, this means that single-mode contours are unsuitable for decision making, but that they may be helpful for portraying exposure and changes to exposure.

8.12 Of the average-day modes, the existing 92-day summer average mode was found to correlate better (r^2=0.88) than shorter average modes (r^2=0.69-83). There was therefore no evidence found to support a change from the current practice of basing $L_{Aeq,16h}$ on an average summer day.

How does annoyance relate to exposure?

8.13 Mean annoyance score and the likelihood of being highly annoyed were found to increase with increasing noise exposure ($L_{Aeq,16h}$). The relationship found was close to linear, though annoyance levels plateau at low exposure and do not reach zero annoyance.

How do the results compare with ANIS, ANASE & Miedema?

8.14 Annoyance scores were found to be comparable with those found for the ANASE restricted sites, but lower than found by the full ANASE study, and higher than found by ANIS.

8.15 For a given noise exposure, a lower proportion of respondents was found to be highly annoyed than compared with ANASE, the results of which were considered unreliable.

8.16 For a given noise exposure, a higher proportion of respondents was found to be highly annoyed than compared with ANIS. This is highlighted in

Table 31, which presents tabular data from Figure 8 (Chapter 5), as an update to Table 3 of CAP 725 Appendix B.

Table 31: Percentage highly annoyed as a function average summer day noise exposure, $L_{Aeq,16h}$

Average summer day noise exposure, $L_{Aeq,16h}$ (dB)	% highly annoyed	
	ANIS 1982	SoNA 2014
51	3%	7%
54	5%	9%
57	9%	13%
60	14%	17%
63	23%	23%
66	34%	31%
69	48%	39%

8.17 The same percentage of respondents said by ANIS to be highly annoyed at 57 dB $L_{Aeq,16h}$ now occurs at 54 dB. Comparing with the results in Table 31, the 'Miedema' dose response function[43], predicts 12% highly annoyed at 54 dB and 16% at 57 dB.

How do measures of health and well-being relate to exposure?

8.18 Noise exposure and reported annoyance were compared against self-reported health rating (5-point scale) and the Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS), a measure of well-being. Poorer health ratings and lower SWEMWBS scores were found to be associated annoyance, but not with noise exposure.

What non-acoustical factors seem to influence annoyance?

8.19 Evidence was found that non-acoustic factors such as noise sensitivity, approximated social grade, and expectations – both prior to moving to an area exposed to aircraft noise and in the future – influence reported aircraft noise annoyance and these non-acoustic factors may be as important as the noise exposure level.

[43] Miedema & Oudshoorn (2001). Miedema H M E & Oudshoorn C G M, "Annoyance from Transportation Noise: Relationships with Exposure Metrics DNL and DENL and Their Confidence Intervals", Environmental Health Perspectives, Volume 109, Number 4, April 2001.

8.20 From the survey as a whole, 9% of respondents were estimated to be highly annoyed at an exposure level of 54 dB $L_{Aeq,16h}$. For the most sensitive individual the likelihood of being highly annoyed rises to 25%, the same as would occur at 64 dB and for the least sensitive it reduces to 3%. For the most sensitive and those expecting more noise next summer, at 54 dB, 49% are estimated to be highly annoyed, whereas for the most sensitive expecting less noise next summer the likelihood falls back to 9%.

8.21 An indication was found that urban/rural classification may be a non-acoustic factor, however, this was confounded by approximated social grade and the presence of double-glazing.

Recommendations for future surveys

8.22 The survey format has been designed for more frequent use. Noting the importance of non-acoustic factors identified that may be subject to greater variation over time, it is recommended that future surveys be undertaken more frequently.

Appendix A

Glossary of terms

ANASE	Attitudes to Noise from Aviation Sources in England (2002 survey reported 2007)
ANIS	Aircraft Noise Index Study (1982 survey reported in 1985)
APF	Aviation Policy Framework
dB	Decibel
dBA	Decibel A-weighted scale
$L_{Aeq,16h}$	Equivalent continuous sound level, 0700-2300
L_{ASmax}	Maximum single event noise level (time weighted slow)
L_{den}	Annual average 24-hour day, evening, night level
N	Sample size
N65	Number of events of 65 dB L_{ASmax} or more during an average summer day (0700-2300)
N70	Number of events of 70 dB L_{ASmax} or more during an average summer day (0700-2300)
NNAS	National Noise Attitude Survey
OR	Odds ratio
REF	Reference state for the independent variable used in logistic regression
SID	Standard Instrument Departure Route
SoNA	Survey of Noise Attitudes
SWEMWBS	Short Warwick-Edinburgh Mental Well-Being Score

Appendix B

Noise indices

Introduction

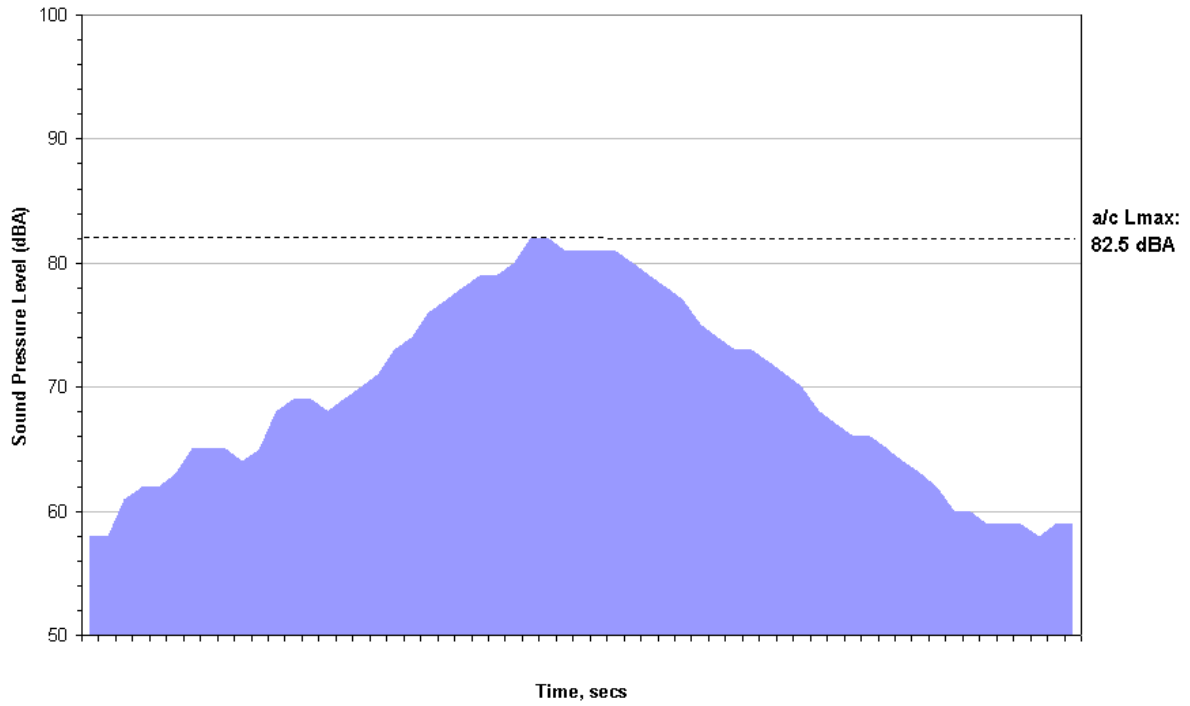
Noise indices must be reliable; thus they must not only correlate adequately with impact, but also be relatively simple to understand, readily definable by measurement or prediction, robust (which means that they are insensitive to unavoidable or unpredictable uncertainties), and realistic by accounting for factors that common sense tells people are important. As a rule, the major impact around airports is from air noise[44] which, for the most part, is a clearly identifiable part of the total noise climate. Thus, aircraft noise indices are expected to be sensitive to factors such as the numbers of aircraft heard and their noise levels, differences between day and night activity.

Single event L_{ASmax}

As an aircraft flies towards a location on the ground, the instantaneous noise level will rise to a maximum value. The maximum noise level, L_{ASmax}, will often, but not always be associated with the closest point between the aircraft path and a given location on the ground. As the aircraft then moves further away, the instantaneous noise level will then decrease as shown in Figure 10.

[44] By convention, the noise generated by aircraft during landing and take-off, including the noise generated whilst accelerating to take off and decelerating after landing. Noise generated during taxi from and to the runway and whilst parked is considered ground noise.

Figure 10: Noise event time history showing maximum noise level at a given location as an aircraft flies past



Equivalent Continuous Sound Level, L_{Aeq}

Currently the most commonly used long-term indicator is the Equivalent Continuous Sound Level, L_{Aeq}. This is the hypothetical steady state sound level that, over a given period of time, contains the same sound energy as the fluctuating sound over the same time period.

$L_{Aeq,16h}$ was adopted in 1990 on the basis of the 1982 Aircraft Noise Index Study, ANIS[45]. The reference time period is an average summer day, from June 16th to September 15th inclusive and from 7am to 11pm. The summer day period dates back to the recommendations in the 1963 Wilson Committee report on aircraft noise, which recommended measuring noise exposure during the summer months because people were more likely to have windows open, be outdoors, and aviation activity is at its most intense. In addition to these reasons, warmer summer temperatures adversely affect aircraft performance and lead to increased noise exposure compared to other times of the year. The time period of 7am to 11pm, recognises that daytime and night-time noise exposure can lead to quite different reactions in

45 Brooker et al 1985. Brooker P, Critchley J B, Monkman D J & Richmond C. DR Report 8402: United Kingdom Aircraft Noise Study: Main Report, January 1985.

people (principally daytime annoyance and night-time sleep disturbance) and thus it is better to define day and night noise exposure separately.

At the time $L_{Aeq,16h}$ was adopted in 1990, the UK government defined three threshold levels for policy consideration: 57, 63 and 69 dB $L_{Aeq,16h}$ representing, low, moderate and high annoyance. In the 2003 Air Transport White Paper, 57 dB $L_{Aeq,16h}$ was defined as marking the approximate onset of significant community annoyance, and this was re-affirmed in the Government's 2013 Aviation Policy Framework[46].

L_{den} and the EU Environmental Noise Directive

In 2002 the European Commission published Directive 2002/49/EC, establishing a common environmental noise indicator for the European Union. The day, evening, night level, L_{den} is a 24-hour L_{Aeq} indicator, determined as an annual average. It separates the 24 hours into three periods, a 12-hour day from 7am to 7pm, a 4-hour evening period from 7pm to 11pm and an 8-hour night period from 11pm to 7am[47]. Weightings are applied to the evening and night periods such that one evening flight counts as 3.16 day flights and one night period flight counts as 10 day flights. These weightings are specifically to reflect the likely increased sensitivity to a given noise exposure during the evening and night periods. As a result, there is no precise relationship between $L_{Aeq,16h}$ and L_{den}, it depends on the amount of noise in each period. For larger UK airports with some night flights L_{den} is numerically around 1.5 dB higher than the corresponding $L_{Aeq,16h}$.

N70 and N65

The N70 metric was devised to represent 'Number Above' contours, combining information on single event noise levels with aircraft movement numbers that are louder than 70 dB L_{ASmax}. The N70 is useful as it is an arithmetic indicator. All other things being equal, if the number of aircraft movements over an area doubles, the

46 2013 Aviation Policy Framework, Cm 8584, ISBN 9780101858427, Department for Transport, March 2013.

47 EU Member States may shorten the evening period by one or two hours and lengthen the day and/or the night period accordingly, provided that this choice is the same for all the noise sources in their country.

N70 doubles. However, if the extra movements were of a quieter type, not exceeding 70 dB L_{ASmax} at the location, then the N70 would remain unchanged. The N70 is also a useful metric as it permits measured noise levels to be very neatly summarised for any given period. This type of presentation can be very useful as a supplement to a L_{Aeq} type metric and as a communication tool.

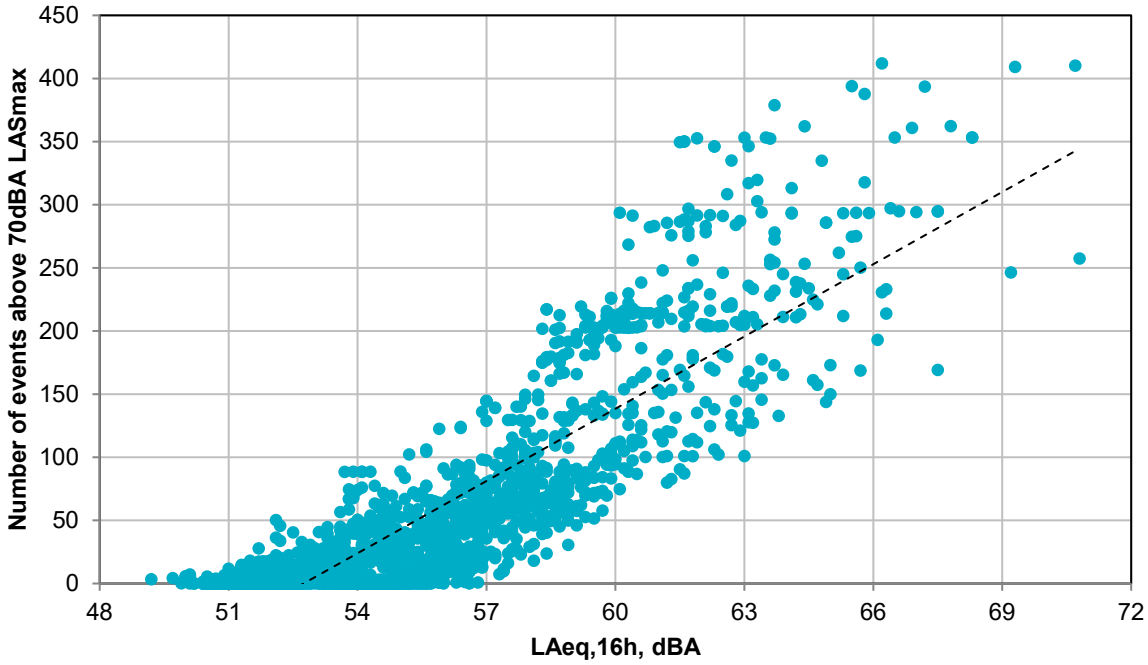
Although it has existed as an indicator to report noise measurements for many decades, N70 gained prominence as a result of its use in Australia in the late 1990s[48], where it supplemented the national indicator (the Australian Noise Exposure Forecast). In that case, 70 dB L_{ASmax} was adopted as, after allowing for 10 dB for outdoor to indoor sound transmission losses, it represented 60 dB L_{ASmax}, internally, which is recognised in Australia as a speech interference level. If the same principles were applied to the UK, where average outdoor to indoor sound transmission reductions are higher for typical UK housing stock, a higher level than N70 would be selected.

There is no exact relationship between $L_{Aeq,16h}$ and N70, as $L_{Aeq,16h}$ takes into account the amount of sound energy of every event, whether it be above 70 dB L_{ASmax} or not, whereas N70 only considers events above the 70 dB L_{ASmax} threshold.

Figure 11 shows the relationship between N70 and $L_{Aeq,16h}$ estimated for the respondent locations used in the SoNA 2014 survey using the CAA ANCON aircraft noise model (see Chapter 4 for more details).

[48] Southgate, D, “Expanding Ways to Describe and Assess Aircraft Noise”, Department of Transport and Regional Services, Australia, March 2000, ISBN 0 642 42262 1.

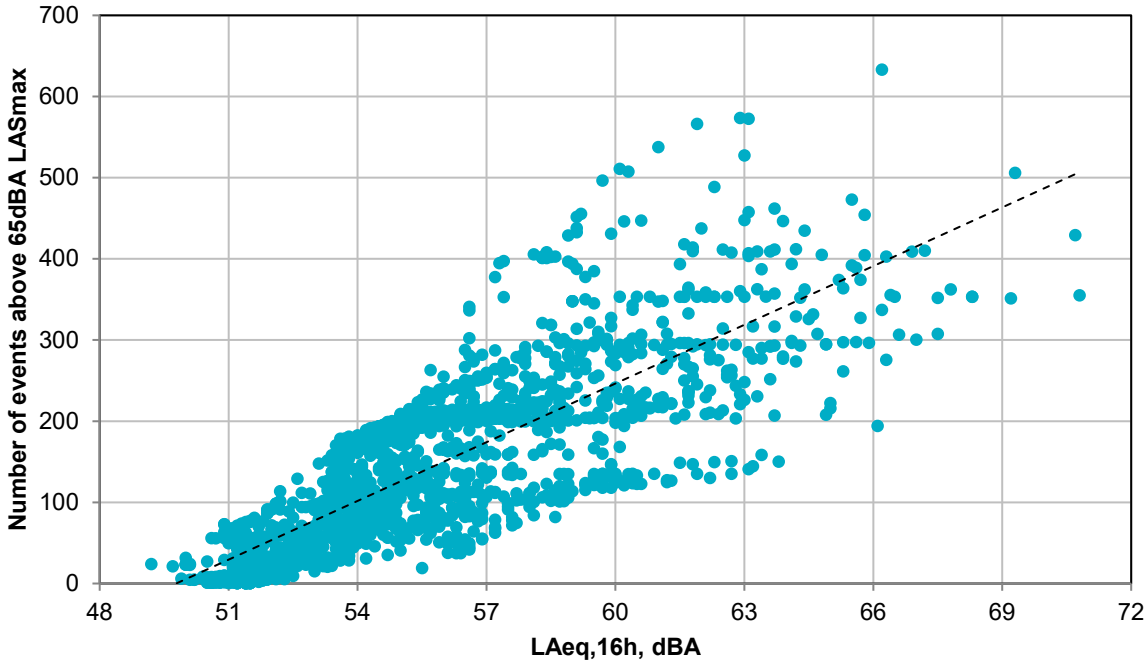
Figure 11: Relationship between N70 and $L_{Aeq,16h}$ for resident locations surveyed



It can be seen that N70 varies by approximately a factor of at least 2 for a given $L_{Aeq,16h}$, or by 3 dB for a given N70. This scatter occurs because the N70 indicator only changes when aircraft maximum noise levels drop below 70 dB L_{ASmax}, whereas $L_{Aeq,16h}$ indicators respond to any change in individual maximum event level (L_{ASmax}) or change in event duration.

As can also be seen, N70 begins to reach zero at levels below about 55 dB $L_{Aeq,16h}$. Therefore, an additional indicator, N65, the number of noise events above 65 dB L_{ASmax} was also examined. Figure 12 shows the relationship between N65 and $L_{Aeq,16h}$ for SoNA 2014 respondent locations.

Figure 12: Relationship between N65 and $L_{Aeq,16h}$ for resident locations surveyed



There is a wider degree of scatter between N65 and $L_{Aeq,16h}$ than for N70. This is because, at higher noise exposure levels, all noise events will eventually exceed 65 dB L_{ASmax} and thus N65 will reach a maximum value equal to the total number of aircraft movements, whereas $L_{Aeq,16h}$ will continue to increase. Conversely, N65 only reaches zero at just over 51 dB $L_{Aeq,16h}$.

Appendix C

SoNA 2014 questionnaire

SECTION A
A1. *How long have you lived in this home?*
○ Less than 6 months
○ 6 months - 1 year
○ 1 - 2 years
○ 2 - 5 years
○ 5 - 10 years
○ 10 years or more
○ Don't know

{If less than 6 months, ask A1a. Otherwise go to filter before A1b.}
A1a. *How many months is that?*
[Write in. If less than one month, code as 0.]
{Open text box. Single number allowed, within the range 0-5.}

{If coded less than "10 years or more" at A1, ask A1b.}
A1b. *And how long have you lived in this area?*
[If asked, "area" can be interpreted as a district, borough or town.]
○ Less than 6 months
○ 6 months - 1 year
○ 1 - 2 years
○ 2 - 5 years
○ 5 - 10 years
○ 10 years or more
○ Don't know

A2. [Code type of dwelling, checking with the respondent as necessary.]
○ Flat: purpose-built
○ Flat: conversion
○ Maisonette (flat on two or more floors): purpose-built
○ Maisonette (flat on two or more floors): conversion
○ Bungalow: detached
○ Bungalow: semi-detached (incl. linked semi-detached) / end terrace
○ Bungalow: mid-terrace
○ House with two or more storeys: detached
○ House with two or more storeys: semi-detached (incl. linked semi-detached) / end terrace
○ House with two or more storeys: mid-terrace
○ Cluster home (a home joined to others at the back as well as the sides(s))
○ Other
{If flat/maisonette, ask A2a, else go to A3.}
A2a. [Code: On which floor of the building is the entrance to this particular flat/maisonette? i.e. not the entrance to the building as a whole. Enter number of floor. Enter -1 for basement and 0 for ground floor.]
{Open text box. Single number allowed, within the range -1 to 50.}

A2b [Code: What is immediately above the flat or maisonette?
[If the dwelling is a maisonette, this means above the upper storey of the maisonette.]
☐ Flat roof
☐ Loft space (for storage only) and pitched roof
☐ Pitched roof forming the ceiling of a room in the dwelling
☐ One or more other flats/maisonettes
A3. *Do you have use of an outdoor space such as a garden, terrace or balcony here?*
[Includes shared facilities if private.]

☐ Yes – garden
☐ Yes – balcony
☐ Yes – terrace
☐ No – none§

A3a. *On the whole, how much do you like living in this neighbourhood? Please provide your answer on a scale of 1 to 7, where 1 equals definitely like and 7 equals definitely don't like.*

[Showcard A3a]

○ 1 Definitely like
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7 Definitely don't like
○ Don't know

A4. *Is there anything you particularly like about this neighbourhood?*

[Do not read out or show the screen. Try to fit respondent's reply to precodes as much as possible.]

☐ Any mention of quietness / peacefulness / freedom from noises or sources of noise
☐ Any mention of sounds/noises that are liked
☐ Any positive mention of airport, air travel or aircraft
☐ Everything
☐ Any other features that are liked (specify)

{Open text box, text scrolls along if too long for the box.}

☐ Nothing liked§
☐ Don't know§

A5. *Is there anything you particularly dislike about this neighbourhood?*

[Do not read out or show the screen. Try to fit respondent's reply to precodes as much as possible.]

☐ Any mention of disliking aircraft noise
☐ Any mention of disliking other noise (e.g. it's noisy / noise not liked / noise effects / lack of peace & quiet)
☐ Any mention of disliking quietness (or disliking absence of noise/sounds)
☐ Any mention of disliking being close to an airport, without mentioning noise {Go to A5a.}
☐ Potential source of noise [Specify and code below if a potential source of noise.] {Go to A5b.}

☐ Any other features that are disliked [Specify and code below if anything else disliked.]

☐ Nothing disliked§
☐ Don't know§

{Ask A5a and/or A5b as routed from A5. Otherwise skip to A6.}

A5a. *You mentioned that you dislike being close to the airport. What is it in particular that you dislike?*
○ Dislike is wholly or partly about noise
○ Dislike is not about noise

A5b. *You mentioned that you dislike {{from A5: open text}}*
[Read out only the potential source(s) of noise, not anything that is specifically mentioned as a noise, or anything that clearly has nothing to do with noise.]
What is it in particular that you dislike?
○ Dislike is wholly or partly about noise
○ Dislike is not about noise

A6. *This card shows a number of different problems that some people may have with their local environment. Would you please pick up to five that you are personally most affected by?*
[Showcard A6]
☐ Pollution of rivers, lakes, the sea, beaches, etc.
☐ Air pollution from traffic or local industry/agriculture
☐ Loss of natural environment – gardens, green spaces or plant/animal life
☐ Traffic congestion, parking, speed or danger
☐ Extreme weather (e.g. flooding, drought, high winds, snow and ice)
☐ Dust and dirt
☐ Smells
☐ Litter and/or rubbish
☐ Pests, including wild/feral animals, birds, insects or fouling by animals other than dogs
☐ "Light pollution" from streetlights, floodlights, security lights, shops, and other artificial light from outside the home
☐ Fouling by dogs
☐ Noise
☐ None of these§

In the rest of the questionnaire I'm going to ask you questions about when you are at home. {If A3 answered "garden, balcony or terrace", say:} *By that, I mean inside your home or outdoors at home, for example {{A3 response}}*[49] *This applies throughout the remainder of the interview.*
A7a. Now please think for a moment about all the sounds that come from outside your own home – whether they are sounds that you like or noises that you dislike. Overall, do these sounds make it better or worse to be living here for you personally?
[If asked, this includes noise from inside neighbours' homes.]
[Showcard A7a]
○ 1 Definitely better
○ 2
○ 3
○ 4 Neither better nor worse
○ 5
○ 6
○ 7 Definitely worse
○ Don't know

A7b. *How sensitive would you say you are to noise?*
[Showcard A7b]
○ 1 Not at all sensitive
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7 Very sensitive
○ Don't know

A8a. *Thinking about the last 12 months or so, when you are here at home, how much does noise from outside your own home bother, disturb or annoy you?*
[If asked, this includes noise from inside neighbours' homes.]

[49] Wherever this text insert appears, CAPI inserts "in your garden, on your balcony, on your terrace" or whatever part of this is relevant, given the answer to A3.

[Showcard A8a]
○ Not at all
○ Slightly
○ Moderately
○ Very
○ Extremely
○ Don't know
○ Don't hear
{If A8a coded "Not at all" or "Don't know", ask A8a(i). Otherwise go to A8b.}
A8a(i). Is that because you never hear any noise from outside your own home?
○ Never hear noise from outside my home
○ Hear noise from outside my home, but it does not bother, disturb or annoy me at all
○ Don't know
A8b. *Next is a 0-to-10 opinion scale for how much noise from outside your own home bothers, disturbs or annoys you when you are here at home. If you are not at all annoyed choose 0; if you are extremely annoyed choose 10; if you are somewhere in between, choose a number between 0 and 10.*
[If asked, this includes noise from inside neighbours' homes.]
[If respondent states that they do not hear any noise, then code 98, for don't know code 99.]

A8b. *Thinking about the last 12 months or so, what number from 0 to 10 best shows how much you are bothered, disturbed or annoyed by noise from outside your own home?*
[Showcard A8b][50]

0 Not at all	1	2	3	4	5	6	7	8	9	10 Extremely
○	○	○	○	○	○	○	○	○	○	○

○ Don't know ○ Don't hear
{If A8b coded "Not at all or "Don't know", ask A8b(i). Otherwise go to filter after A8b(i).}

[50] All columns the same width.

A8b(i). Is that because you never hear any noise from outside your own home?
- ○ Never hear noise from outside my home
- ○ Hear noise from outside my home, but it does not bother, disturb or annoy me at all
- ○ Don't know

{If "Not at all", "Don't hear" or "Don't know" at A8a and 8-10 at A8b
or
"Very" or "Extremely" at A8a and "Not at all", "Don't hear" or "Don't know" at A8b,
new screen and insert instruction:}
[You have coded conflicting responses at A8a and A8b. Please clarify with respondent and recode A8a and/or A8b if appropriate. Press next to amend or confirm codes.]
From this point on, I'm going to be asking about sounds and noises only. The next few questions are about different types of noise. I will show you a few examples of each type of noise that you might have heard, but by no means do these cover all possibilities, they are examples only.
[*Allow the respondent a few seconds to look at the picture, before asking the question.]*
A9a. *Thinking about the last 12 months or so, when you are here at home, how much does noise from aircraft, airports or airfields, bother, disturb or annoy you?*
[Showcards A9a-A9o]
- ○ Not at all
- ○ Slightly
- ○ Moderately
- ○ Very
- ○ Extremely
- ○ Don't know
- ○ Don't hear

{If A9a coded "Not at all" or "Don't know" ask A10a.}
A10a. Is that because you never hear any noise from aircraft, airports or airfields?
- ○ Never hear noise from this source
- ○ Hear noise from this source, but it does not bother, disturb or annoy me at all
- ○ Don't know

{Repeat A9b-n and (where appropriate) A10b-n for the following noise categories, replacing "*aircraft, airports or airfields"*, in this order and with the relevant show screens.}
A9b. *trains or railway stations* [Picture Card A9b]
A9c. *road traffic* [Picture Card A9c]
A9d. *sea, river or canal traffic* [Picture Card A9d]
A9e. *building, construction, demolition, renovation or roadworks* [Picture Card A9e]
A9f. *neighbours (inside their homes)* [Picture Card A9f]
A9g. *neighbours (outside their homes)* [Picture Card A9g]
A9h. *other people nearby* [Picture Card A9h]
A9i. *sports* [Picture Card A9i]
A9j. *other entertainment or leisure* [Picture Card A9j]
A9k. *industrial sites* [Picture Card A9k]
A9l. *other commercial premises* [Picture Card A9l]
A9m. *forestry, farming or agriculture* [Picture Card A9m]
A9n. *community buildings and spaces* [Picture Card A9n]

A9o. *Thinking about the last 12 months or so, when you are here at home, does noise from any other source outside your home bother, disturb or annoy you?*
○ Yes
○ No

{If A9o coded "No" skip to A11.}
[If respondent does not mention at least one specific source of noise, prompt for one.
Ensure source is external to the respondent's home.
If more than one source is mentioned, ask for the one that most bothers, disturbs or annoys the respondent.
Write in one selected other noise source. Enter source of noise, e.g. "owls", not "noise from owls".]
{Open text box.}

[Fit to a precoded type if possible, by going back to the relevant A9 question, otherwise maintain "Any other noise" code and tick one box below.]
○ Military activity (other than vehicles on the road or aircraft/airfields)
○ Wild birds
○ Wild animals
○ Weather (e.g. wind, rain, storms)
○ Running water (e.g. rivers, waterfalls) or waves
○ Wind turbines (other than those belonging to a neighbouring home)
○ Other

A11. *I would now like you to think about all these types of noise that I have been asking about. Taking all these noises together, please look at the statements on this card and tell me which one best describes the extent to which noise spoils your home life.*
[Showcard A11]
○ Not at all
○ Not very much
○ A little
○ Quite a lot
○ Totally
○ Don't know

{RTN Section asked if road traffic noise bothers, disturbs or annoys at least "Slightly" (codes 2-5 at A9c).
NN Section asked if noise from neighbours (inside their homes) and/or neighbours (outside their homes) and/or other people nearby bothers, disturbs or annoys at least "Slightly" (codes 2-5 at 9f-h).

[Read out:]
The following questions ask you to reflect over the last year or so about noises you might have heard when you have been here at this home.
{If A3 answered "Yes", say:} *Please remember that when we say "at home", we mean "when you have been at home, either inside your home or {{A3 response}} at home".*

SECTION RTN – ROAD TRAFFIC NOISE

I would now like to ask you some questions specifically about noise from road traffic.

PICTURECARD RTN1

RTN1. *What are the three particular kinds of road traffic noise that most bother, disturb or annoy you? So, thinking about these sorts of things...*

[Unprompted – code specific noise source – please try to use the precoded list.]

{Allow one to three to be coded.}

☐ No particular noise type[§51]

Traffic Noises

☐ Vehicles starting / stopping / ticking over (at traffic lights, crossings, etc.)
☐ Engine revving
☐ Air brakes
☐ Brake/tyre squeal
☐ Vehicles accelerating / going too fast
☐ Car alarms
☐ Vehicle reversing/turning signals
☐ Noisy exhausts
☐ Loose/faulty parts rattling, whining, etc.
☐ Police / ambulance / fire engine sirens
☐ Noise from irregularities in the road surface – drain covers, traffic calming, cobbles, etc.
☐ Vehicles collecting rubbish, recycling or scrap
☐ Ice cream van chimes
☐ Other music from vehicles
☐ Vehicle horns
☐ Road accidents
☐ Congestion
☐ The background "hum" of road traffic
☐ Informal / illegal motor sports or racing
☐ Pedestrian crossing signals
☐ Any other kind of noise from traffic

{Open text box, text scrolls along if too long for the box.}

☐ Any other kind of noise from traffic

{Open text box, text scrolls along if too long for the box.}

☐ Any other kind of noise from traffic

{Open text box, text scrolls along if too long for the box.}

Noises from types of road

☐ Motorways
☐ Other dual carriageway roads
☐ Single carriageway main roads
☐ Residential/estate roads/country lanes
☐ Car parks
☐ Any other kind of road

{Open text box, text scrolls along if too long for the box.}

☐ Any other kind of road

{Open text box, text scrolls along if too long for the box.}

Vehicles

☐ Heavy lorries
☐ Smaller lorries
☐ Delivery vans
☐ Buses / coaches
☐ Private cars / taxis
☐ Motor bikes / scooters
☐ Refuse collection
☐ Electric vehicles
☐ Horse drawn vehicles
☐ Any other kind vehicle

{Open text box, text scrolls along if too long for the box.}

☐ Any other kind of vehicle

{Open text box, text scrolls along if too long for the box.}

☐ Any other kind of vehicle

{Open text box, text scrolls along if too long for the box.}

THERE ARE NO QUESTIONS RTN2 NOR RTN3

[51] In effect, this functions as a "Don't know" code in RTN1, NN1 and OSN1.

RTN4. *Does noise from road traffic interfere with any of these aspects of your home life? Please just read out the letters that apply*
[IF YES AT A3 - Showcard RTN4 VERSION 1]
[IF NO AT A3 - Showcard RTN4 VERSION 2]

1	Studying or working at home	○
2	Having a conversation (including on the phone or online[52])	○
3	Quiet leisure activities such as reading, writing or resting	○
4	Listening to TV, radio or music	○
5	Other leisure activities that involve you making a noise such as gaming or making music	○
6	Being able to use every room in the home	○
7	{If yes at A3:}[53] Spending time outdoors at home	○
8	Having the windows or doors open	○
9	Sleeping patterns such as the time you go to bed or get up, or being kept awake	○
	None of these	
	Don’t know	

{Go to next noise type. If no others filtered in from A9, go to Section CAN.}

[52] Interviewer briefing/notes to say this includes computer-based calls, audio or audio-visual (e.g. Skype) here and for analogous questions in other sections.

[53] {Shading of the rows skips to the next row if this row is omitted. CAPI did not select garden, balcony or terrace according to answer at A3.}

SECTION NN – NEIGHBOUR NOISE

I would now like to ask you some questions specifically about noise from neighbours and other people when they are nearby.

PICTURECARD NN1

NN1. *What are the three particular kinds of noise from neighbours and other people nearby that most bother, disturb or annoy you?*

So, thinking about these sorts of things...

[Unprompted – code specific noise source – please try to use the precoded list.]

{Allow one to three to be coded.}

☐ No particular noise type§

SUB-HEADING: Noise from inside neighbours' homes

☐ Radio, TV and music (from inside neighbouring homes or outside)
☐ Neighbours' fireworks
☐ Parties (held inside neighbouring homes or outdoors (without fireworks))
☐ Voices / shouting / arguments (from inside other homes or from outside)
☐ Neighbours doing DIY inside (hammering, drilling, etc.)
☐ Alarms (e.g. burglar, fire or smoke)
☐ Phones/mobiles ringing (from inside or outside)*
☐ Dogs (from inside or outside)*
☐ Other domestic animals / pets (from inside or outside)*
☐ Neighbours' footsteps, electric sockets / switches, doors banging, or other banging on walls or floors
☐ Domestic equipment (vacuum cleaners, washing machines, dishwashers, tumble dryers, boilers, etc.)
☐ Any other noise from neighbours inside their homes

{Open text box, text scrolls along if too long for the box.}

SUB-HEADING: Noise from outside neighbours' homes

☐ Neighbours' wind turbine, air conditioning, generator, heat pump, etc.
☐ Noises from people in neighbouring gardens

{Open text box, text scrolls along if too long for the box.}

☐ Cutting/pruning/grinding trees in gardens or in the street or communal areas
☐ Neighbours and other people nearby putting out bins or waste for recycling
☐ Neighbours working outside (DIY, gardening, repairing vehicles, etc.)
☐ Waste collection or wheelie bin cleaning services
☐ Other deliveries or collections (e.g. post, supermarkets, mail/online orders)
☐ Neighbours' vehicles (e.g. doors slamming, starting up, driving off)
☐ Any other noise from neighbours outside their homes

{Open text box, text scrolls along if too long for the box.}

SUB-HEADING: Other noises from people nearby

☐ Any other noise from people nearby who are not neighbours

{Open text box, text scrolls along if too long for the box.}

{If "Other domestic animals and pets" is one of the chosen options, then clarify by asking NN1a.}

NN1a. *What other type of animal or pet is this?*
[Write in animal types and code below.]

{Open text box, text scrolls along if too long for the box.}

☐ Cat
☐ Cockerel
☐ Other bird
☐ Other type
○ Don't know

{If any chosen option could emanate from either inside the neighbour's house, or outside (marked * at NN1) then clarify by asking NN1b, with as many rows in the response table as are required.}

NN1b. *Were you thinking about noise from inside someone's home or from outside, when you selected …?*
[Read out noise types and code response.]

	Inside	Outside	Both
{{Noise type from NN1}}	○	○	○
{{Noise type from NN1}}	○	○	○

NN4. D*oes noise from neighbours and other people when they are nearby interfere with any of these aspects of your home life? Please just read out the letters that apply.*
[IF YES AT 13 - Showcard NN4 VERSION 1]
[IF NO AT 13 - Showcard NN4 VERSION 2]

1	Studying or working at home	○
2	Having a conversation (including on the phone or online[54])	○
3	Quiet leisure activities such as reading, writing or resting	○
4	Listening to TV, radio or music	○
5	Other leisure activities that involve you making a noise such as gaming or making music	○
6	Being able to use every room in the home	○
7	{If yes at A3:}[55] Spending time outdoors at home	○
8	Having the windows or doors open	○
9	Sleeping patterns such as the time you go to bed or get up, or being kept awake	○
	None of these	○
	Don't know	○

{Go to next noise type. If no others filtered in from A9, go to Section CAN.}

[54] Interviewer briefing/notes to say this includes computer-based calls, audio or audio-visual (e.g. Skype) here and for analogous questions in other sections.

[55] {Shading of the rows skips to the next row if this row is omitted. CAPI did not select garden, balcony or terrace according to answer at A3.}

SECTION CAN – CIVIL AVIATION NOISE[56]
SCREENER IF RESPONDENT HAS LIVED IN HOME FOR LESS THAN 6 MONTHS – CODE 1 AT QUESTION A1

S1: *Can I just check – have you lived in this home since mid-June 2014?*
Yes – CONTINUE WITH QUESTION PREAMBLE AND FROM CAN1
No (if no – only the following questions get asked CAN15a, CAN15b, , CAN21a,(and b/c depending on ans to 21a), CAN22d, CAN23a/b/c/ CAN 22D, CAN26a, b, CAN 28, CAN29, CAN30, 31)
PLEASE REFER TO TEXT BEFORE CAN 21 FOR THOSE WHO HAVE RESIDED IN HOME AFTER MID-JUNE 2014 – THEY WON'T GET THE TEXT BELOW – BUT A VARIANT OF IT.

I would now like to ask more about noise specifically from large and small commercial and private aeroplanes. That means I would like you to ignore any noise you hear from any helicopters or from military aircraft, for this section of the interview.
These questions are also specifically about your experiences during this summer. By summer I mean the period roughly from mid-June to mid-September 2014.
{If A3 answered "garden, balcony or terrace", say:} *Also, please remember that when we say "at home", we mean when you have been at home, either inside your home or {{A3 response}} at home. So, to confirm, this is what we are now talking about.*
[Showcard CANP]
Response to aircraft noise
CAN1. *So, thinking about this summer, when you were here at home, how much did each of these different types of noise from aeroplanes bother, disturb or annoy you?*
[Showcard CAN1]

	Not at all	Slightly	Moderately	Very	Extremely	Don't know
Overall noise of all kinds, from aeroplanes	○	○	○	○	○	○
Noise from aeroplanes on the ground at an airport (e.g. taxiing planes, engine testing)	○	○	○	○	○	○
Noise from aeroplanes taking off and climbing	○	○	○	○	○	○
Noise from aeroplanes descending and landing	○	○	○	○	○	○
Noise from aeroplanes in flight	○	○	○	○	○	○
Noise from aeroplanes during the day (7 a.m. - 11 p.m.)	○	○	○	○	○	○
Noise from aeroplanes during the night (11 p.m. - 7 a.m.)	○	○	○	○	○	○

{If "Not at all" or don't know to any item at CAN1 ask CAN1a for each item a not at all or dk response is given before moving on to the next item.}
CAN1a. *Is that because you did not hear this kind of noise?*
○ I did not hear this kind of noise
○ I did hear this kind of noise but it did not bother, disturb or annoy me at all
○ Don't know

{If CAN1 (iii) and (iv) given an equal rating other than "Not at all" or "Don't know", ask CAN1c before moving on to the next item.}
CAN1c. *You gave "*descending and landing" *the same rating as "taking off and climbing" – is that because they affect you equally or because you are not sure whether the aeroplanes were arriving or departing?*
○ Affected equally

[56] This is the policy topic for 2014 and is more detailed but restricted in scope than Section AN.

○ Not sure whether the aeroplanes were arriving or departing
○ Don't know

{If coded "Not at all", Don't know" or "Don't hear" to all CAN1,ask only CAN 8, CAN15a, CAN15b, 17a/b, can21a-c, 21d and CAN23a, CAN23b, CAN23c, CAN26a, CAN26b, CAN28, CAN29, CAN30, CAN31 AND CAN34 then go to section HL as per specification

THERE IS NO QUESTION CAN 2

CAN3. *Looking at this card, and still thinking about the summer, could you tell me when you were most bothered, disturbed or annoyed, at home, by noise from aeroplanes?*[57]
[If asked, tell respondents they should tick the box if any part of the period applies.]
[Showcard CAN3[58]]

	6 a.m. – 7 a.m.	7 a.m. – 12 noon	12 noon – 7 p.m.	7 p.m. – 11 p.m.	11 p.m. – midnight	midnight – 6 a.m.
Mon-Fri	☐	☐	☐	☐	☐	☐
Sat	☐	☐	☐	☐	☐	☐
Sun	☐	☐	☐	☐	☐	☐

	midnight – 6 a.m.	6 a.m. – 7 a.m.	7 a.m. – 12 noon	12 noon – 7 p.m.	7 p.m. – 11 p.m.	11 p.m. – midnight
Mon-Fri	☐	☐	☐	☐	☐	☐
Sat	☐	☐	☐	☐	☐	☐
Sun	☐	☐	☐	☐	☐	☐

{If CAN3 unanswered, ask CAN3a.}
CAN3a. *Is there definitely no particular time of day or day of the week?*
○ Yes – no particular time/day
○ No – there was a particular time/day [Recode CAN3.] {Go back to CAN3.}
CAN4. *Looking at this card, and thinking about a typical week during the summer, could you tell me any times and days when you do not know about the noise because you were usually not at home then?*
{Show only the periods not coded at CAN3.}
[Showcard CAN3 again][59]
CAN5. H*ow often, on average, were you bothered, disturbed or annoyed by noise from aeroplanes in summer? Was it …*
[Read out and code first to apply.]
○ *Every day*
○ *Most days*
○ *A few days a week*
○ *At least once a week*
○ *At least once a month*
○ *Less often*
○ Don't know
CAN6. *And how often, on average, did you hear noise from aeroplanes in summer? Was it …*
[Read out and code first to apply.]
○ *Every day*
○ *Most days*
○ *A few days a week*
○ *At least once a week*

[57] The order in which the periods are listed here (and in CAN4) needs to be agreed following the pilot survey, with these two alternatives each being tested in half the sample.

[58] This showcard will require two versions – one for each version of the question

○ *At least once a month*
○ *Less often*
○ Don't know

{If response to CAN6 is less often than CAN5, ask CAN6a}
CAN6a. *I've recorded that you were bothered, disturbed or annoyed {{answer to CAN5}} but that you only heard the noise from aeroplanes {{answer at CAN6}}. Can I just check if that is correct?*
○ Yes correct {continue}
○ No not correct {present the following instruction to interviewers.}
[Either recode CAN6 or go back and recode CAN5.]
CAN7. *Did noise from aeroplanes interfere with any of these aspects of your home life in the summer? Please just read out the letters that apply*
[Showcard CAN7]

		Yes
A	*Studying or working at home*	○
B	*Having a conversation (including on the phone or online[60])*	○
C	*Quiet leisure activities such as reading, writing, resting*	○
D	*Listening to TV, radio or music*	○
E	*Other leisure activities that involve you making a noise such as gaming or making music*	○
F	*Being able to use every room in the home*	○
G	*{If has garden, balcony or terrace at A3} Spending time outdoors at home*	○
H	*Having the windows or doors open*	○
I	*Enjoying the local parks and open spaces*	○
J	*Having friends or family round*	○
K	*Spending time outdoors in the neighbourhood*	○
L	*Sleeping patterns such as the time you go to bed or get up, or being kept awake*	○
	None of these	

{If "Yes" to "Sleeping patterns", ask CAN7a.}
CAN7a. *Over the summer, how often was your sleep affected in some way by noise from aeroplanes? This could include being kept awake or woken up, or changing the times when you go to bed or get up.*
[Read out and code first to apply.]
○ *Every day*
○ *Most days*
○ *A few days a week*
○ *At least once a week*
○ *At least once a month*
○ *Less often*
○ Don't know

[60] Interviewer briefing/notes to say this includes computer-based calls, audio or audio-visual (e.g. Skype) here and for analogous questions in other sections.

CAN7b. *Thinking about the summer, when you were here at home, what number from 0 to 10 best shows the degree to which your sleep was disturbed by noise from aeroplanes?*
[Showcard CAN7b][61]

0 Not at all disturbed	1	2	3	4	5	6	7	8	9	10 Extremely disturbed
○	○	○	○	○	○	○	○	○	○	○

○ Don't know

CAN8. *Did noise from aeroplanes have any of these effects on your household?*

[Read out]	Yes	No	Not applicable	Don't know
It frightened you	○	○		○
It frightened your children	○	○	○ {Skip next item}	○
It woke your children	○	○		○
It bothered, disturbed or annoyed someone else in the household	○	○	○ {Skip next item}	○
It woke someone else in the household	○	○		○
It upset or woke your pets	○	○	○	○

THERE IS NO QUESTION CAN 9

{If code 2-5 at CAN1i, ask CAN10. Otherwise go to CAN11a.}
CAN10. *Which one of the following issues, to do with aeroplane noise this summer, concerned you the most? And the next most ...?*
[Showcard CAN10] . Encourage the respondent to avoid tied ranks but allow if necessary.

	Flights at night (11 p.m. to 7 a.m.)
	Flights during the evening (7 p.m. to 11 p.m.)
	Flights during the day (7 a.m. to 7 p.m.)
	Flights that don't seem to be on the expected flight path
	The number of flights
	The loudness of the aeroplanes
	A lack of quiet between individual flights
	Not knowing when there will be times during the day without aeroplane noise

○ No (other) issues
○ Don't know

[61] All columns the same width.

CAN11a. *How much would you say you were bothered, disturbed or annoyed by the noise from aeroplanes this summer, while it was going on?*
[Showcard CAN11a]
- ○ Not at all
- ○ Slightly
- ○ Moderately
- ○ Very
- ○ Extremely
- ○ Don't know
- ○ Don't hear

CAN11b. *And how much, if at all, do you feel that the noise from aeroplanes spoiled your home life this summer in general, not just when the noise was going on?*
[Showcard CAN11b]
- ○ Not at all
- ○ Slightly
- ○ Moderately
- ○ Very
- ○ Extremely
- ○ Don't know
- ○ Don't hear

THERE IS NO QUESTION CAN 12
THERE IS NO QUESTION CAN 13
CAN13a. *Thinking about next summer, do you expect that noise from aeroplanes will be more next summer or less?*
[Showcard CAN13a]
- ○ 1 Expect it to be less
- ○ 2
- ○ 3
- ○ 4 Expect it to be roughly the same
- ○ 5
- ○ 6
- ○ 7 Expect it to be more
- ○ Don't know

THERE IS NO QUESTION CAN 14

Modification of exposure inside the home – behavioural aspects

~CAN15a. *What kind of windows do you have in the room where you sleep?*
[Probe and code all that apply.]

	Single-glazed	Secondary glazed/double glazed or better'	Don't know
Openable	☐	☐	☐
Non-openable	☐	☐	☐

~CAN15b. *What kind of windows do you have in the other room where you spend most time at home?*
[Probe and code all that apply.]

	Single-glazed	Secondary glazed/double glazed or better'	Don't know
Openable	☐	☐	☐
Non-openable	☐	☐	☐

If not lived here since mid-June 2014 – go to CAN21a
THERE IS NO QUESTION CAN16
CAN17a. *Did you ever close the windows, or keep the windows closed, for any of these reasons during the summer?* [If yes, probe to code which reasons.]
[Showcard CAN17a]
☐ Noise from aeroplanes
☐ Other noise coming in through the window
☐ To keep warm or save energy
☐ Other reasons to do with conditions outdoors (e.g. smoke, odours, wind, rain)
☐ Security
☐ Safety (e.g. to prevent children falling out)
☐ To keep pets in
☐ To keep animals/insects/pests out
☐ Habit/preference for no particular reason
☐ Window not openable
☐ Other (please specify)
{Single-line open text box – text scrolls along if too long for box.}

☐ None of these§
CAN17b. *Were there times when you wanted to have a window open anywhere in your home for any of these reasons, but you had it closed to keep out noise from aeroplanes?*
[Showcard CAN17b, probe for which reasons apply.]
Would have liked to have the window open …
☐ To keep cool
☐ To avoid condensation
☐ For fresh air / to prevent odour
☐ To talk to someone or hear what is happening outside
☐ Out of habit or preference for no particular reason
☐ Other (please specify)
{Single-line open text box – text scrolls along if too long for box.}

☐ No, none of these§
CAN18a. *When your windows were closed, were you sometimes still able to hear noise from aeroplanes?*
○ Yes
○ No
○ Don't know

Check on whether summer is the worst time of year
CAN19. *Does noise from aeroplanes bother, disturb or annoy you the same amount all year round or more in certain seasons?*

[Probe as necessary for which seasons.]
☐ Spring
☐ Summer
☐ Autumn
☐ Winter
☐ All year round – SINGLE CODE ONLY
☐ No particular season – SINGLE CODE ONLY
☐ Don't know§

THERE IS NO QUESTION CAN 20
FOR THOSE NOT RESIDENT SINCE AT LEAST MID-JUNE 2014/THE SUMMER
I would now like to ask you a few questions about noise specifically from large and small commercial and private aeroplanes. That means I would like you to ignore any noise that you hear from any helicopters or from military aircraft, for this section of the interview.
So just to confirm, this is what we are now talking about
SHOWCARD CANP
Actions taken
I would now like you to think about anything else you have done or tried to do about noise from aeroplanes – in general, not just this summer.
This will be modified for those who have not resided in home since mid-June as follows: *I would like you to think about anything you have done or tried to do about noise from aeroplanes in general.*
~CAN21a. *As far as you know, has any work such as this been done on this home, to try to keep noise out?*
[Showcard CAN21a]
☐ Changes to the windows
☐ Changes to the ceiling or roof
☐ Changes to the walls
☐ Mechanical ventilation installed
☐ Any other changes [Write in]
{Open text box, text scrolls along if too long for the box.}
☐ Don't know§
{If nothing done, skip to CAN22d.}

CAN21b. *Was it done mainly because of noise from aeroplanes, mainly because of some other noise or mainly for some other reason?*

○ Noise from aeroplanes
○ Other noise
○ Other reason [Write in]
{Open text box, text scrolls along if too long for the box.}

○ Don't know

~CAN21c. *And how was the work paid for?*
[Showcard CAN21c]
☐ Done before you moved in
☐ Paid for by you or someone else in your household
☐ Paid for by an airport
☐ Paid for by central Government or local authority (Council)
☐ Paid for by someone else [Write in]
{Open text box, text scrolls along if too long for the box.}

☐ Don't know§

{If only "Done before you moved in" coded, go to filter before CAN22.}
CAN21d. *And when was the work done?*
[Showcard CAN21d]
☐ Since this summer
☐ During this summer
☐ Before this summer
☐ Don't know§

~CAN22d. *Have you or anyone in your household done any of the things on this card about noise from aeroplanes (remembering that this does not include helicopters or military aircraft), whilst living in this home, within the last five years?*
[Showcard CAN22d]

○ Yes (Go to CAN23a)
○ No (Go to CAN26a)
○ Don't know (Go to CAN26a)

~CAN23a. *And was it about noise in the summer, other times of year, or both?*
○ Summer
○ Other times of year
○ Both
○ Don't know

~CAN23b. *Which of these things on this card have you or anyone else in your household done about the noise from aeroplanes within the last five years?*
[Showcard CAN23b]
☐ Made our own noise (e.g. playing music) so that we could not hear the noise from elsewhere
☐ Used earplugs or headphones to avoid hearing the noise
☐ Started, signed or participated in a campaign, protest or petition
☐ Took advice, e.g. from Citizens Advice Bureau, another advice or legal organisation
☐ Went on holiday
☐ Went to somewhere quiet outdoors in the area (e.g. a park, open space or country area)
☐ Went to somewhere quiet outdoors away from the area (e.g. a park, open space or country area)
☐ Went to another town
☐ Used a different room at home
☐ Went to someone else's home
☐ Went to somewhere else indoors (e.g. a library or place of worship)

Complained/wrote/spoke to:
☐ an airport, airport owner or airport operator
☐ one or more airlines
☐ the Civil Aviation Authority
☐ a newspaper or TV/radio station
☐ a resident's association
☐ the Environmental Health Department in the Local Authority (Council)
☐ another Local Authority (Council) Department
☐ a Government Department
☐ the Police
☐ a Councillor
☐ a Member of Parliament[62]
☐ someone else, (please specify)
{Open text box, text scrolls along if too long for the box.}

☐ Did something else to stop the noise being made or heard (please specify)
{Open text box, text scrolls along if too long for the box.}

☐ Exactly the same action taken as reported earlier {skip to CAN24}
☐ Don't know
~CAN23c. *Was the issue resolved to your satisfaction when you {{Action from CAN23b}}, only partially or not at all?*
[If multiple action of the same kind about exactly the same issue, code final outcome.]
○ Yes
○ Partially
○ Not at all
○ Don't know
Confounding factors
~CAN26a. *Have you taken any flights from any UK airport, for either work or leisure, in the past five years?*
[If yes, probe for how often.]
○ Yes, more than once a year
○ Yes, but only about once a year or less
○ No, not at all
○ Don't remember
{If Yes, ask CAN26b. Otherwise go to CAN28}.
~CAN26b. *Have you used [INSERT NAME OF AIRPORT FROM SAMPLE] Airport for either work or leisure flights in the past five years?*
[If yes, and if "more than once a year" at CAN26a, probe for how often.]
○ Yes, more than once a year
○ Yes, but only about once a year or less
○ No, not at all
○ Don't remember

[62] If respondent asks, this includes UK Parliament, European Parliament and Scottish, Welsh or Northern Irish devolved government.

CAN28. *Are you aware of any of the following?*
[Read out]
☐ *[INSERT NAME OF AIRPORT FROM SAMPLE] Airport Consultative Committee*
☐ *[INSERT NAME OF AIRPORT FROM SAMPLE] Airport Noise Action Plan*
☐ *[INSERT NAME OF AIRPORT FROM SAMPLE] Airport Master Plan*
☐ *[INSERT NAME OF AIRPORT FROM SAMPLE] Airport website information on noise*
☐ Any *[INSERT NAME OF AIRPORT FROM SAMPLE] Airport schemes that provide direct benefits to residents, for example for sound insulation, relocation or noise compensation*
☐ *None of these*§

~CAN29. *Are you aware of any attempts by [INSERT NAME OF AIRPORT FROM SAMPLE] Airport or the airlines to improve control of the noise from aeroplanes?*
○ Yes [Prompt and write in.]
{Open text box. “Return” key can be used within the box.}.
○ No

~CAN30. *Are you aware of anything that [INSERT NAME OF AIRPORT FROM SAMPLE] Airport has sponsored or supported in the local community?*
○ Yes [Prompt and write in.]
{Open text box. “Return” key can be used within the box.}.
○ No

~CAN31 *To what extent do you agree or disagree with the following statements?*
[Showcard CAN31]

INTERVIEWER NOTE: THESE WILL BE IN A DIFFERENT ORDER EACH TIME – THE INTERVIEWER READS OUT THE OPTIONS, AND THE RESPONDENT WILL ANSWER FROM STRONGLY AGREE TO STRONGLY DISAGREE	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Noise from aeroplanes is bad for the health of myself or my household	○	○	○	○	○
Noise from aeroplanes is bad for children's education at the local schools	○	○	○	○	○
Aeroplanes cause air pollution around here	○	○	○	○	○
Having an airport in the area is good for the local economy	○	○	○	○	○
I worry about plane crashes around here	○	○	○	○	○
Noise from aeroplanes makes my home less valuable	○	○	○	○	○
Having an airport in the area makes my home more valuable	○	○	○	○	○
It is convenient to have an airport in the area	○	○	○	○	○
Air travel harms the environment	○	○	○	○	○
I like flying	○	○	○	○	○
I worry about more land being taken over by the airport	○	○	○	○	○
I like watching the aeroplanes	○	○	○	○	○

Final ratings
ASK IF LIVED AT HOME SINCE MID-JUNE 2014.
CAN32. *Thinking again about just this summer – so from mid-June to mid-September – how much did noise from aeroplanes bother, disturb or annoy you in each of these locations?*
[Showcard CAN32]

	Not at all	Slightly	Moderately	Very	Extremely	Don't know	Don't hear
Noise from aeroplanes while indoors at home	○	○	○	○	○	○	○
{If "Yes" at A3:} Noise from aeroplanes while outdoors at home	○	○	○	○	○	○	○
Noise from aeroplanes while outdoors around the neighbourhood	○	○	○	○	○	○	○
Overall noise from aeroplanes at home and around the neighbourhood.	○	○	○	○	○	○	○

{If "Not at all" or "Don't know" to any item at CAN32, ask CAN32a before moving on to the next item.}

CAN32a. *Is that because you did not hear this kind of noise?*
- ○ I did not hear this kind of noise
- ○ I did hear this kind of noise but it did not bother, disturb or annoy me at all
- ○ Don't know

To sum up your answers, I would like you to use a 0-to-10 opinion scale for how much noise from aeroplanes bothered, disturbed or annoyed you when you were here at home this summer. If you were not at all annoyed, choose 0; if you were extremely annoyed, choose 10; if you were somewhere in between, choose a number between 0 and 10.
[If respondent states that they do not hear any noise, then code 98, for don't know code 99.]

THERE IS NO QUESTION CAN 33
CAN34. *Thinking about this summer, what number from 0 to 10 best shows how much you were bothered, disturbed or annoyed by noise from aeroplanes?*
[Showcard CAN34][63]

0 Not at all	1	2	3	4	5	6	7	8	9	10 Extremely
○	○	○	○	○	○	○	○	○	○	○

○ Don't know ○ Don't hear

SECTION HL – INDIVIDUAL HEALTH
I would now like to ask you a few questions about your health today.
HL1. *In general, would you say your health is:*
[Showcard HL1]
- ○ Excellent
- ○ Very good
- ○ Good
- ○ Fair
- ○ Poor
- ○ Don't know

HL2. *Do you often feel tired and not rested in the morning?*
- ○ Yes
- ○ No

HL3. *During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep because of noise?*
[Showcard HL3]
- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week
- ○ Would rather not say

[63] All columns the same width.

HL4. *I'm going to read out some statements about feelings and thoughts. For each one, please tell me how often, if at all, you have felt this way over the last two weeks. Please read out the letter that applies?*
[Showcard HL4]

[Show on screen in random order.]	A) All of the time	B) Often	C) Some of the time	D) Rarely	E) None of the time	F) Don't know/ refused
I've been feeling optimistic about the future	○	○	○	○	○	○
I've been feeling useful	○	○	○	○	○	○
I've been feeling relaxed	○	○	○	○	○	○
I've been dealing with problems well	○	○	○	○	○	○
I've been thinking clearly	○	○	○	○	○	○
I've been feeling close to other people	○	○	○	○	○	○
I've been able to make up my own mind about things	○	○	○	○	○	○

Source: Warwick–Edinburgh Mental Well-being Scale (WEMWBS)

SECTION H – HOUSEHOLD INFORMATION
I would like to finish by asking you a few questions about this home and your household.
SoNA2013 items
H2. *In what year was your home originally built?*
[Prompt if necessary.]
○ Before 1919
○ 1919 – 1940
○ 1941 – 1960
○ 1961 – 1990
○ 1991 – 2000
○ 2001 – 2010
○ 2011 – 2014
○ Don't know
H3. *Which of these applies to your home?*
[Showcard H3]
○ Being bought on a mortgage
○ Owned outright by household
○ Rented from local authority
○ Rented from housing association
○ Rented from private landlord
○ Shared ownership
○ Tied to employment
○ Other
○ Refused

H4a. *How did you come to be living here?*
[Showcard H4a]
○ My choice
○ Choice made with someone else in the household
○ Choice made by someone else in the household
○ Choice made by landlord (e.g. Local Authority, housing association)
○ Choice made by someone else outside the household, e.g. employer
○ Other (please specify)
{Open text box. “Return” key can be used within the box.}

Refused§

H4a(ii). *Prior to moving here, were you aware of a possibility of hearing noise from the airport?*
[Showcard H4a(ii)]
○ I have always lived here
○ No
○ Yes, but the noise was more than I expected
○ Yes, and the noise was roughly what I expected
○ Yes, but the noise was less than I expected
○ Yes, but the noise has got worse since I moved here

Don’t know

Refused

H4b. *Which (if any) of these things do you not like about living in this home?*
[Showcard H4b]
☐ Not knowing the neighbourhood
☐ Being far from family/friends
☐ Being far from work
☐ Being far from your own community
☐ The neighbours
☐ Crime/violence/gangs/youths/drug dealers
☐ The local schools
☐ The transport links
☐ Lack of parks, lakes, countryside or other open spaces
☐ The shops
☐ Not enough parking
☐ Other local facilities
☐ Dog fouling
☐ Traffic/roads/close to roads
☐ Litter
☐ Generally dislike the neighbourhood
☐ None of these§

H4c. *And which (if any) of these things do you see as good things about living in this home?*
[Showcard H4c]
☐ Born in this neighbourhood
☐ Being near family/friends
☐ Being near work
☐ Being near your own community
☐ Friendly area/good neighbours/community spirit
☐ Safety/low crime
☐ The local schools
☐ The transport links
☐ Parks, lakes, countryside or other open spaces
☐ The shops
☐ Other local facilities
☐ Generally clean and tidy
☐ Generally like the neighbourhood
☐ None of these§

H5. *Which of these age groups are you in?*
[Showcard H5]
○ 18 – 19 years
○ 20 – 24 years
○ 25 – 34 years

○ 35 – 44 years
○ 45 – 54 years
○ 55 – 64 years
○ 65 – 74 years
○ 75 years or older
○ Refused

H6. [Code respondent gender.]
○ Male
○ Female

H7a. *Please tell me if you have other household members in the following age categories?*
[Showcard H7a]
☐ Under 1
☐ 1-4 years
☐ 5-10 years
☐ 11-15 years
☐ 16-17 years
☐ 18-19 years
☐ 20-24 years
☐ 25-34 years
☐ 35-44 years
☐ 45-54 years
☐ 55-64 years
☐ 65-74 years
☐ 75 years or older
☐ None§
☐ Refused§

{If any coded at H7a, ask H7b.}
H7b. *How many people in each age group, other than yourself, live in this household?*
[Probe for each displayed age group.]

	1	2	3	4	5	6	7	8	9	10+
{{Age group}}	○	○	○	○	○	○	○	○	○	○

○ Refused§

H8. *Which of these best describes your current situation?*
[Showcard H8]
○ Working full time (30 hours a week or more)
○ Working part time
○ Unemployed and looking for work
○ Retired from paid work altogether
○ In full-time education
○ Looking after the home or family
○ Something else
○ Refused

{If working full or part time, ask H9a. Otherwise go to filter before H10a.}
H9a. *Do you ever work from home?*
○ Yes
○ No

{If "Yes" at H9a, ask H9b. Otherwise go to H9c.}
H9b. *How many days in a typical week do you work from home?*
○ Less than 3
○ 3 to 4
○ 5 to 7
○ Varies
○ Don't know

H9c. *Which of the following times of day do you normally work?*
[Showcard H9c]
○ Mostly during the day
○ Mostly in the evenings

○ Mostly at night
○ Varying shift patterns
○ Don't know

Airport-related employment
{If working, ask H10a.}
H10a. *Does your work include any of these kinds of employment?*
[Showcard H10a]
☐ Working for an airport
☐ Working for an airline
☐ Working for another company that does business at an airport
☐ Work that is not at an airport but gets some benefit from the airport being there
☐ Other work related to the aircraft or air travel industry.
☐ None of these§
{If retired, ask H10b.}
H10b *Did your work, before you retired, include any of these kinds of employment?*
[Showcard H10b]
☐ Working for an airport
☐ Working for an airline
☐ Working for another company that does business at an airport
☐ Work that is not at an airport but gets some benefit from the airport being there
☐ Other work related to the aircraft or air travel industry.
☐ None of these§
{If anyone else aged 16+ in the household at H7a, ask H10c.}
H10c *Does anyone else in the household have work that includes any of these kinds of employment?*
[Showcard H10c]
☐ Working for an airport
☐ Working for an airline
☐ Working for another company that does business at an airport
☐ Work that is not at an airport but gets some benefit from the airport being there
☐ Other work related to the aircraft or air travel industry.
☐ None of these§
SoNA2013 items
ASK ALL

ALL QUESTIONS BELOW BASED ON CIE, WHETHER RESPONDENT OR ANOTHER MEMBER OF HOUSEHOLD.
IF THE CIE IS RETIRED AND RECEIVES A PENSION FROM THEIR LAST COMPANY, QUESTIONS SHOULD BE BASED ON THEIR POSITION WHILST WORKING AT THE COMPANY
IF THE CIE IS A WIDOW/WIDOWER AND THEIR LARGEST SOURCE OF INCOME IS A PENSION FROM THEIR PARTNERS LAST COMPANY, QUESTIONS SHOULD BE BASED ON THEIR PARTNERS POSITION WHILST WORKING AT THE COMPANY
NOW COLLECT DETAILS OF RESPONDENT'S JOB .
THE CHIEF INCOME EARNER IS :
THERE IS NO QUESTION H11

H12a. *What type of firm do you work for?*

{Open text box, text scrolls along if too long for the box.}

○ Refused
H12b. *What do you do? What does the work involve?*

{Open text box, text scrolls along if too long for the box.}

○ Refused
H12c. *Is the work manual/non manual?*
○ Manual
○ Non manual
○ Refused

H12d. *Are you an employee or self employed?*

- ○ Employed
- ○ Self employed
- ○ Refused

H12e. *Do you have any position/rank/grade in the organisation? (PROMPT: Foreman, Sergeant, Manager, Chief Executive etc.)*

{Open text box, text scrolls along if too long for the box.}

- ○ Refused

H12f. *How many people work at the same place?*

{Allow numerals only}

- ○ Refused

H12g. *How many people are you responsible for?*

{Allow numerals only}

- ○ Refused

H12h. [Type in any other relevant information regarding people they are responsible for.]
(E.G. OTHER SALESMEN, MANAGERS, CLERICAL OR MANUAL WORKERS)

{Open text box, text scrolls along if too long for the box.}

- ○ Refused

H12i. *What is the job title of the person you report to?*

{Open text box, text scrolls along if too long for the box.}	{Allow numerals only}

- ○ Refused

H12i. *What qualifications do you have that are relevant to your job?*
[COLLECT ALL AND PROBE FOR LEVEL E.G. BELOW, AT, ABOVE DEGREE LEVEL]1

{Open text box, text scrolls along if too long for the box.}	{Allow numerals only}

○ Refused

H13. *Occupation of Chief Income Earner*
{SUMMARISE RESPONSES TO H12 IN BOX BELOW}

Type of firm:	
Job:	
Employment status:	
No. of people at place of work:	
No. of people responsible for:	
Qualifications:	
Position/rank/grade:	
Report to:	

[CIE/Respondent is in group ...][64]
○ A
○ B
○ C1
○ C2
○ D
○ E

H14a. *The Department for the Environment, Food and Rural Affairs (Defra) and the Department for Transport (DfT) would like to combine the answers you have given with other information on local noise and noise sources. To do this they would need to know your full address, and I need to ask your permission for us to include your address with the survey data.*
I can guarantee that your address will only be used by Defra and DfT and people working on behalf of Defra and DfT, and will only be used to combine your answers with information about noise. Is it OK to include your address with the survey data or would you prefer not?
○ Yes – can include address
○ No – would prefer not

H14b. *There are no plans at present for any follow-up interview to this survey, but if there were in future would you be prepared to take part in further research on similar topics for Defra or DfT? Your address details may be passed on to Defra and/ or DfT to be used by either themselves or another research organisation – they will only be used for research purposes*
○ Yes – prepared to take part
○ No – would prefer not

H15a. [Record: Is the respondent address exactly as given in the Contact Sheet?]
○ Yes {Ask H15b.}
○ No {Skip to H15c.}

[64] Standard social group classification.

H15b. [Enter name, address and telephone details, explain to respondent that we ask for phone number so that a certain percentage of interviews can be checked – explain that if they do not want to be called for further research by {{fieldwork contractor}} this number will not be passed on to other {{fieldwork contractor}} researchers. Ensure you write in the full address and postcode (this is on your sample list).]

Title:	{Drop-down: Mr / Mrs / Miss / Ms}
Name:	{Open text box}
Phone number:	{0nnnn nnnnnn required} [Enter 01, 02 or 03 for a landline, 07 for a mobile then 3 further digits, a space and the rest of the phone number, e.g. 02072 890901.]
Phone type:	{Drop-down: Home / Mobile / Ex-directory / Refused}

{Go to H16.}

H15c. [Enter name and telephone details, explain to respondent that we ask for phone number so that a certain percentage of interviews can be checked – explain that if they do not want to be called for further research by {{fieldwork contractor}} this number will not be passed on to other {{fieldwork contractor}} researchers.]

Title:	{Drop-down: Mr / Mrs / Miss / Ms}
Name:	{Open text box}
Phone number:	{0nnnn nnnnnn required} [Enter 01, 02 or 03 for a landline, 07 for a mobile then 3 further digits, a space and the rest of the phone number, e.g. 02072 890901.]
Phone type:	{Drop-down: Home / Mobile / Ex-directory / Refused}

H16. *If we needed to check anything about any of your answers would it be all right if we contacted you again?*

○ Yes
○ No

Appendix D

2014 noise exposure contours for study airports

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Figure 1: Birmingham

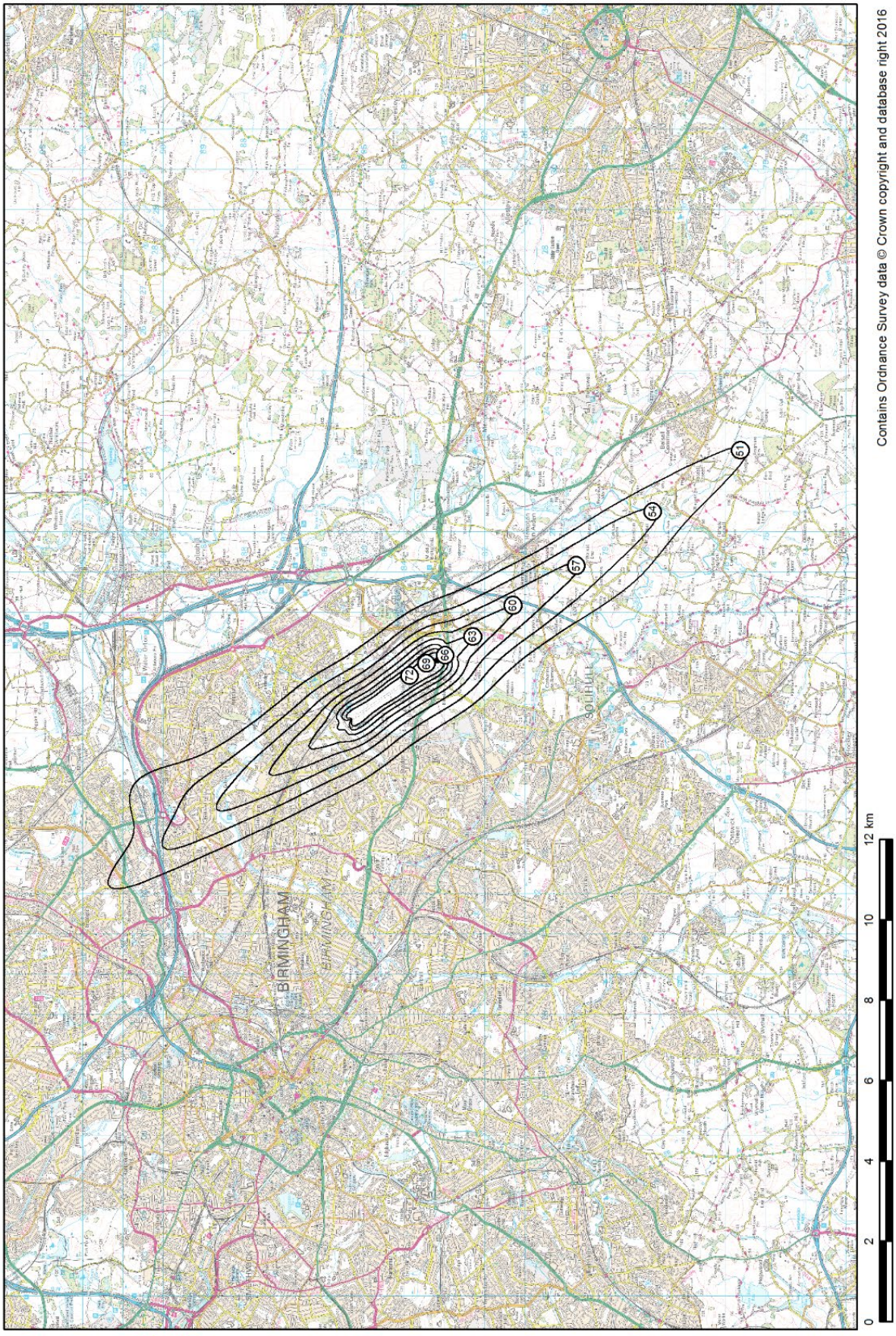


Figure 2: East Midlands

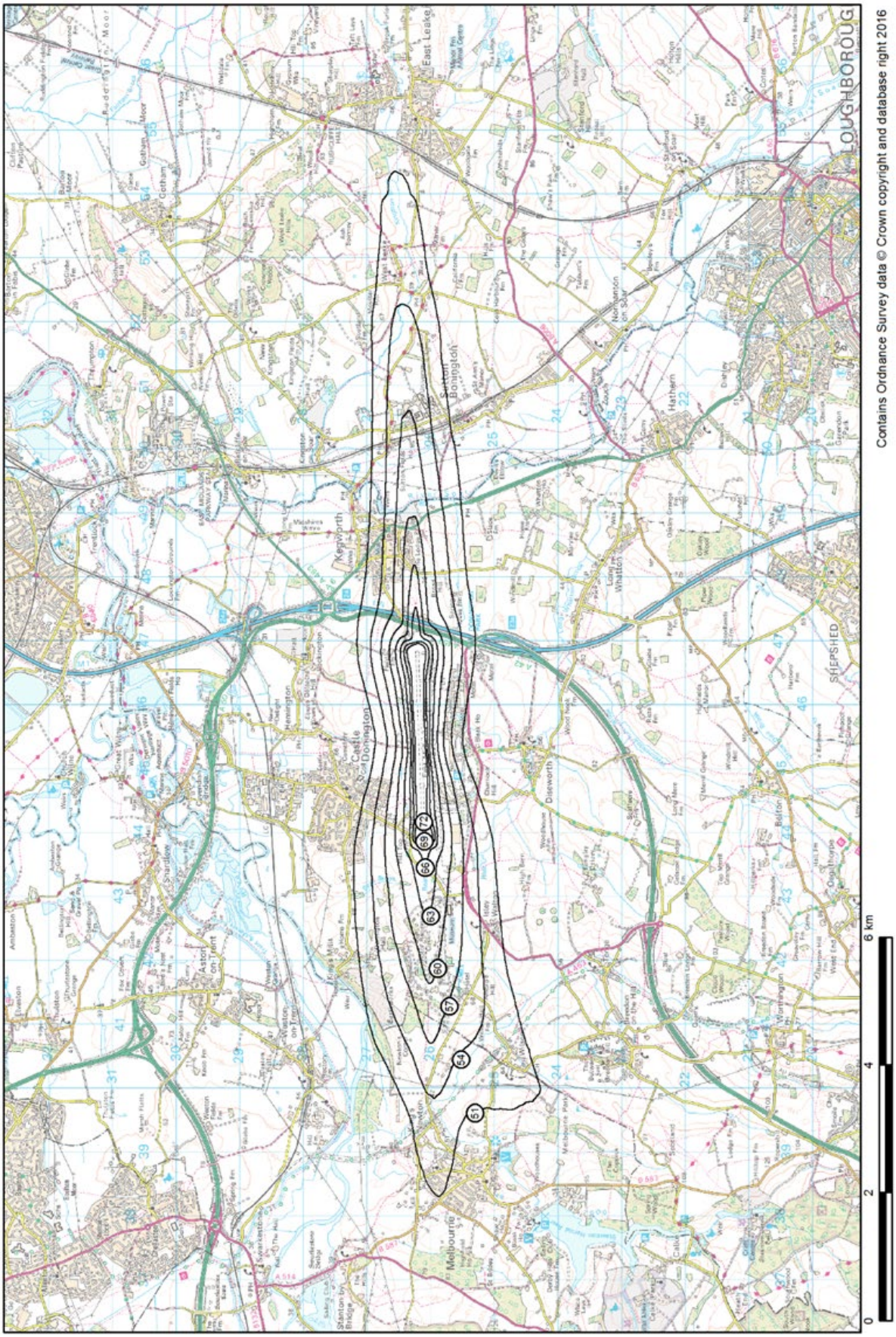


Figure 3: Gatwick

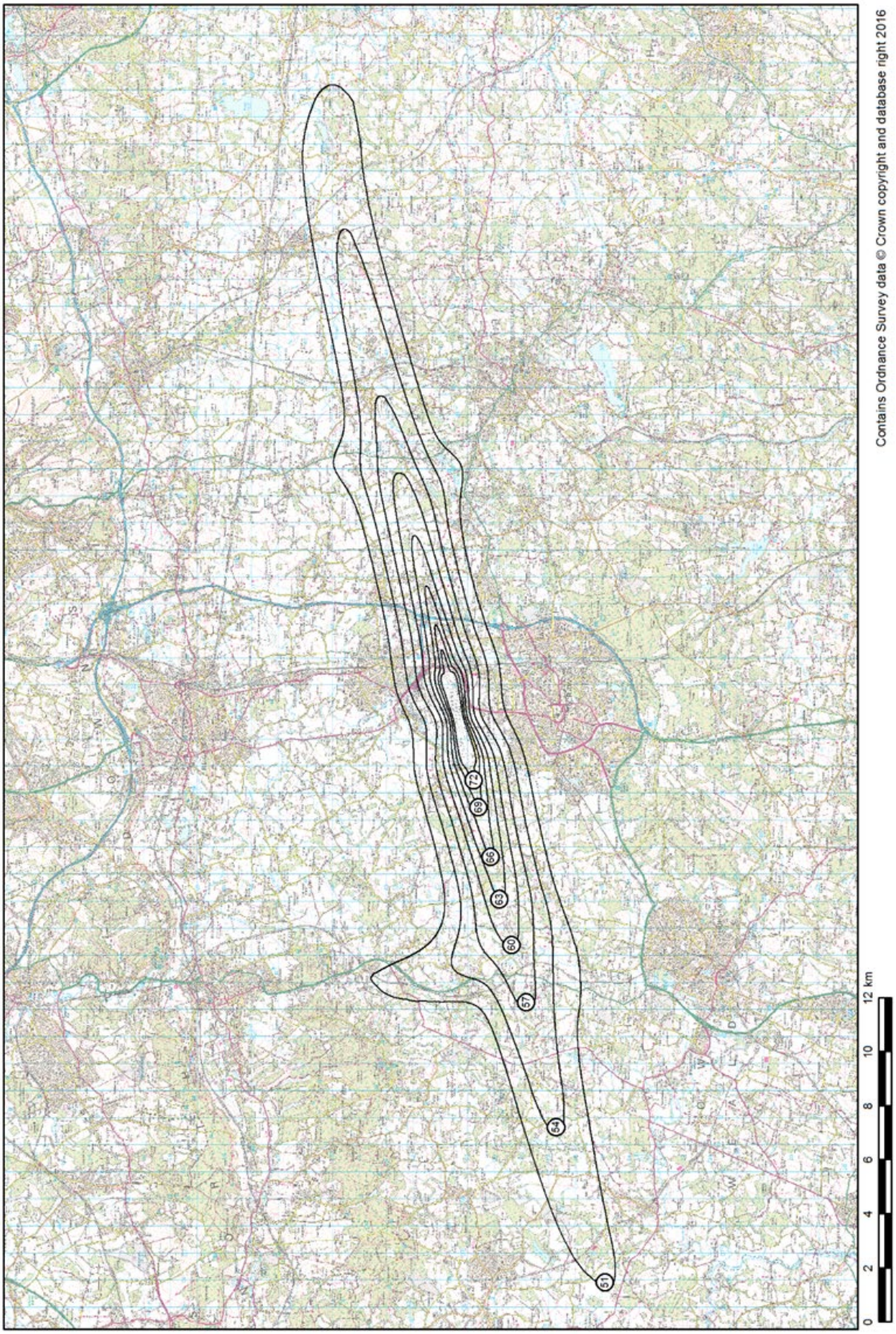


Figure 4: Heathrow

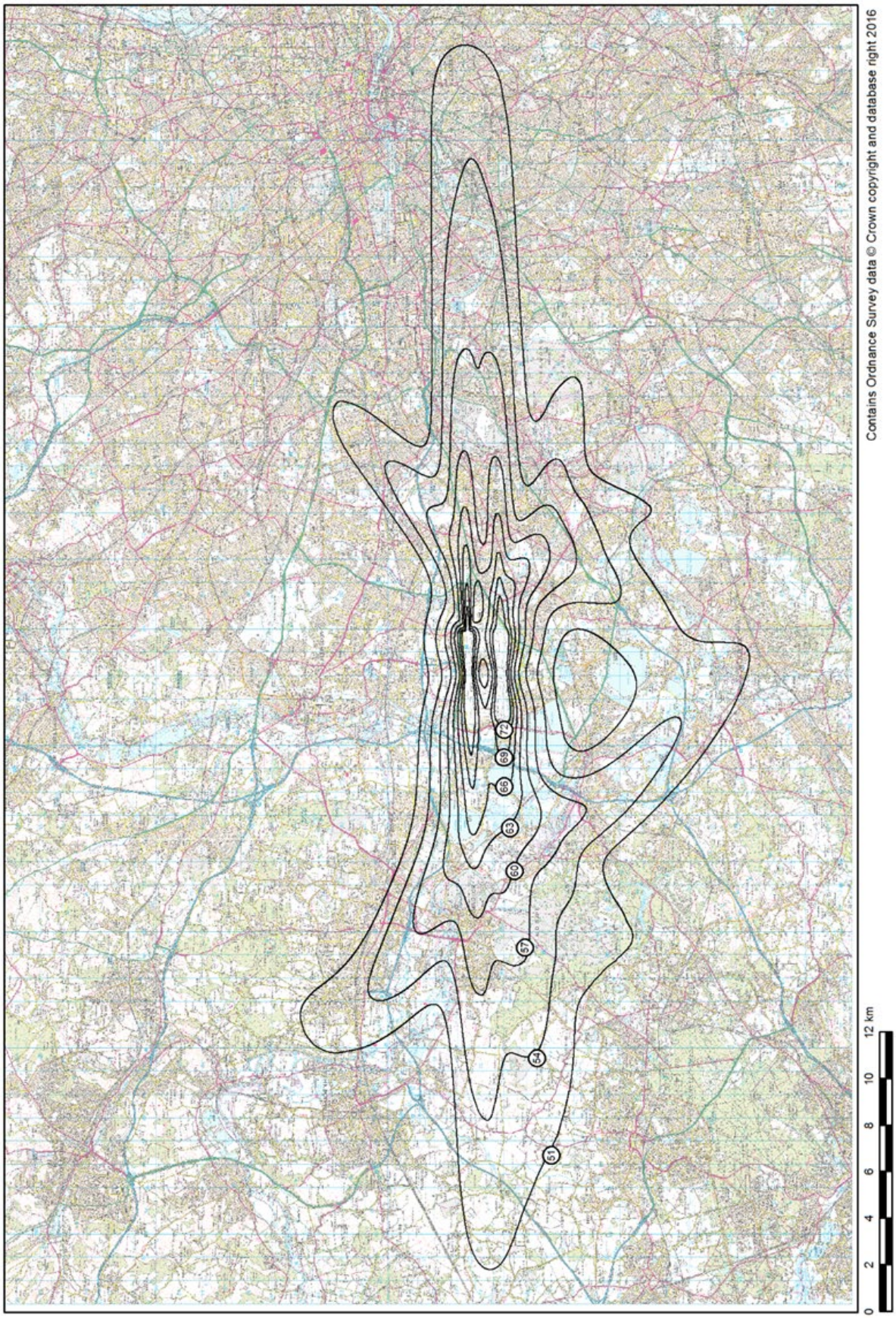


Figure 5: London City

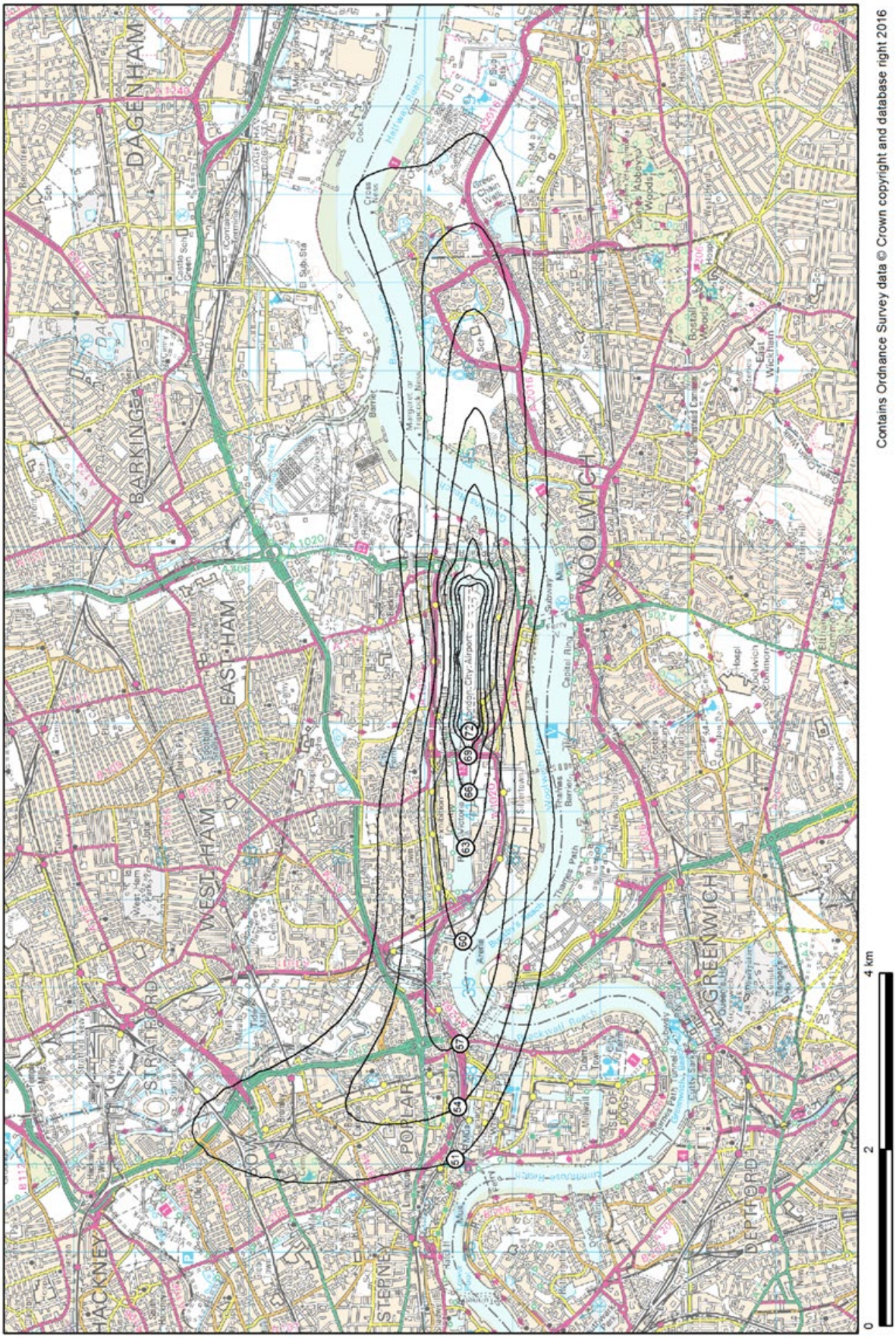


Figure 6: Luton

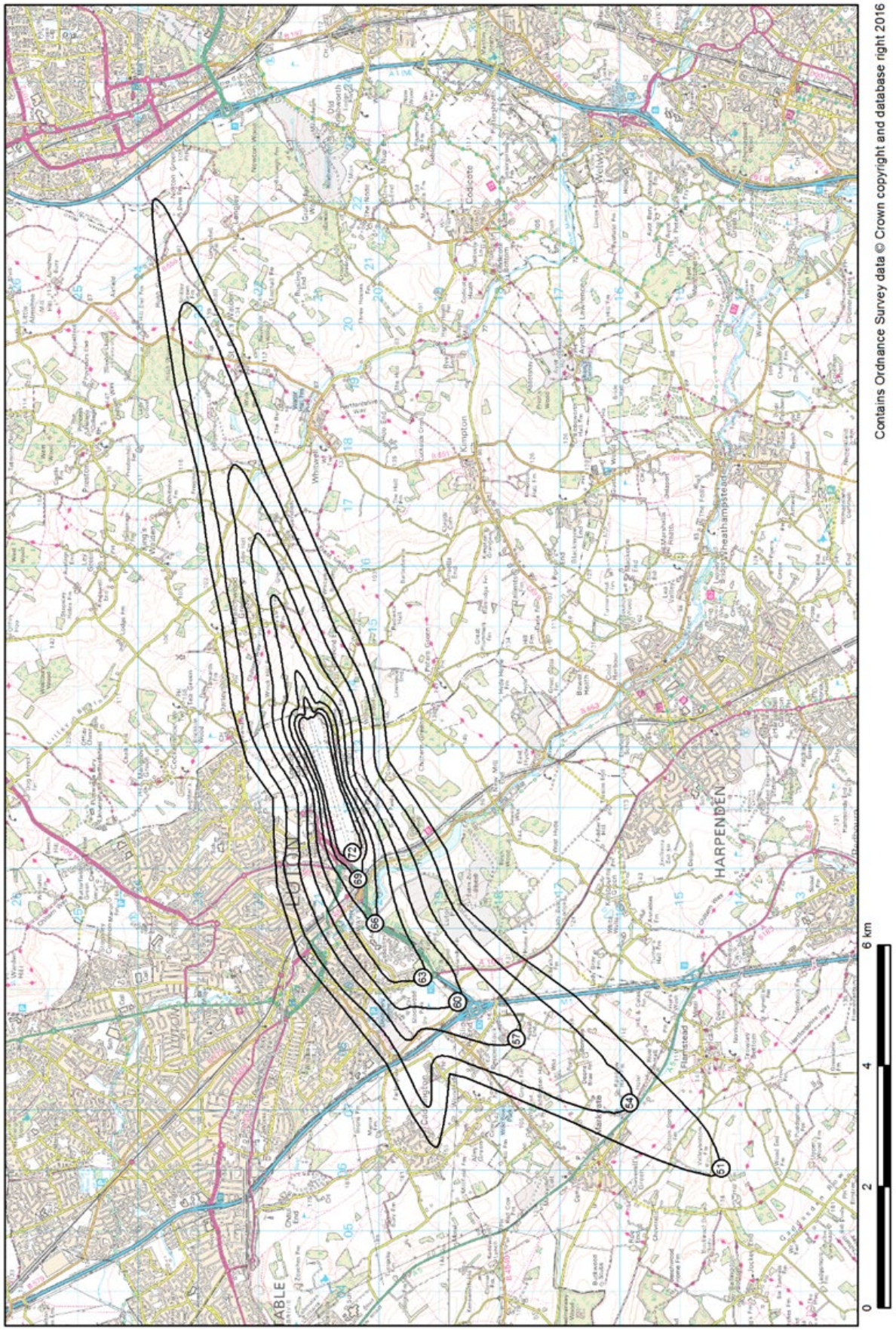


Figure 7: Manchester

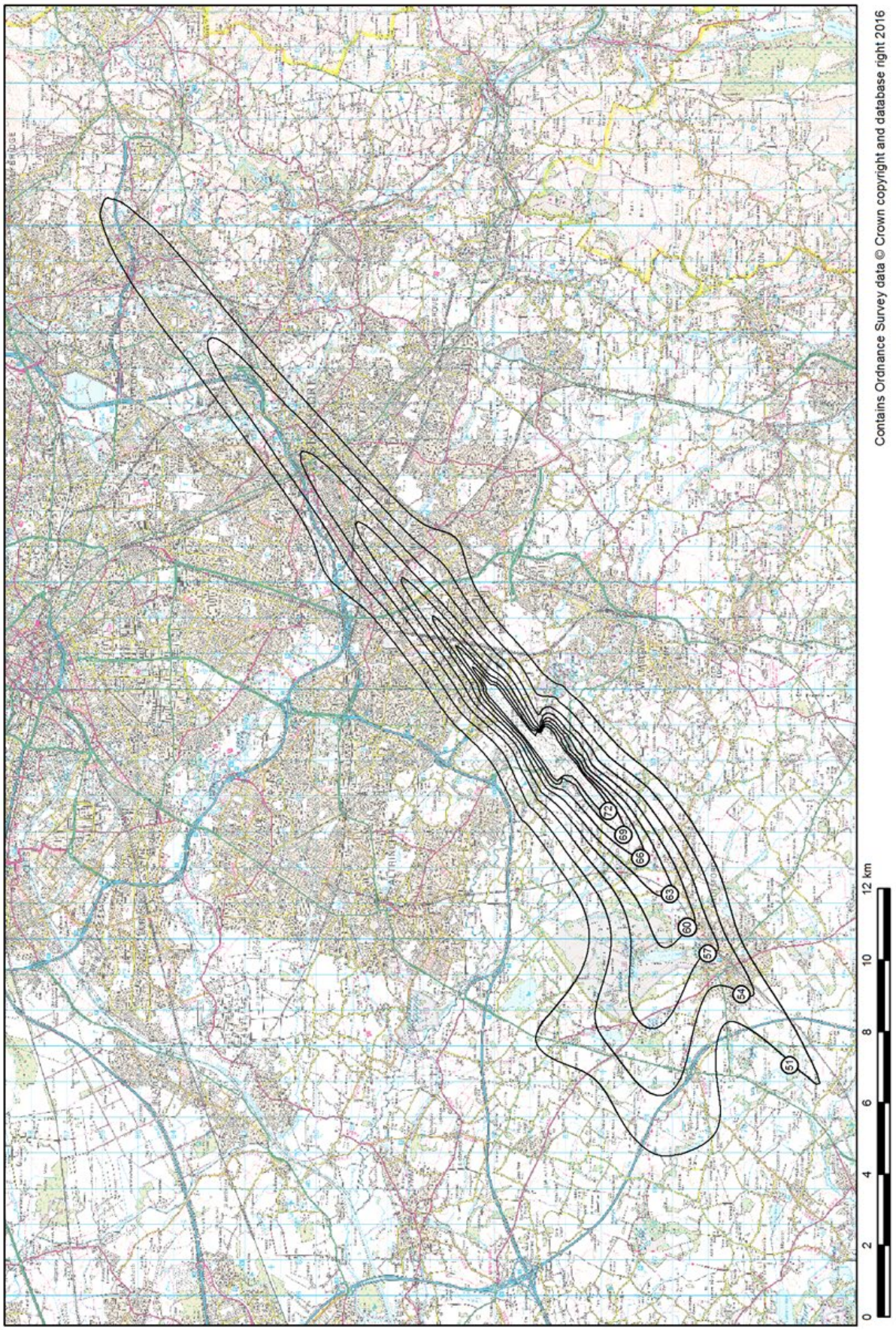


Figure 8: Newcastle

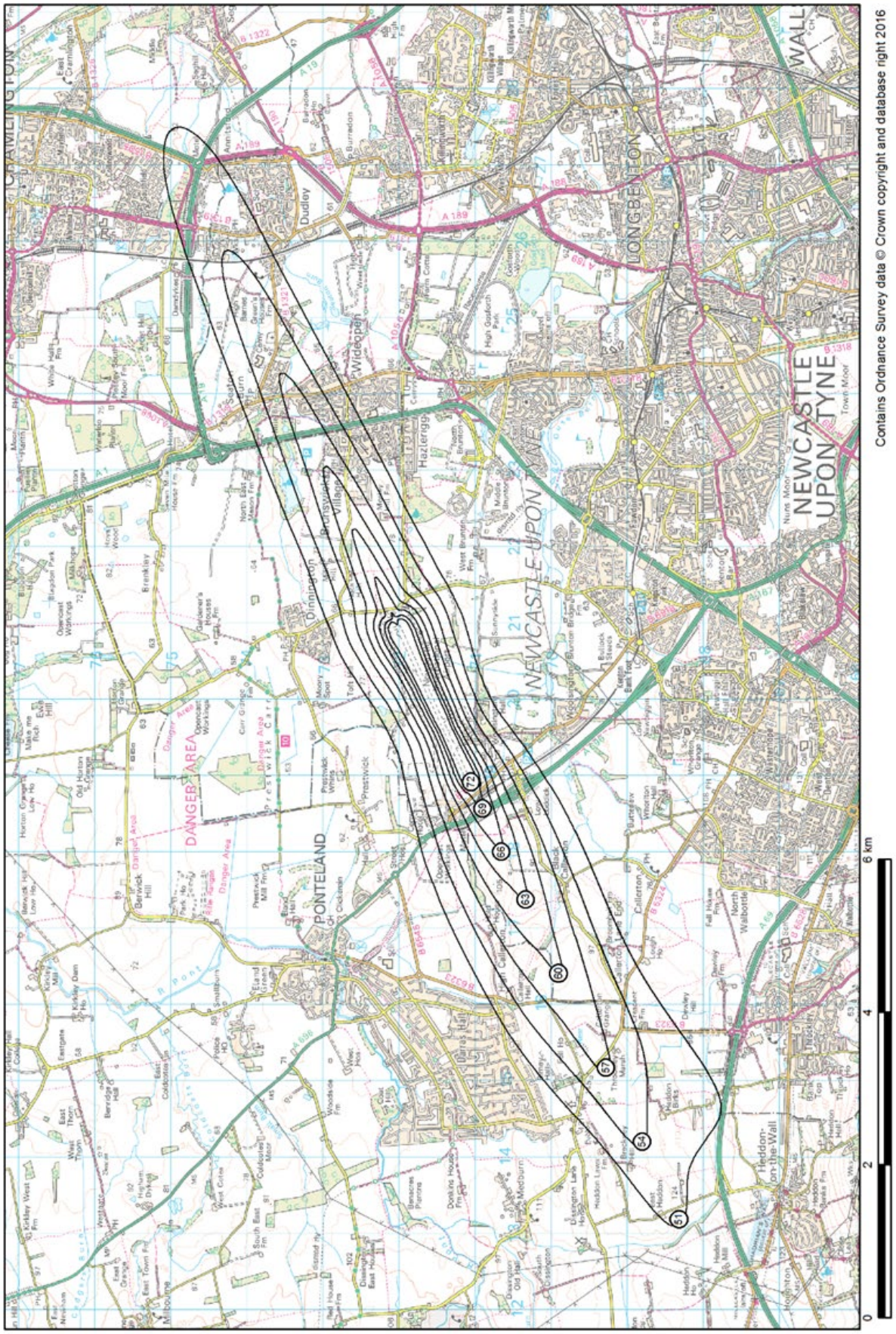
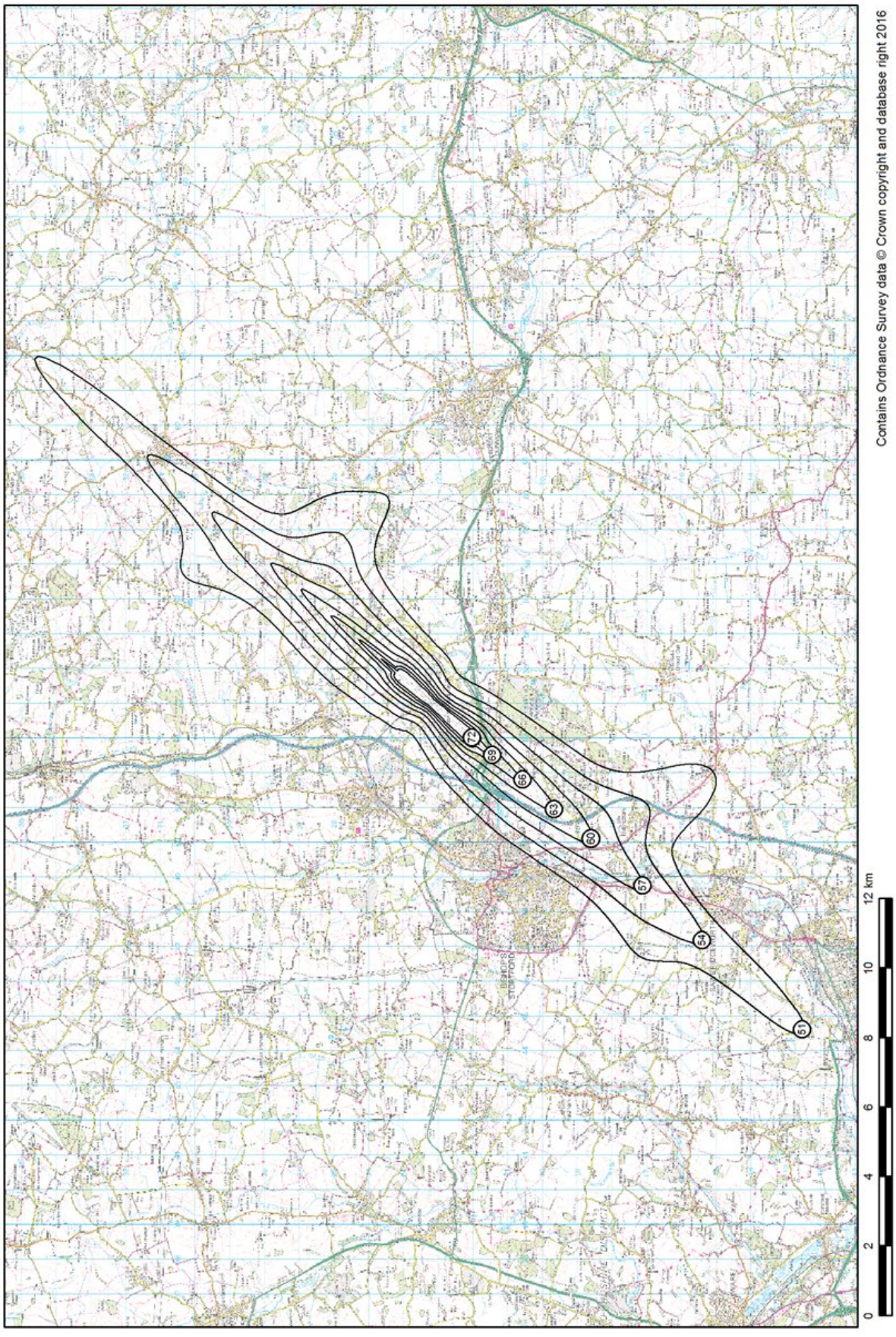


Figure 9: Stansted



Appendix E

Airport developments, consultations and trials during 2014

During 2014, several of the airports surveyed announced developments, undertook consultations and or operated airspace trials that altered either the actual and/or potentially the perceived noise exposure in their vicinity, leading to both increases and decreases in noise exposure. Any of these factors may have had an impact on the responses given in survey interviews, as might a respondent's expectation of what might follow as a result of the development, consultation and/or trial. Details of relevant developments, consultations and trials are summarised below.

Birmingham Airport

In July 2014, the new extended runway at Birmingham airport was opened. The longer runway can cater for larger aircraft and allows for more flights to long haul destinations. A trial of revised PBN departure routes to the south of the airport commenced on 1 May 2014 and ended on 13 February 2015.

Gatwick

In August 2013, Gatwick airport gained approval for nine PBN departure routes, replicating previously flown departure routes flown using conventional navigation. The transition to PBN enabled more precise navigation concentrating aircraft departure tracks. Initially, use was voluntary, but by 1 May 2014, all operators capable of flying the PBN departure routes were required to do so.

Gatwick airport carried out a six-month trial of a potential new departure route, known as ADNID. This commenced on the 10 February 2014 and ended on 8 August 2014. The trial was on westerly departures. This was to test for PBN which allowed aircraft to fly more precise routes. In addition, a 12-week consultation which also ended on 8 August 2014 took place and asked for views on three departure routes, including the ADNID route and respite on arrival routes.

Heathrow

Heathrow undertook a series of departure trials using both conventional and Performance Based Navigation (PBN) during 2014. The trials allowed aircraft departure routes to be followed more precisely and also included the trialling of new departure routes to provide resilience and/or alternating flight paths. From 16 December 2013 to 15 June 2014, trials took place on one easterly and one westerly departure route. From 28 July 2014 to 12 November 2014 trials took place which affected 2 easterly departure routes to the south. The remaining 4 easterly departure routes were not affected. From 25 August 2014 to 12 November 2014, Heathrow undertook a series of westerly departure trials. These affected three of the six routes.

London City

From 4 September to the 27 November 2014, London City airport consulted on proposals to modernise its flight paths by introducing PBN departure routes that replicated its existing conventional navigation departure routes that are reliant on ground based navigational aids and allows aircraft to follow more precise routes.

Luton airport

On 30 April 2014, the Secretary of State for the Department for Communities and Local Government announced that he did not wish to call in Luton airport's planning application for proposed alterations to access roads to the airport, alterations to the terminal, new car parks, next taxiways and extension to existing taxiways. The planning application will enable the airport to increase the number of flights and accommodate up to 18 million passengers per year in 2030.

Newcastle airport

During 2014 Newcastle International Airport Limited carried out a public consultation on a series of Standard Instrument Departure (SID) routes, which replicated the established departure routes. Approval of the SIDs was granted in 2015.

Stansted

Throughout 2014 Stansted airport continued a limited PBN trial on two departure routes to the east of the airport. The trial initially commenced with easyJet but was

extended to other operators who had Required Navigation Performance[65] (RNP)1 approval.

NATS carried out a 12-week consultation on a proposed airspace change which ended on 8 June 2014. This proposal sought to place most of the departure flights to the south onto the existing eastbound departure routes (using the existing conventional SID). This did not involve any new flight paths. The aim was to avoid congestion, reduce delays, fuel consumption and the amount of carbon dioxide emitted. The proposal was approved in October 2015.

The airport also consulted on its draft sustainable development plan during 2014. This consultation focused on growing and developing the airport and making best use of a single runway operation.

Other developments

During the SoNA 2014 interview period, work was continuing by the Airport Commission in preparation for its final report into airport capacity in the South East.

The Commission consulted on its detailed assessments of the three shortlisted options. This consultation ran for three months from November 2014 to February 2015. In December 2014 as part of the consultation on the three shortlisted options the Commission held two public consultation discussion sessions, one at Heathrow and the other at Gatwick. Speakers at these events included MPs, councillors, campaign groups and representatives of local and regional businesses as well as the promoters of the three shortlisted schemes.

65 A form of Performance-Based Navigation.