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5. Noise: Baseline

Prepared for the Airports Commission

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Jacobs U.K. Limited

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Executive Summary

The Airports Commission Appraisal Framework considers the aviation noise implications of airport schemes at both a national and local level. The local and national noise appraisal methodologies both determine the noise implications of a scheme by comparison with the base case future noise environments that would result without the scheme.

This report quantifies the predicted current and future levels of noise for the baseline scenarios associated with three shortlisted schemes. The shortlisted schemes are:

- Gatwick Airport Second Runway (Gatwick 2R) which is promoted by Gatwick Airport Ltd (GAL);
- Heathrow Airport Northwest Runway (Heathrow NWR) which is promoted by Heathrow Airport Ltd (HAL); and,
- Heathrow Airport Extended Northern Runway (Heathrow ENR) which is promoted by Heathrow Hub (HH).

The baseline scenarios are defined as the 'Do-Minimum' (DM) level of development, which can be described as *'how noise will develop in the surrounding area in the absence of an additional runway scheme'*. The DM cases account for any proposed changes to the airports as indicated in their respective current master plans.

Aviation noise associated with the DM scenarios for the base year (2030), an intermediate year (2040), and end year (2050) is considered. For context, the current noise situations at each airport in 2013[1] are described. The report describes how noise exposure will change at the national and local levels in the absence of a scheme, and identifies the underlying reasons for these changes.

For the local situations, the full range of noise metrics identified for the 'noise scorecard' are reported and examined in detail to identify trends and the underlying causes. For the national situation, a smaller number of noise exposure based metrics is considered.

The local study areas at Gatwick and Heathrow relevant to each scheme are considered and reported on separately. In the case of the Heathrow NWR and Heathrow ENR schemes, the DM scenarios are the same, although the study areas for these options differ as they are derived from the total area covered by both the DM and with scheme noise contours for each option.

[1] L_{den} metrics for the current situation are based on 2011 due to the schedule of Strategic Noise Mapping.

Gatwick Airport

The current aviation noise metrics calculated for Gatwick Airport are summarised in Table **0.1** below.

Table 0.1 : Current aviation noise levels for Gatwick Airport

Period	Population Noise Exposure					
			EU measure		Supplementary	
Day	>57 dB $L_{Aeq,16hr}$	3,550			N70 >50	2,500
Night	>48 dB $L_{Aeq,8hr}$	11,200			N60 >50	4,900
24-hour			>55 dB L_{den}	11,300		

During the period considered by this study, it is forecast that the annual aircraft movements at Gatwick Airport will increase by 14% from 250,520 in 2013 to 285,420 in 2050. In the absence of any changes to operations, aircraft or destinations, the predicted effect of this activity change would be an increase in in daytime/night-time noise exposure of 0.6 dB(A) at locations around the airport.

However, it is expected that there will be significant changes in the aircraft operated over this 37 year period, and by 2050, around 90% of the aircraft operating at Gatwick Airport will be new or re-engined aircraft. The new and re-engined aircraft are likely to be quieter than current aircraft; this change will lead to smaller areas being subject to current noise levels in the future assessment years. The resulting changes in population impacted over the period 2013 to 2050 are summarised in Table **0.2** and Table **0.3** below.

Table 0.2 : Current vs 2030 DM aviation noise levels for Gatwick Airport

Period	Population Noise Exposure					
	UK measure		EU measure		Supplementary	
Day	>57 dB $L_{Aeq,16hr}$	(1,700)			N70 >50	(700)
Night	>48 dB $L_{Aeq,8hr}$	500			N60 >50	2,300
24-hour			>55 dB L_{den}	(1,900)		

Note: Numbers in parentheses represent reductions

Table 0.3 : Current vs 2050 DM aviation noise levels for Gatwick Airport

Period	Population Noise Exposure					
	UK measure		EU measure		Supplementary	
Day	>57 dB $L_{Aeq,16hr}$	(2,100)			N70 >50	(600)
Night	>48 dB $L_{Aeq,8hr}$	0			N60 >50	2,200
24-hour			>55 dB L_{den}	(1,800)		

Note: Numbers in parentheses represent reductions

Without development, from the current situation to 2030 and 2050 there will be reductions in the daytime metrics due to improvements in aircraft technology which offset forecast increase in ATM and population growth. However, the number of people exposed to more than 50 events exceeding 60 dB $L_{AS,Max}$ at night will increase, as a result of a forecast increase in westerly take-offs during the night 'shoulder periods' (23:00-23:30 and 06:00-07:00).

The effect of population growth is significant, and would result in a 19% increase in assessed population from 2013 to 2050 for the 54 dB $L_{Aeq,16h}$ metric if the noise impacted area were to remain constant over this period.

Heathrow Airport

The current aviation noise metrics calculated for Heathrow Airport are summarised in Table **0.4** below.

Table 0.4 : Current aviation noise levels for Heathrow Airport

Period	Population Noise Exposure					
			EU measure		Supplementary	
Day	>57 dB $L_{Aeq,16hr}$	266,100			N70 >50	217,700
Night	>48 dB $L_{Aeq,8hr}$	421,300			N60 >50	2,600
24-hour			>55 dB L_{den}	766,100		

During the period considered by this study, it is forecast that the annual aircraft movements at Heathrow Airport will reduce by 0.2% from 471,936 in 2013 to 471,132 in 2050. This forecast fluctuates over the intervening years, with some showing increases on current levels of activity, and others showing decreases. In the absence of any changes to operations, aircraft or destinations, there would be no perceptible change in noise in 2050 as a result of this activity change.

However, it is expected that there will be significant changes in the aircraft operated over this 37 year period, and by 2050, around 95% of the aircraft operating at Heathrow Airport will be new or re-engined aircraft. The new and re-engined aircraft are likely to be quieter than current aircraft; this change will lead to smaller areas being subject to current noise levels in the future assessment years. The resulting changes in population impacted over the period 2013 to 2050 are summarised in Table **0.5** and Table **0.6** below.

Table 0.5 : Current vs 2030 DM aviation noise levels for Heathrow Airport

Period	Population Noise Exposure					
	UK measure		EU measure		Supplementary	
Day	>57 dB $L_{Aeq,16h}$	(44,900)			N70 >50	(33,600)
Night	>48 dB $L_{Aeq,8hr}$	(150,100)			N60 >50	(2,600)
24-hour			>55 dB L_{den}	(185,600)		

Note: Numbers in parentheses represent reductions

Table 0.6 : Current vs 2050 DM aviation noise levels for Heathrow Airport

Period	Population Noise Exposure					
	UK measure		EU measure		Supplementary	
Day	>57 dB $L_{Aeq,16hr}$	(196,800)			N70 >50	(28,200)
Night	>48 dB $L_{Aeq,8hr}$	(48,200)			N60 >50	3,900
24-hour			>55 dB L_{den}	(182,600)		

Note: Numbers in parentheses represent reductions

Without development, from the current situation to 2030 and 2050 there will be reductions in the primary exposure based metrics due to improvements in aircraft technology which offset forecast increase in ATM and population growth. However, the number of people exposed to more than 50 events exceeding 60 dB $L_{AS,Max}$ at night will increase, as a result forecast growth in the Americas and Far East routes operating during the night 'shoulder periods' (23:00-23:30 and 06:00-07:00).

National

The current National aviation noise metrics are summarised in Table **0.7** below.

Table 0.7 : Current aviation noise levels for Heathrow Airport

Period	Population Noise Exposure			
	UK measure		EU measure	
Day	>57 dB $L_{Aeq,16hr}$	363,450		
Night	>48 dB $L_{Aeq,8hr}$	578,950		
24-hour			>55 dB L_{den}	1,006,000

The two tables and associated commentary below provide an overview of the changes in the National baseline situation which are predicted over the period 2013 to 2050.

During the period considered by this study, it is forecast that the national annual aircraft movements will increase by 45% from 1,590,000 in 2013 to 2,310,000 in 2050. However, it is expected that there will be significant changes in the aircraft operated at each airport over this 37 year period, and the resulting changes in population impacted over the period 2013 to 2050 are summarised in Table **0.8** and Table **0.9** below.

Table 0.8 : Current vs 2030 DM National aviation noise levels

Period	Population Noise Exposure			
	UK measure		EU measure	
Day	>57 dB $L_{Aeq,16hr}$	(22,700)		
Night	>48 dB $L_{Aeq,8hr}$	(129,850)		
24-hour			>55 dB L_{den}	(127,250)

Note: Numbers in parentheses represent reductions

Table 0.9 : Current vs 2050 DM National aviation noise levels

Period	Population Noise Exposure			
	UK measure		EU measure	
Day	>57 dB $L_{Aeq,16hr}$	(6,400)		
Night	>48 dB $L_{Aeq,8hr}$	15,550		
24-hour			>55 dB L_{den}	(60,300)

Note: Numbers in parentheses represent reductions

Between the current and 2030 DM situation there are significant reductions predicted in all aviation noise metrics. These reductions are due to improvements in aircraft technology offsetting an increase of 390,000 ATMs nationally.

Between the current and 2050 DM situations, reductions in the daytime and 24 hour metrics due to improvements in aircraft technology, but increases in the night-time metrics due to increased nigh-time aircraft movements at some airports.

1 Introduction

This report identifies the ‘Do-Minimum’ (DM) scenarios for noise which will be used to appraise the three shortlisted schemes:

- Gatwick Airport Second Runway (Gatwick 2R) promoted by Gatwick Airport Ltd (GAL);
- Heathrow Airport Northwest Runway (Heathrow NWR) promoted by Heathrow Airport Ltd (HAL); and,
- Heathrow Airport Extended Northern Runway (Heathrow ENR) promoted by Heathrow ENR (HH).

In April 2014, an Appraisal Framework was published by the Airport Commission which identified the methodology that was to be used to further assess the three shortlisted schemes. Potential environmental impacts from the three schemes will be appraised in accordance with the Appraisal Framework (Section A.5): *“Noise”.* The objective for this module is *“To minimise and where possible reduce noise impacts”.*

This appraisal module provides a consistent approach to evaluating the Promoters’ submissions, and determining whether schemes have minimised and, wherever possible, have reduced the population that would be exposed to aircraft noise.

The appraisal module considers the noise implications of a scheme at both the national and local level. Both are based on comparisons of the development scenarios against DM situations. The national assessment considers only aviation noise, while the local assessment considers changes to noise environments in and around short-listed airports, including particular areas of tranquillity and ground noise.

This report sets out the DM situations which would exist at Gatwick Airport and Heathrow Airport. The DM situations take into account any proposed changes to the airports as indicated in their respective current master plans, and represent the future DM scenario in the absence of any new runways. Factors included in the DM scenarios include the predicted change in passenger numbers at both airports, which will affect the number of aircraft movements, planned noise control measures which are to be implemented by the airports, population growth in the areas surrounding the airports, and the transition to a quieter modern aircraft fleet.

In relation to the DM scenarios, a base date of 2030 and an end date of 2050 are used. The end date does not coincide with the wider appraisal end date, as longer-term forecasts of the input data on which noise modelling is based cannot be made with reasonable accuracy. The potential noise impacts are therefore considered only over the period where reasonable forecasts can be made.

The noise assessment requirements are listed in Section 5 of the Appraisal Framework: *“Noise”.* This report is structured to address each of the core noise components in turn for each shortlisted scheme and considers the following comparisons:

- Current vs 2030 DM;
- 2030 DM vs 2040 DM;
- 2040 DM vs 2050 DM; and,
- Current vs 2050 DM.

For each comparison, the following noise issues are considered:

- Local Aviation noise:
  - Daytime noise, evaluated in terms of the $_{LAeq,16h}$ exposure metric and the N70 supplementary metric
  - Night-time noise, evaluated in terms of the $_{LAeq,8h}$ exposure metric and the N60 supplementary metric
  - 24-hour noise, evaluated in terms of the L_{den} exposure metric preferred by the EU
- Ground noise; and,
- National Aviation Noise.

The methodology is contained within Appendix A.

1.1 Introduction to noise

Noise is often defined as unwanted sound. Sound is measured in terms of sound pressure level, and the normal unit of measurement is the decibel (dB(A)). Sound pressure levels range from the threshold of hearing at 0 dB(A) to levels of over 130 dB(A) at which point noise becomes painful.

Sound consists of vibrations transmitted to the ear as rapid variations in air pressure. The more rapid the fluctuation, the higher the frequency of the sound. Frequency is the number of pressure fluctuations per second and is expressed in Hertz (Hz).

The sensitivity of the human ear varies with frequency. To allow for this phenomenon, sound level meters are often equipped with a set of filters that modify the response of the sound level meter in a similar way to the human ear; these filters are referred to as the ‘A-weighting network’. The ‘dB(A)’ notation is used to indicate when noise levels have been filtered using the A-weighting network.

Some common levels of noise on the A-weighted scale are given in Table 1.1 below.

Table 1.1 Common Levels of Noise, After Sharland,(1972)

Sound Pressure Level, dB(A)	Typical environment	Average subjective description
140	30m from military aircraft take-off	Intolerable
100	Underground station platform	Very noisy
90	Heavy lorries at 6m	Very noisy
60	Restaurant	Noisy
50	General office	Quiet
20	Background in TV studios	Very quiet

Noise Metrics

The subjective response to noise is dependent not only upon the sound pressure level and its frequency but also on its duration, regularity and the time of day it occurs.

Noise levels in the environment fluctuate continuously in response to events, for instance with aircraft passing overhead, or with changes in the quantity and speed of road traffic on nearby roads. For this reason, summarising a noise environment with a single measure is difficult.

In response, a number of noise metrics have been developed to describe particular aspects of a noise environment. These have in the past been broadly categorised by the CAA[2] as **single event metrics**, **exposure metrics** and **supplementary metrics**.

(i) Single Event Metrics

Single event metrics describe one aspect of a single noise event, such as an aircraft over-flight. The most common single event metric is $L_{AS,max}$, which describes the sound pressure **L**evel of the **A**-weighted, **max**imum noise level recorded during the event, with the time-response of the sound level meter set to **S**low (1s). Although not good practice, this metric is often shortened to $L_{A,max}$ or even L_{max}. While the LAS,$_{max}$ metric tells us how loud an event is, it's primary disadvantage is that it does not give any information about an events duration.

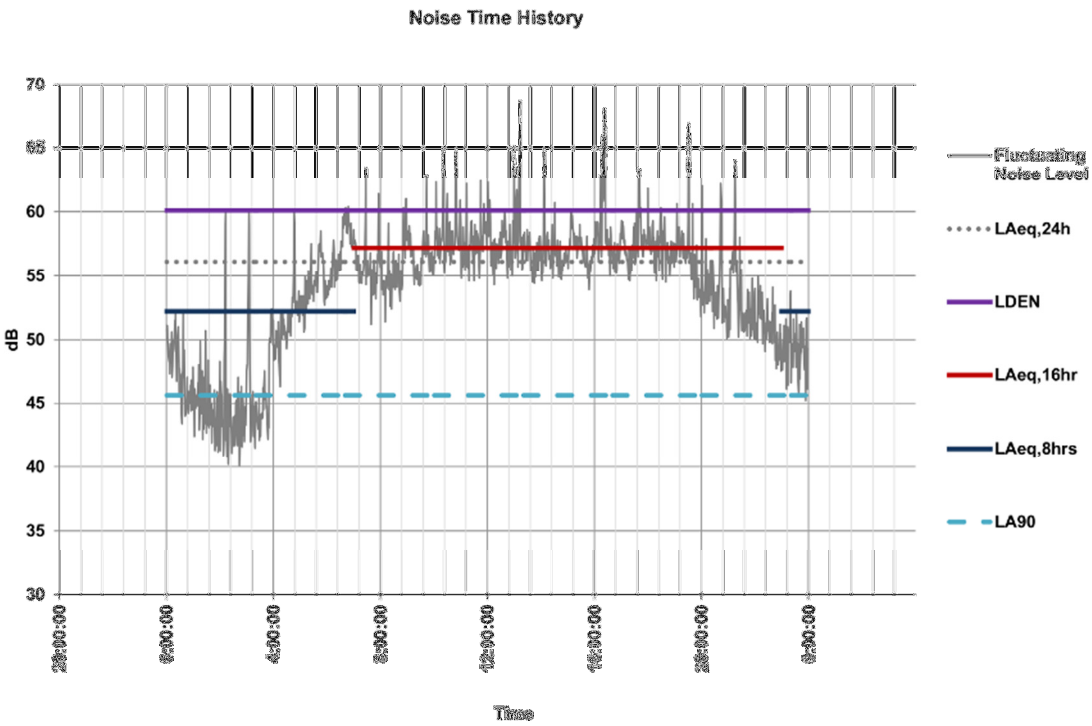
(ii) Exposure metrics

Exposure metrics are intended to quantify noise exposure over a given period of time. There are a wide range of exposure metrics which are used to describe aircraft noise. The most common is the **A**-weighted **eq**uivalent continuous sound pressure **L**evel measured over a certain **T**ime period ($L_{Aeq,T}$). This metric gives an indication of the continuous steady sound level that would contain the same sound

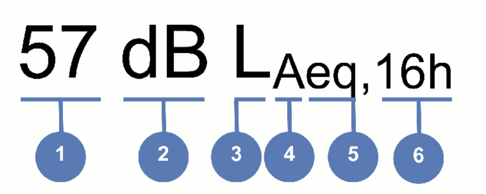
[2] ERCD REPORT 0904 Metrics for Aircraft Noise, K Jones and R Cadoux, 2009.

energy as the actual fluctuating noise level of a time period, and studies[3] have shown that a large proportion of measured variation in annoyance can be accounted for by the L_{Aeq} metric. Figure 1.1 below provides a graphical illustration of the L_{Aeq} measured over several periods compared with the actual fluctuating noise level. The figure also shows the L_{den} and L_{A90} metrics which are explained below.

Figure 1.1 Illustration of noise exposure metrics



The nomenclature used to represent noise exposure metrics can appear complicated, however once understood it is logical and efficient. Take for instance the noise level above which a rapid increase in community annoyance[4] due to aircraft during the daytime is observed:



The above descriptor is comprised as follows:

1. The first part of the exposure metric identifies its numeric value. This value is usually given as a whole number or to one decimal place. Where values are given to one decimal place, this is normally required for compliance with a particular standard or convention, and it does not necessarily imply that the values are accurate to one decimal place.

[3] ANASE - Attitudes to Noise from Aviation Sources in England,
[4] The Use of Leq as an Aircraft Noise Index, DORA Report 9023, Civil Aviation Authority, 1990

2. The second group of characters indicate that the units of the noise descriptor are decibels.
3. The third grouping (‘L’) indicates that the quantity is a sound pressure level. Other less common quantities are sound intensity level (LI) and sound power level (LW).
4. The fourth grouping (‘A’) denotes that the sound pressure level is evaluated using the A-weighted filter network. There are two competing conventions regarding the position of this identifier, either immediately after the ‘L’ as shown in the example above, or alternatively in brackets following the units. Therefore whilst appearing different, 57 dB $L_{Aeq,16hrs}$ and 57 dB(A) $L_{eq,16hrs}$ are equivalent and may be used interchangeably. Which convention is used is a matter of preference; however it is considered good practice to remain consistent within a document for the convenience of the reader.
5. The fifth grouping of characters identify the statistical index. In this example, the letters indicate that the quantity is in terms of the **eq**uivalent continuous noise level (eq), which has some similarities with the concept of an average noise level. Other common quantities include:
    - $L_{Aeq,16hr}$ which is the A-weighted equivalent continuous noise level, assessed over an **average summertime daytime** / **evening** period (07.00-23.00).
    - $L_{Aeq,8hr}$ which is the A-weighted equivalent continuous noise level, assessed over an **average summertime night** period (23.00-07.00).
    - L_{night} which is the A-weighted equivalent continuous noise level, assessed over an **annual average night** period (23.00-07.00).
    - L_{den} which is the A-weighted equivalent continuous noise level, evaluated over an **annual average 24 hour** period, with a 10 dB penalty added to the levels at night (23.00-07.00) and a 5 dB penalty added to the levels in the evening (19.00-23.00) to reflect people's increased sensitivity to noise during these periods.
6. The sixth and final quantity shown after the statistical index is the duration over which the quantity is evaluated. This is typically represented in minutes or hours, e.g. 15min, 16h.

(iii) Supplementary metrics

Supplementary metrics are frequently used in conjunction with exposure metrics to provide additional information about the potential impact of the noise exposure.

The N70 and N60 metrics relate to the number of times a threshold level (in this case 70 dB L_{ASmax} and 60 dB L_{ASmax}) are exceeded within the time period of interest. These metrics were developed for Sydney airport, and are therefore based on Australian standards, but are now in wider use.

The N70 is generally used in relation to the daytime, and was chosen because the Australian government considered that external single event noise levels due to aircraft would be attenuated by approximately 10 dB(A) by the fabric of a house with open windows, resulting in an indoor level of 60 dB(A). Australian Standard AS2021 specifies 60 dB(A) as the indoor design sound level for normal domestic areas in dwellings.

N60 is used for the night period. The level of 60 dB(A) was chosen because an external single event noise level of 60 dB(A) equates to the sleep disturbance level of 50 dB(A) specified in AS2021. The N60 >25 metric provides an estimate of the number of people exposed to at least 25 events each night where the external noise level exceeds 60 dB L_{ASmax}.

It should be noted that the 'number above' metrics have two weaknesses; firstly they do not provide any information about the number of events that may occur under the threshold level, and secondly they do not provide any indication as to the extent to which the threshold was exceeded (i.e. an event measuring 82 dB L_{ASmax} is treated in the same way as an event at 71 dB L_{ASmax}). Therefore although these metrics are useful in communicating the impact of aircraft noise, they cannot replace $L_{Aeq,T}$ type metrics for aircraft noise assessment.

Decibel Addition

If the sound levels from two or more sources have been measured or predicted separately, and the combined sound level is required, the sound levels must be added together. However, due to the fact the decibel is a logarithmic value they cannot be added together using normal arithmetic.

Table 1.2 below provides a quick guide to adding two sound levels together. First the difference between the higher and lower noise level must be calculated, and then the corresponding amount in the right hand side of the table must be added to the higher of the two noise levels.

Table 1.2 Guide to decibel addition

Difference between noise levels, dB	Amount to be added to higher level, dB
0	3.0
1	2.5
2	2.1
3	1.8
4	1.5
5	1.2
10	0.4
15	0.1

As an example, when adding sound pressure levels of 50.0 dB(A) and 55.0 dB(A) together, the difference between them is 5.0 dB(A) and therefore 1.2 dB(A) should be added to the higher value. The resulting sound pressure level would be 56.2 dB(A).

It is important when adding noise levels to ensure that both quantities are in the same exposure based metric and they refer to the same time periods. It is not possible to add metrics of different types or time periods without conversion, which is non-trivial and in many cases may not even be possible.

Ground Reflected Levels

Due to the effects of reflection, sound pressure levels measured close to large reflecting surfaces orientated near perpendicular to the direction the sound waves are traveling are higher than those that are measured away from reflective surfaces.
For sound propagation largely in the vertical direction (e.g. from an airborne aircraft towards the ground), the ground itself causes reflection. Unless stated otherwise, the airborne aircraft noise levels presented in this report includes the effects of ground reflection, calculated for a receptor at a height of 1.5m above ground level.

1.2 Legislation, Standards and Guidance

This section covers key legislation, relevant technical standards and guidance which inform the current and future DM scenarios.

Legislation

EU Directive 2002/30/EC, commonly referred to as the European Noise Directive (END) sets out requirements and procedures for introducing noise related operating restrictions at Community Airports. In the UK, the provisions of the END are enacted in Environmental Noise (England) Regulations 2006, as amended.

The Environmental Noise (England) Regulations 2006 applies to airports that have more than 50,000 movements of civil subsonic jet aircraft per calendar year. Qualifying airports must implement or update noise action plans every five years or whenever a major development which affects the existing noise situation occurs. The noise action plans should be based on noise maps. The noise action plans must be designed to manage noise issues and effects, including noise reduction if necessary.

The noise maps produced to satisfy the END are in terms of the L_{den} noise metric, and are based on an average annual day. The appraisal framework module 5: 'Noise' is cognisant of this and has included the L_{den} metric within the noise scorecards which inform the appraisal process.

Technical Documents and Standards

The International Civil Aviation Organization (ICAO), Resolution A33/7, 'Balanced Approach to Aircraft Noise Management' sets out a balanced approach to reducing noise. This approach involves identifying the noise issues relevant to an airport, then analysing the various measures available to reduce noise through the exploration of the following four principal elements:

- reduction at source (quieter aircraft);
- land-use planning and management;
- noise abatement operations procedures; and
- operating restrictions (e.g. operating restrictions and noise charge).

The recommended practices for implementing this balanced approach are contained in ICAO Doc 9829 – '*Guidance on the balanced approach to aircraft noise management*'.In respect of reducing noise at source, ICAO recommends technical standards to limit noise. Aircraft and engines are independently assessed and certified against these standards before entering service. ICAO noise standards are referred to by 'Chapter', which refers to the chapter in the proceedings of meetings where the noise standard is agreed:

- Chapter 2, Committee on Aircraft Noise (CAN), 1973
- Chapter 3, Committee on Aircraft Noise (CAN), 1977
- Chapter 4, Committee on Aviation Environmental Protection 5, 2001 (CAEP/5-2001)
- Chapter 14, Committee on Aviation Environmental Protection 9, 2013 (CAEP/9-2013)

The technical standards for noise have become progressively more stringent with each Chapter.

Guidance

(a) Noise Road-Map

Sustainable Aviation (SA) has published the "Noise Road-Map – A blueprint for managing noise from aviation sources to 2050" which articulates their vision of how the aviation industry can maintain sustainable growth between now and 2050 whilst managing noise from aircraft operations. Included in the road map is a section on SA's view of the potential for reducing aircraft noise at source, and an industry commitment to working to achieve the goals of Flightpath 2050 (equivalent to 0.3 dB improvement in noise emissions per aircraft operation per year) and CLEEN (to develop and demonstrate by 2015 technology that reduces noise by 42 dB cumulatively relative to the Chapter 3 standard).

SA is a non-profit making organisation which is funded by its signatories, who also provide technical expertise. SA's signatories include over 90 per cent of UK airlines, airports and air navigation service providers, as well as major UK aerospace manufacturers.

Guidelines for Community Noise

The 'Guidelines for Community Noise' published by the World Health Organisation (WHO) in 1999 provides guidance on acceptable internal and external noise levels in buildings and outdoor living areas.

Night Noise Guidelines for Europe

A more recent World Health Organisation publication 'Night noise guidelines for Europe' (2009) provide further information on the health effects of night noise, and derives health-based guideline values.

Good practice guide on noise exposure and potential health effects

European Environmental Agency (EEA) Technical report No 11/2010 "Good practice guide on noise exposure and potential health effects" published in 2010 sets out the recommendations of the Expert Panel on Noise which supports the European Environment Agency and European Commission on linking action planning to recent evidence relating to the health impacts of environmental noise.

2 Methodology

This sections covers an outline of the methodology combined with the assumptions used to predict:

- Local noise baseline;
- Local noise contours;
- National noise baseline; and
- National noise contours.

Further detail on methodology is provided in Appendix A.

2.1 Local Noise

The purpose of the Local Noise Assessment is to consider the potential noise impacts of the three shortlisted schemes in detail. The shortlisted schemes are based at Gatwick and Heathrow airports, and to inform the assessment, noise exposure contours metrics have been calculated for these airports. This report considers the contours and noise metrics calculated for the current situation, 2030 DM, 2040 DM and 2050 DM scenarios, and the differences between them which indicate how noise exposure will develop in the absence of a runway scheme.

The noise metrics calculated for each scenario are based on the requirements of appraisal module 5: 'Noise' and comprise:

- $L_{Aeq,16h}$ noise contours from 54 dB to 72 dB, in 3 dB intervals;
- $L_{Aeq,8h}$ noise contours from 48 dB to 72 dB, in 3 dB intervals;
- L_{den} (Day-Evening-Night level) noise contours from 55 dB to 75 dB, in 5 dB intervals;
- N70 (16-hour average day) contours (>20 to >500); and
- N60 (8-hour average night) contours (>25 to >500).

2.2 Local Noise contours

For the Local Noise Assessment, noise contours were calculated by the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) on behalf of the Airports Commission. These noise contours were calculated using the UK civil aircraft noise model ANCON (version 2.3) which is developed and maintained by ERCD on behalf of the Department for Transport (DfT).

ANCON is fully compliant with the latest European guidance on noise modelling, ECAC.CEAC Doc 29 (3rd edition), published in December 2005.

Noise predictions and the subsequent estimations of population noise exposure are sensitive to the following input data:

- The assumed number of Air Transport Movements[5] (ATM) and associated aircraft fleet mix;
- Arrival and departure flight paths, threshold displacements[6], approach path angles, take-off power and climb rates;

[5] Also referred to as Air Traffic Movements

- The allocation of ATMs to runways and flight tracks;
- Runway modal split[7] assumptions; and,
- The population data used to calculate numbers of persons and households exposed to the various noise metrics.

The noise contours and population exposure for the current scenarios are based on radar track data of aircraft movements over the 92-day summer period at each airport. For each type of aircraft within ANCON, average flight profiles of height, speed and thrust were reviewed, and if necessary adjusted to match the radar data.

For the DM scenarios, ERCD has calculated the noise contours and population exposure based on Airport Commission Demand Forecast 2014 (Passenger forecast and ATM numbers) and conservative fleet mix assumptions for each airport, which are presented in Appendix A.1 (d).

The ATM forecasts assume that the current Quota Count systems for managing noise between 23.30 and 06.00 will not change, although there are some increases to the number of aircraft movements in the periods 23.00-23.30 and 06.00-07.00, which count towards the night-time noise metrics, in some scenarios.

2.3 National Noise

The national noise assessment considers the UK situation, and so it extends to a number of major airports including those whose development has been shortlisted. This is to give context to the noise exposure at the shortlisted airports and also to reflect the national implications should one of the shortlisted options proceed.

Ideally the national noise assessment would include all UK airports, but this is impractical. Therefore noise predictions have been limited to the UK's twelve largest airports, plus one airport qualifying for other reasons, as this selection is considered to give a good indication of the national impact.

For this appraisal the airports assessed are those with at least 50,000 air transport movements in 2011, and which were required to carry out noise mapping under the Environmental Noise Regulations that apply in England or Scotland. In addition, London Southend has been included as it has developed significantly since 2011 and, given its location, may be significantly affected by the shortlisted options. The list of airports included in the national noise study is:

- Aberdeen
- Birmingham
- Bristol
- East Midlands
- Edinburgh
- Gatwick
- Glasgow
- Heathrow

[6] The threshold is the part of the runway where an aircraft lands / takes off. Displacement moves this further along the runway inside the airport boundary, with the result that approaches and take-offs are at a greater height above neighbouring communities.
[7] Runway modal split refers to the proportion of use for landing or take off, or both.

- London City
- Luton
- Manchester
- Southend
- Stansted

The baseline noise predictions for these airports takes into account changes indicated in their respective master plans, the latest forecasts of future traffic, assessed noise characteristics of future aircraft, and the anticipated effects of population growth.

The noise metrics calculated for each scenario less extensive than for the Local Noise Assessment and comprise:

- $L_{Aeq,16h}$ noise contours from 54 dB to 72 dB, in 3 dB intervals;
- $L_{Aeq,8h}$ noise contours from 48 dB to 72 dB, in 3 dB intervals; and,
- L_{den} (Day-Evening-Night level) noise contours from 55 dB to 75 dB, in 5 dB intervals.

2.4 National Noise contours

The noise predictions undertaken for the short-listed options at Heathrow and Gatwick airports were prepared by ERCD using the Civil Aviation Authority's ANCON model.

The airborne aircraft noise predictions for the other airports considered by the national noise assessment were calculated by Bickerdike Allen Partners (BAP) using the publically available Federal Aviation Authority Integrated Noise Model (INM) Version 7.0d. This section provides a summary of the main inputs and parameters to the noise modelling undertaken by BAP, and further details are provided in the National Noise Assessment report.

INM is the most widely used model in the world for airborne aircraft noise prediction, and its core computation modules are compliant with international standards and documents including European Civil Aviation Conference (ECAC) Document 29 and International Civil Aviation Organization (ICAO) Circular 205. INM will not, however, produce identical results to the ANCON model used for the local noise assessments, although reasonable agreement between the models can generally be expected.

2.5 Limitations and Assumptions

This report is based on:

- Noise modelling undertaken by ERCD and BAP,

which itself was based on:

- 2014 demand forecasts provided by Airport Commission; and
- Detailed aircraft movement (schedule) data provided by LeighFisher

ANCON and INM both estimate long-term average impacts using average input conditions. Some differences between predictions and measured values is to be expected as daily aircraft movements, aircraft load factors, weather conditions and other variables vary on a daily basis. Differences between predicted and actual noise levels will also occur because some complex noise propagation phenomena (e.g. noise refraction due to temporary temperature inversions) are not explicitly modelled by either ANCON or INM.

Population data has been provided by CACI Ltd, comprising a 2013 postcode database which is an update of the latest 2011 Census, and forecasts for 2030, 2040 and 2050. Each postcode in the database is described by a single geographical point, and if this point is within a contour then all of the population assigned to the postcode are counted.

Due to the nature of the postcode database, similar contours may have different population counts when the geographical point representing a postcode lies just inside one contour and just outside another. When the population inside a contour is small, this can lead to large percentage changes in assessed population despite the change in contour area and/or shape being small.

These population forecasts include growth at locations in close proximity to the shortlisted airports. However, in practice it is unlikely that the planning authority will permit any new dwellings in locations already subject to aircraft noise levels at or above the Significant Observed Adverse Effect Level[8] (SOAEL) for environmental noise adopted by the local planning authorities.

Given the wider limitations of ATM forecasts, projected fleet mixes and schedules, there is a risk that the results are accorded a level of accuracy and precision that is inappropriate for the level of assessment undertaken.

In the context of such limitations, difficulties with identifying changes in noise levels at specific locations are not considered to be significant, but are noted as follows:

- A restriction to assessing specific noise impacts to specific buildings, was that the extent of the OS MasterMap® Address Layer 2 data provided to Jacobs, which provides building classifications, does not cover the full Study Areas for the shortlisted schemes, so some receptor locations may not be identified.
- Results of the noise modelling undertaken by ERCD are provided as contours rather than a rectilinear grid of calculation points.

These difficulties preclude a detailed consideration of the change in noise levels at individual amenity buildings within the study area.

[8] The National Planning Policy Framework (NPPF) states that planning policies and decisions should aim to avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development. The Noise Policy Statement for England 2010 (NPSE) expands on the term 'significant adverse impact' and defines the Significant Observed Adverse Effect Level (SOAEL) as the level above which significant adverse effects on health and quality of life occur.

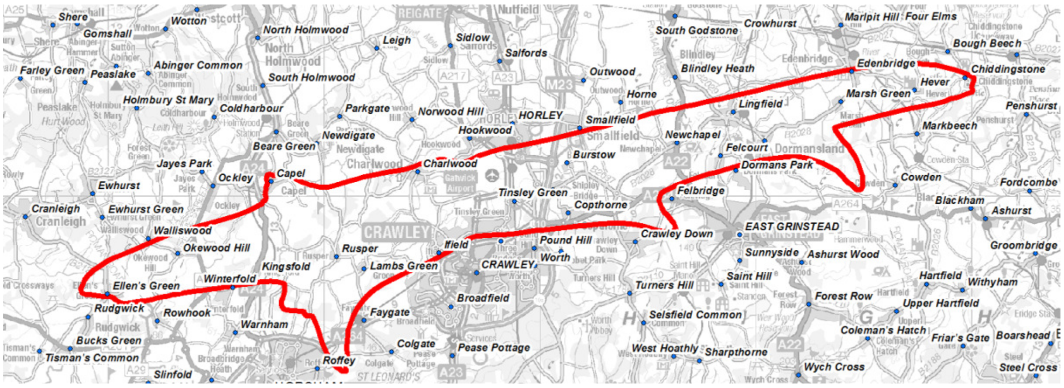
3 Gatwick Second Runway

This section establishes the Local Noise Assessment study area for the Gatwick Second Runway option, identifies settlements which may be affected by noise, and examines the distribution of population within and around the study area.

3.1 Study Area

The noise study area for Gatwick Airport is derived from the total area covered by the DM and Do-Something noise contours that have been calculated by ERCD on behalf of the Airports Commission, and is shown in Figure 3.1 below.

Figure 3.1 : Gatwick Airport Noise Study Area



In addition to the northern extent of Crawley, the noise study area for Gatwick includes the settlements of:

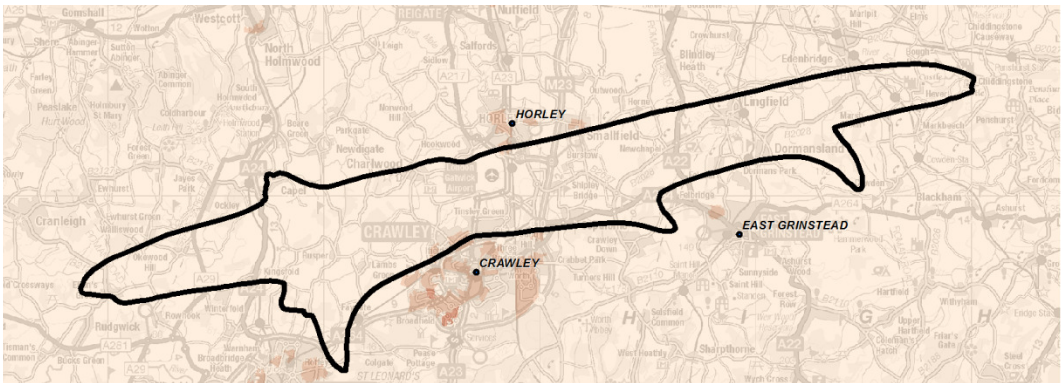
- Burstow, Surrey
- Capel, Surrey
- Charlwood, Surrey
- Chiddingstone, Kent
- Copthorne, West Sussex
- Dormans Park, Surrey
- Dormansland, Surrey
- Edenbridge, Kent
- Ellen's Green, Surrey
- Faygate, West Sussex
- Felbridge, Surrey
- Felcourt, Surrey
- Hever, Kent
- Ifield, West Sussex
- Kingsfold, West Sussex
- Lambs Green, West Sussex
- Lingfield, Surrey
- Marsh Green, Kent
- Newchapel, Surrey
- Okewood Hill, Surrey

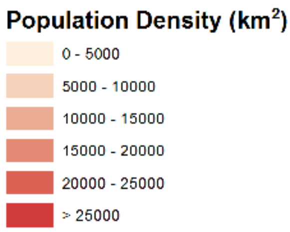
- Rusper, West Sussex
- Shipley Bridge, Surrey
- Smallfield, Surrey
- Three Bridges, West Sussex
- Tinsley Green, West Sussex
- Walliswood, Surrey
- Winterfold, West Sussex

3.2 Population

To visualise the population distribution around Gatwick Airport, the forecast 2030 populations associated with the postcode points falling within each Lower Layer Super Output Area[9] (LSOA) have been summated and then divided by the area of the LSOA to give an approximate population density for the LSOA.

Figure 3.2 : Gatwick Second Runway Study Area Forecast Population Densities (2030)





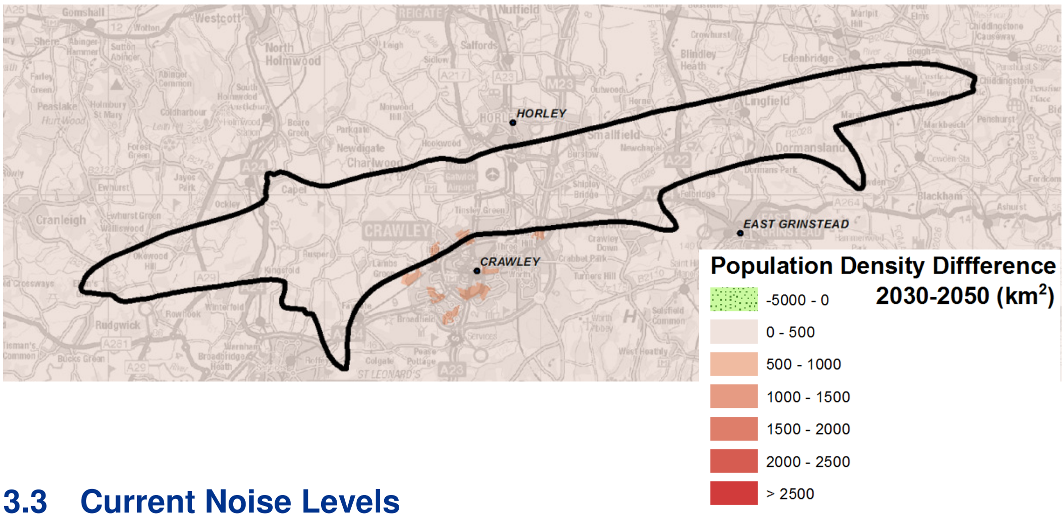
It can be seen from Figure **3.2** that the population density for the majority of the study area around Gatwick is less than 5,000 people/km^2.

The exceptions to this are areas at Horley, Crawley, East Grinstead and Horsham, where greater population densities are observed.

Figure **3.3** below shows the predicted change in population density over the period from 2030 to 2050. It can be seen that most areas will be subject to a population growth in the range 0-500 people/km^2 during this period, although there is greater increases predicted for parts of Crawley, including some which fall within the study area for Gatwick Airport. A comparison with Figure **3.2** shows that the areas subject to the greatest forecast population growth are those which already have the highest population density in the area. The population exposure metrics for 2050 can therefore be expected to be particularly sensitive to any changes in contour areas towards the southern extent of the study area.

[9] Lower Layer Super Output Areas are contiguous geographic areas designed to improve the reporting of small area statistics in England and Wales. The mean population in each LSOA is 1,500.

Figure 3.3 : 2030 vs 2050 Difference in Population Densities around Gatwick Airport



3.3 Current Noise Levels

The current aviation noise levels due to Gatwick Airport are presented Table **3.1** below, using the range of metrics advocated by the 'scorecard' approach of the noise appraisal module.

Table 3.1 : Current aviation noise levels for Gatwick Airport (2011/2013)

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	9,700			N70 >20	6,300
	>57 dB $L_{Aeq,16h}$	3,550			N70 >50	2,500
	>60 dB $L_{Aeq,16h}$	1,200			N70 >100	1,400
	>63 dB $L_{Aeq,16h}$	350			N70 >200	900
	>66 dB $L_{Aeq,16h}$	150			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	0				
	>72 dB $L_{Aeq,16h}$	0				
Night	>48 dB $L_{Aeq,8h}$	11,200			N60 >25	11,600
	>51 dB $L_{Aeq,8h}$	5,050			N60 >50	4,900
	>54 dB $L_{Aeq,8h}$	1,550			N60 >100	<50
	>57 dB $L_{Aeq,8h}$	450			N60 >200	0
	>60 dB $L_{Aeq,8h}$	150			N60 >500	0
	>63 dB $L_{Aeq,8h}$	50				
	>66 dB $L_{Aeq,8h}$	0				
	>69 dB $L_{Aeq,8h}$	0				
	>72 dB $L_{Aeq,8h}$	0				
24-hour			>55 dB L_{den}	11,300	N60 + N70 >25	-
			>60 dB L_{den}	2,000	N60 + N70 >50	7,400
			>65 dB L_{den}	500	N60 + N70 >100	<1,450
			>70 dB L_{den}	<100	N60 + N70 >200	900
			>75 dB L_{den}	0	N60 + N70 >500	<50

3.4 Noise Sensitive Buildings

Table **3.2** below sets out the numbers of noise sensitive buildings within each noise contour in the current situation.

Table 3.2 : Numbers of Noise Sensitive Buildings within Current Situation Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	15	0	11	N70 >20	9	0	6
	>57 dB $L_{Aeq,16h}$	3	0	2	N70 >50	3	0	2
	>60 dB $L_{Aeq,16h}$	2	0	2	N70 >100	2	0	2
	>63 dB $L_{Aeq,16h}$	2	0	2	N70 >200	2	0	2
	>66 dB $L_{Aeq,16h}$	1	0	2	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	15	1	11	N60 >25	15	1	13
	>51 dB $L_{Aeq,8h}$	8	0	5	N60 >50	8	0	5
	>54 dB $L_{Aeq,8h}$	2	0	2	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	2	0	2	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	2	0	1	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	1				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	13	0	10				
	>60 dB L_{den}	3	0	2				
	>65 dB L_{den}	2	0	2				
	>70 dB L_{den}	0	0	1				
	>75 dB L_{den}	0	0	0				

3.5 Current vs 2030 Do-Minimum

This section considers the predicted changes in noise exposure between the current and 2030 DM situations in the absence of a runway development scheme at Gatwick Airport.

Over the period from 2013 to 2030, an increase of 27,399 ATMs are predicted for Gatwick Airport (from 250,520 to 277,919), and the fleet mix is expected to change from over 100% current generation aircraft to:

- 29% Current
- 70% Imminent
- <1% Future

Table **3.3** below sets out the scorecard noise metrics for the 2030 DM situation predicted by ERCD on behalf of the Airports Commission. A commentary on how each of these metrics differs from the current situation is provided in the sections below.

Table 3.3 : DM aviation noise levels for Gatwick Airport (2030)

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	8,000			N70 >20	2,100
	>57 dB $L_{Aeq,16h}$	2,200			N70 >50	1,800
	>60 dB $L_{Aeq,16h}$	1,100			N70 >100	1,400
	>63 dB $L_{Aeq,16h}$	400			N70 >200	800
	>66 dB $L_{Aeq,16h}$	300			N70 >500	200
	>69 dB $L_{Aeq,16h}$	200				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	11,700			N60 >25	11,800
	>51 dB $L_{Aeq,8h}$	5,600			N60 >50	7,200
	>54 dB $L_{Aeq,8h}$	1,700			N60 >100	200
	>57 dB $L_{Aeq,8h}$	600			N60 >200	
	>60 dB $L_{Aeq,8h}$	400			N60 >500	
	>63 dB $L_{Aeq,8h}$	300				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	9,400		
			>60 dB L_{den}	1,900		
			>65 dB L_{den}	400		
			>70 dB L_{den}	200		
			>75 dB L_{den}	<50		

3.5.1 Day Metrics

(a) $L_{Aeq,16h}$ Noise Exposure Metric

This section considers the potential changes from the current to the 2030 DM scenarios, in terms of the $L_{Aeq,16h}$ noise exposure metric calculated for an average summer's day.

Figure 3.4 : 2013 Current Gatwick Airport $L_{Aeq,16h}$ Contours

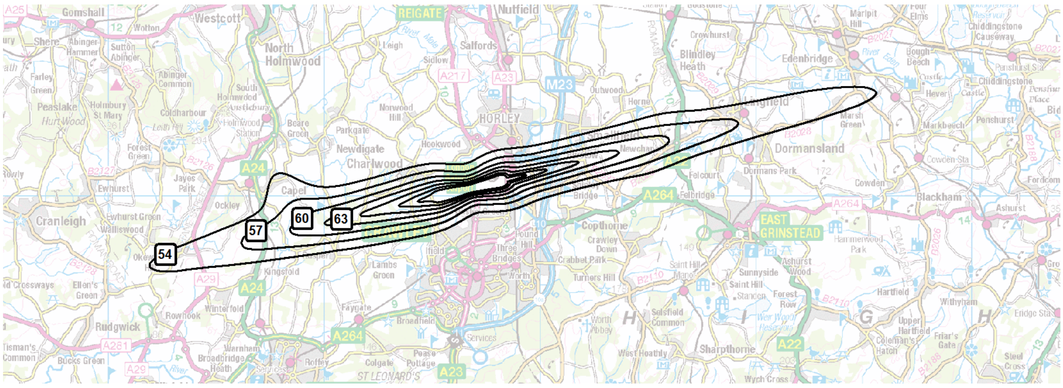
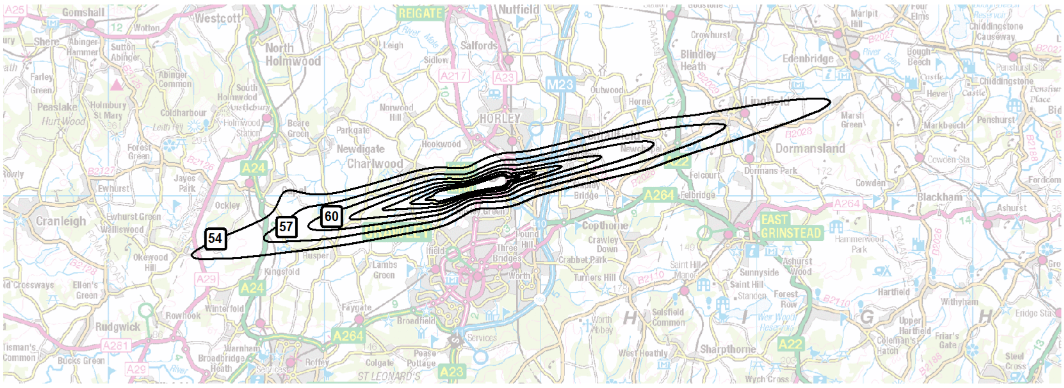


Figure 3.5 : 2030 DM Gatwick Airport $L_{Aeq,16h}$ Contours



It can be seen from Figure 3.4 and Figure 3.5 above that the 54 and 57 dB contours are smaller in the 2030 DM scenario than in the current situation. This is due to the anticipated improvements in aircraft technology between the current day and 2030 which are expected to reduce the noise emissions of aircraft. This technological improvement offsets population growth and the increase in aircraft movements expected over this period, and the net result is a decrease in the number of people exposed to noise levels of 57 dB $L_{Aeq,16hs}$ or more.

The expected changes in population within each contour are set out below. The greatest changes are within the lower contour bands, with the upper contour bands showing smaller increases. Although increases in the population are forecast in the upper contour bands, the actual area covered by these contours reduces; the increases in population exposure are therefore due to assumed population growth.

- >54 dB a reduction of 1,700 (from 9,700 to 8,000)
- >57 dB a reduction of 1,350 (from 3,550 to 2,200)
- >60 dB a reduction of 100 (from 1,200 to 1,100)
- >63 dB an increase of 50 (from 350 to 400)
- >66 dB an increase of 150 (from 150 to 300)
- >69 dB an increase of 200 (from 0 to 200)
- >72 dB an increase of less than 50 (from 0 to <50)

It is noted that while the population forecasts supplied by CACI show population growth within the areas covered by the higher contours, it is considered unlikely that any new noise sensitive dwellings will be consented in areas which are already subject to noise levels above the local planning authorities adopted SOAEL.

(b) N70 Supplementary Metric

This section considers the potential changes in terms of the N70 metric, between the calculated current and 2030 DM scenarios at Gatwick Airport.

Figure 3.6 : 2013 Current Gatwick Airport N70 Contours

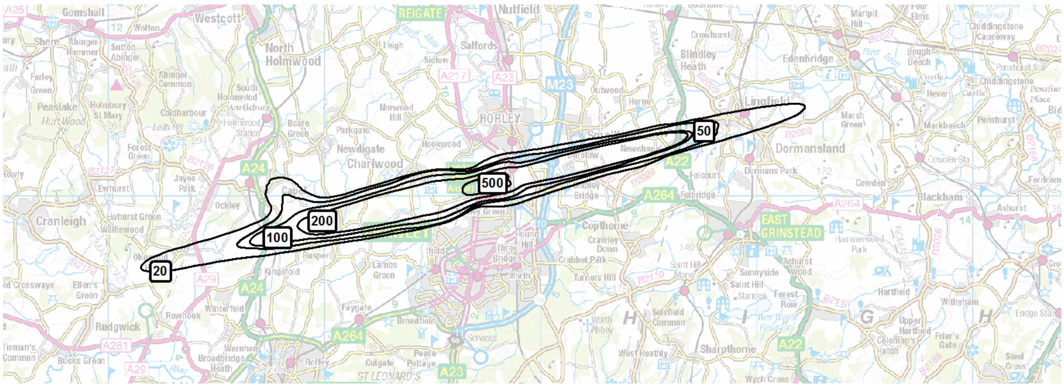
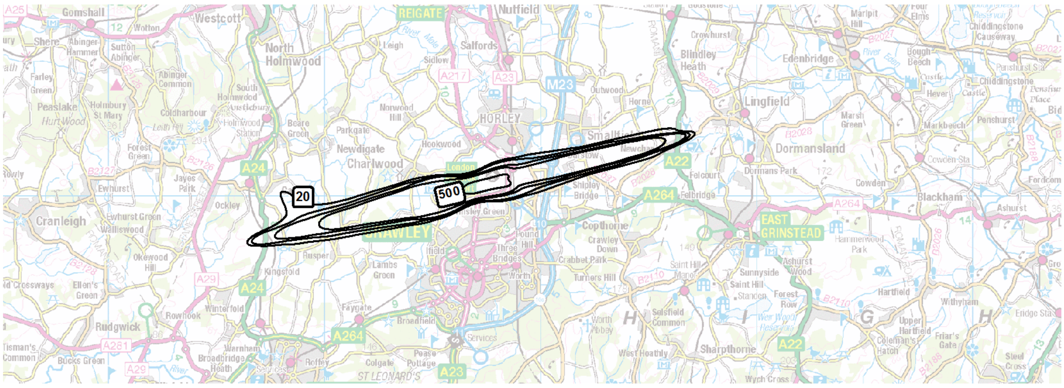


Figure 3.7 : 2030 DM Gatwick Airport N70 Contours



Comparing Figure 3.6 and Figure 3.7, significant differences in the extent of the N70 contours are evident, with the N70 >20 contour calculated for the 2030 DM situation being smaller than its equivalent in the current situation. This is because the 'number above' metrics are particularly sensitive to the $L_{AS,max}$ noise levels associated with aircraft, and the reduction in the areas covered by these contours reflects the anticipated improvements in aircraft technology between the current day and 2030. The expected change in population exposure for each contour is given below:

- >20 a reduction of 4,200 (from 6,300 to 2,100)
- >50 a reduction of 700 (from 2,500 to 1,800)
- >100 no change (from 1,400 to 1,400)
- >200 a reduction of 100 (from 900 to 800)
- >500 an increase of less than 200 (from <50 to 200)

The population within the N70 >500 contour band is forecast to increase. This is a result of forecast population growth, since the area covered by this contour is predicted to reduce in the 2030 DM situation compared to the current scenario.

However, as can be seen from Figure 3.8 below, the N70 >500 contour falls almost entirely within the confines of the airport and the Gatwick Gate Industrial Estate; it is not predicted to extend south of the A23. It is therefore unlikely that any dwellings will be consented within this contour.

Figure 3.8 : 2030 DM Gatwick Airport N70 >500 Contour

World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

3.5.2 Night Metrics

(a) $L_{Aeq,8h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night, between the calculated current and 2030 DM scenarios at Gatwick Airport.

Figure 3.9 : 2013 current Gatwick Airport $L_{Aeq,8h}$ Contours

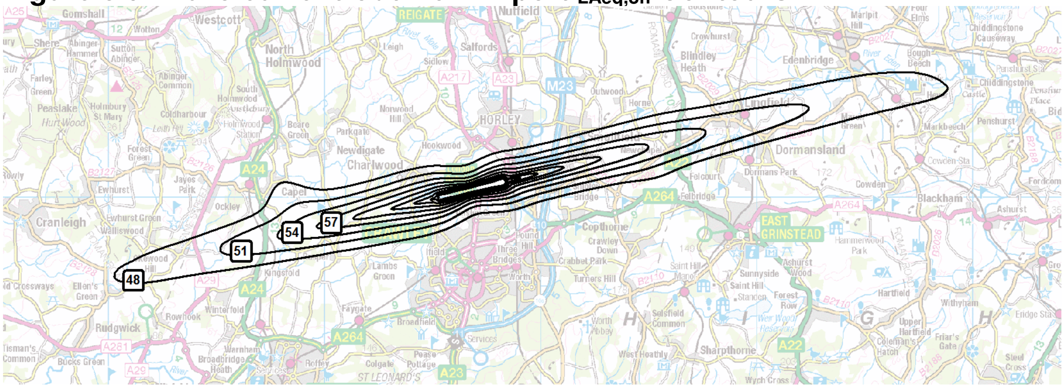
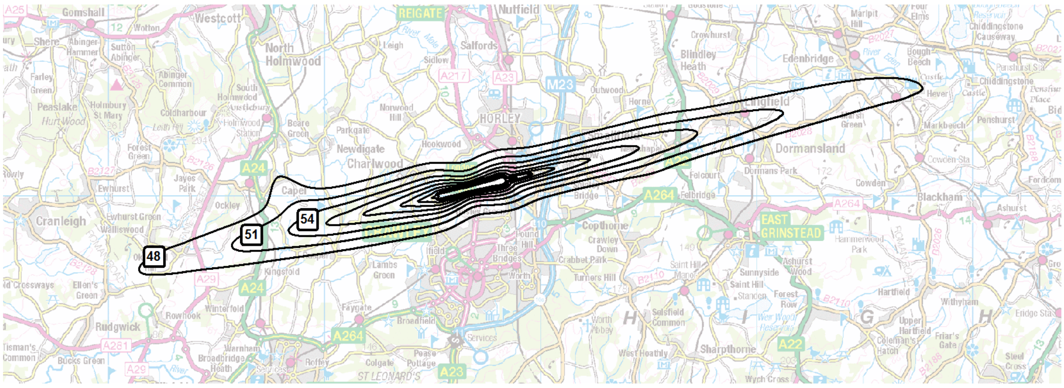


Figure 3.10 : 2030 DM Gatwick Airport $L_{Aeq,8h}$ Contours



The $L_{Aeq,8h}$ >48, >51, >54, >57, >60 and >63 dB contours are smaller in the 2030 DM scenario than in the current situation. The areas covered by the $L_{Aeq,8h}$ >66, >69 and >72 contours remain constant. Despite the contours predicted for 2030 being either smaller or the same as for the current situation, the following increases in population exposure are expected, due to population growth between the two assessment years:

- >48 dB an increase of 500 (from 11,200 to 11,700)
- >51 dB an increase of 550 (from 5,050 to 5,600)
- >54 dB an increase of 150 (from 1,550 to 1,700)
- >57 dB an increase of 150 (from 450 to 600)
- >60 dB an increase of 250 (from 150 to 400)
- >63 dB an increase of 250 (from 50 to 300)
- >66 dB an increase of <50 (from 0 to <50)
- >69 dB an increase of <50 (from 0 to <50)
- >72 dB an increase of <50 (from 0 to <50)

As noted for the daytime $L_{Aeq,16h}$ metric, while the population forecasts supplied by CACI show population growth within the areas covered by the higher contours, it is considered unlikely that any new noise sensitive dwellings will be consented in areas which are already subject to noise levels above the local planning authorities adopted SOAEL.

The reduction in the night $L_{Aeq,8h}$ contours of approximately 10% between the current situation and the 2030 DM scenario is less pronounced than the reduction of approximately 30% for the daytime $L_{Aeq,16h}$ contours. This is a result of a proportionally larger increase in ATMs during the night shoulder period (23.00-23.30 and 06.00-07.00) compared with daytime ATMs. No changes to the current night Quota Count system are assumed. For the daytime $L_{Aeq,16h}$ metric the increases in population growth are completely offset by this reduction, leading to a decrease in population exposed. However for the night $L_{Aeq,8h}$ metric the increases in population are not completely offset by the reduction leading to a net increase in population exposed.

(b) N60 Supplementary Metric

This section considers the potential changes in terms of the N60 metric, between the calculated current and 2030 DM scenarios at Gatwick Airport.

Figure 3.11 : 2013 Current Gatwick Airport N60 Contours

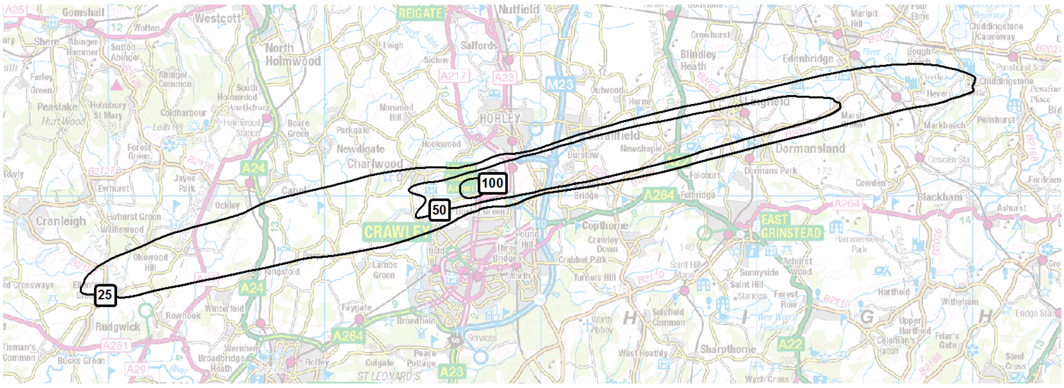
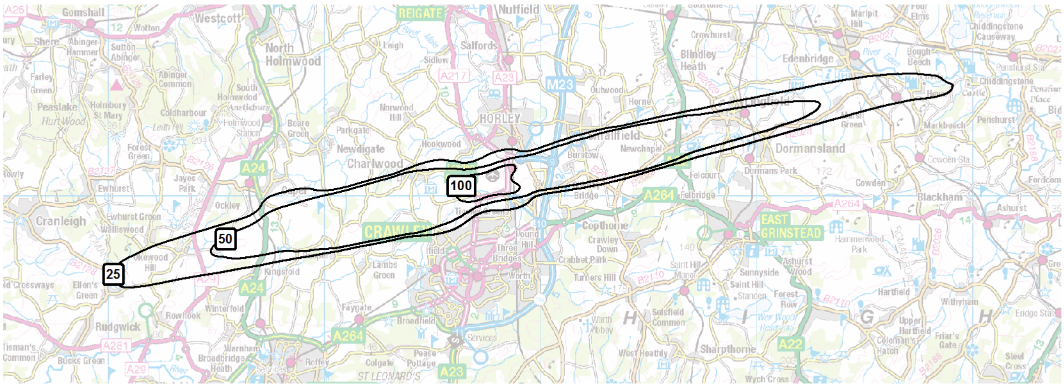


Figure 3.12 : 2030 DM Gatwick Airport N60 Contours



The N60 >25 contour for the 2030 DM situation is predicted to be 15.7 km^2 smaller than the equivalent contour in the current scenario. However, the population within this contour increases by 200 in the 2030 DM situation. This is partly due to population growth, and partly because the 2030 contour is slightly wider (in the north-south axis) than the current contour as a result of a forecast 11% increase in aircraft movements, and includes more of the north-west fringe of Crawley.

The N60 >50 contour for the 2030 DM situation shows an increase in both the area covered (21.6 km^2) and the population included (2,300) when compared to the current situation. The N60 >50 contour to the west of the airport is primarily due to westerly take-offs at night, which are forecast to increase significantly by 2030. The N60 >25 and N60 >50 contours to the east of the airport are primarily caused by arrivals, and show reductions in area due to the quieter fleet mix assumed for 2030.

The changes in population within the 2030 DM contours in comparison to the current contours are:

- >25 an increase of 200 (from 11,600 to 11,800)
- >50 an increase of 2,300 (from 4,900 to 7,200)
- >100 an increase of less than 200 (from <50 to 200)

3.5.3 L_{den}

This section considers the potential changes in terms of the L_{den} noise exposure metric, calculated for an average summer's night, between the calculated current and 2030 DM scenarios at Gatwick Airport.

Figure 3.13 : 2011 Current Gatwick Airport L_{den} Contours

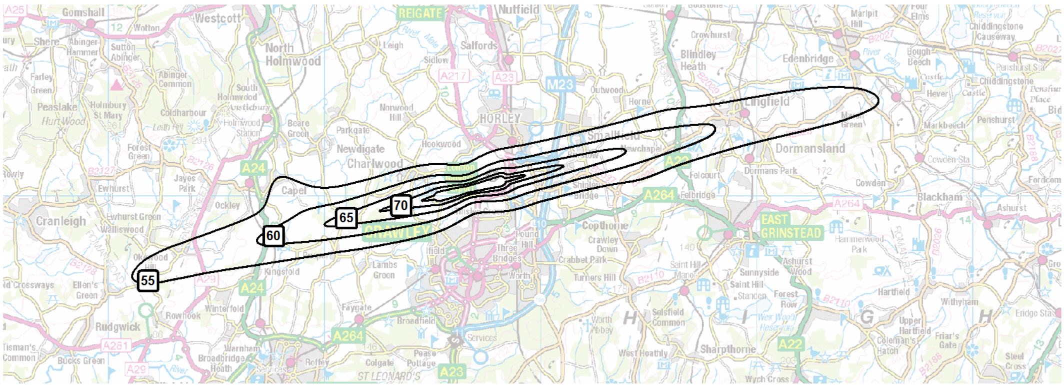
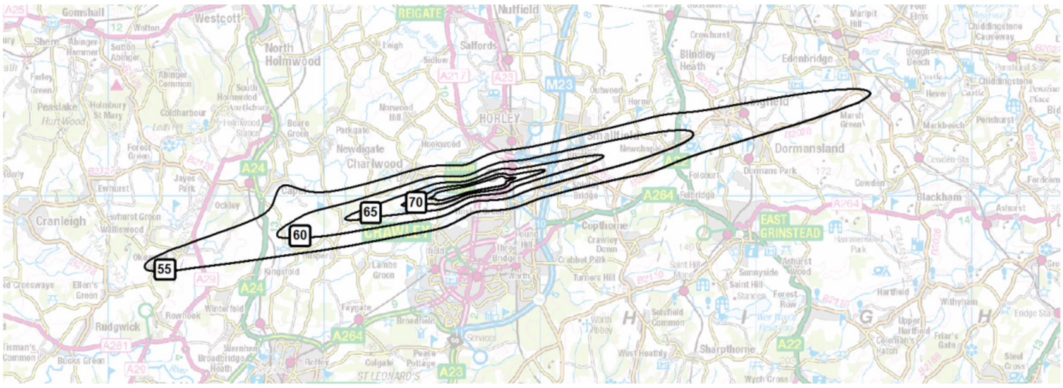


Figure 3.14 : 2030 DM Gatwick Airport L_{den} Contours



In all cases, the 2030 DM L_{den} contours cover smaller areas than the equivalent current contours. As can be seen from the list below, these reductions in area are generally associated with corresponding reductions in the population exposed. However, there are potentially small increases associated with the >70 dB and >75 dB contours as a result of population growth:

- >55 dB a reduction of 1,900 (from 11,300 to 9,400)
- >60 dB a reduction of 100 (from 2,000 to 1,900)
- >65 dB a reduction of 100 (from 500 to 400)
- >70 dB an increase from <100 to 200
- >75 dB an possible increase from 0 to <50

As noted for other metrics, while the population forecasts supplied by CACI show population growth within the areas covered by the higher contours, it is considered unlikely that any new noise sensitive dwellings will be consented in areas which are already subject to noise levels above the local planning authorities adopted SOAEL.

3.5.4 Noise Sensitive Buildings

Table **3.4** below sets out the numbers of noise sensitive buildings within each noise contour in the 2030 DM situation.

Table 3.4 : Numbers of Noise Sensitive Buildings within 2030 DM Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	9	0	8	N70 >20	3	0	2
	>57 dB $L_{Aeq,16h}$	3	0	2	N70 >50	3	0	2
	>60 dB $L_{Aeq,16h}$	2	0	2	N70 >100	2	0	2
	>63 dB $L_{Aeq,16h}$	2	0	2	N70 >200	2	0	2
	>66 dB $L_{Aeq,16h}$	0	0	1	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	0		0	0	0
Night	>48 dB $L_{Aeq,8h}$	12	0	10	N60 >25	14	1	11
	>51 dB $L_{Aeq,8h}$	7	0	5	N60 >50	8	0	6
	>54 dB $L_{Aeq,8h}$	2	0	2	N60 >100	1	0	1
	>57 dB $L_{Aeq,8h}$	2	0	2	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	2	0	2	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	1				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	12	0	10				
	>60 dB L_{den}	3	0	2				
	>65 dB L_{den}	2	0	2				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

Table **3.5** below shows the difference in the number of noise sensitive buildings within each noise contour for the 2030 DM scenario compared with the current scenario.

Table 3.5 : Difference in Number of Noise Sensitive Buildings in 2030 DM Situation

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(6)	0	(3)	N70 >20	(6)	0	(4)
	>57 dB $L_{Aeq,16h}$	0	0	0	N70 >50	0	0	0
	>60 dB $L_{Aeq,16h}$	0	0	0	N70 >100	0	0	0
	>63 dB $L_{Aeq,16h}$	0	0	0	N70 >200	0	0	0
	>66 dB $L_{Aeq,16h}$	(1)	0	(1)	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	0		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(3)	(1)	(1)	N60 >25	(1)	0	(2)
	>51 dB $L_{Aeq,8h}$	(1)	0	0	N60 >50	0	0	1
	>54 dB $L_{Aeq,8h}$	0	0	0	N60 >100	1	0	1
	>57 dB $L_{Aeq,8h}$	0	0	0	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	0	0	1	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	0				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	(1)	0	0				
	>60 dB L_{den}	0	0	0				
	>65 dB L_{den}	0	0	0				
	>70 dB L_{den}	0	0	(1)				
	>75 dB L_{den}	0	0	0				

3.5.5 Ground Noise

The results of the current and 2030 DM ground noise predictions for Gatwick Airport are given in Table **3.6**. This shows the area predicted to be exposed to 57 dB $L_{Aeq,16h}$ and above, and the resulting population contained within an equivalent area centred on the airport, shaped to account for the location of the runways and aprons.

Table 3.6 : Ground Noise Exposure at Gatwick Airport

	current (2013)	2030 DM
Exposed Area, km^2 (57 dB $L_{Aeq,16h}$)	11.0	14.9
Population within Exposed Area[(1)]	900	3,150

Compared to the current situation an increase in the amount of ground noise is forecast in 2030 irrespective of whether any development takes place. This is due to the forecast increase in aircraft activity outweighing any improvements in the ground noise performance of the aircraft fleet.

3.6 2030 Do-Minimum vs 2040 Do-Minimum

This section considers the predicted changes in noise exposure between 2030 and 2040 DM scenarios that would ensue in the absence of a runway development scheme at Gatwick Airport.

Over the period from 2030 to 2040, an increase of 2,714 ATMs are predicted for Gatwick Airport (from 277,919 to 280,633), and the fleet mix is expected to change as follows:

- Current: from 29% to 11%
- Imminent: from 70% to 83%
- Future: from <1% to 6%

Table **3.7** below sets out the scorecard noise metrics for the 2040 DM situation predicted by ERCD on behalf of the Airports Commission. A commentary on how each of these metrics differs from the 2030 DM situation is provided in the sections below.

Table 3.7 : DM Aviation Noise Levels for Gatwick Airport (2040)

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	7,400			N70 >20	2,200
	>57 dB $L_{Aeq,16h}$	2,200			N70 >50	1,700
	>60 dB $L_{Aeq,16h}$	900			N70 >100	1,400
	>63 dB $L_{Aeq,16h}$	500			N70 >200	800
	>66 dB $L_{Aeq,16h}$	300			N70 >500	200
	>69 dB $L_{Aeq,16h}$	200				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	11,100			N60 >25	12,200
	>51 dB $L_{Aeq,8h}$	5,500			N60 >50	7,200
	>54 dB $L_{Aeq,8h}$	1,700			N60 >100	200
	>57 dB $L_{Aeq,8h}$	600			N60 >200	0
	>60 dB $L_{Aeq,8h}$	400			N60 >500	0
	>63 dB $L_{Aeq,8h}$	300				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	9,200		
			>60 dB L_{den}	1,700		
			>65 dB L_{den}	400		
			>70 dB L_{den}	200		
			>75 dB L_{den}	<50		

3.6.1 Day Metrics

(a) $L_{Aeq,16h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,16h}$ noise exposure metric, calculated for an average summer's night, between the predicted 2030 DM and 2040 DM scenarios at Gatwick Airport.

Figure 3.15 : 2030 DM Gatwick Airport $L_{Aeq,16h}$ Contours

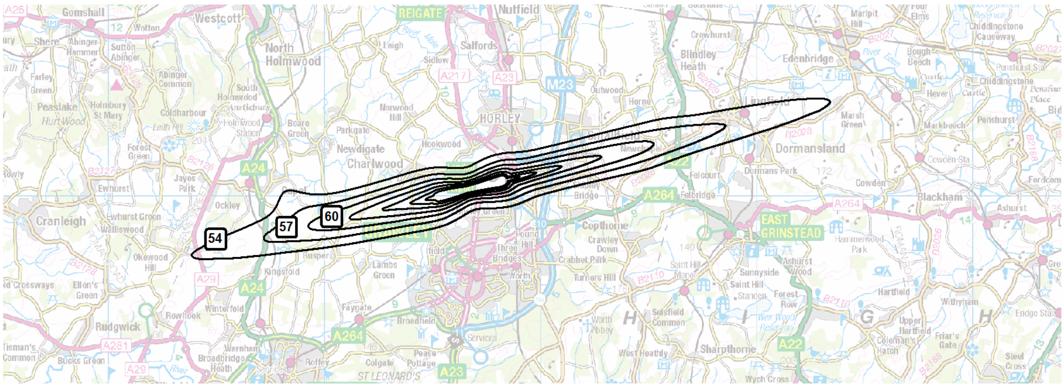
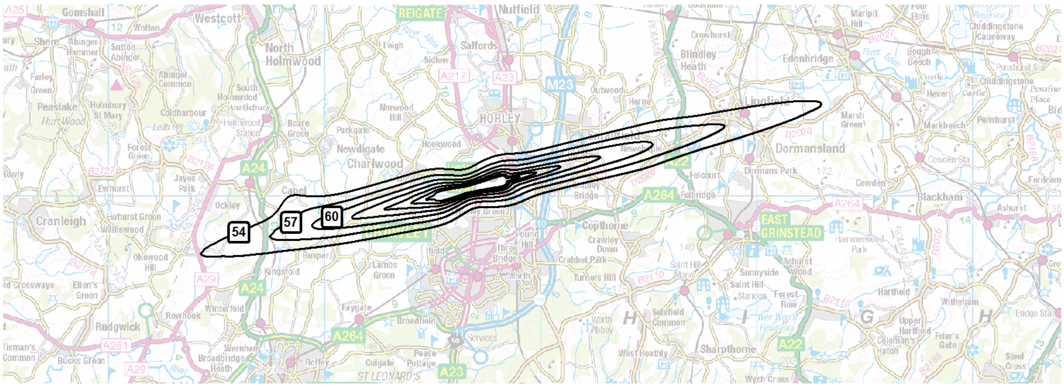


Figure 3.16 : 2040 DM Gatwick Airport $L_{Aeq,16h}$ Contours



The noise contours calculated for the 2040 DM situation are all smaller in area than those calculated for the 2030 DM situation (ranging from a 4.5 km^2 reduction in the >54 dB contour, to a 0.1 km^2 reduction for the >72 dB contour). This is due to a greater proportion of quieter aircraft in the 2040 fleet mix than in the 2030 fleet mix. However, as a result of forecast population growth, the reductions in contour area are not mirrored in the population exposures which are calculated to be:

- >54 dB a reduction of 600 (from 8,000 to 7,400)
- >57 dB no change (from 2,200 to 2,200)
- >60 dB a reduction of 200 (from 1,100 to 900)
- >63 dB an increase of 100 (from 400 to 500)
- >66 dB no change (from 300 to 300)
- >69 dB no change (from 200 to 200)
- >72 dB no discernible change (from <50 to <50)

(b) N70 Supplementary Metric

This section considers the potential changes in terms of the N70 metric, between the predicted 2030 DM and 2040 DM scenarios at Gatwick Airport.

Figure 3.17 : 2030 DM Gatwick Airport N70 Contours

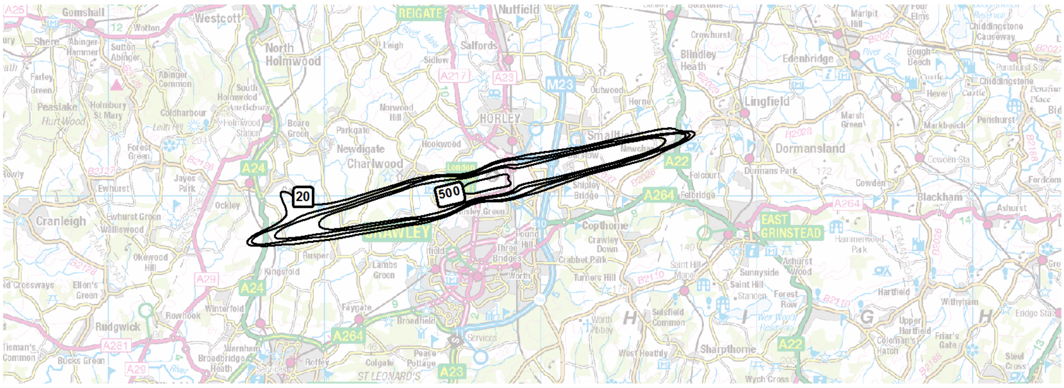
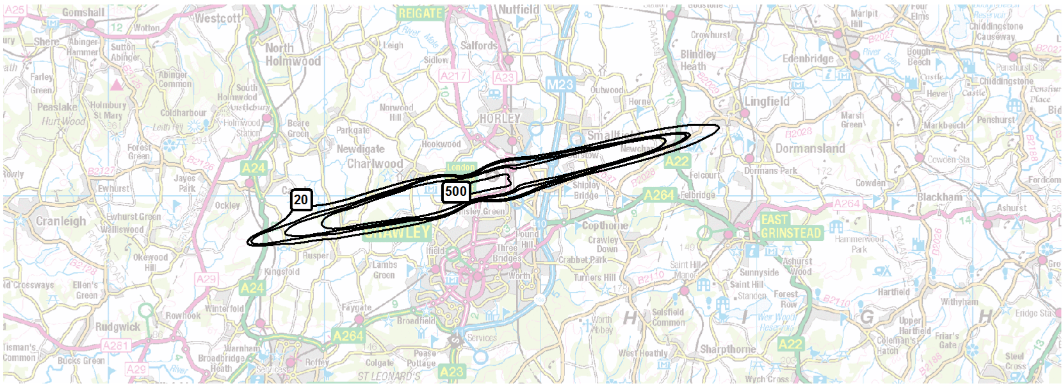


Figure 3.18 : 2040 DM Gatwick Airport N70 Contours



The noise contours calculated for the 2040 DM situation are either smaller than, or in the case of the >500 contour, the same as those calculated for the 2030 DM situation. These reductions in contour areas are only weakly reflected in the associated population within each contour, due to forecast population growth between 2030 and 2040:

- >20 an increase of 100 (from 2,100 to 2,200)
- >50 a reduction of 100 (from 1,800 to 1,700)
- >100 no change (from 1,400 to 1,400)
- >200 no change (from 800 to 800)
- >500 no change (from 200 to 200)

3.6.2 Night Metrics

(a) $L_{Aeq,8h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night, between the predicted 2030 DM and 2040 DM scenarios at Gatwick Airport.

Figure 3.19 : 2030 DM Gatwick Airport $L_{Aeq,8h}$ Contours

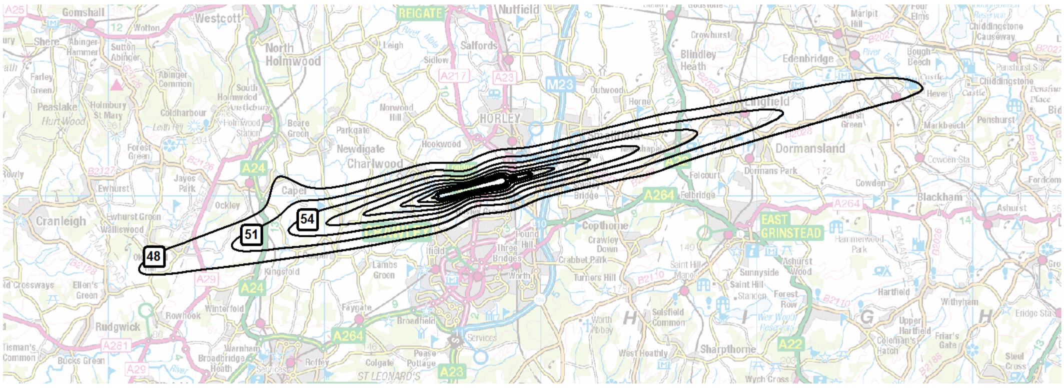
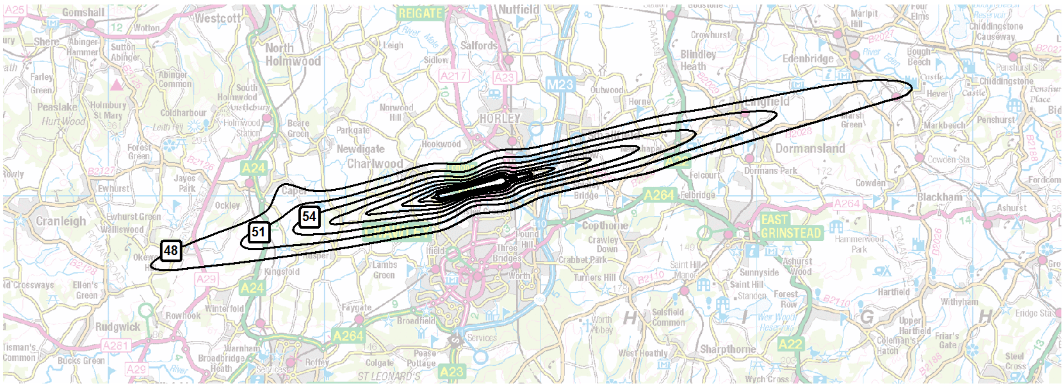


Figure 3.20 : 2040 DM Gatwick Airport $L_{Aeq,8h}$ Contours



The areas covered by the >48, >51, >54, >57, >60 and >63 dB contours show reductions in the 2040 DM scenario compared to the 2030 DM scenario, ranging from 6.7 km^2 for the >48 dB contour to 0.1 km^2 for the >63 dB contour. These reductions are due to improvements in aircraft noise emissions which offset the 1.3% increase in night shoulder period (23.00-23.30 and 06.00-07.00) ATMs forecast between 2030 and 2040. There are no changes to the areas covered by the >66, >69 and >72 dB contours. With the effects of population growth between 2030 and 2040, the changes in population exposure are expected to be:

- >48 dB a reduction of 600 (from 11,700 to 11,100)
- >51 dB a reduction of 100 (from 5,600 to 5,500)
- >54 dB no change (from 1,700 to 1,700)
- >57 dB no change (from 600 to 600)
- >60 dB no change (from 400 to 400)
- >63 dB no change (from 300 to 300)
- >66 dB no discernible change (from <50 to <50)
- >69 dB no discernible change (from <50 to <50)
- >72 dB no discernible change (from <50 to <50)

(b) N60 Supplementary Metric

This section considers the potential changes in terms of the N60 metric, between the predicted 2030 DM and 2040 DM scenarios at Gatwick Airport.

Figure 3.21 : 2030 DM Gatwick Airport N60 Contours

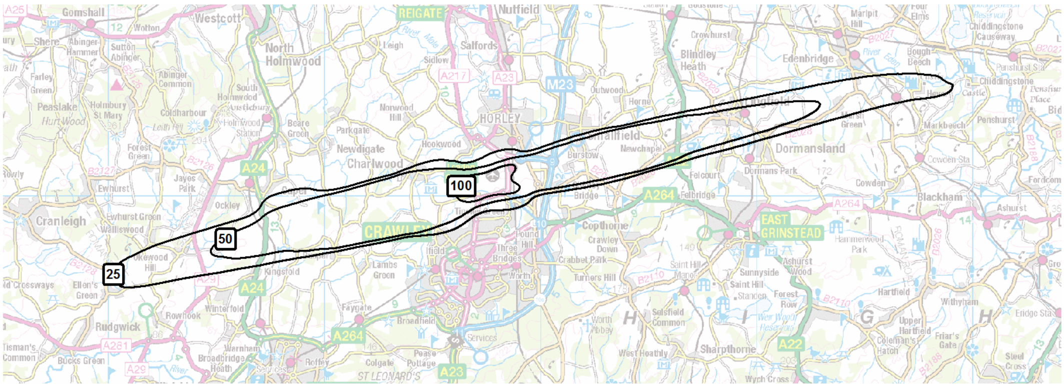
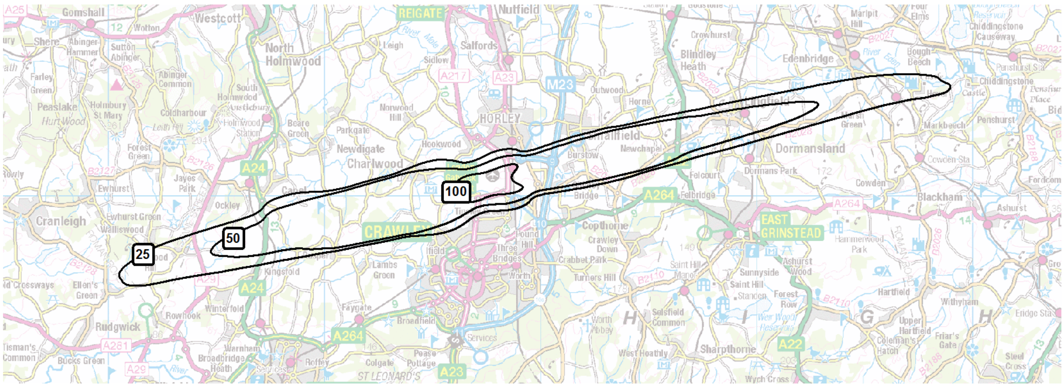


Figure 3.22 : 2040 DM Gatwick Airport N60 Contours



There is little change in the areas covered, or shape of, the N60 contours between the 2030 and 2040 DM scenarios. This is because the increase in night-time ATMs between these two scenarios is small (1.3%) and improvements in aircraft technology are anticipated. Reductions for the >25 (2.2km^2) and >50 (0.8 km^2) contours are predicted in the 2040 DM situation, and an increase (0.2 km^2) is expected for the >100 contour. Although the N60 >25 contour reduces slightly in area in the 2040 DM situation, the population within this contour is expected to rise by 400 as a result of population growth:

- >25 an increase of 400 (from 11,800 to 12,200)
- >50 no change (from 7,200 to 7,200)
- >100 no change (from 200 to 200)

3.6.3 L_{den}

This section considers the potential changes in terms of the L_{den} noise exposure metric, calculated for an average summer's night, between the predicted 2030 DM and 2040 DM scenarios at Gatwick Airport.

Figure 3.23 : 2030 DM Gatwick Airport L_{den} Contours

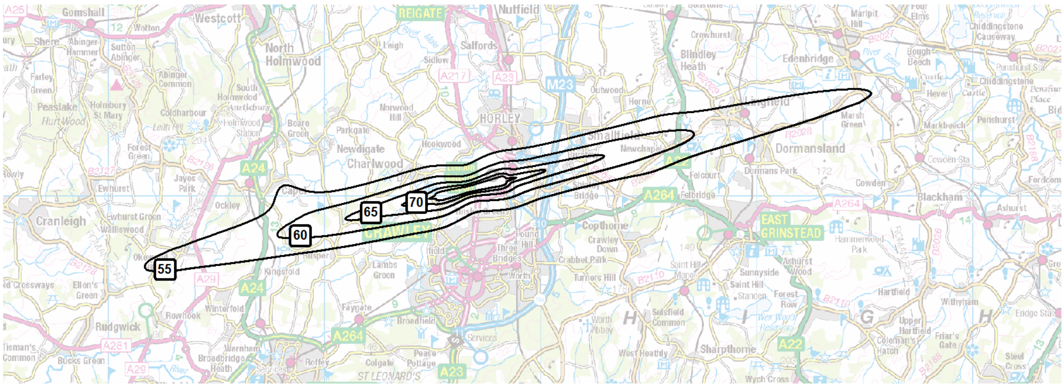
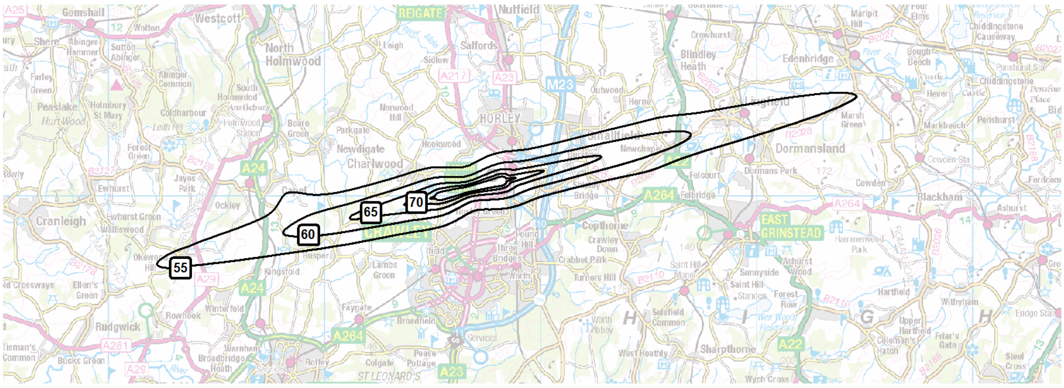


Figure 3.24 : 2040 DM Gatwick Airport L_{den} Contours



There are reductions in the areas covered by the >55, >60, >65 and >70 dB L_{den} contours in the 2040 DM situation compared to the 2030 DM situation, ranging from 6.6 km^2 for the >55 dB contour to 0.2 km^2 for the >75 dB contour. This is because improvements in aircraft technology are anticipated over this period. The area covered by the >75 dB contour remains the same in both scenarios. The reductions in contour areas are due to improvements in aircraft technology. The corresponding changes in population exposure for the 2040 DM scenario are:

- >55 dB a reduction of 200 (from 9,400 to 9,200)
- >60 dB a reduction of 200 (from 1,900 to 1,700)
- >65 dB no change (from 400 to 400)
- >70 dB no change (from 200 to 200)
- >75 dB no discernible change (from <50 to <50)

3.6.4 Noise Sensitive Buildings

Table **3.8** below sets out the numbers of noise sensitive buildings within each noise contour for the 2040 situation.

Table 3.8 : Numbers of Noise Sensitive Buildings within 2040 DM Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	8	0	6	N70 >20	3	0	2
	>57 dB $L_{Aeq,16h}$	3	0	2	N70 >50	3	0	2
	>60 dB $L_{Aeq,16h}$	2	0	2	N70 >100	2	0	2
	>63 dB $L_{Aeq,16h}$	2	0	2	N70 >200	2	0	2
	>66 dB $L_{Aeq,16h}$	0	0	1	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	12	0	10	N60 >25	14	1	11
	>51 dB $L_{Aeq,8h}$	7	0	5	N60 >50	8	0	6
	>54 dB $L_{Aeq,8h}$	2	0	2	N60 >100	1	0	1
	>57 dB $L_{Aeq,8h}$	2	0	2	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	1	0	2	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	1				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	10	0	9				
	>60 dB L_{den}	2	0	2				
	>65 dB L_{den}	2	0	2				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

Table **3.9** below shows the difference in the number of noise sensitive buildings within each noise contour for the 2040 DM scenario compared to the 2030 DM scenario.

Table 3.9 : Difference in Number of Noise Sensitive Buildings in 2040 DM Situation

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $_{LAeq,16h}$	(1)	0	(2)	N70 >20	0	0	0
	>57 dB $_{LAeq,16h}$	0	0	0	N70 >50	0	0	0
	>60 dB $_{LAeq,16h}$	0	0	0	N70 >100	0	0	0
	>63 dB $_{LAeq,16h}$	0	0	0	N70 >200	0	0	0
	>66 dB $_{LAeq,16h}$	0	0	0	N70 >500	0	0	0
	>69 dB $_{LAeq,16h}$	0	0	0				
	>72 dB $_{LAeq,16h}$	0	0	0				
Night	>48 dB $_{LAeq,8h}$	0	0	0	N60 >25	0	0	0
	>51 dB $_{LAeq,8h}$	0	0	0	N60 >50	0	0	0
	>54 dB $_{LAeq,8h}$	0	0	0	N60 >100	0	0	0
	>57 dB $_{LAeq,8h}$	0	0	0	N60 >200	0	0	0
	>60 dB $_{LAeq,8h}$	(1)	0	0	N60 >500	0	0	0
	>63 dB $_{LAeq,8h}$	0	0	0				
	>66 dB $_{LAeq,8h}$	0	0	0				
	>69 dB $_{LAeq,8h}$	0	0	0				
	>72 dB $_{LAeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	(2)	0	(1)				
	>60 dB L_{den}	(1)	0	0				
	>65 dB L_{den}	0	0	0				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

3.7 2040 Do-Minimum vs 2050 Do-Minimum

This section considers the predicted changes in noise exposure between 2040 and 2050 DM scenarios that would arise in the absence of a runway development scheme at Gatwick Airport.

Over the period from 2040 to 2050, an increase of 4,787 ATMs are predicted for Gatwick Airport (from 280,633 to 285,42033), and the fleet mix is expected to change as follows:

- Current: from 11% to 9%
- Imminent: from 83% to 50%
- Future: from 6% to 40%

Table **3.10** below sets out the scorecard noise metrics for the 2050 DM situation predicted by ERCD on behalf of the Airports Commission. A commentary on how each of these metrics differs from the 2040 DM situation is provided in the sections below.

Table 3.10 : DM aviation noise levels for Gatwick Airport (2050)

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	7,600			N70 >20	3,300
	>57 dB $L_{Aeq,16h}$	2,800			N70 >50	1,900
	>60 dB $L_{Aeq,16h}$	1,200			N70 >100	1,400
	>63 dB $L_{Aeq,16h}$	500			N70 >200	800
	>66 dB $L_{Aeq,16h}$	300			N70 >500	200
	>69 dB $L_{Aeq,16h}$	200				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	11,200			N60 >25	11,700
	>51 dB $L_{Aeq,8h}$	5,600			N60 >50	7,100
	>54 dB $L_{Aeq,8h}$	1,700			N60 >100	200
	>57 dB $L_{Aeq,8h}$	600			N60 >200	0
	>60 dB $L_{Aeq,8h}$	400			N60 >500	0
	>63 dB $L_{Aeq,8h}$	300				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	9,500		
			>60 dB L_{den}	1,800		
			>65 dB L_{den}	500		
			>70 dB L_{den}	200		
			>75 dB L_{den}	<50		

3.7.1 Day Metrics

(a) $L_{Aeq,16h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,16h}$ noise exposure metric, calculated for an average summer's night, between the predicted 2040 DM and 2050 DM scenarios at Gatwick Airport.

Figure 3.25 : 2040 DM Gatwick Airport $L_{Aeq,16h}$ Contours

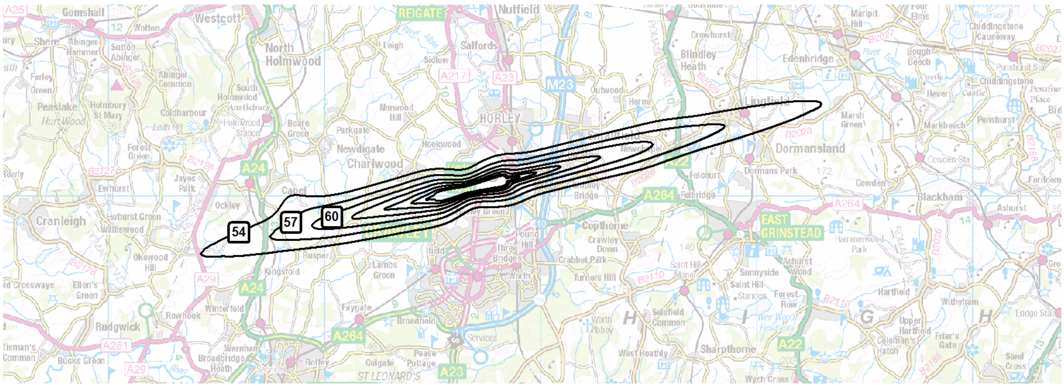
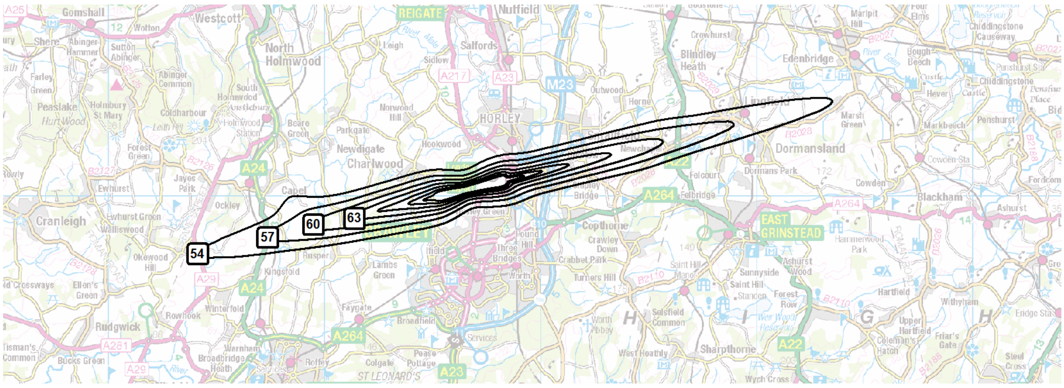


Figure 3.26 : 2050 DM Gatwick Airport $_{LAeq,16h}$ Contours



There are increases predicted in the areas covered by the 2050 DM contours compared to the 2040 DM contours, in the range 0.1 km^2 (>72 dB) to 1.0 km^2 (>54 dB) as a result of increased ATMs, despite anticipated improvements in fleet mix. The corresponding changes in population exposure in the 2050 DM scenario are:

- >54 dB an increase of 200 (from 7,400 to 7,600)
- >57 dB an increase of 600 (from 2,200 to 2,800)
- >60 dB an increase of 300 (from 900 to 1,200)
- >63 dB no change (from 500 to 500)
- >75 dB no change (from <50 to <50)
- >69 dB no change (from 200 to 200)
- >72 dB no change (from <50 to <50)

(b) N70 Supplementary Metric

This section considers the potential changes in terms of the N70 metric, between the predicted 2040 DM and 2050 DM scenarios at Gatwick Airport.

Figure 3.27 : 2040 DM Gatwick Airport N70 Contours

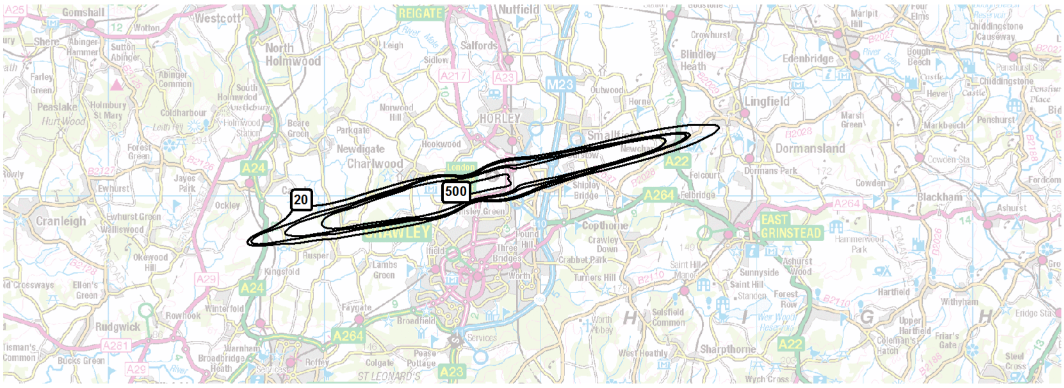
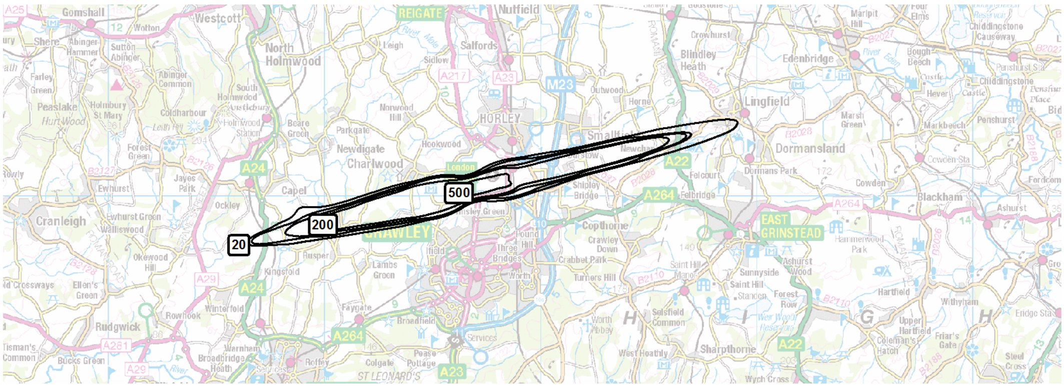


Figure 3.28 : 2050 DM Gatwick Airport N70 Contours



The daytime N70 contours for the 2050 DM scenario show increases of between 0.3 and 0.9 km^2 over the 2040 DM situation as a result of increase in ATMs despite anticipated improvements in fleet mix, and the changes in population exposure are as follows:

- >20 an increase of 1,100 (from 2,200 to 3,300)
- >50 an increase of 200 (from 1,700 to 1,900)
- >100 no change (from 1,400 to 1,400)
- >200 no change (from 800 to 800)
- >500 no change (from 200 to 200)

The N70 >20 contour increases by just 1% in the Do-Something scenario compared with the DM scenario, which is less than the increases in areas observed for the corresponding Do-Something LAeq,16h metrics (which differ from the DM contours by between 2% to 8%). However, the population enclosed within the N70 > 20 contour is forecast to increase by 50% over the DM scenario, as the increase in contour area is primarily to the east over Lingfield which is populous in comparison to the other areas covered by the contour, and due to population growth in this area between 2040 and 2050.

The N70 >50 contour is forecast to be 4% larger in the Do-Something scenario compared with the DM scenario, but does not include any new populous areas. Therefore the increase in population (200) associated with this contour in the Do-Something scenario is primarily due to forecast population growth.

3.7.2 Night Metrics

(a) $L_{Aeq,8h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night, between the predicted 2040 DM and 2050 DM scenarios at Gatwick Airport.

Figure 3.29 : 2040 DM Gatwick Airport $L_{Aeq,8h}$ Contours

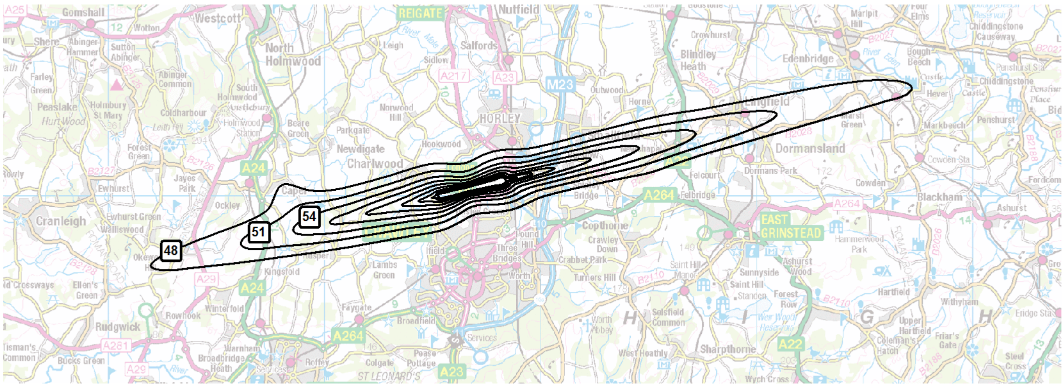
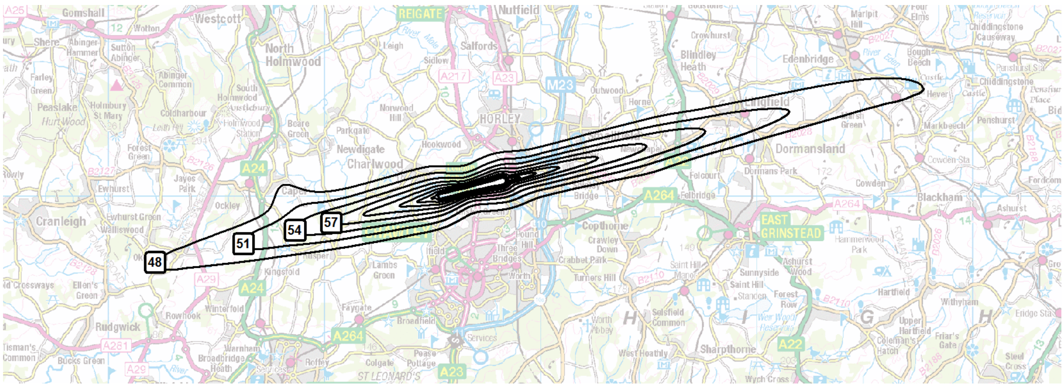


Figure 3.30 : 2050 DM Gatwick Airport $L_{Aeq,8h}$ Contours



Little change in the $L_{Aeq,8h}$ contours is predicted between the 2040 and 2050 DM scenarios, with the maximum difference between equivalent contours being an increase of 0.2 km^2 (for the >54 and >57 dB contours). This is because there is little change in night-time ATMs in 2040 compared with 2030 (an increase of 2.2%) and improvements in aircraft technology are anticipated. The changes in population exposure in the 2050 DM scenario compared to the 2040 DM scenario, are shown below:

- >48 dB an increase of 100 (from 11,100 to 11,200)
- >51 dB an increase of 100 (from 5,500 to 5,600)
- >54 dB no change (from 1,700 to 1,700)
- >57 dB no change (from 600 to 600)
- >60 dB no change (from 400 to 400)
- >63 dB no change (from 300 to 300)
- >66 dB no discernible change (from <50 to <50)
- >69 dB no discernible change (from <50 to <50)
- >72 dB no discernible change (from <50 to <50)

(b) N60 Supplementary Metric

This section considers the potential changes in terms of the N60 metric, between the predicted 2040 DM and 2050 DM scenarios at Gatwick Airport.

Figure 3.31 : 2040 DM Gatwick Airport N60 Contours

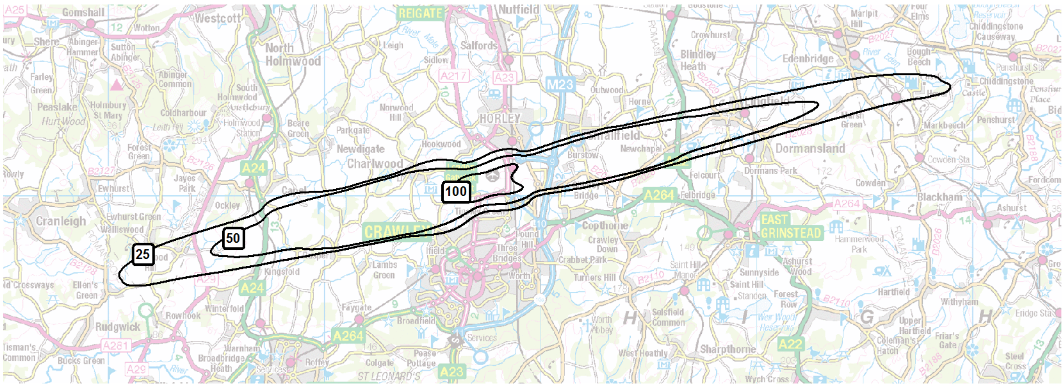
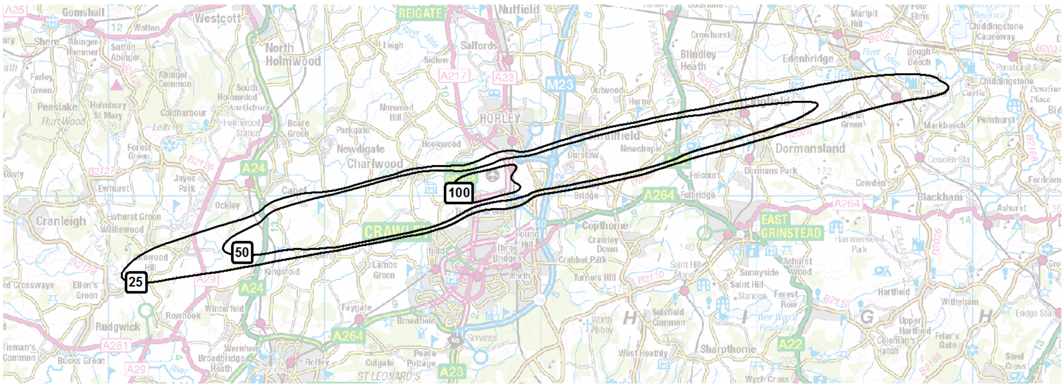


Figure 3.32 : 2050 DM Gatwick Airport N60 Contours



Greater differences are evidence in the N60 contours than the $L_{Aeq,8h}$ contours, as they are very sensitive to the $L_{AS,max}$ noise levels of individual aircraft which are predicted to decrease between 2040 and 2050 as a result of improvements in aircraft technology.

The >25 and >50 contours in the 2050 DM scenario show reductions of 2.4 km^2 and 2.0 km^2 respectively when compared to the 2040 DM situation. The >100 contour shows an increase of 0.2 km^2, but this does not result in an increase in the population it encompasses. The changes in population exposure for the 2050 DM scenario are:

- >25 a reduction of 500 (from 12,200 to 11,700)
- >50 a reduction of 100 (from 7,200 to 7,100)
- >100 no change (from 200 to 200)

3.7.3 L_{den}

This section considers the potential changes in terms of the L_{den} noise exposure metric, calculated for an average summer's night, between the predicted 2040 DM and 2050 DM scenarios at Gatwick Airport.

Figure 3.33 : 2040 DM Gatwick Airport L_{den} Contours

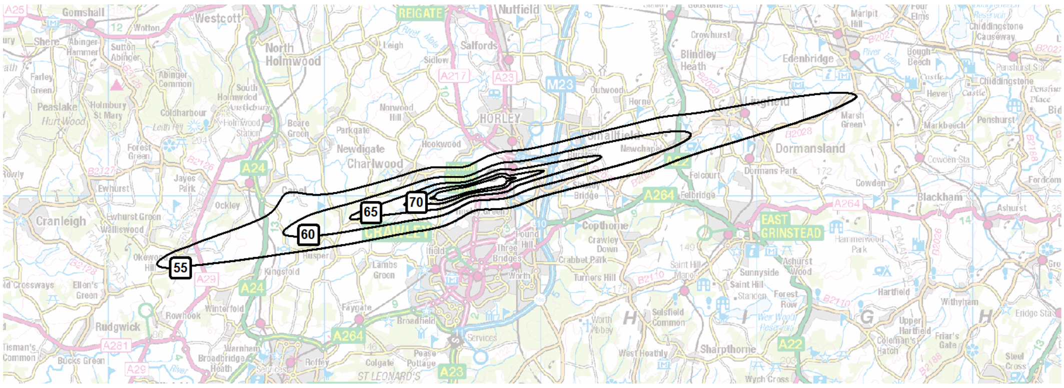
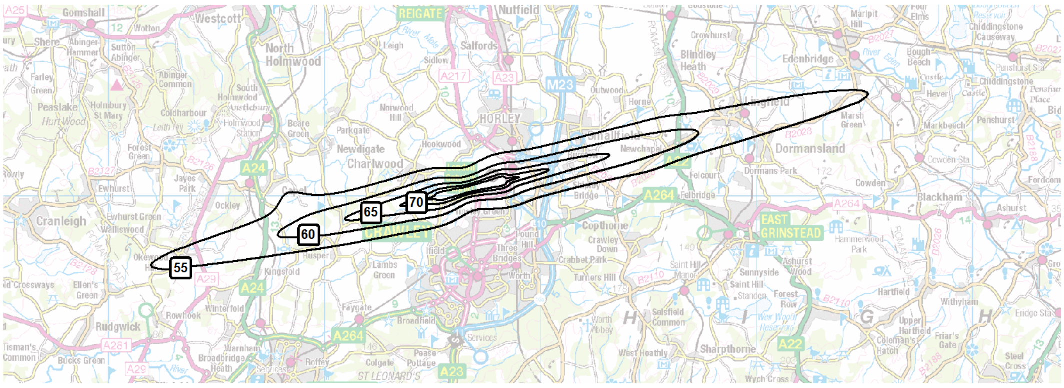


Figure 3.34 : 2050 DM Gatwick Airport L_{den} Contours



In comparison to the 2040 DM situation, the 2050 DM L_{den} contours show increases in the range 1.1 km^2 (>55 dB) to 0.1 km^2 (>70 dB), with the exception of the >75 dB contour where the differences are too small to be identified when rounding to one decimal place. These increases occur due to the increases in ATM forecast, despite the anticipated improvement in fleet mix over this period. The corresponding increases in population for the 2050 DM scenario are as follows:

- >55 dB an increase of 300 (from 9,200 to 9,500)
- >60 dB an increase of 100 (from 1,700 to 1,800)
- >65 dB an increase of 100 (from 400 to 500)
- >70 dB no change (from 200 to 200)
- >75 dB no discernible change (from <50 to <50)

3.7.4 Noise Sensitive Buildings

Table **3.11** below sets out the numbers of noise sensitive buildings within each noise contour in the 2050 DM situation.

Table 3.11 : Numbers of Noise Sensitive Buildings within 2040 DM Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	8	0	6	N70 >20	3	0	2
	>57 dB $L_{Aeq,16h}$	3	0	2	N70 >50	3	0	2
	>60 dB $L_{Aeq,16h}$	2	0	2	N70 >100	2	0	2
	>63 dB $L_{Aeq,16h}$	2	0	2	N70 >200	2	0	2
	>66 dB $L_{Aeq,16h}$	0	0	1	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	12	0	10	N60 >25	13	1	11
	>51 dB $L_{Aeq,8h}$	7	0	5	N60 >50	8	0	5
	>54 dB $L_{Aeq,8h}$	2	0	2	N60 >100	1	0	1
	>57 dB $L_{Aeq,8h}$	2	0	2	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	1	0	1	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	1				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	10	0	9				
	>60 dB L_{den}	2	0	2				
	>65 dB L_{den}	2	0	2				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

Table **3.12** below shows the difference in the number of noise sensitive buildings within each noise contour for the 2050 DM scenario compared to the 2040 DM scenario.

Table 3.12 : Difference in Number of Noise Sensitive Buildings in 2030 DM Situation

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB LAeq,16h	0	0	0	N70 >20	0	0	0
	>57 dB LAeq,16h	0	0	0	N70 >50	0	0	0
	>60 dB LAeq,16h	0	0	0	N70 >100	0	0	0
	>63 dB LAeq,16h	0	0	0	N70 >200	0	0	0
	>66 dB LAeq,16h	0	0	0	N70 >500	0	0	0
	>69 dB LAeq,16h	0	0	0				
	>72 dB LAeq,16h	0	0	0				
Night	>48 dB LAeq,8h	0	0	0	N60 >25	(1)	0	0
	>51 dB LAeq,8h	0	0	0	N60 >50	0	0	(1)
	>54 dB LAeq,8h	0	0	0	N60 >100	0	0	0
	>57 dB LAeq,8h	0	0	0	N60 >200	0	0	0
	>60 dB LAeq,8h	0	0	(1)	N60 >500	0	0	0
	>63 dB LAeq,8h	0	0	0				
	>66 dB LAeq,8h	0	0	0				
	>69 dB LAeq,8h	0	0	0				
	>72 dB LAeq,8h	0	0	0				
24-hour	>55 dB L_{den}	0	0	0				
	>60 dB L_{den}	0	0	0				
	>65 dB L_{den}	0	0	0				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

3.8 Current vs 2050 Do-Minimum

This section considers the predicted changes in noise exposure between the current situation and 2050 DM scenario in the absence of a runway development scheme at Gatwick Airport.

Over the period from 2040 to 2050, an increase of 34,900 ATMs are predicted for Gatwick Airport (from 250,520 to 285,42033), and the fleet mix is expected to change as follows:

- Current: from 100% to 9%
- Imminent: from 0% to 50%
- Future: from 0% to 40%

Table **3.10** above sets out the scorecard noise metrics for the 2050 DM situation predicted by ERCD on behalf of the Airports Commission. A commentary on how each of these metrics differs from the current situation is provided in the sections below.

3.8.1 Day Metrics

(a) $L_{Aeq,16h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,16h}$ noise exposure metric, calculated for an average summer's night, between the current situation and that predicted for 2050 in the absence of a runway development scheme at Gatwick Airport.

Figure 3.35 : 2013 Current Gatwick Airport $L_{Aeq,16h}$ Contours

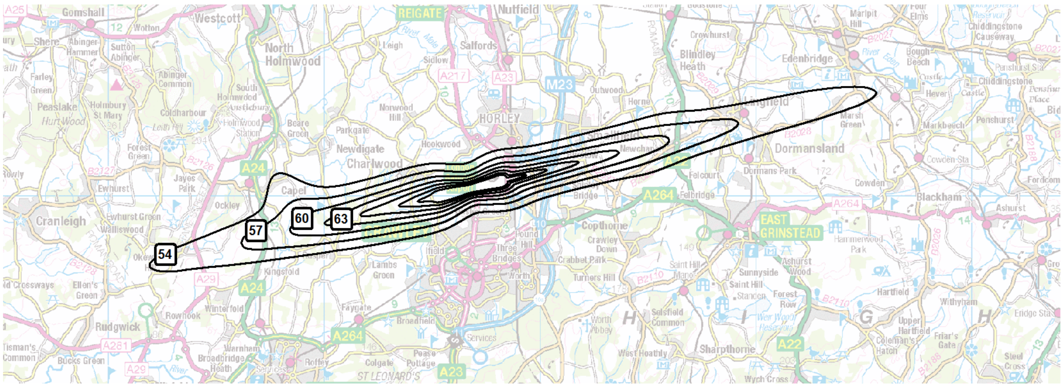
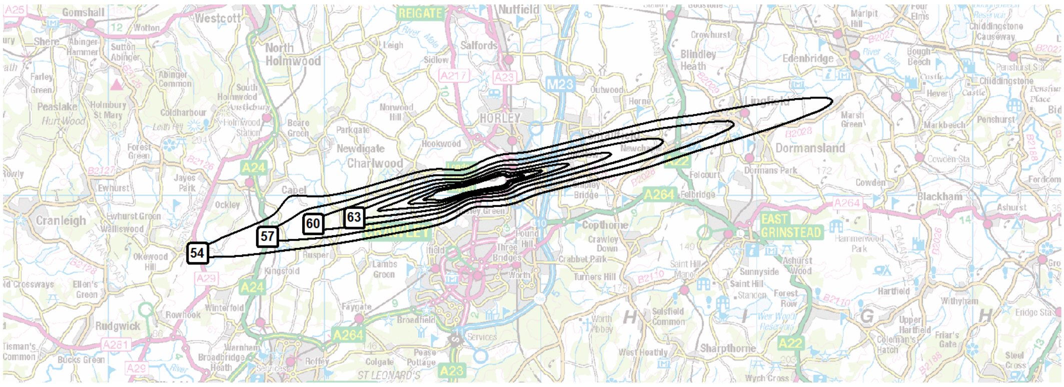


Figure 3.36 : 2050 DM Gatwick Airport $L_{Aeq,16h}$ Contours



Compared to the 2013 current situation, the $L_{Aeq,16h}$ contours for the 2050 DM situation all show a reduction in area, ranging from 0.4 km^2 (>72 dB) to 22.5 km^2 (>54 dB), as a result of the anticipated improvements in aircraft technology which will offset the increase in ATMs.

For the >54 and >57 dB Do-Something contours, the reduced areas covered in comparison to the DM contours result in a smaller population enclosed. However, for the >63 to >72 dB contours, increases in population enclosed are expected despite the reductions in areas covered, as a result of population growth over the intervening period. The expected difference in population within each contour are as follows:

- >54 dB a reduction of 2,100 (from 9,700 to 7,600)
- >57 dB a reduction of 750 (from 3,550 to 2,800)
- >60 dB no change (from 1,200 to 1,200)
- >63 dB an increase of 150 (from 350 to 500)

- >66 dB an increase of 150 (from 150 to 300)
- >69 dB an increase of 200 (from 0 to 200)
- >72 dB an increase of less than 50

(b) N70 Supplementary Metric

This section considers the potential changes in terms of the N70 metric, between the predicted 2011/2013 current and 2050 DM scenarios at Gatwick Airport.

Figure 3.37 : 2013 Current Gatwick Airport N70 Contours

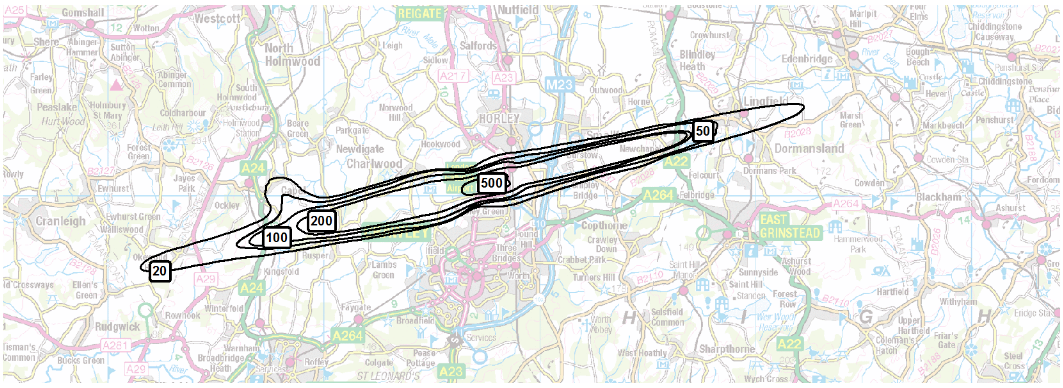
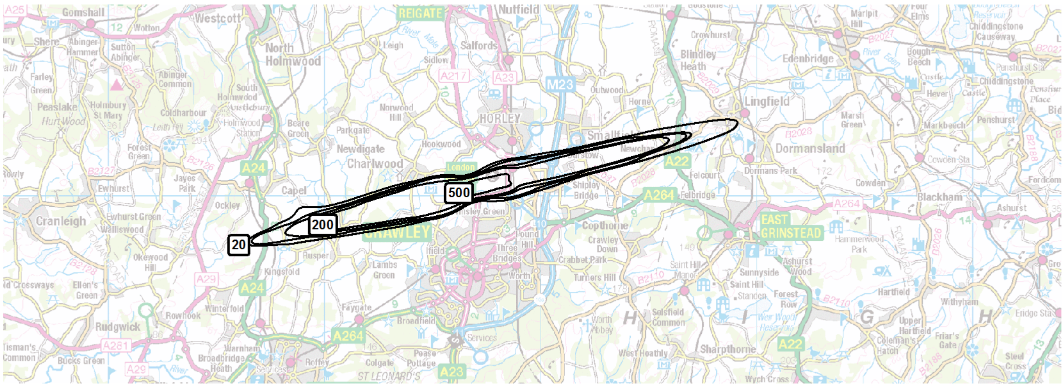


Figure 3.38 : 2050 DM Gatwick Airport N70 Contours



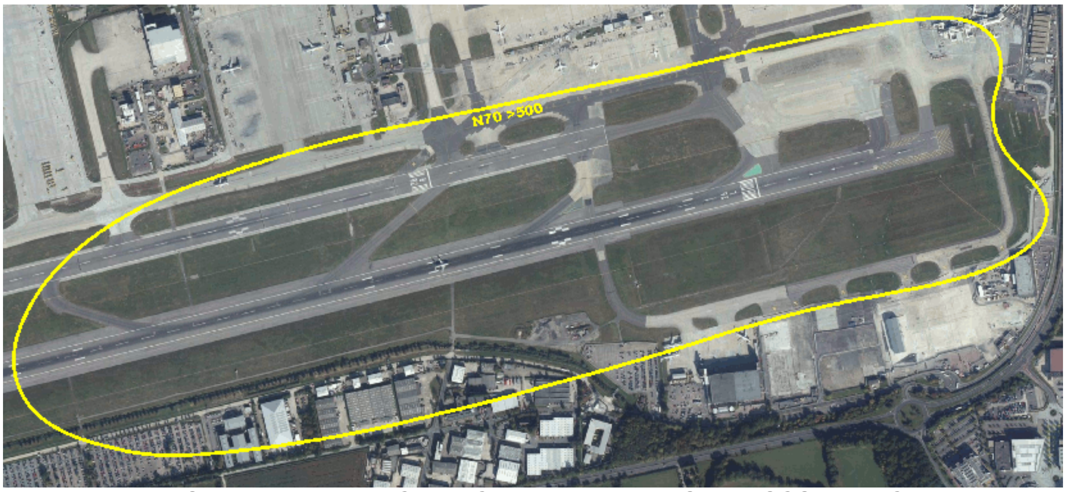
As can be seen by comparing Figure 3.37 and Figure 3.38, the areas covered by the N70 contours are generally predicted to reduce in the 2050 DM scenario when compared to the current situation as a result of improvements in aircraft technology over this period, despite an increase in ATMs. The exception is the N70 >500 contour which increases by 0.1 km^2. The expected difference in population within each contour are as follows:

- >20 a reduction of 3,000 (from 6,300 to 3,300)
- >50 a reduction of 600 (from 2,500 to 1,900)
- >100 no change (from 1,400 to 1,400)
- >200 a reduction of 100 (from 900 to 800)
- >500 an increase of 200 (from 0 to 200)

The population within the N70 >500 contour band is forecast to increase. However, as can be seen from Figure 3.39 below, the 2050 N70 >500 contour falls almost entirely within the confines of the airport, car park and the Gatwick Gate Industrial

Estate; it is not predicted to extend south of the A23. It is therefore unlikely that any dwellings will be consented within this contour.

Figure 3.39 : 2030 DM Gatwick Airport N70 >500 Contour



World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

3.8.2 Night Metrics

(a) $L_{Aeq,8h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night, between the calculated current and 2050 DM scenarios at Gatwick Airport.

Figure 3.40 : 2013 current Gatwick Airport $L_{Aeq,8h}$ Contours

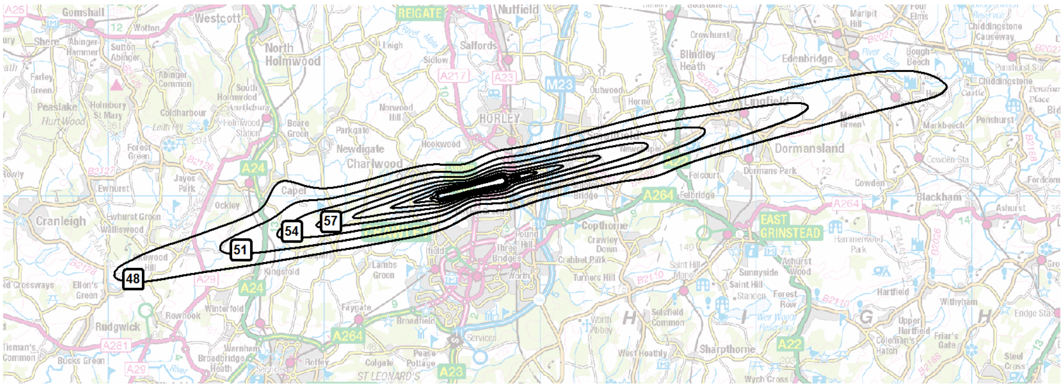
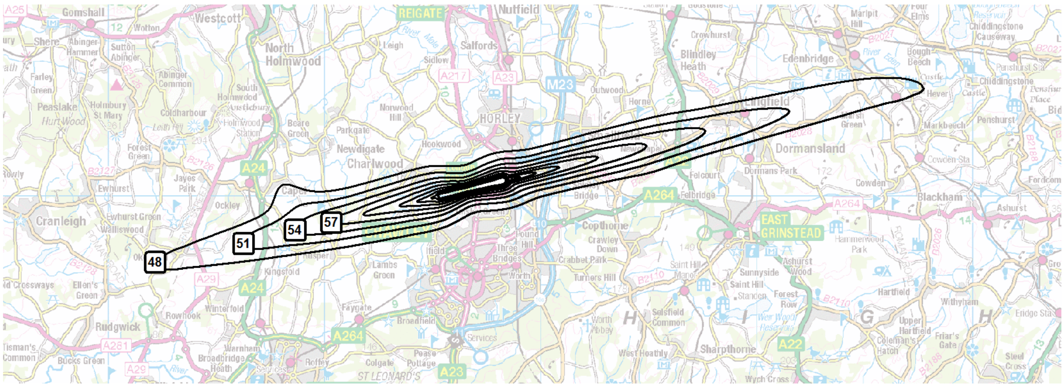


Figure 3.41 : 2050 DM Gatwick Airport $L_{Aeq,8h}$ Contours



In all cases, the 2050 DM $L_{Aeq,8h}$ contours are either smaller or the same size as the equivalent current contour as a result of improvements in aircraft technology offsetting the forecast increase in ATM. However, due to forecast population growth, the population within contours generally increases in the 2050 DM scenario compared to the current situation:

- >48 dB no change (from 11,200 to 11,200)
- >51 dB an increase of 550 (from 5,050 to 5,600)
- >54 dB an increase of 150 (from 1,550 to 1,700)
- >57 dB an increase of 150 (from 450 to 600)
- >60 dB an increase of 250 (from 150 to 400)
- >63 dB an increase of 250 (from 50 to 300)
- >66 dB an increase of less than 50
- >69 dB an increase of less than 50
- >72 dB an increase of less than 50

(b) N60 Supplementary Metric

This section considers the potential changes in terms of the N60 metric, between the calculated current and 2050 DM scenarios at Gatwick Airport.

Figure 3.42 : 2013 Current Gatwick Airport N60 Contours

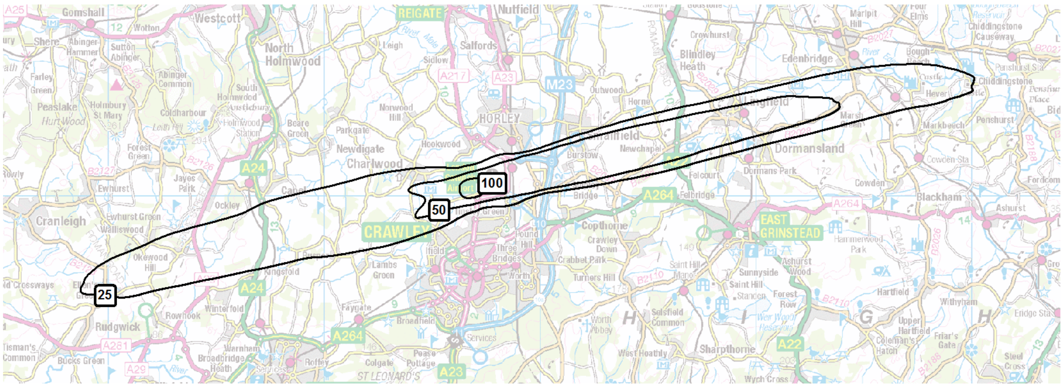
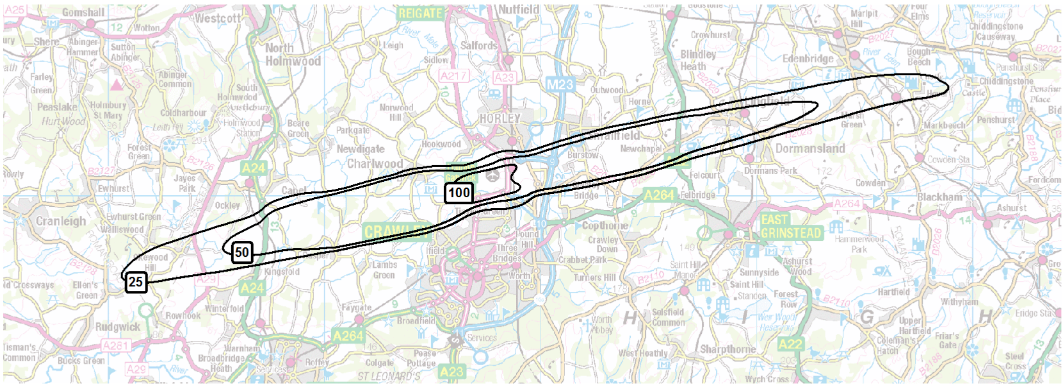


Figure 3.43 : 2050 DM Gatwick Airport N60 Contours



It can be seen from Figure 3.42 and Figure 3.43 that the N60 contours predicted for the current and 2050 DM situations are quite different, particularly for the N60 >50 contour which extends further to the west in the 2050 DM scenario than in the current situation. The N60 >50 contour to the west of the airport is primarily due to westerly take-offs at night, which are forecast to increase in the 2050 DM scenario. The N60 >25 and N60 >50 contours to the east of the airport are primarily caused by arrivals, and show reductions in area due to the quieter fleet mix assumed for 2050.

The changes in population exposure in the 2050 DM scenario compared to the current scenario are shown below:

- >25 an increase of 100 (from 11,600 to 11,700)
- >50 an increase of 2,200 (from 4,900 to 7,100)
- >100 an increase from <50 to 200

3.8.3 L_{den}

This section considers the potential changes in terms of the L_{den} noise exposure metric, calculated for an average summer’s night, between the calculated current and 2050 DM scenarios at Gatwick Airport.

Figure 3.44 : 2011 Current Gatwick Airport L_{den} Contours

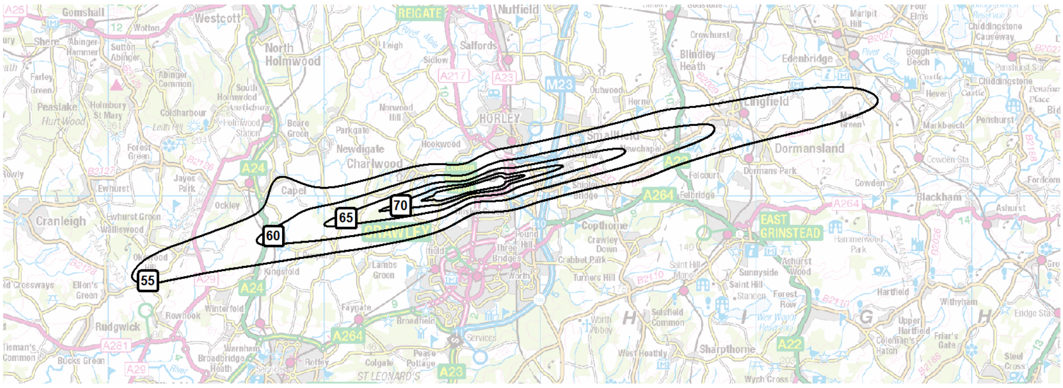
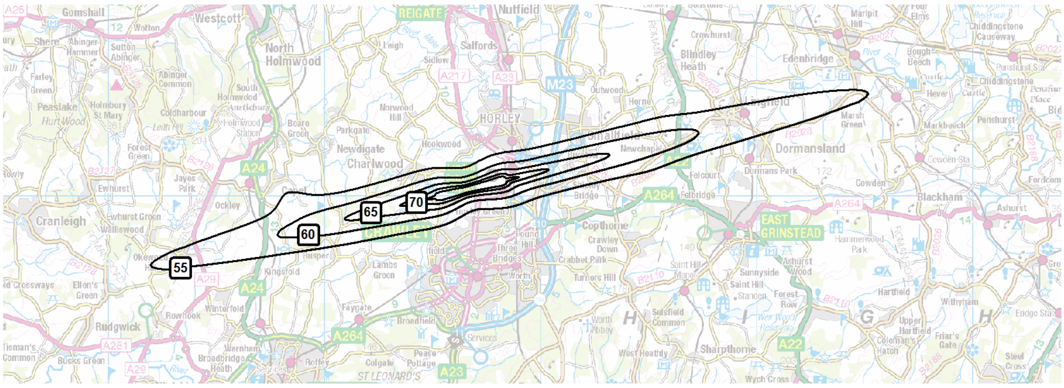


Figure 3.45 : 2050 DM Gatwick Airport L_{den} Contours



In comparison to the current situation, all of the 2050 DM L_{den} contours show reductions ranging from 0.3 km^2 (>75 dB) to 20.5 km^2 (>55 dB) as a result of improvements in aircraft noise emissions offsetting increases in ATM. The changes in population for the 2050 DM scenario are as follows:

- >55 dB a reduction of 1,800 (from 11,300 to 9,500)
- >60 dB a reduction of 200 (from 2,000 to 1,800)
- >65 dB no change (from 500 to 500)
- >70 dB an increase from <100 to 200
- >75 dB an increase from 0 to <50

As noted for other metrics, while the population forecasts supplied by CACI show population growth within the areas covered by the higher contours, it is considered unlikely that any new noise sensitive dwellings will be consented in areas which are already subject to noise levels above the local planning authorities adopted SOAEL.

3.8.4 Noise Sensitive Buildings

Table **3.13** below sets out the numbers of noise sensitive buildings within each noise contour in the 2050 situation.

Table 3.13 : Numbers of Noise Sensitive Buildings within 2050 DM Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	8	0	6	N70 >20	3	0	2
	>57 dB $L_{Aeq,16h}$	3	0	2	N70 >50	3	0	2
	>60 dB $L_{Aeq,16h}$	2	0	2	N70 >100	2	0	2
	>63 dB $L_{Aeq,16h}$	2	0	2	N70 >200	2	0	2
	>66 dB $L_{Aeq,16h}$	0	0	1	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	12	0	10	N60 >25	13	1	11
	>51 dB $L_{Aeq,8h}$	7	0	5	N60 >50	8	0	5
	>54 dB $L_{Aeq,8h}$	2	0	2	N60 >100	1	0	1
	>57 dB $L_{Aeq,8h}$	2	0	2	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	1	0	1	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	1				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	10	0	9				
	>60 dB L_{den}	2	0	2				
	>65 dB L_{den}	2	0	2				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

Table 3.14 below shows the difference in the number of noise sensitive buildings within each noise contour for the 2050 DM scenario compared to the current scenario.

Table 3.14 : Difference in Number of Noise Sensitive Buildings in 2030 DM Situation

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(7)	0	(5)	N70 >20	(6)	0	(4)
	>57 dB $L_{Aeq,16h}$	0	0	0	N70 >50	0	0	0
	>60 dB $L_{Aeq,16h}$	0	0	0	N70 >100	0	0	0
	>63 dB $L_{Aeq,16h}$	0	0	0	N70 >200	0	0	0
	>66 dB $L_{Aeq,16h}$	(1)	0	(1)	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	(3)	(1)	(1)	N60 >25	(2)	0	(2)
	>51 dB $L_{Aeq,8h}$	(1)	0	0	N60 >50	0	0	0
	>54 dB $L_{Aeq,8h}$	0	0	0	N60 >100	1	0	1
	>57 dB $L_{Aeq,8h}$	0	0	0	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	(1)	0	0	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	0				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	(3)	0	(1)				
	>60 dB L_{den}	(1)	0	0				
	>65 dB L_{den}	0	0	0				
	>70 dB L_{den}	0	0	(1)				
	>75 dB L_{den}	0	0	0				

4 Heathrow Northwest Runway

This section establishes the Local Noise Assessment study area for the Heathrow Northwest (Heathrow NWR) option, identifies settlements which may be affected by noise, and examines the distribution of population within and around the study area.

4.1 Study Area

The noise study area for the Heathrow Airport proposal is derived from the total area covered by the DM and Do-Something noise contours that have been calculated by ERCD on behalf of the Airports Commission, and is shown in below.

Figure 4.1 : Heathrow Airport Noise Study Area

The noise study area for Heathrow Airport includes the urban areas of:

- Acton, Ealing
- Barnes, Richmond Upon Thames
- Battersea, Wandsworth
- Brentford, Hounslow
- Brixton, Lambeth
- Chelsea, Kensington and Chelsea
- Chiswick, Hounslow
- Clapham, Lambeth
- Ealing, Ealing
- Egham, Surrey County
- Eton, Windsor and Maidenhead
- Feltham, Hounslow
- Fulham, Hammersmith and Fulham
- Hounslow, Hounslow
- Isleworth, Hounslow
- Kensington, Kensington and Chelsea
- Putney, Wandsworth
- Richmond, Richmond Upon Thames
- Twickenham, Richmond Upon Thames
- Wandsworth, Wandsworth
- West Drayton, Hillingdon
- Windsor, Windsor and Maidenhead

The study area also includes the smaller settlements of:

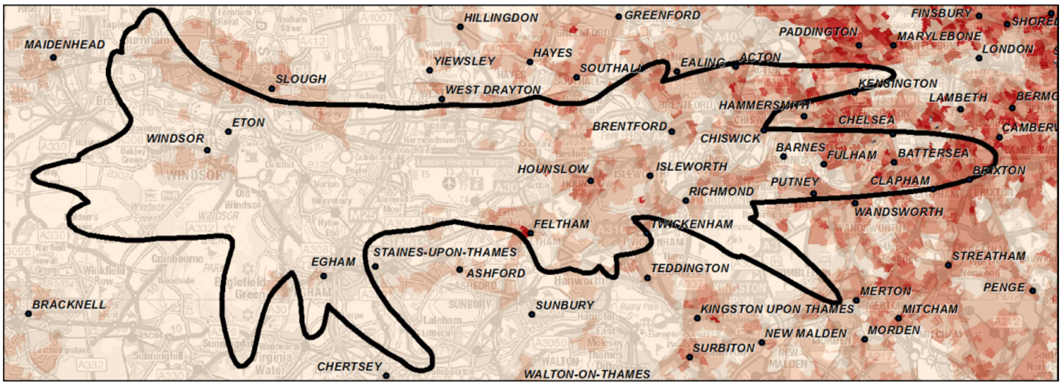
- Boveney, Buckinghamshire County
- Burnham, Buckinghamshire County
- Colnbrook, Slough
- Cranbourne, Bracknell Forest
- Cranford, Hounslow
- Datchet, Windsor and Maidenhead
- Dorney, Buckinghamshire County
- East Bedfont, Hounslow
- Fifield, Windsor and Maidenhead
- Hanworth, Hounslow
- Harmondsworth, Hillingdon
- Hatton, Hounslow
- Heston, Hounslow
- Horton, Windsor and Maidenhead
- Hythe End, Windsor and Maidenhead
- Kew, Richmond Upon Thames
- Langley, Slough
- Longford, Hillingdon
- Mortlake, Richmond Upon Thames
- Norwood Green, Ealing
- Oakley Green, Windsor and Maidenhead
- Old Windsor, Windsor and Maidenhead
- Poyle, Slough
- Richings Park, Buckinghamshire County
- Sipson, Hillingdon
- Stanwell Moor, Surrey County
- Stanwell, Surrey County
- Thorpe, Surrey County
- Upton, Slough
- Virginia Water, Surrey County
- Wentworth, Surrey County
- Wimbledon, Merton
- Wraysbury, Windsor and Maidenhead

4.2 Population

To visualise the population distribution around Heathrow Airport, the forecast 2030 populations associated with the postcode points falling within each Lower Layer Super Output Area[10] (LSOA) have been summated and then divided by the area of the LSOA to give an approximate population density for the LSOA.

[10] Lower Layer Super Output Areas are contiguous geographic areas designed to improve the reporting of small area statistics in England and Wales. The mean population in each LSOA is 1,500.

Figure 4.2 : Heathrow North West Study Area Forecast Population Densities (2030)



It can be seen from Figure 4.2 that the population density for the majority of the study area to the west of Heathrow is less than 5,000 people/km^2 with the exceptions of Windsor and the southern extent of Slough. Population densities in areas to the east of the airport increase with proximity to central London, and the eastern extent of the study area includes populous areas such as Battersea, Brentford, Clapham, Chelsea, Chiswick, Fulham, Hammersmith, Isleworth, Kensington, Putney, Richmond and Wandsworth. Other populous areas within or adjacent to the study area include Feltham, Hounslow and Twickenham and West Drayton.

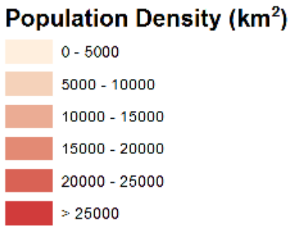


Figure 4.3 below shows the change in population densities that are forecast in the period 2030 to 2050. Most of the study area to the east of the airport is expected to have population growth in the range 0-500 people/km^2, apart from the around Eton where a reduction in population is forecast. This is due to a single postcode point associated with a large population which is present in the 2030 forecast but not in the 2050 forecast.

It is generally the most populous areas where the greatest population increases are forecast; the areas to the east of the airport identified above as having higher population densities all show greater increases than in the remaining parts of the study area. The population exposure metrics for 2050 can therefore be expected to be particularly sensitive to any changes in contour areas towards the eastern extent of the study area.

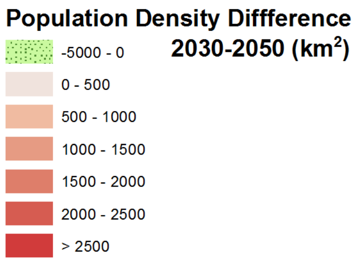
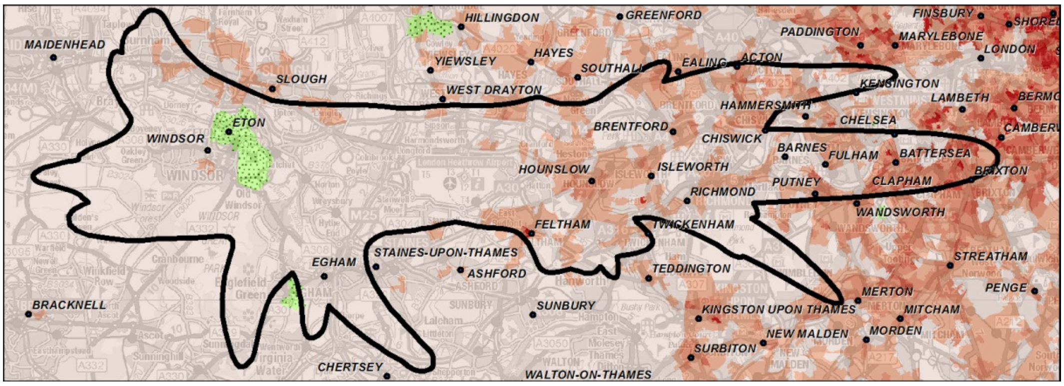


Figure 4.3 : 2030 vs 2050 Difference in Population Densities around Heathrow Airport



4.3 Current Noise Levels

The current aviation noise levels due to Heathrow Airport are presented in Table **4.1** below, using the range of metrics advocated by the ‘scorecard’ approach of the noise appraisal module.

Table 4.1 : current aviation noise levels for Heathrow Airport (2011/2013)

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	632,600			N70 >20	368,100
	>57 dB $L_{Aeq,16h}$	266,100			N70 >50	217,700
	>60 dB $L_{Aeq,16h}$	118,800			N70 >100	113,000
	>63 dB $L_{Aeq,16h}$	48,400			N70 >200	62,700
	>66 dB $L_{Aeq,16h}$	14,400			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	3,400				
	>72 dB $L_{Aeq,16h}$	200				
Night	>48 dB $L_{Aeq,8h}$	421,300			N60 >25	346,300
	>51 dB $L_{Aeq,8h}$	190,800			N60 >50	2,600
	>54 dB $L_{Aeq,8h}$	103,200			N60 >100	0
	>57 dB $L_{Aeq,8h}$	48,200			N60 >200	0
	>60 dB $L_{Aeq,8h}$	16,700			N60 >500	0
	>63 dB $L_{Aeq,8h}$	4,500				
	>66 dB $L_{Aeq,8h}$	1,600				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	766,100		
			>60 dB L_{den}	191,500		
			>65 dB L_{den}	52,700		
			>70 dB L_{den}	6,600		
			>75 dB L_{den}	100		

4.4 Noise Sensitive Buildings

Table 4.2 below sets out the numbers of noise sensitive buildings within each noise contour in the current situation.

Table 4.2 : Numbers of Noise Sensitive Buildings within current Situation Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	466	7	274	N70 >20	243	6	154
	>57 dB $L_{Aeq,16h}$	167	5	114	N70 >50	133	4	94
	>60 dB $L_{Aeq,16h}$	64	0	46	N70 >100	61	0	43
	>63 dB $L_{Aeq,16h}$	15	0	16	N70 >200	26	0	19
	>66 dB $L_{Aeq,16h}$	7	0	4	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	1	0	1				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	313	6	193	N60 >25	260	3	151
	>51 dB $L_{Aeq,8h}$	115	2	83	N60 >50	1	0	1
	>54 dB $L_{Aeq,8h}$	54	0	33	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	20	0	12	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	4	0	3	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	2	0	2				
	>66 dB $L_{Aeq,8h}$	2	0	1				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	570	16	344				
	>60 dB L_{den}	119	3	82				
	>65 dB L_{den}	20	0	13				
	>70 dB L_{den}	1	0	2				
	>75 dB L_{den}	0	0	0				

4.5 Current vs 2030 Do-Minimum

This section considers the predicted changes in noise exposure between the current situation and the 2030 DM situation in the absence of a runway development scheme at Heathrow Airport.

Over the period from 2013 to 2030, a 2.5% increase in ATMs is predicted for Heathrow Airport (an increase of 11,920 from 471,936 to 483,856). The fleet mix is expected to change as follows:

- Current: from 95% to 32%
- Imminent: from 5% to 67%
- Future: from <1% to <1%

Table **4.3** below sets out the scorecard noise metrics for the 2030 DM situation predicted by ERCD on behalf of the Airports Commission. A commentary on how each of these metrics differs from the current situation is provided in the sections below.

Table 4.3 : DM aviation noise levels for Heathrow Airport (2030)

Period	Average measure (Contour maps with population/area/other sites affected)				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	493,600			N70 >20	291,800
	>57 dB $L_{Aeq,16h}$	221,200			N70 >50	184,100
	>60 dB $L_{Aeq,16h}$	109,000			N70 >100	122,600
	>63 dB $L_{Aeq,16h}$	35,200			N70 >200	63,300
	>66 dB $L_{Aeq,16h}$	7,900			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	2,100				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	271,200			N60 >25	150,500
	>51 dB $L_{Aeq,8h}$	151,300			N60 >50	50
	>54 dB $L_{Aeq,8h}$	61,100			N60 >100	0
	>57 dB $L_{Aeq,8h}$	21,900			N60 >200	0
	>60 dB $L_{Aeq,8h}$	3,900			N60 >500	0
	>63 dB $L_{Aeq,8h}$	1,300				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	580,500		
			>60 dB L_{den}	169,600		
			>65 dB L_{den}	34,800		
			>70 dB L_{den}	3,000		
			>75 dB L_{den}	<50		

4.5.1 Day Metrics

(a) $L_{Aeq,16h}$ Noise Exposure Metric

This section considers the potential changes from the current to the 2030 DM scenarios, in terms of the $L_{Aeq,16h}$ noise exposure metric calculated for an average summer's day.

Figure 4.4 : 2013 Current Heathrow Airport $L_{Aeq,16h}$ Contours

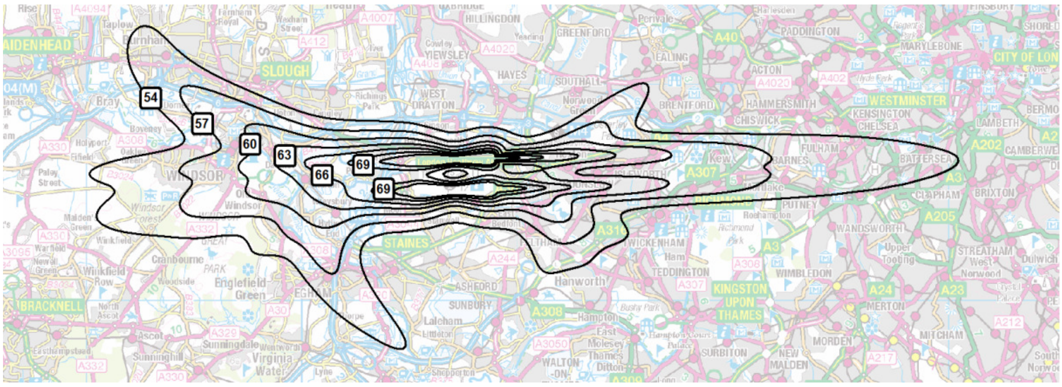
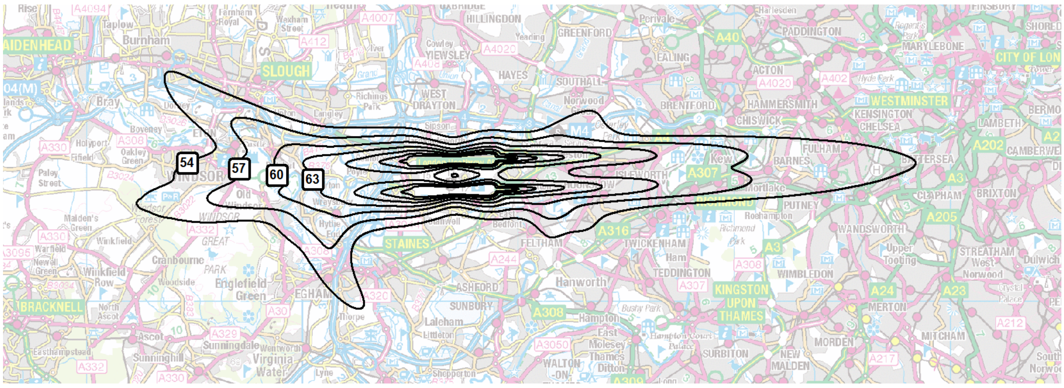


Figure 4.5 : 2030 DM Heathrow Airport $L_{Aeq,16h}$ Contours



It can be seen from Figure 4.4 and Figure 4.5 that the areas covered by the 2030 DM contours are smaller than the corresponding current contours. This is a result of the advances in aircraft technology which are expected over this period, and which have a greater effect than the 2.5% increase in ATMs that is forecast. The reduction in contour areas in the 2030 DM situation outweighs the effect of population growth, and results in reductions in the number of people within each contour in comparison with the current situation, as set out below:

- >54 dB a reduction of 139,000 (from 632,600 to 493,600)
- >57 dB a reduction of 44,900 (from 266,100 to 221,200)
- >60 dB a reduction of 9,800 (from 118,800 to 109,000)
- >63 dB a reduction of 13,200 (from 48,400 to 35,200)
- >66 dB a reduction of 6,500 (from 14,400 to 7,900)
- >69 dB a reduction of 1,300 (from 3,400 to 2,100)
- >72 dB a reduction from 200 to <50

(b) N70 Supplementary Metric

This section considers the potential changes in terms of the N70 metric, between the predicted 2013 current and 2030 DM scenarios at Heathrow Airport.

Figure 4.6 : 2013 Current Heathrow Airport N70 Contours

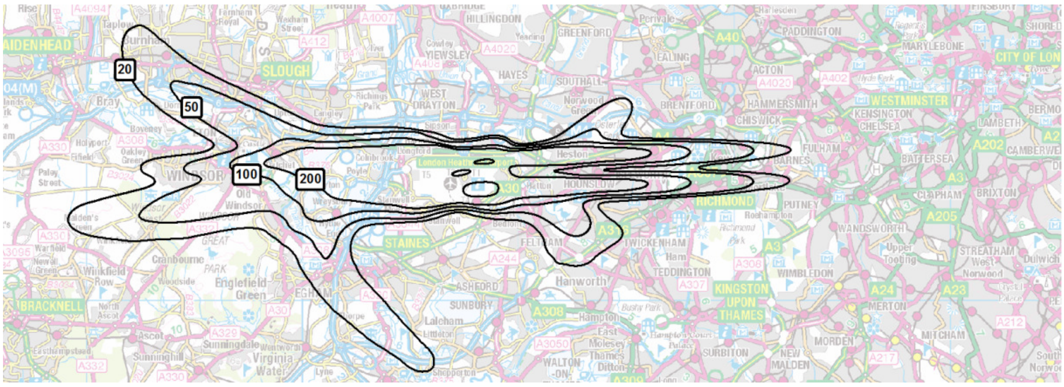
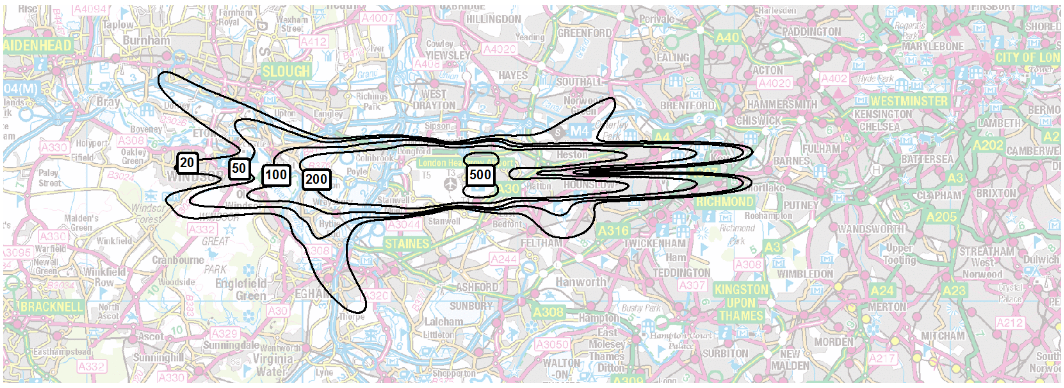


Figure 4.7 : 2030 DM Heathrow Airport N70 Contours



For the N70 metric, in all cases the 2030 DM contours are smaller than the equivalent current contours as a result of improvement in aircraft technology. However, increases in population exposure are seen in the >100 and >200 contours, primarily due to changes in the shape of the contours and forecast population growth:

- >20 a reduction of 76,300 (from 368,100 to 291,800)
- >50 a reduction of 33,600 (from 217,700 to 184,100)
- >100 an increase of 9,600 (from 113,000 to 122,600)
- >200 an increase of 600 (from 62,700 to 63,300)
- >500 no discernible change (from <50 to <50)

4.5.2 Night Metrics

(a) $L_{Aeq,8h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night, between the calculated current and 2030 DM scenarios at Heathrow Airport.

Figure 4.8 : 2013 current Heathrow Airport $_{LAeq,8h}$ Contours

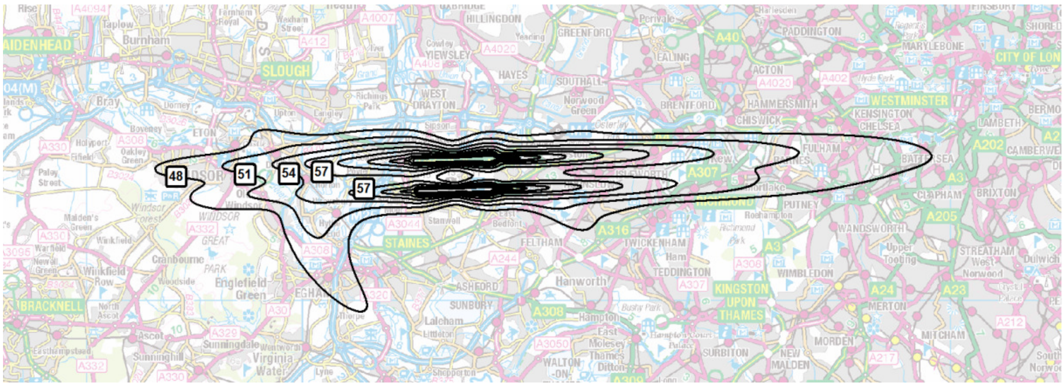
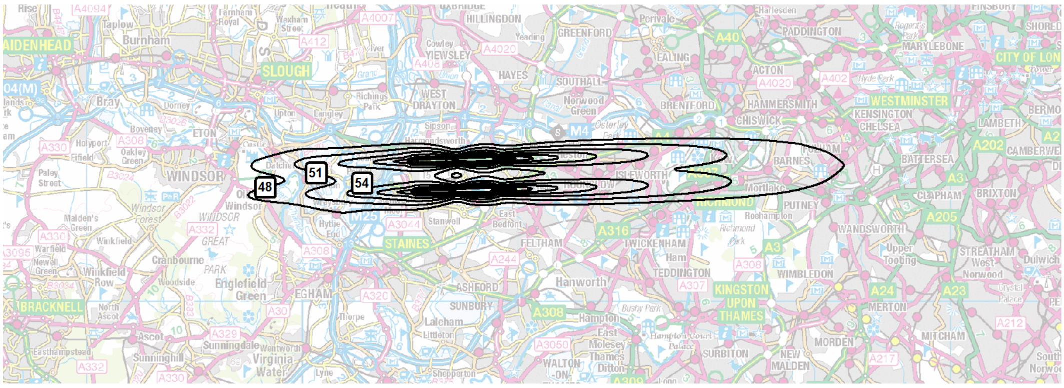


Figure 4.9 : 2030 DM Heathrow Airport $_{LAeq,8h}$ Contours



When considering night-time noise exposure, in all cases the 2030 DM $L_{Aeq,8h}$ contours are smaller than the equivalent current contours. The reductions ranging from 48.6 km^2 (>48 dB) to 0.4 km^2 (>72 dB) and are due to the anticipated improvement in aircraft technology, which offsets the forecast population growth over this period. Reductions in the population included within most contours are also predicted, as detailed below:

- >48 dB a reduction of 150,100 (from 421,300 to 271,200)
- >51 dB a reduction of 39,500 (from 190,800 to 151,300)
- >54 dB a reduction of 42,100 (from 103,200 to 61,100)
- >57 dB a reduction of 26,300 (from 48,200 to 21,900)
- >60 dB a reduction of 12,800 (from 16,700 to 3,900)
- >63 dB a reduction of 3,200 (from 4,500 to 1,300)
- >66 dB a reduction from 1600 to <50
- >69 dB no discernible change (from <50 to <50)
- >72 dB no discernible change (from <50 to <50)

(b) N60 Supplementary Metric

This section considers the potential changes in terms of the N60 metric, between the calculated current and 2030 DM scenarios at Heathrow Airport.

Figure 4.10 : 2013 current Heathrow Airport N60 Contours

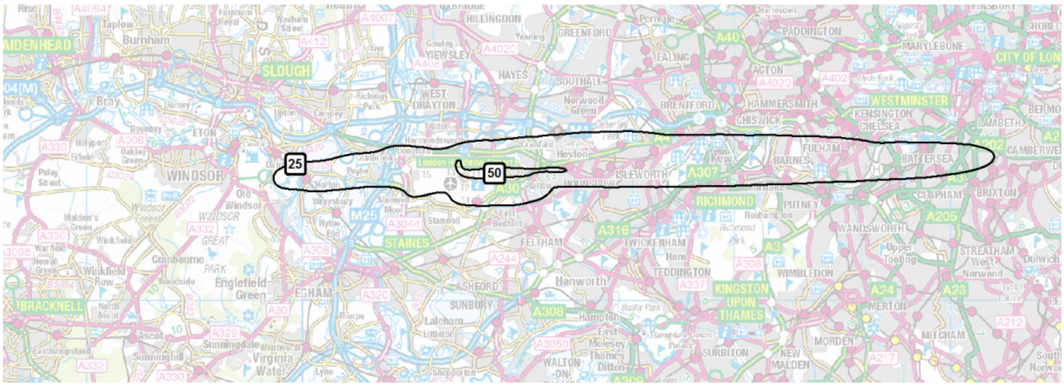
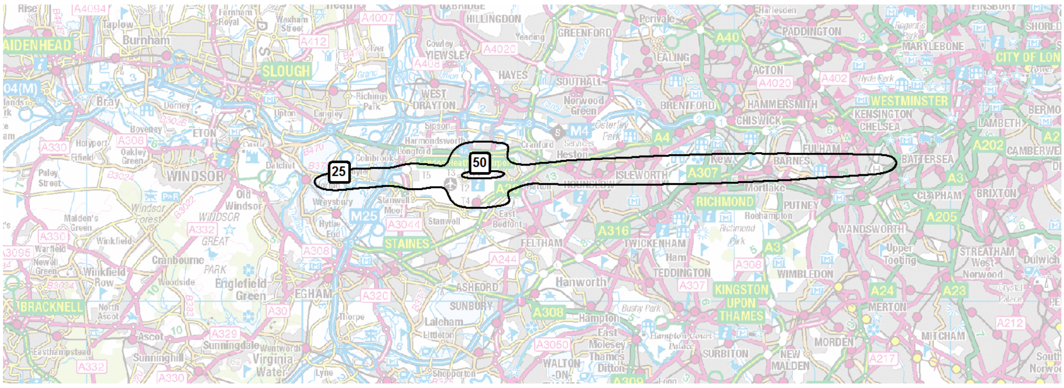


Figure 4.11 : 2030 DM Heathrow Airport N60 Contours



It can be seen from Figure 4.10 and Figure 4.11 that the shape and size of the N60 contours differ considerably between the current and 2030 DM situations. Both the 2030 DM contours are smaller than their equivalent in the current situation, with reductions of 35.6 km^2 (for the >25 contour) and 1.2 km^2 (for the >50 contour) as a result of improvements in aircraft technology. The populations falling within the contours are also predicted to reduce as follows:

- >25 A reduction of 195,800 (from 346,300 to 150,500)
- >50 A reduction from 2600 to <50

4.5.3 L_{den}

This section considers the potential changes in terms of the L_{den} noise exposure metric, calculated for an average summer's night, between the calculated current and 2030 DM scenarios at Heathrow Airport.

Figure 4.12 : 2011 current Heathrow Airport L_{den} Contours

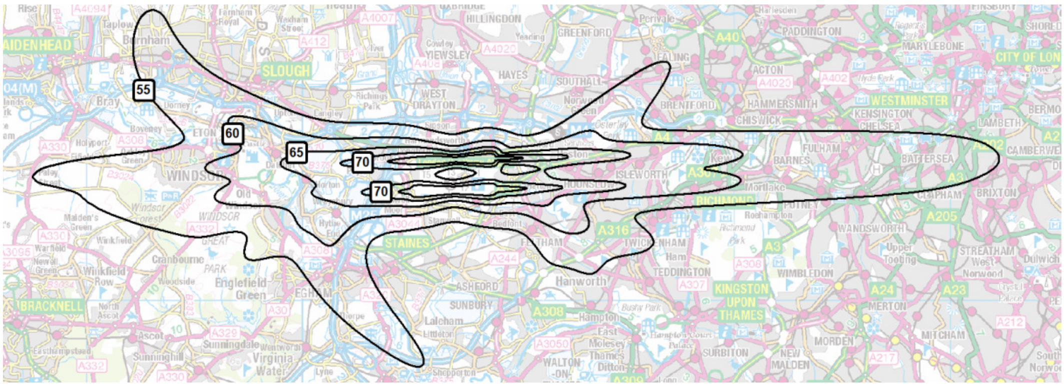
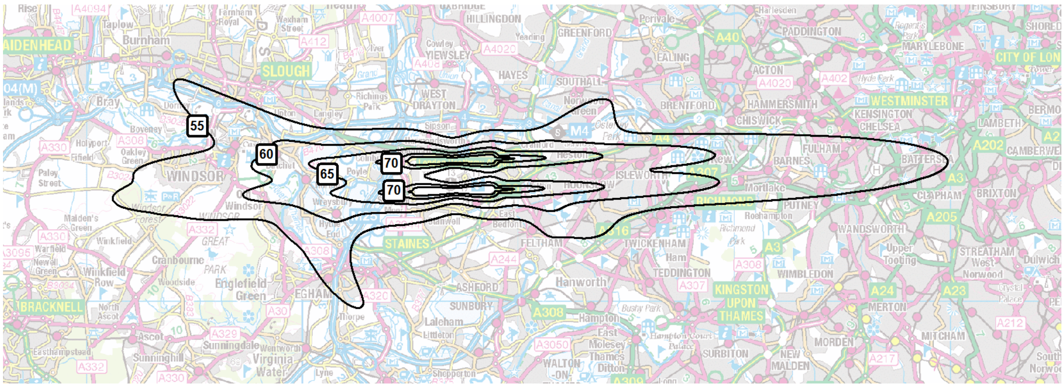


Figure 4.13 : 2030 DM Heathrow Airport L_{den} Contours



All of the L_{den} contours are predicted to be smaller in the 2030 DM scenario than in the current scenario, with the reductions ranging from 69.1 km^2 for the >55 dB contour to 1.1 km^2 for the >75 dB contour. This is due to the anticipated improvements in aircraft technology and fleet mix, which outweigh the effects the increase in ATMs over this period. There are corresponding reductions in the population within each contour band as follows:

- >55 dB a reduction of 185,600 (from 766,100 to 580,500)
- >60 dB a reduction of 21,900 (from 191,500 to 169,600)
- >65 dB a reduction of 17,900 (from 52,700 to 34,800)
- >70 dB a reduction of 3,600 (from 6,600 to 3,000)
- >75 dB a change from 100 to <50

4.5.4 Noise Sensitive Buildings

Table **4.4** below sets out the numbers of noise sensitive buildings within each noise contour in the 2030 situation.

Table 4.4 : Numbers of Noise Sensitive Buildings within 2030 DM Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	312	5	191	N70 >20	149	3	104
	>57 dB $L_{Aeq,16h}$	110	2	78	N70 >50	92	2	69
	>60 dB $L_{Aeq,16h}$	38	0	26	N70 >100	58	0	39
	>63 dB $L_{Aeq,16h}$	12	0	9	N70 >200	20	0	15
	>66 dB $L_{Aeq,16h}$	2	0	2	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	153	3	101	N60 >25	103	3	67
	>51 dB $L_{Aeq,8h}$	75	2	46	N60 >50	0	0	1
	>54 dB $L_{Aeq,8h}$	18	0	14	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	3	0	7	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	1	0	1	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	0				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	382	6	228				
	>60 dB L_{den}	75	2	54				
	>65 dB L_{den}	10	0	9				
	>70 dB L_{den}	1	0	1				
	>75 dB L_{den}	0	0	0				

Table **4.5** below shows the difference in the number of noise sensitive buildings within each noise contour for the 2030 DM scenario compared to the current scenario.

Table 4.5 : Difference in Number of Noise Sensitive Buildings in 2030 DM Situation

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(154)	(2)	(83)	N70 >20	(94)	(3)	(50)
	>57 dB $L_{Aeq,16h}$	(57)	(3)	(36)	N70 >50	(41)	(2)	(25)
	>60 dB $L_{Aeq,16h}$	(26)	0	(20)	N70 >100	(3)	0	(4)
	>63 dB $L_{Aeq,16h}$	(3)	0	(7)	N70 >200	(6)	0	(4)
	>66 dB $L_{Aeq,16h}$	(5)	0	(2)	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	(1)	0	(1)				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	(160)	(3)	(92)	N60 >25	(157)	0	(84)
	>51 dB $L_{Aeq,8h}$	(40)	0	(37)	N60 >50	(1)	0	0
	>54 dB $L_{Aeq,8h}$	(36)	0	(19)	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(17)	0	(5)	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	(3)	0	(2)	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	(2)	0	(2)				
	>66 dB $L_{Aeq,8h}$	(2)	0	(1)				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	(188)	(10)	(116)				
	>60 dB L_{den}	(44)	(1)	(28)				
	>65 dB L_{den}	(10)	0	(4)				
	>70 dB L_{den}	0	0	(1)				
	>75 dB L_{den}	0	0	0				

4.5.5 Ground Noise

The results of the current and 2030 DM ground noise predictions for Heathrow Airport are given in Table **4.6** below. They include the resulting area predicted to be exposed to 57 dB L_{Aeq16h} and above, and the population contained within an equivalent area centred on the airport and allowing for the location of the runways and aprons.

Table 4.6 : Ground Noise Exposure at Heathrow Airport – Northwest Runway

	current (2013)	2030 DM
Exposed Area, km^2 (57 dB $L_{Aeq,16h}$)	29.3	30.5
Population within Exposed Area(1)	30,650	30,750

(1) Rounded to the nearest 50.

Compared to the current situation there is little change expected in the amount of ground noise in 2030 under the DM case, with reductions in noise from aircraft offset by slight increase in ATMs and population growth.

4.6 2030 Do-Minimum vs 2040 Do-Minimum

This section considers the predicted changes in noise exposure between 2030 and 2040 DM scenarios that would ensue in the absence of a runway development scheme at Heathrow Airport.

Over the period from 2030 to 2040, a 0.1% increase in ATMs is predicted for Heathrow Airport (an increase of 661 from 483,856 to 484,517). The fleet mix is expected to change as follows:

- Current: from 32% to 13%
- Imminent: from 67% to 76%
- Future: from <1% to 10%

Table **4.7** below sets out the scorecard noise metrics for the 2040 DM situation predicted by ERCD on behalf of the Airports Commission. A commentary on how each of these metrics differs from the 2030 DM situation is provided in the sections below.

Table 4.7 : DM Aviation Noise Levels for Heathrow Airport (2040)

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	460,600			N70 >20	278,300
	>57 dB $L_{Aeq,16h}$	219,400			N70 >50	187,900
	>60 dB $L_{Aeq,16h}$	103,800			N70 >100	124,700
	>63 dB $L_{Aeq,16h}$	33,900			N70 >200	62,200
	>66 dB $L_{Aeq,16h}$	7,100			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	2,100				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	337,000			N60 >25	258,300
	>51 dB $L_{Aeq,8h}$	184,600			N60 >50	<50
	>54 dB $L_{Aeq,8h}$	81,300			N60 >100	0
	>57 dB $L_{Aeq,8h}$	31,400			N60 >200	0
	>60 dB $L_{Aeq,8h}$	6,400			N60 >500	0
	>63 dB $L_{Aeq,8h}$	2,400				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	588,900	N60 + N70 >25	-
			>60 dB L_{den}	179,500	N60 + N70 >50	<187950
			>65 dB L_{den}	36,200	N60 + N70 >100	124,700
			>70 dB L_{den}	3,100	N60 + N70 >200	62,200
			>75 dB L_{den}	<50	N60 + N70 >500	<50

4.6.1 Day Metrics

(a) $L_{Aeq,16h}$ Noise Exposure Metric

This section considers the potential changes from the 2030 DM to the 2040 DM scenarios, in terms of the $L_{Aeq,16h}$ noise exposure metric calculated for an average summer's day.

Figure 4.14 : 2030 DM Heathrow Airport $L_{Aeq,16h}$ Contours

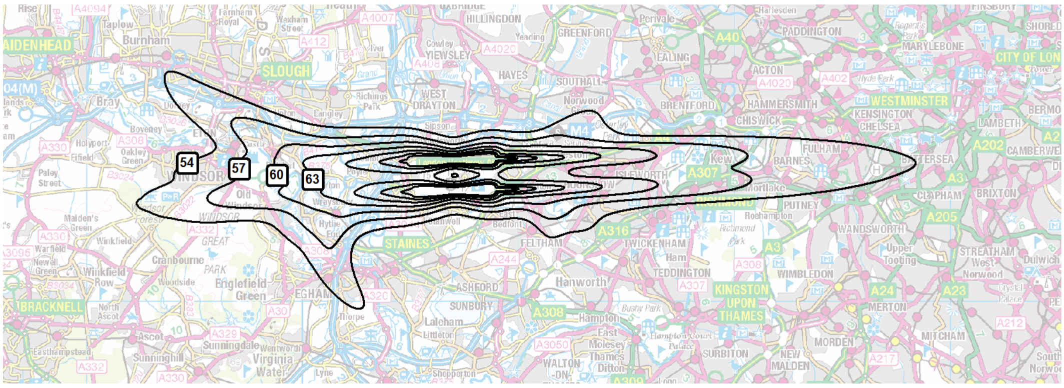
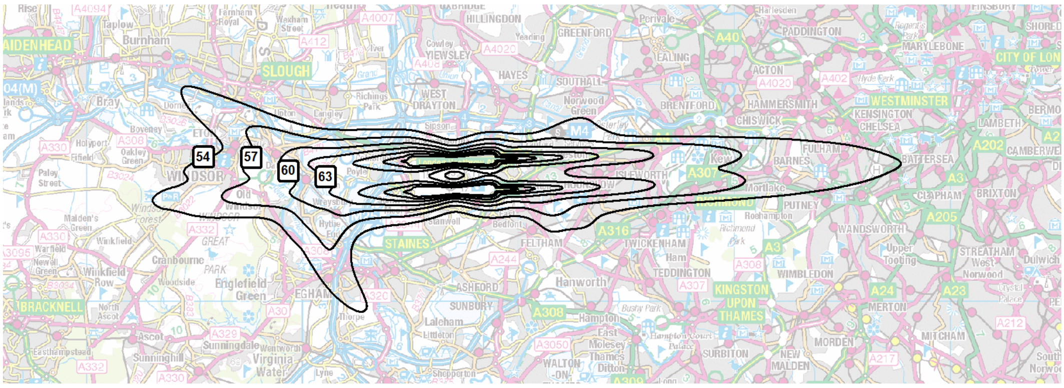


Figure 4.15 : 2040 DM Heathrow Airport $L_{Aeq,16h}$ Contours



The areas enclosed within the 2040 DM contours are smaller than the corresponding 2030 DM contours, although the reductions are not as significant as between the current and 2030 DM situations because the forecast fleet mix is not expected to change as much during this period as between 2013 and 2030. Nonetheless, there are reductions in the number of people within each contour band predicted for the contours >54 dB to >66 dB inclusive, and there is no change predicted for the populations within the >69 dB and >72 dB contours:

- >54 dB a reduction of 33,000 (from 493,600 to 460,600)
- >57 dB a reduction of 1,800 (from 221,200 to 219,400)
- >60 dB a reduction of 5,200 (from 109,000 to 103,800)
- >63 dB a reduction of 1,300 (from 35,200 to 33,900)
- >66 dB a reduction of 800 (from 7,900 to 7,100)
- >69 dB no change (from 2,100 to 2,100)
- >72 dB no discernible change (from <50 to <50)

4.6.1.1 N70 Supplementary Metric

This section considers the potential changes in terms of the N70 metric, between the predicted 2030 DM and 2040 DM scenarios at Heathrow Airport.

Figure 4.16 : 2030 DM Heathrow Airport N70 Contours

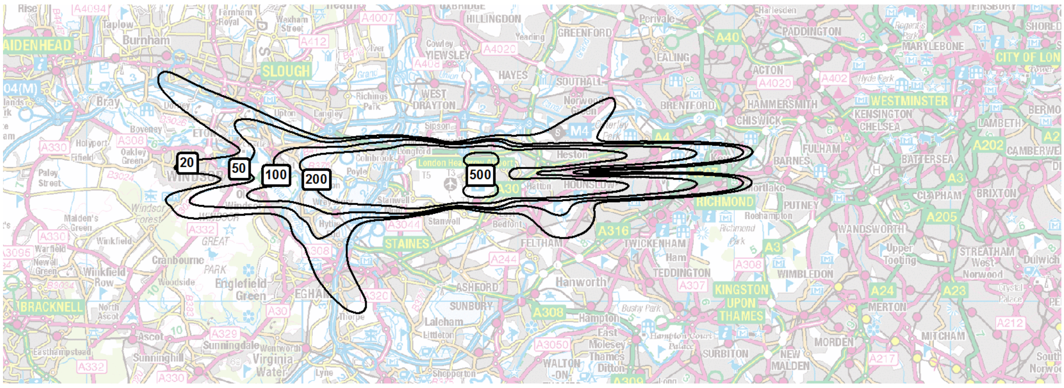
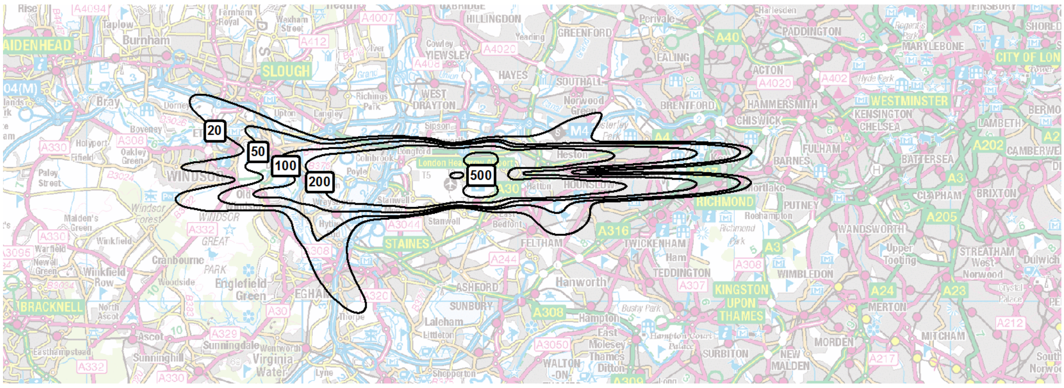


Figure 4.17 : 2040 DM Heathrow Airport N70 Contours



For the N70 metric, comparing the 2040 DM and 2030 DM contours shows reductions in the areas covered by the >20, >50, >100 and >200 contours due to the anticipated improvements in aircraft technology over this period. The areas covered by the >500 contours are the same in both scenarios, although in the 2040 situation the contours at each runway are slightly smaller, and a new contour is formed between the runways as a result of the change in fleet mix.

The changes in population exposure from the 2030 DM scenario to the 2040 DM scenario are:

- >20 a reduction of 13,500 (from 291,800 to 278,300)
- >50 an increase of 3,800 (from 184,100 to 187,900)
- >100 an increase of 2,100 (from 122,600 to 124,700)
- >200 a reduction of 1,100 (from 63,300 to 62,200)
- >500 no discernible change (from <50 to <50)

4.6.2 Night Metrics

(a) $L_{Aeq,8h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night, between the predicted 2030 DM and 2040 DM scenarios at Heathrow Airport.

Figure 4.18 : 2030 DM Heathrow Airport $L_{Aeq,8h}$ Contours

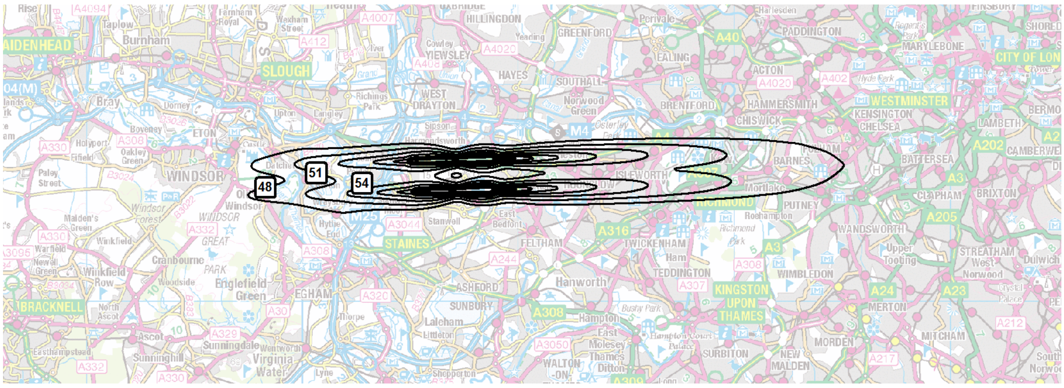
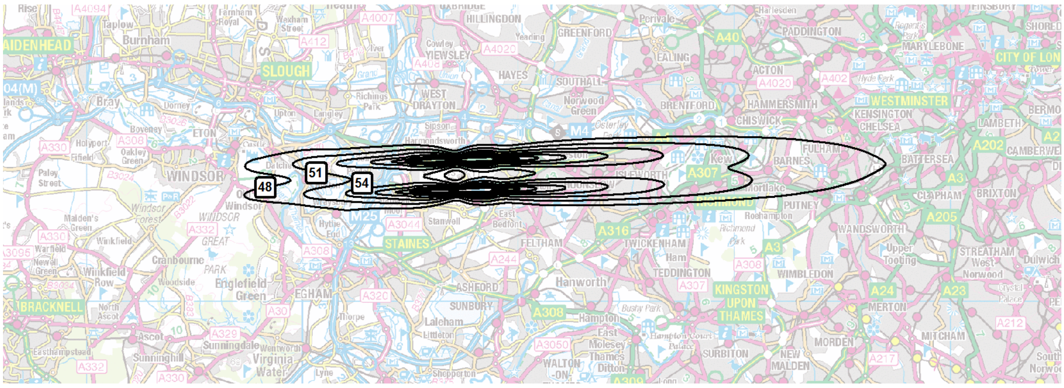


Figure 4.19 : 2040 DM Heathrow Airport $L_{Aeq,8h}$ Contours



When comparing areas covered by the $L_{Aeq,8h}$ contours for the 2030 and 2040 DM situations, small increases are predicted for the >48, >51, >54 >60 and >63 dB contours. No change is calculated for the areas covered by the >66, >69 and >72 dB contours. This trend for the night-time $L_{Aeq,8h}$ metric differs from reductions calculated for the daytime $L_{Aeq,16h}$ metric, because of growth in average summer's night flights is forecast (9.4%) between 2030 and 2040, which will primarily occur during the night-time shoulder periods (23.00 – 23.30 and 06.00 – 07.00). No changes to the current night Quota Count system are assumed.

The following changes in the populations within each contour are predicted for the 2040 DM scenario:

- >48 dB an increase of 65,800 (from 271,200 to 337,000)
- >51 dB an increase of 33,300 (from 151,300 to 184,600)
- >54 dB an increase of 20,200 (from 61,100 to 81,300)
- >57 dB an increase of 9,500 (from 21,900 to 31,400)
- >60 dB an increase of 2,500 (from 3,900 to 6,400)
- >63 dB an increase of 1,100 (from 1,300 to 2,400)
- >66 dB no discernible change (from <50 to <50)
- >69 dB no discernible change (from <50 to <50)
- >72 dB no discernible change (from <50 to <50)

(b) N60 Supplementary Metric

This section considers the potential changes in terms of the N60 metric, between the calculated 2030 DM and 2040 DM scenarios at Heathrow Airport.

Figure 4.20 : 2030 DM Heathrow Airport N60 Contours

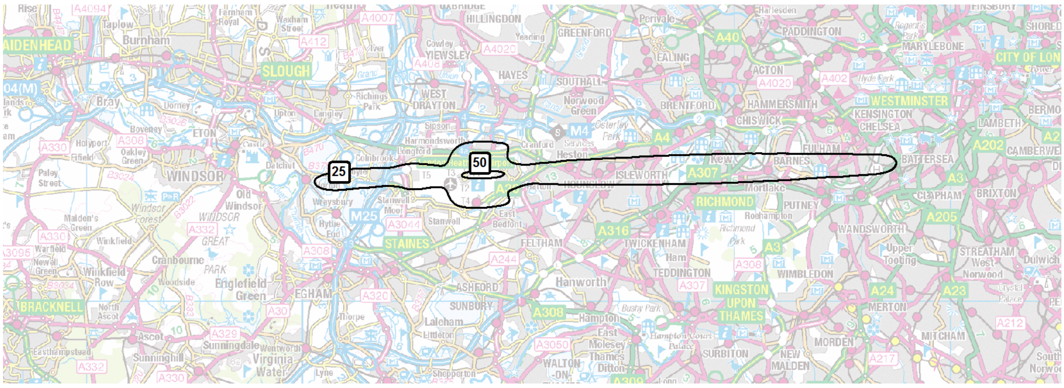
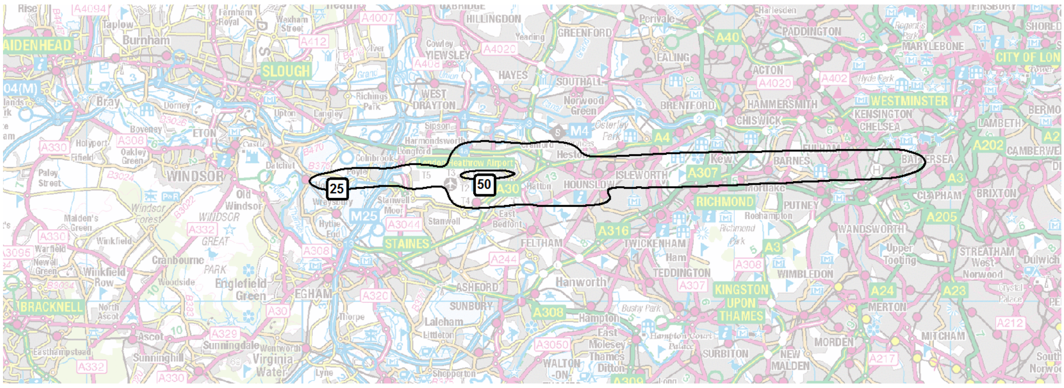


Figure 4.21 : 2040 DM Heathrow Airport N60 Contours



Between the 2030 and 2040 DM scenarios, the area within the N60 >25 contour is expected to increase by 12.6 km^2 (36%), and the area within the N60 >50 contour is predicted to increase by 0.3 km^2. These increases are driven by the significant increase (9.4% between 2030 and 2040) in ATMs anticipated during the shoulder periods (23.00-23.30 and 06.00-07.00). No changes to the current night Quota Count system are assumed. The corresponding changes in the population enclosed within each contour are:

- >25 an increase of 107,800 (from 150,500 to 258,300)
- >50 no discernible change (from 50 to <50)

The population within the >25 contour increases by 72% which is far more than the 36% that the contour area increases by; the reason for this is that much of the enlarged contour is situated over the densely populated areas of west London, and the population exposure is very sensitive to increases in contour area in this location.

4.6.3 L_{den}

This section considers the potential changes in terms of the L_{den} noise exposure metric, calculated for an average summer's night, between the predicted 2030 DM and 2040 DM scenarios at Heathrow Airport.

Figure 4.22 : 2030 DM Heathrow Airport L_{den} Contours

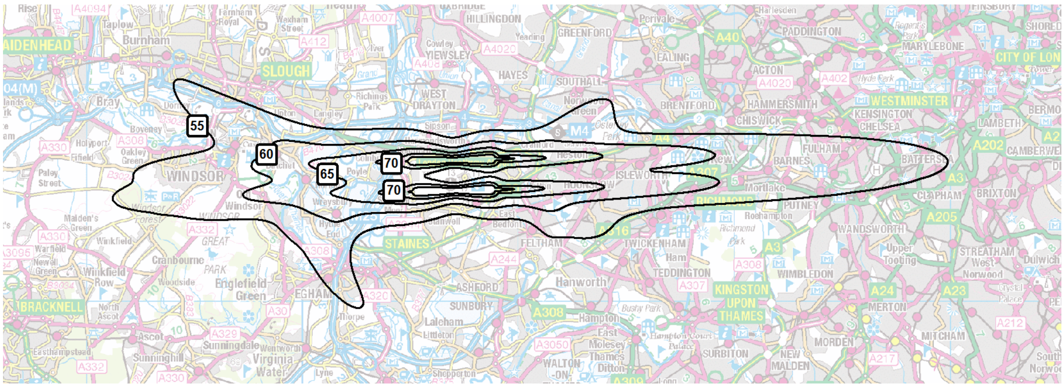
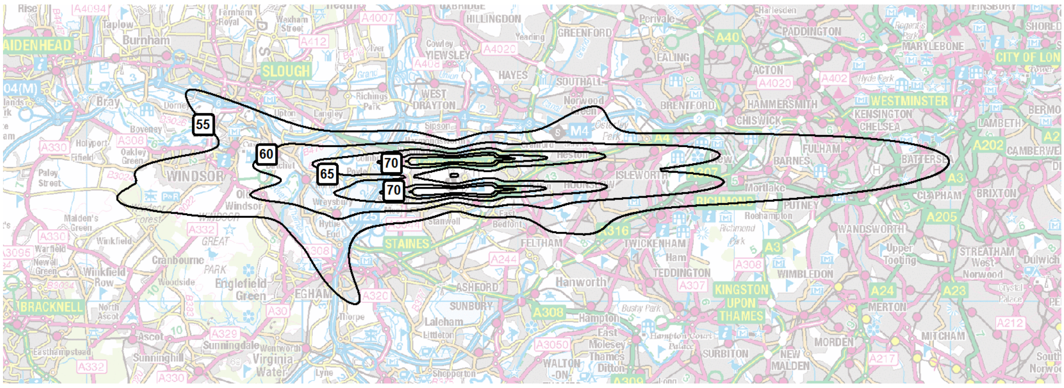


Figure 4.23 : 2040 DM Heathrow Airport L_{den} Contours



Reductions of between 7.6 km^2 (>55) and 0.2 km^2 (>75) are predicted for all of the 2040 DM L_{den} contours in comparison to the equivalent 2030 DM contours. The L_{den} metric is generally sensitive to changes in the night-time period, but the forecast reductions differ from the increases predicted for $L_{Aeq,8h}$ and N60 metrics. This is because the L_{den} is based on an annual average night rather than an average summer's night, and the increase in ATMs for an annual average night is only 3.2% over this period (compared to 9.4% for an average summer's night).

Although reductions in contour areas are predicted, due to forecast population growth, the number of people encapsulated within most contours is expected to increase:

- >55 dB an increase of 8,400 (from 580,500 to 588,900)
- >60 dB an increase of 9,900 (from 169,600 to 179,500)
- >65 dB an increase of 1,400 (from 34,800 to 36,200)
- >70 dB an increase of 100 (from 3,000 to 3,100)
- >75 dB no discernible change (from <50 to <50)

4.6.4 Noise Sensitive Buildings

Table **4.8** below sets out the numbers of noise sensitive buildings within each noise contour in the 2040 situation.

Table 4.8 : Numbers of Noise Sensitive Buildings within 2040 DM Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	265	5	170	N70 >20	134	3	97
	>57 dB $L_{Aeq,16h}$	100	2	72	N70 >50	87	2	68
	>60 dB $L_{Aeq,16h}$	33	0	25	N70 >100	54	0	33
	>63 dB $L_{Aeq,16h}$	11	0	9	N70 >200	19	0	15
	>66 dB $L_{Aeq,16h}$	2	0	1	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	194	3	119	N60 >25	155	3	90
	>51 dB $L_{Aeq,8h}$	89	2	57	N60 >50	0	0	2
	>54 dB $L_{Aeq,8h}$	30	0	22	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	6	0	8	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	1	0	2	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	0				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	367	6	221				
	>60 dB L_{den}	74	2	52				
	>65 dB L_{den}	10	0	9				
	>70 dB L_{den}	1	0	1				
	>75 dB L_{den}	0	0	0				

Table **4.9** below shows the difference in the number of noise sensitive buildings within each noise contour for the 2040 DM scenario compared to the 2030 DM scenario.

Table 4.9 : Difference in Number of Noise Sensitive Buildings in 2040 DM Situation

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(47)	0	(21)	N70 >20	(15)	0	(7)
	>57 dB $L_{Aeq,16h}$	(10)	0	(6)	N70 >50	(5)	0	(1)
	>60 dB $L_{Aeq,16h}$	(5)	0	(1)	N70 >100	(4)	0	(6)
	>63 dB $L_{Aeq,16h}$	(1)	0	0	N70 >200	(1)	0	0
	>66 dB $L_{Aeq,16h}$	0	0	(1)	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	41	0	18	N60 >25	52	0	23
	>51 dB $L_{Aeq,8h}$	14	0	11	N60 >50	0	0	1
	>54 dB $L_{Aeq,8h}$	12	0	8	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	3	0	1	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	0	0	1	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	0	0	0				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	(15)	0	(7)				
	>60 dB L_{den}	(1)	0	(2)				
	>65 dB L_{den}	0	0	0				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

4.7 2040 Do-Minimum vs 2050 Do-Minimum

This section considers the predicted changes in noise exposure between 2040 and 2050 DM scenarios that would arise in the absence of a runway development scheme at Heathrow Airport.

Over the period from 2040 to 2050, a 2.8% decrease in ATMs is predicted for Heathrow Airport (a reduction of 13,385 from 484,517 to 471,132). The fleet mix is expected to change over this period as follows:

- Current: from 13% to 4%
- Imminent: from 76% to 33%
- Future: from 10% to 63%

Table **4.10** below sets out the scorecard noise metrics for the 2050 DM situation predicted by ERCD on behalf of the Airports Commission. A commentary on how each of these metrics differs from the 2040 DM situation is provided in the sections below.

Table 4.10 : DM Aviation Noise Levels for Heathrow Airport (2050)

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	435,800			N70 >20	274,100
	>57 dB $L_{Aeq,16h}$	219,600			N70 >50	189,500
	>60 dB $L_{Aeq,16h}$	103,800			N70 >100	129,400
	>63 dB $L_{Aeq,16h}$	34,900			N70 >200	71,200
	>66 dB $L_{Aeq,16h}$	7,700			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	2,100				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	373,100			N60 >25	320,700
	>51 dB $L_{Aeq,8h}$	197,400			N60 >50	6,500
	>54 dB $L_{Aeq,8h}$	89,200			N60 >100	
	>57 dB $L_{Aeq,8h}$	33,900			N60 >200	
	>60 dB $L_{Aeq,8h}$	7,100			N60 >500	
	>63 dB $L_{Aeq,8h}$	2,600				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	583,500	N60 + N70 >25	-
			>60 dB L_{den}	182,100	N60 + N70 >50	196,000
			>65 dB L_{den}	36,400	N60 + N70 >100	129,400
			>70 dB L_{den}	3,100	N60 + N70 >200	71,200
			>75 dB L_{den}	<50	N60 + N70 >500	<50

4.7.1 Day Metrics

(a) $L_{Aeq,16h}$ Noise Exposure Metric

This section considers the potential changes from the 2040 DM to the 2050 DM scenarios, in terms of the $L_{Aeq,16h}$ noise exposure metric calculated for an average summer's day.

Figure 4.24 : 2040 DM Heathrow Airport $L_{Aeq,16h}$ Contours

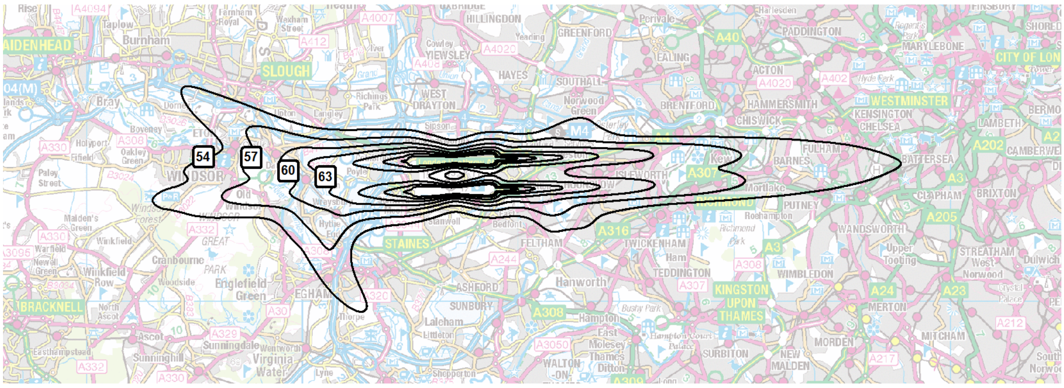
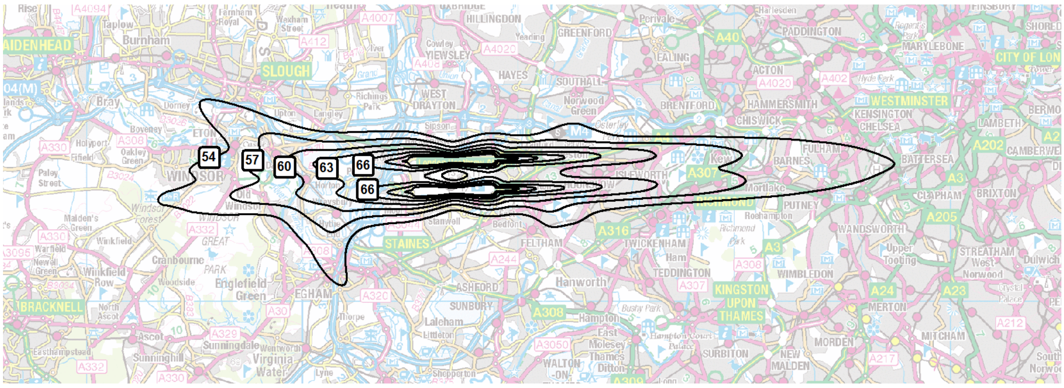


Figure 4.25 : 2050 DM Heathrow Airport $L_{Aeq,16h}$ Contours



Due to the combined effects of a reduction in ATMs and improvements in aircraft technology / fleet mix, the contours calculated for the 2050 DM scenario all cover smaller areas than the equivalent contours for the 2040 DM scenario. The reductions in areas range from 11.6 km^2 for the >54 dB contour to just 0.2 km^2 for the >72 dB contour.

However, the trend with respect to the population contained within each contour is less clear, with some contours predicted to have a reduction and others predicted to have an increase. This is due to the interaction between contour areas and forecast population increases, which are not distributed homogenously in the area around the airport. The change in population contained within each contour is shown below:

- >54 dB a reduction of 24,800 (from 460,600 to 435,800)
- >57 dB an increase of 200 (from 219,400 to 219,600)
- >60 dB no change (from 103,800 to 103,800)
- >63 dB an increase of 1,000 (from 33,900 to 34,900)
- >66 dB an increase of 600 (from 7,100 to 7,700)
- >69 dB no change (from 2,100 to 2,100)
- >72 dB no discernible change (from <50 to <50)

(b) N70 Supplementary Metric

This section considers the potential changes in terms of the N70 metric, between the predicted 2040 DM and 2050 DM scenarios at Heathrow Airport.

Figure 4.26 : 2040 DM Heathrow Airport N70 Contours

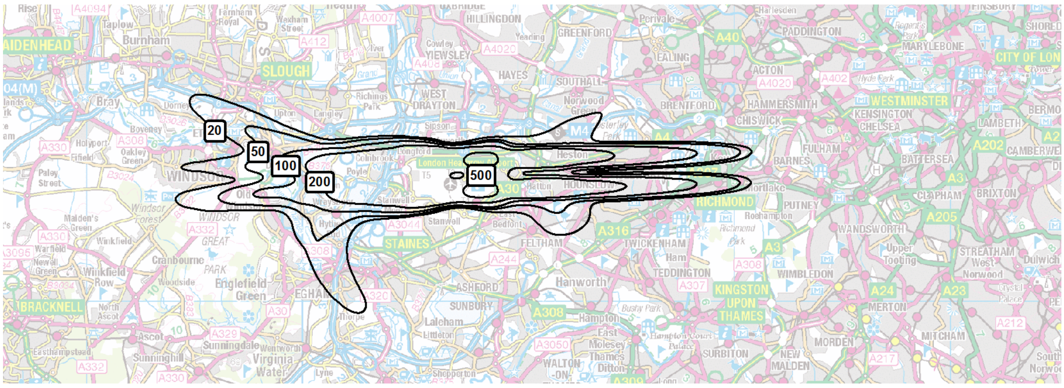
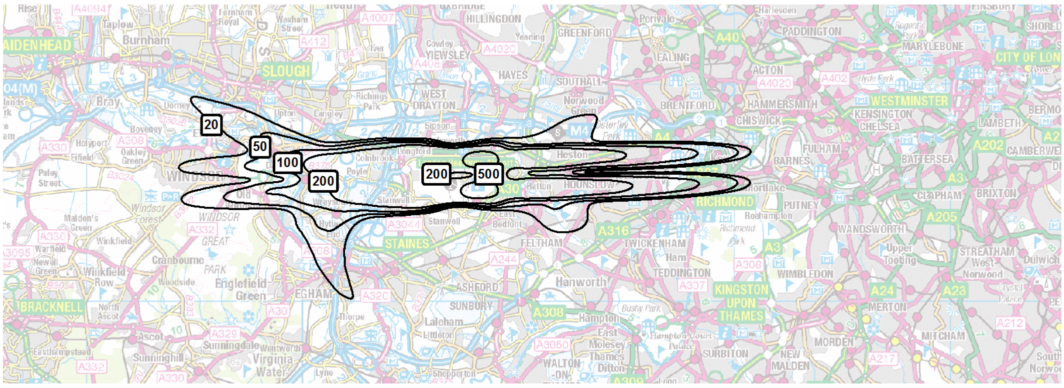


Figure 4.27 : 2050 DM Heathrow Airport N70 Contours



A reduction in area covered by the >20, >50 and >100 contours is predicted for the 2050 DM scenario in comparison to the 2040 DM scenario. This can be seen to some in Figure 4.27, which displays narrower 'horns' due to westerly departures turning to the north-west and south respectively. Closer to the airport, an increase in area of 1.0 km^2 is predicted for the >200 and an increase in area of 0.3 km^2 is predicted for the >500 contour. These changes are caused by the competing effects of different fleet mixes, growth in certain routes, and an overall reduction in ATMs.

The changes in the populations included within each contour are given below:

- >20 a reduction of 4,200 (from 278,300 to 274,100)
- >50 an increase of 1,600 (from 187,900 to 189,500)
- >100 an increase of 4,700 (from 124,700 to 129,400)
- >200 an increase of 9,000 (from 62,200 to 71,200)
- >500 no discernible change (from <50 to <50)

Although the >50 and >100 contour areas reduce between the 2040 and 2050 DM situations, the population within them increases due to forecast population growth.

4.7.2 Night Metrics

(a) $L_{Aeq,8h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night, between the predicted 2040 DM and 2050 DM scenarios at Heathrow Airport.

Figure 4.28 : 2040 DM Heathrow Airport $L_{Aeq,8h}$ Contours

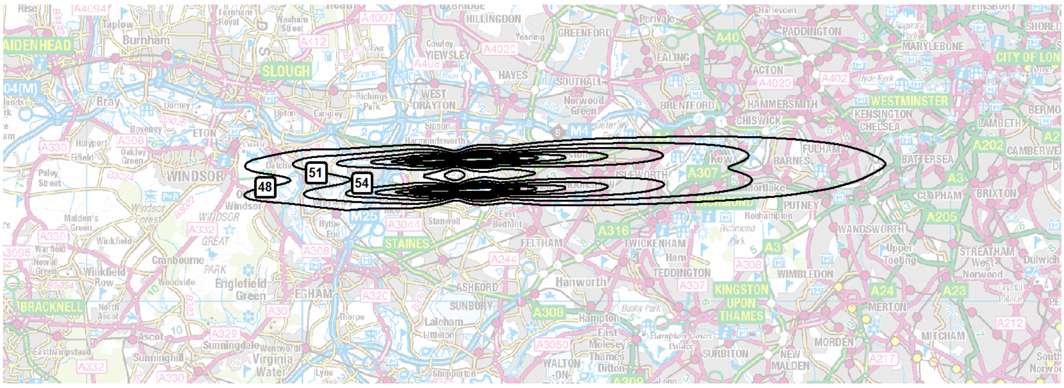
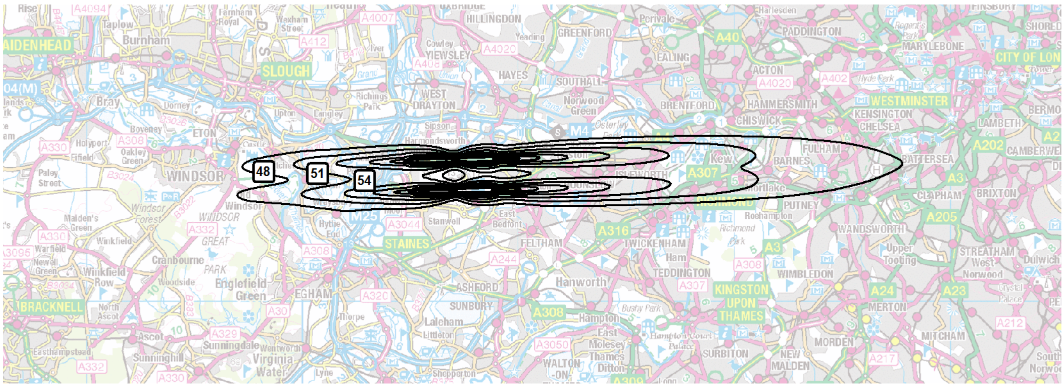


Figure 4.29 : 2050 DM Heathrow Airport $L_{Aeq,8h}$ Contours



The differences between the 2040 and 2050 DM $L_{Aeq,8h}$ night-time contours are hard to distinguish from Figure 4.28 and Figure 4.29, with increases of between 0.1 km^2 (>72) and 3.0 km^2 predicted for the 2050 DM situation. The differences in these contours are small because the forecast growth in average summer's night ATMs during the shoulder periods (23.00-23.30 and 06.00-07.00) over this period is just 1.7% and the effect of this is largely offset by improvements in aircraft technology. No changes to the current night Quota Count system are assumed. However, these small increases, when coupled with forecast population growth, result in the increases in the number of people within the >48 dB to >63 dB contours:

- >48 dB an increase of 36,100 (from 337,000 to 373,100)
- >51 dB an increase of 12,800 (from 184,600 to 197,400)
- >54 dB an increase of 7,900 (from 81,300 to 89,200)
- >57 dB an increase of 2,500 (from 31,400 to 33,900)
- >60 dB an increase of 700 (from 6,400 to 7,100)
- >63 dB an increase of 200 (from 2,400 to 2,600)

- >66 dB no discernible change (from <50 to <50)
- >69 dB no discernible change (from <50 to <50)
- >72 dB no discernible change (from <50 to <50)

There is very little change for the >66, >69 and >72 dB contours (0.1 km^2) and there are no changes expected in population within these contours.

(b) N60 Supplementary Metric

This section considers the potential changes in terms of the N60 metric, between the calculated 2040 DM and 2050 DM scenarios at Heathrow Airport.

Figure 4.30 : 2040 DM Heathrow Airport N60 Contours

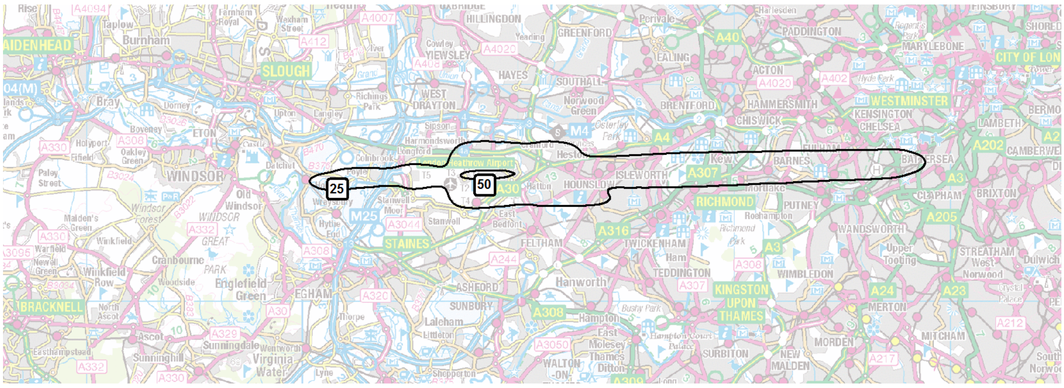
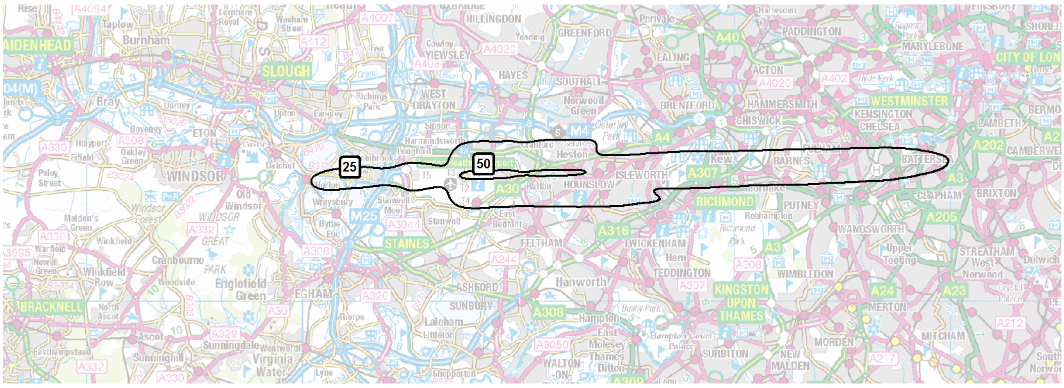


Figure 4.31 : 2050 DM Heathrow Airport N60 Contours



Some differences are evident in the shape and size of the 2040 and 2050 DM N60 contours, with the areas enclosed in the 2050 DM situation being larger. The >25 contour is expected to increase in area by 6.3 km^2, while the >50 contour is expected to increase in area by 0.8 km^2, primarily towards the east. The N60 metric is more sensitive to the number of aircraft movements than the $L_{Aeq,8h}$ metric and therefore show a greater increase in response to the increase in early morning (06.00-07.00) arrivals which are forecast (mostly due to Far East and Americas routes). No changes to the current night Quota Count system are assumed.

The increased areas covered by the contours result in increases in the number of people within the contour for the 2050 DM scenario in comparison to the 2040 DM scenario:

- >25 an increase of 62,400 (from 258,300 to 320,700)

- >50 an increase of over 6,450 (from <50 to 6,500)

4.7.3 L_{den}

This section considers the potential changes in terms of the L_{den} noise exposure metric, calculated for an average summer's night, between the predicted 2040 DM and 2050 DM scenarios at Heathrow Airport.

Figure 4.32 : 2040 DM Heathrow Airport L_{den} Contours

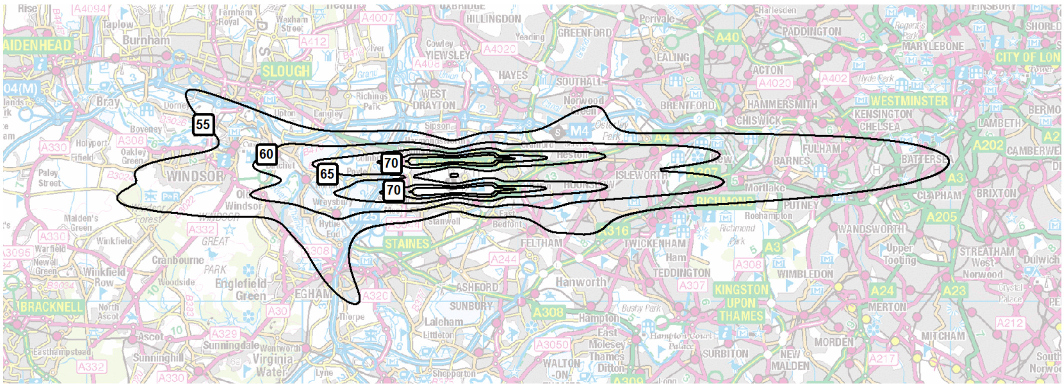
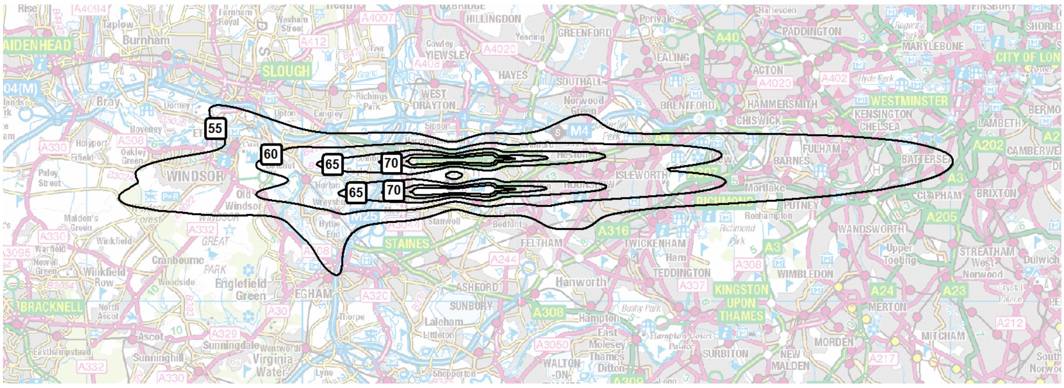


Figure 4.33 : 2050 DM Heathrow Airport L_{den} Contours



A reduction in the areas covered by all of the L_{den} contours is predicted for the 2050 DM scenario in comparison to the 2040 DM scenario, as a result of improvements in aircraft technology which offsets the forecast growth in ATMs. The reductions range from 9.4 km^2 for the >55 dB contour to 0.1 km^2 for the >75 dB contour.

The resultant changes in the population within each contour band are as follows:

- >55 dB a reduction of 5,400 (from 588,900 to 583,500)
- >60 dB an increase of 2,600 (from 179,500 to 182,100)
- >65 dB an increase of 200 (from 36,200 to 36,400)
- >70 dB no change (from 3,100 to 3,100)
- >75 dB no discernible change (from <50 to <50)

4.7.4 Noise Sensitive Buildings

Table **4.11** below sets out the numbers of noise sensitive buildings within each noise contour in the 2050 situation.

Table 4.11 : Numbers of Noise Sensitive Buildings within 2050 DM Noise Contours

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	244	5	157	N70 >20	130	3	93
	>57 dB $L_{Aeq,16h}$	99	2	68	N70 >50	87	2	64
	>60 dB $L_{Aeq,16h}$	33	0	23	N70 >100	56	1	35
	>63 dB $L_{Aeq,16h}$	11	0	9	N70 >200	21	0	15
	>66 dB $L_{Aeq,16h}$	1	0	2	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	216	3	130	N60 >25	177	3	101
	>51 dB $L_{Aeq,8h}$	95	2	60	N60 >50	2	0	2
	>54 dB $L_{Aeq,8h}$	34	0	24	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	6	0	8	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	1	0	2	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	1	0	1				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	358	6	219				
	>60 dB L_{den}	75	2	54				
	>65 dB L_{den}	8	0	8				
	>70 dB L_{den}	1	0	1				
	>75 dB L_{den}	0	0	0				

Table **4.12** below shows the difference in the number of noise sensitive buildings within each noise contour for the 2050 DM scenario compared to the 2040 DM scenario.

Table 4.12 : Difference in Number of Noise Sensitive Buildings in 2050 DM Situation

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(21)	0	(13)	N70 >20	(4)	0	(4)
	>57 dB $L_{Aeq,16h}$	(1)	0	(4)	N70 >50	0	0	(4)
	>60 dB $L_{Aeq,16h}$	0	0	(2)	N70 >100	2	1	2
	>63 dB $L_{Aeq,16h}$	0	0	0	N70 >200	2	0	0
	>66 dB $L_{Aeq,16h}$	(1)	0	1	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	0	0	0				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	22	0	11	N60 >25	22	0	11
	>51 dB $L_{Aeq,8h}$	6	0	3	N60 >50	2	0	0
	>54 dB $L_{Aeq,8h}$	4	0	2	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	0	0	0	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	0	0	0	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	1	0	1				
	>66 dB $L_{Aeq,8h}$	0	0	0				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	(9)	0	(2)				
	>60 dB L_{den}	1	0	2				
	>65 dB L_{den}	(2)	0	(1)				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

4.8 Current vs 2050 Do-Minimum

This section considers the predicted changes in noise exposure between the current situation and the 2050 DM scenario in the absence of a runway development scheme at Heathrow Airport.

Over the period from 2013 to 2030, a 0.2 % decrease in ATMs is predicted for Heathrow Airport (a reduction of 804 from 471,936 to 471,132). The fleet mix is expected to change as follows:

- Current: from 100% to 4%
- Imminent: from 0% to 33%
- Future: from 0% to 63%

Table **4.10** in Section 4.6.4 sets out the scorecard noise metrics for the 2050 DM situation predicted by ERCD on behalf of the Airports Commission. A commentary on how each of these metrics differs from the current situation is provided in the sections below.

4.8.1 Day Metrics

(a) $L_{Aeq,16h}$ Noise Exposure Metric

This section considers the potential changes from the current to the 2050 DM scenarios, in terms of the $L_{Aeq,16h}$ noise exposure metric calculated for an average summer's day.

Figure 4.34 : 2013 current Heathrow Airport $L_{Aeq,16h}$ Contours

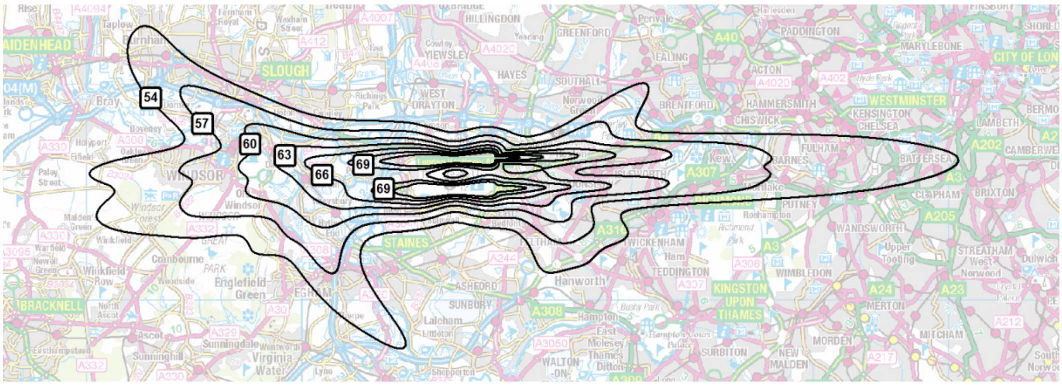
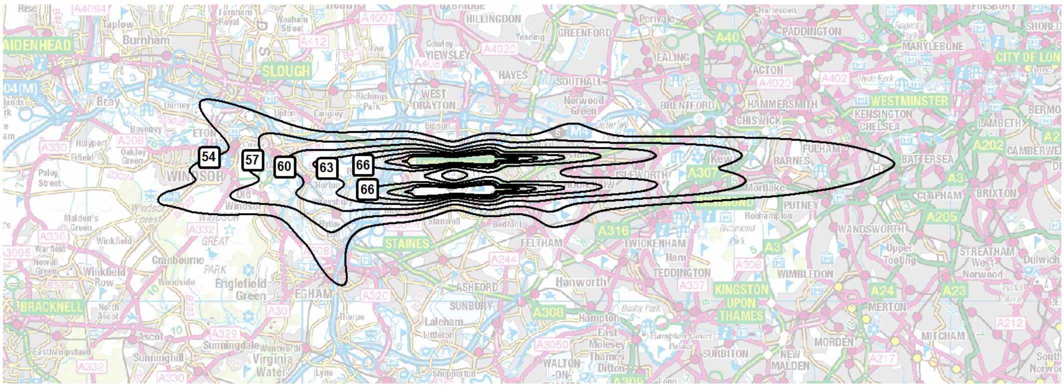


Figure 4.35 : 2050 DM Heathrow Airport $L_{Aeq,16h}$ Contours



All of the contours calculated for the 2050 DM scenario encapsulate smaller areas than the equivalent contours for the current scenario. The reductions in areas range from 81.6 km^2 for the >54 dB contour to 2.0 km^2 for the >72 dB contour. As the number of ATMs only reduces by 0.2% between these scenarios, the reduction in noise exposure is a result of the anticipated introduction of imminent and future aircraft types, which outweighs the effect of population growth.

When compared to the current scenario, the number of people within each contour for the 2050 DM scenario is less than for the current situation as detailed below:

- >54 dB a reduction of 196,800 (from 632,600 to 435,800)
- >57 dB a reduction of 46,500 (from 266,100 to 219,600)
- >60 dB a reduction of 15,000 (from 118,800 to 103,800)
- >63 dB a reduction of 13,500 (from 48,400 to 34,900)
- >66 dB a reduction of 6,700 (from 14,400 to 7,700)
- >69 dB a reduction of 1,300 (from 3,400 to 2,100)
- >72 dB a change from 200 to <50

(b) N70 Supplementary Metric

This section considers the potential changes in terms of the N70 metric, between the predicted 2011/2013 current and 2050 DM scenarios at Heathrow Airport.

Figure 4.36 : 2013 Current Heathrow Airport N70 Contours

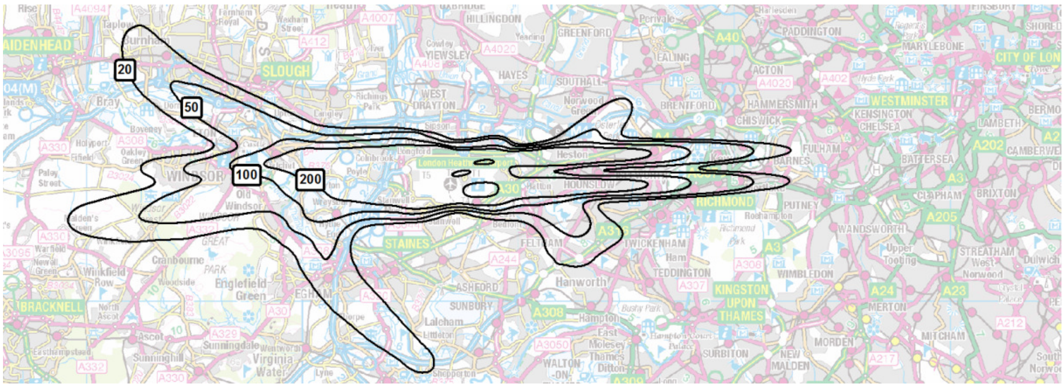
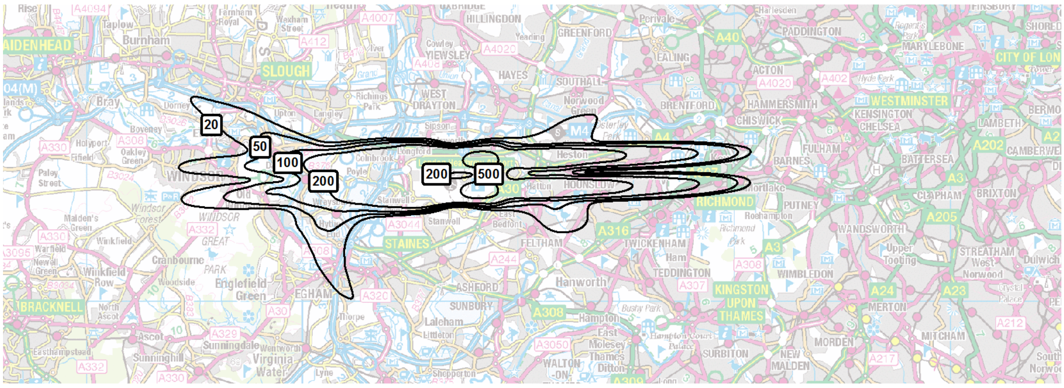


Figure 4.37 : 2050 DM Heathrow Airport N70 Contours



The N70 contours calculated for the 2050 DM scenario cover smaller areas than the equivalent contours for the current scenario, with the exception of the >500 contour. The reductions in areas range from 69.3 km^2 for the >20 contour to 3.7 km^2 for the >200 contour. The >500 contour is predicted to increase in area by 1.1 km^2, due the competing effects of different fleet mixes, growth in certain routes, an overall increase in ATMs, although this increase in area does not result in a discernible increase in population within this contour.

The resulting changes in population within each contour for the 2050 DM scenario in comparison to the current scenario are:

- >20 a reduction of 94,000 (from 368,100 to 274,100)
- >50 a reduction of 28,200 (from 217,700 to 189,500)
- >100 an increase of 16,400 (from 113,000 to 129,400)
- >200 an increase of 8,500 (from 62,700 to 71,200)
- >500 no discernible change (from <50 to <50)

4.8.2 Night Metrics

(a) $L_{Aeq,8h}$ Noise Exposure Metric

This section considers the potential changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night, between the calculated current and 2050 DM scenarios at Heathrow Airport.

Figure 4.38 : 2013 Current Heathrow Airport $L_{Aeq,8h}$ Contours

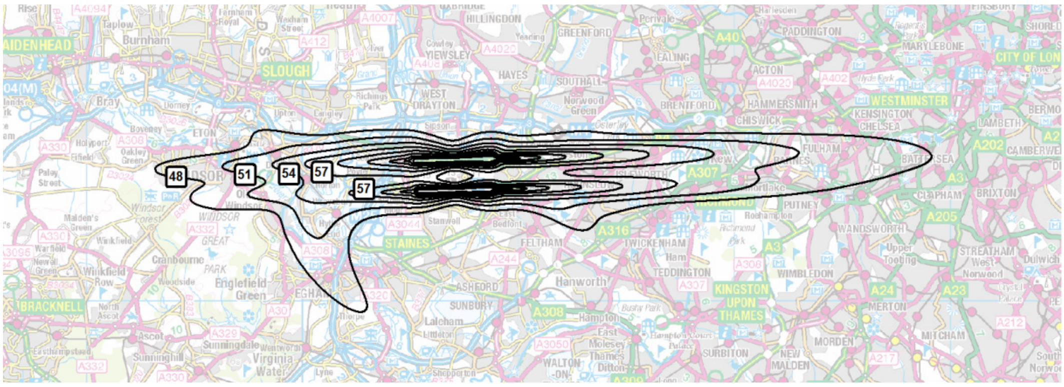
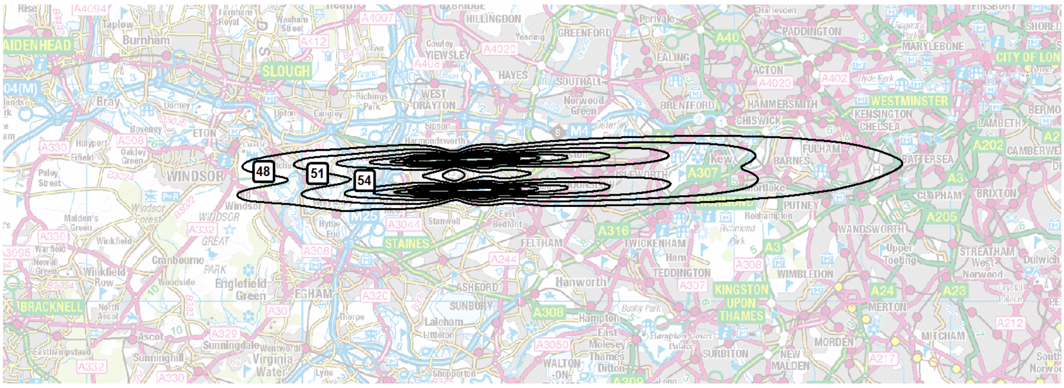


Figure 4.39 : 2050 DM Heathrow Airport $L_{Aeq,8h}$ Contours



All of the $L_{Aeq,8h}$ contours calculated for the 2050 DM scenario are smaller in area than the equivalent contours for the current scenario. The reductions in contour areas range from 41.0 km^2 for the >48 dB contour to 0.3 km^2 for the >72 dB contour as a result of anticipated improvements to aircraft technology which offsets the effects of the forecast increase in ATMs during the shoulder periods (23.00-23.30 and 06.00-07.00).

When compared to the current scenario, the populations within each $L_{Aeq,8h}$ contour for the 2050 DM scenario are generally less than or equal to the current situation, except for the >51 dB contour in which there is an increase due to the competing effect of population growth:

- >48 dB a reduction of 48,200 (from 421,300 to 373,100)
- >51 dB an increase of 6,600 (from 190,800 to 197,400)
- >54 dB a reduction of 14,000 (from 103,200 to 89,200)
- >57 dB a reduction of 14,300 (from 48,200 to 33,900)
- >60 dB a reduction of 9,600 (from 16,700 to 7,100)

- >63 dB a reduction of 1,900 (from 4,500 to 2,600)
- >66 dB a reduction from 1,600 to <50
- >69 dB no discernible change (from <50 to <50)
- >72 dB no discernible change (from <50 to <50)

(b) N60 Supplementary Metric

This section considers the potential changes in terms of the N60 metric, between the current and 2050 DM scenarios at Heathrow Airport.

Figure 4.40 : 2013 Current Heathrow Airport N60 Contours

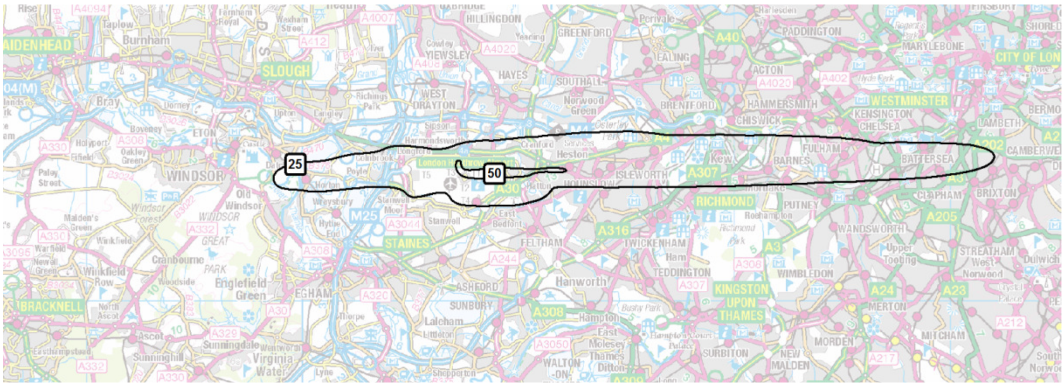
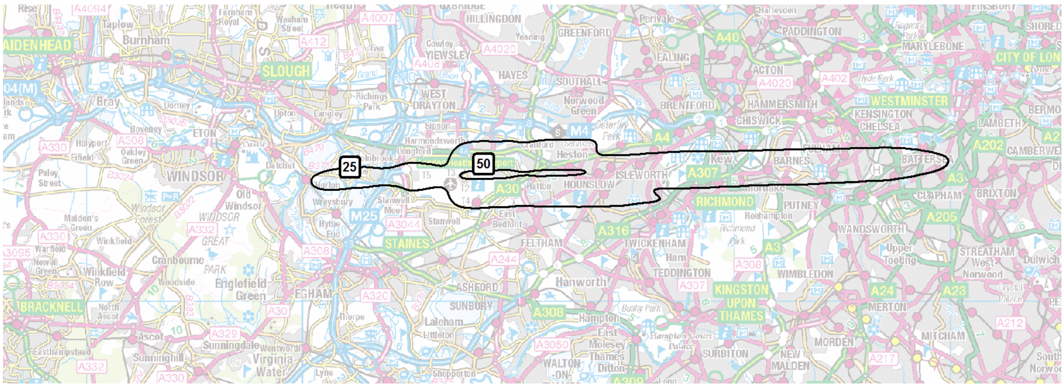


Figure 4.41 : 2050 DM Heathrow Airport N60 Contours



Compared to the current situation, the 2050 DM N60 >25 contour is 16.7 km^2 smaller in area, and the >50 contour is 0.1 km^2 smaller. These reductions in the areas are due to anticipated improvements in aircraft technology over this period. The populations within each contour are expected to change as follows:

- >25 a reduction of 25,600 (from 346,300 to 320,700)
- >50 an increase of 3,900 (from 2,600 to 6,500)

The increase in population within the N60 >50 contour is due to the extension of the contour to the east in the 2050 scenario, as this area (north of Hounslow) is populous and is forecast to become more so by 2050.

4.8.3 L_{den}

This section considers the potential changes in terms of the L_{den} noise exposure metric, calculated for an average summer's night, between the calculated current and 2050 DM scenarios at Heathrow Airport.

Figure 4.42 : 2011 Current Heathrow Airport L_{den} Contours

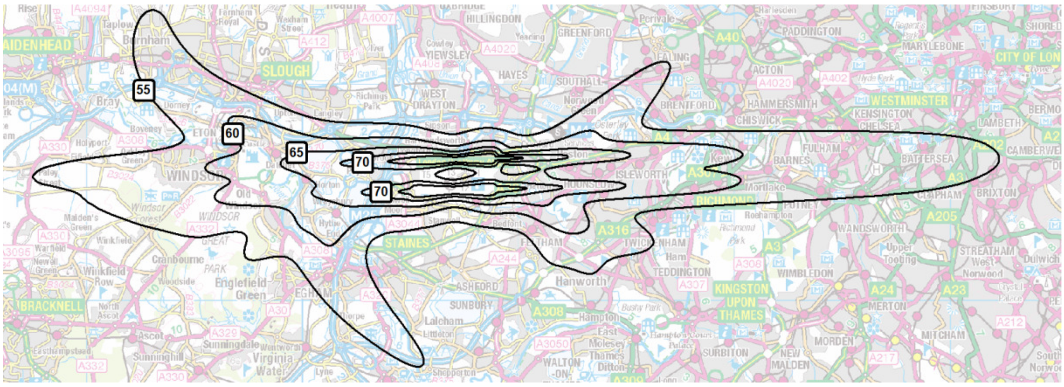
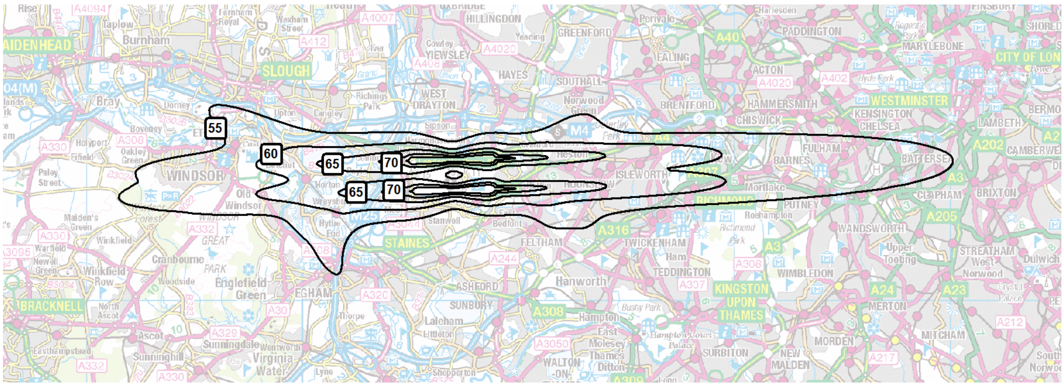


Figure 4.43 : 2050 DM Heathrow Airport L_{den} Contours



All of the L_{den} contours are predicted to be smaller in the 2050 DM scenario than in the current scenario, with the reductions ranging from 86.1 km^2 for the >55 dB contour to 1.4 km^2 for the >75 dB contour, as a result of anticipated improvements to aircraft technology. There are corresponding reductions in the population within each contour band as follows:

- >55 dB a reduction of 182,600 (from 766,100 to 583,500)
- >60 dB a reduction of 9,400 (from 191,500 to 182,100)
- >65 dB a reduction of 16,300 (from 52,700 to 36,400)
- >70 dB a reduction of 3,500 (from 6,600 to 3,100)
- >75 dB a reduction from 100 to <50

4.8.4 Noise Sensitive Buildings

Table **4.13** below shows the difference in the number of noise sensitive buildings within each noise contour for the 2050 DM scenario compared to the current scenario.

Table 4.13 : Difference in Number of Noise Sensitive Buildings in 2050 DM Situation

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(222)	(2)	(117)	N70 >20	(113)	(3)	(61)
	>57 dB $L_{Aeq,16h}$	(68)	(3)	(46)	N70 >50	(46)	(2)	(30)
	>60 dB $L_{Aeq,16h}$	(31)	0	(23)	N70 >100	(5)	1	(8)
	>63 dB $L_{Aeq,16h}$	(4)	0	(7)	N70 >200	(5)	0	(4)
	>66 dB $L_{Aeq,16h}$	(6)	0	(2)	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	(1)	0	(1)				
	>72 dB $L_{Aeq,16h}$	0	0	0				
Night	>48 dB $L_{Aeq,8h}$	(97)	(3)	(63)	N60 >25	(83)	0	(50)
	>51 dB $L_{Aeq,8h}$	(20)	0	(23)	N60 >50	1	0	1
	>54 dB $L_{Aeq,8h}$	(20)	0	(9)	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(14)	0	(4)	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	(3)	0	(1)	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	(1)	0	(1)				
	>66 dB $L_{Aeq,8h}$	(2)	0	(1)				
	>69 dB $L_{Aeq,8h}$	0	0	0				
	>72 dB $L_{Aeq,8h}$	0	0	0				
24-hour	>55 dB L_{den}	(212)	(10)	(125)				
	>60 dB L_{den}	(44)	(1)	(28)				
	>65 dB L_{den}	(12)	0	(5)				
	>70 dB L_{den}	0	0	(1)				
	>75 dB L_{den}	0	0	0				

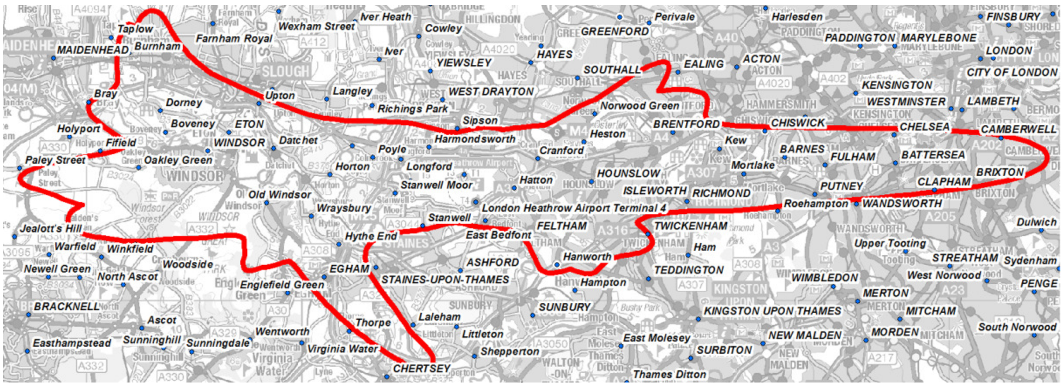
5 Heathrow Extended Northern Runway

This section establishes the Local Noise Assessment study area for the Heathrow Airport Extended Northern Runway (Heathrow ENR) option, identifies settlements which may be affected by noise, and examines the distribution of population within and around the study area.

5.1 Study Area

The noise study area for the Heathrow Extended Northern Runway option is derived from the total area covered by the DM and Do-Something noise contours that have been calculated by ERCD on behalf of the Airports Commission, and is shown in below.

Figure 5.1 : Heathrow ENR Noise Study Area



The noise study area for Heathrow ENR includes the urban areas of:

- Barnes, Richmond Upon Thames
- Battersea, Wandsworth
- Brentford, Hounslow
- Brixton, Lambeth
- Camberwell, Southwar
- Chelsea, Kensington and Chelsea
- Chiswick, Hounslow
- Clapham, Lambeth
- Ealing, Ealing
- Egham, Surrey County
- Eton, Windsor and Maidenhead
- Feltham, Hounslow
- Fulham, Hammersmith and Fulham
- Hounslow, Hounslow
- Isleworth, Hounslow
- Putney, Wandsworth
- Richmond, Richmond Upon Thames
- Twickenham, Richmond Upon Thames
- Wandsworth, Wandsworth
- Windsor, Windsor and Maidenhead

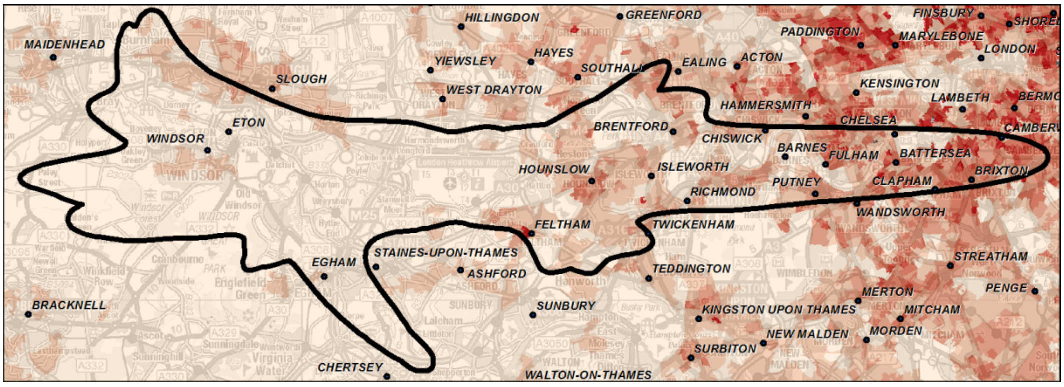
The study area also includes the smaller settlements of:

- Boveney, Buckinghamshire County
- Bray, Windsor and Maidenhead
- Burnham, Buckinghamshire County
- Colnbrook, Slough
- Cranbourne, Bracknell Forest
- Cranford, Hounslow
- Datchet, Windsor and Maidenhead
- Dorney, Buckinghamshire County
- East Bedfont, Hounslow
- Fifield, Windsor and Maidenhead
- Hanworth, Hounslow
- Harmondsworth, Hillingdon
- Hatton, Hounslow
- Heston, Hounslow
- Horton, Windsor and Maidenhead
- Hythe End, Windsor and Maidenhead
- Kew, Richmond Upon Thames
- Laleham, Surrey County
- Longford, Hillingdon
- Mortlake, Richmond Upon Thames
- Norwood Green, Ealing
- Oakley Green, Windsor and Maidenhead
- Old Windsor, Windsor and Maidenhead
- Paley Street, Windsor and Maidenhead
- Poyle, Slough
- Roehampton, Wandsworth
- Sipson, Hillingdon
- Stanwell, Surrey County
- Stanwell Moor, Surrey County
- Taplow, Buckinghamshire County
- Thorpe, Surrey County
- Upton, Slough
- Wraysbury, Windsor and Maidenhead

5.2 Population

To visualise the population distribution around Heathrow Airport, the forecast 2030 populations associated with the postcode points falling within each Lower Super Output Area (LSOA) have been summated and then divided by the area of the LSOA to give an approximate population density for the LSOA.

Figure 5.2 : Heathrow ENR Study Area Forecast Population Densities (2030)



The population density in the part of the study area to the west of Heathrow Airport is generally less than 5,000 people/km^2, with the exception of Windsor and the southern extent of Slough. Population densities in the areas to the east of the airport increase with proximity to central London, and the eastern extent of the study area includes populous areas such as Battersea, Brentford, Brixton, Camberwell, Clapham, Chelsea, Chiswick, Fulham, Isleworth, Putney and Wandsworth. Other highly populous areas within or adjacent to the study area include Feltham, Hounslow, Twickenham and West Drayton.

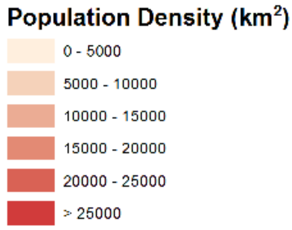


Figure *5.3* below shows the change in population densities that are forecast in the period 2030 to 2050. Most of the study area to the west of the airport is expected to have population growth in the range 0-500 people/km^2, apart from the around Eton where a reduction in population is forecast. This is due to a single postcode point associated with a large population which is present in the 2030 forecast but not in the 2050 forecast.

Again, it is generally the most populous areas that are forecast to have the greatest population increases; the areas to the east of the airport identified above as having higher population densities all show greater increases than in the remaining parts of the study area. The population exposure metrics for 2050 can therefore be expected to be particularly sensitive to any changes in contour areas towards the eastern extent of the study area.

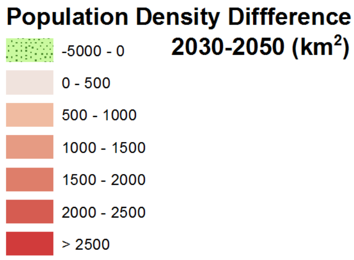
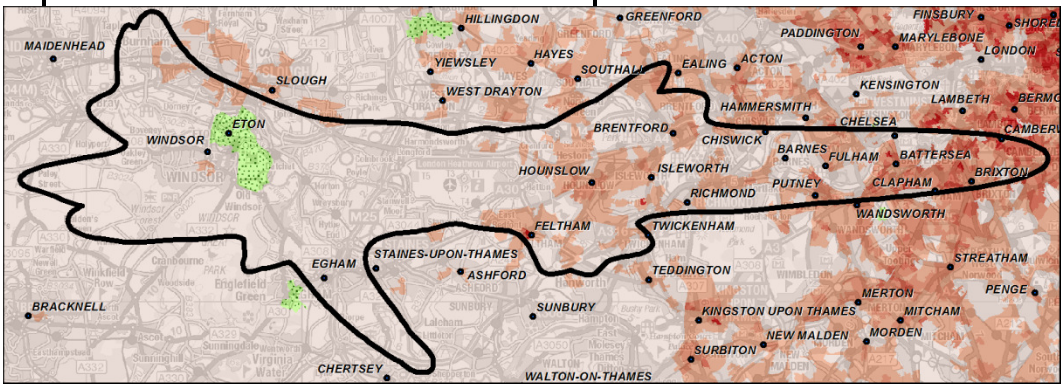


Figure 5.3 : 2030 vs 2050 Difference in Population Densities around Heathrow Airport



5.3 Noise Levels

As the Heathrow ENR scheme is an independent proposal for Heathrow Airport, the current and future year DM scenarios in the absence of the scheme are the identical to those described in Sections 4.3 to 4.8 of this report for the Heathrow Airport Northwest Runway option.

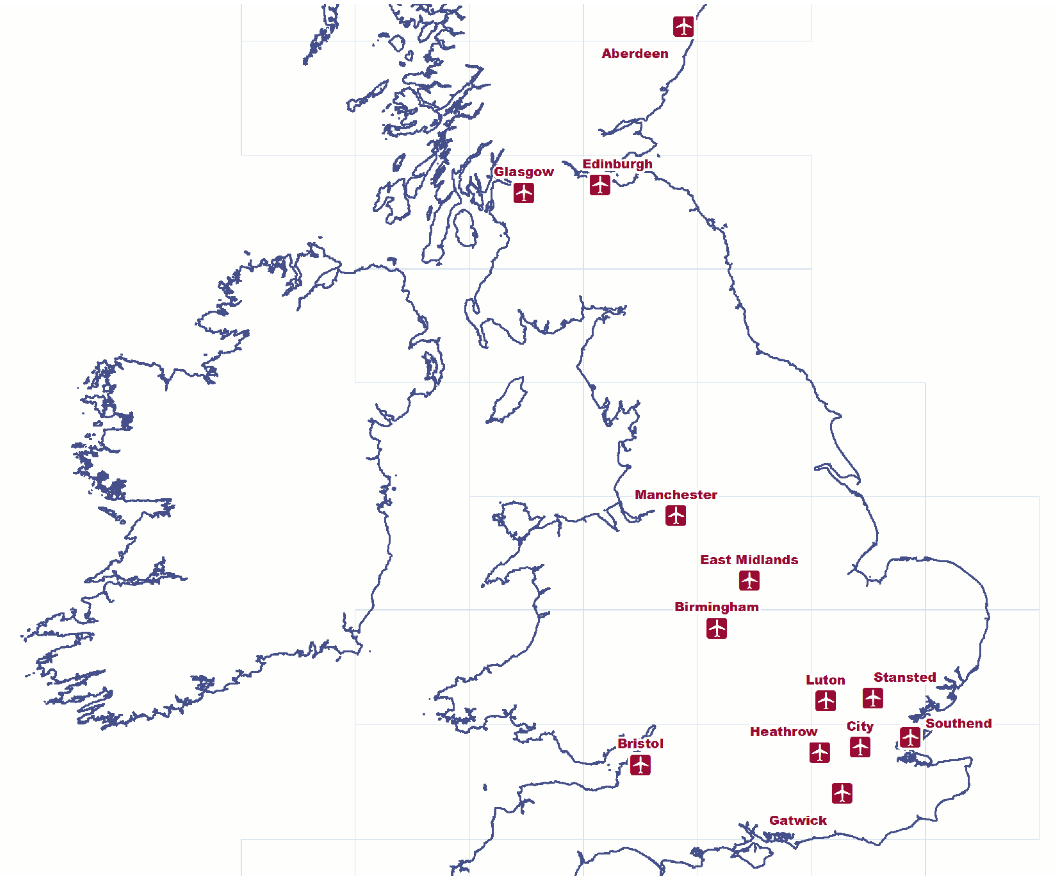
6 National Noise Baseline

This section of the report documents the noise exposure associated with the current and DM scenarios at 13 airports around the UK, to provide an indication of how noise levels might develop in the absence of a runway scheme.

6.1 Study Area

The study area for the National Noise Assessment comprises the areas covered by the noise contours around thirteen selected airports, which are shown in Figure 6.1 below (please note that "London" has been omitted from the names of the airports in the south-east for clarity of labelling).

Figure 6.1 : National Noise Assessment Study Area



6.2 Noise Metrics

The following sections detail the calculated $L_{Aeq,16h}$ (average summer's day) $L_{Aeq,8h}$ (average summer's night) and L_{den} (average annual day-evening-night) metrics for each region, and in total, for the current and DM scenarios. A breakdown per airport is provided within Appendix D.

6.2.1 Current Noise Levels

Table 6.1 : 2013 Current National Noise Exposures

Period	Metric	Noise Contour Areas, km^2			
		Scottish	English Regional	London Terminal Management Area	Total
Day	>54 dB $L_{Aeq,16h}$	39,900	97,700	717,450	855,050
	>57 dB $L_{Aeq,16h}$	13,000	51,400	299,050	363,450
	>60 dB $L_{Aeq,16h}$	4,450	17,150	130,500	152,100
	>63 dB $L_{Aeq,16h}$	450	4,300	50,350	55,100
	>66 dB $L_{Aeq,16h}$	0	950	14,800	15,750
	>69 dB $L_{Aeq,16h}$	0	50	3,400	3,450
	>72 dB $L_{Aeq,16h}$	0	0	200	200
Night	>48 dB $L_{Aeq,8h}$	27,150	105,100	446,700	578,950
	>51 dB $L_{Aeq,8h}$	8,950	54,850	200,800	264,600
	>54 dB $L_{Aeq,8h}$	2,650	17,750	106,550	126,950
	>57 dB $L_{Aeq,8h}$	450	4,500	48,800	53,750
	>60 dB $L_{Aeq,8h}$	0	1,350	16,850	18,200
	>63 dB $L_{Aeq,8h}$	0	300	4,550	4,850
	>66 dB $L_{Aeq,8h}$	0	0	1,600	1,600
	>69 dB $L_{Aeq,8h}$	0	0	0	0
	>72 dB $L_{Aeq,8h}$	0	0	0	0
24-hour	>55 dB L_{den}	47,100	132,700	826,200	1,006,000
	>60 dB L_{den}	6,600	35,700	206,300	248,600
	>65 dB L_{den}	200	4,600	54,900	59,700
	>70 dB L_{den}	0	0	6,600	6,600
	>75 dB L_{den}	0	0	100	100

For the current situation, the total number of people within each contour are set out below:

- >57 dB $L_{Aeq,16h}$ = 363,450
- >48 dB $L_{Aeq,8h}$ = 578,950
- >55 dB L_{den} = 1,006,000

6.2.2 2030 Do-Minimum

Table 6.2 : 2030 DM National Noise Exposures

Period	Metric	Noise Contour Areas, km^2			
		Scottish	English Regional	London Terminal Management Area	Total
Day	>54 dB $L_{Aeq,16h}$	42,050	108,300	607,550	757,900
	>57 dB $L_{Aeq,16h}$	14,250	57,500	269,000	340,750
	>60 dB $L_{Aeq,16h}$	5,450	24,650	125,100	155,200
	>63 dB $L_{Aeq,16h}$	500	4,650	38,750	43,900
	>66 dB $L_{Aeq,16h}$	50	1,400	8,900	10,350
	>69 dB $L_{Aeq,16h}$	0	150	2,300	2,450
	>72 dB $L_{Aeq,16h}$	0	0	0	0
Night	>48 dB $L_{Aeq,8h}$	26,850	115,750	306,500	449,100
	>51 dB $L_{Aeq,8h}$	9,050	62,650	165,950	237,650
	>54 dB $L_{Aeq,8h}$	3,200	21,850	65,000	90,050
	>57 dB $L_{Aeq,8h}$	450	4,550	22,750	27,750
	>60 dB $L_{Aeq,8h}$	0	1,950	4,300	6,250
	>63 dB $L_{Aeq,8h}$	0	350	1,600	1,950
	>66 dB $L_{Aeq,8h}$	0	0	0	0
	>69 dB $L_{Aeq,8h}$	0	0	0	0
	>72 dB $L_{Aeq,8h}$	0	0	0	0
24-hour	>55 dB L_{den}	52,400	142,450	683,900	878,750
	>60 dB L_{den}	8,650	44,250	191,100	244,000
	>65 dB L_{den}	450	4,450	36,550	41,450
	>70 dB L_{den}	0	400	3,200	3,600
	>75 dB L_{den}	0	0	0	0

For the 2030 DM situation, the total number of people within each contour are set out below:

- >57 dB $L_{Aeq,16h}$ a population of 340,750
- >48 dB $L_{Aeq,8h}$ a population of 449,100
- >55 dB L_{den} a population of 878,750

6.2.3 Current vs 2030 Do-Minimum

Table 6.3 : 2013 Current vs 2030 DM National Noise Exposures

Period	Metric	Noise Contour Areas, km[2]			
		Scottish	English Regional	London Terminal Management Area	Total
Day	>54 dB $L_{Aeq,16h}$	2,150	10,600	(109,900)	(97,150)
	>57 dB $L_{Aeq,16h}$	1,250	6,100	(30,050)	(22,700)
	>60 dB $L_{Aeq,16h}$	1,000	7,500	(5,400)	3,100
	>63 dB $L_{Aeq,16h}$	(50)	350	(11,600)	(11,300)
	>66 dB $L_{Aeq,16h}$	0	450	(5,800)	(5,350)
	>69 dB $L_{Aeq,16h}$	0	100	(1,100)	(1,000)
	>72 dB $L_{Aeq,16h}$	0	50	(100)	(50)
Night	>48 dB $L_{Aeq,8h}$	(300)	10,650	(140,200)	(129,850)
	>51 dB $L_{Aeq,8h}$	100	7,800	(34,850)	(26,950)
	>54 dB $L_{Aeq,8h}$	550	4,100	(41,550)	(36,900)
	>57 dB $L_{Aeq,8h}$	0	100	(26,050)	(25,950)
	>60 dB $L_{Aeq,8h}$	0	600	(12,500)	(11,900)
	>63 dB $L_{Aeq,8h}$	0	50	(2,950)	(2,900)
	>66 dB $L_{Aeq,8h}$	0	50	(1,500)	(1,450)
	>69 dB $L_{Aeq,8h}$	0	0	50	50
	>72 dB $L_{Aeq,8h}$	0	0	50	50
24-hour	>55 dB L_{den}	5,300	9,750	(142,300)	(127,250)
	>60 dB L_{den}	2,050	8,550	(15,200)	(4,600)
	>65 dB L_{den}	200	(250)	(18,400)	(18,450)
	>70 dB L_{den}	0	0	(3,600)	(3,600)
	>75 dB L_{den}	0	0	0	0

The national population predicted to be exposed to average summer daytime noise levels of at least 57 dB $L_{Aeq,16h}$ in 2030 is 22,700 less than in the current scenario. The number of people exposed to night-time noise levels of at least 48 dB $L_{Aeq,8h}$ is forecast to reduce by 129,850, while a reduction of 127,250 people exposed to noise levels of at least 55 dB L_{den} is expected.

These reductions are due to improvements in aircraft technology offsetting an increase of 390,000 ATMs nationally.

6.2.4 2040 Do-Minimum

Table 6.4 : 2040 DM National Noise Exposures

Period	Metric	Population Noise Exposure			
		Scottish	English Regional	London Terminal Management Area	Total
Day	>54 dB $L_{Aeq,16h}$	49,300	125,400	570,250	744,950
	>57 dB $L_{Aeq,16h}$	15,700	67,000	263,700	346,400
	>60 dB $L_{Aeq,16h}$	5,700	29,950	119,700	155,350
	>63 dB $L_{Aeq,16h}$	500	7,300	36,700	44,500
	>66 dB $L_{Aeq,16h}$	0	1,950	7,700	9,650
	>69 dB $L_{Aeq,16h}$	0	300	2,300	2,600
	>72 dB $L_{Aeq,16h}$	0	0	0	0
Night	>48 dB $L_{Aeq,8h}$	29,250	132,450	371,950	533,650
	>51 dB $L_{Aeq,8h}$	9,550	73,000	200,250	282,800
	>54 dB $L_{Aeq,8h}$	3,500	28,300	85,350	117,150
	>57 dB $L_{Aeq,8h}$	450	6,150	32,250	38,850
	>60 dB $L_{Aeq,8h}$	0	2,150	6,850	9,000
	>63 dB $L_{Aeq,8h}$	0	400	2,700	3,100
	>66 dB $L_{Aeq,8h}$	0	0	0	0
	>69 dB $L_{Aeq,8h}$	0	0	0	0
	>72 dB $L_{Aeq,8h}$	0	0	0	0
24-hour	>55 dB L_{den}	63,300	163,150	692,650	919,100
	>60 dB L_{den}	9,200	53,000	200,700	262,900
	>65 dB L_{den}	450	6,200	38,200	44,850
	>70 dB L_{den}	0	700	3,300	4,000
	>75 dB L_{den}	0	0	0	0

For the 2030 DM situation, the total number of people within each contour are set out below:

- >57 dB $L_{Aeq,16h}$ a population of 346,400
- >48 dB $L_{Aeq,8h}$ a population of 533,650
- >55 dB L_{den} a population of 919,100

6.2.5 2030 Do-Minimum vs 2040 Do-Minimum

Table 6.5 : 2030 DM vs 2040 DM National Noise Exposures

Period	Metric	Population Noise Exposure			
		Scottish	English Regional	London Terminal Management Area	Total
Day	>54 dB $L_{Aeq,16h}$	7,250	17,100	(37,300)	(12,950)
	>57 dB $L_{Aeq,16h}$	1,450	9,500	(5,300)	5,650
	>60 dB $L_{Aeq,16h}$	250	5,300	(5,400)	150
	>63 dB $L_{Aeq,16h}$	0	2,700	(2,100)	600
	>66 dB $L_{Aeq,16h}$	0	550	(1,250)	(700)
	>69 dB $L_{Aeq,16h}$	0	150	0	150
	>72 dB $L_{Aeq,16h}$	0	0	0	0
Night	>48 dB $L_{Aeq,8h}$	2,400	16,700	65,450	84,550
	>51 dB $L_{Aeq,8h}$	500	10,350	34,300	45,150
	>54 dB $L_{Aeq,8h}$	300	6,450	20,350	27,100
	>57 dB $L_{Aeq,8h}$	0	1,600	9,500	11,100
	>60 dB $L_{Aeq,8h}$	0	200	2,550	2,750
	>63 dB $L_{Aeq,8h}$	0	50	1,100	1,150
	>66 dB $L_{Aeq,8h}$	0	0	0	0
	>69 dB $L_{Aeq,8h}$	0	0	0	0
	>72 dB $L_{Aeq,8h}$	0	0	0	0
24-hour	>55 dB L_{den}	10,900	20,700	8,750	40,350
	>60 dB L_{den}	550	8,750	9,600	18,900
	>65 dB L_{den}	0	1,800	1,600	3,400
	>70 dB L_{den}	0	300	100	400
	>75 dB L_{den}	0	50	0	50

The national population predicted to be exposed to average summer daytime noise levels of at least 57 dB $L_{Aeq,16h}$ in 2040 is 5,650 more than in the 2030 DM scenario. The number of people exposed to night-time noise levels of at least 48 dB $L_{Aeq,8h}$ is forecast to increase by 84,550, while an increase of 40,350 people exposed to noise levels of at least 55 dB L_{den} is expected.

These increases are due to an increase of 150,000 ATMs nationally.

6.2.6 2050 Do-Minimum

Table 6.6 : 2050 DM National Noise Exposures

Period	Metric	Population Noise Exposure			
		Scottish	English Regional	London Terminal Management Area	Total
Day	>54 dB $L_{Aeq,16h}$	56,600	155,050	533,500	745,150
	>57 dB $L_{Aeq,16h}$	17,700	82,400	256,950	357,050
	>60 dB $L_{Aeq,16h}$	6,150	37,700	114,850	158,700
	>63 dB $L_{Aeq,16h}$	500	10,600	36,750	47,850
	>66 dB $L_{Aeq,16h}$	0	2,450	8,100	10,550
	>69 dB $L_{Aeq,16h}$	0	700	2,350	3,050
	>72 dB $L_{Aeq,16h}$	0	0	0	0
Night	>48 dB $L_{Aeq,8h}$	31,050	158,000	405,450	594,500
	>51 dB $L_{Aeq,8h}$	10,400	86,950	211,200	308,550
	>54 dB $L_{Aeq,8h}$	3,900	36,800	93,150	133,850
	>57 dB $L_{Aeq,8h}$	450	9,300	34,800	44,550
	>60 dB $L_{Aeq,8h}$	0	2,550	7,550	10,100
	>63 dB $L_{Aeq,8h}$	0	650	2,900	3,550
	>66 dB $L_{Aeq,8h}$	0	0	0	0
	>69 dB $L_{Aeq,8h}$	0	0	0	0
	>72 dB $L_{Aeq,8h}$	0	0	0	0
24-hour	>55 dB L_{den}	69,650	197,600	678,450	945,700
	>60 dB L_{den}	9,600	66,750	198,750	275,100
	>65 dB L_{den}	450	10,250	37,800	48,500
	>70 dB L_{den}	0	1,350	3,350	4,700
	>75 dB L_{den}	0	0	0	0

For the 2030 DM situation, the total number of people within each contour are set out below:

- >57 dB $L_{Aeq,16h}$ a population of 357,050
- >48 dB $L_{Aeq,8h}$ a population of 594,500
- >55 dB L_{den} a population of 945,700

6.2.7 2040 Do-Minimum vs 2050 Do-Minimum

Table 6.7 : 2040 DM vs 2050 DM National Noise Exposures

Period	Metric	Population Noise Exposure			
		Scottish	English Regional	London Terminal Management Area	Total
Day	>54 dB $L_{Aeq,16h}$	7,300	29,650	(36,750)	200
	>57 dB $L_{Aeq,16h}$	2,000	15,400	(6,750)	10,650
	>60 dB $L_{Aeq,16h}$	450	7,750	(4,850)	3,350
	>63 dB $L_{Aeq,16h}$	0	3,250	100	3,350
	>66 dB $L_{Aeq,16h}$	0	550	400	950
	>69 dB $L_{Aeq,16h}$	0	400	50	450
	>72 dB $L_{Aeq,16h}$	0	0	0	0
Night	>48 dB $L_{Aeq,8h}$	1,800	25,550	33,500	60,850
	>51 dB $L_{Aeq,8h}$	850	13,950	10,950	25,750
	>54 dB $L_{Aeq,8h}$	400	8,500	7,800	16,700
	>57 dB $L_{Aeq,8h}$	0	3,150	2,550	5,700
	>60 dB $L_{Aeq,8h}$	0	450	650	1,100
	>63 dB $L_{Aeq,8h}$	0	250	200	450
	>66 dB $L_{Aeq,8h}$	0	0	0	0
	>69 dB $L_{Aeq,8h}$	0	0	0	0
	>72 dB $L_{Aeq,8h}$	0	0	0	0
24-hour	>55 dB L_{den}	6,350	34,450	(14,200)	26,600
	>60 dB L_{den}	400	13,750	(1,950)	12,200
	>65 dB L_{den}	0	4,050	(400)	3,650
	>70 dB L_{den}	0	650	50	700
	>75 dB L_{den}	0	0	0	0

The national population predicted to be exposed to average summer daytime noise levels of at least 57 dB $L_{Aeq,16h}$ in 2050 is 10,650 more than in the 2040 DM scenario. The number of people exposed to night-time noise levels of at least 48 dB $L_{Aeq,8h}$ is forecast to increase by 60,850, while an increase of 26,600 people exposed to noise levels of at least 55 dB L_{den} is expected.

These increases are due to an increase of 180,000 ATMs nationally.

6.2.8 Current vs 2050 Do-Minimum

Table 6.8 : Current vs 2050 DM National Noise Exposures

Period	Metric	Population Noise Exposure			
		Scottish	English Regional	London Terminal Management Area	Total
Day	>54 dB $L_{Aeq,16h}$	16,700	57,350	(183,950)	(109,900)
	>57 dB $L_{Aeq,16h}$	4,700	31,000	(42,100)	(6,400)
	>60 dB $L_{Aeq,16h}$	1,700	20,550	(15,650)	6,600
	>63 dB $L_{Aeq,16h}$	(50)	6,300	(13,600)	(7,350)
	>66 dB $L_{Aeq,16h}$	0	1,550	(6,650)	(5,100)
	>69 dB $L_{Aeq,16h}$	0	650	(1,050)	(400)
	>72 dB $L_{Aeq,16h}$	0	50	(100)	(50)
Night	>48 dB $L_{Aeq,8h}$	3,900	52,900	(41,250)	15,550
	>51 dB $L_{Aeq,8h}$	1,450	32,100	10,400	43,950
	>54 dB $L_{Aeq,8h}$	1,250	19,050	(13,400)	6,900
	>57 dB $L_{Aeq,8h}$	0	4,850	(14,000)	(9,150)
	>60 dB $L_{Aeq,8h}$	0	1,250	(9,300)	(8,050)
	>63 dB $L_{Aeq,8h}$	0	350	(1,650)	(1,300)
	>66 dB $L_{Aeq,8h}$	0	50	(1,500)	(1,450)
	>69 dB $L_{Aeq,8h}$	0	0	50	50
	>72 dB $L_{Aeq,8h}$	0	0	50	50
24-hour	>55 dB L_{den}	22,550	64,900	(147,750)	(60,300)
	>60 dB L_{den}	3,000	31,050	(7,550)	26,500
	>65 dB L_{den}	200	5,600	(17,200)	(11,400)
	>70 dB L_{den}	0	950	(3,450)	(2,500)
	>75 dB L_{den}	0	50	0	50

The national population predicted to be exposed to average summer daytime noise levels of at least 57 dB $L_{Aeq,16h}$ in 2050 is 6,400 less than in the current scenario. The number of people exposed to night-time noise levels of at least 48 dB $L_{Aeq,8h}$ is forecast to increase by 15,550, while a reduction of 60,300 people exposed to noise levels of at least 55 dB L_{den} is expected.

These increases are primarily due to an increase of 720,000 ATMs nationally.

Glossary

Term	Description
Aircraft Movement	Any aircraft take-off or landing at an airport, including both commercial and non-commercial flights. Each landing or take-off is a separate movement.
ATM	Air Transport Movement. Landings or take-offs of aircraft engaged on the transport of passengers, freight or mail on commercial terms, including empty flights, charter and air taxi movements.
A-Weighted	This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Background Noise	
Broadband	Distributed over a wide section of the audible range.
CAA	Civil Aviation Authority
CRTN	Calculation of Road Traffic Noise
Day-evening-night Noise Indicator	A-Weighted Equivalent Continuous Noise Level evaluated over a 24-hour period, with a 10 dB penalty for night-time levels (23.00 – 07.00) and a 5 dB penalty for the evening period (19.00 – 23.00) to reflect peoples enhanced sensitivity to noise during the evening and night. This is the preferred EU noise indicator for aircraft noise exposure.
dB	Abbreviation of decibel.
DM	Do-Minimum
ERCD	Environmental Research and Consultancy Department of the Civil Aviation Authority.
Equivalent Continuous Sound Level	The Equivalent Continuous Sound Pressure Level is the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
FAS	Future Airspace Strategy
L_{Aeq}	A-weighted Equivalent Continuous Sound Level
$L_{AS,max}$	A-weighted Maximum sound level measured with the Slow (1s) response time.
L_{DEN} or L_{den}	See: Day-evening-night Noise Indicator
N60	Number of noise events above 60 dB $L_{AS,max}$.
N70	Number of noise events above 70 dB $L_{AS,max}$.

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Appendix A Methodology

This Appendix covers an outline of the methodology used to:

- predict aviation noise levels at Gatwick and Heathrow airports
- predict ground noise levels at Gatwick and Heathrow airports
- predict aviation noise levels at 11 other UK airports

The section also describes the population data that has been used by the Local and National noise studies, and explains how it is used to derive population noise exposure estimates.

A.1 Local Noise

The purpose of the Local Noise Assessment is to consider the three shortlisted schemes in detail. The shortlisted schemes are based at Gatwick and Heathrow airports, so noise exposure contours metrics have been calculated by the Environmental Research and Consultancy Division (ERCD) of the Civil Aviation Authority (CAA) for these airports. This report considers the contours and noise metrics calculated by ERCD for the current situation, 2030 DM, 2040 DM and 2050 DM scenarios, and the differences between them which indicate how noise exposure will develop in the absence of a runway scheme.

The noise metrics calculated for each scenario are based on the requirements of appraisal module 5: 'Noise' and comprise:

- $L_{Aeq,16h}$ noise contours from 54 dB to 72 dB, in 3 dB intervals;
- $L_{Aeq,8h}$ noise contours from 48 dB to 72 dB, in 3 dB intervals;
- L_{den} (Day-Evening-Night level) noise contours from 55 dB to 75 dB, in 5 dB intervals;
- N70 (16-hour average day) contours (>20 to >500); and
- N60 (8-hour average night) contours (>25 to >500).

The first three of the metrics above are 'exposure' metrics, which are used to provide a description of the noise exposure experienced over a given time period. L_{Aeq} based metrics take into account the number of noise events, the noise energy and duration of those events.

The $L_{Aeq,16h}$ metric is evaluated over an average summer's day, from 07.00 to 23.00 hours. This metric was first adopted by Government in 1990, which defined the 57 dB $L_{Aeq,16h}$ contour as being broadly equivalent to the onset of annoyance. In respect of this metric, ERCD Report 0705 states:

"It has become general usage to describe 57, 63 and 69 dBA L_{eq} [dB $L_{Aeq,16h}$] as denoting low, medium and high community annoyance respectively, whilst noting that 57 dBA L_{eq} [dB $L_{Aeq,16h}$] is also taken to describe the onset of significant community annoyance".

The $L_{Aeq,8h}$ metric is evaluated over an average summer's night, from 23.00 to 07.00 hours. Historically the level of 48 dB $L_{Aeq,8h}$ was a threshold in planning; at levels below this, new noise sensitive development was not subject to any planning conditions in respect of noise. This threshold is compatible with achieving an internal level of 35 dB $L_{Aeq,8h}$ which is recommended in the World Health Organisation's (WHO) "Guidelines for Community Noise" (WHO, 1999) in order to "preserve the restorative powers of sleep with partially open windows". More recently, the WHO has set out in their Night Noise Guidelines for Europe (WHO, 2009) a feasibility based interim target of 55 dB $L_{Aeq,8h}$, above which cardiovascular effects become the major public health concern.

The L_{den} metric is a 24-hour measure with a +5 dB weighting applied to noise occurring in the evening period (19.00 to 23.00) and a +10 dB weighting applied to noise occurring overnight (23.00 to 07.00), when it is considered that peoples sensitivities are heightened. The L_{den} metric is the European Union (EU) policy indicator, whereby people exposed to 55 dB or more are considered to be affected by aircraft noise[11].

In addition to the exposure metrics, two supplementary noise metrics are also provided for each scenario; the N70 and N60. These relate to the number of noise events above 70 dB $L_{AS,max}$ during the daytime (07.00 to 23.00) and 60 dB $L_{AS,max}$ during the night-time (23.00 to 07.00).

These metrics are presented using a 'scorecard' approach in the body of this report.

(a) Computer Models

For the Local Noise Assessment, noise contours were calculated by the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) on behalf of the Airports Commission. These noise contours were calculated using the UK civil aircraft noise model ANCON (version 2.3) which is developed and maintained by ERCD on behalf of the Department for Transport (DfT).

ANCON is fully compliant with the latest European guidance on noise modelling, ECAC.CEAC Doc 29 (3rd edition), published in December 2005.

Noise predictions and the subsequent estimations of population noise exposure are very sensitive to the following input data:

- The assumed number of Air Transport Movements[12] (ATM) and associated aircraft fleet mix;
- Arrival and departure flight paths, threshold displacements[13], approach path angles, take-off power and climb rates;
- The allocation of ATMs to runways and flight tracks;
- Runway modal split[14] assumptions; and,
- The population data used to calculate numbers of persons and households exposed to the various noise metrics.

[11] Civil Aviation Authority Environmental Research and Consultancy Department, Noise Analysis: Stansted (Revision D issued: 25 September 2013)
[12] Also referred to as Air Traffic Movements
[13] The threshold is the part of the runway where an aircraft lands / takes off. Displacement moves this further along the runway inside the airport boundary, with the result that approaches and take-offs are at a greater height above neighbouring communities.
[14] Runway modal split refers to the proportion of use for landing or take off, or both.

The noise contours and population exposure for the current scenarios are based on radar track data of aircraft movements over the 92-day summer period at each airport. For each type of aircraft within ANCON, average flight profiles of height, speed and thrust were reviewed, and if necessary adjusted to match the radar data.

For the DM scenarios, ERCD has calculated the noise contours and population exposure based on Airport Commission Demand Forecast 2014 (Passenger forecast and ATM numbers) and conservative fleet mix assumptions for each airport, which are presented in the following sections of this report.

(b) Air Transport Movements

ERCD calculates noise exposure contours annually for Gatwick and Heathrow Airports, based on radar track data of all summer period aircraft movements.

The $L_{Aeq,16h}$, $L_{Aeq,8h}$, N70 and N60 metrics for the current situation are based on the 2013 noise exposure contours calculated by ERCD, which are the most recently calculated. However, L_{den} contours are produced at 5-year intervals to meet the requirements of the Environmental Noise (England) Regulations 2006 (UK Government, 2006). These contours were last calculated for 2011. The current metrics therefore a combination of outputs from the 2011 and 2013 models prepared by ERCD. It should also be noted that the L_{den} metrics used by the EU relate to an annual average day, rather than an average summer's day which is traditionally used in the UK.

For 2030 and beyond, the noise models are based on the ATMs arising from the Airport Commission Demand Forecast 2014 for DM passenger numbers. The ATM forecasts have been broken down into a schedule of arrivals and departures with specific aircraft types flying along certain Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs) at specified times of the day by LeighFisher Limited, on behalf of the Airports Commission. The methodology used by LeighFisher to do this is documented in Appendix B.

The forecasts only include air transport movements[15], but this is not expected to significantly affect the predicted noise exposures. Table **0.1** below shows the annual aircraft movements used to inform the current and DM noise models. The top section of the table indicates the assessment year for which each noise metric has been calculated.

[15] Not all aircraft movements at airports are classified as ATMs; aircraft movements will include aspects of air taxi, aircraft positioning and emergency flights for example. It has not been possible to estimate non-ATM aircraft movements in the future, but their additional impact is not considered significant. In 2013 the percentage of ATMs to aircraft movements was 99.5% at LHR and 97.5% at LGW (source: CAA UK Airport Statistics 2013 Annual, Table 03 1 Aircraft Movements 2013).

Table 0.1 : Annual Aircraft Movements for current and DM scenarios.

	Annual Aircraft Movements				
	2011	2013	2030	2040	2050
Metric					
$L_{Aeq,16h}$		✓	✓	✓	✓
N70		✓	✓	✓	✓
$L_{Aeq,8h}$		✓	✓	✓	✓
N60		✓	✓	✓	✓
L_{den}	✓		✓	✓	✓
Airport					
Gatwick	251,067	250,520	277,919	280,633	285,420
Heathrow	480,906	471,936	483,856	484,517	471,132

(c) Fleet Mix

As a result of technological advances, aircraft produced today are considerably quieter than those of 50 years ago[16], and this trend is expected to continue. The Sustainable Aviation Noise Road-Map[17] defines three generations of aircraft and sets out assumptions concerning the noise emissions of each generation:

- ***'Current'*** Aircraft represent the Chapter 3/4 aircraft which are already established in service. The noise characteristics of these aircraft are well defined;
- ***'Imminent'*** Aircraft (Generation 1 Aircraft) are already entering service or are currently offered for sale to the market (including all-new aircraft as well as re-engined aircraft). The noise characteristics of these aircraft are well defined; and,
- ***'Future'*** Aircraft (Generation 2 Aircraft) are currently being developed. The technology and design of these aircraft is yet to be realised, and their noise characteristics are subject to significant uncertainty. However, a current forecast of -0.1dB per annum improvement in noise emissions for these aircraft is adopted in the Sustainable Aviation Noise Road-Map.

The assumed transitions from the existing aircraft fleet mixes, which are predominantly 'current' generation, to higher proportions of Generation 1 and Generation 2 aircraft for the DM noise models are set out in Table **0.2** below. The 2030 to 2050 figures are derived from the Airport Commission Demand Forecast 2014 for DM passenger numbers.

Table 0.2 : Aircraft fleet mixes used in Local DM noise models

Airport	Aircraft Generation	Year		
		2030	2040	2050
Gatwick Airport	current	29%	11%	9%
	Generation 1	70%	83%	50%
	Generation 2	0%	6%	40%
Heathrow Airport	current	32%	13%	4%
	Generation 1	67%	76%	33%
	Generation 2	0%	10%	63%

Note: Totals may not add up to 100% due to rounding

[16] ICAO, 2010. International Civil Aviation Organisation Environmental Report 2010.
[17] www.sustainableaviation.co.uk

(d) Ground Noise

Ground noise is the noise due to aircraft taxiing and manoeuvring on the runways and aprons, and from other ground-side noise sources including:

- aircraft auxiliary power units;
- aircraft engine ground running;
- ground support vehicles, and
- engine test facilities.

There is no definitive agreement on the method of assessment of aircraft ground noise impact. Various methods have been adopted in the past, and these have led to the assessment of ground noise in terms of the equivalent continuous sound level, $L_{Aeq,T}$. Various time periods have been used, and in this report consideration has been given to the $L_{Aeq,16h}$ metric for the daytime period: 0700-2300h.

The ground noise level assessed at various receptors can be compared to the existing ambient environmental noise and published guidelines for the assessment of environmental noise. The World Health Organisation (WHO) recommends a guideline value of 50 dB $L_{Aeq,16h}$ to prevent “moderate” community annoyance and 55 dB $L_{Aeq,16h}$ for “serious” community annoyance. The 55 dB $L_{Aeq,16h}$ guideline is comparable to the daytime aircraft noise level of 57 dB $L_{Aeq,16h}$ in the current Aviation Policy Framework where it is treated as marking the approximate onset of significant community annoyance.

For Gatwick and Heathrow airports, consideration has been given to their current layouts for both the current (2013) and DM analysis, including the location of aprons, taxiways and runways.

Using the airport layouts the total amount of ground noise has been estimated, allowing for both the level of activity and the mix of aircraft types. This has then been converted into a broad and approximate noise exposed area, taking into account the airport layout, for which the population has been determined.
The methodology is presented in more detail in Appendix C.

A.2 National Noise

The national noise assessment considers the UK situation, and so it extends to a number of major airports including those whose development has been shortlisted. This is to give context to the noise exposure at the shortlisted airports and also to reflect the national implications should one of the shortlisted options proceed.

Ideally the national noise assessment would include all UK airports, but this is impractical. Therefore noise predictions have been limited to the UK’s twelve largest airports, plus one airport qualifying for other reasons, as this selection is considered to give a good indication of the national impact.

There are a number of ways to measure the largest airports, passenger numbers, movement numbers, and possibly even the population affected by them. For this appraisal the airports assessed are those with at least 50,000 air transport movements in 2011, and which were required to carry out noise mapping under the Environmental Noise Regulations that apply in England or Scotland. In addition, London Southend has been included as it has developed significantly since 2011 and, given its location, may be significantly affected by the shortlisted options.

The airports included in the national noise study are:

- Aberdeen
- Birmingham
- Bristol
- East Midlands
- Edinburgh
- Gatwick
- Glasgow
- Heathrow
- London City
- Luton
- Manchester
- Southend
- Stansted

The baseline noise predictions for these airports takes into account changes indicated in their respective master plans, the latest forecasts of future traffic, assessed noise characteristics of future aircraft, and the anticipated effects of population growth.

The noise metrics calculated for each scenario less extensive than for the Local Noise Assessment and comprise:

- $L_{Aeq,16h}$ noise contours from 54 dB to 72 dB, in 3 dB intervals;
- $L_{Aeq,8h}$ noise contours from 48 dB to 72 dB, in 3 dB intervals; and,
- L_{den} (Day-Evening-Night level) noise contours from 55 dB to 75 dB, in 5 dB intervals.

(a) Computer Models

The noise predictions undertaken for the short-listed options at Heathrow and Gatwick airports were prepared by ERCD using the Civil Aviation Authority's ANCON model.

The airborne aircraft noise predictions for the other airports considered by the national noise assessment were calculated by Bickerdike Allen Partners (BAP) using the publically available Federal Aviation Authority Integrated Noise Model (INM) Version 7.0d. This section provides a summary of the main inputs and parameters to the noise modelling undertaken by BAP, and further details are provided in the National Noise Assessment report.

INM is the most widely used model in the world for airborne aircraft noise prediction, and its core computation modules are compliant with international standards and documents including European Civil Aviation Conference (ECAC) Document 29 and International Civil Aviation Organization (ICAO) Circular 205. INM will not, however, produce identical results to the ANCON model used for the local noise assessments, although reasonable agreement between the models can generally be expected.

The following inputs have been adopted for the INM noise models:

- Default meteorological parameters: an air temperature of 25°C, atmospheric pressure of 760 mm Hg, and a headwind of 8 nm/h (4.1 m/s).

- Flat, acoustically absorbent (porous) ground is assumed around the airports.
- INM standard flight profiles are used (except for London City arrivals).
- INM aircraft substitutions are used, subject to modifications as used by CAA for noise performance of new quieter types.
- Aircraft movements are provided by the Commission.
- The relationship between aircraft movements on annual summer’s days and annual average days is based on historical data for each airport.
- Daily traffic distribution assumes 10% of aircraft movements occur during the night period 23:00-07:00, unless particular restrictions apply at an airport.
- Runway modal split obtained from historical data, or 75% has been assumed where annual modal split data is not available.
- Runways, arrival and departure routes are taken to be as currently published in the UK Aeronautical Information Publication (AIP), with the exception of the assessment of Birmingham Airport in 2013 which was taken from an earlier version of the AIP as the recent runway extension was not completed in 2013.
- Arrival routes are all assumed to be straight, following the centreline of the runway. Approach slopes are assumed to be 3°, unless otherwise specified in the airport’s AIP entry.

Further detail on the INM aircraft noise modelling are available in Appendix B of the Aviation Noise National Report (Jacobs, October 2014).

(b) Air Transport Movements

Actual annual movement numbers by aircraft type for 2013 have been provided by the DfT.

Forecast annual movement numbers by aircraft type have been provided by the Airports Commission for each scenario for 2030, 2040, and 2050. For the baseline “Do Minimum” scenarios, forecasts have been provided both on the basis of “carbon traded” and “carbon capped”. For the developed scenarios, only a “carbon capped” forecast has been provided. Therefore the “carbon capped” forecasts have been used in all DM scenarios to allow for direct comparison.

The forecasts only include air transport movements[18]. Therefore these forecasts represent an underestimation of the total air traffic in the future. This is not expected to significantly affect the national exposure, although it may have a significant effect on some of the smaller airports where a large proportion of the movements are made up of general aviation or business aviation aircraft.

Estimates of the annual ATM have provided by the Airports Commission, and are presented in Table **0.3** below.

[18] Not all aircraft movements at airports are classified as ATMs; aircraft movements will include aspects of air taxi, aircraft positioning and emergency flights for example. It has not been possible to estimate non-ATM aircraft movements in the future, but their additional impact is not considered significant. In 2013 the percentage of ATMs to aircraft movements was 99.5% at LHR and 97.5% at LGW (source: CAA UK Airport Statistics 2013 Annual, Table 03 1 Aircraft Movements 2013).

Table 0.3 : Approximate National ATMs for Baseline Scenarios

Year	Approximate National ATMs
Current (2013)	1,590,000
2030 DM	1,980,000
2040 DM	2,130,000
2050 DM	2,310,000

The movement numbers provided give annual totals by aircraft type. Typically in the UK there is a summer peak to reflect the holiday season; therefore the average summer day will often be busier than the average annual day. For each airport assessed using INM, the historical average of the ratio between summer and annual movements over the period 2004-2013 has been applied. This has been determined from UK Airport Statistics published by the CAA, on the basis of an even spread of traffic during the months of July and September. The summer total ranges between 25% and 29% of the annual total depending on the airport. This summer factor has been applied equally to each aircraft type.

The movement numbers provided only include 24 hour totals. Unless there are operating restrictions on the airport (e.g. it is closed for part/all of the night time period) then it has been assumed that 70% of the activity, split equally by type and operation, occurs during the daytime period, 20% of the activity occurs during the evening period and the remaining 10% occurs during the night time period.

(c) Fleet Mix

The INM software contains a database of aircraft, however there are a number of *imminent* and *future* aircraft types in the forecasts which have not yet entered service. These have been modelled by using an existing similar aircraft as a surrogate type and adjusting the noise levels as required, for arrivals and departures separately. The surrogate types and adjustments are based on the assumptions made by the CAA for their modelling of London Heathrow and London Gatwick airports.

A summary of the aircraft generations forecast at each airport for the DM scenarios is provided in Table **A.1** below, derived from the Assessment of Need carbon capped scenario Airport Commission Demand Forecast 2014. In all cases this shows a progression towards quieter aircraft types over time, with Generation 2 aircraft first appearing in the 2040 forecasts.

Table A.4 : Aircraft fleet mixes used in National DM noise models

Airport	Aircraft Generation	2030	2040	2050
Aberdeen	current	84%	68%	63%
	Generation 1	16%	24%	15%
	Generation 2	0%	9%	22%
Birmingham	current	50%	22%	16%
	Generation 1	50%	67%	43%
	Generation 2	0%	11%	41%
Bristol	current	32%	9%	7%
	Generation 1	68%	84%	58%
	Generation 2	0%	7%	35%
East Midlands	current	37%	24%	21%
	Generation 1	63%	75%	57%
	Generation 2	0%	2%	22%
Edinburgh	current	41%	22%	20%
	Generation 1	59%	70%	42%
	Generation 2	0%	8%	38%
Gatwick	current	26%	7%	4%
	Generation 1	74%	88%	54%
	Generation 2	0%	5%	42%
Glasgow	current	47%	28%	24%
	Generation 1	53%	63%	32%
	Generation 2	0%	9%	44%

Airport	Aircraft Generation	2030	2040	2050
Heathrow	current	29%	10%	3%
	Generation 1	71%	78%	31%
	Generation 2	0%	12%	66%
London City	current	58%	24%	17%
	Generation 1	42%	60%	37%
	Generation 2	0%	16%	46%
Luton	current	24%	6%	5%
	Generation 1	76%	89%	42%
	Generation 2	0%	5%	53%
Manchester	current	32%	13%	8%
	Generation 1	68%	79%	48%
	Generation 2	0%	8%	45%
Southend	current	15%	1%	0%
	Generation 1	85%	97%	73%
	Generation 2	0%	2%	26%
Stansted	current	18%	6%	5%
	Generation 1	82%	92%	68%
	Generation 2	0%	2%	27%

A.3 Population Data

The population data used for both the Local and National studies is derived from census information. Specifically, databases containing post codes and their corresponding populations have been supplied by CACI Ltd for 2011, 2013, 2030, 2040, and 2050. If the post code point lies within the threshold of a particular contour then the population value is included in the total count within the contour.

7 Appendix B Aircraft Movement Forecasts

APPRAISAL MODULE 5: NOISE

AVERAGE DAY FORECASTING METHODOLOGY

Prepared for

Airports Commission

29th October 2014

Leigh|Fisher

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1. INTRODUCTION

As part of the Airports Commission's appraisal process set forward in its Appraisal Framework Module 5, the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) has forecast noise exposure contours for the three proposals shortlisted by the Airports Commission. The ECRD was tasked with simulating aviation noise by modelling aircraft arrivals and departures utilising its Air Noise Contour (ANCON) model.

In order to conduct this simulation, the ECRD required forecasts of total annual air transport movements (ATMs) broken down into schedules of departures, allocated to Standard Instrument Departure routes (SIDs), and arrivals with specific aircraft types at specified times of the day. LeighFisher was retained to develop and provide this information based on the traffic forecasts provided by the Airports Commission.

This report describes the methodology and assumptions adopted to determine the following two average day summary tables:

- **Average day of the year**: representing the average number of movements of a whole calendar year created by summing every day's scheduled movements and dividing the total by 365. This drives the L_{den} and other metrics[1].
- **Average day of the summer**: similar to the above, but restricted to the summer period being from the 16th June to the 15th September (inclusive), equalling a period of 92 days. This drives the $LA_{eq,16h}$ and other metrics[1].

As several demand scenarios were developed by the Airports Commission, each scenario had a separate forecast number of movements. Chapter 2 provides an overview of the modelled scenarios and Chapter 3 details the methodology.

This report describes the methodology of the step between the annual forecasts and the noise modelling. Thus the output of this methodology was the input for the ERCD, for whose methodology and conclusions reference should be made to their report.

[1] See the ECRD report containing all relevant metrics.

2. OVERVIEW OF DEMAND SCENARIOS

The demand scenarios that were modelled in 2030, 2040 and 2050 for Gatwick Airport Second Runway, Heathrow Airport North West Runway and Heathrow Airport Extended Northern Runway are summarised in Table 1 below. Where applicable, the movements were capped to the capacity of the airport. In the ”without scheme” scenarios this was achieved through a daily ATM capacity (see Section 3.2.1) whereas for all “with scheme” scenarios an annual limit was established which was translated into a daily capacity limit: 560,000 ATMs (Gatwick Airport Second Runway), 740,000 ATMs (Heathrow Airport North West Runway) and 700,000 ATMs (Heathrow Airport Extended Northern Runway) respectively.

Table 1 - Overview of demand scenarios

<table>
<tr><th colspan="2">[movements]</th><th colspan="2">Gatwick Airport Second Runway</th><th>Heathrow Airport North West Runway</th><th>Heathrow Airport Extended Northern Runway</th></tr>
<tr><td rowspan="4">Do minimum</td><td>2030</td><td colspan="2">277,919</td><td colspan="2">483,856</td></tr>
<tr><td>2040</td><td colspan="2">280,633</td><td colspan="2">484,517</td></tr>
<tr><td>2050</td><td colspan="2">285,420</td><td colspan="2">471,132</td></tr>
<tr><td>Source</td><td colspan="4">Baseline Carbon Capped</td></tr>
<tr><td rowspan="4">Do something</td><td>2030</td><td colspan="2">318,909</td><td>652,216</td><td>654,489</td></tr>
<tr><td>2040</td><td colspan="2">379,752</td><td>750,498*</td><td>709,329*</td></tr>
<tr><td>2050</td><td colspan="2">475,932</td><td>753,341*</td><td>710,863*</td></tr>
<tr><td>Source</td><td colspan="4">Assessment of Need Carbon Capped</td></tr>
<tr><td rowspan="4">If other airport develops</td><td>2030</td><td>237,538</td><td>241,047</td><td colspan="2">486,364</td></tr>
<tr><td>2040</td><td>235,223</td><td>244,636</td><td colspan="2">484,520</td></tr>
<tr><td>2050</td><td>259,844</td><td>272,370</td><td colspan="2">466,179</td></tr>
<tr><td>Source</td><td colspan="4">Assessment of Need Carbon Capped</td></tr>
<tr><td rowspan="4">Worst case</td><td>2030</td><td colspan="2">480,623</td><td>745,640*</td><td>482,035</td></tr>
<tr><td>2040</td><td colspan="2">566,428*</td><td>748,983*</td><td>702,893*</td></tr>
<tr><td>2050</td><td colspan="2">556,387</td><td>743,582*</td><td>703,693*</td></tr>
<tr><td>Source</td><td colspan="2">Low Cost is King Carbon Traded</td><td>Low Cost is King Carbon Traded</td><td>Global Growth Carbon Traded</td></tr>
<tr><td rowspan="4">Do something with HAL fleet mix</td><td>2030</td><td colspan="2">-</td><td>(see “Do something”)</td><td>-</td></tr>
<tr><td>2040</td><td colspan="2">-</td><td>(see “Do something”)</td><td>-</td></tr>
<tr><td>2050</td><td colspan="2">-</td><td>-</td><td>-</td></tr>
<tr><td>Source</td><td colspan="2">-</td><td>Assessment of Need Carbon Capped with HAL fleet mix</td><td>-</td></tr>
</table>

*Forecast predicts more than the airport capacity, therefore the movements have been limited as noted above.

The last scenario modelled the “Assessment of Need Carbon Capped” demand scenario for Heathrow Airport North West Runway applying Heathrow Airport Limited’s (HAL) submitted fleet mix forecast for 2030 and 2040. HAL did not provide a forecast for 2050. This was conducted with the aspiration of removing one of the variables in the outcome of the noise modelling to allow better comparison between the Airports Commission’s and any scheme promoter’s results.

3. METHODOLOGY

This chapter describes the methodology adopted to develop average day summary tables based on annual ATMs of demand scenarios, fleet mix and market splits. The first section provides an overview of the general principles behind the applied methodology. The following sections discuss the calculations and assumptions in depth for each step.

3.1 OVERVIEW

Starting with the annual ATM demand scenarios three major steps were followed as depicted in Figure 1:

1. **Daily Forecast**: The annual movements of a demand scenario were allocated into daily movements using 2011 as the base year, respecting the daily capacity in terms of aircraft movements for each scheme. This required an understanding of the seasonal, weekly and daily variations occurring over the year. Each airport had provided four representative days in 2011 to be used as a basis for the development of the forecasts. Based on the seasonal variations, a certain number of forecast movements were added to these four days, each representing a three month period in the year.
2. **Schedule Development**: Taking the movements for those four days, the movements were divided across markets, or regions in the world, reflective of the Airports Commission's demand scenario market splits. Next, an aircraft type was assigned to each flight respecting the demand scenario's fleet mix, recognising that the fleet mix differs depending on the market being served. The market split also determines the SID allocation: aircraft flying north are more likely to take a northern SID for example. The last factor is the day/evening/night split, i.e. the time of day that the flight departs or lands. This again was determined per market and driven by the 2011 schedule taking into account the movement limits for the day/evening/night period.
3. **Average Day Forecast**: Taking the output of the previous step, each of the four schedules were weighted according to their proportion of their respective three month periods. By summing the four periods and dividing them by 365 the average day of the year was created. For the summer period only the summer schedule, of the four schedules produced, was weighed according to the summer forecast. By dividing this by 92 the average day of the summer is developed.

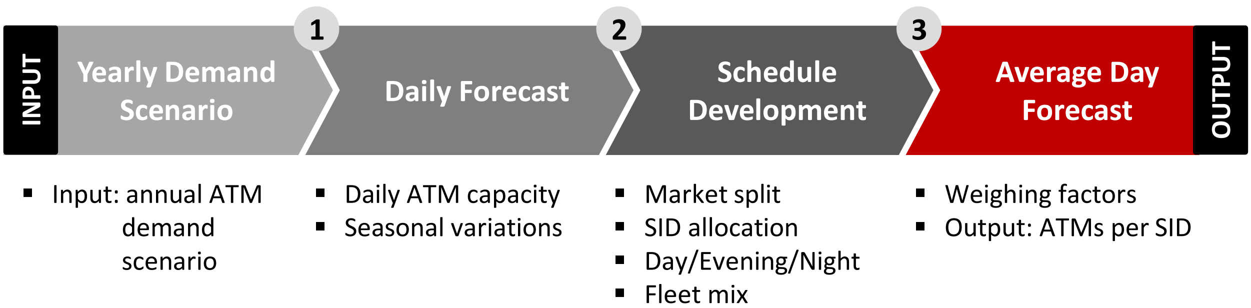

Figure 1 - General principles and major steps behind the methodology.

3.2 DAILY FORECAST

This section describes how the demand scenario in terms of annual movements was translated into daily movements.

3.2.1 Daily ATM Capacity

With reference to Chapter 2, two types of scenarios were modelled: one without development ("without scheme") and one with ("with scheme"). For the "without scheme" scenarios, the number of movements was taken from the slot coordination declaration for winter 2013 and summer 2014[2], the latest available data at the time of modelling. For the "with scheme" scenarios, the daily limit was based on the submissions by the scheme promoters, ensuring that the total number of movements resulted in roughly the capacity limit for that particular scheme. This results in the daily limits as shown in Table 2.

The table also shows the distribution between day, evening and night: these are the time periods as defined by the CAA for the noise modelling.

- **Day**: from 0700 till 1859
- **Evening**: from 1900 till 2259
- **Night**: from 2300 till 0659

Table 2 - Daily capacity limits split by day, evening and night for the different scenarios.

<table>
<tr><th colspan="2">[movements]</th><th>Gatwick Airport Second Runway</th><th>Heathrow Airport North West Runway</th><th>Heathrow Airport Extended Northern Runway</th></tr>
<tr><td rowspan="4">Without scheme</td><td>Day</td><td>Winter: 565
Summer: 626</td><td colspan="2">Winter: 996
Summer: 1,010</td></tr>
<tr><td>Evening</td><td>Winter: 144
Summer: 184</td><td colspan="2">Winter: 274
Summer: 295</td></tr>
<tr><td>Night</td><td>Winter: 44
Summer: 139</td><td colspan="2">Winter: 64
Summer: 63</td></tr>
<tr><td>Total</td><td>Winter: 753
Summer: 949</td><td colspan="2">Winter: 1,334
Summer: 1,368</td></tr>
<tr><td rowspan="4">With scheme</td><td>Day</td><td>1,084</td><td>1,447</td><td>1,392</td></tr>
<tr><td>Evening</td><td>302</td><td>461</td><td>399</td></tr>
<tr><td>Night</td><td>148</td><td>120</td><td>127</td></tr>
<tr><td>Total</td><td>1,534</td><td>2,028</td><td>1,918</td></tr>
</table>

In the "without scheme" scenarios, there is a split between winter and summer as these scenarios describe the case at each of the airports without development and are therefore comparable to today in terms of daily capacity. As is discussed later in Section 3.3.5, these forecast schedules could be developed to a greater level of detail than the "with scheme" schedules. At Heathrow Airport the difference between the seasons is limited, but at Gatwick Airport a significant seasonal variation can be observed.

Current restrictions to the number of night flights were preserved insofar as possible. For Gatwick Airport the number of night movements in the "with scheme" scenarios is limited to the actual number of night flights as submitted in the 2011 schedules, i.e. 148 ATMs. This is representative of the night quota currently in place at Gatwick Airport. However, for all Heathrow Airport scenarios demand in certain markets forced a limited number of arrivals into the night period as the first few hours of operation were also over demanded.

[2] Airport Coordination Limited (ACL) UK – Retrieved from http://www.acl-uk.org on 20th June 2014

As the "with scheme" scenarios change the characteristics of the airport in terms of daily capacity completely, it was impossible to create these schedules to the same level of detail as the "without scheme" scenarios. A constant daily capacity limit was adopted throughout the whole year and reflected the hourly movements as submitted by the scheme promoters as closely as possible. These limits were relatively increased or decreased to allow the daily movements to sum over an entire year to the annual capacity limits as discussed in Chapter 2.

3.2.2 Seasonal Variations

The base year, 2011, was retrieved from OAG for both Gatwick and Heathrow airports to analyse how the aircraft movements were spread across the year[3]. Figure 2 shows how the traffic at Heathrow Airport is relatively flat throughout the year: weekly trends are more visible than seasonal differences. At Gatwick Airport one can see the weekly trends, but it is clear that the difference between summer and winter is significant. Note that both airports have a low amount of flights through the Christmas and New Year period.

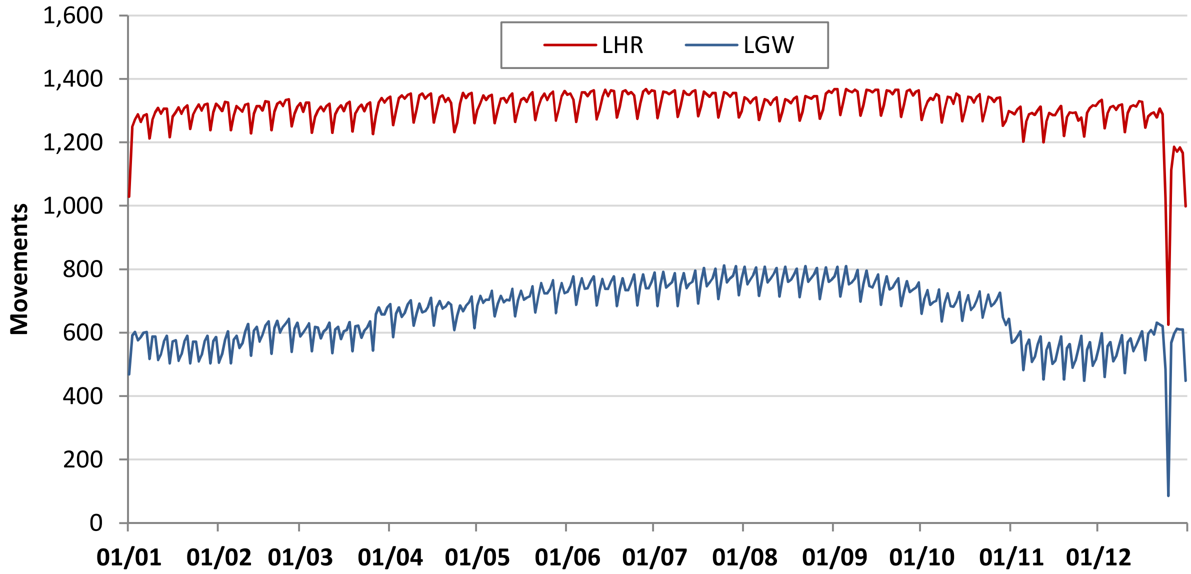

Figure 2 - 2011 daily movements for London Heathrow (LHR) and London Gatwick (LGW)[3].

As it is important to show the seasonal variations in the forecasts, GAL and HAL were asked to provide four days equally spread in 2011 representing the seasons. Each day served as a starting point for its three month period in the forecast schedule and, therefore, as an indication of the market splits, aircraft types and destinations (hence, SIDs) that were flown typically that month. The number of movements on that particular 2011 day mattered less for the output as each day was weighed in the overall forecast of the year in order to match the annual ATMs forecast. The days that were submitted and used for the remainder of the methodology are shown in Table 3 below.

[3] Based on 2011 data extracted from OAG Analyser, OAG Aviation Worldwide Ltd. - Data retrieved on 16th June 2014

Table 3 - 2011 schedule days as submitted by GAL and HAL.

	GAL	HAL
Winter	19/02	16/03
Spring	20/05	15/06
Summer	19/08	14/09
Autumn	18/11	14/12

We note that there is a difference between the number of scheduled flights according to OAG and the schedules as submitted by the promoter. However, as mentioned previously, the number of movements on the particular day was up- or down-scaled according to the yearly demand scenario such that the total number of annual ATMs matched the demand scenarios prepared by the Airports Commission.

In order to reflect both seasonal and day of the week variations, as was shown in Figure 2, the following method was applied to the total number of movements for each day:

- The daily movements in 2011 were expressed as a percentage of the daily limit for the applicable scenario.
- The highest percentage across the whole year represented the busiest day and vice-versa for the lowest percentage. Assuming that the busy days are more likely to be favoured by airlines and will therefore continue to be popular, most growth was assigned to the higher percentage days. By means of a quadratic formula, growth was assigned more to those busy days and as such, the balance between busy and quiet days was maintained and, indeed, slightly increased.
- If an airport was forecast with significant growth the quadratic formula would create a large difference between the busiest and the quietest day of the year. In those cases, part of the annual growth was uniformly distributed over the year and the remaining growth was assigned using the quadratic formula.
- In this way, the difference between e.g. a Friday in August and a Friday in December was maintained, but equally so was the difference between a Sunday and a Friday in August.
- By checking the annual total of ATMs and altering the distribution in the quadratic formula between the highest and lowest day (the Christmas and New Year period was excluded as being exceptional), the annual ATMs forecast was respected.
- After assigning the growth to each day, daily throughput was tested against the daily capacity as discussed in Section 3.2.1. If the growth exceeded capacity for a particular day, it was assumed to be displaced to the two days on each side. This would represent an airline wishing to fly on, for example, a Friday but not being able to and therefore opting for a slot on the Thursday or Saturday instead. Although this behaviour might not always exactly represent reality, at this stage of the noise modelling it was considered to be a valid assumption.
- As such, the forecast ATMs are distributed across the year for each of the scenarios in 2030, 2040 and 2050 for the three schemes, representing a total of 33 demand scenarios.

3.3 SCHEDULE DEVELOPMENT

This section describes the steps and assumptions that led to the development of each schedule.

3.3.1 Market Splits

With the growth assigned to each of the four days mentioned previously, the total number of flights was matched to the market splits as stated by the Airports Commission's demand scenarios. This meant adding flights to certain markets and removing some from others. The global markets or regions that were used were defined as follows:

- Africa
- Americas
- Australasia
- Europe
- Far East
- Middle East

These regions were chosen as they reflect the direction aircraft might take to reach their destination after taking off to one of these regions. This was important for the SID allocation.

3.3.2 SID Allocation

The ECRD required only departing flights to be allocated to a flight path (SID). The arrivals were allocated to the correct standard arrival routes (STAR) by the ECRD depending on the mode of operation for the airport in each particular scenario. We note that this may result in a different outcome than originally proposed by the promoter, for example to operate compass departures and terminal arrivals.

Based on analysis of 2013 data carried out by the ECRD, we produced a table presenting the percentage breakdown of the utilised SID for flights heading towards a particular airport. For example, flights to Paris (CDG) fly 90% using SID_A, 10% using SID_B and 0% using SID_C.

All airports within a certain country were combined as a single destination and by weighting the SIDs distribution by number of flights we determined the SID distribution for any flight to that particular country. Similarly, markets/regions were allocated.

Thus, for each flight in a schedule, we either knew the airport (for flights from the 2011 schedule) or the market it was serving (for added flights reflecting growth in the schedule). Therefore, it was possible to assign a SID distribution to each flight. We note that this is dependent on the 2013 data and that if markets shift significantly in the future forecasts, the adopted airports and countries might no longer be representative for a particular region's SIDs. However, as it is not possible to determine the exact destination of each flight in the future forecast, we consider the approach to be valid for the six regions defined previously.

3.3.3 Day/Evening/Night

Based on the 2011 schedule and the demand scenario's market splits, we determined whether a flight to for example Europe is more likely to operate during the day, evening or night – periods as defined in Section 3.2.1. Once each future flight had been allocated to a time period within its market, the day, evening and night capacity as defined in Table 2 was checked: if the capacity was exceeded, we allocated those flights to the remaining periods with spare capacity, again according to their relative weight within that market.

If for example a schedule required ten additional flights to Europe and 80% of the flights depart during the day, 10% during the evening and 10% during the night, then the following situation may occur:

- Adding eight flights to the day, one to the evening and one to the night breaches the capacity during the day by two flights.
- Therefore those two flights were assigned to the evening and night period according to the relative weight: one flight into the evening and the other into the night period.

3.3.4 Fleet Mix

The fleet mix detailing each aircraft type (existing or a new generation) was provided for each demand scenario by the Airports Commission. Given that it would be impossible to predict with accuracy how the split between all aircraft types in 2011 translated into the demand scenario, we divided the aircraft types into six classes, corresponding to the seat classes as used by the ECRD when creating or evaluating future generations of aircraft. The seat classes are defined as detailed in Table 4.

As the ECRD has a database of first and second generation aircraft with noise assumptions, the fleet mix of the Airports Commission needed to be compared to this database. This resulted in a few aircraft types that could not be assigned and, therefore, would not have noise assumptions in the ANCON model. This was resolved by the ECRD in their modelling approach for which we refer to their report. Note that there were also two freight aircraft present in the fleet: one domestic assumed to be a B737 (seat class 3) and one international a B747 (seat class 5).

Similar to the day, evening and night split, the seat classes were assigned to the additional flights based on the split of seat classes in the 2011 schedule and adjusted to match the demand scenario's seat class mix. Note that the seat classes are only adjusted within their respective market to remain close to that observed today while acknowledging the demand scenario's fleet mix.

Table 4 - Seat classes as defined by the ECRD[4].

[seats]	From	To
1	0	69
2	70	150
3	151	250
4	251	350
5	351	500
6	501	1,000

3.3.5 Without Scheme Scenarios

As discussed in Chapter 2, the "without scheme" scenarios had been developed to a greater level of detail than the "with scheme" scenarios: rather than assigning the new flights to a period of the day, each additional flight was allocated a specific hour of departure or arrival. This was determined by the hourly capacity as defined by ACL (see Section 3.2.1), the times of the day at which flights to that specific market occur and respecting as far as possible flight pairs and their turnaround time. As such each schedule was built up to a full forecast schedule. The assignment of SIDs and fleet mix was undertaken in the same manner as described previously.

3.3.6 HAL Fleet Mix

As stated in Table 1 a scenario was modelled using HAL's fleet mix. As discussed, this scenario sought to remove one of the parameters of the noise modelling in order to better compare the Airports Commission outcome with that of a scheme promoter to give an idea of how a change of such an assumption can impact on the noise results of any scheme.

HAL clarified its fleet mix in further submissions to the Airports Commission which allowed us to redevelop the "with something" scenario in order to reflect HAL's fleet mix[5].

[4] Based on ERCD Report 0307 - December 2003
[5] HAL fleet mix developed from "01 Heathrow 3RNW – Air and Ground Noise Assessment.pdf", "3R_2030_fleet-v5.pdf" and "Fleet Mix Summary.xlsx"

3.3.7 Heathrow Hub Modes of Operation

As a sensitivity test, the Airports Commission wished to reflect the modes of operation as proposed by HH[6]. Therefore, these modes were allocated to the day/evening/night periods as defined above.

Table 5 - Operation modes of HH allocated to day/evening/night periods

	Day	Evening	Night
Early respite	-	-	33%
Peak	74%	-	67%
Southern relief	26%	-	-
Northern relief	-	100%	-

3.4 AVERAGE DAY FORECAST

The weighing factors used to scale each of the four schedules up to their respective three month period were determined based on the demand scenario in terms of annual movements as described previously. Note that there is a discrepancy between the provided 2011 schedule with growth assigned to it and the OAG 2011 year overview. This discrepancy was solved in this step by appropriately correcting the weighing factors.

All flights were summed per SID within one seat class for a certain year in the day, evening and night period, the specific aircraft types were assigned within their respective seat class and the total number of movements was divided by 365 to obtain the average day of the year.

For the average day of the summer, only the schedule in the summer was used and scaled up according to the yearly demand scenario after which the flights were summed again and finally divided by 92.

In this way, an output table was created showing aircraft types and their corresponding SIDs. A single statement of all arrivals per aircraft type was presented. Such tables were created for the day, evening and night periods for both average days and for each forecast year: 2030, 2040 and 2050. This was undertaken for all previously described demand scenarios.

[6] See submission by the scheme promoter

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8 Appendix C Bickerdike Allen Partners Technical Note on Ground Noise

AIRPORTS COMMISSION

GROUND NOISE – LOCAL IMPACTS

1.0 INTRODUCTION

Any one of the three short listed airport schemes, Gatwick Airport Second Runway (Gatwick 2R) promoted by Gatwick Airport Ltd (GAL); Heathrow Airport Northwest Runway (Heathrow NWR) promoted by Heathrow Airport Ltd (HAL); and, Heathrow Airport Extended Northern Runway (Heathrow ENR) promoted by Heathrow Hub (HH) will give rise to varying levels of ground noise over the coming years, as compared to their corresponding no development (Do-Minimum) case. An estimate is made and presented in this section of how the impacts of airport related ground noise will vary under each scheme in turn, when compared to the current and Do-Minimum case. This has been assessed having regard to the key drivers that affect the levels of ground noise from aircraft activity around an airport, specifically contributions from aircraft taxiing, aircraft manoeuvring and aircraft Auxiliary Power Unit (APU) usage on aprons and taxiways.

Aircraft using their engines to assist retardation during landing is known as applying reverse thrust. Whilst this occurs when the aircraft is on the ground, the noise it generates is considered in the assessment of airborne aircraft noise, as the corresponding contours allow for the activity on the airport runways during both take-off and landing.

The change in ground noise levels for each of the three airport schemes will be dependent to differing extents on the change in runway, taxiway and apron layouts, and their usage, the change over time in the number of annual movements and also the change in the aircraft mix. Consideration has been given to each of these key parameters in assessing how ground noise levels are likely to change from current (2013), to 2030 Do-Minimum and with each of the three short listed schemes implemented.

2.0 METHODOLOGY

The simplified methodology adopted in undertaking this appraisal of ground noise is presented in Appendix A and provides a means of assessing to what extent ground noise is likely to increase or decrease over time. The aim has not been to assess qualitatively the detailed ground noise levels associated with each scheme and time period. The methodology is designed to provide an indication of the general spatial change in the extent of ground noise arising under each airport development scheme, compared to the current and Do-Minimum case.

For Gatwick and Heathrow airports, consideration has been given to their current layouts for both the current (2013) and Do-Minimum analysis, including the location of aprons, taxiways and runways. For each developed scheme, alterations to the airport runway, taxiway and apron infrastructure have been taken into account in assessing how ground noise levels will change in the future.

Using the airport layouts the total amount of ground noise has been estimated, allowing for both the level of activity and the mix of aircraft types. This has then been converted into a broad and approximate noise exposed area, taking into account the airport layout, for which the population has been determined.

There is no definitive agreement on the method of assessment of aircraft ground noise impact. Various methods have been adopted in the past, and these have led to the assessment of ground noise in terms of the equivalent continuous sound level, $L_{Aeq,T}$. Various time periods have been used, and in this report consideration has been given to the $L_{Aeq,16h}$ metric for the daytime period: 0700-2300h.

The ground noise level assessed at various receptors can be compared to the existing ambient environmental noise and published guidelines for the assessment of environmental noise. The World Health Organisation (WHO) recommends a guideline value of 50 dB $L_{Aeq,16h}$ to prevent "moderate" community annoyance and 55 dB $L_{Aeq,16h}$ for "serious" community annoyance. The 55 dB $L_{Aeq,16h}$ guideline is comparable to the daytime aircraft noise level of 57 dB $L_{Aeq,16h}$ in the current Aviation Policy Framework where it is treated as marking the approximate onset of significant community annoyance.

3.0 RESULTS

The results of this ground noise assessment are intended to allow a qualitative assessment to be made as to the relative increase or decrease in ground noise. They are not precise quantities in their own right due to the simplified modelling technique used, to be more precise would require extensive details not currently available; such as number of engines used by aircraft when taxiing, detailed taxiway routes and apron usage patterns, degree of queuing and holding, ground noise emission characteristics of new aircraft etc.

3.1 Gatwick 2R Scheme

The results of the assessment for Gatwick Airport and the Gatwick 2R scheme are given in Table 1. They include the resulting area predicted to be exposed to 57 dB $L_{Aeq,16h}$ and above, and the population contained within an equivalent area centred on the airport and shaped to account for the location of the runways and aprons. The equivalent areas that have been determined are shown on Figure LNA A1 within the Noise Figures Report.

	Current (2013)	2030			
		Do-Minimum	Gatwick 2R	Heathrow NWR	Heathrow ENR
Exposed Area, km^2 (57 dB $L_{Aeq,16h}$)	11.0	14.9	14.1	13.1	13.3
Population within Exposed Area[1]	900	3,150	1,000	1,900	2,050

[1] Rounded to the nearest 50.

Table 1: Ground Noise Exposure at Gatwick Airport

Compared to the current situation an increase in the amount of ground noise is forecast in 2030 irrespective of whether any development takes place. This is due to the forecast increase in aircraft activity outweighing any improvements in the ground noise performance of the aircraft fleet.

Of the scenarios in 2030 the least amount of ground noise is forecast to occur with Heathrow Airport developed, as this is expected to limit growth at Gatwick Airport. Conversely the greatest amount of ground noise is forecast to occur in the Do-Minimum case.

With the Gatwick 2R scheme the forecast amount of ground noise is less than the Do-Minimum case despite a greater level of aircraft activity due to an assessed reduction in the taxiing involved, principally due to the creation of a new terminal and aprons between the proposed runway and the existing runway.

In terms of the population within the exposed area, the lowest figure arises in 2030 for the Gatwick 2R scheme. This is due to the developed airport changing the location of some of the sources of ground noise. That is a similar population number exposed as currently and much less than with the Do-Minimum case.

3.2 Heathrow NWR Scheme

The results of the assessment for the Heathrow NWR scheme are given in Table 2. They include the resulting area predicted to be exposed to 57 dB $L_{Aeq,16h}$ and above, and the population contained within an equivalent area centred on the airport and allowing for the location of the runways and aprons. The equivalent areas that have been determined are shown on Figure LNA A2 which can be found in the Noise Figures Report.

	Current (2013)	2030		
		Do-Minimum	**Gatwick 2R**	**Heathrow NWR**
Exposed Area, km^2 (57 dB $L_{Aeq,16h}$)	29.3	30.5	30.5	37.4
Population within Exposed Area[(1)]	30,650	30,750	30,750	27,000

[(1)] Rounded to the nearest 50.

Table 2: Ground Noise Exposure at Heathrow (including with NWR)

Compared to the current situation there is little change expected in the amount of ground noise in 2030 under the Do-Minimum case, and this has the same forecast activity, and consequential ground noise, as the Gatwick 2R scenario.

With the Heathrow NWR scheme the forecast amount of ground noise is more than the Do-Minimum case due to the greater level of aircraft activity.

In terms of the population within the exposed area the lowest figure arises in 2030 for the Heathrow NWR scheme. This is despite the exposed area to ground noise being the highest, and is due to the developed airport changing the location of some of the sources of ground noise. For example the areas near the M4 and M25 motorways, in close proximity to the new northern runway, are lightly populated. The number of people impacted by ground noise is appraised as less than now, and less than in the Do-Minimum case in 2030.

3.3 Heathrow ENR Scheme

The results of the assessment for the Heathrow ENR scheme are given in Table 3. They include the resulting area predicted to be exposed to 57 dB $L_{Aeq,16h}$ and above, and the population contained within an equivalent area centred on the airport and allowing for the location of the runways and aprons. The equivalent areas that have been determined are shown on Figure LNA A3 which can be found in the Noise Figures Report.

Compared to the current situation there is little change expected in the amount of ground noise in 2030 under the Do-Minimum case, and this has the same forecast activity, and consequential ground noise, as the Gatwick 2R scenario.

With the Heathrow ENR scheme the forecast amount of ground noise is slightly higher than the Do-Minimum case reflecting the greater level of aircraft activity.

In terms of the population within the exposed area the lowest figure arises in 2030 for the Heathrow ENR scheme. This is due to the developed airport changing the location of some of the sources of ground noise.

	Current (2013)	2030		
		Do-Minimum	Gatwick 2R	Heathrow ENR
Exposed Area, km^2 (57 dB $L_{Aeq,16h}$)	29.3	30.5	30.5	33.5
Population within Exposed Area[(1)]	30,650	30,750	30,750	29,300

[(1)] Rounded to the nearest 50.

Table 3: Ground Noise Exposure at Heathrow (including with ENR)

4.0 SUMMARY

The appraisal identifies with respect to ground noise at Gatwick and Heathrow Airports:

- Considerably greater ground noise at Heathrow, now and in the future.
- Comparing the Do-Minimum scenarios, ground noise at Gatwick will increase to a greater extent over current levels (35% in exposed area) as compared to Heathrow where only a slight change is predicted (4%).
- Comparing the Gatwick 2R scheme with the Do-Minimum scenario, ground noise at Gatwick will decrease slightly, by 5% in exposed area, and the impact will decrease significantly, by 68% in terms of population within the exposed area. This is due to the altered layout reducing the taxiing involved, and changing the location of some of the sources of ground noise.
- Comparing the Heathrow NWR scheme with the Do-Minimum scenario, ground noise at Heathrow will increase, by 23% in exposed area, but the impact will decrease, by 12% in terms of population within the exposed area. This is due to the altered layout changing the location of some of the sources of ground noise.
- Comparing the Heathrow ENR scheme with the Do-Minimum scenario, ground noise at Heathrow will increase, by 10% in exposed area, but the impact will decrease, by 5% in terms of population within the exposed area. This is due to the altered layout changing the location of some of the sources of ground noise.

APPENDIX A - GROUND NOISE ASSESSMENT METHODOLOGY

A simplified methodology has been developed to enable a qualitative assessment of ground noise for the National Noise Study to be undertaken. The method takes account of the key parameters that contribute to ground noise at an airport, namely aircraft taxiing on aprons and runways, manoeuvring and use of APU's on the apron stands.

The methodology is based on determining an overall noise emission reference level for a given airport under a specified set of conditions. This facilitates a quick comparison between airports to show how the general noisiness of ground noise will vary between airports and development cases over time.

A further step has been taken to establish the broad and approximate area of ground noise contours for each airport. This enables a comparison to be made with population by area data obtained from the National Noise Study air noise assessment.

The key procedures setting out the methodology are set out below:-

Airport Layout

The runway and apron layout of each of the airports under each of the schemes has been assessed and standard taxi routes for departures and arrivals examined to determine typical routes for analysis purposes.

Duration of Activities

The typical durations associated with taxiing, manoeuvring and APU usage have been identified based on typical practice also taking account of the typical departure and arrival routes. The durations have been determined based on:

Aircraft taxiing speed:	10 ms^{-1}
Aircraft manoeuvring:	10 seconds per turn
Aircraft APU:	30 minutes before departure and after arrival

Reference Noise Levels

For each aircraft type associated with each airport, including both existing and future aircraft types, a reference noise level (SEL) at a distance of 152 metres has been allocated separately to taxiing, manoeuvring and APU usage.

Aircraft Movements

For each airport in turn, the number of annual and daily movements has been determined from the forecast data. The data has been separated out by aircraft type for each of the three development schemes and the Do-Minimum case for the year 2030. For the current (2013) assessment the actual summer movements have been factored to convert them to an average annual day.

Calculation of Ground Noise SEL & L_{Aeq}

The ground noise emission for each airport has been calculated in terms of dB L_{Aeq} for a single day. For each aircraft type, the reference noise level has been factored by the time spent taxiing, manoeuvring and using the APU. This has then been factored by the number of aircraft movements and added logarithmically. The resulting SELs have been combined and expressed as a $L_{Aeq,16h}$ value.

Calculation of Ground Noise Area

An approximate area affected by noise at 57 dB has been obtained by modelling the activity as a point source, radiating hemispherically over soft ground.

Assessment of Ground Noise Exposed Area

With the approximate area of ground noise exposure calculated above, and study of each airport layout, an equivalent area has been appraised with the same overall area that would contain the ground noise emission computed on the theoretical basis of a point source at the centre of the airport radiating sound equally in all directions. The analysis does not attempt to take into account the numerous large buildings that occur around the perimeter of airports and form effective noise screens, or any purpose built noise barriers. It also does not take into account with respect to impact, the effect of other noise sources (airborne aircraft noise, road and rail access noise).

Appendix D National Noise Baseline - Noise metrics per airport

Table D.1 : Current National Noise Exposures

Metric		Population Noise Exposure													
		Aberdeen	Birmingham	Bristol	East Midlands	Edinburgh	Glasgow	London City	London Gatwick*	London Heathrow*	London Luton	London Stansted	Manchester	London Southend	Total
Day	>54 dB $L_{Aeq,16h}$	14,500	39,050	1,500	3,600	4,850	20,550	61,400	9,700	632,600	7,900	4,700	53,550	1,150	855,050
	>57 dB $L_{Aeq,16h}$	4,400	18,150	800	1,250	3,550	5,050	24,050	3,550	266,100	3,850	1,400	31,200	100	363,450
	>60 dB $L_{Aeq,16h}$	1,350	6,550	250	600	1,900	1,200	8,450	1,200	118,800	1,350	650	9,750	50	152,100
	>63 dB $L_{Aeq,16h}$	<50	1,350	0	250	450	<50	1,400	350	48,400	<50	150	2,700	50	55,250
	>66 dB $L_{Aeq,16h}$	0	0	0	0	<50	0	250	150	14,400	0	<50	950	0	15,850
	>69 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	0	3,400	0	0	50	0	3,450
	>72 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	0	200	0	0	0	0	200
Night	>48 dB $L_{Aeq,8h}$	6,250	34,600	1,300	19,450	4,400	16,500	2,600	11,200	421,300	7,100	4,050	49,750	450	578,950
	>51 dB $L_{Aeq,8h}$	1,700	16,050	750	10,550	3,450	3,800	300	5,050	190,800	3,250	1,300	27,500	100	264,600
	>54 dB $L_{Aeq,8h}$	250	5,900	200	3,750	1,400	1,000	0	1,550	103,200	1,200	500	7,900	100	126,950
	>57 dB $L_{Aeq,8h}$	0	850	0	1,400	450	0	0	450	48,200	<50	150	2,250	0	53,800
	>60 dB $L_{Aeq,8h}$	0	0	0	600	<50	0	0	150	16,700	0	<50	750	0	18,300
	>63 dB $L_{Aeq,8h}$	0	0	0	250	0	0	0	50	4,500	0	0	50	0	4,850
	>66 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	1,600	0	0	0	0	1,600
	>69 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	<50	0	0	0	0	50
	>72 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	<50	0	0	0	0	50
24-hour	>55 dB L_{den}	12,400	44,200	2,200	12,900	4,900	29,800	26,100	11,300	766,100	14,300	7,400	73,400	1,000	1,006,000
	>60 dB L_{den}	2,800	13,400	800	2,600	700	3,100	6,600	2,000	191,500	4,700	1,400	18,900	100	248,600
	>65 dB L_{den}	<100	1,700	<100	800	200	0	400	500	52,700	1,000	300	2,100	<100	60,000
	>70 dB L_{den}	0	<100	<100	<100	0	0	0	<100	6,600	0	<100	<100	0	7,200
	>75 dB L_{den}	0	0	0	0	0	0	0	0	100	0	0	0	0	100

Table D.2 : 2030 DM National Noise Exposures

	Population Noise Exposure	

Metric		Aberdeen	Birmingham	Bristol	East Midlands	Edinburgh	Glasgow	London City	London Gatwick*	London Heathrow*	London Luton	London Stansted	Manchester	London Southend	Total
Day	>54 dB $L_{Aeq,16h}$	19,900	31,100	1,850	4,250	5,850	16,300	82,350	8,000	493,600	10,200	5,800	71,100	7,600	757,900
	>57 dB $L_{Aeq,16h}$	6,100	13,000	900	2,050	4,100	4,050	35,100	2,200	221,200	5,100	3,550	41,550	1,850	340,750
	>60 dB $L_{Aeq,16h}$	1,750	3,900	400	650	2,800	900	12,350	1,100	109,000	1,600	850	19,700	200	155,200
	>63 dB $L_{Aeq,16h}$	50	400	0	400	450	0	2,900	400	35,200	<50	150	3,850	100	43,950
	>66 dB $L_{Aeq,16h}$	0	0	0	0	50	0	700	300	7,900	<50	<50	1,400	<50	10,500
	>69 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	200	2,100	0	0	150	0	2,450
	>72 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	<50	<50	0	0	<50	0	150
Night	>48 dB $L_{Aeq,8h}$	8,700	26,600	1,650	23,050	5,100	13,050	6,250	11,700	271,200	8,500	5,250	64,450	3,600	449,100
	>51 dB $L_{Aeq,8h}$	2,350	10,550	800	14,200	3,750	2,950	1,000	5,600	151,300	4,050	3,250	37,100	750	237,650
	>54 dB $L_{Aeq,8h}$	350	2,950	300	3,650	2,350	500	50	1,700	61,100	1,450	500	14,950	200	90,050
	>57 dB $L_{Aeq,8h}$	0	<50	0	1,250	450	0	0	600	21,900	<50	150	3,300	100	27,850
	>60 dB $L_{Aeq,8h}$	0	0	0	650	<50	0	0	400	3,900	0	<50	1,300	<50	6,400
	>63 dB $L_{Aeq,8h}$	0	0	0	250	0	0	0	300	1,300	0	0	100	0	1,950
	>66 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	<50	0	150
	>69 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	0	0	100
	>72 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	0	0	100
24-hour	>55 dB L_{den}	22,300	39,500	2,200	20,050	7,500	22,600	65,800	9,400	580,500	13,100	7,350	80,700	7,750	878,750
	>60 dB L_{den}	2,750	9,000	750	3,600	3,550	2,350	14,000	1,900	169,600	3,150	1,950	30,900	500	244,000
	>65 dB L_{den}	<50	300	0	650	450	0	1,100	400	34,800	<50	150	3,500	100	41,550
	>70 dB L_{den}	0	0	0	100	0	0	0	200	3,000	0	0	300	0	3,600
	>75 dB L_{den}	0	0	0	0	0	0	0	<50	<50	0	0	0	0	100

Table D.3 : Current vs 2030 DM National Noise Exposures

Metric		Population Noise Exposure													
		Aberdeen	Birmingham	Bristol	East Midlands	Edinburgh	Glasgow	London City	London Gatwick*	London Heathrow*	London Luton	London Stansted	Manchester	London Southend	Total
Day	>54 dB $L_{Aeq,16h}$	5,400	(7,950)	350	650	1,000	(4,250)	20,950	(1,700)	(139,000)	2,300	1,100	17,550	6,450	(97,150)
	>57 dB $L_{Aeq,16h}$	1,700	(5,150)	100	800	550	(1,000)	11,050	(1,350)	(44,900)	1,250	2,150	10,350	1,750	(22,700)
	>60 dB $L_{Aeq,16h}$	400	(2,650)	150	50	900	(300)	3,900	(100)	(9,800)	250	200	9,950	150	3,100
	>63 dB $L_{Aeq,16h}$	0	(950)	0	150	0	(50)	1,500	50	(13,200)	0	0	1,150	50	(11,300)
	>66 dB $L_{Aeq,16h}$	0	0	0	0	0	0	450	150	(6,100)	50	0	450	50	(5,350)
	>69 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	200	(600)	0	0	100	0	(1,000)
	>72 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	50	(150)	0	0	50	0	(50)
Night	>48 dB $L_{Aeq,8h}$	2,450	(8,000)	350	3,600	700	(3,450)	3,650	500	(150,100)	1,400	1,200	14,700	3,150	(129,850)
	>51 dB $L_{Aeq,8h}$	650	(5,500)	50	3,650	300	(850)	700	550	(39,500)	800	1,950	9,600	650	(26,950)
	>54 dB $L_{Aeq,8h}$	100	(2,950)	100	(100)	950	(500)	50	150	(42,100)	250	0	7,050	100	(36,900)
	>57 dB $L_{Aeq,8h}$	0	(800)	0	(150)	0	0	0	150	(26,300)	0	0	1,050	100	(25,950)
	>60 dB $L_{Aeq,8h}$	0	0	0	50	0	0	0	250	(12,800)	0	0	550	50	(11,900)
	>63 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	250	(3,200)	0	0	50	0	(2,900)
	>66 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	50	(1,550)	0	0	50	0	(1,450)
	>69 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	50	0	0	0	0	0	50
	>72 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	50	0	0	0	0	0	50
24-hour	>55 dB L_{den}	9,900	(4,700)	0	7,150	2,600	(7,200)	39,700	(1,900)	(185,600)	(1,200)	(50)	7,300	6,750	(127,250)
	>60 dB L_{den}	(50)	(4,400)	(50)	1,000	2,850	(750)	7,400	(100)	(21,900)	(1,550)	550	12,000	400	(4,600)
	>65 dB L_{den}	(50)	(1,400)	(100)	(150)	250	0	700	(100)	(17,900)	(950)	(150)	1,400	0	(18,450)
	>70 dB L_{den}	0	(100)	(100)	0	0	0	0	100	(3,600)	0	(100)	200	0	(3,600)
	>75 dB L_{den}	0	0	0	0	0	0	0	50	(50)	0	0	0	0	0

Table D.4 : 2040 DM National Noise Exposures

Metric		Population Noise Exposure													
		Aberdeen	Birmingham	Bristol	East Midlands	Edinburgh	Glasgow	London City	London Gatwick*	London Heathrow*	London Luton	London Stansted	Manchester	London Southend	Total
Day	>54 dB $L_{Aeq,16h}$	27,400	37,750	1,950	5,850	5,950	15,950	75,700	7,400	460,600	13,100	5,900	79,850	7,550	744,950
	>57 dB $L_{Aeq,16h}$	7,250	16,550	1,000	2,400	4,000	4,450	30,750	2,200	219,400	5,750	3,700	47,050	1,900	346,400
	>60 dB $L_{Aeq,16h}$	1,950	4,600	450	900	2,850	900	11,450	900	103,800	2,600	750	24,000	200	155,350
	>63 dB $L_{Aeq,16h}$	50	600	<50	600	450	0	1,500	500	33,900	500	200	6,100	100	44,550
	>66 dB $L_{Aeq,16h}$	0	0	0	100	<50	0	250	300	7,100	<50	<50	1,850	50	9,800
	>69 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	200	2,100	0	0	300	0	2,600
	>72 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	<50	<50	0	0	<50	0	150
Night	>48 dB $L_{Aeq,8h}$	10,550	32,450	1,800	24,500	5,200	13,500	3,450	11,100	337,000	11,500	5,250	73,700	3,650	533,650
	>51 dB $L_{Aeq,8h}$	2,700	13,300	950	15,750	3,900	2,950	700	5,500	184,600	5,350	3,400	43,000	700	282,800
	>54 dB $L_{Aeq,8h}$	400	3,750	400	3,900	2,350	750	0	1,700	81,300	1,700	450	20,250	200	117,150
	>57 dB $L_{Aeq,8h}$	0	<50	0	2,050	450	0	0	600	31,400	<50	150	4,100	100	38,950
	>60 dB $L_{Aeq,8h}$	0	0	0	650	<50	0	0	400	6,400	<50	<50	1,500	50	9,150
	>63 dB $L_{Aeq,8h}$	0	0	0	250	0	0	0	300	2,400	0	0	150	0	3,100
	>66 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	<50	0	150
	>69 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	0	0	100
	>72 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	0	0	100
24-hour	>55 dB L_{den}	33,350	46,200	2,400	22,150	7,750	22,200	61,750	9,200	588,900	17,100	7,400	92,400	8,300	919,100
	>60 dB L_{den}	3,250	10,750	850	4,000	3,650	2,300	12,700	1,700	179,500	4,200	1,900	37,400	700	262,900
	>65 dB L_{den}	<50	600	<50	800	450	0	800	400	36,200	500	200	4,800	100	44,950
	>70 dB L_{den}	0	0	0	100	0	0	0	200	3,100	0	0	600	0	4,000
	>75 dB L_{den}	0	0	0	0	0	0	0	<50	<50	0	0	<50	0	150

Table D.5 : 2030 DM vs 2040 DM National Noise Exposures

Metric		Population Noise Exposure													
		Aberdeen	Birmingham	Bristol	East Midlands	Edinburgh	Glasgow	London City	London Gatwick*	London Heathrow*	London Luton	London Stansted	Manchester	London Southend	Total
Day	>54 dB $L_{Aeq,16h}$	7,500	6,650	100	1,600	100	(350)	(6,650)	(600)	(33,000)	2,900	100	8,750	(50)	(12,950)
	>57 dB $L_{Aeq,16h}$	1,150	3,550	100	350	(100)	400	(4,350)	0	(1,800)	650	150	5,500	50	5,650
	>60 dB $L_{Aeq,16h}$	200	700	50	250	50	0	(900)	(200)	(5,200)	1,000	(100)	4,300	0	150
	>63 dB $L_{Aeq,16h}$	0	200	50	200	0	0	(1,400)	100	(1,300)	450	50	2,250	0	600
	>66 dB $L_{Aeq,16h}$	0	0	0	100	0	0	(450)	0	(800)	0	0	450	0	(700)
	>69 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	0	0	0	0	150	0	150
	>72 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Night	>48 dB $L_{Aeq,8h}$	1,850	5,850	150	1,450	100	450	(2,800)	(600)	65,800	3,000	0	9,250	50	84,550
	>51 dB $L_{Aeq,8h}$	350	2,750	150	1,550	150	0	(300)	(100)	33,300	1,300	150	5,900	(50)	45,150
	>54 dB $L_{Aeq,8h}$	50	800	100	250	0	250	(50)	0	20,200	250	(50)	5,300	0	27,100
	>57 dB $L_{Aeq,8h}$	0	0	0	800	0	0	0	0	9,500	0	0	800	0	11,100
	>60 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	2,500	50	0	200	0	2,750
	>63 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	1,100	0	0	50	0	1,150
	>66 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	>69 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	>72 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-hour	>55 dB L_{den}	11,050	6,700	200	2,100	250	(400)	(4,050)	(200)	8,400	4,000	50	11,700	550	40,350
	>60 dB L_{den}	500	1,750	100	400	100	(50)	(1,300)	(200)	9,900	1,050	(50)	6,500	200	18,900
	>65 dB L_{den}	0	300	50	150	0	0	(300)	0	1,400	450	50	1,300	0	3,400
	>70 dB L_{den}	0	0	0	0	0	0	0	0	100	0	0	300	0	400
	>75 dB L_{den}	0	0	0	0	0	0	0	0	0	0	0	50	0	50

Table D.6 : 2050 DM National Noise Exposures

Metric		Population Noise Exposure													
		Aberdeen	Birmingham	Bristol	East Midlands	Edinburgh	Glasgow	London City	London Gatwick*	London Heathrow*	London Luton	London Stansted	Manchester	London Southend	Total
Day	>54 dB $L_{Aeq,16h}$	34,250	52,000	2,200	7,300	6,150	16,200	62,250	7,600	435,800	11,650	5,600	93,550	10,600	745,150
	>57 dB $L_{Aeq,16h}$	8,600	25,200	1,250	2,600	4,150	4,950	22,850	2,800	219,600	5,100	3,750	53,350	2,850	357,050
	>60 dB $L_{Aeq,16h}$	2,000	8,900	600	900	3,000	1,150	7,200	1,200	103,800	1,800	550	27,300	300	158,700
	>63 dB $L_{Aeq,16h}$	50	2,050	50	650	450	0	1,050	500	34,900	<50	150	7,850	150	47,900
	>66 dB $L_{Aeq,16h}$	0	<50	0	100	<50	0	50	300	7,700	<50	<50	2,350	50	10,750
	>69 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	200	2,100	0	0	700	50	3,050
	>72 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	<50	<50	0	0	<50	0	150
Night	>48 dB $L_{Aeq,8h}$	11,400	46,750	2,050	25,550	5,700	13,950	1,500	11,200	373,100	9,550	5,350	83,650	4,750	594,500
	>51 dB $L_{Aeq,8h}$	2,950	20,300	1,100	16,850	3,900	3,550	250	5,600	197,400	3,950	3,150	48,700	850	308,550
	>54 dB $L_{Aeq,8h}$	400	6,950	450	4,300	2,700	800	0	1,700	89,200	1,500	450	25,100	300	133,850
	>57 dB $L_{Aeq,8h}$	0	750	<50	2,100	450	0	0	600	33,900	<50	150	6,450	150	44,650
	>60 dB $L_{Aeq,8h}$	0	<50	0	700	<50	0	0	400	7,100	<50	0	1,850	50	10,250
	>63 dB $L_{Aeq,8h}$	0	0	0	350	0	0	0	300	2,600	0	0	300	0	3,550
	>66 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	<50	0	150
	>69 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	0	0	100
	>72 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	<50	<50	0	0	0	0	100
24-hour	>55 dB L_{den}	38,850	63,400	3,150	23,300	8,600	22,200	51,700	9,500	583,500	15,950	7,250	107,750	10,550	945,700
	>60 dB L_{den}	3,500	17,850	950	4,450	3,700	2,400	8,550	1,800	182,100	3,250	1,600	43,500	1,450	275,100
	>65 dB L_{den}	<50	2,000	<50	900	450	0	400	500	36,400	150	200	7,350	150	48,600
	>70 dB L_{den}	0	0	0	250	0	0	0	200	3,100	0	0	1,100	50	4,700
	>75 dB L_{den}	0	0	0	0	0	0	0	<50	<50	0	0	<50	0	150

Table D.7 : 2040 DM vs 2050 DM National Noise Exposures

Metric		Population Noise Exposure													
		Aberdeen	Birmingham	Bristol	East Midlands	Edinburgh	Glasgow	London City	London Gatwick*	London Heathrow*	London Luton	London Stansted	Manchester	London Southend	Total
Day	>54 dB $L_{Aeq,16h}$	6,850	14,250	250	1,450	200	250	(13,450)	200	(24,800)	(1,450)	(300)	13,700	3,050	200
	>57 dB $L_{Aeq,16h}$	1,350	8,650	250	200	150	500	(7,900)	600	200	(650)	50	6,300	950	10,650
	>60 dB $L_{Aeq,16h}$	50	4,300	150	0	150	250	(4,250)	300	0	(800)	(200)	3,300	100	3,350
	>63 dB $L_{Aeq,16h}$	0	1,450	0	50	0	0	(450)	0	1,000	(450)	(50)	1,750	50	3,350
	>66 dB $L_{Aeq,16h}$	0	50	0	0	0	0	(200)	0	600	0	0	500	0	950
	>69 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	0	0	0	0	400	50	450
	>72 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Night	>48 dB $L_{Aeq,8h}$	850	14,300	250	1,050	500	450	(1,950)	100	36,100	(1,950)	100	9,950	1,100	60,850
	>51 dB $L_{Aeq,8h}$	250	7,000	150	1,100	0	600	(450)	100	12,800	(1,400)	(250)	5,700	150	25,750
	>54 dB $L_{Aeq,8h}$	0	3,200	50	400	350	50	0	0	7,900	(200)	0	4,850	100	16,700
	>57 dB $L_{Aeq,8h}$	0	700	50	50	0	0	0	0	2,500	0	0	2,350	50	5,700
	>60 dB $L_{Aeq,8h}$	0	50	0	50	0	0	0	0	700	0	(50)	350	0	1,100
	>63 dB $L_{Aeq,8h}$	0	0	0	100	0	0	0	0	200	0	0	150	0	450
	>66 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	>69 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	>72 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-hour	>55 dB L_{den}	5,500	17,200	750	1,150	850	0	(10,050)	300	(5,400)	(1,150)	(150)	15,350	2,250	26,600
	>60 dB L_{den}	250	7,100	100	450	50	100	(4,150)	100	2,600	(950)	(300)	6,100	750	12,200
	>65 dB L_{den}	0	1,400	0	100	0	0	(400)	100	200	(350)	0	2,550	50	3,650
	>70 dB L_{den}	0	0	0	150	0	0	0	0	0	0	0	500	50	700
	>75 dB L_{den}	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table D.8 : Current vs 2050 DM National Noise Exposures

Metric		Population Noise Exposure													
		Aberdeen	Birmingham	Bristol	East Midlands	Edinburgh	Glasgow	London City	London Gatwick*	London Heathrow*	London Luton	London Stansted	Manchester	London Southend	Total
Day	>54 dB $L_{Aeq,16h}$	19,750	12,950	700	3,700	1,300	(4,350)	850	(2,100)	(196,800)	3,750	900	40,000	9,450	(109,900)
	>57 dB $L_{Aeq,16h}$	4,200	7,050	450	1,350	600	(100)	(1,200)	(750)	(46,500)	1,250	2,350	22,150	2,750	(6,400)
	>60 dB $L_{Aeq,16h}$	650	2,350	350	300	1,100	(50)	(1,250)	0	(15,000)	450	(100)	17,550	250	6,600
	>63 dB $L_{Aeq,16h}$	0	700	50	400	0	(50)	(350)	150	(13,500)	0	0	5,150	100	(7,350)
	>66 dB $L_{Aeq,16h}$	0	50	0	100	0	0	(200)	150	(6,300)	50	0	1,400	50	(5,100)
	>69 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	200	(600)	0	0	650	50	(400)
	>72 dB $L_{Aeq,16h}$	0	0	0	0	0	0	0	50	(150)	0	0	50	0	(50)
Night	>48 dB $L_{Aeq,8h}$	5,150	12,150	750	6,100	1,300	(2,550)	(1,100)	0	(48,200)	2,450	1,300	33,900	4,300	15,550
	>51 dB $L_{Aeq,8h}$	1,250	4,250	350	6,300	450	(250)	(50)	550	6,600	700	1,850	21,200	750	43,950
	>54 dB $L_{Aeq,8h}$	150	1,050	250	550	1,300	(200)	0	150	(14,000)	300	(50)	17,200	200	6,900
	>57 dB $L_{Aeq,8h}$	0	(100)	50	700	0	0	0	150	(14,300)	0	0	4,200	150	(9,150)
	>60 dB $L_{Aeq,8h}$	0	50	0	100	0	0	0	250	(9,600)	50	(50)	1,100	50	(8,050)
	>63 dB $L_{Aeq,8h}$	0	0	0	100	0	0	0	250	(1,900)	0	0	250	0	(1,300)
	>66 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	50	(1,150)	0	0	50	0	(1,450)
	>69 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	50	0	0	0	0	0	50
	>72 dB $L_{Aeq,8h}$	0	0	0	0	0	0	0	50	0	0	0	0	0	50
24-hour	>55 dB L_{den}	26,450	19,200	950	10,400	3,700	(7,600)	25,600	(1,800)	(182,600)	1,650	(150)	34,350	9,550	(60,300)
	>60 dB L_{den}	700	4,450	150	1,850	3,000	(700)	1,950	(200)	(9,400)	(1,450)	200	24,600	1,350	26,500
	>65 dB L_{den}	(50)	300	(50)	100	250	0	0	0	(16,300)	(850)	(100)	5,250	50	(11,400)
	>70 dB L_{den}	0	(100)	(100)	150	0	0	0	100	(3,500)	0	(100)	1,000	50	(2,500)
	>75 dB L_{den}	0	0	0	0	0	0	0	50	(50)	0	0	50	0	50

Appendix E Noise Modelling for the Airports Commission: Methodology and Assumptions

Environmental Research and Consultancy Department

Noise Modelling for the Airports Commission: Methodology and Assumptions

October 2014

Executive Summary

The Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) has been commissioned by the Airports Commission to calculate forecast noise exposure contours for the three short-listed proposals to meet long-term capacity demand in the south east of the UK.

This document presents the methodology used, and assumptions made, in the calculation of the noise contours. The results are presented separately by the Airports Commission.

CHAPTER 1

Introduction

Background

1.1 The Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) has been commissioned by the Airports Commission to calculate forecast noise exposure contours for the three proposals to meet long-term capacity demand in the south east of the UK. The proposals are those that have been short-listed by the Airports Commission.

1.2 This document presents the methodology used, and assumptions made, in the calculation of the noise contours. These are addressed in Chapter 2, and given in terms of the various inputs to the modelling, i.e. routes, aircraft types, etc, and in each case are discussed in general terms before making any scenario-specific comments. The noise contour results are presented separately in documentation prepared by the Airports Commission.

1.3 In undertaking the work, account has been taken of the information presented in the Airports Commission Appraisal Framework on the modelling of aviation noise.

CHAPTER 2

Methodology

2.1 This section presents what has been calculated for each of the scenarios modelled.

Calculations

Noise metrics

2.2 Since 1990, the established index for relating the amount of aircraft noise exposure to community annoyance has been the Equivalent Continuous Sound Level metric, or Leq. In the UK this metric is applied to an average summer day (taking into account traffic between 16 June and 15 September inclusive) over 16 hours, between 07:00 and 23:00 local time. The background to the use of this metric is explained in DORA Report 9023[1].

2.3 The Airports Commission Appraisal Framework has introduced a number of additional noise metrics based on both average noise exposure and also on the number of noise events. Results have been calculated for the metrics listed below. The magnitude and extent of the aircraft noise around an airport is depicted on maps by plotting contours of constant metric values as described below.

- LAeq,16h metric calculated for average summer day movements over the 16-hour daytime period between 07:00 and 23:00. Noise exposure contours produced from 54 to 72 dB in 3 dB steps.
- LAeq,8h metric calculated for average summer night movements over the 8-hour night-time period between 23:00 and 07:00. Noise exposure contours produced from 48 to 72 dB, where relevant, in 3 dB steps.
- Lden metric calculated for the average annual daily movements over the 24-hour period, with weightings of 5 dB for evening (19:00 - 23:00) and 10 dB for night-time (23:00 - 07:00). Noise exposure contours produced from 55 to 75 dB in 5 dB steps.

[1] The Use of Leq as an Aircraft Noise Index, DORA Report 9023, Civil Aviation Authority, September 1990.

- N70 'number above' metric, which describes the number of noise events (N) exceeding an outdoor maximum noise level of 70 dB LAmax, calculated for the average summer day movements over the 16-hour period between 07:00 and 23:00. Noise event contours produced of N greater than 20, 50, 100, 200 and 500 events where relevant.
- N60, similar to the N70 metric, but calculated for the average summer night movements over the 8-hour period between 23:00 and 07:00. Noise event contours produced of N greater than 25 and 50 events where relevant.
- Lnight metric calculated for the annual average daily movements over the 8-hour night period. Noise exposure contours produced from 50 to 70 dB in 5 dB steps. Although Lnight did not form part of the assessment framework, alongside Lden, it is one of the noise assessment metrics used by the European Commission under the Environmental Noise Directive.

Areas, Populations and Households

2.4 Estimates have been made of the numbers of people, households and the areas enclosed within the noise contours. The population data used for the current scenarios (scenarios are described in Chapter 3) are a 2013 update of the latest 2011 Census supplied by CACI Limited[2]. The population data used for the 2030, 2040 and 2050 scenarios are forecasts for these respective years also provided by CACI Limited.

2.5 The CACI population database contains data referenced at the postcode level. Population and household numbers associated with each postcode are assigned to a single co-ordinate located at the postcode's centroid.

2.6 Populations and households are calculated by summing populations and households associated with postcodes that are enclosed by the contour boundaries. The results have been presented cumulatively, rather than per contour band.

2.7 Any people or households located within the new expanded airport boundaries for the proposal scenarios have been excluded from the

[2] www.caci.co.uk

population and household estimates. The area estimates include land within the airport boundaries.

Noise Sensitive Buildings

2.8 Estimates have been made of the numbers of noise sensitive buildings (NSBs) situated within the contours, using the InterestMap™ [3] 'Points of Interest' (2013) database. For the purposes of this study, the noise sensitive buildings that have been considered are schools, hospitals and places of worship.

2.9 The estimates have been made on the same basis as for the estimates presented in the Gatwick and Heathrow annual noise contour reports, as produced by ERCD for DfT.

Newly Affected People

2.10 The numbers of people newly affected by the proposals have been calculated. Threshold levels of 57 dB LAeq,16h and 55 dB Lden have been used as criteria for being newly affected under these metrics respectively.

2.11 The numbers of people newly removed from these contours have also been calculated. These have been combined with the numbers of newly affected people to give the numbers of net newly affected people. Positive results indicate that a proposal adds more people to the threshold level contours than it removes; negative results indicate that a proposal removes more people from the threshold level contours than it adds.

2.12 The proposal scenarios have been compared with both the current and the future do-minimum scenarios.

Monetisation

2.13 Monetisation estimates have been made based on the methodological guidance in the Airports Commission Appraisal Framework. They use the noise contour and population estimate results and consider: Annoyance, Sleep Disturbance, Acute Myocardial Infarction (AMI) and Hypertension.

2.14 The basis for the Annoyance calculations is the WHO Burden of

[3] InterestMap™ is distributed by Landmark Information Group Ltd and derived from Ordnance Survey 'Points of Interest' data.

Disease from Environmental Noise[4], which sets out a methodology for estimating the monetary value associated with environmental noise exposure based on the number of people estimated as highly annoyed based on the 24-hour Lden metric. The methodology first estimates the number of people described as highly annoyed and uses a recommended Disability Weighting (DW) of 0.02 in order to estimate the number of Quality Adjusted Life Years (QALYs) lost due to daytime annoyance. Recommended sensitivity values of DW of 0.01 and 0.12 were also used.

2.15 The Airports Commission Appraisal Framework, however, required that the monetary value be based on daytime annoyance, in order to avoid any risk of doubling counts with night-time sleep disturbance. Thus, there was a need to adjust the WHO recommended dose response relationship so that annoyance was expressed in terms of average summer day LAeq,16h. Although the Burden of Disease methodology recommends that LAeq,16h = Lden - 2, this in fact varies from airport to airport depending on the proportion of noise in the day, evening and night periods, and the variation between summer average and annual average day. Analysis of average summer day LAeq,16h and average annual day Lden data for Heathrow and Gatwick airports showed that the difference is 1.6 for both airports.

2.16 The basis for the Sleep Disturbance, AMI and Hypertension calculations is ERCD report 1209 ‘Proposed methodology for estimating the cost of sleep disturbance from aircraft noise’[5].

2.17 The annual noise costs have been integrated over the 60-year period following the opening year. Specialist economic advice was provided by Airports Commission consultants on relevant elements of this part of the calculation. An opening year of 2025 has been used for the Gatwick Airport Second Runway (LGW 2R) scheme, and 2026 for the Heathrow Airport Northwest Runway (LHR NWR) and Heathrow Airport Extended Northern Runway (LHR ENR) schemes, as advised by the Airports Commission.

[4] WHO Regional Office for Europe (2011), Burden of Disease Estimation from Environmental Noise, 2011.

[5],Proposed Methodology for Estimating the Cost of Sleep Disturbance from Aircraft Noise, ERCD Report 1209, January 2013.

Noise modelling

2.18 This section describes the noise model used to undertake the calculations.

The ANCON noise model

2.19 The noise contours were calculated using the UK Civil Aircraft Noise Contour model ANCON (version 2.3). The ANCON model is developed and maintained by ERCD on behalf of the Department for Transport (DfT) and is used for the production of historic and forecast contours for Heathrow, Gatwick and Stansted airports, and a number of regional airports in the UK. A technical description of ANCON is provided in R&D Report 9842[6].

2.20 ANCON is fully compliant with the latest European guidance on noise modelling, ECAC.CEAC Doc 29 (3rd edition), published in December 2005[7]. This guidance document represents internationally agreed best practice as implemented in modern aircraft noise models.

Noise calculations

2.21 Aviation noise is calculated for take-off and landing operations, accounting for engine and airframe noise. The contours show ‘air noise’, which comprises the noise from aircraft whilst flying in the air and when on the runway during the take-off and landing roll. Noise from ground-based activities such as aircraft taxiing and engine testing (‘ground noise’) is not considered here.

Scenarios

2.22 The Airports Commission specified a number of scenarios for which noise modelling results were required. The full list of scenarios is presented in Appendix B.

2.23 Each scenario has a unique identifier to explicitly identify the data relating to each scenario.

2.24 The scenarios are summarised as follows:

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[6] Ollerhead J B, Rhodes D P, Viinikainen M S, Monkman D J, Woodley A C, The UK Civil Aircraft Noise Contour Model ANCON: Improvements in Version 2. R&D Report 9842, July 1999

[7] European Civil Aviation Conference. Report on Standard Method of Computing Noise Contours around Civil Airports ECAC.CEAC Doc 29, 3rd edition, Volumes 1 & 2, December 2005

Current scenarios

2.25 Noise calculations for Heathrow and Gatwick airport using the latest set of data available for both airports. This includes:

- LAeq,16h and LAeq,8h metrics for 2013, taken from the annual noise contour reports (ERCD Reports 1401[8] and 1402[9]). The N70 and N60 noise contours were computed using the same underlying data;
- Lden and Lnight metrics for 2011 are those produced for the Round 2 noise mapping for the Environmental Noise Directive (ERCD reports 1204[10] and 1205[11]).

Do-minimum scenarios

2.26 Noise calculations for Heathrow and Gatwick airport using the most recent (2013) noise model data, with forecast traffic for 2030, 2040 and 2050.

Do-something scenarios

2.27 Noise calculations for the proposed schemes:

- Gatwick LGW 2R (Gatwick Airport Second Runway) for which a single proposal was modelled (i.e. with no sensitivity testing);
- Heathrow LHR NWR (Heathrow Airport Northwest Runway), for which three options were provided plus sensitivity testing:
  - Minimise total affected people (T)
  - Minimise newly affected people (N)
  - Provision of Respite (R)
  - Sensitivity testing was carried out for the Minimise total affected people (T) option for approaches on a 3.5 degree glide-slope, and for the scheme promoter's fleet mix.

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[8] Noise Exposure Contours for Heathrow Airport 2013, ERCD report 1401, October 2014

[9] Noise Exposure Contours for Gatwick Airport 2013, ERCD report 1402, October 2014

[10] Strategic Noise Maps for Heathrow Airport 2011, ERCD report 1204, June 2013

[11] Strategic Noise Maps for Gatwick Airport 2011, ERCD report 1205, June 2013

- Heathrow LHR ENR (Heathrow Airport Extended Northern Runway), for which one option was modelled with a sensitivity test on an alternative operating mode.

National assessment scenarios

2.28 Noise calculations were undertaken for Gatwick do-minimum with Heathrow LHR NWR taken forward, and separately with Heathrow LHR ENR taken forward. Equivalent calculations were not carried out for Heathrow do-minimum with Gatwick LGW 2R taken forward, because a pre-screening exercise showed there was not likely to be a significant difference between this and the Heathrow do-minimum scenario.

Carbon-traded scenarios

2.29 Further noise calculations for the proposed schemes with traffic forecasts provided assuming carbon trading was undertaken.

CHAPTER 3

Input Data

3.1 In order to determine the aircraft noise exposure levels around an airport, information is required on the types of aircraft operating, the number of movements by each aircraft type, their noise characteristics and their position in three dimensions with respect to ground locations in the vicinity of the airport. The following sections describe the various input data requirements.

Aircraft models

Existing aircraft

3.2 The ANCON noise model uses a series of aircraft datasets to represent the real aircraft types that are included in a scenario. These are referred to as ANCON types.

3.3 For existing aircraft types, radar data and noise measurements are collected from around Heathrow and Gatwick Airports. The radar data is used to generate aircraft performance information, which along with the noise source database, allows the noise emissions associated with aircraft operations to be estimated. The noise measurements allow for validation of the aircraft noise source and propagation characteristics.

3.4 An illustration of the techniques used in processing radar and noise monitoring data, including an illustration of noise monitoring locations used by ERCD is provided in ERCD Report 0406[12]. The most recent noise monitoring positions used are reported in CAP 1149.[13]

3.5 The ANCON types are based on these data, which is reviewed and updated annually as part of the generation of average summer day noise contours. Collecting local data and reviewing it on a regular basis ensures that the ANCON databases reflect local practices and

[12] Techniques used by ERCD for the Measurement and Analysis of Aircraft Noise and Radar Data, ERCD Report 0406, January 2005. ISBN 1-904862-13-6

[13] Noise Monitor Positions at Heathrow, Gatwick and Stansted Airports, CAP 1149, March 2014, Civil Aviation Authority.

procedures, such as the requirements stipulated in the Aeronautical Information Publication (AIP).

3.6 For this analysis for the Airports Commission, information relating to existing aircraft types was based on radar data and noise measurements for 2013.

Imminent and future aircraft

3.7 Paragraphs 5.6 to 5.12 of the Airports Commission Discussion Paper 5: Aviation Noise summarises how over the last fifty years new aircraft have become progressively quieter, and how this trend is expected to continue out to 2020. It also reported on how beyond 2020, the International Civil Aviation Organization (ICAO) anticipates that the rate of noise reduction might reduce somewhat but still continue on a downward path.

3.8 To reflect this in the noise modelling, the same approach has been used as in previous assessments and described in ERCD Report 0307[14]. For each imminent and future aircraft type, an explicit 'surrogate' has been chosen from the ANCON type models for 2013, a similar aircraft type whose certificated noise levels are known.

3.9 The ANCON type for a given imminent or future aircraft type is derived by taking the noise model data for the surrogate aircraft, and adjusting it based on the differences between the future type's predicted certification data (based on available manufacturers' data and current industry knowledge) and the surrogate aircraft's known data.

3.10 Further information on the process and rationale is summarised in Appendix C.

Vertical profiles

3.11 Departing aircraft are modelled using the average departure profiles calculated during the 2013 review (see 3.6 and 3.8). Consequently, each ANCON type is modelled with its own profile based on recent operations.

3.12 For clarity, no specific departure angle is assumed for noise

[14] Updated Methodology and Supplementary Information Relating to Future Aircraft Noise Exposure Estimates for UK Airports, ERCD Report 0307, December 2003. ISBN 1-904763-34-0

modelling. Aircraft do not depart at a fixed climb angle, as their rate of climb is dependent on an aircraft's fundamental performance characteristics, its take-off weight, local meteorological conditions and any procedural constraints.

3.13 Arriving aircraft are assumed to follow standard ILS approaches in all scenarios. Approaches are modelled based on the average profiles calculated during the 2013 review. These incorporate a 3 degree glide path from around 3,000 ft altitude to ground level (from approximately 17.5 km distance to the runway threshold). Before this point, any level flight segments flown prior to joining the ILS are incorporated in the average arrival profile.

3.14 The standard profiles have been adjusted to represent the 3.2 degree glide path that is assumed for all future scenarios. This decision was made on the basis that systematic non-site-specific developments should be applied to all scenarios so that the assessment can be made on a comparable basis. 3.2 degrees was chosen as this represents the best approximation to all the proposals.

3.15 A sensitivity test has been undertaken for the Heathrow LHR NWR scheme (minimise total people affected) in 2050 with the glide path angle adjusted to 3.5 degrees (scenario ID: H50-3R-T-35).

3.16 The application of reverse thrust following touchdown was modelled for all ANCON types where applicable.

Runways

3.17 Information on runway ends and any displaced thresholds were provided by scheme proposers. Specific details are as follows:

Current and do-minimum scenarios

3.18 The existing runways and thresholds at Heathrow and Gatwick airports were used for these scenarios.

Gatwick LGW 2R

3.19 For the proposal scenarios, the runway thresholds provided by the scheme promoter were used for the existing and second runway.

Heathrow LHR NWR

3.20 Details for the existing and third runway, as required for noise modelling purposes, have been provided by the scheme promoter.

Heathrow LHR ENR

3.21 The coordinates of the existing south runway have been used.

3.22 The runway coordinates for the northern runway ends were provided by the scheme promoter, and have been used in the noise modelling.

3.23 Because the northern runway extension shortens the existing northern runway, LeighFisher (consultants to the Airports Commission) identified that 3 to 10% of ICAO Code E and Code F aircraft departures would be required to use only the south runway. However, the Airports Commission concluded that it was not necessary to reflect this level of complexity in the noise modelling for reasons of proportionality.

3.24 It was assumed that landing runway thresholds were not displaced for any runway.

Routes

3.25 All proposals assume departing aircraft follow standard instrument departures (SIDs). ERCD provided Jacobs with information on historical SID usage by aircraft type for Heathrow and Gatwick in 2013. It is understood that Jacobs used this information as a basis to allocate aircraft to SIDs for the proposal scenarios, which LeighFisher used to develop traffic forecasts for each scenario. These traffic forecasts were provided as inputs to the noise modelling, and included the allocation of operations to SIDs.

3.26 Departure routes for do-minimum and do-something scenarios assume use of Performance-Based Navigation (PBN). Therefore, departure flight path dispersion settings were adjusted, based on an analysis of radar data from Heathrow and Gatwick of aircraft undertaking PBN departure operations.

3.27 Arrival operations have been allocated equally to arrival routes on a pro-rata basis. Arrival routes for the do-minimum and do-something scenarios use representative arrival dispersion settings for Heathrow and Gatwick respectively.

3.28 It is understood that NATS have reviewed and approved the proposed route designs on behalf of the Airports Commission, and that they are compatible with anticipated future airspace and navigational technology.

3.29 Departure and arrival routes have been provided to the Airports Commission in graphical and CAD formats. Details specific to the scenarios and schemes are given below.

Do-minimum scenarios

3.30 The mean tracks calculated for operations during summer 2013 have been used as the routes for the Gatwick base case scenarios. The routes used in 2013 analysis work concerning the ending of the Cranford Agreement were used for the Heathrow base case scenarios. Dispersion has also been calculated for the 2013 summer period and applied to the modelled routes.

Gatwick LGW 2R

3.31 The Airports Commission, NATS agreed that the scheme promoter's proposed departure routes represented the best available estimate for a two parallel-runway airport. It is understood that all proposed departure routes will integrate into existing and future LAMP strategies (see 3.28).

3.32 Arrival routes were developed comprising a separate base leg from the south for each runway and direction, and were agreed with the Airports Commission and NATS.

Heathrow LHR NWR

3.33 The scheme promoter proposed three different airspace designs, each with varying departure and arrival routes, depending on what noise outcome was desired. It was concluded that these represented the best available data and are summarised as follows:

- minimise the total number of people affected by noise
- minimise the number of people newly affected by noise
- provision of respite

3.34 It is understood that Point Merge will not be taken forward at Heathrow due to the limitations on the use of vectoring. Some of the routes for this scheme incorporate off-set approaches.

Heathrow LHR ENR

3.35 Departure routes are based on the indicative mixed mode departure routes used in the 2007 analysis for the Project for the Sustainable

Development of Heathrow (PSDH)[15]. The westerly departure routes from the north runway are displaced to incorporate the extended runway.

3.36 Five different operating modes are presented by the scheme promoter in section 3.3.3 of their scheme proposal[16]. Departure routes have been developed for the 'Peak Flow' operating mode, and also for a sensitivity test on using the five operating modes as presented in the scheme proposals. This is denoted the ‘respite’ scenario, and additional southbound departure routes from the northern runways have been agreed with NATS where required to reflect the forecast.

3.37 Arrival routes are those used in the PSDH analysis and comprise three ‘herring-bone’ base leg joins to the final approach. Approach streams to the northern runways are from the north, and approach streams to the southern runway are from the south. The curved, angled and off-set approach principles that were presented by the scheme promoter have not been modelled as these were not sufficiently well-defined.

Traffic

3.38 LeighFisher provided average summer and average annual aircraft movement numbers by aircraft type, time period (day, evening and night, as needed for the noise metrics), and SID for each scenario.

3.39 Because future ANCON types are represented by adjustments to existing types, they are also linked to a manufacturer. In contrast the forecasts are more generic, with imminent and future aircraft types listed as generic types by seat capacity, rather than a specific aircraft type. In such cases, the forecast was allocated to ANCON types on the basis of equal market share, i.e. movements were allocated equally amongst all manufacturers providing one or more suitable aircraft, then the movements for each manufacturer were divided equally amongst their respective aircraft. Further information on this approach is given in Appendix A of ERCD Report 0307 mentioned previously.

[15] Revised Future Aircraft Noise Exposure Estimates for Heathrow Airport, ERCD 0705, November 2007

[16] HH/RIL Updated Scheme Design document, dated May 2014

3.40 The forecasts are assumed to be compatible with the proposers' anticipated maximum hourly throughput.

3.41 In order to support these numbers of operations, A-CDM is assumed to be active for these scenarios.

3.42 Appendix D provides a breakdown of the traffic forecasts for average summer 16-hour day and 8-hour night for the scenarios modelled.

3.43 Sensitivity testing has been undertaken for the Heathrow LHR NWR scheme for the minimise total people affected scenario, using the fleet mix used in the Heathrow Airport Ltd submission (scenario ID: H-3R-T-F). The traffic forecast for this was provided by LeighFisher for 2030 and 2040 (the years assessed by Heathrow Airport Ltd), and the noise modelling results calculated on the same basis as for the other scenarios.

Operating modes

Westerly/Easterly runway modal split

3.44 The future scenarios are modelled using a common set of westerly/easterly runway modal splits for each airport respectively. For the summer LAeq,16h and N70 metrics, these are based on the average of the modal splits for the previous 20 years. For the other metrics, they are based on the average of the modal splits for the previous 5 years for Heathrow, and 10 years for Gatwick, as shown here:

Time period (metric)	Modal split (% westerly),	
	Gatwick	Heathrow
Summer day (LAeq,16h, N70)	74	77
Summer night (LAeq,8h, N60)	78	83
Annual 12-hour day (Lden component)	67	70
Annual 4-hour evening (Lden component)	68	70
Annual 8-hour night (Lden component and Lnight)	68	72

3.45 The Heathrow do-minimum scenario (H-2R), and Heathrow LHR ENR (H-HH-X) and Heathrow LHR NWR (H-3R-T, H-3R-N and H-3R-R) proposal scenarios reflect the average modals splits for Heathrow. The Gatwick do-minimum (G-1R) and LGW 2R (G-2R-X) scenarios reflect the average modal splits for Gatwick.

Gatwick LGW 2R

3.46 The layout of the Gatwick proposal indicates that there will be higher demand for landing on the northern runway. However, in the absence of quantitative information on this aspect, landing traffic has been apportioned equally across both runways where possible.

3.47 Compass departures are proposed by the scheme promoter and the forecast allocates operations to the available SIDs. Balancing SIDs have been used to apportion departing traffic equally across both runways where possible. The Airports Commission has informed us that the SIDs will enable one-minute departure splits if required.

Heathrow LHR NWR

3.48 Each of the three options listed in 3.33 is treated as a separate analysis scenario, i.e. for H-3R-T, H-3R-N and H-3R-R there is no combining of route options in any model runs.

3.49 However, within each of these options, four runway operating modes are proposed by the scheme promoter, who advised that these modes will be used equally (the mode will change once per day on a four-day cycle). Since the modelling is concerned with long-term averages, each mode is assumed to operate for 25% of the time.

3.50 The four modes comprise the new and south runways being used for different combinations of departures, landings or mixed-mode operation (both departures and landings), and the existing north runway for departures or landings.

3.51 Compass departures are proposed by the scheme promoter and the forecast allocates operations to the available SIDs. Balancing SIDs have been used to apportion departing traffic equally between both the departures and mixed mode runways where possible within each operating mode.

Heathrow LHR ENR

3.52 As mentioned in 3.36, the Heathrow LHR ENR scheme proposes five operating modes that are to occur during specific time periods each day. The Airports Commission has stated that by 2037, runway demand will exceed supply at Heathrow with three runways. In this case, it will only be possible to use the Peak Flow mode. Therefore, as advised by the Airports Commission, the do-something scenarios for the Heathrow LHR ENR (H-HH-X) scheme have been modelled using the 'Peak Flow' operating mode throughout.

3.53 The analysis for 2030 includes a sensitivity test on the use of the five operating modes, denoted as the ‘respite’ scenario (scenario ID: H30-HH-R). LeighFisher has provided information to apportion the forecast traffic for 2030 amongst the modes. This is necessary for cases where more than one operating mode occurs during a given time period.

3.54 Compass departures have been proposed by the scheme promoter, and the forecast allocates operations to the available SIDs. Balancing SIDs have been used to equalise the traffic between the north and south runways where possible.

Compatibilities

3.55 The modelling assumed the following technological concepts being in place by the respective assessment years.

- Performance Based Navigation
- Steeper ILS approaches

3.56 It should be noted that some scenarios for LHR NWR also included off-set approaches

APPENDIX A

Glossary

A-CDM	Airport Collaborative Decision Making
ANCON	The UK Civil Aircraft Noise Contour model, developed and maintained by ERCD.
dB	Decibel units describing sound level or changes of sound level.
dBA	Units of sound level on the A-weighted scale, which incorporates a frequency weighting approximating the characteristics of human hearing.
CAD	Computer Aided Design
DfT	Department for Transport (UK Government)
ECAC	European Civil Aviation Conference
ERCD	Environmental Research and Consultancy Department of the Civil Aviation Authority.
ILS	Instrument Landing System; a ground-based system that provides precision guidance to an aircraft approaching and landing on a runway.
LAeq,16h	Equivalent sound level of aircraft noise in dBA, often called ‘equivalent continuous sound level’. For conventional historical contours this is based on the daily average movements that take place within the 16-hour period (0700-2300 local time) over the 92-day summer period from 16 June to 15 September inclusive.
LAeq,8h	Equivalent sound level of aircraft noise in dBA often called ‘equivalent continuous sound level’. This is based on the daily average movements that take place within the 8-hour period (2300-0700 local time) over the 92-day summer period from 16 June to 15 September inclusive.
Lden	Equivalent sound level of aircraft noise in dBA for the average 24-hour annual period with 5 dB weightings for Levening and 10 dB weightings for Lnight.
Lnight	Equivalent sound level of aircraft noise in dBA for the average 8-hour annual night period (2300-0700 local time).
LAMP	London Airspace Modernisation Programme
N70 & N60	‘Number above’ contours describe the number of noise events (N) exceeding an outdoor maximum noise level of 70 dBA Lmax for N70 (based on an average summer’s 16-hour day), and 60 dBA Lmax for N60 (based on an average summer’s 8-hour night).
PBN	Performance-based navigation

Point Merge	Point Merge is a system by which aircraft, in a queue to land, fly an extended flight path around an arc instead of holding in circular stacks.
SID	Standard Instrument Departure

APPENDIX B

Scenarios

Scenario		Assessment year			
		2011/13	2030	2040	2050
Current scenarios					
Gatwick		G11-1R / G13-1R	G30-1R	G40-1R	G50-1R
Heathrow		H11-2R / H13-2R	H30-2R	H40-2R	H50-2R
Do-minimum scenarios					
Gatwick		-	G30-1R	G40-1R	G50-1R
Heathrow		-	H30-2R	H40-2R	H50-2R
Do-something scenarios					
Gatwick	No sensitivity test	-	G30-2R-X	G40-2R-X	G50-2R-X
Heathrow LHR NWR	Minimise total affected	-	H30-3R-T	H40-3R-T	H50-3R-TR
	Minimise newly affected	-	H30-3R-N	H40-3R-N	H50-3R-N
	Respite option	-	H30-3R-R	H40-3R-R	H50-3R-R
	Sensitivity 3.5° approach	-	-	-	H50-3R-T-35
	Sensitivity HAL fleet*	-	H30-3R-T-F	H40-3R-T-F	-
Heathrow LHR ENR	No sensitivity test (Peak Flow operating mode)	-	H30-HH-X	H40-HH-X	H50-HH-X
	Respite operating modes	-	H30-HH-R	-	-
National assessment scenarios					
Gatwick do-minimum with Heathrow LHR NWR*		-	G30-1R-3R	G40-1R-3R	G50-1R-3R
Gatwick do-minimum with Heathrow LHR ENR*		-	G30-1R-HH	G40-1R-HH	G50-1R-HH
Carbon-traded scenarios					
Gatwick LGW 2R		-	G30-2R-X-C	G40-2R-X-C	G50-2R-X-C
Heathrow LHR NWR		-	H30-3R-T-C	H40-3R-T-C	H50-3R-T-C
Heathrow LHR ENR		-	H30-HH-X-C	H40-HH-X-C	H50-HH-X-C

* LAeq,16h, LAeq,8h and Lden metrics only

APPENDIX C

Future Aircraft Types for Forecasting

Introduction

The requirement to forecast aircraft noise exposure to 2050 necessitates the definition of future aircraft types and their associated noise characteristics.

Historical trends clearly show that each generation of aircraft are quieter than their predecessor, significantly so in some cases. This is a reflection of the introduction of new technologies, of which some are aimed purely at reducing aircraft noise, whilst others are, for example, aimed at reducing fuel burn.

This changing of noise performance over time necessitates the need to take into account how the aircraft fleet will change.

Methodology

For each future aeroplane type, an explicit ‘surrogate’ has been chosen; a similar aircraft type whose certificated noise levels are known. For a given future type, the noise model data for this surrogate aircraft are then adjusted based on the differences between the future type’s predicted certification data and the surrogate aircraft’s known data.

The same approach has been used as in previous assessments such as the noise study undertaken in support of the Department for Transport’s (DfT) Consultation: Adding Capacity at Heathrow Airport, which formed part of the Project for the Sustainable Development of Heathrow (PSDH)[17].

Future aircraft types

The assumptions on the noise characteristics of the future aircraft types presented in this assessment are based on the latest available data. They update the assumptions used in the previous ERCD studies and are aligned to the ICAO report on long-term noise technology goals[18] and guidance in The

[17] ERCD Report 0705, Revised Future Aircraft Noise Exposure Estimates for Heathrow Airport, November 2007. www.caa.co.uk/ERCDreport0705

[18] ICAO (2014), Report by the Second CAEP Noise Technology Independent Expert Panel, ICAO Doc. 10017, ISBN 978-92-9249-401-8, ICAO, 2014.

Sustainable Aviation Noise Road-Map[19]. There are two categories of future aircraft:

- Imminent aircraft types incorporating Generation 1 technology with significant fuel burn and noise benefits. These have recently entered, or are currently offered for sale to the market, and include all-new aircraft as well as re-engined aircraft.
- Future aircraft types incorporating Generation 2 technology, which aim to achieve the noise goals set out in Flightpath 2050[20]. These types are envisaged to eventually replace the Imminent Generation 1 aircraft.

In the former case, the noise characteristics are well-defined. In the latter case, the assumptions are based on expected technological advances and underlying trends as well as the entry into service (EIS) date of the Generation 2 aircraft type relative to Generation 1 predecessors.

Use has been made of the ICAO and Sustainable Aviation assumption of a 0.1 dB/year baseline rate of improvement from the Generation 1 introduction dates (assuming no technological step-changes or major configuration changes). Tables C1 and C2 below identify the new types, presenting the category, types, number of seats and approximate entry into service year.

[19] The SA Noise Road-Map, A Blueprint for Managing Noise from Aviation Sources to 2050. 2013, Sustainable Aviation.

[20] Flightpath 2050, Europe's Vision for Aviation. 2011, European Commission.

Table C1: Generation 1 Imminent aircraft types and modelling assumptions

Aircraft category	Aircraft type	Seats	Approx. entry into service
Airbus single-aisle	A319 NEO	120	2016
Airbus single-aisle	A320 NEO	150	2016
Airbus single-aisle	A321 NEO	180	2016
Airbus twin-aisle	A350-800	250	2014
Airbus twin-aisle	A350-900	300	2015
Airbus twin-aisle	A350-1000	350	2016
Airbus very large	A380-900	650	2020
Boeing single-aisle	B737-7 MAX	140	2017
Boeing single-aisle	B737-8 MAX	170	2018
Boeing single-aisle	B737-9 MAX	180	2018
Boeing twin-aisle	B777-8X	353	2019
Boeing twin-aisle	B777-9X	407	2019
Boeing twin-aisle	B787-8	210-250	2012
Boeing twin-aisle	B787-9	250-290	2014
Boeing twin-aisle	B787-10	300-330	2017
Boeing very large	B747-8	470	2012
Boeing very large	B747-8F	n/a	2011
Generic regional jet	E175-E2	80	2020
Generic regional jet	E190-E2	97	2018
Generic regional jet	E195-E2	118	2019

Table C2: Generation 2 Future aircraft types and modelling assumptions

Aircraft category	Aircraft type	Seats	Approx. entry into service
Large twin-turboprop	LTT G2	80	2025
Airbus single-aisle	A319 NEO G2	120	2025
Airbus single-aisle	A320 NEO G2	150	2025
Airbus single-aisle	A321 NEO G2	180	2025
Airbus twin-aisle	A350-800 G2	250	2035
Airbus twin-aisle	A350-900 G2	300	2040
Airbus twin-aisle	A350-1000 G2	350	2040
Airbus very large	A380-800 NEO G2	550	2040
Airbus very large	A380-900 NEO G2	650	2040
Boeing single-aisle	B737-7 MAX G2	140	2025
Boeing single-aisle	B737-8 MAX G2	170	2025
Boeing single-aisle	B737-9 MAX G2	180	2025
Boeing twin-aisle	B777-8X G2	350	2040
Boeing twin-aisle	B777-9X G2	400	2040
Boeing twin-aisle	B787-8 G2	220	2035
Boeing twin-aisle	B787-9 G2	250	2040
Boeing twin-aisle	B787-10 G2	300	2040
Boeing very large	B747-8 G2	470	2040
Generic regional jet	E175-E2 G2	80	2035
Generic regional jet	E190-E2 G2	97	2035
Generic regional jet	E195-E2 G2	118	2035

APPENDIX D

Traffic Forecasts

Table D1: 16-hour average summer day air traffic forecast for Heathrow Airport current, do minimum and North West Runway scenarios

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
1	Small twin-turboprop	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Embraer 135/145	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	0.3	9.0	5.0	2.1	21.2	30.6	9.2
1	New G1 CL1	0.0	0.0	0.0	2.4	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0	3.6	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0	1.8	0.0	0.0	0.0
2	BAe 146/Avro RJ	1.8	0.0	0.0	0.0	0.0	0.0	0.0
2	Airbus A318	3.2	1.5	0.0	0.0	1.9	0.0	0.0
2	Airbus A319	263.9	21.0	0.0	0.0	28.6	0.0	0.0
2	Boeing 717	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	11.7	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	23.5	10.1	0.0	0.0	12.5	0.0	0.0
2	Bombardier RJ 700/900	2.1	0.0	0.0	0.0	0.0	0.0	0.0
2	Bombardier C Series	0.0	5.4	3.6	1.0	6.7	5.3	1.5
2	Bombardier DHC-8 Q400	0.0	50.0	41.0	29.4	61.9	60.8	47.8
2	Embraer 170/175	0.0	0.0	0.0	0.4	0.0	0.0	0.0
2	Embraer 190/195	3.3	18.0	3.6	0.9	22.2	5.3	1.5
2	Fokker 100	4.7	0.0	0.0	0.0	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	0.0	18.0	15.3	4.0	22.3	22.7	6.5
2	Post 2016 G2 Airbus A319/320	0.0	150.0	137.3	26.1	240.9	243.6	42.1
2	New G1 CL2	0.0	29.6	73.4	49.6	36.7	108.9	80.8
2	New G2 Post 2030 CL2	0.0	0.0	18.4	36.9	0.0	27.3	60.1
2	New G3 Post 2040 CL2	0.0	0.0	0.0	12.3	0.0	0.0	20.1
3	Airbus A300	3.7	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A310	0.4	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A320/321	485.4	89.3	0.0	0.0	124.5	0.0	0.0
3	Airbus A350-800	0.0	49.4	42.6	5.7	74.9	72.0	10.3

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
3	Boeing 737-800/900	19.0	23.6	0.0	0.0	37.0	0.0	0.0
3	Boeing 757-200/300	17.1	0.0	0.0	0.0	0.0	0.0	0.0
3	Boeing 767-200	0.9	0.0	0.0	0.0	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	1.4	0.0	0.0	0.0	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	0.0	103.1	92.3	12.6	161.6	167.6	24.3
3	Post 2016 G2 Airbus A321	0.0	103.1	92.3	12.6	161.6	167.6	24.3
3	New G1 CL3	0.0	77.9	190.9	161.8	118.0	322.7	292.1
3	New G2 Post 2030 CL3	0.0	0.0	41.4	291.3	0.0	69.9	526.1
3	New G3 Post 2040 CL3	0.0	0.0	0.0	98.9	0.0	0.0	178.5
4	Airbus A330-200/300	47.3	15.3	0.0	0.0	20.8	0.0	0.0
4	Airbus A340-200/300	10.4	0.0	0.0	0.0	0.0	0.0	0.0
4	Airbus A350 PAX/900	0.0	53.1	48.1	8.2	62.0	59.4	12.0
4	Boeing 767-300/400	85.3	0.0	0.0	0.0	0.0	0.0	0.0
4	Boeing 787	6.9	155.9	136.1	20.8	210.9	194.3	35.2
4	McDonnell Douglas MD11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	New G1 CL4	0.0	58.4	82.8	61.7	68.2	102.2	90.0
4	New G2 Post 2030 CL4	0.0	0.0	47.7	120.9	0.0	58.9	176.4
4	New G3 Post 2040 CL4	0.0	0.0	0.0	96.6	0.0	0.0	140.9
5	Airbus A340-500/600	18.7	7.1	0.0	0.0	7.7	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-400	76.9	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	0.0	59.8	45.2	11.2	60.9	49.2	10.7
5	Boeing 777	151.0	127.9	66.3	0.9	132.7	72.7	1.0
5	New G1 CL5 (Twin)	0.0	21.0	30.7	10.5	21.1	31.0	9.3
5	New G2 Post 2030 CL5	0.0	0.0	40.6	87.3	0.0	41.1	76.8
5	New G3 Post 2040 CL5	0.0	0.0	0.0	57.6	0.0	0.0	50.7
6	Airbus A380 pax	20.0	26.0	24.0	1.4	31.3	28.6	1.1
6	New G1 CL6	0.0	0.0	0.0	13.0	0.0	0.0	10.3
6	New G2 Post 2030 CL6	0.0	0.0	0.0	7.4	0.0	0.0	5.9
6	New G3 Post 2040 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		1258.8	1283.6	1278.5	1251.2	1748.1	1941.9	1945.5

Table D2: 8-hour average summer night air traffic forecast for Heathrow Airport current, do minimum and North West Runway scenarios

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
1	Small twin-turboprop	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Embraer 135/145	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	0.0	0.0	0.0	0.4	0.0	0.0	1.0
1	New G1 CL1	0.0	0.0	0.0	0.5	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0	0.7	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0	0.4	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Airbus A318	0.0	0.1	0.0	0.0	0.1	0.0	0.0
2	Airbus A319	5.6	1.1	0.0	0.0	1.0	0.0	0.0
2	Boeing 717	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.6	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	0.0	0.5	0.0	0.0	0.4	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Bombardier C Series	0.0	0.3	0.1	0.0	0.2	0.2	0.1
2	Bombardier DHC-8 Q400	0.0	2.6	1.7	0.4	2.2	1.8	2.1
2	Embraer 170/175	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Embraer 190/195	0.0	0.9	0.1	0.0	0.8	0.2	0.1
2	Fokker 100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	0.0	0.9	0.6	0.0	0.8	0.7	0.3
2	Post 2016 G2 Airbus A319/320	0.0	7.9	5.6	0.3	8.4	7.3	1.8
2	New G1 CL2	0.0	1.6	3.0	0.6	1.3	3.3	3.5
2	New G2 Post 2030 CL2	0.0	0.0	0.8	0.5	0.0	0.8	2.6
2	New G3 Post 2040 CL2	0.0	0.0	0.0	0.2	0.0	0.0	0.9
3	Airbus A300	0.7	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A320/321	9.6	2.6	0.0	0.0	5.8	0.0	0.0
3	Airbus A350-800	0.0	1.4	1.5	0.3	3.5	3.3	0.3
3	Boeing 737-800/900	0.8	0.7	0.0	0.0	1.7	0.0	0.0
3	Boeing 757-200/300	1.6	0.0	0.0	0.0	0.0	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	0.0	3.0	3.2	0.6	7.5	7.7	0.7

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
3	Post 2016 G2 Airbus A321	0.0	3.0	3.2	0.6	7.5	7.7	0.7
3	New G1 CL3	0.0	2.3	6.6	7.7	5.5	14.8	8.2
3	New G2 Post 2030 CL3	0.0	0.0	1.4	13.9	0.0	3.2	14.7
3	New G3 Post 2040 CL3	0.0	0.0	0.0	4.7	0.0	0.0	5.0
4	Airbus A330-200/300	4.3	1.3	0.0	0.0	1.6	0.0	0.0
4	Airbus A340-200/300	1.3	0.0	0.0	0.0	0.0	0.0	0.0
4	Airbus A350 PAX/900	0.0	4.5	4.4	0.6	4.9	5.6	1.2
4	Boeing 767-300/400	8.1	0.0	0.0	0.0	0.0	0.0	0.0
4	Boeing 787	0.4	13.2	12.5	1.5	16.5	18.2	3.5
4	McDonnell Douglas MD11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	New G1 CL4	0.0	4.9	7.6	4.6	5.3	9.6	8.9
4	New G2 Post 2030 CL4	0.0	0.0	4.4	8.9	0.0	5.5	17.4
4	New G3 Post 2040 CL4	0.0	0.0	0.0	7.1	0.0	0.0	13.9
5	Airbus A340-500/600	4.4	0.6	0.0	0.0	0.8	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-400	17.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	0.0	5.2	5.2	1.5	6.6	6.7	1.1
5	Boeing 777	22.1	11.2	7.6	0.1	14.5	10.0	0.1
5	New G1 CL5 (Twin)	0.0	1.8	3.5	1.4	2.3	4.2	1.0
5	New G2 Post 2030 CL5	0.0	0.0	4.7	11.9	0.0	5.6	7.9
5	New G3 Post 2040 CL5	0.0	0.0	0.0	7.8	0.0	0.0	5.2
6	Airbus A380 pax	5.4	2.0	3.0	0.3	5.1	4.1	0.4
6	New G1 CL6	0.0	0.0	0.0	3.0	0.0	0.0	3.6
6	New G2 Post 2030 CL6	0.0	0.0	0.0	1.7	0.0	0.0	2.1
6	New G3 Post 2040 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		82.4	73.9	80.8	82.2	104.1	120.5	107.8

Table D3: 16-hour average summer day air traffic forecast for Heathrow Airport current, do minimum and Extended Northern Runway scenarios

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LHR-ENR 2030	LHR-ENR 2040	LHR-ENR 2050
1	Small twin-turboprop	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Embraer 135/145	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	0.3	9.0	5.0	2.1	18.2	5.1	3.0
1	New G1 CL1	0.0	0.0	0.0	2.4	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0	3.6	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0	1.8	0.0	0.0	0.0
2	BAe 146/Avro RJ	1.8	0.0	0.0	0.0	0.0	0.0	0.0
2	Airbus A318	3.2	1.5	0.0	0.0	2.0	0.0	0.0
2	Airbus A319	263.9	21.0	0.0	0.0	29.3	0.0	0.0
2	Boeing 717	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	11.7	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	23.5	10.1	0.0	0.0	12.9	0.0	0.0
2	Bombardier RJ 700/900	2.1	0.0	0.0	0.0	0.0	0.0	0.0
2	Bombardier C Series	0.0	5.4	3.6	1.0	6.9	4.9	1.6
2	Bombardier DHC-8 Q400	0.0	50.0	41.0	29.4	63.5	55.6	50.5
2	Embraer 170/175	0.0	0.0	0.0	0.4	0.0	0.0	0.0
2	Embraer 190/195	3.3	18.0	3.6	0.9	22.8	4.9	1.6
2	Fokker 100	4.7	0.0	0.0	0.0	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	0.0	18.0	15.3	4.0	22.8	20.8	6.8
2	Post 2016 G2 Airbus A319/320	0.0	150.0	137.3	26.1	247.1	223.0	44.4
2	New G1 CL2	0.0	29.6	73.4	49.6	37.6	99.7	85.2
2	New G2 Post 2030 CL2	0.0	0.0	18.4	36.9	0.0	25.0	63.4
2	New G3 Post 2040 CL2	0.0	0.0	0.0	12.3	0.0	0.0	21.2
3	Airbus A300	3.7	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A310	0.4	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A320/321	485.4	89.3	0.0	0.0	121.7	0.0	0.0
3	Airbus A350-800	0.0	49.4	42.6	5.7	73.2	65.1	9.2
3	Boeing 737-800/900	19.0	23.6	0.0	0.0	36.1	0.0	0.0
3	Boeing 757-200/300	17.1	0.0	0.0	0.0	0.0	0.0	0.0
3	Boeing 767-200	0.9	0.0	0.0	0.0	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	1.4	0.0	0.0	0.0	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	0.0	103.1	92.3	12.6	158.0	151.6	21.7

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LHR-ENR 2030	LHR-ENR 2040	LHR-ENR 2050
3	Post 2016 G2 Airbus A321	0.0	103.1	92.3	12.6	158.0	151.6	21.7
3	New G1 CL3	0.0	77.9	190.9	161.8	115.4	291.9	261.5
3	New G2 Post 2030 CL3	0.0	0.0	41.4	291.3	0.0	63.2	470.8
3	New G3 Post 2040 CL3	0.0	0.0	0.0	98.9	0.0	0.0	159.8
4	Airbus A330-200/300	47.3	15.3	0.0	0.0	22.9	0.0	0.0
4	Airbus A340-200/300	10.4	0.0	0.0	0.0	0.0	0.0	0.0
4	Airbus A350 PAX/900	0.0	53.1	48.1	8.2	68.4	58.8	11.0
4	Boeing 767-300/400	85.3	0.0	0.0	0.0	0.0	0.0	0.0
4	Boeing 787	6.9	155.9	136.1	20.8	232.8	192.3	32.4
4	McDonnell Douglas MD11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	New G1 CL4	0.0	58.4	82.8	61.7	75.3	101.1	82.7
4	New G2 Post 2030 CL4	0.0	0.0	47.7	120.9	0.0	58.3	162.0
4	New G3 Post 2040 CL4	0.0	0.0	0.0	96.6	0.0	0.0	129.5
5	Airbus A340-500/600	18.7	7.1	0.0	0.0	7.2	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-400	76.9	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	0.0	59.8	45.2	11.2	56.8	53.8	11.0
5	Boeing 777	151.0	127.9	66.3	0.9	123.7	79.6	1.0
5	New G1 CL5 (Twin)	0.0	21.0	30.7	10.5	19.7	34.0	9.6
5	New G2 Post 2030 CL5	0.0	0.0	40.6	87.3	0.0	45.0	79.2
5	New G3 Post 2040 CL5	0.0	0.0	0.0	57.6	0.0	0.0	52.3
6	Airbus A380 pax	20.0	26.0	24.0	1.4	25.3	31.5	1.6
6	New G1 CL6	0.0	0.0	0.0	13.0	0.0	0.0	15.1
6	New G2 Post 2030 CL6	0.0	0.0	0.0	7.4	0.0	0.0	8.6
6	New G3 Post 2040 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		1258.8	1283.6	1278.5	1251.2	1757.6	1816.9	1818.6

Table D4: 8-hour average summer night air traffic forecast for Heathrow Airport current, do minimum and Extended Northern Runway scenarios

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LHR-ENR 2030	LHR-ENR 2040	LHR-ENR 2050
1	Small twin-turboprop	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Embraer 135/145	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	0.0	0.0	0.0	0.4	1.0	0.0	1.0
1	New G1 CL1	0.0	0.0	0.0	0.5	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0	0.7	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0	0.4	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Airbus A318	0.0	0.1	0.0	0.0	0.1	0.0	0.0
2	Airbus A319	5.6	1.1	0.0	0.0	0.8	0.0	0.0
2	Boeing 717	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.6	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	0.0	0.5	0.0	0.0	0.4	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Bombardier C Series	0.0	0.3	0.1	0.0	0.2	0.1	0.1
2	Bombardier DHC-8 Q400	0.0	2.6	1.7	0.4	1.7	1.6	2.6
2	Embraer 170/175	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Embraer 190/195	0.0	0.9	0.1	0.0	0.6	0.1	0.1
2	Fokker 100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	0.0	0.9	0.6	0.0	0.6	0.6	0.4
2	Post 2016 G2 Airbus A319/320	0.0	7.9	5.6	0.3	6.7	6.3	2.3
2	New G1 CL2	0.0	1.6	3.0	0.6	1.0	2.8	4.4
2	New G2 Post 2030 CL2	0.0	0.0	0.8	0.5	0.0	0.7	3.3
2	New G3 Post 2040 CL2	0.0	0.0	0.0	0.2	0.0	0.0	1.1
3	Airbus A300	0.7	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A320/321	9.6	2.6	0.0	0.0	5.0	0.0	0.0
3	Airbus A350-800	0.0	1.4	1.5	0.3	3.0	3.6	0.3
3	Boeing 737-800/900	0.8	0.7	0.0	0.0	1.5	0.0	0.0
3	Boeing 757-200/300	1.6	0.0	0.0	0.0	0.0	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	0.0	3.0	3.2	0.6	6.5	8.3	0.7

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LHR-ENR 2030	LHR-ENR 2040	LHR-ENR 2050
3	Post 2016 G2 Airbus A321	0.0	3.0	3.2	0.6	6.5	8.3	0.7
3	New G1 CL3	0.0	2.3	6.6	7.7	4.8	16.0	8.4
3	New G2 Post 2030 CL3	0.0	0.0	1.4	13.9	0.0	3.5	15.2
3	New G3 Post 2040 CL3	0.0	0.0	0.0	4.7	0.0	0.0	5.1
4	Airbus A330-200/300	4.3	1.3	0.0	0.0	1.4	0.0	0.0
4	Airbus A340-200/300	1.3	0.0	0.0	0.0	0.0	0.0	0.0
4	Airbus A350 PAX/900	0.0	4.5	4.4	0.6	4.2	5.7	1.2
4	Boeing 767-300/400	8.1	0.0	0.0	0.0	0.0	0.0	0.0
4	Boeing 787	0.4	13.2	12.5	1.5	14.1	18.6	3.4
4	McDonnell Douglas MD11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	New G1 CL4	0.0	4.9	7.6	4.6	4.6	9.8	8.6
4	New G2 Post 2030 CL4	0.0	0.0	4.4	8.9	0.0	5.6	16.9
4	New G3 Post 2040 CL4	0.0	0.0	0.0	7.1	0.0	0.0	13.5
5	Airbus A340-500/600	4.4	0.6	0.0	0.0	1.1	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-400	17.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	0.0	5.2	5.2	1.5	8.6	7.0	1.5
5	Boeing 777	22.1	11.2	7.6	0.1	18.7	10.3	0.1
5	New G1 CL5 (Twin)	0.0	1.8	3.5	1.4	3.0	4.4	1.3
5	New G2 Post 2030 CL5	0.0	0.0	4.7	11.9	0.0	5.8	10.5
5	New G3 Post 2040 CL5	0.0	0.0	0.0	7.8	0.0	0.0	6.9
6	Airbus A380 pax	5.4	2.0	3.0	0.3	5.1	3.0	0.4
6	New G1 CL6	0.0	0.0	0.0	3.0	0.0	0.0	3.6
6	New G2 Post 2030 CL6	0.0	0.0	0.0	1.7	0.0	0.0	2.1
6	New G3 Post 2040 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		82.4	73.9	80.8	82.2	101.1	121.9	115.6

Table D5: 16-hour average summer day air traffic forecast for Gatwick Airport current, do minimum and Two-Runway scenarios

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LGW-2R 2030	LGW-2R 2040	LGW-2R 2050
1	Small twin-turboprop	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1	Bombardier RJ100/200	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1	Large twin-turboprop	31.7	0.4	0.0	0.0	1.2	0.0	0.0
1	Embraer 135/145	0.2	1.9	0.1	0.0	5.5	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	3.0	4.6	10.6	3.0	25.2	20.2	30.4
1	New G1 CL1	0.0	0.8	3.8	0.9	2.2	3.1	3.1
1	New G2 Post 2030 CL1	0.0	0.0	3.0	1.4	0.0	2.4	4.6
1	New G3 Post 2040 CL1	0.0	0.0	0.0	0.7	0.0	0.0	2.3
2	BAe 146/Avro RJ	0.6	0.0	0.0	0.0	0.0	0.0	0.0
2	Airbus A318	0.1	2.1	0.0	0.0	2.7	0.0	0.0
2	Airbus A319	248.5	26.6	0.0	0.0	33.6	0.0	0.0
2	Boeing 737-200/300/400/500	86.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	0.4	15.4	0.1	0.2	19.5	0.2	0.2
2	Bombardier RJ 700/900	0.3	0.0	0.0	0.0	0.0	0.0	0.0
2	Bombardier C Series	0.0	6.7	3.5	0.7	8.9	7.0	2.8
2	Bombardier DHC-8 Q400	0.0	39.9	29.4	22.8	54.5	64.0	88.9
2	Embraer 170/175	18.4	3.8	1.7	0.4	4.9	2.5	0.7
2	Embraer 190/195	12.7	14.4	2.6	0.7	19.7	5.7	2.9
2	Fokker 100	0.8	0.0	0.0	0.0	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	0.0	33.9	34.4	6.6	42.1	51.5	17.8
2	Post 2016 G2 Airbus A319/320	0.0	120.4	109.2	49.5	147.7	175.8	97.7
2	New G1 CL2	0.0	27.0	65.0	50.2	36.1	129.1	169.4
2	New G2 Post 2030 CL2	0.0	0.0	13.9	45.8	0.0	29.5	139.9
2	New G3 Post 2040 CL2	0.0	0.0	0.0	17.1	0.0	0.0	49.6
3	Airbus A300	2.7	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A310	1.2	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A320/321	132.6	43.1	1.3	0.0	45.4	1.6	0.0
3	Airbus A350-800	0.0	15.8	12.0	1.5	14.1	16.7	2.6
3	Boeing 737-800/900	84.2	30.2	1.3	0.0	29.2	1.6	0.0
3	Boeing 757-200/300	27.9	1.9	0.0	0.0	1.7	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	1.5	0.0	0.0	0.0	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	0.0	112.3	117.0	70.3	108.7	148.7	90.4
3	Post 2016 G2 Airbus A321	0.0	59.3	58.9	28.6	56.8	77.3	38.0

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LGW-2R 2030	LGW-2R 2040	LGW-2R 2050
3	New G1 CL3	0.0	135.0	198.6	186.0	129.9	251.3	252.7
3	New G2 Post 2030 CL3	0.0	0.0	12.6	141.1	0.0	17.3	206.0
3	New G3 Post 2040 CL3	0.0	0.0	0.0	59.7	0.0	0.0	86.7
4	Airbus A330-200/300	11.5	4.1	0.4	0.0	5.4	0.4	0.0
4	Airbus A340-200/300	0.1	0.0	0.0	0.0	0.0	0.0	0.0
4	Airbus A350 PAX/900	0.0	11.8	14.1	5.4	14.5	13.3	7.0
4	Boeing 767-300/400	8.5	0.1	0.0	0.0	0.1	0.0	0.0
4	Boeing 787	4.3	34.5	38.1	6.7	47.6	39.8	9.7
4	New G1 CL4	0.0	9.9	22.4	19.8	16.4	21.2	23.8
4	New G2 Post 2030 CL4	0.0	0.0	12.6	38.6	0.0	11.9	46.1
4	New G3 Post 2040 CL4	0.0	0.0	0.0	30.8	0.0	0.0	36.6
5	Airbus A340-500/600	0.2	0.8	0.0	0.0	1.7	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-400	8.5	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	0.0	4.3	5.2	2.5	8.6	7.6	8.2
5	Boeing 777	20.6	7.4	5.8	0.2	15.0	8.5	0.6
5	New G1 CL5 (Twin)	0.0	0.8	1.5	1.9	1.5	2.2	6.5
5	New G2 Post 2030 CL5	0.0	0.0	0.1	2.6	0.0	0.1	8.9
5	New G3 Post 2040 CL5	0.0	0.0	0.0	0.5	0.0	0.0	1.7
6	Airbus A380 pax	0.1	0.0	0.0	0.0	0.0	0.0	0.0
6	New G1 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	New G2 Post 2030 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	New G3 Post 2040 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		706.8	769.4	779.2	796.3	900.6	1110.7	1436.0

Table D6: 8-hour average summer night air traffic forecast for Gatwick Airport current, do minimum and Two-Runway scenarios

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LGW-2R 2030	LGW-2R 2040	LGW-2R 2050
1	Small twin-turboprop	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Large twin-turboprop	0.1	0.1	0.0	0.0	0.3	0.0	0.0
1	Embraer 135/145	0.1	0.5	0.0	0.0	1.2	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	0.3	1.1	1.8	0.5	5.5	3.6	4.3
1	New G1 CL1	0.0	0.2	0.6	0.2	0.5	0.6	0.4
1	New G2 Post 2030 CL1	0.0	0.0	0.5	0.2	0.0	0.4	0.7
1	New G3 Post 2040 CL1	0.0	0.0	0.0	0.1	0.0	0.0	0.3
2	BAe 146/Avro RJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Airbus A318	0.0	0.3	0.0	0.0	0.4	0.0	0.0
2	Airbus A319	27.8	4.2	0.0	0.0	4.9	0.0	0.0
2	Boeing 737-200/300/400/500	8.4	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	0.0	2.5	0.1	0.1	2.8	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Bombardier C Series	0.0	1.1	0.6	0.2	1.3	0.9	0.3
2	Bombardier DHC-8 Q400	0.0	6.3	5.2	5.5	7.9	8.1	8.9
2	Embraer 170/175	0.0	0.6	0.3	0.1	0.7	0.3	0.1
2	Embraer 190/195	0.3	2.3	0.5	0.2	2.9	0.7	0.3
2	Fokker 100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	0.0	5.4	6.1	1.6	6.1	6.5	1.8
2	Post 2016 G2 Airbus A319/320	0.0	19.1	19.2	11.9	21.4	22.3	9.7
2	New G1 CL2	0.0	4.3	11.4	12.1	5.2	16.4	16.9
2	New G2 Post 2030 CL2	0.0	0.0	2.4	11.0	0.0	3.7	13.9
2	New G3 Post 2040 CL2	0.0	0.0	0.0	4.1	0.0	0.0	4.9
3	Airbus A300	0.6	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A320/321	35.7	8.1	0.2	0.0	6.1	0.2	0.0
3	Airbus A350-800	0.0	3.0	2.2	0.2	1.9	1.7	0.2
3	Boeing 737-800/900	12.5	5.7	0.2	0.0	3.9	0.2	0.0
3	Boeing 757-200/300	11.7	0.4	0.0	0.0	0.2	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	0.0	21.2	20.9	11.0	14.6	14.9	8.2
3	Post 2016 G2 Airbus A321	0.0	11.2	10.5	4.5	7.6	7.7	3.5

Seat Cat.	Aircraft Type	2013	DM 2030	DM 2040	DM 2050	LGW-2R 2030	LGW-2R 2040	LGW-2R 2050
3	New G1 CL3	0.0	25.4	35.5	29.2	17.4	25.2	23.0
3	New G2 Post 2030 CL3	0.0	0.0	2.3	22.2	0.0	1.7	18.8
3	New G3 Post 2040 CL3	0.0	0.0	0.0	9.4	0.0	0.0	7.9
4	Airbus A330-200/300	3.6	1.1	0.1	0.0	1.2	0.1	0.0
4	Airbus A340-200/300	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Airbus A350 PAX/900	0.0	3.0	2.8	1.0	3.2	2.6	0.9
4	Boeing 767-300/400	2.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Boeing 787	0.9	8.8	7.6	1.3	10.5	7.6	1.3
4	New G1 CL4	0.0	2.5	4.5	3.7	3.6	4.1	3.2
4	New G2 Post 2030 CL4	0.0	0.0	2.5	7.2	0.0	2.3	6.1
4	New G3 Post 2040 CL4	0.0	0.0	0.0	5.8	0.0	0.0	4.9
5	Airbus A340-500/600	0.0	0.2	0.0	0.0	0.4	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-400	0.5	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	0.0	1.2	2.4	1.3	1.8	1.9	0.6
5	Boeing 777	3.1	2.1	2.7	0.1	3.1	2.1	0.0
5	New G1 CL5 (Twin)	0.0	0.2	0.7	1.0	0.3	0.6	0.5
5	New G2 Post 2030 CL5	0.0	0.0	0.0	1.3	0.0	0.0	0.7
5	New G3 Post 2040 CL5	0.0	0.0	0.0	0.3	0.0	0.0	0.1
6	Airbus A380 pax	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	New G1 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	New G2 Post 2030 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	New G3 Post 2040 CL6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		107.6	142.1	143.9	147.1	136.7	136.3	142.4

Table D7: 16-hour average summer day air traffic forecast for Heathrow Airport North West Runway Carbon-traded scenarios

Seat Cat.	Aircraft Type	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
1	Small twin-turboprop	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0
1	Embraer 135/145	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	10.1	4.0	6.0
1	New G1 CL1	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0
2	Airbus A318	1.8	0.0	0.0
2	Airbus A319	34.2	0.0	0.0
2	Boeing 717	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	11.6	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0
2	Bombardier C Series	6.0	4.8	1.1
2	Bombardier DHC-8 Q400	55.5	54.8	33.8
2	Embraer 170/175	0.0	0.0	0.0
2	Embraer 190/195	19.9	4.8	1.1
2	Fokker 100	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	20.9	20.5	4.6
2	Post 2016 G2 Airbus A319/320	243.5	229.8	48.4
2	New G1 CL2	33.0	98.2	57.1
2	New G2 Post 2030 CL2	0.0	24.6	42.5
2	New G3 Post 2040 CL2	0.0	0.0	14.2
3	Airbus A300	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0
3	Airbus A320/321	124.4	0.0	0.0
3	Airbus A350-800	75.2	56.4	7.7
3	Boeing 737-800/900	48.4	0.0	0.0
3	Boeing 757-200/300	0.0	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	204.3	179.7	55.5

Seat Cat.	Aircraft Type	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
3	Post 2016 G2 Airbus A321	178.8	149.4	33.0
3	New G1 CL3	182.4	340.7	306.2
3	New G2 Post 2030 CL3	0.0	55.1	415.5
3	New G3 Post 2040 CL3	0.0	0.0	153.8
4	Airbus A330-200/300	23.0	0.0	0.0
4	Airbus A340-200/300	0.0	0.0	0.0
4	Airbus A350 PAX/900	73.0	67.5	11.8
4	Boeing 767-300/400	0.0	0.0	0.0
4	Boeing 787	234.0	190.7	30.1
4	McDonnell Douglas MD11	0.0	0.0	0.0
4	New G1 CL4	80.3	116.2	88.5
4	New G2 Post 2030 CL4	0.0	67.0	173.4
4	New G3 Post 2040 CL4	0.0	0.0	138.6
5	Airbus A340-500/600	8.1	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	63.1	53.9	11.8
5	Boeing 777	137.9	80.0	1.1
5	New G1 CL5 (Twin)	21.8	33.9	14.7
5	New G2 Post 2030 CL5	0.0	44.9	121.8
5	New G3 Post 2040 CL5	0.0	0.0	80.4
6	Airbus A380 pax	33.3	33.8	4.0
6	New G1 CL6	0.0	11.3	43.0
6	New G2 Post 2030 CL6	0.0	2.3	24.5
6	New G3 Post 2040 CL6	0.0	0.0	0.1
Total		1924.4	1924.4	1924.4

Table D8: 8-hour average summer night air traffic forecast for Heathrow Airport North West Runway Carbon-traded scenarios

Seat Cat.	Aircraft Type	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
1	Small twin-turboprop	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0
1	Embraer 135/145	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	0.0	0.0	0.0
1	New G1 CL1	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0
2	Airbus A318	0.1	0.0	0.0
2	Airbus A319	1.5	0.0	0.0
2	Boeing 717	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	0.5	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0
2	Bombardier C Series	0.3	0.1	0.1
2	Bombardier DHC-8 Q400	2.4	1.0	2.0
2	Embraer 170/175	0.0	0.0	0.0
2	Embraer 190/195	0.8	0.1	0.1
2	Fokker 100	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	0.9	0.4	0.3
2	Post 2016 G2 Airbus A319/320	10.4	4.2	2.9
2	New G1 CL2	1.4	1.8	3.4
2	New G2 Post 2030 CL2	0.0	0.5	2.5
2	New G3 Post 2040 CL2	0.0	0.0	0.8
3	Airbus A300	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0
3	Airbus A320/321	4.5	0.0	0.0
3	Airbus A350-800	2.7	2.8	0.3
3	Boeing 737-800/900	1.7	0.0	0.0
3	Boeing 757-200/300	0.0	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	7.3	8.8	1.9

Seat Cat.	Aircraft Type	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
3	Post 2016 G2 Airbus A321	6.4	7.3	1.1
3	New G1 CL3	6.6	16.7	10.5
3	New G2 Post 2030 CL3	0.0	2.7	14.2
3	New G3 Post 2040 CL3	0.0	0.0	5.3
4	Airbus A330-200/300	2.2	0.0	0.0
4	Airbus A340-200/300	0.0	0.0	0.0
4	Airbus A350 PAX/900	7.0	5.4	0.9
4	Boeing 767-300/400	0.0	0.0	0.0
4	Boeing 787	22.4	15.2	2.4
4	McDonnell Douglas MD11	0.0	0.0	0.0
4	New G1 CL4	7.7	9.3	7.1
4	New G2 Post 2030 CL4	0.0	5.4	13.8
4	New G3 Post 2040 CL4	0.0	0.0	11.1
5	Airbus A340-500/600	1.1	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	8.3	8.4	1.5
5	Boeing 777	18.1	12.5	0.1
5	New G1 CL5 (Twin)	2.9	5.3	1.8
5	New G2 Post 2030 CL5	0.0	7.0	15.0
5	New G3 Post 2040 CL5	0.0	0.0	9.9
6	Airbus A380 pax	3.0	3.6	0.6
6	New G1 CL6	0.0	1.2	6.7
6	New G2 Post 2030 CL6	0.0	0.2	3.8
6	New G3 Post 2040 CL6	0.0	0.0	0.0
Total		120.0	120.0	120.0

Table D9: 16-hour average summer day air traffic forecast for Heathrow Airport Extended Northern Runway Carbon-traded scenarios

Seat Cat.	Aircraft Type	LHR-ENR 2030	LHR-ENR 2040	LHR-ENR 2050
1	Small twin-turboprop	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0
1	Embraer 135/145	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	9.1	3.0	6.0
1	New G1 CL1	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0
2	Airbus A318	1.9	0.0	0.0
2	Airbus A319	28.2	0.0	0.0
2	Boeing 717	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	12.3	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0
2	Bombardier C Series	6.6	4.6	1.2
2	Bombardier DHC-8 Q400	60.9	52.6	36.5
2	Embraer 170/175	0.0	0.0	0.0
2	Embraer 190/195	21.8	4.6	1.2
2	Fokker 100	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	21.9	19.6	4.9
2	Post 2016 G2 Airbus A319/320	239.8	201.8	36.1
2	New G1 CL2	36.1	94.3	61.6
2	New G2 Post 2030 CL2	0.0	23.7	45.8
2	New G3 Post 2040 CL2	0.0	0.0	15.3
3	Airbus A300	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0
3	Airbus A320/321	123.8	0.0	0.0
3	Airbus A350-800	74.9	61.1	8.7
3	Boeing 737-800/900	36.9	0.0	0.0
3	Boeing 757-200/300	0.0	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	161.5	141.1	20.6

Seat Cat.	Aircraft Type	LHR-ENR 2030	LHR-ENR 2040	LHR-ENR 2050
3	Post 2016 G2 Airbus A321	161.5	141.1	20.6
3	New G1 CL3	118.0	273.9	245.7
3	New G2 Post 2030 CL3	0.0	59.3	442.5
3	New G3 Post 2040 CL3	0.0	0.0	150.2
4	Airbus A330-200/300	23.4	0.0	0.0
4	Airbus A340-200/300	0.0	0.0	0.0
4	Airbus A350 PAX/900	73.3	69.2	10.9
4	Boeing 767-300/400	0.0	0.0	0.0
4	Boeing 787	238.1	200.9	29.5
4	McDonnell Douglas MD11	0.0	0.0	0.0
4	New G1 CL4	80.6	119.1	81.6
4	New G2 Post 2030 CL4	0.0	68.6	159.7
4	New G3 Post 2040 CL4	0.0	0.0	127.7
5	Airbus A340-500/600	8.8	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	68.6	56.7	12.1
5	Boeing 777	150.0	84.4	1.1
5	New G1 CL5 (Twin)	23.7	36.0	15.0
5	New G2 Post 2030 CL5	0.0	47.7	124.5
5	New G3 Post 2040 CL5	0.0	0.0	82.2
6	Airbus A380 pax	25.2	30.5	3.7
6	New G1 CL6	0.0	10.7	39.4
6	New G2 Post 2030 CL6	0.0	2.1	22.4
6	New G3 Post 2040 CL6	0.0	0.0	0.1
Total		1806.8	1806.8	1806.8

Table D10: 8-hour average summer night air traffic forecast for Heathrow Airport Extended Northern Runway Carbon-traded scenarios

Seat Cat.	Aircraft Type	LHR-ENR 2030	LHR-ENR 2040	LHR-ENR 2050
1	Small twin-turboprop	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0
1	Embraer 135/145	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	1.0	0.0	0.0
1	New G1 CL1	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0
2	Airbus A318	0.1	0.0	0.0
2	Airbus A319	1.5	0.0	0.0
2	Boeing 717	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	0.6	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0
2	Bombardier C Series	0.3	0.1	0.1
2	Bombardier DHC-8 Q400	3.1	1.5	2.0
2	Embraer 170/175	0.0	0.0	0.0
2	Embraer 190/195	1.1	0.1	0.1
2	Fokker 100	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	1.1	0.5	0.3
2	Post 2016 G2 Airbus A319/320	12.4	5.6	2.0
2	New G1 CL2	1.9	2.6	3.4
2	New G2 Post 2030 CL2	0.0	0.7	2.5
2	New G3 Post 2040 CL2	0.0	0.0	0.8
3	Airbus A300	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0
3	Airbus A320/321	4.6	0.0	0.0
3	Airbus A350-800	2.8	2.9	0.3
3	Boeing 737-800/900	1.4	0.0	0.0
3	Boeing 757-200/300	0.0	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	6.0	6.7	0.8

Seat Cat.	Aircraft Type	LHR-ENR 2030	LHR-ENR 2040	LHR-ENR 2050
3	Post 2016 G2 Airbus A321	6.0	6.7	0.8
3	New G1 CL3	4.4	13.1	9.5
3	New G2 Post 2030 CL3	0.0	2.8	17.1
3	New G3 Post 2040 CL3	0.0	0.0	5.8
4	Airbus A330-200/300	2.6	0.0	0.0
4	Airbus A340-200/300	0.0	0.0	0.0
4	Airbus A350 PAX/900	8.0	6.4	1.2
4	Boeing 767-300/400	0.0	0.0	0.0
4	Boeing 787	26.0	18.6	3.1
4	McDonnell Douglas MD11	0.0	0.0	0.0
4	New G1 CL4	8.8	11.0	8.6
4	New G2 Post 2030 CL4	0.0	6.3	16.9
4	New G3 Post 2040 CL4	0.0	0.0	13.5
5	Airbus A340-500/600	1.1	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	8.3	8.9	1.2
5	Boeing 777	18.1	13.3	0.1
5	New G1 CL5 (Twin)	2.9	5.6	1.5
5	New G2 Post 2030 CL5	0.0	7.5	12.3
5	New G3 Post 2040 CL5	0.0	0.0	8.1
6	Airbus A380 pax	3.0	4.3	0.8
6	New G1 CL6	0.0	1.5	9.1
6	New G2 Post 2030 CL6	0.0	0.3	5.2
6	New G3 Post 2040 CL6	0.0	0.0	0.0
Total		127.0	127.0	127.0

Table D11: 16-hour average summer day air traffic forecast for Gatwick Airport Two-Runway Carbon-traded scenarios

Seat Cat.	Aircraft Type	LGW-2R 2030	LGW-2R 2040	LGW-2R 2050
1	Small twin-turboprop	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0
1	Large twin-turboprop	0.9	0.0	0.0
1	Embraer 135/145	4.3	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	27.6	7.7	2.0
1	New G1 CL1	1.8	3.6	0.0
1	New G2 Post 2030 CL1	0.0	2.9	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0
2	Airbus A318	3.8	0.0	0.0
2	Airbus A319	42.4	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	24.1	0.1	0.1
2	Bombardier RJ 700/900	0.0	0.0	0.0
2	Bombardier C Series	14.9	10.9	2.6
2	Bombardier DHC-8 Q400	118.3	110.7	83.5
2	Embraer 170/175	3.3	2.1	0.0
2	Embraer 190/195	42.6	9.7	2.6
2	Fokker 100	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	42.5	41.4	11.3
2	Post 2016 G2 Airbus A319/320	219.2	210.8	56.0
2	New G1 CL2	70.0	198.6	141.0
2	New G2 Post 2030 CL2	0.0	49.8	104.9
2	New G3 Post 2040 CL2	0.0	0.0	35.0
3	Airbus A300	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0
3	Airbus A320/321	108.5	1.4	0.0
3	Airbus A350-800	41.1	30.2	4.8
3	Boeing 737-800/900	23.2	1.4	0.0
3	Boeing 757-200/300	2.2	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	91.7	87.2	24.4
3	Post 2016 G2 Airbus A321	75.2	69.7	14.5

Seat Cat.	Aircraft Type	LGW-2R 2030	LGW-2R 2040	LGW-2R 2050
3	New G1 CL3	81.8	153.1	151.8
3	New G2 Post 2030 CL3	0.0	29.7	272.6
3	New G3 Post 2040 CL3	0.0	0.0	86.6
4	Airbus A330-200/300	12.8	0.6	0.0
4	Airbus A340-200/300	0.0	0.0	0.0
4	Airbus A350 PAX/900	32.3	41.4	11.8
4	Boeing 767-300	0.2	0.0	0.0
4	Boeing 787	119.9	108.9	20.8
4	New G1 CL4	37.4	67.3	58.0
4	New G2 Post 2030 CL4	0.0	37.9	113.0
4	New G3 Post 2040 CL4	0.0	0.0	90.1
5	Airbus A340-500/600	3.6	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	29.9	27.8	5.2
5	Boeing 777	70.9	44.8	0.6
5	New G1 CL5 (Twin)	13.1	21.1	10.6
5	New G2 Post 2030 CL5	0.0	25.2	64.3
5	New G3 Post 2040 CL5	0.0	0.0	40.3
6	Airbus A380 pax	9.9	12.2	0.0
6	New G1 CL6	0.0	0.0	0.0
6	New G2 Post 2030 CL6	0.0	0.0	0.0
6	New G3 Post 2040 CL6	0.0	0.0	0.0
Total		1369.2	1408.2	1408.2

Table D12: 8-hour average summer night air traffic forecast for Gatwick Airport Two-Runway Carbon-traded scenarios

Seat Cat.	Aircraft Type	LGW-2R 2030	LGW-2R 2040	LGW-2R 2050
1	Small twin-turboprop	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0
1	Large twin-turboprop	0.3	0.0	0.0
1	Embraer 135/145	1.2	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	7.9	1.6	0.0
1	New G1 CL1	0.5	0.8	0.0
1	New G2 Post 2030 CL1	0.0	0.6	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0
2	Airbus A318	0.4	0.0	0.0
2	Airbus A319	4.8	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	2.7	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0
2	Bombardier C Series	1.7	1.4	0.4
2	Bombardier DHC-8 Q400	13.3	14.6	13.0
2	Embraer 170/175	0.4	0.3	0.0
2	Embraer 190/195	4.8	1.3	0.4
2	Fokker 100	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	4.8	5.4	1.8
2	Post 2016 G2 Airbus A319/320	24.6	27.7	8.7
2	New G1 CL2	7.9	26.1	22.0
2	New G2 Post 2030 CL2	0.0	6.5	16.3
2	New G3 Post 2040 CL2	0.0	0.0	5.5
3	Airbus A300	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0
3	Airbus A320/321	10.6	0.1	0.0
3	Airbus A350-800	4.0	2.6	0.4
3	Boeing 737-800/900	2.3	0.1	0.0
3	Boeing 757-200/300	0.2	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	9.0	7.6	2.2
3	Post 2016 G2 Airbus A321	7.4	6.1	1.3

Seat Cat.	Aircraft Type	LGW-2R 2030	LGW-2R 2040	LGW-2R 2050
3	New G1 CL3	8.0	13.3	13.9
3	New G2 Post 2030 CL3	0.0	2.6	25.0
3	New G3 Post 2040 CL3	0.0	0.0	7.9
4	Airbus A330-200/300	1.1	0.0	0.0
4	Airbus A340-200/300	0.0	0.0	0.0
4	Airbus A350 PAX/900	2.8	3.3	0.8
4	Boeing 767-300	0.0	0.0	0.0
4	Boeing 787	10.5	8.6	1.4
4	New G1 CL4	3.3	5.3	4.0
4	New G2 Post 2030 CL4	0.0	3.0	7.8
4	New G3 Post 2040 CL4	0.0	0.0	6.2
5	Airbus A340-500/600	0.4	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	3.0	2.6	0.5
5	Boeing 777	7.2	4.2	0.1
5	New G1 CL5 (Twin)	1.3	2.0	1.0
5	New G2 Post 2030 CL5	0.0	2.4	5.9
5	New G3 Post 2040 CL5	0.0	0.0	3.7
6	Airbus A380 pax	0.0	0.0	0.0
6	New G1 CL6	0.0	0.0	0.0
6	New G2 Post 2030 CL6	0.0	0.0	0.0
6	New G3 Post 2040 CL6	0.0	0.0	0.0
Total		146.2	150.4	150.4

Table D13: 16-hour average summer day air traffic forecast for Heathrow Airport North West Runway scenarios if Gatwick Airport develops

Seat Cat.	Aircraft Type	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
1	Small twin-turboprop	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0
1	Embraer 135/145	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	7.0	5.0	7.9
1	New G1 CL1	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0
2	Airbus A318	1.5	0.0	0.0
2	Airbus A319	21.2	0.0	0.0
2	Boeing 717	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	10.1	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0
2	Bombardier C Series	5.4	3.5	0.9
2	Bombardier DHC-8 Q400	49.9	39.5	28.0
2	Embraer 170/175	0.0	0.0	0.0
2	Embraer 190/195	17.9	3.5	0.9
2	Fokker 100	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	17.9	14.7	3.8
2	Post 2016 G2 Airbus A319/320	155.5	132.1	22.0
2	New G1 CL2	29.5	70.8	47.2
2	New G2 Post 2030 CL2	0.0	17.8	35.1
2	New G3 Post 2040 CL2	0.0	0.0	11.7
3	Airbus A300	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0
3	Airbus A320/321	89.7	0.0	0.0
3	Airbus A350-800	50.6	43.5	5.8
3	Boeing 737-800/900	24.2	0.0	0.0
3	Boeing 757-200/300	0.0	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	105.7	93.9	12.6

Seat Cat.	Aircraft Type	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
3	Post 2016 G2 Airbus A321	105.7	93.9	12.6
3	New G1 CL3	79.7	194.9	164.3
3	New G2 Post 2030 CL3	0.0	42.2	295.8
3	New G3 Post 2040 CL3	0.0	0.0	100.4
4	Airbus A330-200/300	15.7	0.0	0.0
4	Airbus A340-200/300	0.0	0.0	0.0
4	Airbus A350 PAX/900	54.2	49.1	8.5
4	Boeing 767-300/400	0.0	0.0	0.0
4	Boeing 787	160.1	136.6	20.5
4	McDonnell Douglas MD11	0.0	0.0	0.0
4	New G1 CL4	59.7	84.5	63.4
4	New G2 Post 2030 CL4	0.0	48.7	124.2
4	New G3 Post 2040 CL4	0.0	0.0	99.3
5	Airbus A340-500/600	7.0	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	58.5	45.8	9.6
5	Boeing 777	125.2	66.9	0.8
5	New G1 CL5 (Twin)	20.5	30.5	9.6
5	New G2 Post 2030 CL5	0.0	40.4	79.9
5	New G3 Post 2040 CL5	0.0	0.0	52.7
6	Airbus A380 pax	27.2	25.1	21.7
6	New G1 CL6	0.0	0.0	0.0
6	New G2 Post 2030 CL6	0.0	0.0	0.0
6	New G3 Post 2040 CL6	0.0	0.0	0.0
Total		1299.8	1282.8	1239.2

Table D14: 8-hour average summer night air traffic forecast for Heathrow Airport North West Runway scenarios if Gatwick Airport develops

Seat Cat.	Aircraft Type	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
1	Small twin-turboprop	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0
1	Large twin-turboprop	0.0	0.0	0.0
1	Embraer 135/145	0.0	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	0.0	0.0	2.0
1	New G1 CL1	0.0	0.0	0.0
1	New G2 Post 2030 CL1	0.0	0.0	0.0
1	New G3 Post 2040 CL1	0.0	0.0	0.0
2	BAe 146/Avro RJ	0.0	0.0	0.0
2	Airbus A318	0.1	0.0	0.0
2	Airbus A319	1.0	0.0	0.0
2	Boeing 717	0.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	0.5	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0
2	Bombardier C Series	0.3	0.1	0.0
2	Bombardier DHC-8 Q400	2.4	1.7	0.4
2	Embraer 170/175	0.0	0.0	0.0
2	Embraer 190/195	0.9	0.1	0.0
2	Fokker 100	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	0.9	0.6	0.0
2	Post 2016 G2 Airbus A319/320	7.6	5.6	0.3
2	New G1 CL2	1.4	3.0	0.6
2	New G2 Post 2030 CL2	0.0	0.8	0.5
2	New G3 Post 2040 CL2	0.0	0.0	0.2
3	Airbus A300	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0
3	Airbus A320/321	2.8	0.0	0.0
3	Airbus A350-800	1.6	1.5	0.3
3	Boeing 737-800/900	0.7	0.0	0.0
3	Boeing 757-200/300	0.0	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	3.3	3.2	0.6

Seat Cat.	Aircraft Type	LHR-NWR 2030	LHR-NWR 2040	LHR-NWR 2050
3	Post 2016 G2 Airbus A321	3.3	3.2	0.6
3	New G1 CL3	2.5	6.7	7.9
3	New G2 Post 2030 CL3	0.0	1.4	14.3
3	New G3 Post 2040 CL3	0.0	0.0	4.8
4	Airbus A330-200/300	1.3	0.0	0.0
4	Airbus A340-200/300	0.0	0.0	0.0
4	Airbus A350 PAX/900	4.3	4.3	0.6
4	Boeing 767-300/400	0.0	0.0	0.0
4	Boeing 787	12.8	12.0	1.3
4	McDonnell Douglas MD11	0.0	0.0	0.0
4	New G1 CL4	4.8	7.4	4.1
4	New G2 Post 2030 CL4	0.0	4.3	8.1
4	New G3 Post 2040 CL4	0.0	0.0	6.5
5	Airbus A340-500/600	0.7	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	5.6	5.5	1.4
5	Boeing 777	11.9	8.0	0.1
5	New G1 CL5 (Twin)	2.0	3.7	1.4
5	New G2 Post 2030 CL5	0.0	4.9	11.3
5	New G3 Post 2040 CL5	0.0	0.0	7.5
6	Airbus A380 pax	2.0	3.0	6.9
6	New G1 CL6	0.0	0.0	0.0
6	New G2 Post 2030 CL6	0.0	0.0	0.0
6	New G3 Post 2040 CL6	0.0	0.0	0.0
Total		74.4	81.2	81.7

Table D15: 16-hour average summer day air traffic forecast for Gatwick Airport Two-Runway scenarios if Heathrow Airport develops

		With LHR-NWR			With LHR-ENR		
Seat Cat.	Aircraft Type	2030	2040	2050	2030	2040	2050
1	Small twin-turboprop	0.0	0.0	0.0	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0	0.0	0.0	0.0
1	Large twin-turboprop	0.6	0.0	0.0	0.4	0.0	0.0
1	Embraer 135/145	2.9	0.1	0.0	1.7	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	19.8	31.4	33.9	11.3	17.1	10.2
1	New G1 CL1	1.2	8.4	5.9	0.7	4.7	7.4
1	New G2 Post 2030 CL1	0.0	6.7	8.9	0.0	3.7	11.1
1	New G3 Post 2040 CL1	0.0	0.0	4.5	0.0	0.0	5.6
2	BAe 146/Avro RJ	0.0	0.0	0.0	0.0	0.0	0.0
2	Airbus A318	1.7	0.0	0.0	1.8	0.0	0.0
2	Airbus A319	22.0	0.0	0.0	23.2	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	12.9	0.1	0.1	13.5	0.1	0.1
2	Bombardier RJ 700/900	0.0	0.0	0.0	0.0	0.0	0.0
2	Bombardier C Series	4.8	4.0	0.6	5.1	4.6	0.9
2	Bombardier DHC-8 Q400	27.2	19.3	18.0	27.9	22.7	26.6
2	Embraer 170/175	3.0	4.0	1.0	3.4	4.5	1.2
2	Embraer 190/195	9.9	1.8	0.6	10.1	2.1	0.9
2	Fokker 100	0.0	0.0	0.0	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	29.3	28.7	5.6	30.8	32.3	6.9
2	Post 2016 G2 Airbus A319/320	96.7	87.7	44.5	102.9	99.9	51.8
2	New G1 CL2	19.4	45.6	40.9	20.0	53.0	55.9
2	New G2 Post 2030 CL2	0.0	9.2	38.0	0.0	10.8	49.5
2	New G3 Post 2040 CL2	0.0	0.0	14.2	0.0	0.0	18.1
3	Airbus A300	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A320/321	27.4	1.2	0.0	27.7	1.3	0.0
3	Airbus A350-800	10.6	7.5	1.2	11.1	8.0	1.3
3	Boeing 737-800/900	25.5	1.2	0.0	26.0	1.3	0.0
3	Boeing 757-200/300	1.6	0.0	0.0	1.6	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	93.6	95.0	59.9	95.7	98.4	61.7
3	Post 2016 G2 Airbus A321	45.4	43.9	24.1	46.9	45.9	25.0

		With LHR-NWR			With LHR-ENR		
Seat Cat.	Aircraft Type	2030	2040	2050	2030	2040	2050
3	New G1 CL3	116.5	158.2	156.5	118.7	163.8	162.8
3	New G2 Post 2030 CL3	0.0	8.0	118.9	0.0	8.6	126.2
3	New G3 Post 2040 CL3	0.0	0.0	49.8	0.0	0.0	52.4
4	Airbus A330-200/300	3.0	0.3	0.0	3.2	0.4	0.0
4	Airbus A340-200/300	0.0	0.0	0.0	0.0	0.0	0.0
4	Airbus A350 PAX/900	9.2	9.5	4.5	9.6	12.0	4.0
4	Boeing 767-300	0.0	0.0	0.0	0.0	0.0	0.0
4	Boeing 787	24.4	20.4	4.8	26.1	26.1	4.3
4	New G1 CL4	7.5	11.2	12.3	7.9	14.2	11.1
4	New G2 Post 2030 CL4	0.0	6.1	23.9	0.0	7.8	21.6
4	New G3 Post 2040 CL4	0.0	0.0	19.1	0.0	0.0	17.2
5	Airbus A340-500/600	0.8	0.0	0.0	0.7	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	4.2	4.7	0.3	3.6	2.4	2.0
5	Boeing 777	7.3	5.1	0.0	6.3	2.5	0.1
5	New G1 CL5 (Twin)	0.8	1.5	0.2	0.7	0.7	1.6
5	New G2 Post 2030 CL5	0.0	0.1	0.3	0.0	0.0	2.2
5	New G3 Post 2040 CL5	0.0	0.0	0.1	0.0	0.0	0.4
6	Airbus A380 pax	0.0	0.0	0.0	0.0	0.0	0.0
6	New G1 CL6	0.0	0.0	0.0	0.0	0.0	0.0
6	New G2 Post 2030 CL6	0.0	0.0	0.0	0.0	0.0	0.0
6	New G3 Post 2040 CL6	0.0	0.0	0.0	0.0	0.0	0.0
Total		629.1	621.0	692.8	638.6	648.9	740.5

Table D16: 8-hour average summer night air traffic forecast for Gatwick Airport Two-Runway scenarios if Heathrow Airport develops

		With LHR-NWR			With LHR-ENR		
Seat Cat.	Aircraft Type	2030	2040	2050	2030	2040	2050
1	Small twin-turboprop	0.0	0.0	0.0	0.0	0.0	0.0
1	Bombardier RJ100/200	0.0	0.0	0.0	0.0	0.0	0.0
1	Large twin-turboprop	0.2	0.0	0.0	0.2	0.0	0.0
1	Embraer 135/145	1.0	0.0	0.0	0.8	0.0	0.0
1	Executive Jet (Chapter 2)	0.0	0.0	0.0	0.0	0.0	0.0
1	Executive Jet (Chapter 3)	6.9	5.8	6.1	5.3	4.4	2.8
1	New G1 CL1	0.4	1.5	1.1	0.3	1.2	2.0
1	New G2 Post 2030 CL1	0.0	1.2	1.6	0.0	1.0	3.0
1	New G3 Post 2040 CL1	0.0	0.0	0.8	0.0	0.0	1.5
2	BAe 146/Avro RJ	0.0	0.0	0.0	0.0	0.0	0.0
2	Airbus A318	0.3	0.0	0.0	0.3	0.0	0.0
2	Airbus A319	4.0	0.0	0.0	4.0	0.0	0.0
2	Boeing 737-200/300/400/500	0.0	0.0	0.0	0.0	0.0	0.0
2	Boeing 737-600/700/Freight Dom	2.3	0.0	0.0	2.3	0.0	0.0
2	Bombardier RJ 700/900	0.0	0.0	0.0	0.0	0.0	0.0
2	Bombardier C Series	0.9	0.7	0.1	0.9	0.8	0.2
2	Bombardier DHC-8 Q400	5.0	3.2	3.1	4.8	3.9	5.4
2	Embraer 170/175	0.5	0.7	0.2	0.6	0.8	0.2
2	Embraer 190/195	1.8	0.3	0.1	1.8	0.4	0.2
2	Fokker 100	0.0	0.0	0.0	0.0	0.0	0.0
2	New Gen Post 2016 B737-600/700	5.3	4.8	1.0	5.3	5.6	1.4
2	Post 2016 G2 Airbus A319/320	17.7	14.6	7.8	17.8	17.3	10.4
2	New G1 CL2	3.5	7.6	7.1	3.5	9.2	11.2
2	New G2 Post 2030 CL2	0.0	1.5	6.6	0.0	1.9	9.9
2	New G3 Post 2040 CL2	0.0	0.0	2.5	0.0	0.0	3.6
3	Airbus A300	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A310	0.0	0.0	0.0	0.0	0.0	0.0
3	Airbus A320/321	4.7	0.2	0.0	5.0	0.3	0.0
3	Airbus A350-800	1.8	1.5	0.2	2.0	1.6	0.2
3	Boeing 737-800/900	4.3	0.2	0.0	4.7	0.3	0.0
3	Boeing 757-200/300	0.3	0.0	0.0	0.3	0.0	0.0
3	Boeing 767-200	0.0	0.0	0.0	0.0	0.0	0.0
3	McDonnell Douglas MD80 series	0.0	0.0	0.0	0.0	0.0	0.0
3	Ilyushin Il-62	0.0	0.0	0.0	0.0	0.0	0.0
3	New Gen Post 2016 B737-800/900	15.9	18.9	11.5	17.3	19.6	9.8
3	Post 2016 G2 Airbus A321	7.7	8.7	4.6	8.5	9.2	4.0

		With LHR-NWR			With LHR-ENR		
Seat Cat.	Aircraft Type	2030	2040	2050	2030	2040	2050
3	New G1 CL3	19.8	31.5	30.1	21.4	32.7	26.0
3	New G2 Post 2030 CL3	0.0	1.6	22.9	0.0	1.7	20.1
3	New G3 Post 2040 CL3	0.0	0.0	9.6	0.0	0.0	8.4
4	Airbus A330-200/300	0.8	0.1	0.0	0.8	0.1	0.0
4	Airbus A340-200/300	0.0	0.0	0.0	0.0	0.0	0.0
4	Airbus A350 PAX/900	2.3	2.5	0.9	2.3	2.4	0.8
4	Boeing 767-300	0.0	0.0	0.0	0.0	0.0	0.0
4	Boeing 787	6.2	5.3	1.0	6.3	5.3	0.8
4	New G1 CL4	1.9	2.9	2.5	1.9	2.9	2.1
4	New G2 Post 2030 CL4	0.0	1.6	4.9	0.0	1.6	4.1
4	New G3 Post 2040 CL4	0.0	0.0	3.9	0.0	0.0	3.3
5	Airbus A340-500/600	0.5	0.0	0.0	0.5	0.0	0.0
5	Boeing 747-300	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-400	0.0	0.0	0.0	0.0	0.0	0.0
5	Boeing 747-8/Freight Intl	2.4	2.0	1.2	2.4	1.2	1.8
5	Boeing 777	4.2	2.1	0.1	4.2	1.3	0.1
5	New G1 CL5 (Twin)	0.5	0.6	1.0	0.5	0.4	1.4
5	New G2 Post 2030 CL5	0.0	0.0	1.3	0.0	0.0	1.9
5	New G3 Post 2040 CL5	0.0	0.0	0.3	0.0	0.0	0.4
6	Airbus A380 pax	0.0	0.0	0.0	0.0	0.0	0.0
6	New G1 CL6	0.0	0.0	0.0	0.0	0.0	0.0
6	New G2 Post 2030 CL6	0.0	0.0	0.0	0.0	0.0	0.0
6	New G3 Post 2040 CL6	0.0	0.0	0.0	0.0	0.0	0.0
Total		123.2	121.5	134.0	125.8	126.8	137.0