JACOBS®

5. Noise: Local Assessment

Prepared for the Airports Commission

November 2014

Jacobs U.K. Limited

This document has been prepared by a division, subsidiary or affiliate of Jacobs U.K. Limited ("Jacobs") in its professional capacity as consultants in accordance with the terms and conditions of Jacobs' contract with the commissioning party (the "Client"). Regard should be had to those terms and conditions when considering and/or placing any reliance on this document. No part of this document may be copied or reproduced by any means without prior written permission from Jacobs. If you have received this document in error, please destroy all copies in your possession or control and notify Jacobs.

Any advice, opinions, or recommendations within this document (a) should be read and relied upon only in the context of the document as a whole; (b) do not, in any way, purport to include any manner of legal advice or opinion; (c) are based upon the information made available to Jacobs at the date of this document and on current UK standards, codes, technology and construction practices as at the date of this document. It should be noted and it is expressly stated that no independent verification of any of the documents or information supplied to Jacobs has been made. No liability is accepted by Jacobs for any use of this document, other than for the purposes for which it was originally prepared and provided. Following final delivery of this document to the Client, Jacobs will have no further obligations or duty to advise the Client on any matters, including development affecting the information or advice provided in this document.

This document has been prepared for the exclusive use of the Client and unless otherwise agreed in writing by Jacobs, no other party may use, make use of or rely on the contents of this document. Should the Client wish to release this document to a third party, Jacobs may, at its discretion, agree to such release provided that (a) Jacobs' written agreement is obtained prior to such release; and (b) by release of the document to the third party, that third party does not acquire any rights, contractual or otherwise, whatsoever against Jacobs and Jacobs, accordingly, assume no duties, liabilities or obligations to that third party; and (c) Jacobs accepts no responsibility for any loss or damage incurred by the Client or for any conflict of Jacobs' interests arising out of the Client's release of this document to the third party.

Contents

Executive Summary **i**

1 Introduction **1**
1.1 Context and Scope 1
1.2 Introduction to Noise 2

2 Methodology **7**
2.1 Methodology 7
2.2 Limitations and Assumptions 9

3 Gatwick Airport Second Runway **10**
3.1 Scheme description 10
3.2 Study Area 10
3.3 Routes 11
3.4 Population 12
3.5 Baseline Noise Levels 13
3.6 Scorecards for 'Assessment of Need' Option 15
3.7 Appraisal of 'Assessment of Need' Option 17
3.8 Scorecards for 'Carbon Traded' Option (Gatwick-2R-X-C) 44
3.9 Appraisal of 'Carbon Traded' Option (Gatwick-2R-X-C) 46
3.10 Ground Noise 68
3.11 Monetisation 69
3.12 Promoter's Submission 70
3.13 Commentary on promoter's Submission 72
3.14 Mitigation 73
3.15 Conclusions 74

4 Heathrow Airport Northwest Runway **75**
4.1 Scheme description 75
4.2 Baseline 75
4.3 Routes 77
4.4 Population 78
4.5 Baseline Noise Levels 80
4.6 Scorecards for 'Minimise Total' Option (Heathrow-NWR-T) 83
4.7 Assessment of 'Minimise Total' Option (Heathrow-NWR-T) 85
4.8 Scorecards for 'Minimise Total Carbon Traded' Option (Heathrow-NWR-T-C) 110
4.9 Assessment of 'Minimise Total Carbon Traded' Option (Heathrow-NWR-T-C) 112
4.10 Scorecards for 'Minimise New' Option (Heathrow-NWR-N) 134
4.11 Assessment of 'Minimise New' Option (Heathrow-NWR-N) 136
4.12 Scorecards for 'Respite' Option (Heathrow-NWR-R) 159
4.13 Assessment of 'Respite' Option (Heathrow-NWR-R) 161
4.14 Scorecard for '3.5˚ Approach' Option (Heathrow-NWR-T-35) 186

4.15 Assessment of '3.5˚ Approach' Option (Heathrow-NWR-T-35) 187
4.16 Ground Noise 196
4.17 Monetisation (Heathrow-NWR-T) 197
4.18 Monetisation (Heathrow-NWR-N) 199
4.20 Promoter's Submission 201
4.21 Commentary on promoter's Submission 203
4.22 Mitigation 205
4.23 Conclusions 205

5 Heathrow Extended Northern Runway (Heathrow-ENR) 207
5.1 Scheme description 207
5.2 Baseline 207
5.3 Routes 209
5.4 Population 210
5.5 Baseline Noise Levels 211
5.6 Scorecards for Heathrow Extended Northern Runway (Heathrow-ENR) 211
5.7 Assessment of Heathrow Airport Extended Northern Runway (Heathrow-ENR) 213
5.8 Scorecards for 'Carbon Traded' Option (Heathrow-ENR-X-C) 237
5.9 Assessment of 'Carbon Traded' Option (Heathrow-ENR-X-C) 239
5.10 Scorecard for 'Respite' Option (Heathrow-ENR-R) 260
5.11 Assessment of 'Respite' Option (Heathrow-ENR-R) 260
5.12 Ground Noise 270
5.13 Monetisation (Heathrow-ENR) 271
5.14 Monetisation (Heathrow-ENR-R) 272
5.15 Promoter's Submission 274
5.16 Commentary on promoter's Submission 275
5.17 Mitigation 276
5.18 Conclusions 276

Glossary

References

Appendix A Methodology

Executive Summary

The Airports Commission Appraisal Framework considers the aviation noise implications of airport schemes at both a national and local level.

This report quantifies the likely local noise effects of three shortlisted schemes, which 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).

For each scheme, relevant options and sensitivity tests are also assessed. Collectively, these are referred to as the 'Do-Something' options. The basis of the appraisal is a comparison of the effects of the shortlist schemes with the noise baselines for the assessment years.

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. The current situation is calculated from the actual aircraft movements at each airport in 2011 and 2013. The population noise exposures for the current and DM situations are detailed in the Noise: Baseline Report (Jacobs 2014).

The Appraisal Framework requires base and end year comparisons.

For the Local Noise Assessment, a base date of 2030, an interim date of 2040 and an end date of 2050 are used. These dates do not coincide with the wider appraisal start and end dates, which are derived from an available scheme completion date (2025 / 2026) and a 60 year appraisal period.

This is because 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. For monetisation purposes, noise impacts identified in 2050 are presumed to hold for the remainder of the assessment period.

Gatwick Second Runway

For the carbon capped Gatwick 2R option, the following differences in aircraft noise exposure are predicted in comparison to the DM situation for each assessment year:

Table A1 : Predicted impacts of Gatwick Second Runway Option

Metric	Period	Value	Area (km²)			Population		
			2030	2040	2050	2030	2040	2050
$L_{Aeq,16h}$	Summer average	>54	16.2	23.1	35.7	9,600	12,000	17,000
$L_{Aeq,16h}$	Summer average	>57	11.5	15.3	23.6	2,700	3,100	4,400
$L_{Aeq,8h}$	Summer average	>48	1.1	(1.8)	(0.6)	10,600	6,300	7,400
L_{den}	Annual average	>55	13.0	17.4	24.9	12,700	12,100	15,100
N70	Summer average	>20	25.2	22.0	29.7	8,400	7,800	8,200
N60	Summer average	>25	(5.7)	(8.6)	(5.2)	7,700	5,900	6,800

Note: Numbers in parentheses show a reduction in population exposure

Heathrow Northwest Runway

For the carbon capped Heathrow NWR option, the following differences in aircraft noise exposure are predicted in comparison to the DM situation for each assessment year:

Table A2 : Predicted impacts of Heathrow North West Runway Option

Metric	Period	Value	Area (km²)			Population		
			2030	2040	2050	2030	2040	2050
$L_{Aeq,16h}$	Summer average	>54	32.1	39.8	41.7	(37,400)	28,000	56,100
$L_{Aeq,16h}$	Summer average	>57	24.5	28.1	27.7	15,900	30,500	29,700
$L_{Aeq,8h}$	Summer average	>48	30.4	28.6	17.8	(4,400)	(28,500)	(77,300)
L_{den}	Annual average	>55	36.4	48.4	50.9	(24,300)	29,200	54,200
N70	Summer average	>20	22.1	21.0	16.6	(14,200)	600	1,700
N60	Summer average	>25	14.7	16.2	(1.8)	(21,900)	(61,100)	(173,400)

Note: Numbers in parentheses show a reduction in population exposure

Heathrow Extended Northern Runway

For the carbon capped Heathrow ENR option, the following differences in aircraft noise exposure are predicted in comparison to the DM situation for each assessment year:

Table A3 : Predicted impacts of Heathrow Extended Northern Runway Option

Metric	Period	Value	Area (km²)			Population		
			2030	2040	2050	2030	2040	2050
$L_{Aeq,16h}$	Summer average	>54	43.9	48.3	44.6	216,200	265,400	266,800
$L_{Aeq,16h}$	Summer average	>57	24.6	27.5	25.3	76,200	86,300	84,300
$L_{Aeq,8h}$	Summer average	>48	30.9	36.1	30.5	121,500	139,700	143,200
L_{den}	Annual average	>55	48.6	56.2	51.7	226,300	267,300	269,000
N70	Summer average	>20	16.6	20.8	11.6	6,500	28,500	14,300
N60	Summer average	>25	38.0	46.1	37.5	197,700	239,600	200,200

Note: Numbers in parentheses show a reduction in population exposure

1 Introduction

This section provides context for the report, outlines the scope of the assessment, and provides an introduction to noise and noise metrics.

1.1 Context and Scope

This report has been prepared to provide evidence to support the Airports Commission's Appraisal Framework Module 5: Noise The objective for the 'Noise' appraisal module is "*To minimise and where possible reduce noise impacts*".

Noise is a complex subject and there are challenges around modelling, describing and evaluating it. Individuals may respond to noise in different ways, and therefore community response relationships are used as the basis for estimating noise impacts for a 'typical' person. A number of the consultation responses to the Commission's spring 2013 Aviation Noise discussion paper urged the Commission to apply a combination of metrics to noise appraisal, and this approach is adopted in this appraisal module.

The appraisal module considers the noise implications of a scheme at both the national and local level. Both are based on comparisons of the schemes (referred to as the 'Do-Something' options), to Do-Minimum (DM) situations. The Assessment Report associated with the Place module offers consideration of tranquillity in context of landscape and heritage.

The Appraisal Framework indicates that a 60 year period should be adopted between the base and end years for appraisals. However, it also notes that the time-horizons for the datasets supporting some assessment modules, including noise, are much shorter. This noise assessment of the schemes adopts 2030 as the base year. For each scheme, ERCD has provided future year noise contours for 2030, 2040 and 2050 which is the upper end of the time-horizon that assumptions about input data can be realistically made. This range of results is sufficient for comparison with the assessment years selected in all of the promoter's submissions, but does not enable a quantitative assessment for the appraisal end year.

Jacobs have been commissioned to provide an independent assessment of the three schemes shortlisted by the Airports Commission. The local noise assessment is follows the methodology set out in the noise appraisal module, and is based on the outputs of noise modelling for each scheme. The noise modelling has been undertaken using the ANCON model of the Environmental Research and Consultancy Department (ERCD) arm of the Civil Aviation Authority (CAA). The model scenarios considered by this report are set out in Table 1.1 below.

Table 1.1 ANCON Model Scenarios

Airport	Scheme	Scheme Notation
Gatwick	DM (1 Runway) Second Runway (capped) Second Runway (traded)	Gatwick-1R Gatwick-2R-X Gatwick-2R-X-C
Heathrow	DM (2 Runways) Northwest Runway Minimise Total (capped) Northwest Runway Minimise Total (traded) Northwest Runway Minimise New (capped) Northwest Runway Respite (capped) Northwest Runway 3.5 deg app (capped)	Heathrow-2R Heathrow-NWR-T Heathrow-NWR-T-C Heathrow-NWR-N Heathrow-NWR-R Heathrow-NWR-T-35
Heathrow	Extended Northern Runway (capped) Extended Northern Runway (traded) Extended Northern Runway Respite (cappred)	Heathrow-ENR Heathrow-ENR-X-C Heathrow-ENR-R

The methodology applied in this report is described in Appendix A.

1.2 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 1.2 below.

Table 1.2 Common Levels of Noise

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

After Sharland, 1972

(a) 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 as **single event metrics**, **exposure metrics** and **supplementary metrics** (Jones et al, 2009).

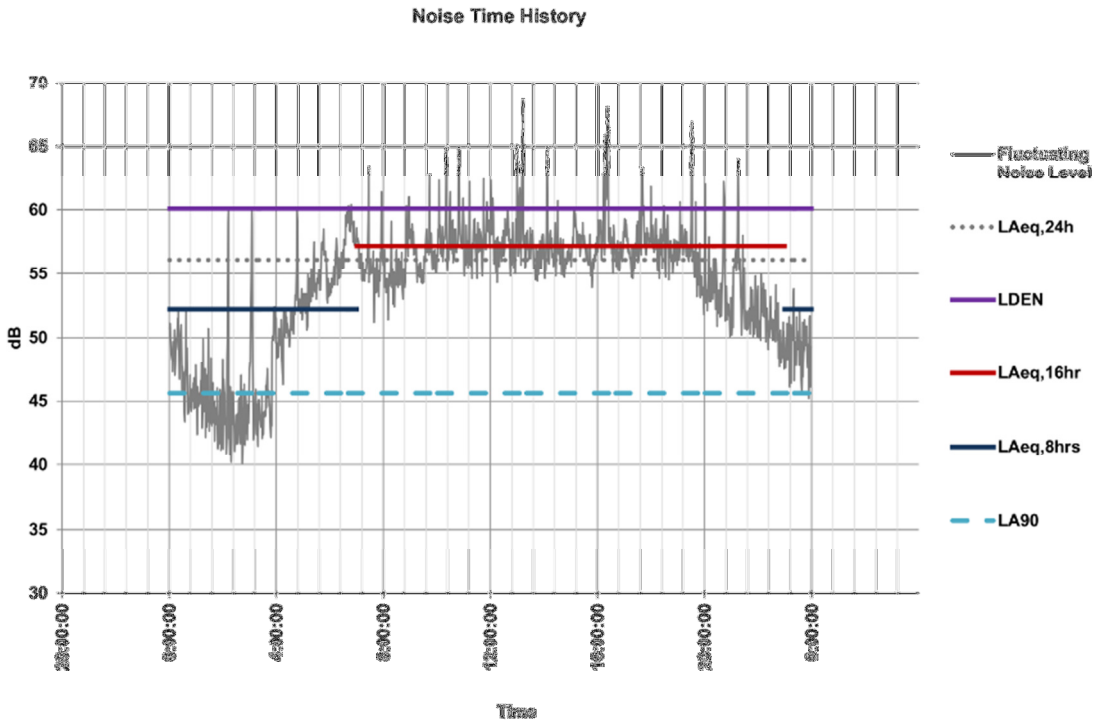
(i) Single Event Metrics

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 $L_{AS,max}$ metric tells us how loud an event is, it's primary disadvantage is that it does not give any information about an events duration.

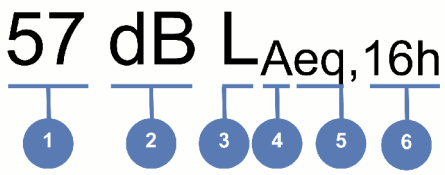
(ii) Exposure metrics

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 energy as the actual fluctuating noise level of a time period, and studies have shown that a large proportion of measured variation in annoyance can be accounted for by the L_{Aeq} metric (ANASE). 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 due to aircraft during the daytime is observed (CAA, 1990):



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.
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 $L_{Aeq,16h}$ and 57 dB(A) $L_{eq,16h}$ 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:
   - $L_{Aeq,16h}$ which is the A-weighted equivalent continuous noise level, assessed over an **average summertime daytime** / **evening** period (07.00-23.00).
   - $L_{Aeq,8h}$ 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} (or 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 $L_{AS,max}$ and 60 dB $L_{AS,max}$) 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 $L_{AS,max}$ is treated in the same way as an event at 71 dB $L_{AS,max}$). 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.

The $L_{A90,T}$ noise metric (see Figure 1.1 above), which is defined as the level exceeded for 90% of the measurement period (T), is often used to describe background noise levels. This can be thought of as representing the underlying level of noise present (from continuous or near continuous sources) during the quieter parts of the measurement, and is frequently used in noise assessments.

(b) 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 1.3 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 1.3 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.

(c) 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.

2 Methodology

2.1 Methodology

The purpose of the Local Noise Assessment is to consider the potential noise impacts of the three shortlisted at Gatwick and Heathrow airports by comparing the baseline of 'do minimum' against the 'do something' scenarios for each of the schemes.

The Appraisal Framework indicates that a 60 year period should be adopted between the base and end years for appraisals. However, it also notes that the time-horizons for the datasets supporting some assessment modules, including noise, are much shorter. Therefore the scheme promoters have selected earlier end years for their submissions, for which reasonable assumptions can be made in respect of input data. These provide a basis to which the Commission can apply logic and best practice to estimate future benefits and dis-benefits to be fed into the wider appraisal.

This noise assessment of the schemes adopts 2030 as the base year. For each scheme, ERCD has provided future year noise contours for 2030, 2040 and 2050 which is the upper end of the time-horizon that assumptions about input data can be realistically made. This range of results is sufficient for comparison with the assessment years selected in all of the promoter's submissions, but as noted above, does not enable a quantitative assessment for the appraisal end year.

2.1.1 Air Noise

The full range of noise metrics that have been considered in this assessment are:

- $L_{Aeq,16h}$ (average summers day) contours from 54 dB to 72 dB in 3 dB intervals
- $L_{Aeq,8h}$ (average summers night) contours from 48 dB to 72 dB in 3 dB intervals
- L_{den} (Day-Evening-Night level) contours from 55 dB to 75 dB in 5 dB intervals
- N70 (16-hour average day) contours (no levels specified)
- N60 (8-hour average night) contours (no levels specified)

Estimates of population noise exposure are very sensitive to input data such as:

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

The scheme promoters have based their noise assessments on their forecasts of ATMs, fleet mixes and population. ERCD has calculated noise contours and population exposure for the Airports Commission based on: DM and Assessment of Need (carbon capped), Low Cost is King (carbon traded) and Global Growth (carbon traded) forecasts (Passengers and ATMs), conservative fleet mix assumptions for

each airport (Appendix A.1), and population data supplied by CACI Limited[1]. The ATM forecasts assume that the current Quota Count system for managing noise between 23.30 and 06.00 will not change, although in some scenarios there are 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.

The population data used for the current scenarios (described in Chapter 3) are the 2013 update of the latest 2011 Census. Population data used for the 2030, 2040 and 2050 are forecasts for these respective years also supplied by CACI Limited.

Taken together, the ERCD and promoter's predictions provide the Commission with a view of the potential impacts of each scheme based on alternative forecasts.

2.1.2 Ground Noise

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, $LA_{eq,T}$. Various time periods have been used, and in this report consideration has been given to the $LA_{eq,16h}$ metric for the daytime period: 0700-2300h.

The simplified methodology adopted in this report for undertaking this appraisal of ground noise is presented in Appendix A(1.5) and provides a means of assessing to what extent ground noise is likely to increase or decrease over time. Numbers of population affected are sensitive to the issues already noted for air noise, and without detailed ground movement modelling must by necessity be approximate indications of ground noise impacts. However, 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 suggested by promoters' submissions 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.

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 $LA_{eq,16h}$ to prevent "moderate" community annoyance and 55 dB $LA_{eq,16h}$ for "serious" community annoyance. The 55 dB $LA_{eq,16h}$ guideline is comparable to the daytime aircraft noise level of 57 dB $LA_{eq,16h}$ in the current Aviation Policy Framework where it is treated as marking the approximate onset of significant community annoyance.

[1] CACI is a professional services and information technology company, providing market intelligence, including population forecasts based on census and other data www.caci.co.uk

2.1.3 Promoters submissions

The promoter's submissions have been reviewed in relation to:

- The requirements of appraisal module 5 'Noise';
- Their stated aviation noise impacts associated with the scheme as determined by comparison to the baselines, using a scorecard approach;
- Comparison to ERCD modelled aviation noise impacts for each proposal, and,
- Measures undertaken to control and mitigate ground noise.

2.2 Limitations and Assumptions

This assessment and therefore, this report are 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.

The noise models used by ERCD (ANCON) estimates long-term average impacts using average input conditions. Some differences between long-term predictions and short term measured values are to be expected as daily aircraft movements and weather conditions vary. 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.

All routes must be considered indicative. They have been prepared as a result of a workshop between the Commission, the CAA, NATS and the promoters, or have been developed from information provided by the operator, for noise modelling purposes only. They should not be considered definitive route designs.

Using current navigation technology, it is recognized that there are occasions when aircraft are unable to fly precisely within routes. Future improvements to navigation and airspace design (e.g. P-RNAV[2]) are expected to improve track-keeping, but it is likely that there will still be occasions when indicated routes cannot be adhered to precisely. The noise models account for spread along routes, but are prepared on the basis that aircraft will adhere to routes wherever possible.

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

[2] Precision Area Navigation, the European terminal airspace area navigation method, and a development of basic area navigation that should improve safety and environmental impact

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 the planning authority may not permit any new dwellings in locations already subject to aircraft noise levels at or above their adopted Significant Observed Adverse Effect Level[3] (SOAEL) for environmental noise.

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.

This precludes a precise consideration of the change in noise levels at individual amenity buildings within the study area.

[3] 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 Airport Second Runway

This chapter focuses on the Gatwick Second Runway proposal and:

- *Summarises the key elements of the scheme, focusing on aspects which are relevant to noise*
- *Summarises the current baseline situation, and describes how it will change over time, in the absence of the scheme*
- *Describes the impacts of the scheme, based on noise modelling undertaken by ECRD using the ANCON model for the Airports Commission*
- *Considers the effects of ground noise*
- *Summarises the monetisation of annoyance and health effects from noise*
- *Reviews the promoter's submissions in respect of noise*
- *Describes the potential for noise mitigation*
- *Reaches conclusions on the likely noise impacts of the scheme*

3.1 Scheme description

The Gatwick 2R scheme is based around a new, wide spaced runway to the south of the existing runway, and a new terminal building located between the runways. The basic proposal will require aircraft using the new runway to taxi across the existing runway, although a possible alternative has been put forward which involves aircraft taxing around the ends of the existing runway.

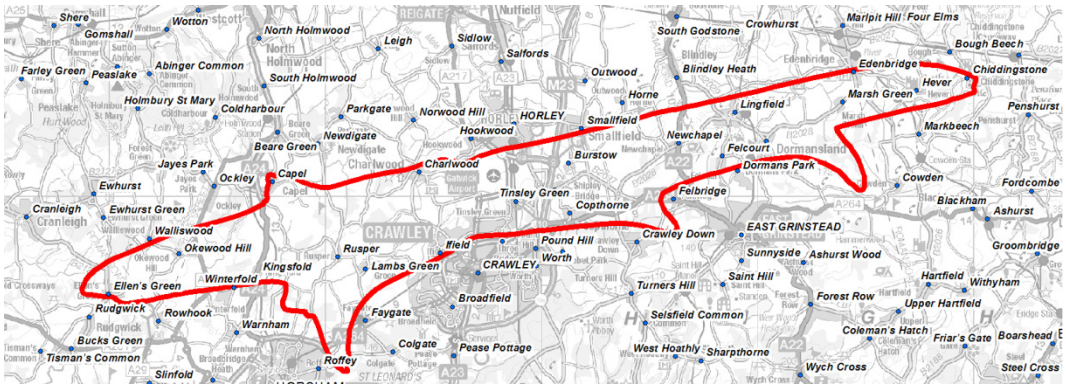
A single proposal was modelled for the Gatwick 2R (i.e. with no sensitivity testing), with calculations undertaken for scenarios without carbon trading and with carbon trading.

3.2 Study Area

The current baseline (2011/2013) and future (2030, 2040 and 2050) DM noise levels that are calculated for Gatwick Airport are set out in the Noise Baseline Report.

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



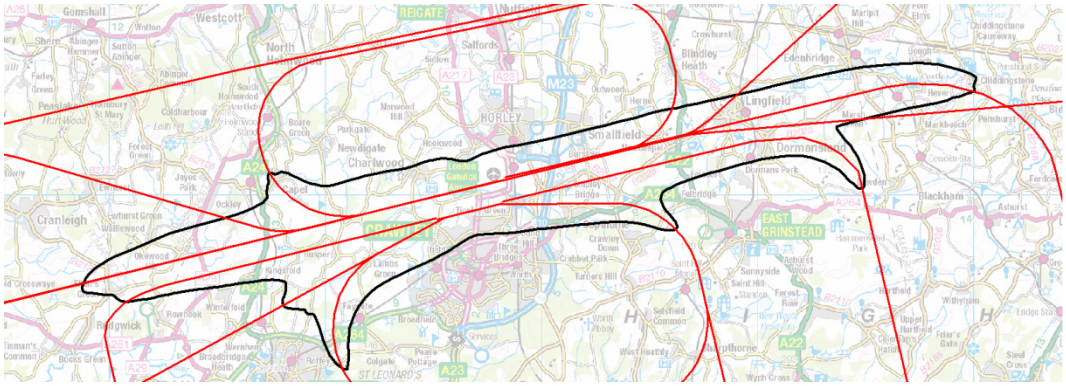
In addition to parts of Crawley, Horley and Horsham, the noise study area for Gatwick includes the settlements of:

- 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

3.3 Routes

Those parts of the indicative routes for the Gatwick 2R scheme that fall within the study area are shown in Figure 3.2 below. These routes have been developed for noise modelling purposes and should not be considered as the final routes of an expanded option.

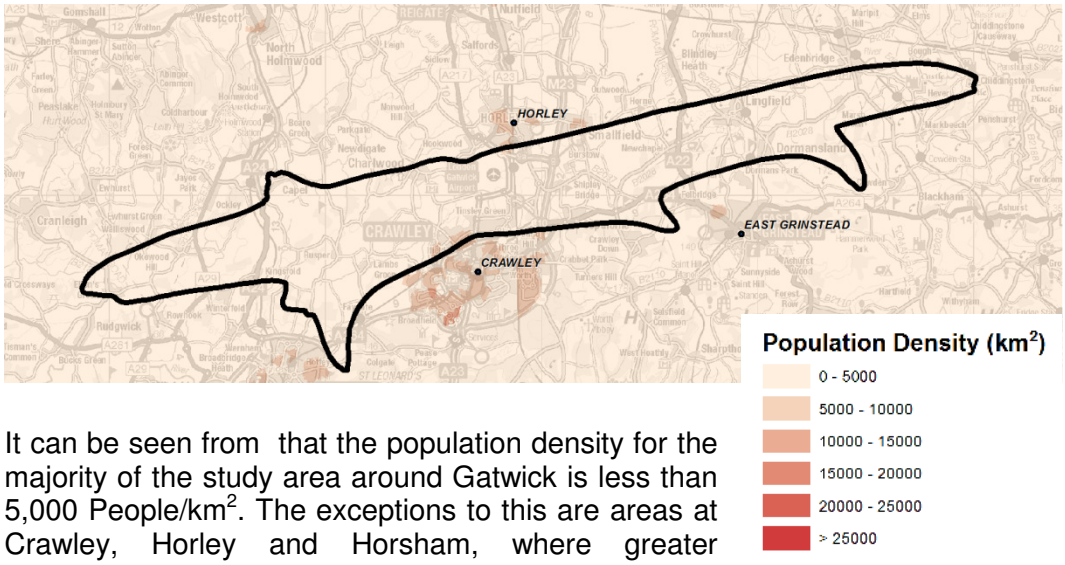
Figure 3.2 : Gatwick Second Runway Indicative Routes



3.4 Population

To visualise the population distribution around Gatwick Airport, the forecast 2030 populations associated with the postcode points falling within each Lower Super Output Area[4] (LSOA) have been summated and then divided by the area of the LSOA to give an approximate population density for the LSOA.

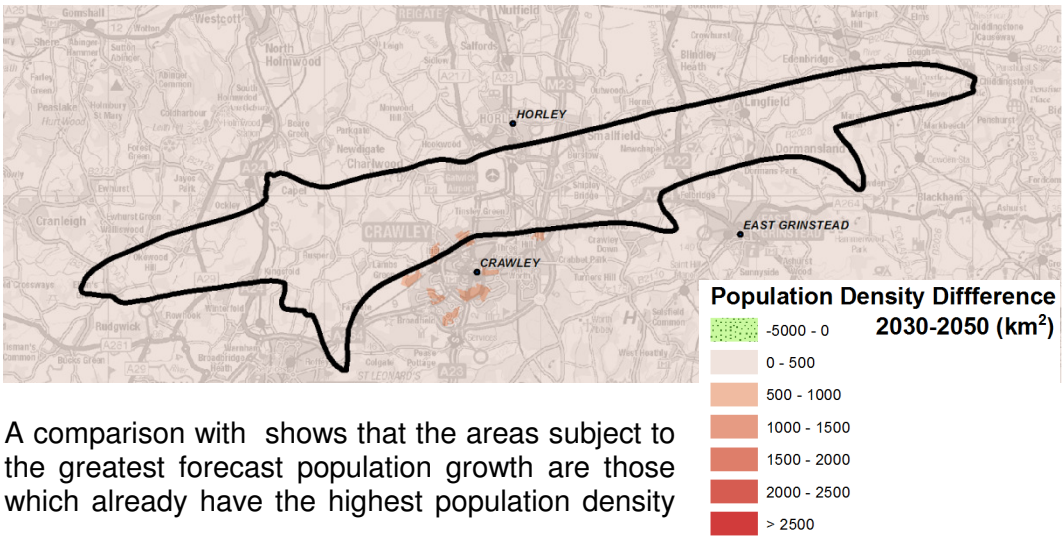
Figure 3.3 : Gatwick Second Runway Study Area Forecast Population Densities (2030)



It can be seen from 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 Crawley, Horley and Horsham, where greater population densities are observed.

Figure 3.4 below shows the predicted difference 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.

Figure 3.4 : 2030 vs 2050 Difference in Population Densities around Gatwick Airport



A comparison with shows that the areas subject to the greatest forecast population growth are those which already have the highest population density

[4] Super output areas (SOAs) as defined by the Office of National Statistics (ONS) were designed to improve the reporting of small area statistics and are built up from groups of output areas (OAs). Lower layer super output areas (LSOAs) statistics were originally released in 2004.

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.

3.5 Baseline Noise Levels

Current and future year DM aviation noise levels associated with Gatwick Airport as calculated by ERCD are presented in Table 3.1 to Table 3.4 below, using the range of metrics advocated by the Appraisal Framework 'scorecard' approach.

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		
			>60 dB L_{den}	2,000		
			>65 dB L_{den}	500		
			>70 dB L_{den}	<100		
			>75 dB L_{den}	0		

Note: L_{den} values relate to 2011.

Table 3.2 : 2030 Do-Minimum Gatwick Airport Scorecard

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	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}	9,400		
			>60 dB L_{den}	1,900		
			>65 dB L_{den}	400		
			>70 dB L_{den}	200		
			>75 dB L_{den}	<50		

Table 3.3 : 2040 Do-Minimum Gatwick Airport Scorecard

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		

Table 3.4 : 2050 Do-Minimum Gatwick Airport Scorecard

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		

Table 3.5 below summarises the predicted difference in noise levels over the periods of interest for the noise assessment. A full description of the changes in each metric can be found in the Noise Baseline Report.

Table 3.5 : Predicted difference in Do-Minimum noise levels for Gatwick Airport

Metric		Current vs 2030 DM	2030 DM vs 2040 DM	2030 DM vs 2050 DM	Current vs 2050 DM
$L_{Aeq,16h}$ (day)	>54	(1,700)	(600)	200	(2,100)
	>57	(1,350)	0.	600	(750)
$L_{Aeq,8h}$ (night)	>48	500	(600)	100	0
L_{den} (24-hour)	>55	(1,900)	(200)	300	(1,800)
N70 (day)	>20	(4,200)	100	1,100	(3,000)
N60 (night)	>25	200	400	(500)	100

Note: Numbers in parentheses represent reductions

The differences above relate to the small changes in the overall level of activity, the expected growth in population near the airport, the altered aircraft mix, and the noise characteristics of the new and the re-engined aircraft.

3.6 Scorecards for 'Assessment of Need' Option

Noise metrics have been produced for the scenarios with the Gatwick 2R option for 2030, 2040 and 2050. These metrics are presented in the scorecard format below.

Table 3.6 : 2030 Gatwick-2R-X Gatwick Airport Scorecard

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	17,600			N70 >20	10,500
	>57 dB $L_{Aeq,16h}$	4,900			N70 >50	5,400
	>60 dB $L_{Aeq,16h}$	1,700			N70 >100	3,200
	>63 dB $L_{Aeq,16h}$	400			N70 >200	400
	>66 dB $L_{Aeq,16h}$	<50			N70 >500	0
	>69 dB $L_{Aeq,16h}$	<50				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	22,300			N60 >25	19,500
	>51 dB $L_{Aeq,8h}$	6,500			N60 >50	1,300
	>54 dB $L_{Aeq,8h}$	2,900			N60 >100	<50
	>57 dB $L_{Aeq,8h}$	800			N60 >200	0
	>60 dB $L_{Aeq,8h}$	200			N60 >500	0
	>63 dB $L_{Aeq,8h}$	<50				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	22,100		
			>60 dB L_{den}	3,300		
			>65 dB L_{den}	300		
			>70 dB L_{den}	<50		
			>75 dB L_{den}	<50		

Table 3.7 : 2040 Gatwick-2R-X Gatwick Airport Scorecard

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	19,400			N70 >20	10,000
	>57 dB $L_{Aeq,16h}$	5,300			N70 >50	7,000
	>60 dB $L_{Aeq,16h}$	1,900			N70 >100	3,600
	>63 dB $L_{Aeq,16h}$	500			N70 >200	1,000
	>66 dB $L_{Aeq,16h}$	<50			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	<50				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	17,400			N60 >25	18,100
	>51 dB $L_{Aeq,8h}$	5,200			N60 >50	1,100
	>54 dB $L_{Aeq,8h}$	2,300			N60 >100	<50
	>57 dB $L_{Aeq,8h}$	500			N60 >200	0
	>60 dB $L_{Aeq,8h}$	100			N60 >500	0
	>63 dB $L_{Aeq,8h}$	<50				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	21,300		
			>60 dB L_{den}	3,200		
			>65 dB L_{den}	300		
			>70 dB L_{den}	<50		
			>75 dB L_{den}	<50		

Table 3.8 : 2050 Gatwick-2R-X Gatwick Airport Scorecard

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	24,600			N70 >20	11,500
	>57 dB $L_{Aeq,16h}$	7,200			N70 >50	8,200
	>60 dB $L_{Aeq,16h}$	2,800			N70 >100	4,100
	>63 dB $L_{Aeq,16h}$	800			N70 >200	1,800
	>66 dB $L_{Aeq,16h}$	200			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	<50				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	18,600			N60 >25	18,500
	>51 dB $L_{Aeq,8h}$	5,400			N60 >50	1,200
	>54 dB $L_{Aeq,8h}$	2,400			N60 >100	<50
	>57 dB $L_{Aeq,8h}$	700			N60 >200	0
	>60 dB $L_{Aeq,8h}$	100			N60 >500	0
	>63 dB $L_{Aeq,8h}$	<50				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	24,600		
			>60 dB L_{den}	3,800		
			>65 dB L_{den}	400		
			>70 dB L_{den}	<50		
			>75 dB L_{den}	<50		

3.7 Appraisal of 'Assessment of Need' Option

The predicted differences in population noise metrics between the Gatwick-2R-X and DM scenarios for equivalent years are considered in detail below. The ATMs used in the noise modelling of these two scenarios are set out in Table 3.9 below.

Table 3.9 : Gatwick Airport - Assessment of Need (Capped) ATMs

	Air Transport Movements		
	2030	2040	2050
Gatwick DM	277,919	280,633	285,420
Gatwick Gatwick-2R-X	318,909	379,752	475,932

3.7.1 Day Metrics

All of the comparisons show an increase in the daytime noise exposure metrics when the Gatwick two runway scenario is compared with the corresponding DM situation.

(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 day that may result from the development of a second runway at Gatwick Airport.

Extracts from the relevant 2030, 2040 and 2050 DM and Gatwick-2R-X scenario $L_{Aeq,16h}$ contour plots are shown in Figure 3.5 to Figure 3.10 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The below analysis shows that, overall, the addition of a second runway at Gatwick results in increases to the number of people included in the $L_{Aeq,16h}$ contours, apart from in the highest contour bands where absolute numbers affected are small. This is due to the predicted increase in ATMs and changes to flight corridors.

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

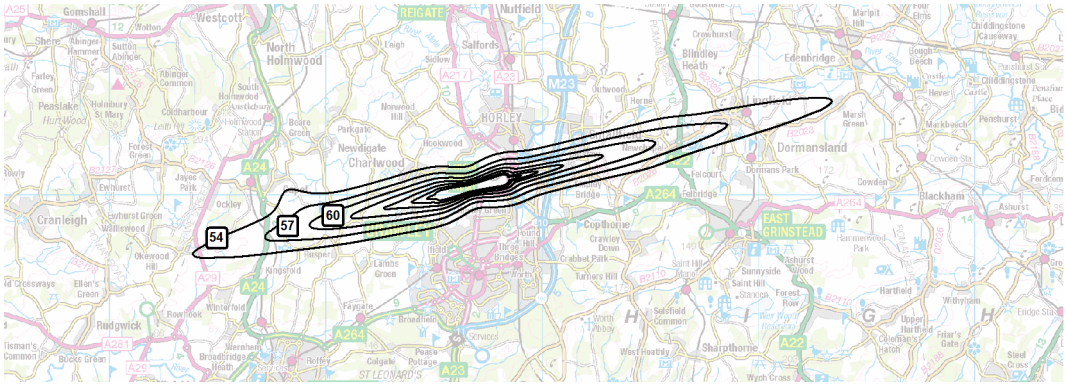
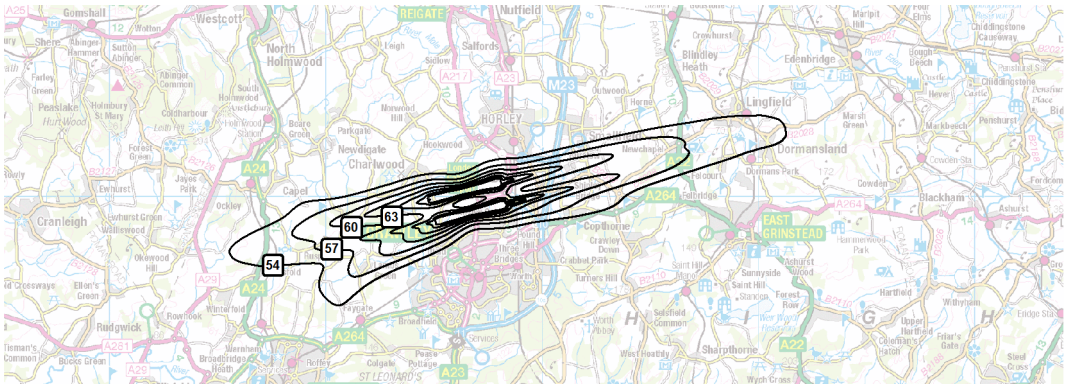


Figure 3.6 : 2030 Gatwick-2R-X Gatwick Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 3.10 below.

Table 3.10 : 2030 DM Gatwick vs 2030 Gatwick-2R-X Gatwick, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	16.2	9,600	3,900
>57	11.5	2,700	1,100
>60	5.6	600	300
>63	3.0	0	100
>66	1.4	300 to <50	100 to <50
>69	0.8	200 to <50	<50 to <50
>72	0.6	<50 to <50	<50 to <50

Note: Numbers in parentheses show a reduction in population exposure

For the 2030 Do-Something scenario, all of the predicted $L_{Aeq,16h}$ contours cover greater areas than in the 2030 DM scenario. The Do-Something contours are shorter in the east-west axis, but wider in the north-south axis, as a result of the routes associated with two runways. The difference routes also leads to increased divergence at the west extent of the contours, where two 'horns' begin to develop.

The overall increases in contour areas are due to increases in forecast ATMs for the Do-Something scenario, the noise effects of which are not entirely countered by forecast improvements in aircraft technology.

In terms of population exposures, the differences in the 2030 Do-Something scenario compared with the 2030 DM scenario are primarily due to the increase in contour areas. Population changes may be summarised as follows:

- *>54 dB: An increase of 9,600 (from 8,000 to 17,600)*
- *>57 dB: An increase of 2,700 (from 2,200 to 4,900)*
- *>60 dB: An increase of 600 (from 1,100 to 1,700)*
- *>63 dB: No discernible difference from (from 400 to 400)*
- *>66 dB: A reduction from 300 to <50*
- *>69 dB: A reduction from 200 to <50*
- *>72 dB: No discernible difference (from <50 to <50)*

The reductions in population observed in the 66dB and 69dB contours are in part because the Do-Something contours are shorter in the east-west axis and do not include as many dwellings to the west of Burstow as the DM contours. Also, a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

For the Gatwick Second Runway (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2030 Do-Something scenario compared to the 2030 DM scenario is 3,800, and the number of people newly removed is 1,000. This results in a net increase in the number of people newly affected of 2,700.

Figure 3.7 : 2040 Do-Minimum Gatwick Airport $L_{Aeq,16h}$ Contours

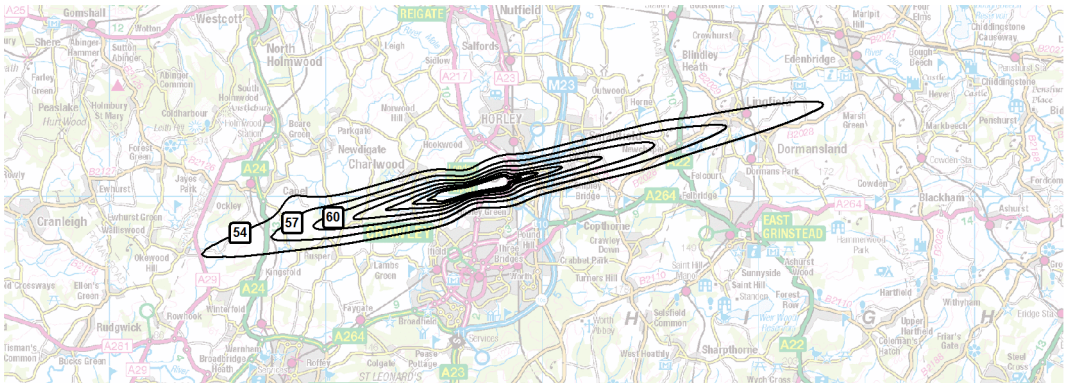
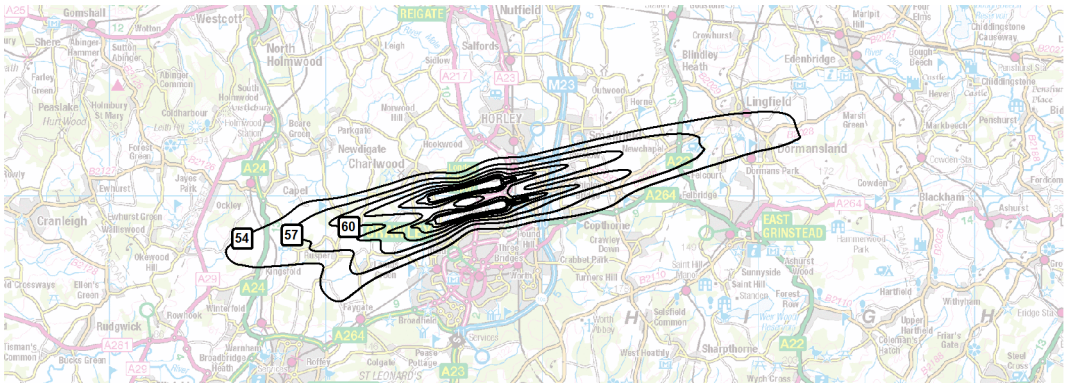


Figure 3.8 : 2040 Gatwick-2R-X Gatwick Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 3.11 below.

Table 3.11 : 2040 DM Gatwick vs 2040 Gatwick-2R-X Gatwick, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	23.1	12,000	4,900
>57	15.3	3,100	1,200
>60	8.1	1,000	500
>63	3.9	0	100
>66	1.9	300 to <50	<50 to <50
>69	1.2	200 to <50	<50 to <50
>72	0.8	<50 to <50	<50 to <50

Note: Numbers in parentheses show a reduction in population exposure

All of the $L_{Aeq,16h}$ contour areas are greater in the Do-Something scenario than the corresponding DM scenario. The Do-Something contours are shorter in the east-west axis, but wider in the north-south axis, as a result of the changes in flight paths due to two runways. The difference in flight paths also leads to increased divergence at the west extent of the contours, with two 'horns' evident.

In terms of population exposures, the differences in the 2040 Gatwick-2R-X scenario compared with the 2040 DM scenario are primarily due to the increase in contour areas:

- >54 dB: An increase of 12,000 (from 7,400 to 19,400)
- >57 dB: An increase of 3,100 (from 2,200 to 5,300)
- >60 dB: An increase of 1,000 (from 900 to 1,900)

- >63 dB: No discernible difference (from 500 to 500)
- >66 dB: A reduction from 300 to <50
- >69 dB: A reduction from 200 to <50
- >72 dB: No discernible difference (<50 to <50)

The reductions in population observed in the 66 and 69 dB contours are in part because the 2040 Do-Something contours are shorter in the east-west axis and do not include as many dwellings to the west of Burstow as the DM contours. Also, a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

For the Gatwick Second Runway (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2040 Do-Something scenario compared to the 2040 DM scenario is 4,000, and the number of people newly removed is 900. This results in a net increase in the number of people newly affected of 3,100.

Figure 3.9 : 2050 DM Gatwick Airport $L_{Aeq,16h}$ Contours

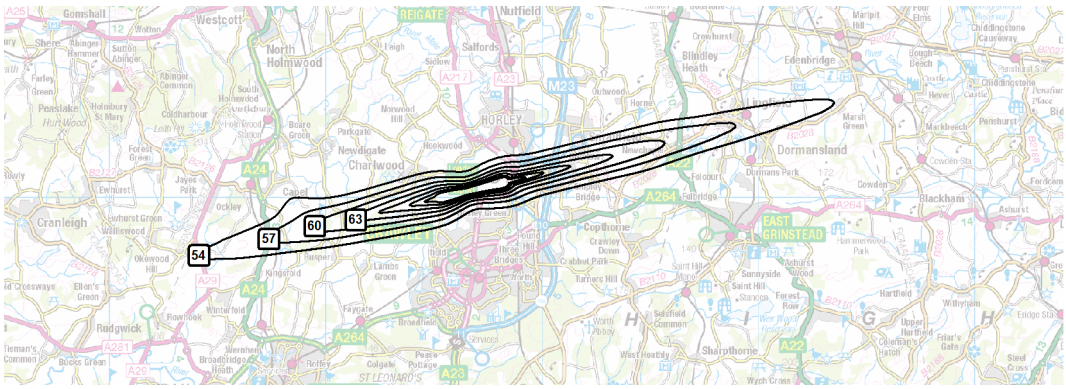
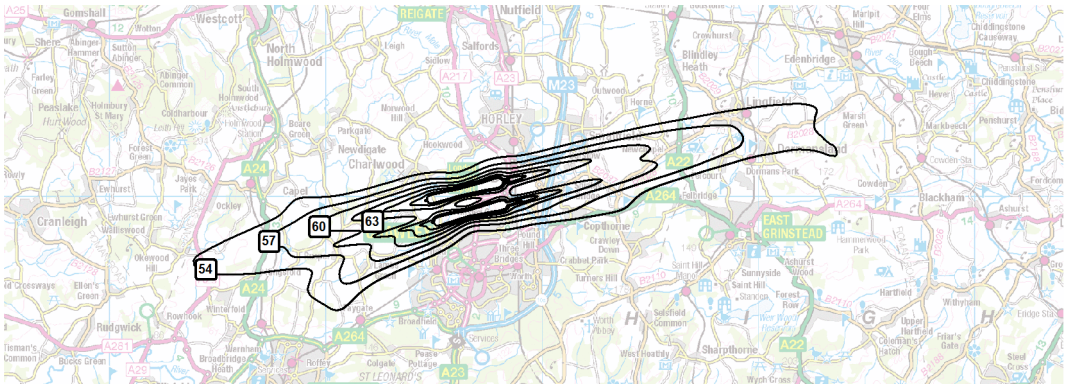


Figure 3.10 : 2050 Gatwick-2R-X Gatwick Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 3.12 below.

Table 3.12 : 2050 DM Gatwick vs 2050 Gatwick-2R-X Gatwick, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	35.7	17,000	6,900
>57	23.6	4,400	1,900
>60	14.5	1,600	800
>63	6.8	300	200
>66	3.2	(100)	0
>69	1.7	200 to <50	<50 to <50
>72	1.0	<50 to <50	<50 to <50

Note: Numbers in parentheses show a reduction in population exposure

All of the 2050 Do-Something $L_{Aeq,16h}$ contour areas are greater in the Do-Something scenario than the corresponding DM scenario. The Do-Something contours are shorter in the east-west axis, but wider in the north-south axis, as a result of the changes in flight paths due to two runways. The difference in flight paths also leads to increased divergence at the west extent of the contours, where two 'horns' begin to develop. In the 2050 Do-Something contours, the eastern extent of the >54 dB contour can be seen to split into two routes, one from the south and one from the east-north-east.

In terms of population exposures, the differences in the 2050 Gatwick-2R-X scenario compared with the 2050 DM scenario are primarily due to the increase in contour areas:

- >54 dB: An increase of 17,000 (from 7,600 to 24,600)
- >57 dB: An increase of 4,400 (from 2,800 to 7,200)
- >60 dB: An increase of 1,600 (from 1,200 to 2,800)
- >63 dB: An increase of 300 (from 500 to 800)
- >66 dB: A reduction of 100 (from 300 to 200)
- >69 dB: A reduction from 200 to <50
- >72 dB: No discernible difference (from <50 to <50)

The reductions in population observed in the 66 and 69 dB contours are in part because the Do-Something contours are shorter in the east-west axis and do not include the dwellings to the west of Burstow. Also, a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

For the Gatwick Second Runway (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2050 Do-Something scenario compared to the 2050 DM scenario is 5,800, and the number of people newly removed is 1,200. This results in a net increase in the number of people newly affected of 4,600.

(b) N70 Supplementary Metric

This section considers predicted changes in terms of the N70 supplementary noise metric, which is a count of the number of people subject to more than 20, 50, 100, 200 or 500 events which exceed 70 dB $L_{AS,Max}$ in an average annual day.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N70 contour plots are shown in Figure 3.11 to Figure 3.17 below to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The Gatwick 2R option results in increases to the number of people subject to noise events over 70 dB $L_{AS,Max}$, which is broadly consistent with the trend displayed by the daytime $L_{Aeq,16h}$ noise exposure metric.

Figure 3.11 : 2030 Do-Minimum Gatwick Airport N70 Contours

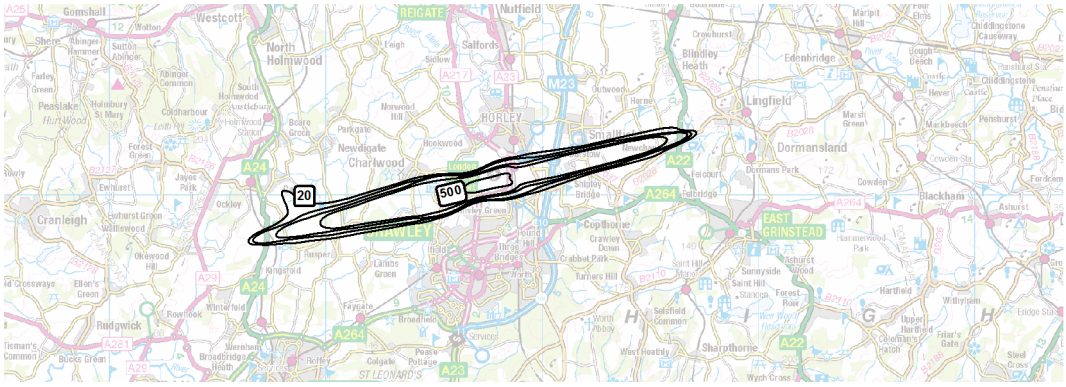
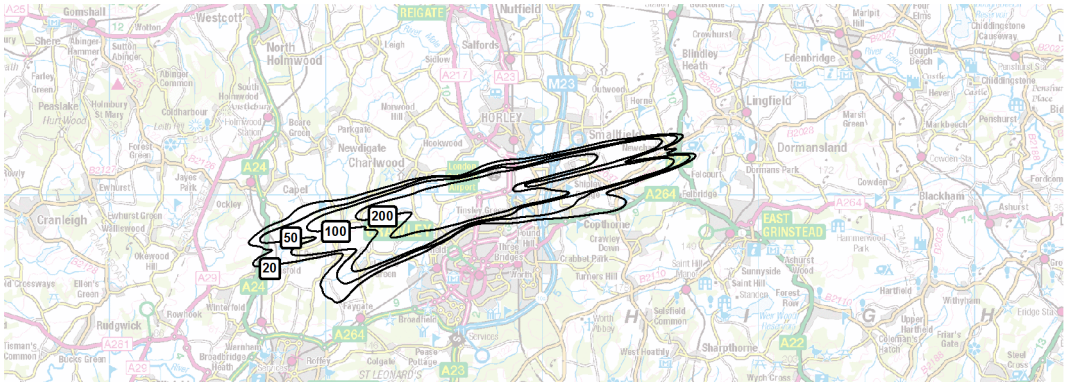


Figure 3.12 : 2030 Gatwick-2R-X Gatwick Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 3.13 below.

Table 3.13 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X Gatwick, N70

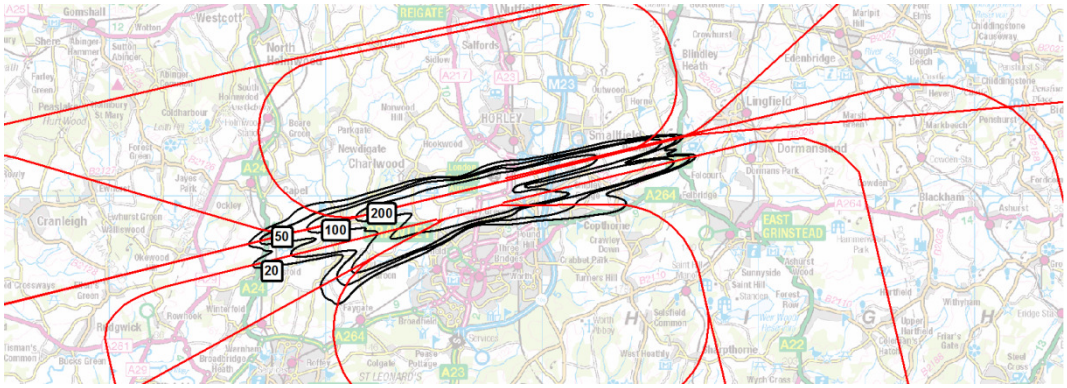
Contour	Area (km²)	Population	Households
>20	25.2	8,400	3,500
>50	18.5	3,600	1,500
>100	11.3	1,800	800
>200	(0.7)	(400)	(100)
>500	(1.1)	(200)	<50 to 0

Note: Numbers in parentheses show a reduction in population exposure

Compared with the DM contours, the Do-Something contours are similar in length along the east-west axis, but wider in the north-south axis, as a result of the second runway and the corresponding changes in flight paths. The difference in flight paths also leads to increased divergence at the east and west extents of the Do-

Something contours, with three 'horns' east and west, as can be seen on Figure 3.13 below.

Figure 3.13 : 2030 Gatwick-2R-X N70 Contours and Routes



For the 2030 Gatwick-2R-X scenario, the N70 contour areas are greater in the Do-Something scenario than the corresponding DM scenario for the >20, >50 and >100 contours. The increases in contour areas are due to increases in forecast ATMs for the Gatwick-2R-X scenario.

The N70 >200 contour in the Do-Something scenario is shorter in the east-west axis than the corresponding DM contour, which leads to reductions in the population enclosed. Although the Do-Something contour is wider in the north-south axis than the DM contour, the additional land covered to the south of Gatwick Airport is mainly commercial. The net effect is a reduction in population within the Do-Something contour compared to the DM contour.

The area associated with the N70 >500 contour in the DM is small, being centred on the existing runway and almost entirely contained within the perimeter of the Airport. With aircraft movements split across two runways, there is no corresponding contour in the 2030 Do-Something scenario, since no point within the Airport is forecast to be subject to more than 500 events exceeding 70 dB $L_{AS,max}$.

In respect of population exposures, differences in the 2030 Gatwick-2R-X scenario compared with the 2030 DM scenario are primarily due to the increase in contour areas:

- *>20 events: An increase of 8,400 (from 2,100 to 10,500)*
- *>50 events: An increase of 3,600 (from 1,800 to 5,400)*
- *>100 events: An increase of 1,800 (from 1,400 to 3,200)*
- *>200 events: A reduction of 400 (from 800 to 400)*
- *>500 events: A reduction of 200 (from 200 to 0)*

The reduction in population within the >500 contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

Figure 3.14 : 2040 DM Gatwick Airport N70 Contours

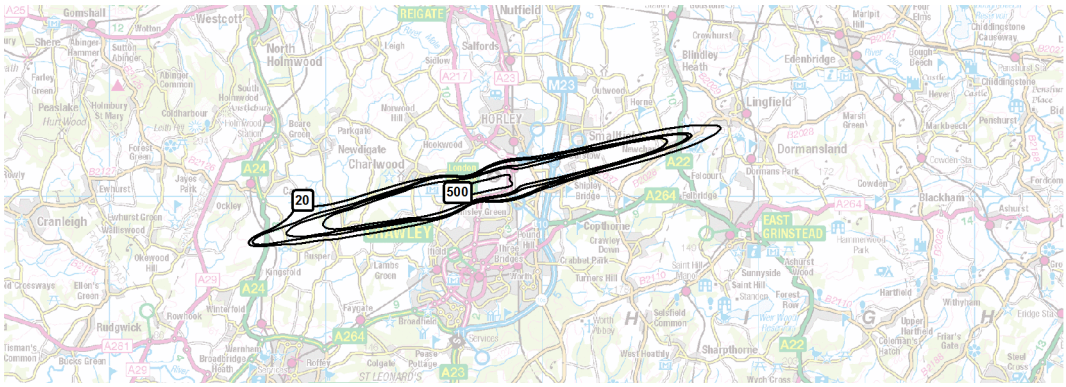
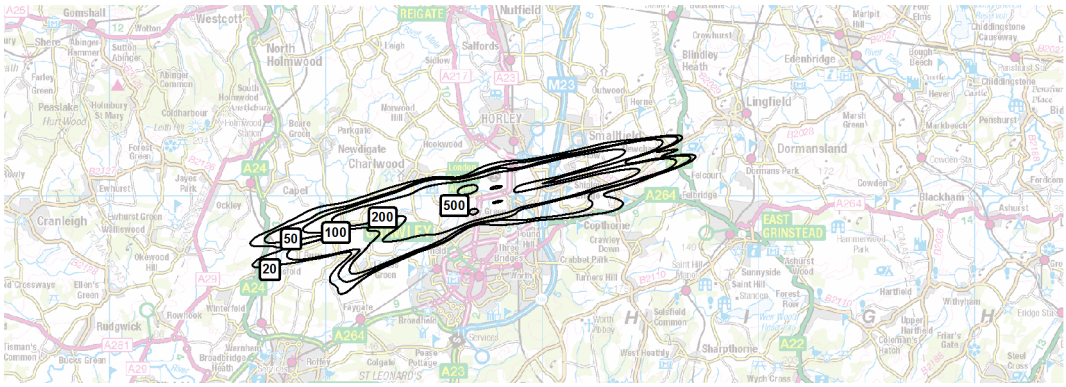


Figure 3.15 : 2040 Gatwick-2R-X Gatwick Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 3.14 below.

Table 3.14 : 2040 Do-Minimum Gatwick vs 2040 Gatwick-2R-X Gatwick, N70

Contour	Area (km^2)	Population	Households
>20	22.0	7,800	3,300
>50	20.0	5,300	2,300
>100	13.0	2,200	1,000
>200	5.1	200	100
>500	(0.7)	200 to <50	<50 to <50

Note: Numbers in parentheses show a reduction in population exposure

For the 2040 Gatwick-2R-X scenario, all of the N70 contour areas are greater in the Do-Something scenario than the corresponding DM scenario except for the >500 contours. Compared with the DM contours, the Do-Something contours are shorter along the east-west axis, but wider in the north-south axis, as a result of the second runway and the corresponding changes in flight paths. The difference in flight paths also leads to increased divergence at the east and west extents of the Do-Something contours, with three 'horns' seen at either end. The increases in contour areas are due to increases in forecast ATMs for the Gatwick-2R-X scenario.

In the Do-Something scenario, four N70 >500 contours are predicted; two are aligned with each runway. The total area covered by these four contours is less than the equivalent contour in the DM scenario, and they are likely to be almost entirely contained within the boundary of the airport.

With the exception of the >500 contour, the differences population exposures for the 2040 Gatwick-2R-X scenario compared with the 2040 DM scenario are primarily due to the increase in contour areas:

- *>20 events: An increase of 7,800 (from 2,200 to 10,000)*
- *>50 events: An increase of 5,300 (from 1,700 to 7,000)*
- *>100 events: An increase of 2,200 (from 1,400 to 3,600)*
- *>200 events: An increase of 200 (from 800 to 1,000)*
- *>500 events: A reduction from 200 to <50*

The reduction in population within the >500 contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

Figure 3.16 : 2050 Do-Minimum Gatwick Airport N70 Contours

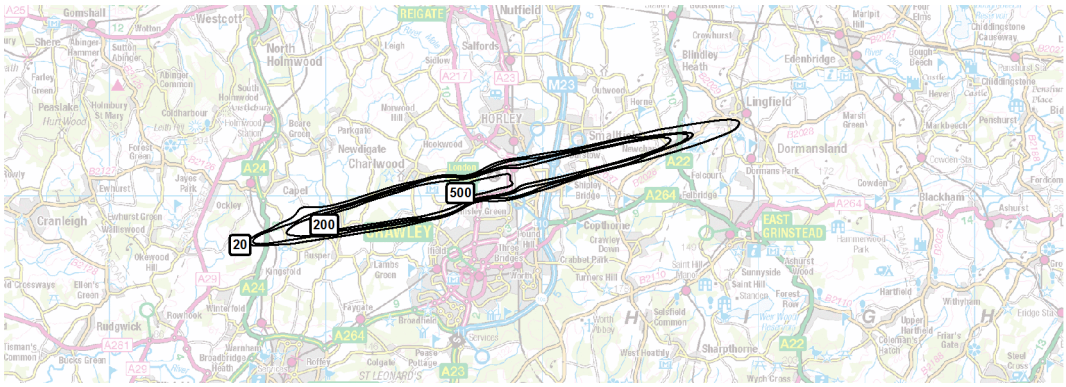
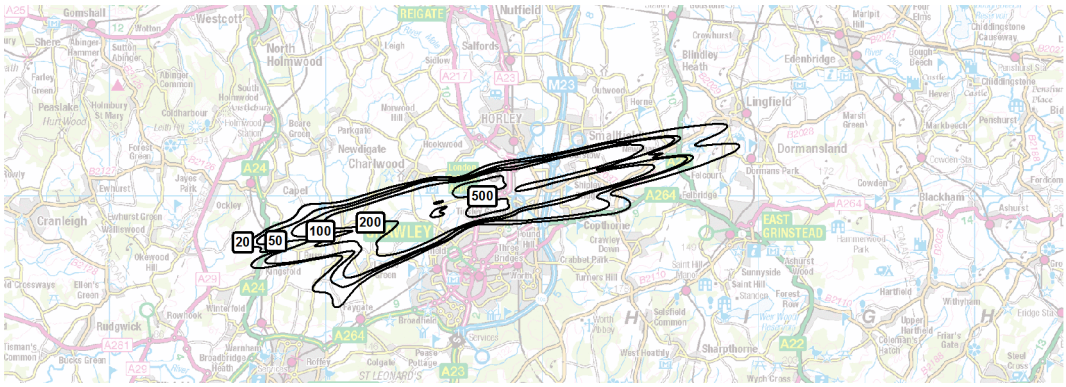


Figure 3.17 : 2050 Gatwick-2R-X Gatwick Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 3.15 below.

Table 3.15 : 2050 DM Gatwick vs 2050 Gatwick-2R-X Gatwick, N70

Contour	Area (km^2)	Population	Households
>20	29.7	8,200	3,400
>50	23.3	6,300	2,700
>100	16.7	2,700	1,100
>200	9.7	1,000	400
>500	1.2	200 to <50	<50 to <50

Note: Numbers in parentheses show a reduction in population exposure

For the 2050 Gatwick-2R-X scenario, all of the N70 contour areas are greater in the Do-Something scenario than the corresponding DM scenario. The DM and Do-Something contours are similar in extent along the east-west axis, and the half of the Do-Something contours emanating from the existing runway are very similar in shape and extent to the DM contours. However, the shape of the DM contours are almost mirrored to the south in the Do-Something contours, as a result of the second runway and the corresponding changes in flight paths. The difference in flight paths also leads to increased divergence at the east and west extents of the Do-Something contours, with distinct 'horns' seen at either end. The increases in contour areas are due to increases in forecast ATMs for the Gatwick-2R-X scenario.

For the 2050 comparison, increases in all of the N70 contours are predicted for the Do-Something scenario as follows:

- *>20 events: An increase of 8,200 (from 3,300 to 11,500)*
- *>50 events: An increase of 6,300 (from 1,900 to 8,200)*
- *>100 events: An increase of 2,700 (from 1,400 to 4,100)*
- *>200 events: An increase of 1,000 (from 800 to 1,800)*
- *>500 events: A change from 200 to <50*

The reduction in population within the >500 contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

3.7.2 Night Metrics

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

This section considers predicted changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario $L_{Aeq,8h}$ contour plots are shown in Figure 3.18 to Figure 3.23 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

In general, the addition of a second runway at Gatwick is predicted to increase in the number of people exposed to night time noise levels of 48 dB $L_{Aeq,8h}$ or greater during an average summer's day. However, this trend is weaker in the higher noise exposure contours, which are constrained to the area close to the airport, and which is not as populous as the areas covered by the lower noise exposure contours.

Figure 3.18 : 2030 Do-Minimum Gatwick Airport $L_{Aeq,8h}$ Contours

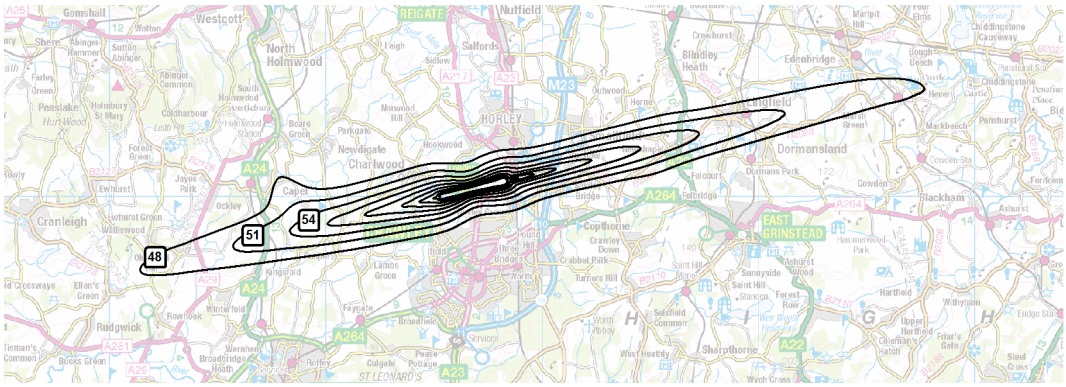
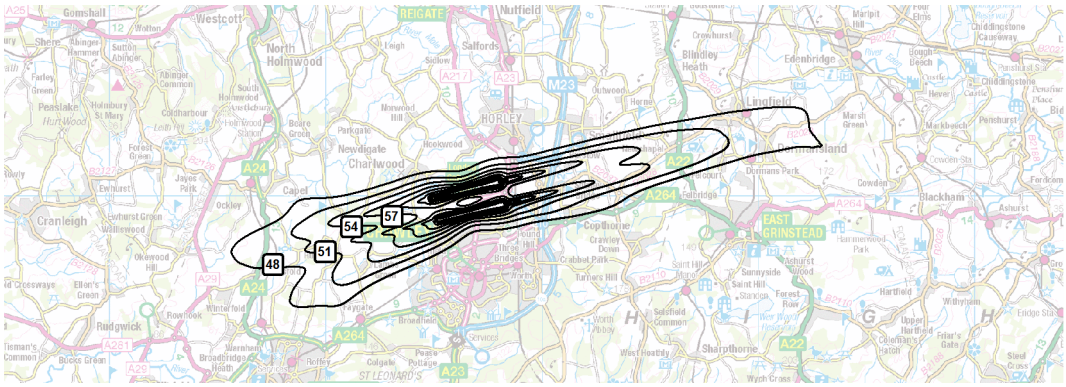


Figure 3.19 : 2030 Gatwick-2R-X Gatwick Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 3.16 below.

Table 3.16 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X Gatwick, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	1.1	10,600	4,300
>51	5.6	900	400
>54	4.0	1,200	500
>57	1.1	200	100
>60	0.5	(200)	0
>63	0.4	300 to <50	<50 to <50
>66	0.4	<50 to <50	<50 to <50
>69	0.3	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses show a reduction in population exposure

For the 2030 Gatwick-2R-X scenario, all of the $L_{Aeq,8h}$ contours are larger than the equivalent 2030 DM contours. This is the result of competing effects which are a reduction in night time aircraft movements in the Do-Something scenario (as a result of greater daytime capacity), and the effects of the extra runway and route layout which tend to increase contour extent. The different arrival and departure tracks associated with the two runway scenario also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >48 dB: An increase of 10,600 (from 11,700 to 22,300)
- >51 dB: An increase of 900 (from 5,600 to 6,500)
- >54 dB: An increase of 1,200 (from 1,700 to 2,900)
- >57 dB: An increase of 200 (from 600 to 800)
- >60 dB: A reduction of 200 (from 400 to 200)
- >63 dB: A reduction from 300 to <50
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

For the >48 to >57 dB contours, which show differences of at least 1.1 km^2, corresponding increases in population within each contour are observed. Of note is the >48 dB contour which shows the greatest difference in population; this is not proportional to its modest increase in area, but due to the contour encroaching on the north fringe of Crawley with its greater population density.

The reduction in population within the >60 and >63 dB contours for the Do-Something scenario compared to the DM are in part because the Do-Something contours are shorter in the east-west axis and do not include as many dwellings within and to the west of Burstow as the DM contours. A number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

Figure 3.20 : 2040 Do-Minimum Gatwick Airport $L_{Aeq,8h}$ Contours

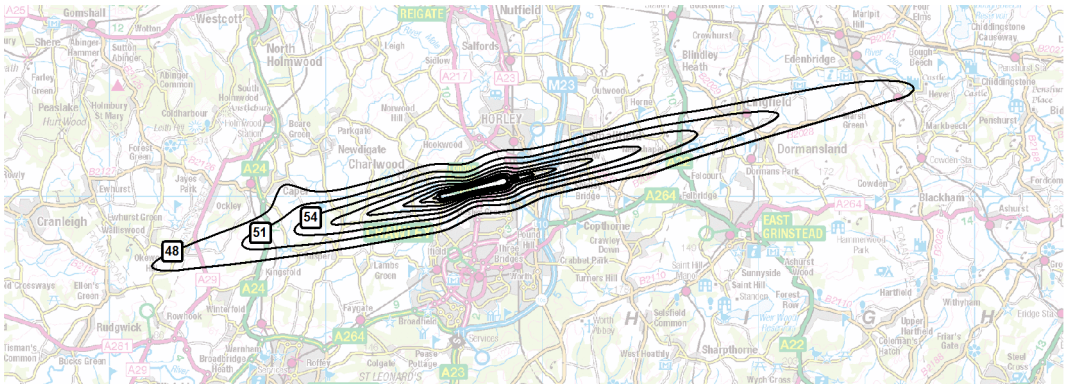
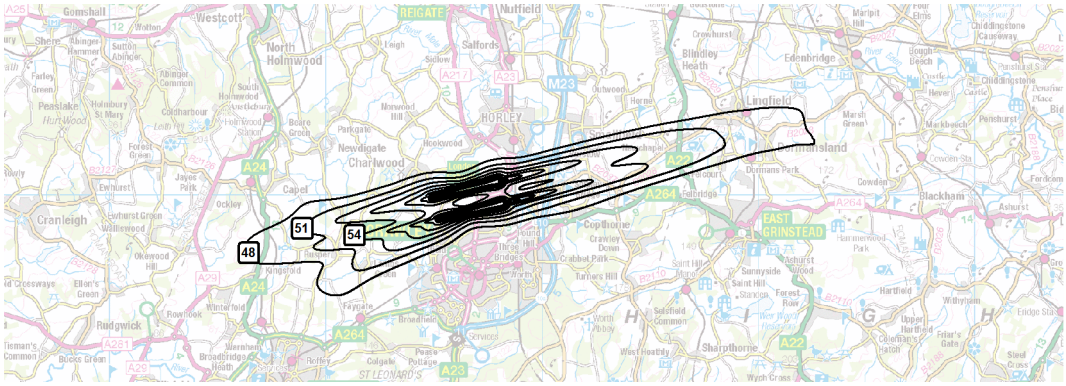


Figure 3.21 : 2040 Gatwick-2R-X Gatwick Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 3.17 below.

Table 3.17 : 2040 DM Gatwick vs 2040 Gatwick-2R-X Gatwick, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	(1.8)	6,300	2,500
>51	3.3	(300)	0
>54	1.7	600	200
>57	(0.6)	(100)	0
>60	(0.6)	(300)	100 to <50
>63	(0.2)	300 to <50	<50 to <50
>66	0.0	<50 to <50	<50 to <50
>69	0.0	<50 to <50	<50 to <50
>72	0.0	<50 to <50	<50 to <50

Note: Numbers in parentheses show a reduction in population exposure

For the 2040 Gatwick-2R-X scenario, the >48 dB $L_{Aeq,8h}$ contour is around 2.4% smaller than the equivalent 2040 DM contour. The smaller >48 dB contour area in the Do-Something scenario is primarily due to a reduction in night-time aircraft movements compared to the DM situation, and is a result of a greater daytime capacity in the two runway scenario.

However, there is a competing effect due to the two runways which results in larger >51 and >54 dB Do-Something contours in comparison to the DM situation.

The resulting differences in population exposure are summarised below:

- >48 dB: An increase of 6,300 (from 11,100 to 17,400)
- >51 dB: A reduction of 300 (from 5,500 to 5,200)
- >54 dB: An increase of 600 (from 1,700 to 2,300)
- >57 dB: A reduction of 100 (from 600 to 500)
- >60 dB: A reduction of 300 (from 400 to 100)
- >63 dB: A reduction from 300 to <50
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

Although the >48 dB contour is smaller in the Do-Something scenario, the second runway and altered flight paths cause it to extend further south and encompass a greater number of households in the north of Crawley and at Rusper. This leads to an increase in population exposure for this contour.

The reduction in population within the >60 and >63 dB contours for the Do-Something scenario compared to the DM may be in part because the Do-Something contours are shorter in the east-west axis and do not include the dwellings within and to the west of Burstow. A number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

Figure 3.22 : 2050 Do-Minimum Gatwick Airport $L_{Aeq,8h}$ Contours

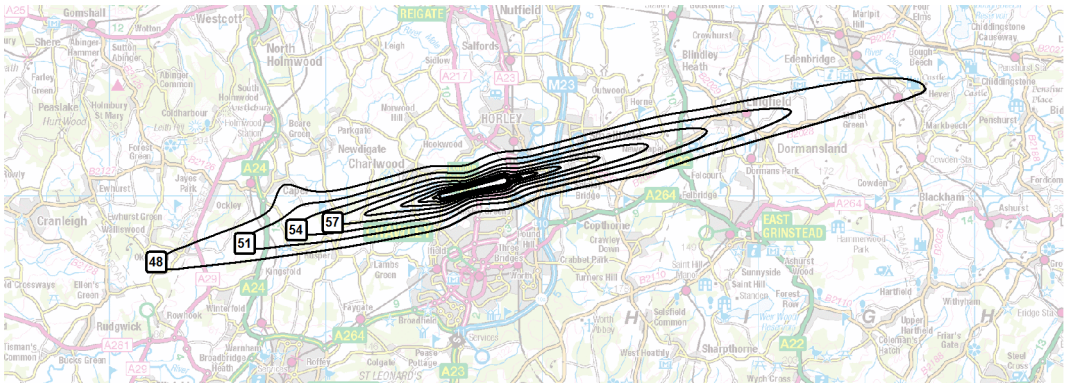
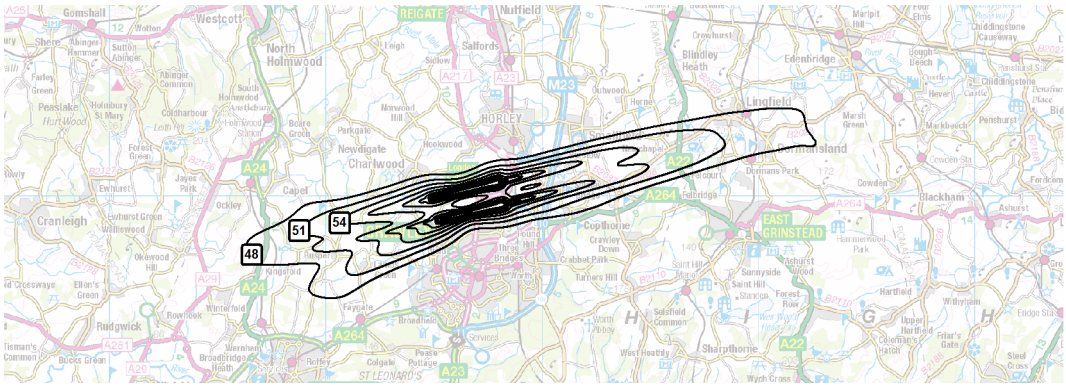


Figure 3.23 : 2050 Gatwick-2R-X Gatwick Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 3.18 below.

Table 3.18 : 2050 DM Gatwick vs 2050 Gatwick-2R-X Gatwick, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	(0.6)	7,400	2,900
>51	4.2	(200)	0
>54	2.6	700	400
>57	(0.1)	100	100
>60	(0.4)	(300)	100 to <50
>63	0.0	300 to <50	<50 to <50
>66	0.1	<50 to <50	<50 to <50
>69	0.2	<50 to <50	<50 to <50
>72	0.1	<50 to <50	<50 to <50

Note: Numbers in parentheses show a reduction in population exposure

For the 2050 Gatwick-2R-X scenario, the >48 dB $L_{Aeq,8h}$ contour is around 0.8% smaller than the equivalent 2040 DM contour, but the second runway and altered routes affect a greater number of households in the north of Crawley and at Rusper leading to an increase in population exposure. The >51 and >54 dB contours are larger in the Do-Something scenario than the DM scenario.

The resulting differences in population exposure are summarised below:

- *>48 dB: An increase of 7,400 (from 11,200 to 18,600)*
- *>51 dB: A reduction of 200 (from 5,600 to 5,400)*
- *>54 dB: An increase of 700 (from 1,700 to 2,400)*
- *>57 dB: An increase of 100 (from 600 to 700)*
- *>60 dB: A reduction of 300 (from 400 to 100)*
- *>63 dB: A reduction from 300 to <50*
- *>66 dB: No discernible difference (from <50 to <50)*
- *>69 dB: No discernible difference (from <50 to <50)*
- *>72 dB: No discernible difference (from <50 to <50)*

The reduction in population within the >60 and >63 dB contours for the Do-Something scenario compared to the DM may be in part because the Do-Something contours are shorter in the east-west axis and do not include as as many dwellings within and to the west of Burstow as the DM contours. A number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

(b) N60 Supplementary Metric

This section considers predicted changes in terms of the N60 supplementary noise metric, which is a count of the number of people subject to more than 25, 50, 100 or 200 events which exceed 60 dB $L_{AS,Max}$ in an average annual night.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N60 contour plots are shown in Figure 3.11 to Figure 3.17 below to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The following comparisons of the Do-Something and DM metrics for 2030, 2040 and 2050 show that the provision of a second runway at Gatwick Airport is likely to increase the population within the N60 >25 contour, due to the inclusion of northern parts of Crawley in this contour, but decrease the number of people in the N60 > 50 contour, for all of the years considered.

Figure 3.24 : 2030 Do-Minimum Gatwick Airport N60 Contours

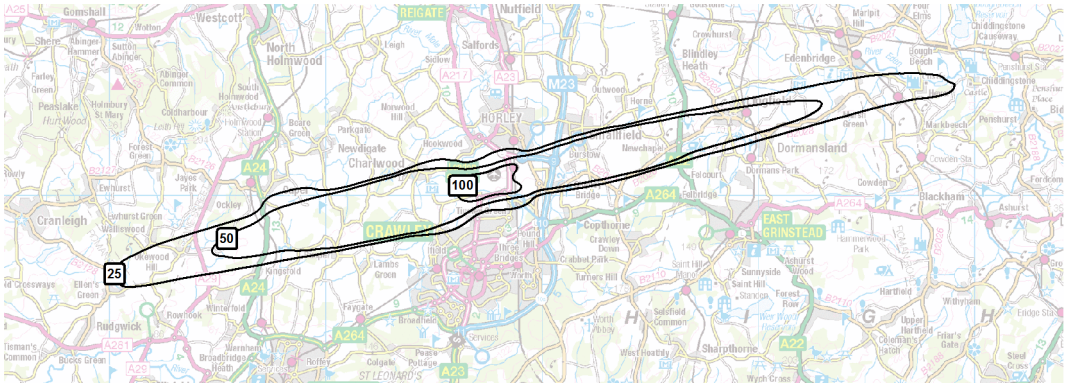
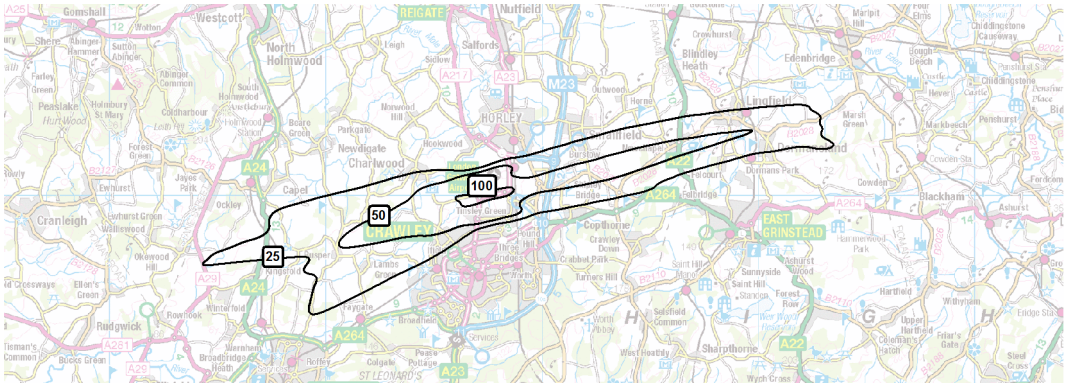


Figure 3.25 : 2030 Gatwick-2R-X Gatwick Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 3.19 below.

Table 3.19 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X Gatwick, N60

Contour	Area (km2)	Population	Households
>25	(5.7)	7,700	3,100
>50	(30.1)	(5,900)	(2,400)
>100	(2.1)	200 to <50	<50 to <50
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses show a reduction in population exposure

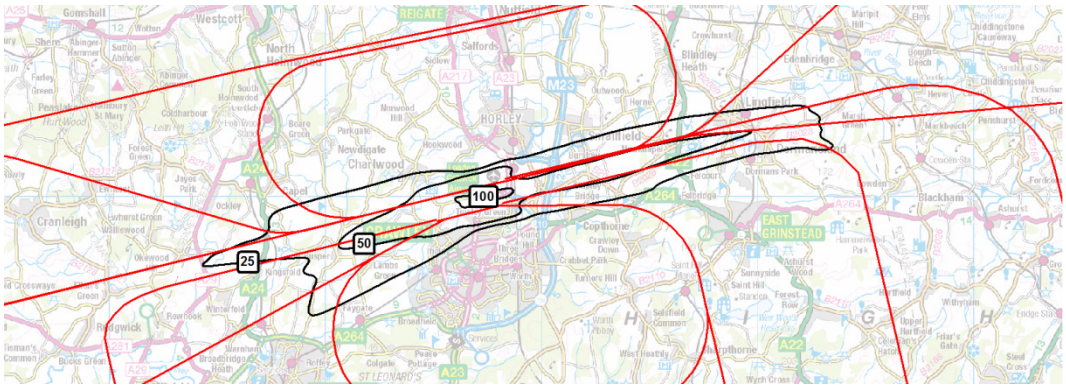
Due to the increased divergence of routes in the Do-Something scenario, the resulting noise contours are wider in the north-south axis, but shorter in the east-west axis than the DM contours.

Overall, the area covered by the >25 contour in the Do-Something scenario is 5.7 km^2 less than in the DM scenario due to a reduction in summer's night ATMs as a result of increased daytime capacity, and a greater dispersion of aircraft on routes which results in areas being overflown less often. However, the population included is 7,700 greater as the contour extends further south from the airport, and includes more of north Crawley.

The Do-Something >50 contour is 30.1 km^2 smaller in area, which is primarily due to the a greater number and spread of SIDs and STARs; with the aircraft movements split between a greater number of routes, the number of movements causing noise levels of over 60 dB $L_{AS,max}$ over any one area decreases (apart from very close to the airport where the routes converge). A contributory factor is a reduction in the number of aircraft movements for an average summer's night in the Do-Something scenario compared to the DM scenario, as there is greater day time capacity.

The >100 contour is 2.1 km^2 smaller in the Do-Something scenario, as this contour is closer to the airport and the routes do not diverge as much. The N60 contours are shown with indicative arrival and departure routes overlaid in Figure 3.26, and from this it can be seen how the routes affect the shape of the contours (e.g. the >25 contour extends furthest in areas close to two or more routes). These routes have been developed for noise modelling purposes and should not be considered as the final routes of an expanded option.

Figure 3.26 : 2030 Gatwick-2R-X N60 Contours and Routes



The differences in population exposure between the 2040 DM and Do-Something scenarios are detailed below:

- *>25 events: An increase of 7,700 (from 11,800 to 19,500)*
- *>50 events: A reduction of 5,900 (from 7,200 to 1,300)*
- *>100 events: A reduction from 200 to <50*

The reduction in population observed in the >100 contour is because a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

Figure 3.27 : 2040 Do-Minimum Gatwick Airport N60 Contours

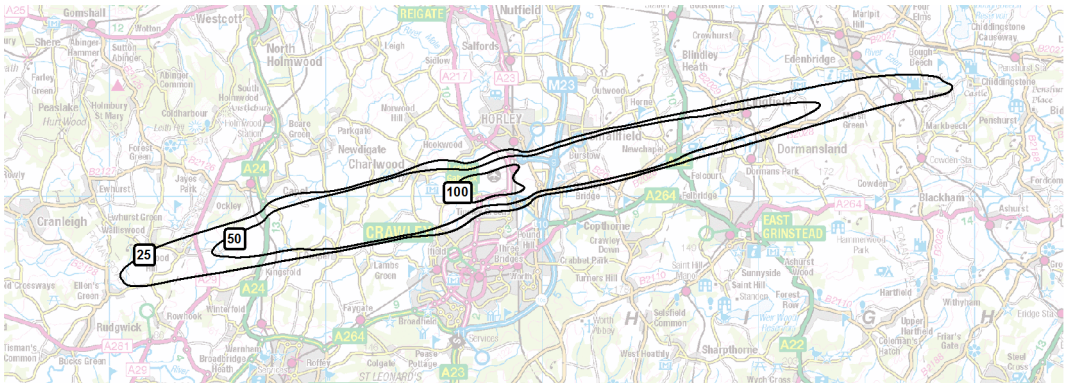
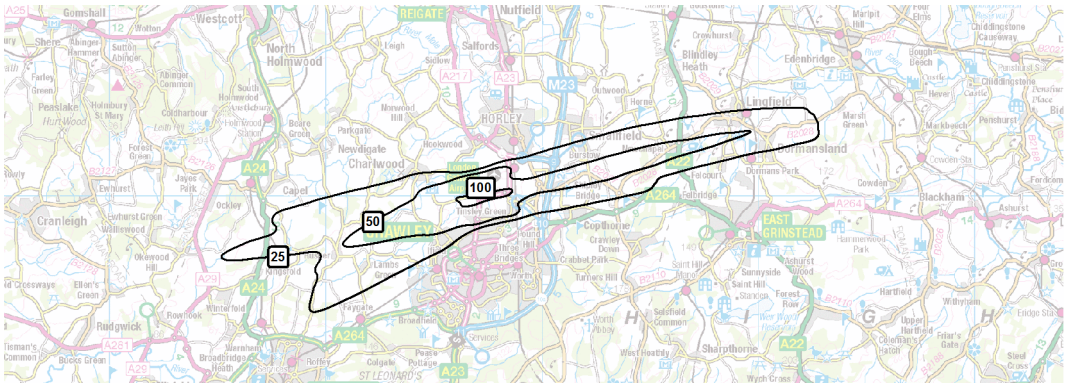


Figure 3.28 : 2040 Gatwick-2R-X Gatwick Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 3.20 below.

Table 3.20 : 2040 DM Gatwick vs 2040 Gatwick-2R-X Gatwick, N60

Contour	Area (km2)	Population	Households
>25	(8.6)	5,900	2,300
>50	(30.5)	(6,100)	(2,300)
>100	(2.4)	200 to <50	<50 to <50
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

A similar trend is observed for the 2040 comparison as for the 2030 comparison, with the Do-Something N60 contours being smaller in area as a result of greater dispersion of aircraft movements on a greater number of approach and departure routes. The greater dispersion of aircraft means that the number of aircraft movements causing noise levels of over 60 dB $L_{AS,max}$ over any one area generally decreases (apart from very close to the airport where the routes converge). There is also a reduction in the number of aircraft movements for an average summer's night in the Do-Something scenario compared to the DM scenario, as there are a greater number of daytime slots available.

The 2040 Do-Something contours are wider in the north-south axis, but shorter in the east-west axis than the equivalent DM contours. This results in an increase in population within the >25 contour which extends over the north of Crawley despite being smaller in area than the equivalent DM contour, but reductions for the >50 and >100 contours which do not encroach on such populous areas. The reductions in

population observed in the >100 contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

The differences in population exposure between the 2040 DM and Do-Something scenarios are detailed below:

- *>25 events: An increase of 5,900 (from 12,200 to 18,100)*
- *>50 events: A reduction of 6,100 (from 7,200 to 1,100)*
- *>100 events: A change from 200 to <50*

Figure 3.29 : 2050 Do-Minimum Gatwick Airport N60 Contours

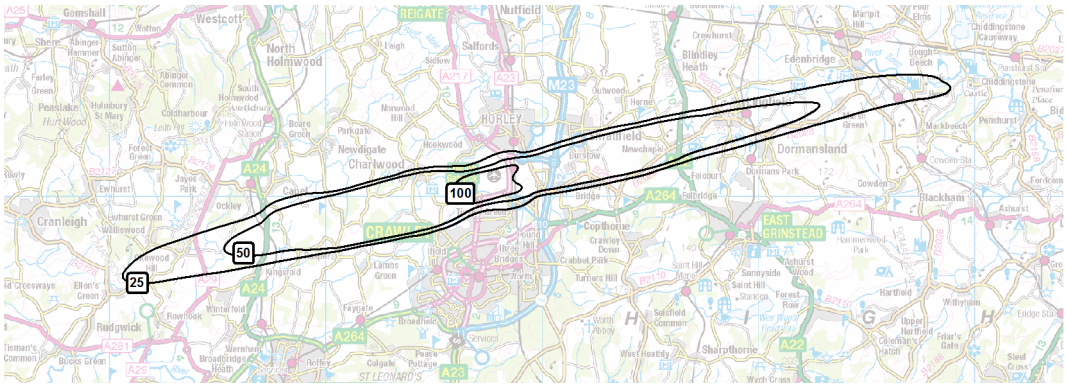
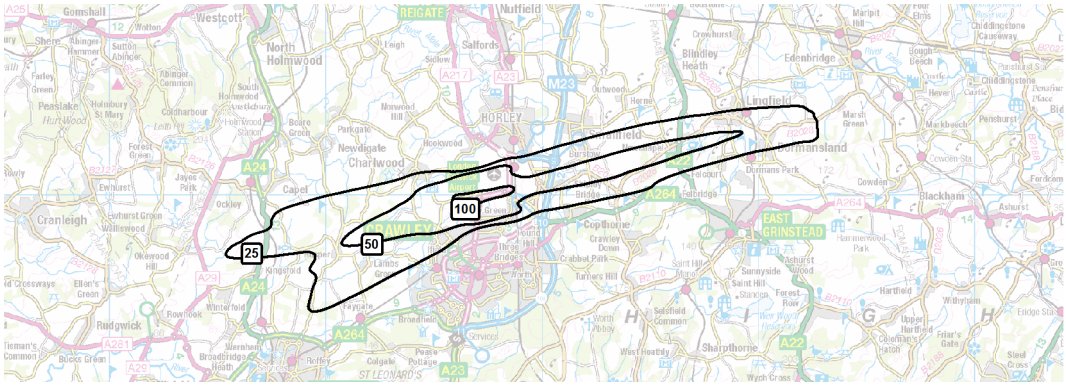


Figure 3.30 : 2050 Gatwick-2R-X Gatwick Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 3.21 below.

Table 3.21 : 2050 DM Gatwick vs 2050 Gatwick-2R-X Gatwick, N60

Contour	Area (km2)	Population	Households
>25	(5.2)	6,800	2,600
>50	(27.7)	(5,900)	(2,300)
>100	(2.3)	200 to <50	<50 to <50
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The trend observed for the 2030 and 2040 situations continues for the 2050 situation, with the Do-Something N60 contours being smaller in area as a result of

greater dispersion of aircraft movements on a greater number of approach and departure routes. The greater dispersion of aircraft means that the number of aircraft movements causing noise levels of over 60 dB $L_{AS,max}$ over any one area generally decreases (apart from very close to the airport where the routes converge). There is also a reduction in the number of aircraft movements for an average summer's night in the Do-Something scenario compared to the DM scenario, as there are a greater number of daytime slots available.

The 2050 Do-Something contours are wider in the north-south axis, but shorter in the east-west axis than the equivalent DM contours. This results in an increase in population within the >25 contour which extends over the north of Crawley despite being smaller in area than the equivalent DM contour, but reductions for the >50 and >100 contours which do not encroach on such populous areas. The reductions in population observed in the >100 contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

The differences in population exposure between the 2050 DM and Do-Something scenarios are detailed below:

- >25 events: An increase of 6,800 (from 11,700 to 18,500)
- >50 events: A reduction of 5,900 (from 7,100 to 1,200)
- >100 events: A reduction from 200 to <50

3.7.3 24-Hour Metric

This section considers predicted changes in terms of the L_{den} day-evening-night noise exposure metric, calculated as an annual average.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario L_{den} contour plots are shown in Figure 3.31 to Figure 3.36 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure 3.31 : 2030 Do-Minimum Gatwick Airport L_{den} Contours

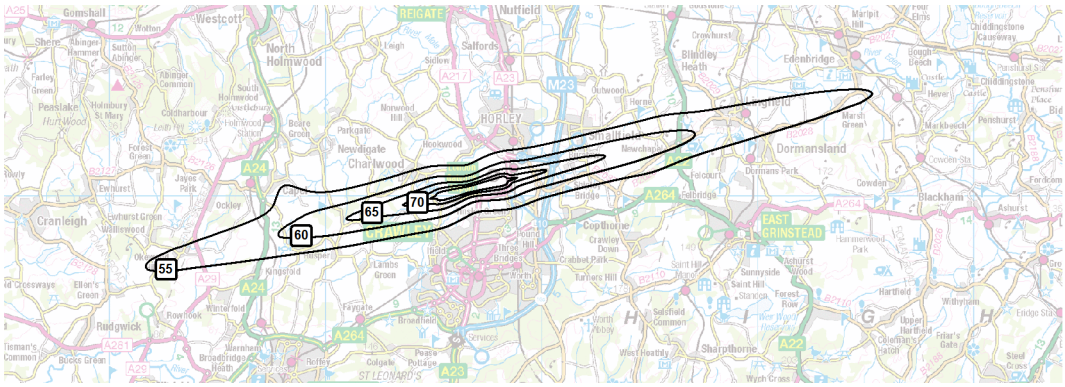
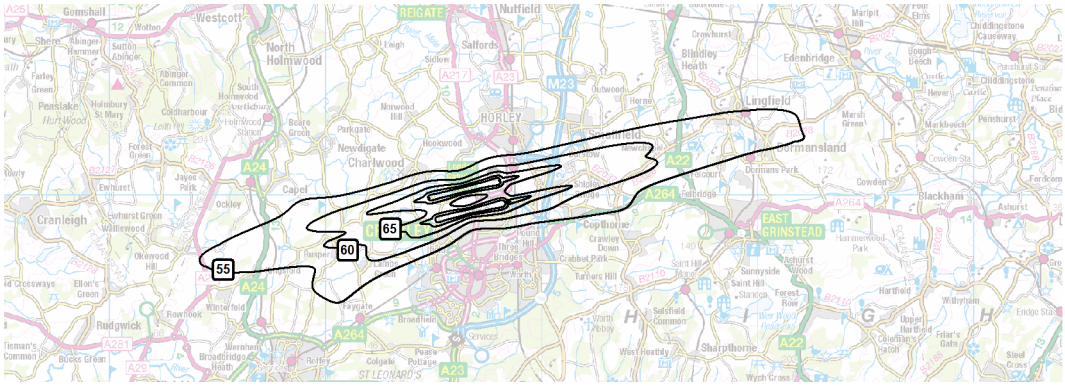


Figure 3.32 : 2030 Gatwick-2R-X Gatwick Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 3.22 below.

Table 3.22 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X Gatwick, L_{den}

Contour	Area (km²)	Population	Households
>55	13.0	12,700	5,200
>60	8.3	1,400	600
>65	2.2	(100)	0
>70	0.7	200 to <50	<50 to <50
>75	0.5	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

For the 2030 Gatwick-2R-X scenario, all the L_{den} contours are larger than the equivalent 2030 DM contours, as a result of increased ATMs. The different arrival and departure tracks associated with the two runway scenario also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >55 dB: An increase of 12,700 (from 9,400 to 22,100)
- >60 dB: An increase of 1,400 (from 1,900 to 3,300)
- >65 dB: A reduction of 100 (from 400 to 300)
- >70 dB: A change from 200 to <50
- >75 dB: A change from <50 to <50

The reductions in population observed in the 65 and 70 dB contours are because the Do-Something contours are shorter in the east-west axis than the DM contours, and do not include as many of the dwellings in or to the west of Burstow as the DM contours. Also, a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model. When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

For the Gatwick Second Runway (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2030 Do-Something scenario compared to the 2030 DM scenario is 16,400, and the number of people newly removed is 3,700. This results in a net increase in the number of people newly affected of 12,700.

Figure 3.33 : 2040 Do-Minimum Gatwick Airport L_{den} Contours

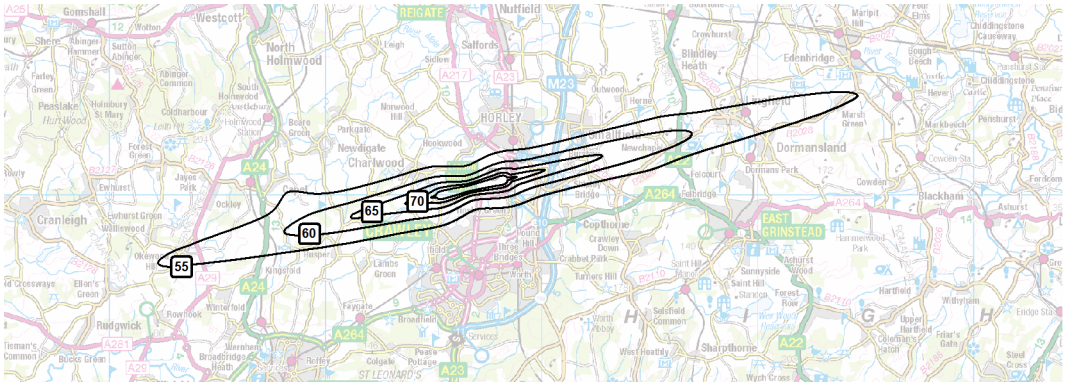
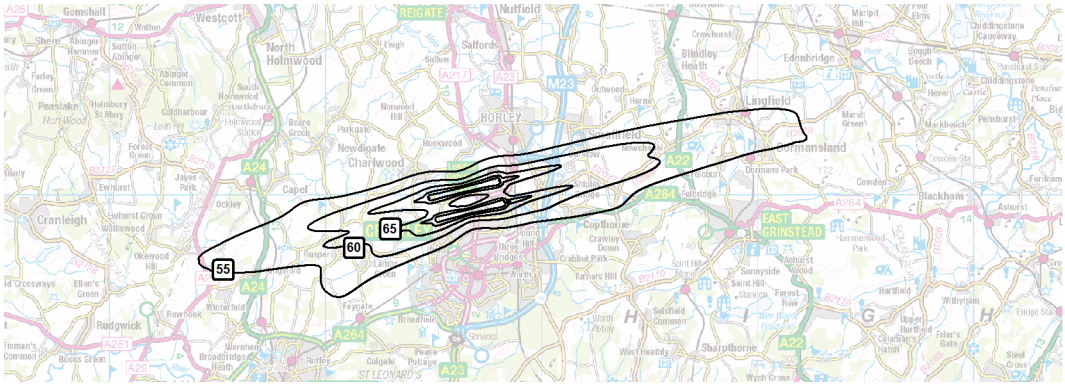


Figure 3.34 : 2040 Gatwick-2R-X Gatwick Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 3.23 below.

Table 3.23 : 2040 Do-Minimum Gatwick vs 2040 Gatwick-2R-X Gatwick, L_{den}

Contour	Area (km^2)	Population	Households
>55	17.4	12,100	4,800
>60	9.4	1,500	600
>65	2.4	(100)	0
>70	0.8	200 to <50	<50 to <50
>75	0.4	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

All of the 2040 Do-Something L_{den} contours are larger than the equivalent 2040 DM contours, as a result of increased ATMs in the Do-Something scenario. The different arrival and departure tracks associated with the two runway scenario also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >55 dB: An increase of 12,100 (from 9,200 to 21,300)
- >60 dB: An increase of 1,500 (from 1,700 to 3,200)
- >65 dB: A reduction of 100 (from 400 to 300)
- >70 dB: A change from 200 to <50
- >75 dB: A change from <50 to <50

The reductions in population observed in the 65 and 70 dB contours are because the Do-Something contours are shorter in the east-west axis than the DM contours, and do not include as many of the dwellings in or to the west of Burstow as the DM contours. Also, a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

For the Gatwick Second Runway (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2040 Do-Something scenario compared to the 2040 DM scenario is 15,800, and the number of people newly removed is 3,400. This results in a net increase in the number of people newly affected of 12,400.

Figure 3.35 : 2050 Do-Minimum Gatwick Airport L_{den} Contours

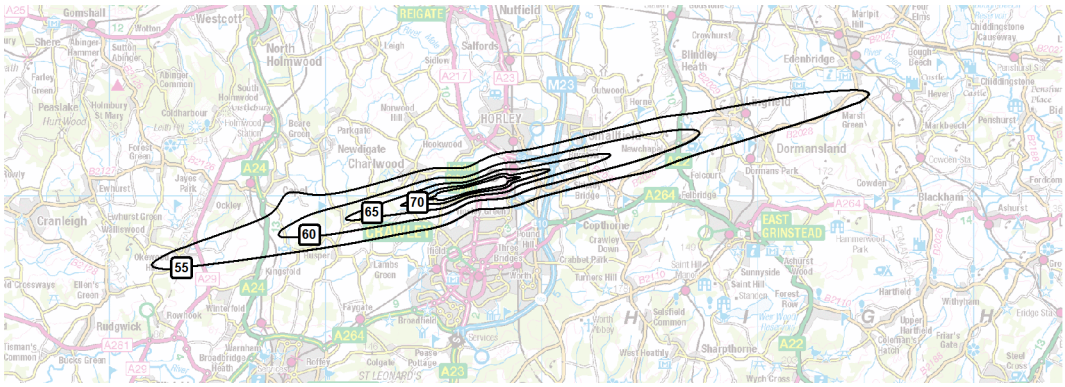
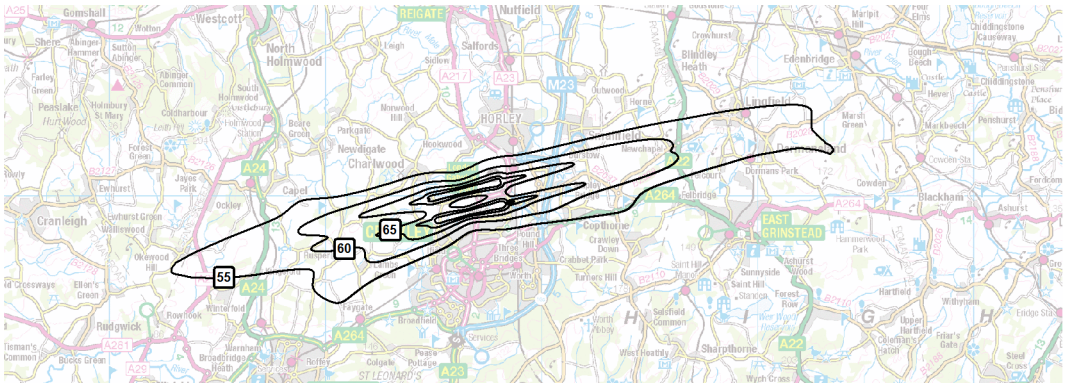


Figure 3.36 : 2050 Gatwick-2R-X Gatwick Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 3.24 below.

Table 3.24 : 2050 Do-Minimum Gatwick vs 2050 Gatwick-2R-X Gatwick, L_{den}

Contour	Area (km²)	Population	Households
>55	24.9	15,100	6,200
>60	13.3	2,000	800
>65	3.7	(100)	0
>70	1.2	200 to <50	<50 to <50
>75	0.6	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The trend continues for the 2050 comparison of the Do-Something to DM scenarios. All of the 2050 Do-Something L_{den} contours are larger than the equivalent 2050 DM contours, as a result of increased ATMs in the Do-Something scenario. The different arrival and departure tracks associated with the two runway scenario also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >55 dB: An increase of 12,100 (from 9,200 to 21,300)
- >60 dB: An increase of 1,500 (from 1,700 to 3,200)
- >65 dB: A reduction of 100 (from 400 to 300)
- >70 dB: A reduction from 200 to <50

- >75 dB: No discernible difference from <50 to <50

The reductions in population observed in the 65 and 70 dB contours are because the Do-Something contours are shorter in the east-west axis than the DM contours, and do not include as many of the dwellings in or to the west of Burstow as the DM contours. Also, a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

When considering the populations included within the smaller contour areas associated with higher noise levels, care should be exercised as the spatial resolution of population data may not support such detailed analysis.

For the Gatwick Second Runway (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2050 Do-Something scenario compared to the 2050 DM scenario is 18,200, and the number of people newly removed is 2,700. This results in a net increase in the number of people newly affected of 15,500.

3.7.4 Sensitive Buildings

The change in number of sensitive buildings within each contour between the 2030 DM and 2030 Gatwick-2R-X scenarios are set out in Table 3.25 below:

Table 3.25 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X Gatwick, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	5	1	0	N70 >20	7	0	4
	>57 dB $L_{Aeq,16h}$	(1)	0	(1)	N70 >50	(1)	0	(1)
	>60 dB $L_{Aeq,16h}$	(1)	0	(2)	N70 >100	(1)	0	(2)
	>63 dB $L_{Aeq,16h}$	(2)	0	(2)	N70 >200	(1)	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 $L_{Aeq,8h}$	8	1	1	N60 >25	3	0	(4)
	>51 dB $L_{Aeq,8h}$	(5)	0	(4)	N60 >50	(7)	0	(6)
	>54 dB $L_{Aeq,8h}$	(1)	0	(2)	N60 >100	(1)	0	(1)
	>57 dB $L_{Aeq,8h}$	(1)	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}	8	1	3				
	>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				

The change in number of sensitive buildings within each contour between the 2040 DM and 2040 Gatwick-2R-X scenarios are set out in Table 3.26 below:

Table 3.26 : 2040 Do-Minimum Gatwick vs 2040 Gatwick-2R-X Gatwick, Sensitive Buildings

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

The change in number of sensitive buildings within each contour between the 2040 DM and 2040 Gatwick-2R-X scenarios are set out in Table 3.29 below:

Table 3.27 : 2050 Do-Minimum Gatwick vs 2050 Gatwick-2R-X Gatwick, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	14	1	8	N70 >20	8	0	3
	>57 dB $L_{Aeq,16h}$	2	0	0	N70 >50	2	0	2
	>60 dB $L_{Aeq,16h}$	(1)	0	(2)	N70 >100	0	0	(1)
	>63 dB $L_{Aeq,16h}$	(1)	0	(2)	N70 >200	(1)	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 $L_{Aeq,8h}$	1	1	(1)	N60 >25	(1)	0	(5)
	>51 dB $L_{Aeq,8h}$	(5)	0	(4)	N60 >50	(7)	0	(5)
	>54 dB $L_{Aeq,8h}$	(1)	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}	11	1	5				
	>60 dB L_{den}	(1)	0	(2)				
	>65 dB L_{den}	(2)	0	(2)				
	>70 dB L_{den}	0	0	0				
	>75 dB L_{den}	0	0	0				

3.8 Scorecards for 'Carbon Traded' Option (Gatwick-2R-X-C)

Noise metrics have been produced for a scenario with the second runway 'Carbon Traded' option at Gatwick Airport for 2030, 2040 and 2050. These metrics are presented in the scorecard format below.

Table 3.28 : 2030 Gatwick-2R-X-C Gatwick Airport Scorecard

Period	Population Noise Exposure UK measure		Population Noise Exposure EU measure		Frequency measure (based on number above contour)	
Day	>54 dB $L_{Aeq,16h}$	30,900			N70 >20	15,400
	>57 dB $L_{Aeq,16h}$	12,700			N70 >50	9,600
	>60 dB $L_{Aeq,16h}$	3,900			N70 >100	4,700
	>63 dB $L_{Aeq,16h}$	1,200			N70 >200	2,400
	>66 dB $L_{Aeq,16h}$	300			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	<50				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	24,500			N60 >25	20,400
	>51 dB $L_{Aeq,8h}$	7,800			N60 >50	1,800
	>54 dB $L_{Aeq,8h}$	3,100			N60 >100	<50
	>57 dB $L_{Aeq,8h}$	900			N60 >200	0
	>60 dB $L_{Aeq,8h}$	200			N60 >500	0
	>63 dB $L_{Aeq,8h}$	<50				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	34,500		
			>60 dB L_{den}	7,200		
			>65 dB L_{den}	1,000		
			>70 dB L_{den}	100		
			>75 dB L_{den}	<50		

Table 3.29 : 2040 Gatwick-2R-X-C Gatwick Airport Scorecard

Period	Population Noise Exposure UK measure		Population Noise Exposure EU measure		Frequency measure (based on number above contour)	
Day	>54 dB $L_{Aeq,16h}$	28,700			N70 >20	15,100
	>57 dB $L_{Aeq,16h}$	11,100			N70 >50	8,500
	>60 dB $L_{Aeq,16h}$	3,900			N70 >100	4,300
	>63 dB $L_{Aeq,16h}$	1,200			N70 >200	2,000
	>66 dB $L_{Aeq,16h}$	300			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	<50				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	20,100			N60 >25	19,500
	>51 dB $L_{Aeq,8h}$	5,600			N60 >50	1,700
	>54 dB $L_{Aeq,8h}$	2,400			N60 >100	<50
	>57 dB $L_{Aeq,8h}$	500			N60 >200	0
	>60 dB $L_{Aeq,8h}$	200			N60 >500	0
	>63 dB $L_{Aeq,8h}$	<50				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	36,600		
			>60 dB L_{den}	7,900		
			>65 dB L_{den}	1,100		
			>70 dB L_{den}	100		
			>75 dB L_{den}	<50		

Table 3.30 : 2050 Gatwick-2R-X-C Gatwick Airport Scorecard

Period	Population Noise Exposure				Frequency measure (based on number above contour)	
	UK measure		EU measure			
Day	>54 dB $L_{Aeq,16h}$	27,800			N70 >20	14,300
	>57 dB $L_{Aeq,16h}$	10,100			N70 >50	9,400
	>60 dB $L_{Aeq,16h}$	3,600			N70 >100	4,400
	>63 dB $L_{Aeq,16h}$	1,100			N70 >200	2,200
	>66 dB $L_{Aeq,16h}$	300			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	<50				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	20,400			N60 >25	19,500
	>51 dB $L_{Aeq,8h}$	5,600			N60 >50	1,600
	>54 dB $L_{Aeq,8h}$	2,500			N60 >100	<50
	>57 dB $L_{Aeq,8h}$	600			N60 >200	0
	>60 dB $L_{Aeq,8h}$	200			N60 >500	0
	>63 dB $L_{Aeq,8h}$	<50				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	35,700		
			>60 dB L_{den}	7,500		
			>65 dB L_{den}	1,100		
			>70 dB L_{den}	100		
			>75 dB L_{den}	<50		

3.9 Appraisal of 'Carbon Traded' Option (Gatwick-2R-X-C)

This option for appraisal assumes the same scheme for development and commercial growth scenario as the above analysis, but with carbon emissions from aviation traded (rather than capped at 37.5 million tonnes) in such a way as to result in the same net effect on UK emissions as a whole. The ATMs used in the noise modelling of these two scenarios are set out in Table 3.31 below.

The forecast ATMs for the 'Carbon Traded' option are greater than for the 'Carbon Capped' option, and therefore it would be expected that the noise contours will be proportionally increased. The predicted differences in population noise metrics between the Gatwick-2R-X-C and DM scenarios for equivalent years are considered in detail below.

Table 3.31 : Gatwick Airport – 'Carbon Traded' Option ATMs

	Air Transport Movements		
	2030	2040	2050
Gatwick DM	277,919	280,633	285,420
Gatwick Gatwick-2R-X-C	480,623	560,000	556,387

3.9.1 Day Metrics

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

This section considers predicted changes in terms of the $L_{Aeq,16h}$ daytime noise exposure metric, calculated as an average summer's day average.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario $L_{Aeq,16h}$ contour plots are shown in Figure 3.37 to Figure 3.42 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure 3.37 : 2030 Do-Minimum Gatwick Airport $L_{Aeq,16h}$ Contours

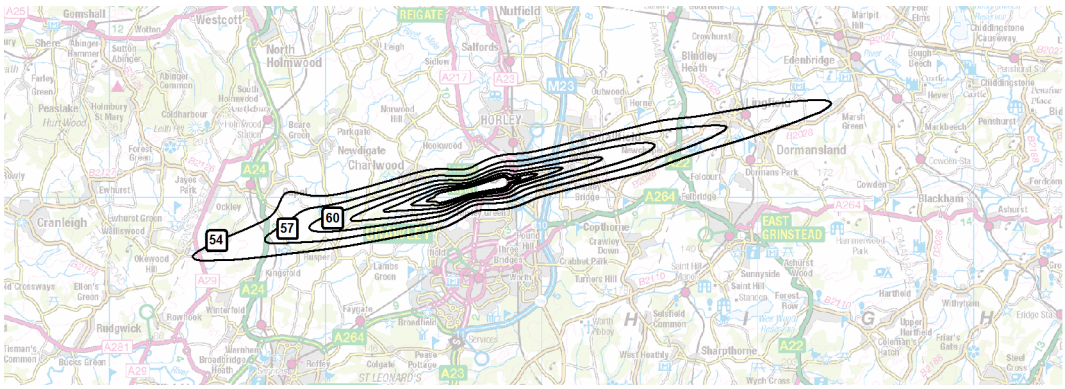
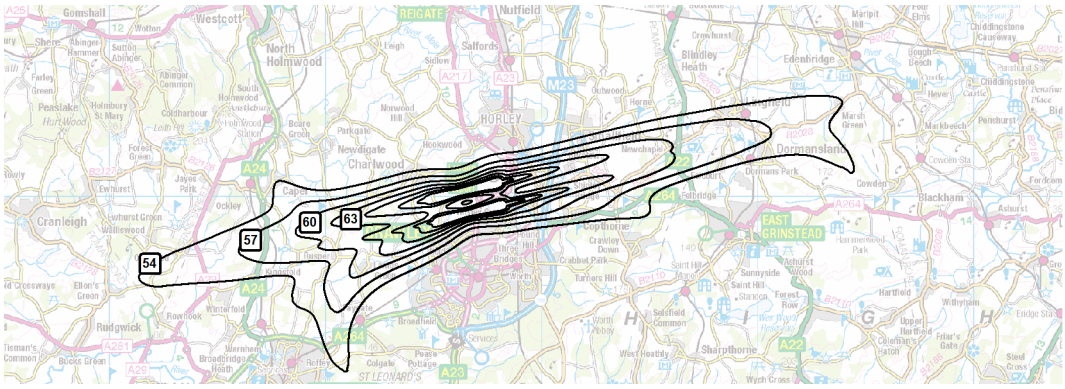


Figure 3.38 : 2030 Gatwick-2R-X-C Gatwick Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.32 below.

Table 3.32 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X-C Gatwick, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	59.2	22,900	9,300
>57	37.0	10,500	4,300
>60	23.0	2,800	1,200
>63	12.7	800	400
>66	6.3	0	0
>69	2.9	200 to <50	<50 to <50
>72	1.6	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

All of the 2030 Do-Something $L_{Aeq,16h}$ contours are larger than the equivalent DM contours, as a result of increased ATMs in the Do-Something scenario. The different arrival and departure tracks associated with the Gatwick 2R proposal also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >54 dB: An increase of 22,900 (from 8,000 to 30,900)

- >57 dB An increase of 10,500 (from 2,200 to 12,700)
- >60 dB An increase of 2,800 (from 1,100 to 3,900)
- >63 dB An increase of 800 (from 400 to 1,200)
- >66 dB No discernible difference (from 300 to 300)
- >69 dB A reduction from 200 to <50
- >72 dB No discernible difference(from <50 to <50)

The reduction in population in the >69 dB contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

Figure 3.39 : 2040 Do-Minimum Gatwick Airport $L_{Aeq,16h}$ Contours

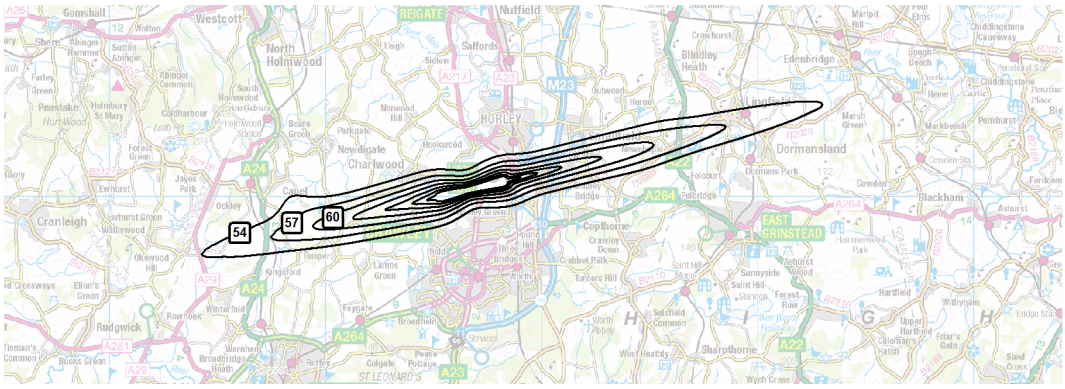
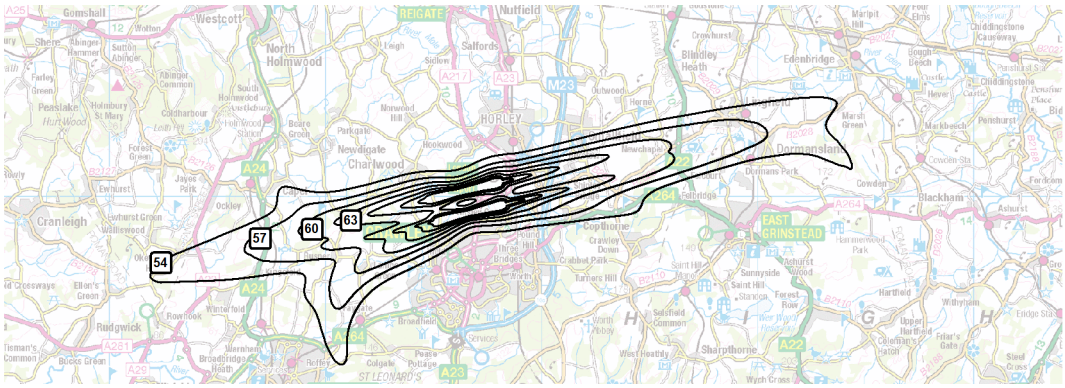


Figure 3.40 : 2040 Gatwick-2R-X-C Gatwick Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.3.3 below.

Table 3.33 : 2040 Do-Minimum Gatwick vs 2040 Gatwick-2R-X-C Gatwick, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	55.6	21,300	8,700
>57	35.2	8,900	3,700
>60	22.1	3,000	1,300
>63	11.9	700	400
>66	5.6	0	<50 to 100
>69	2.7	200 to <50	<50 to <50
>72	1.5	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

All of the 2040 Do-Something $L_{Aeq,16h}$ contours are larger than the equivalent DM contours, as a result of increased ATMs in the Do-Something scenario. The different

arrival and departure tracks associated with the Gatwick 2R proposal also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >54 dB: An increase of 21,300 (from 7,400 to 28,700)
- >57 dB: An increase of 8,900 (from 2,200 to 11,100)
- >60 dB: An increase of 3,000 (from 900 to 3,900)
- >63 dB: An increase of 700 (from 500 to 1,200)
- >66 dB: No discernible difference (from 300 to 300)
- >69 dB: A reduction from 200 to <50
- >72 dB: No discernible difference (from <50 to <50)

The reduction in population in the >69 dB contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

Figure 3.41 : 2050 Do-Minimum Gatwick Airport $L_{Aeq,16h}$ Contours

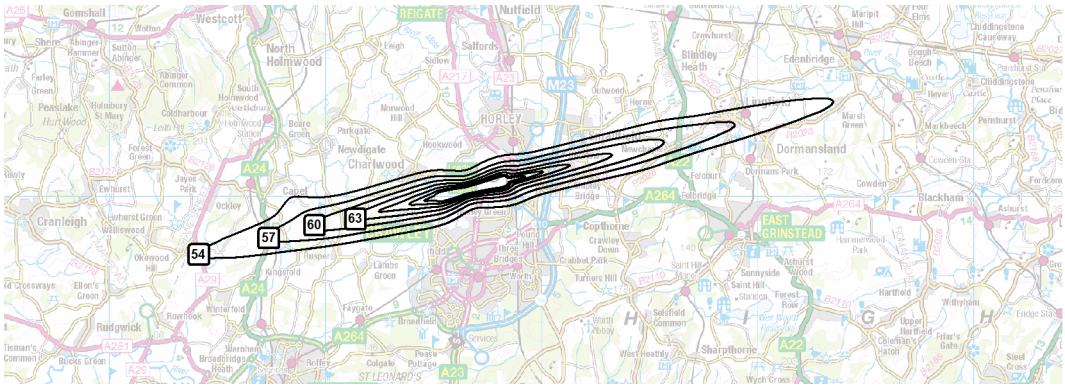
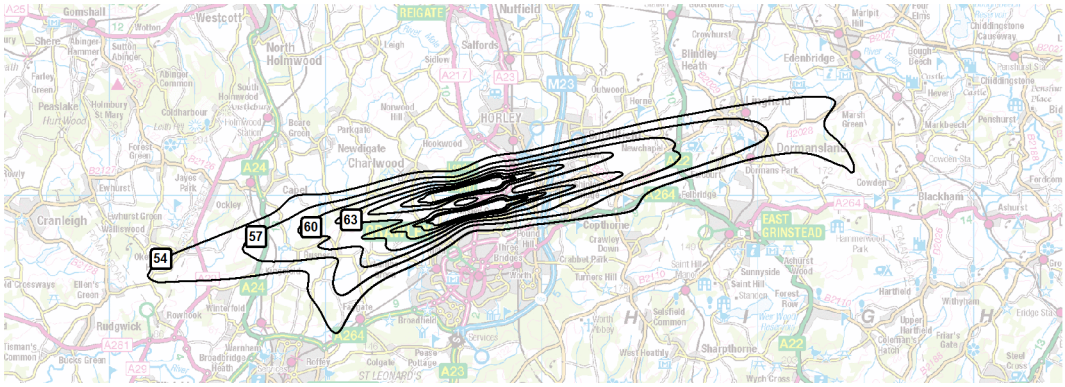


Figure 3.42 : 2050 Gatwick-2R-X-C Gatwick Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.34 below.

Table 3.34 : 2050 Do-Minimum Gatwick vs 2050 Gatwick-2R-X-C Gatwick, $L_{Aeq,16h}$

Contour	Area (km^2)	Population	Households
>54	49.9	20,200	8,200
>57	32.5	7,300	3,000
>60	20.9	2,400	1,100
>63	11.3	600	400
>66	5.3	0	0
>69	2.6	200 to <50	<50 to <50
>72	1.4	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

All of the 2050 Do-Something $L_{Aeq,16h}$ contours are larger than the equivalent DM contours, as a result of increased ATMs in the Do-Something scenario. The different arrival and departure tracks associated with the two runway scenario also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >54 dB: An increase of 20,200 (from 7,600 to 27,800)
- >57 dB: An increase of 7,300 (from 2,800 to 10,100)
- >60 dB: An increase of 2,400 (from 1,200 to 3,600)
- >63 dB: An increase of 600 (from 500 to 1,100)
- >66 dB: No discernible difference (from 300 to 300)
- >69 dB: A reduction from 200 to <50
- >72 dB: No discernible difference (from <50 to <50)

The reduction in population in the >69 dB contour is because a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

(b) N70 Supplementary Metric

This section considers predicted changes in terms of the N70 noise exposure metric, calculated as a summer's day average.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N70 contour plots are shown in Figure 3.43 to Figure 3.49 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure 3.43 : 2030 Do-Minimum Gatwick Airport N70 Contours

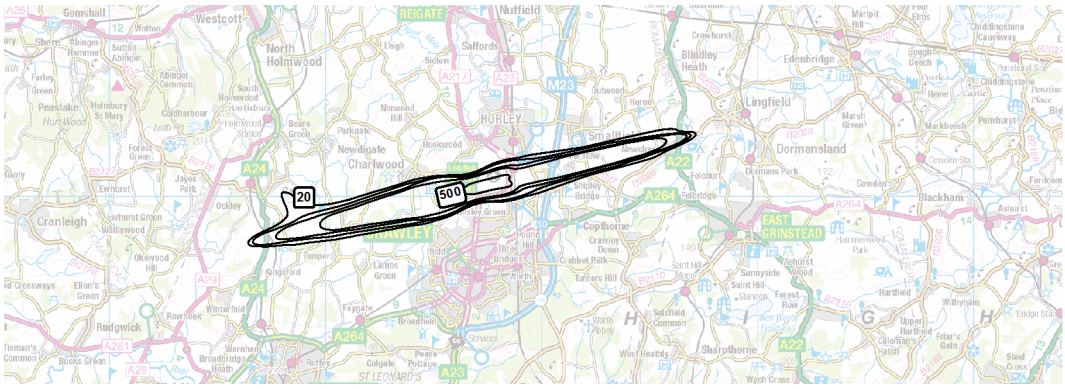
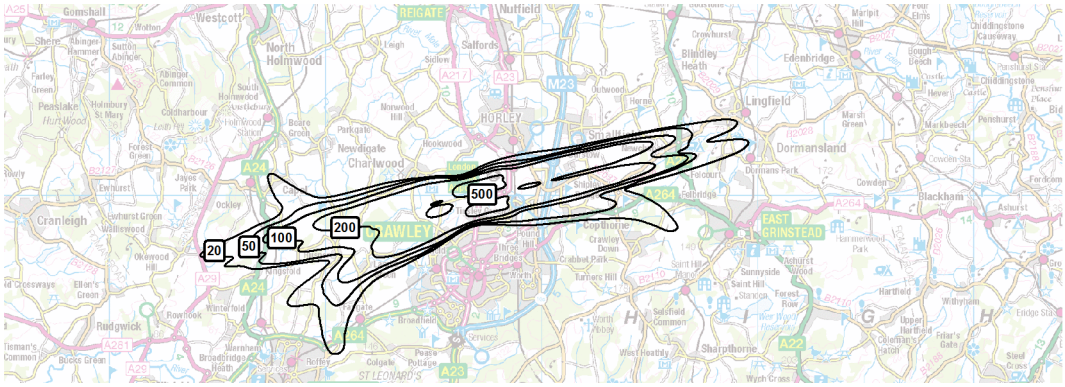


Figure 3.44 : 2030 Gatwick-2R-X-C Gatwick Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 3.35 below.

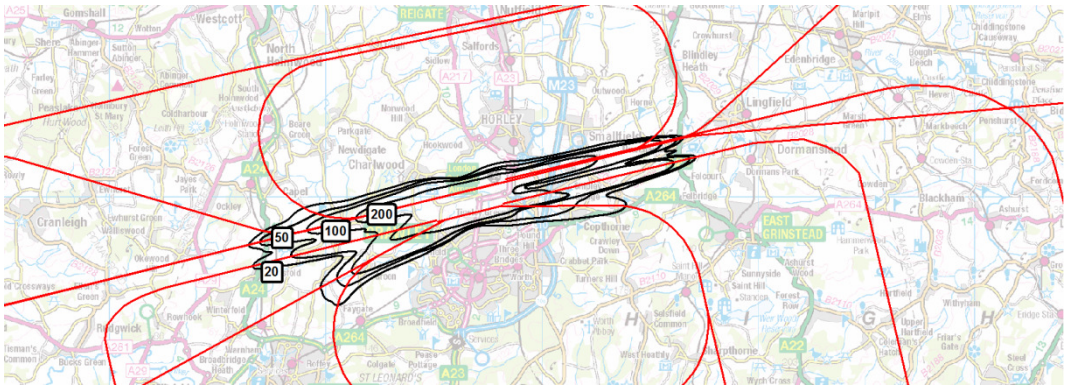
Table 3.35 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X-C Gatwick, N70

Contour	Area (km²)	Population	Households
>20	48.6	13,300	5,600
>50	31.4	7,800	3,200
>100	22.3	3,300	1,400
>200	13.0	1,600	700
>500	1.9	200 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

Compared with the DM contours, the 2030 Do-Something contours extend further in both the east-west axis and north-south axis. This is due to a significant increase in ATMs, the second runway and the corresponding changes in indicative flight paths. The difference in flight paths also leads to increased divergence at the east and west extents of the Do-Something contours, with distinct 'horns' at either end as can be seen on Figure 3.13 below.

Figure 3.45 : 2030 Gatwick-2R-X-C N70 Contours and Indicative Routes



The resulting differences in population exposure are summarised below:

- >20 events: An increase of 13,300 (from 2,100 to 15,400)
- >50 events: An increase of 7,800 (from 1,800 to 9,600)
- >100 events: An increase of 3,300 (from 1,400 to 4,700)
- >200 events: An increase of 1,600 (from 800 to 2,400)
- >500 events: A reduction from 200 to <50

The reduction in population in the >500 contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

Figure 3.46 : 2040 Do-Minimum Gatwick Airport N70 Contours

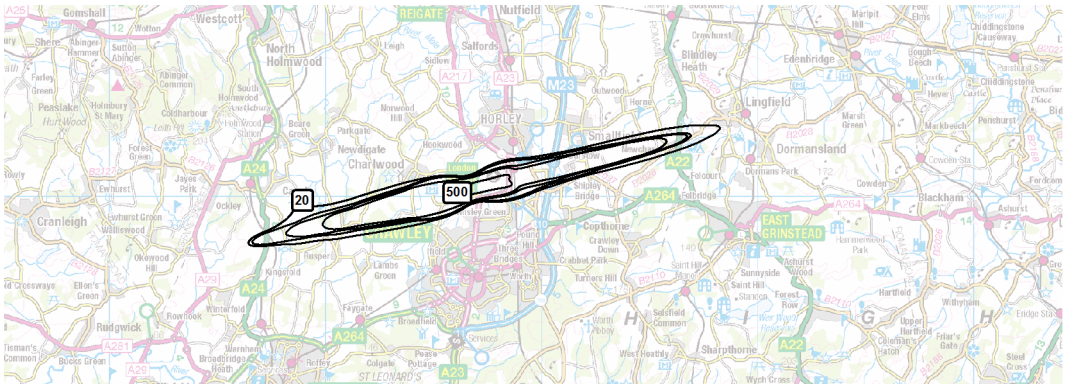
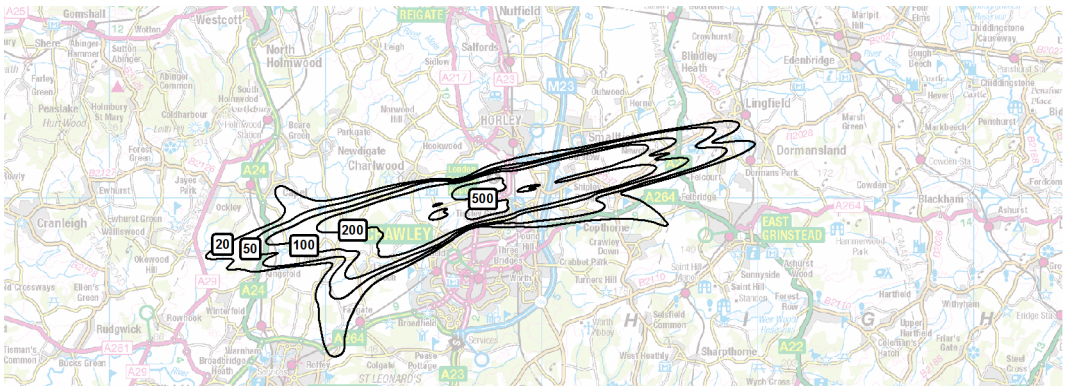


Figure 3.47 : 2040 Gatwick-2R-X-C Gatwick Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 3.36 below.

Table 3.36 : 2040 Do-Minimum Gatwick vs 2040 Heathrow-NWR-Gatwick, N70

Contour	Area (km²)	Population	Households
>20	45.3	12,900	5,400
>50	32.7	6,800	2,900
>100	21.4	2,900	1,200
>200	12.2	1,200	500
>500	1.6	200 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

Compared with the DM contours, the 2040 Do-Something contours extend further in both the east-west axis and north-south axis. This is due to a significantly more increase in ATMs in the Do-Something scenario, the second runway and the corresponding changes in flight paths. The difference in flight paths also leads to increased divergence at the east and west extents of the Do-Something contours.

The resulting differences in population exposure are summarised below:

- >20 events: An increase of 12,900 (from 2,200 to 15,100)
- >50 events: An increase of 6,800 (from 1,700 to 8,500)
- >100 events: An increase of 2,900 (from 1,400 to 4,300)
- >200 events: An increase of 1,200 (from 800 to 2,000)
- >500 events: A change from 200 to <50

The reduction in population in the >500 contour is because a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

Figure 3.48 : 2050 Do-Minimum Gatwick Airport N70 Contours

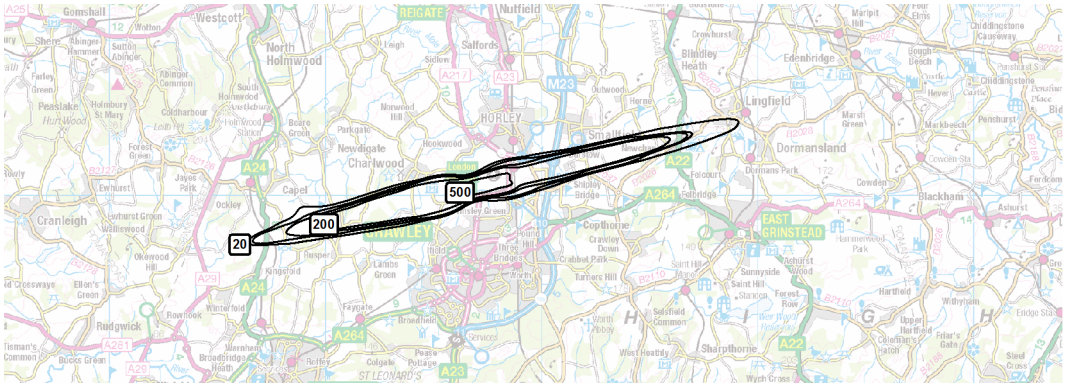
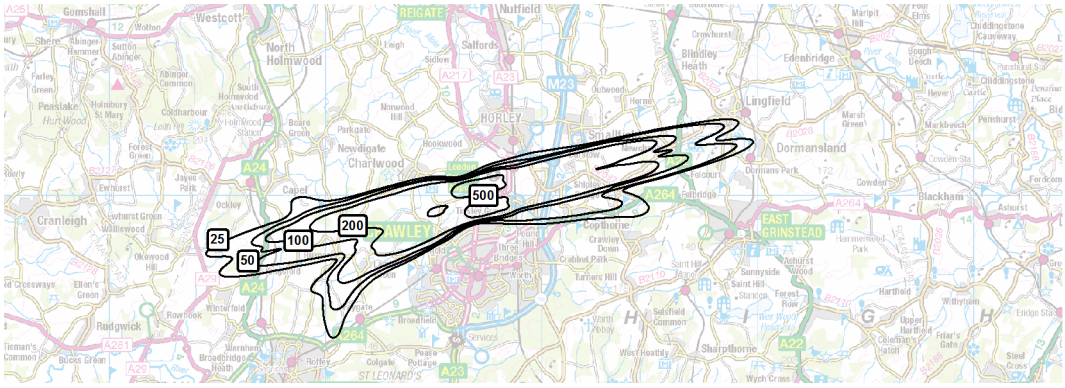


Figure 3.49 : 2050 Gatwick-2R-X-C Gatwick Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 3.37 below.

Table 3.37 : 2050 Do-Minimum Gatwick vs 2050 Gatwick-2R-X-C Gatwick, N70

Contour	Area (km²)	Population	Households
>20	41.7	11,000	4,600
>50	33.3	7,500	3,200
>100	21.5	3,000	1,300
>200	13.7	1,400	600
>500	1.6	200 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

Compared with the DM contours, the 2040 Do-Something contours extend further in both the east-west axis and north-south axis. This is due to a significant increase in ATMs in the Do-Something scenario, the second runway and the corresponding changes in flight paths. The difference in flight paths also leads to increased divergence at the east and west extents of the Do-Something contours.

The resulting differences in population exposure are summarised below:

- >20 events: An increase of 11,000 (from 3,300 to 14,300)

- >50 events: An increase of 7,500 (from 1,900 to 9,400)
- >100 events: An increase of 3,000 (from 1,400 to 4,400)
- >200 events: An increase of 1,400 (from 800 to 2,200)
- >500 events: A reduction from 200 to <50

The reduction in population in the >500 contour is because a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

3.9.2 Night Metrics

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

This section considers predicted changes in terms of the $L_{Aeq,8h}$ daytime noise exposure metric, calculated as a summer's night average.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario $L_{Aeq,8h}$ contour plots are shown in Figure 3.50 to Figure 3.55 provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure 3.50 : 2030 Do-Minimum Gatwick Airport $L_{Aeq,8h}$ Contours

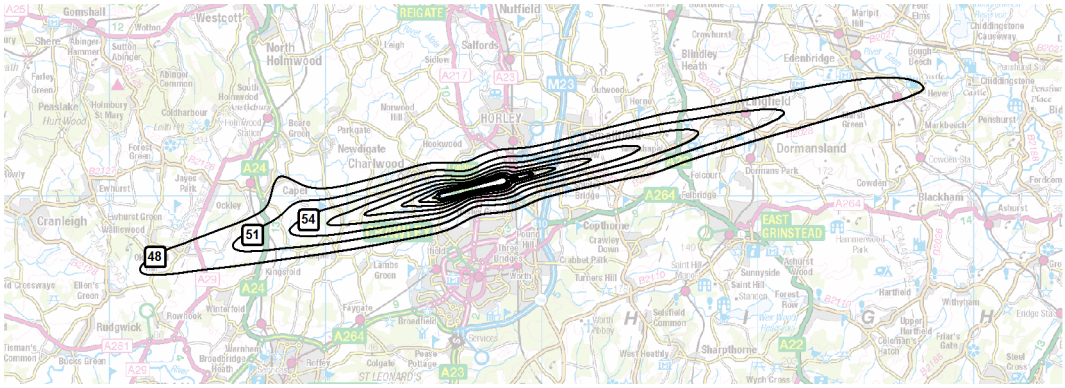
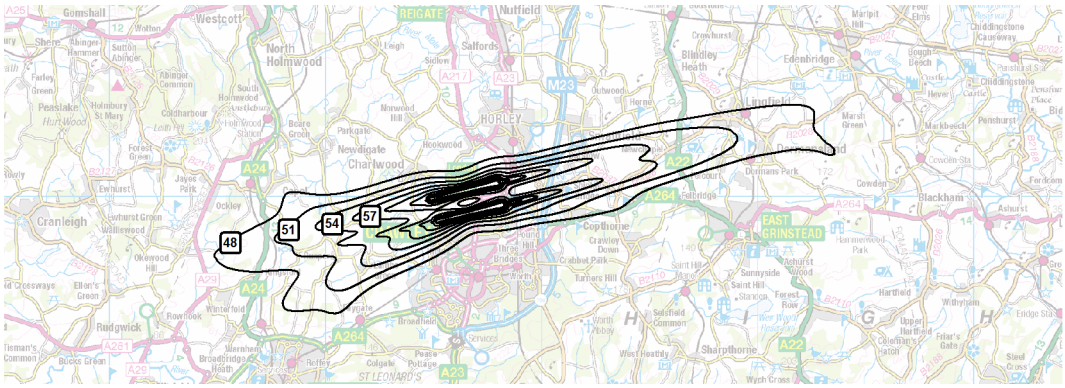


Figure 3.51 : 2030 Gatwick-2R-X-C Gatwick Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table *3.38* below.

Table 3.38 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X-C Gatwick, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	9.3	12,800	5,200
>51	10.7	2,200	1,000
>54	7.8	1,400	600
>57	3.5	300	200
>60	1.6	(200)	0
>63	0.8	300 to <50	<50 to <50
>66	0.6	<50 to <50	<50 to <50
>69	0.4	<50 to <50	<50 to <50
>72	0.3	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In all cases the 2030 Do-Something contours cover a larger area than the equivalent DM contours; this is due to an increase in night-time ATMs, which are accommodated in the night-time shoulder periods (23.00-23.30 and 06.00-07.00). No changes to the Quota Count system is expected. Due to the second runway and additional routes, the shape of the Do-Something contours is different, being shorter in the east-west axis and wider in the north-south axis than the DM contours.

Reflecting their greater area than the equivalent DM contours, the Do-Something >48 to >57 dB contours enclose greater populations. However, despite the increases in areas, the >60 and >63 dB contours show reductions; the reasons for these are twofold. Firstly, the Do-Something contours do not extend as far east over Burstow, and secondly a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

The differences in population exposure between the Do-Something and DM scenarios are summarised below:

- >48 dB: An increase of 12,800 (from 11,700 to 24,500)
- >51 dB: An increase of 2,200 (from 5,600 to 7,800)
- >54 dB: An increase of 1,400 (from 1,700 to 3,100)
- >57 dB: An increase of 300 (from 600 to 900)
- >60 dB: A reduction of 200 (from 400 to 200)
- >63 dB: A reduction from 300 to <50
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

Figure 3.52 : 2040 Do-Minimum Gatwick Airport $L_{Aeq,8h}$ Contours

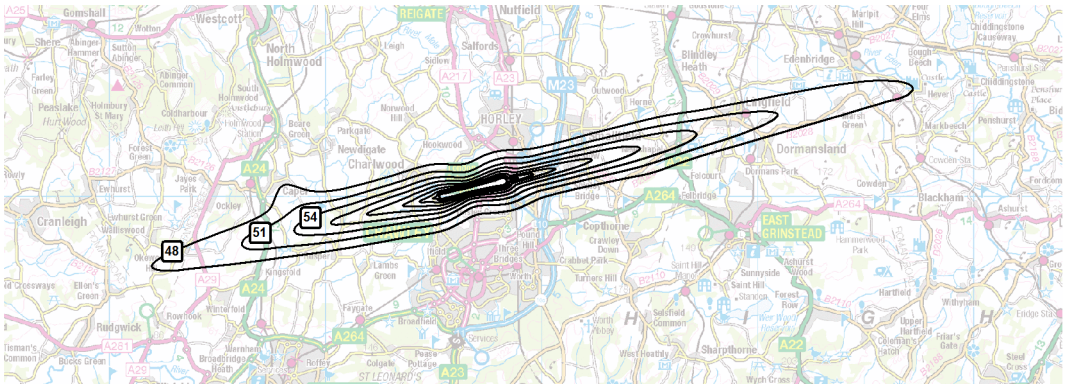
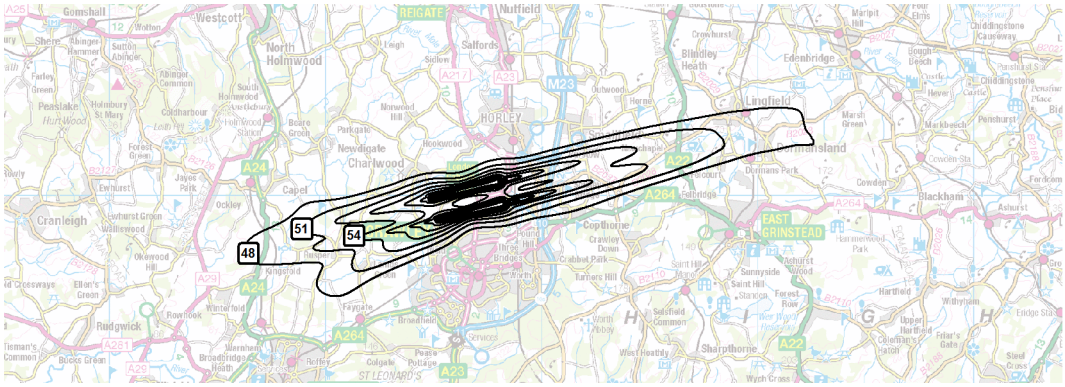


Figure 3.53 : 2040 Gatwick-2R-X-C Gatwick Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 3.39 below.

Table 3.39 : 2040 Do-Minimum Gatwick vs 2040 Gatwick-2R-X-C Gatwick, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	7.5	9,000	3,700
>51	9.2	100	200
>54	6.4	700	300
>57	2.1	(100)	0
>60	0.5	(200)	0
>63	0.4	300 to <50	<50 to <50
>66	0.3	<50 to <50	<50 to <50
>69	0.2	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In all cases the 2040 Do-Something contours cover a larger area than the equivalent DM contours, although the differences are not quite as large as in the 2030 comparison due to growth in the DM scenario between 2030 and 2040. The increases in the 2040 Do-Something contour areas over the equivalent DM contours is due to an increase in night-time ATMs in the shoulder periods (between 23.00-23.30 and 06.00-07.00). No changes to the current night Quota Count system are assumed. As a result of the second runway and additional routes, the shape of the Do-Something contours is different from the DM contours, being shorter in the east-west axis and wider in the north-south axis than the DM contours.

Reflecting their greater area than the equivalent DM contours, the Do-Something >48 to >54 dB contours enclose greater populations. However, despite the increases in areas, the >57 to >63 dB contours show reductions; the reasons for these are twofold. Firstly, the Do-Something contours do not encompass as many properties in the areas around Burstow and Newchapel as the DM. Secondly, a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

The differences in population exposure between the Do-Something and DM scenarios are summarised below:

- >48 dB: An increase of 9,000 (from 11,100 to 20,100)
- >51 dB: An increase of 100 (from 5,500 to 5,600)
- >54 dB: An increase of 700 (from 1,700 to 2,400)
- >57 dB: A reduction of 100 (from 600 to 500)
- >60 dB: A reduction of 200 (from 400 to 200)
- >63 dB: A reduction from 300 to <50
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

Figure 3.54 : 2050 Do-Minimum Gatwick Airport $L_{Aeq,8h}$ Contours

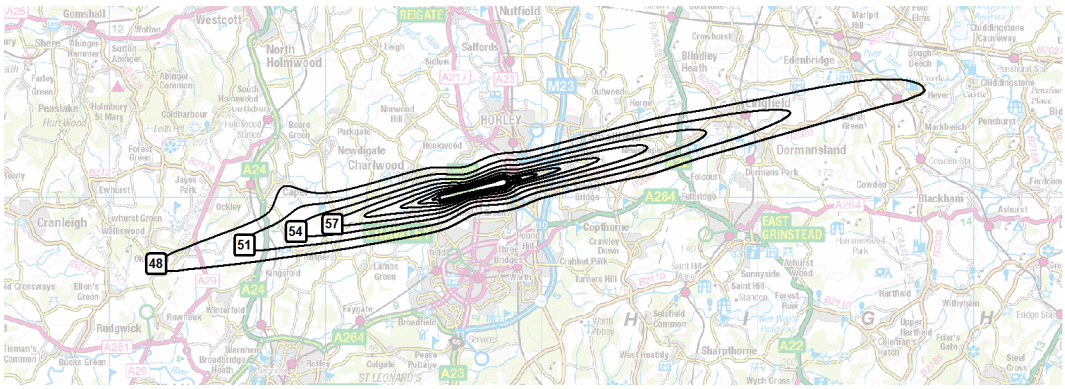
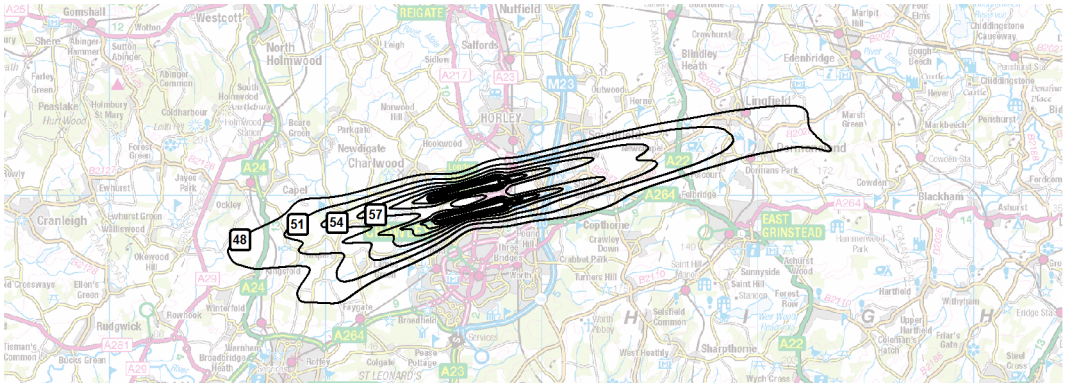


Figure 3.55 : 2050 Gatwick-2R-X-C Gatwick Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 3.40 below.

Table 3.40 : 2050 Do-Minimum Gatwick vs 2050 Gatwick-2R-X-C Gatwick, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	6.5	9,200	3,700
>51	8.9	0	100
>54	6.4	800	400
>57	2.2	0	0
>60	0.6	(200)	0
>63	0.5	300 to <50	<50 to <50
>66	0.3	<50 to <50	<50 to <50
>69	0.3	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In all cases the 2050 Do-Something contours cover a larger area than the equivalent DM contours, although the differences are not quite as large as in the 2030 or 2040 comparisons due to growth in the DM scenario between 2030 and 2050. The increases in the 2050 Do-Something contour areas over the equivalent DM contours are due to an increase in night-time ATMs in the shoulder periods (between 23.00-23.30 and 06.00-07.00) . No changes to the current night Quota Count system are assumed. As a result of the second runway and additional routes, the shape of the Do-Something contours is different from the DM contours, being shorter in the east-west axis and wider in the north-south axis than the DM contours.

Reflecting their greater area than the equivalent DM contours, the Do-Something >48 and >54 dB contours enclose greater populations. However, despite the increases in areas, the >51 and >57 dB contours show no change in population; this is because the number of dwellings to the east and west of the airport which are excluded by the contours in comparison to the DM situation, is offset by the number of dwellings on the north extent of Crawley that are covered by the Do-Something contour.

The >60 and >63 dB contours show reductions as the Do-Something contours do not extend east over Burstow. Also, a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

The differences in population exposure between the Do-Something and DM scenarios are summarised below:

- *>48 dB: An increase of 9,200 (from 11,200 to 20,400)*
- *>51 dB: A reduction of 0 (from 5,600 to 5,600)*
- *>54 dB: An increase of 800 (from 1,700 to 2,500)*
- *>57 dB: A reduction of 0 (from 600 to 600)*
- *>60 dB: A reduction of 200 (from 400 to 200)*
- *>63 dB: A reduction from 300 to <50*
- *>66 dB: No discernible difference (from <50 to <50)*
- *>69 dB: No discernible difference (from <50 to <50)*
- *>72 dB: No discernible difference (from <50 to <50)*

(b) N60 Supplementary Metric

This section considers predicted changes in terms of the N60 noise exposure metric, calculated as a summer's night average.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N60 contour plots are shown in Figure 3.43 to Figure 3.49 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure 3.56 : 2030 Do-Minimum Gatwick Airport N60 Contours

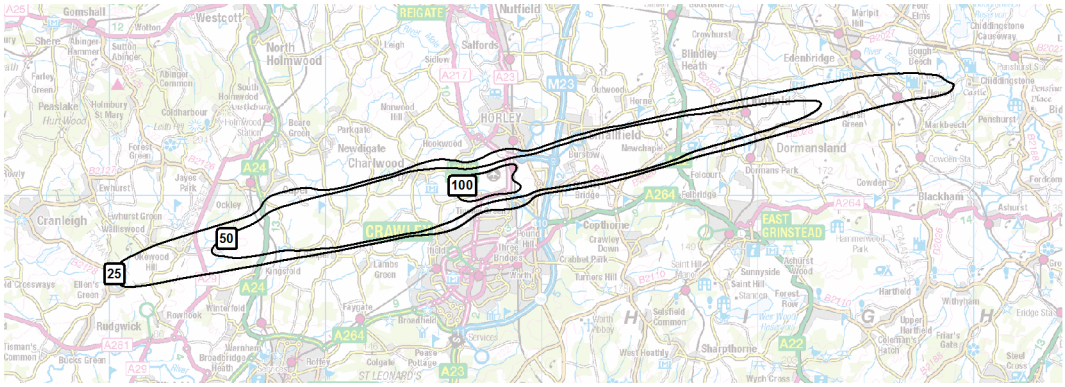
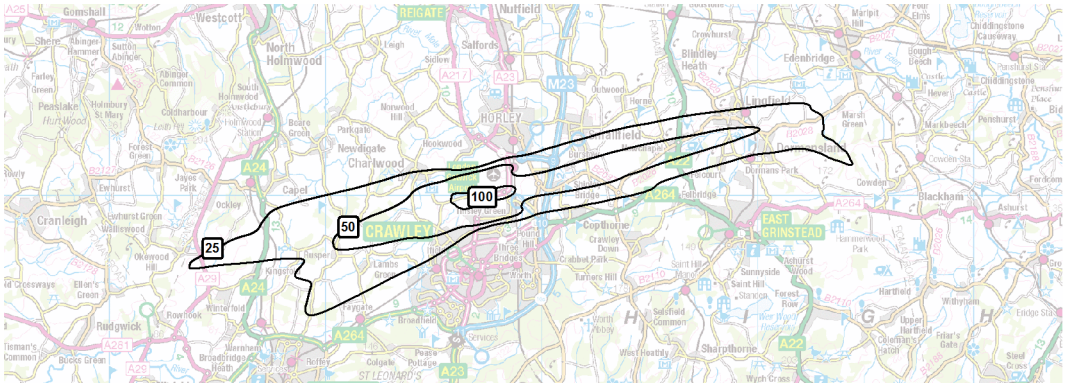


Figure 3.57 : 2030 Gatwick-2R-X-C Gatwick Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 3.41 below.

Table 3.41 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X-C Gatwick, N60

Contour	Area (km2)	Population	Households
>25	(0.6)	8,600	3,500
>50	(26.2)	(5,400)	(2,200)
>100	(1.5)	200 to <50	<50 to <50
>200	0 to	0 to	0 to
>500	0 to	0 to	0 to

Note: Numbers in parentheses represent reductions

Due to the increased divergence of routes in the Do-Something scenario, the resulting noise contours are wider in the north-south axis, but shorter in the east-west axis than the DM contours.

The area covered by the >25 contour in the Do-Something scenario is only 0.6 km^2 less than in the DM scenario. This is due to the competing factors of increased night-time aircraft movements, in the shoulder periods (between 23.00-23.30 and 06.00-07.00), and the dispersion of aircraft movements on a greater number of routes, which results in locations being overflown less often. No changes to the

current night Quota Count system are assumed. However, although the Do-Something contour area does not vary significantly from the DM contour, the population encompassed is 8,600 greater as the Do-Something contour extends further to the south of the airport, and includes more of north Crawley.

The Do-Something >50 contour is 26.2 km^2 smaller in area, which is primarily due to the a greater number and spread of SIDs and STARs; with the aircraft movements split between a greater number of routes, the number of movements causing noise levels of over 60 dB $L_{AS,max}$ over a particular location decreases (apart from very close to the airport where the routes converge). This effect offsets the increase in night-time aircraft movements when the threshold is 50 or more qualifying events.

The >100 contour is 1.5 km^2 smaller in the Do-Something scenario, as this contour is closer to the airport and the routes do not diverge as much. The population within this contour decreases, primarily because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

- *>25 events: An increase of 8,600 (from 11,800 to 20,400)*
- *>50 events: A reduction of 5,400 (from 7,200 to 1,800)*
- *>100 events: A reduction from 200 to <50*

Figure 3.58 : 2040 Do-Minimum Gatwick Airport N60 Contours

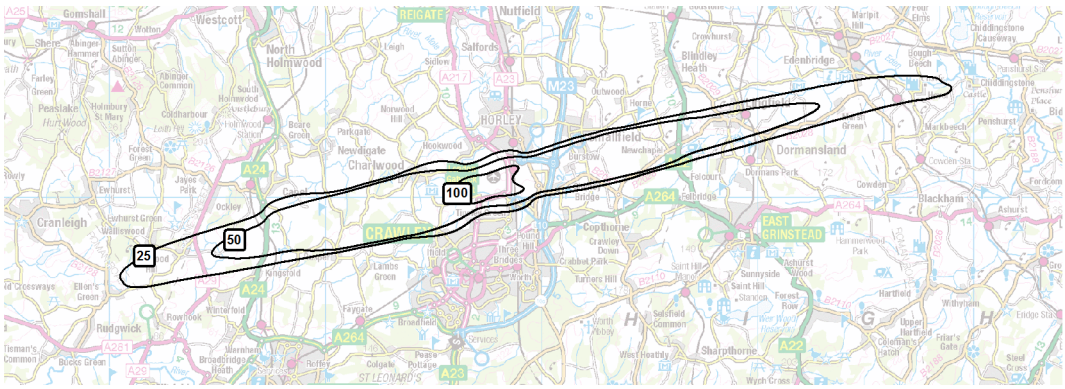
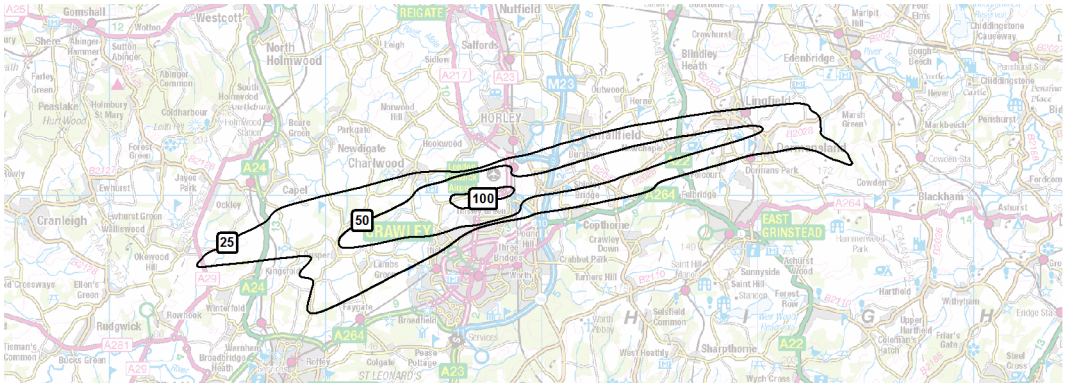


Figure 3.59 : 2040 Gatwick-2R-X-C Gatwick Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 3.42 below.

Table 3.42 : 2040 Do-Minimum Gatwick vs 2040 Gatwick-2R-X-C Gatwick, N60

Contour	Area (km2)	Population	Households
>25	(0.3)	7,300	2,900
>50	(26.2)	(5,500)	(2,100)
>100	(1.9)	200 to <50	<50 to <50
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

Due to the increased divergence of routes in the Do-Something scenario, the resulting noise contours are wider in the north-south axis, but shorter in the east-west axis than the DM contours.

The area covered by the >25 contour in the Do-Something scenario is only 0.3 km^2 less than in the DM scenario. This is due to the competing factors of increased night-time aircraft movements in the shoulder periods (between 23.00-23.30 and 06.00-07.00) and the dispersion of aircraft movements on a greater number of routes, which results in locations being overflown less often. No changes to the current night Quota Count system are assumed. However, although the Do-Something contour area does not vary significantly from the DM contour, the population encompassed is 7,300 greater as the Do-Something contour extends further to the south of the airport, and includes more of north Crawley.

The Do-Something >50 contour is 26.2 km^2 smaller in area, which is primarily due to the a greater number and spread of SIDs and STARs; with the aircraft movements split between a greater number of routes, the number of movements causing noise levels of over 60 dB $L_{AS,max}$ over a particular location decreases (apart from very close to the airport where the routes converge). This effect offsets the increase in night-time aircraft movements when the threshold is 50 or more qualifying events.

The >100 contour is 1.9 km^2 smaller in the Do-Something scenario, as this contour is closer to the airport and the routes do not diverge as much. The population within this contour decreases, partly because of the reduction in area, but also because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

- >25 events: An increase of 7,300 (from 12,200 to 19,500)
- >50 events: A reduction of 5,500 (from 7,200 to 1,700)
- >100 events: A reduction from 200 to <50

Figure 3.60 : 2050 Do-Minimum Gatwick Airport N60 Contours

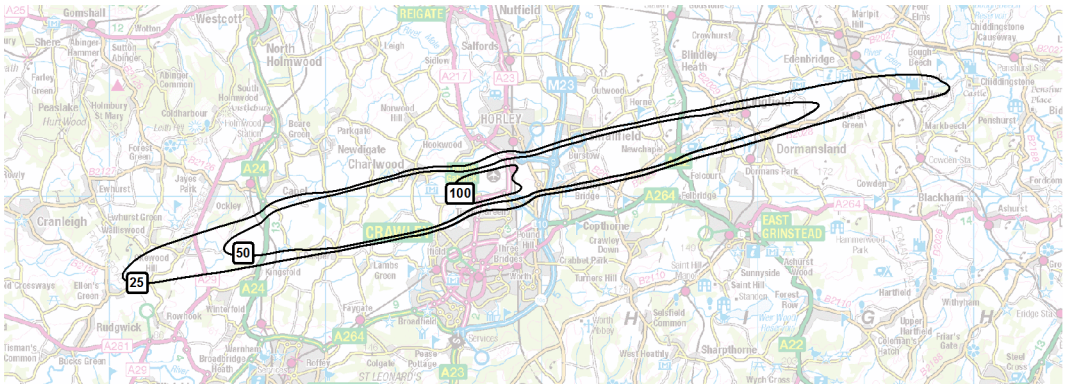
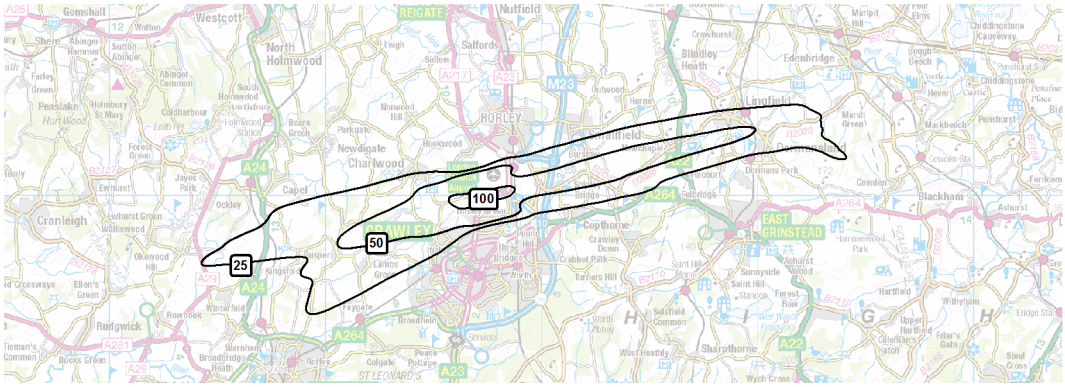


Figure 3.61 : 2050 Gatwick-2R-X-C Gatwick Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 3.43 below.

Table 3.43 : 2050 Do-Minimum Gatwick vs 2050 Gatwick-2R-X-C Gatwick, N60

Contour	Area (km2)	Population	Households
>25	1.2	7,800	3,100
>50	(24.3)	(5,500)	(2,200)
>100	(2.0)	200 to <50	<50 to <50
>200	0	0	0
>500	0	0	0

Note: Numbers in parentheses represent reductions

Due to the increased divergence of routes in the Do-Something scenario, the resulting noise contours are wider in the north-south axis, but shorter in the east-west axis than the DM contours.

The area covered by the >25 contour in the Do-Something scenario is 1.2 km^2 greater than in the DM scenario. This is due to the competing factors of increased night-time aircraft movements in the shoulder periods (23.00-23.30 and 06.00-07.00) and the dispersion of aircraft movements on a greater number of routes, which results in locations being overflown less often. No changes to the current night Quota Count system are assumed. However, although the Do-Something contour area only differs by 1.4% from the DM contour, the population encompassed is 7,300 greater as the Do-Something contour extends further to the south of the airport, and includes more of north Crawley.

The Do-Something >50 contour is 24.3 km^2 smaller in area, which is primarily due to the a greater number and spread of SIDs and STARs; with the aircraft movements split between a greater number of routes, the number of movements causing noise levels of over 60 dB $L_{AS,max}$ over a particular location decreases (apart from very close to the airport where the routes converge). This effect offsets the increase in night-time aircraft movements when the threshold is 50 or more qualifying events.

The >100 contour is 2.0 km^2 smaller in the Do-Something scenario, as this contour is closer to the airport and the routes do not diverge as much. The population within this contour decreases, partly because of the reduction in area, but also because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

- An increase of 7,800 (from 11,700 to 19,500)
- A reduction of 5,500 (from 7,100 to 1,600)
- A reduction from 200 to <50

3.9.3 24-Hour Metric

This section considers predicted changes in terms of the L_{den} day-evening-night noise exposure metric, calculated as an annual average.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario L_{den} contour plots are shown in Figure 3.62 to Figure 3.67 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure 3.62 : 2030 Do-Minimum Gatwick Airport L_{den} Contours

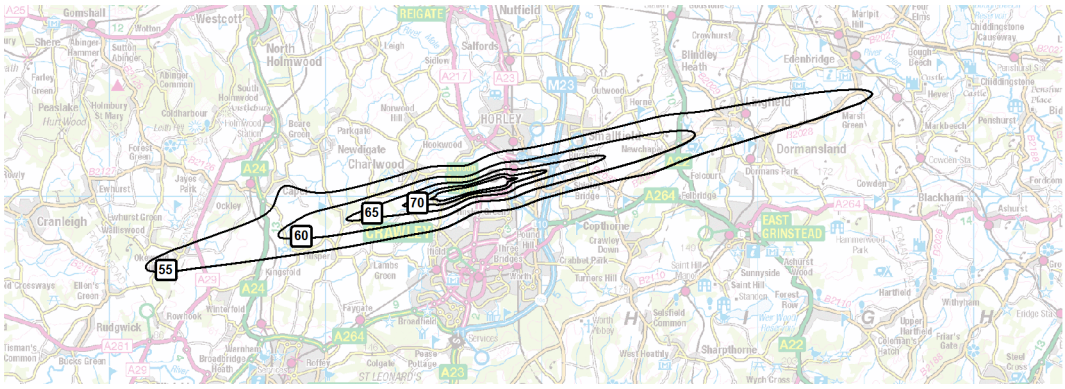
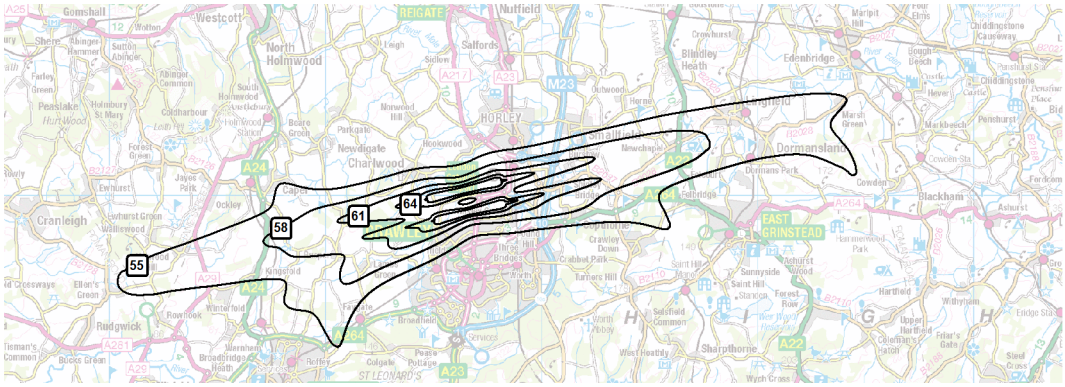


Figure 3.63 : 2030 Gatwick-2R-X-C Gatwick Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 3.44 below.

Table 3.44 : 2030 Do-Minimum Gatwick vs 2030 Gatwick-2R-X-C Gatwick, *L_{den}*

Contour	Area (km²)	Population	Households
>55	53.8	25,100	10,200
>60	25.8	5,300	2,300
>65	9.9	600	300
>70	2.9	(100)	<50 to <50
>75	1.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

All of the 2030 Do-Something L_{den} contours are larger than the equivalent DM contours, as a result of increased ATMs in the Do-Something scenario. The different arrival and departure tracks associated with the two runway scenario also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >55 dB: An increase of 25,100 (from 9,400 to 34,500)
- >60 dB: An increase of 5,300 (from 1,900 to 7,200)
- >65 dB: An increase of 600 (from 400 to 1,000)
- >70 dB: A reduction of 100 (from 200 to 100)
- >75 dB: No discernible difference (from <50 to <50)

The reduction in the >70 dB contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

Figure 3.64 : 2040 Do-Minimum Gatwick Airport L_{den} Contours

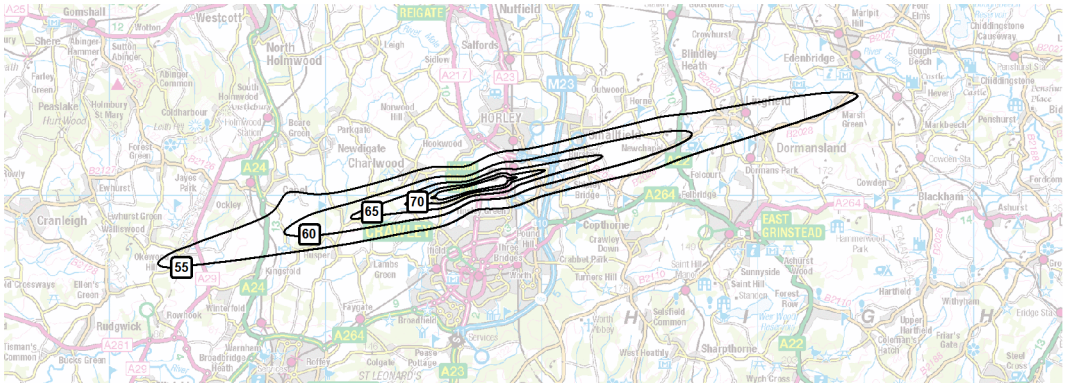
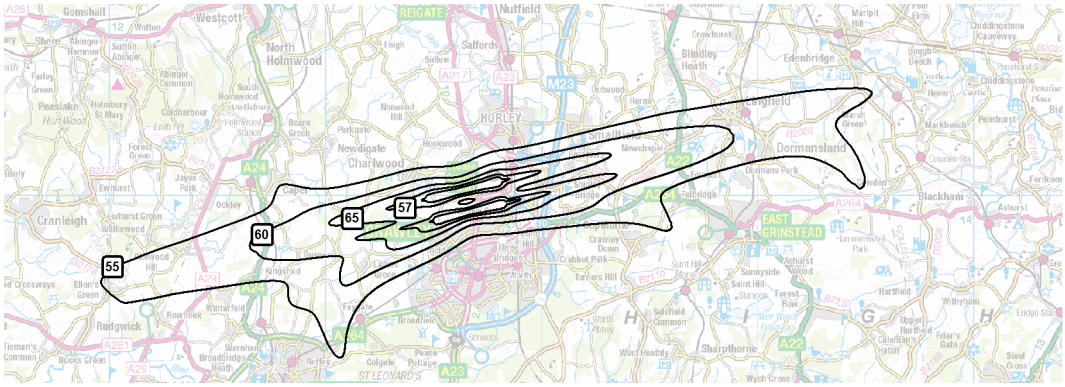


Figure *3.65* : 2040 Gatwick-2R-X-C Gatwick Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 3.45 below.

Table 3.45 : 2040 Do-Minimum Gatwick vs 2040 Gatwick-2R-X-C Gatwick, L_{den}

Contour	Area (km²)	Population	Households
>55	68.8	27,400	11,100
>60	32.7	6,200	2,500
>65	13.1	700	300
>70	3.7	(100)	<50 to <50
>75	1.3	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

All of the 2040 Do-Something L_{den} contours are larger than the equivalent DM contours, as a result of increased ATMs in the Do-Something scenario. The different arrival and departure tracks associated with the two runway scenario also cause the shape of the contours to differ from the DM scenario, with the noise effects of the second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >55 dB: An increase of 27,400 (from 9,200 to 36,600)
- >60 dB: An increase of 6,200 (from 1,700 to 7,900)

- >65 dB: An increase of 700 (from 400 to 1,100)
- >70 dB: A reduction of 100 (from 200 to 100)
- >75 dB: No discernible difference (from <50 to <50)

The reduction in the >70 dB contour is because a number of properties close to the airport in the DM scenario fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

Figure *3.66* : 2050 Do-Minimum Gatwick Airport L_{den} Contours

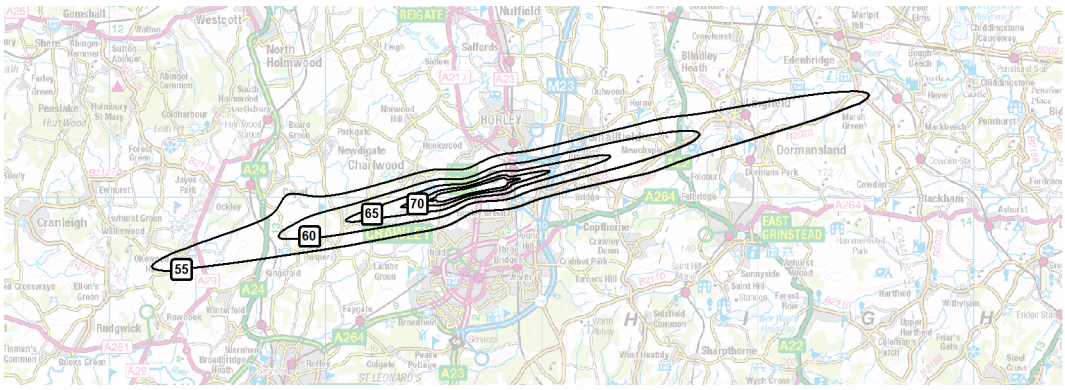
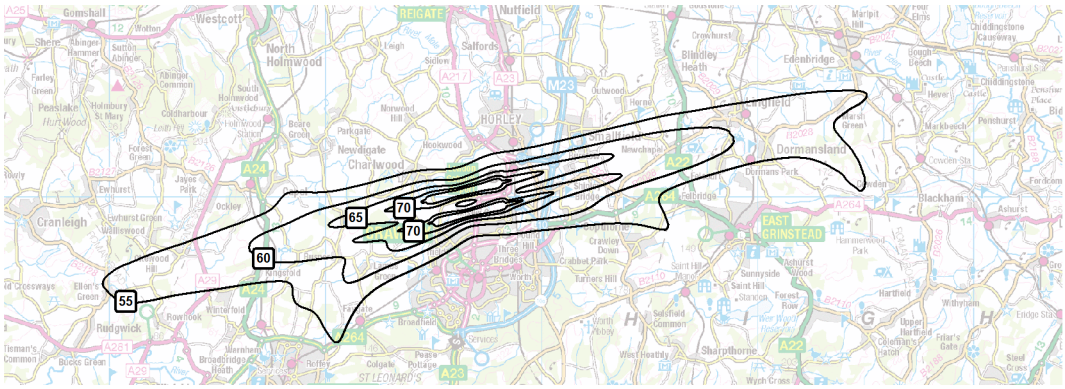


Figure *3.67* : 2050 Gatwick-2R-X-C Gatwick Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 3.46 below.

Table *3.46* : 2050 Do-Minimum Gatwick vs 2050 Gatwick-2R-X-C Gatwick, L_{den}

Contour	Area (km²)	Population	Households
>55	62.8	26,200	10,700
>60	31.0	5,700	2,400
>65	12.6	600	400
>70	3.7	(100)	<50 to <50
>75	1.4	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

All of the 2050 Do-Something L_{den} contours are larger than the equivalent DM contours, as a result of increased ATMs in the Do-Something scenario. The different arrival and departure tracks associated with the two runway scenario also cause the shape of the contours to differ from the DM scenario, with the noise effects of the

second runway and flight paths to/from the south causing the east and west extents of the contours to extend further south.

The resulting differences in population exposure are summarised below:

- >55 dB: An increase of 26,200 (from 9,500 to 35,700)
- >60 dB: An increase of 5,700 (from 1,800 to 7,500)
- >65 dB: An increase of 600 (from 500 to 1,100)
- >70 dB: A reduction of 100 (from 200 to 100)
- >75 dB: No discernible difference (from <50 to <50)

The reduction in the >70 dB contour is because a number of properties close to the airport in the DM scenario would fall within the boundary of the airport in the Do-Something scenario, and are therefore not included in the Do-Something model.

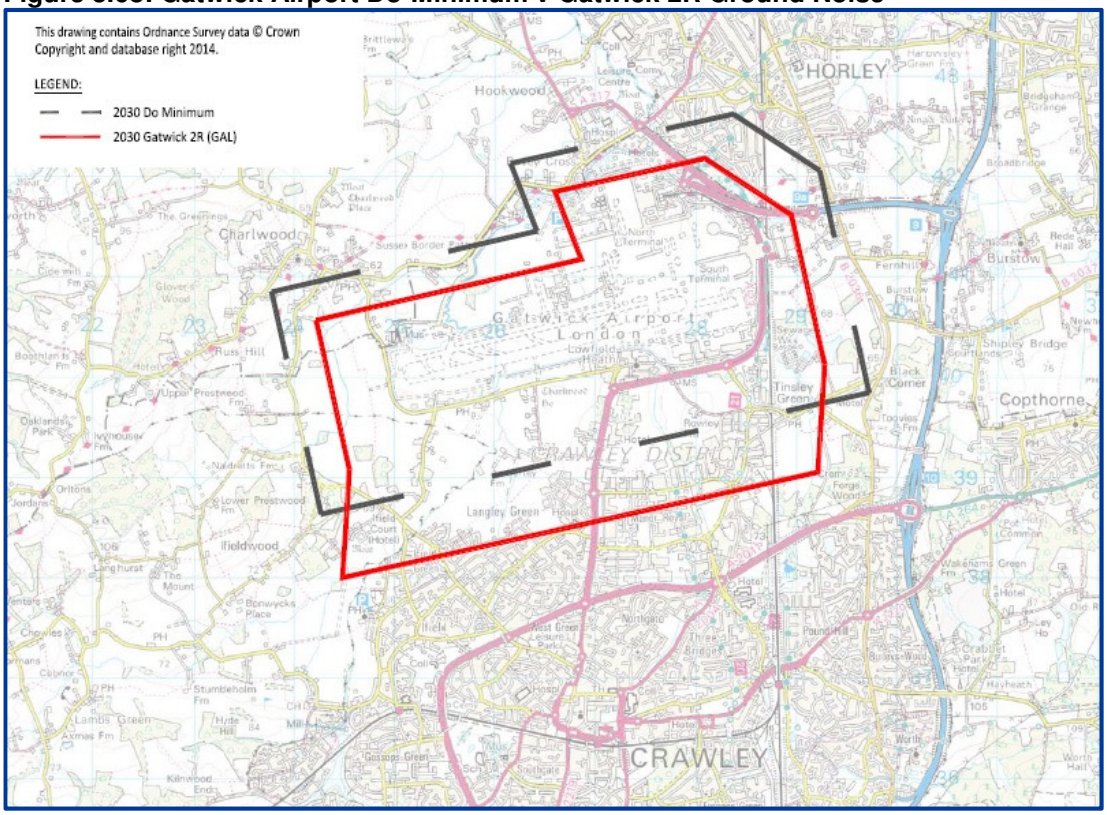
3.10 Ground Noise

The results of the assessment for Gatwick Airport and the Gatwick 2R scheme are given in Table 3.47 and Figure 3.68 below. These show 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 3.47: Ground Noise Exposure at Gatwick Airport

	Current (2013)	2030 DM	2030 Gatwick-2R-X
Exposed Area, km^2 (57 dB $L_{Aeq,16h}$)	11.0	14.9	14.1
Population within Exposed Area[(1)]	900	3,150	1,000

Figure 3.68: Gatwick Airport Do-Minimum v Gatwick 2R Ground Noise



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.

With the Gatwick 2R scheme the forecast amount of ground noise is less than the DM 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 DM case.

3.11 Monetisation

3.11.1 Introduction

This section will cover the monetisation results for annoyance, sleep disturbance, Health-AMI and Health-Hypertension for Gatwick 2R scheme.

Costs are stated in £millions/assessment-year, or when considering totals, £billions/60-years.

3.11.2 Annoyance

The monetisation results for the Gatwick 2R scheme show that the costs associated with annoyance are predicted to range from £2.20 for the 60 year low cost estimates, to £4.50 for the mid and £26.8 for the high cost estimates in the 2030 baseline. These values increase in both the 2040 and 2050 baselines to £4.00, £8.10 and £48.60 respectively in 2050.

The sensitivity analyses shows that an increase in cut–off level from 45dB to 48dB is predicted to result in a decrease in the monetisation values, starting at £1.90, £3.80 and £22.70 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs increase to £2.30, £4.60 and £27.90. There is a further increase in the 2050 low, mid and high scenario at £3.30, £6.60 and £39.60.

3.11.3 Sleep disturbance

For sleep disturbance, the monetisation results range from £2.70 in the low cost 2030 base scenario to £6.90 in the high cost 2030 scenario. All costs are predicted to decrease for the 2040 base scenario, by £1.50 for the mid cost scenario, before increasing slightly for the 2050 scenario but remaining below 2030 levels.

For the sensitivity case, increasing the threshold by 3 dB sees a similar pattern of costs, but starting at £2.10, £3.80 and £5.40 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs decrease to £1.20, £2.00 and £2.90. There is a slight increase in the 2050 low, mid and high scenario at -£1.40, £2.40 and £3.50.

3.11.4 AMI

The monetisation results for AMI are similar for the low, mid and high 2030 and 2040 scenarios, being £1.00 in all cases, and doubling to £2.00 for 2050. There is no change in the sensitivity case.

3.11.5 HT Strokes

The monetisation results for HT strokes for the Gatwick 2R are £0.10 in all cases, i.e. do not noticeably vary with scenario year or sensitivity case.

3.11.6 HT Dementia

Similarly, the results for HT Dementia do not vary from 2030 to 2040 or with sensitivity case, at £0.10. However an increase to £0.20 is shown for the 2050 base and sensitivity cases.

3.11.7 Total

The total monetisation costs for the Gatwick 2R scheme are estimated to be £0.24, £0.40 and £1.5 billion/60 years for the low, mid and high cost scenarios respectively. These costs reduce in all scenarios for the sensitivity case, to £0.19, £0.31 and £1.2 billion/60 years.

In all the assessment year, sleep disturbance and annoyance account for the majority of total costs, with annoyance being the pronounced leader in the high cost scenarios. HT strokes is responsible for the lowest costs in all assessment years, and being equalled by HT dementia for 2030 and 2040.

3.12 Promoter's Submission

This section of the assessment reviews the promoter's submission and summarises their predicted noise impacts of the Scheme.

3.12.1 Information Provided

The promoter's submission for the Gatwick 2R shortlist option is based on results from the ANCON noise model operated by ERCD, using input data specified by the promoter. The modelling is based on the design assumption that with a second runway, Gatwick could serve up to 95mppa in 2050.

The noise models produced by ERCD have been used to calculate the areas of land and populations exposed to the following noise metrics:

- *$L_{Aeq,16h}$ (average summers day) noise contours from 54 dB to 72 dB in 3 dB intervals*
- *L_{night} (average annual night) 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 for greater than 25, 50, 100, 200 and 500 events*
- *N60 (8-hour average night) contours for greater than 25, 50, 100, and 200 events*

The range of metrics provided by the promoter for the modelled scenarios are in accordance with those of the noise appraisal module,

The submission does not include predictions for 2030, which is the base year adopted for this assessment. The promoter's submission contains only 2011 (L_{den}) and 2012 (L_{Aeq}) values and predictions for the 2040 DM, 2040 Do-Something and 2050 Do-Something scenarios. The only year for which both DM and Do-Something predictions exist is 2040; therefore only in 2040 can a comparison with this assessment be made of the likely noise environments with and without the scheme.

3.12.2 Promoter's Noise Metrics

In the absence of the 2030 DM scenario, the 2011 and 2012 base figures provided by the promoter have been used as a substitute for calculating the expected change in noise exposure between the current situation and the 2040 DM scenario. For the $L_{Aeq,16h}$ metric, there is little difference between the 2012 base figures and the 2040 DM values in the promoter's submission (see Appendix B for a full comparison), and therefore the 2012 metrics have been used in place of 2030 metrics.

Table 3.48 Gatwick 2R Scorecard (Promoters Submission)

Metric		2012 Current (1R)	2040 DM (1R)	2040 DS (2R)	2050 DS (2R)	2012 Current vs 2040 DM	2040 DM vs 2040 DS
$L_{Aeq,16h}$ (average summer's day)	>54	-	7,700	32,200	31,400	-	23,700
	>57	3,200	3,100	15,400	14,600	12200	11,500
	>69	0	0	<1000	<1000	<1000	<1000
L_{den}	>55	11,300	9,500	36,900	39,600	25,600	30,100
N70	>50	-	3,000	11,300	10,700	-	7,700
N60	>25	-	5,800	21,300	25,800	-	20,000

Note: Numbers in parentheses represent reductions

(a) Day Metrics

Whilst the information in the promoter's submission is not sufficient to fully populate the scorecard, some observations can be made. Firstly, there is a small reduction in the number of people exposed in each $L_{Aeq,16h}$ band between the 2012 baseline and the 2040 DM case. A similar, but more pronounced reduction in the population exposed for each of the L_{den} contours is also observed. This decrease in noise exposure occurs despite an increase in ATM, and is due to the assumed shift in fleet mix to a higher proportion of quieter aircraft (Imminent and Future types).

Although details of the aircraft substitutions (and corresponding noise reductions) that have been made in the modelling in respect of the Imminent and Future types are provided in the promoter's submission, explicit details of the assumed 2040 and 2050 fleet mix are not given. The promoter assumes that about 85% of aircraft currently operating will be replaced with quieter types by 2040, but it is unclear what proportion of this 85% will be Imminent versus Future types.

The promoter's submission indicates that the proposed second runway at Gatwick would approximately quadruple the population falling within the 54 dB $L_{Aeq,16h}$ contour (from 7,700 to 32,200) , and notes that the majority of those newly effected will be on the northern fringe of Crawley, including Ifield. This estimate includes the

proposed North East Sector development which is expected to account for around 4,700 people or 19% of this increase in overall population exposure.

The submission provides a brief sensitivity test of the effects of end around taxiways, which would require the ends of the runways to be shifted slightly. This test concludes that while this introduces some minor differences in the $L_{Aeq,16h}$ noise contours used for the sensitivity test, the effects are very small (the areas of most contours remain constant when reported to one decimal place) and are considered to be insignificant.

(b) Night Metrics

The promoter has provided night noise data in terms of the L_{night} metric (annual average night) rather than $L_{Aeq,8h}$ (average summer's night) values. Although the range of values reported is compatible with $L_{Aeq,8h}$, the glossary defines L_{night} as the annual average. L_{night} values would be expected to show some similarities in trend to the $L_{Aeq,8h}$ metric, although it is noted that Gatwick does exhibit seasonal variation. Comparing the population exposure estimates for the reported L_{night} metric shows increases in all but the 60 dB contour:

- 45 dB an increase of 38,400 (from 10,900 to 49,300)
- 48 dB an increase of 20,400 (from 5,600 to 26,000)
- 51 dB an increase of 9,500 (from 2,200 to 11,700)
- 54 dB an increase of 4,200 (from 700 to 4,900)
- 57 dB an increase of 700 (from 200 to 900)
- 60 dB an increase of 0 (from 100 to 100)

The promoter's figures do not show any population exposed to noise levels of 63 dB L_{night} or greater.

(c) 24-Hour Metric

The promoters L_{den} population exposure estimates for the 2040 Do-Something scenario shows the following increases over the DM scenario:

- 55 dB an increase of 27,400 (from 9,500 to 36,900)
- 60 dB an increase of 8,600 (from 1,700 to 10,300)
- 65 dB an increase of 1,400 (from 300 to 1,700)
- 70 dB no change (from 100 to 100)
- 75 dB no change (from 0 to 0)

3.13 Commentary on promoter's Submission

The promoter has not provided noise metrics for the 2030 base year adopted by the Commission for this assessment. It has, however, provided DM and Do-Something metrics for 2040 allowing a comparison for this year.

For the 2040 DM scenario, the population exposures and contour areas calculated by and the Airports Commission are generally similar, with the promoter usually providing a slightly higher estimate (see Appendix B for comparisons). A proportion of the difference may be due to the Crawley North East Sector development identified by GAL, which is not specifically included in the CACI population forecast used by ERCD.

In the N60 metric, there is much greater difference observed in the contours, and the ECRD outputs for the promoter produce lesser population exposures than that conducted for the Airports Commission. This difference in population exposure is reflected in the size of the contours for this metric, which are smaller than those presented for the Airports Commission assessment.

The passenger numbers and ATM associated with the promoter's 2040 DM scenario are not stated, but as the $L_{Aeq,16h}$ metrics are similar to those calculated by ERCD, it is unlikely that the difference in N60 metrics is due to these factors. Therefore, the most likely reason for the distinction is a base assumption made on fleet mix by that date, with greater penetration of quieter aircraft types.

For the two runway scenario in 2040, the modelling undertaken for the promoter predicts significantly greater contour areas and population exposure than the Airports Commission assessment, across the board. The primary reason for this is because the promoter is presuming significantly higher passenger numbers and ATMs in their estimates for the 2040 Do-Something scenario, than the AoN forecast generated for the Airports Commission; for 2040 DS the promoter's contours are based on 95mppa while ERCD's are based on 56mppa. In addition GAL outputs presume a 3 degree glide slope compared to a 3.2 degree glide slope assumed within the ERCD modelling for the Airports Commission.

It should also be noted that, other than the inclusion of the North East Sector development, the population data used by the promoter is static (2013) between scenarios, while the Airports Commission analysis is based on projected population data from CACI Ltd. for each assessment year.

3.14 Mitigation

The promoter indicates that it has developed the 'Fly Quiet and Clean' framework which consists of nine components including Continuous Decent Approach, Precision Area Navigation (P-RNAV), aircraft technology improvements and the Noise Action Plan (itself covering a wide range of locally and nationally agreed procedures for noise management).

Specific mitigation measures undertaken and proposed by the promoter for the two runway scenario include:

- Planning applications for noise sensitive development submitted to neighbouring planning authorities should account for the second runway's noise contours.
- Continuation of the Continuous Decent Approach and AIP[5] joining height limits, with both the runway and airspace designed to facilitate these measures.
- The development of new noise preferential routes (NPRs), taking advantage of P-RNAV capabilities. It may be possible to operate a preference for night-time departures from the existing runway, further from the northern fringe of Crawley.
- Further extension of the noise insulation scheme includes the commitment that all houses within the two runway 57 dB $L_{Aeq,16h}$ contour would receive the annual compensation equivalent to Band A Council Tax (currently £1,000).
- Increased stakeholder engagement on issues such as the design of preferential noise routes.

[5] Aeronautical Information Publication

Additional mitigation measures which could be investigated for the Gatwick 2R (or other multiple runway development) scheme include incentives to promote quieter future fleet mixes, and runway alternation schedules that provide respite periods when conditions allow.

3.15 Conclusions

The noise models developed by ERCD for the promoter and the Airports Commission for the 2040 DM agree to within 1,000 people in all bands of the $L_{Aeq,16h}$ metric.

Both promoter and Airports Commission models predict moderate increases in the number affected by noise (both for the daytime and the night-time) for the 2040 Do-Something scenario when compared with the DM option for this year. For the promoter's submission an increase of 23,400 people exposed to 54 dB $L_{Aeq,16h}$ is predicted, while for the Airports Commission modelling an increase of 12,000 is predicted for the same metric. The promoter's metric shows a greater increase, considered to be a consequence of more ambitious growth forecasts, although other factors around fleet mix, approach angles and population growth will play a part.

In general, the assumptions used for the promoter's noise modelling are considered to be conservative (that is the predictions for noise exposure are more likely to be over estimates rather than under estimates). There may also be the opportunity to implement further noise mitigation measures which could potentially reduce the predicted noise exposures, such as noise preferential operation at night and incentives to attract a quieter fleet mix. These measures are not currently incorporated in the modelling undertaken.

4 Heathrow Airport Northwest Runway

This chapter focuses on the Heathrow Northwest Runway proposal and:

- *Summarises the key elements of the scheme, focusing on aspects which are relevant to noise*
- *Summarises the current baseline situation, and describes how it will change over time, in the absence of the scheme*
- *Describes the impacts of the scheme, based on noise modelling undertaken by ECRD using the ANCON model for the Airports Commission*
- *Considers the effects of ground noise*
- *Summarises the monetisation of annoyance and health effects from noise*
- *Reviews the promoter's submissions in respect of noise*
- *Describes the potential for noise mitigation*
- *Reaches conclusions on the likely noise impacts of the scheme*

4.1 Scheme description

The Heathrow Airport Northwest Runway (Heathrow NWR) scheme is based around:

- A 3,500m runway situated to the north-west of the existing Airport, approximately parallel to the M4 and extending over the existing alignment of the M25 which would be re-routed under the runway in a tunnel.
- Two new terminal buildings;
- Aircraft movement areas and taxiways;
- Various aircraft stands (pier serviced stands and remote stands);
- Car parking; and
- Ancillary uses.

Three variations were considered for the Heathrow NWR scheme:

- Minimise total affected people (Heathrow-NWR-T)
- Minimise newly affected people (Heathrow-NWR-N)
- Provision of Respite (Heathrow-NWR-R)

Sensitivity testing was also carried out for the 'minimise total affected people' (T) option with carbon trading (Heathrow-NWR-T-C), for approaches on a 3.5 degree glide-slope (Heathrow-NWR-T-35), and with the scheme promoter's fleet mix.

4.2 Baseline

The current baseline (2013) and future (2030, 2040 and 2050) DM noise levels that are calculated for Heathrow Airport are set out in Noise Baseline Report.

The noise study area for the Heathrow NWR scheme 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

4.3 Routes

Three operational modes are proposed for the Heathrow NWR scheme, each with associated routes:

- Minimise Total
- Minimise New
- Respite

Those parts of the proposed routes for the Heathrow NWR scheme that fall within the study area are shown in Figure 4.2 to Figure 4.4 below. These routes have been developed for noise modelling purposes and should not be considered as the final routes of an expanded option.

Figure 4.2 : Heathrow-NWR-T (Minimise Total) Routes

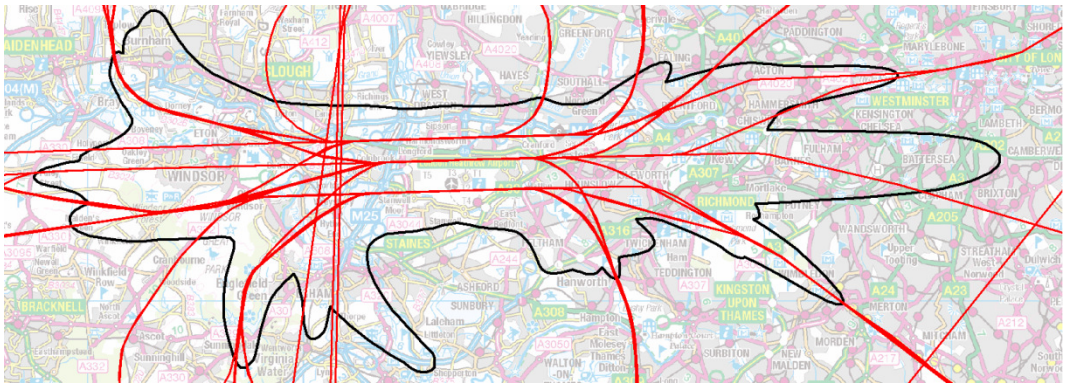


Figure 4.3 : Heathrow-NWR-N (Minimise New) Routes

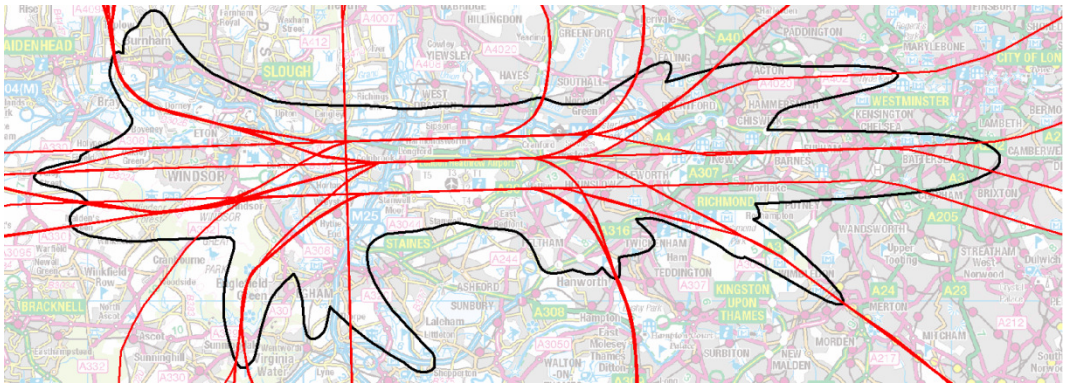
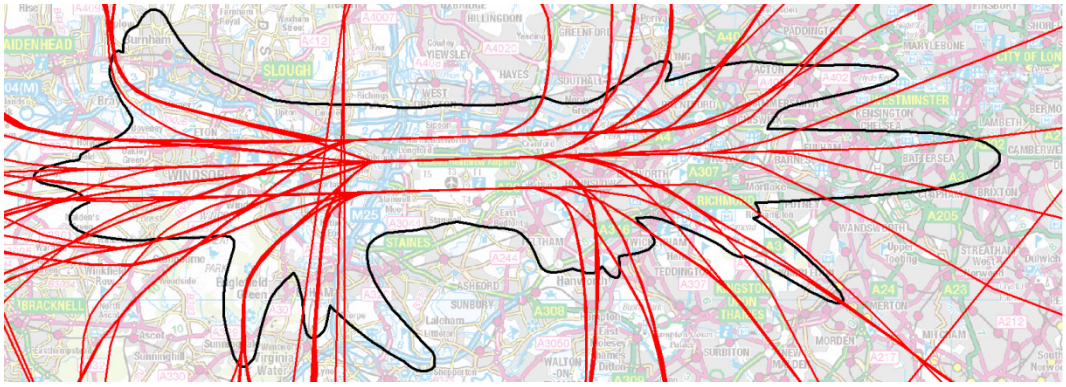


Figure 4.4 : Heathrow-NWR-R (Respite) Routes



4.4 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.

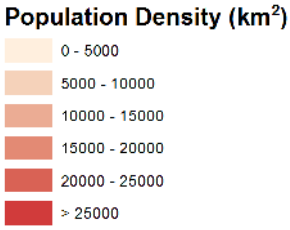
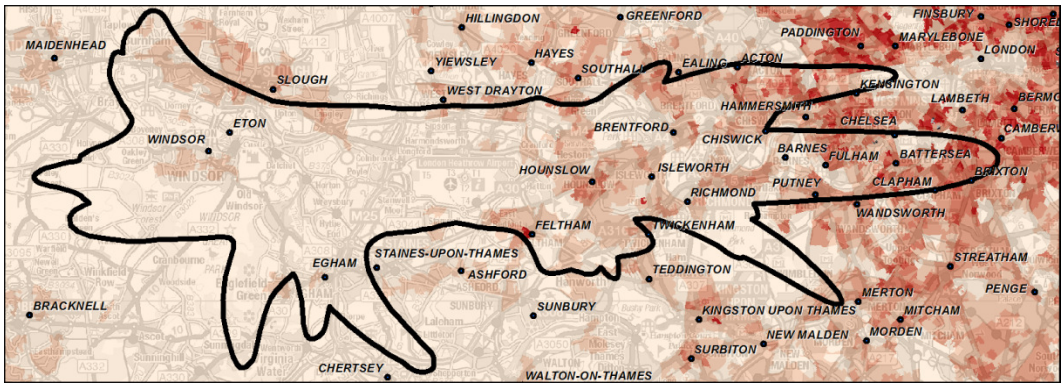


Figure 4.5 : Heathrow North West Study Area Forecast Population Densities (2030)



It can be seen from Figure 4.5 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 4.6 below shows the difference 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 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.

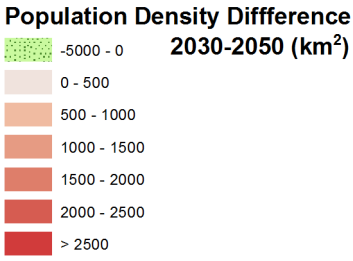
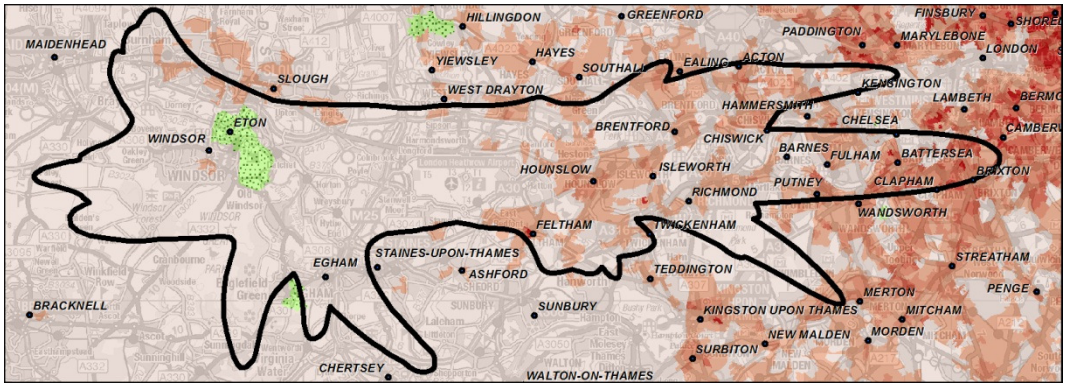


Figure 4.6 : 2030 vs 2050 Difference in Population Densities Around Heathrow Airport



4.5 Baseline Noise Levels

The current and future DM noise levels due to Heathrow Airport are presented in Table 4.1 to Table 4.4 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 and 2013)

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on number above contour)	
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 $L_{Aeq,16h}$	14,000			N70 >500	<50
	>69 dB $L_{Aeq,16h}$	2,700				
	>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 $L_{Aeq,8h}$	1,200				
	>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		

Note: L_{den} results relate to 2011.

Table 4.2 : 2030 Do-Minimum Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on number above contour)	
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		

Table 4.3 : 2040 Do-Minimum Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on number above contour)	
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		
			>60 dB L_{den}			
			>65 dB L_{den}			
			>70 dB L_{den}			
			>75 dB L_{den}			

Table 4.4 : 2050 Do-Minimum Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on number above contour)	
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	0
	>57 dB $L_{Aeq,8h}$	33,900			N60 >200	0
	>60 dB $L_{Aeq,8h}$	7,100			N60 >500	0
	>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		
			>60 dB L_{den}	182,100		
			>65 dB L_{den}	36,400		
			>70 dB L_{den}	3,100		
			>75 dB L_{den}	<50		

Table 4.5 below summarises the predicted difference in noise levels over the periods of interest for the noise assessment.

Table *4.5* : Predicted difference in Do-Minimum noise levels for Heathrow Airport

Metric		Current vs 2030 DM	2030 DM vs 2040 DM	2030 DM vs 2050 DM	Current vs 2050 DM
$L_{Aeq,16h}$ (day)	>54	(139,000)	(33,000)	(24,800)	(196,800)
	>57	(44,900)	(1,800)	200	(46,500)
$L_{Aeq,8h}$ (night)	>48	(150,100)	65,800	36,100	(48,200)
L_{den} (24-hour)	>55	(185,600)	8,400	(5,400)	(182,600)
N70 (day)	>20	(76,300)	(13,500)	(4,200)	(94,000)
N60 (night)	>25	(195,800)	107,800	62,400	(25,600)

Note: Numbers in parentheses represent reductions

It can be seen from Table 4.5 above that a significant decrease in population noise exposure is predicted between the current 2013 situation and the 2030 DM scenario. This reduction is due to improvements in aircraft technology, and uptake over this period of those aircraft by airlines operating at the airport, leading to a quieter fleet mix with a greater proportion of 'imminent' type aircraft such as the Boeing 787 Dreamliner and the Airbus 350 models.

Further reductions in noise are expected between the 2030 DM and 2040 DM scenarios, also as a result of the quieter fleet mix. When comparing the 2040 and 2050 DM scenarios, there is a reduction of 24,800 people exposed to daytime noise levels of 54 dB $L_{Aeq,16h}$ or greater, and a reduction of 4,200 people included in the daytime N70 >20 contour, but all other noise metrics either show no difference or slight increases. As ATMs reduce between 2040 and 2050 in the Do-Minimum scenario, this effect is likely to be linked to population growth within contours, possibly combined with the impacts of specific aircraft types in the fleet mix.

4.6 Scorecards for 'Minimise Total' Option (Heathrow-NWR-T)

Noise metrics have been produced for the Heathrow-NWR-T scenarios at Heathrow Airport for 2030, 2040 and 2050, and are presented below.

Table 4.6 : 2030 Heathrow-NWR-T Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on number above contour)	
Day	>54 dB $L_{Aeq,16h}$	456,200			N70 >20	277,600
	>57 dB $L_{Aeq,16h}$	237,100			N70 >50	196,000
	>60 dB $L_{Aeq,16h}$	128,200			N70 >100	139,700
	>63 dB $L_{Aeq,16h}$	38,300			N70 >200	64,600
	>66 dB $L_{Aeq,16h}$	12,000			N70 >500	200
	>69 dB $L_{Aeq,16h}$	900				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	266,800			N60 >25	128,600
	>51 dB $L_{Aeq,8h}$	167,200			N60 >50	2,600
	>54 dB $L_{Aeq,8h}$	72,200			N60 >100	0
	>57 dB $L_{Aeq,8h}$	11,600			N60 >200	0
	>60 dB $L_{Aeq,8h}$	900			N60 >500	0
	>63 dB $L_{Aeq,8h}$	200				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	556,200		
			>60 dB L_{den}	185,200		
			>65 dB L_{den}	35,500		
			>70 dB L_{den}	900		
			>75 dB L_{den}	<50		

Table 4.7 : 2040 Heathrow-NWR-T Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on number above contour)	
Day	>54 dB $L_{Aeq,16h}$	488,600			N70 >20	278,900
	>57 dB $L_{Aeq,16h}$	249,900			N70 >50	203,800
	>60 dB $L_{Aeq,16h}$	137,000			N70 >100	147,400
	>63 dB $L_{Aeq,16h}$	41,300			N70 >200	76,700
	>66 dB $L_{Aeq,16h}$	11,800			N70 >500	1,100
	>69 dB $L_{Aeq,16h}$	900				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	308,500			N60 >25	197,200
	>51 dB $L_{Aeq,8h}$	188,800			N60 >50	5,400
	>54 dB $L_{Aeq,8h}$	95,700			N60 >100	0
	>57 dB $L_{Aeq,8h}$	18,100			N60 >200	0
	>60 dB $L_{Aeq,8h}$	2,400			N60 >500	0
	>63 dB $L_{Aeq,8h}$	200				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	618,100		
			>60 dB L_{den}	200,400		
			>65 dB L_{den}	41,500		
			>70 dB L_{den}	1,000		
			>75 dB L_{den}	<50		

Table 4.8 : 2050 Heathrow-NWR-T Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on number above contour)	
Day	>54 dB $L_{Aeq,16h}$	491,900			N70 >20	275,800
	>57 dB $L_{Aeq,16h}$	249,300			N70 >50	209,400
	>60 dB $L_{Aeq,16h}$	140,600			N70 >100	155,000
	>63 dB $L_{Aeq,16h}$	42,900			N70 >200	97,600
	>66 dB $L_{Aeq,16h}$	10,900			N70 >500	1,700
	>69 dB $L_{Aeq,16h}$	800				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	295,800			N60 >25	147,300
	>51 dB $L_{Aeq,8h}$	185,600			N60 >50	3,200
	>54 dB $L_{Aeq,8h}$	88,600			N60 >100	0
	>57 dB $L_{Aeq,8h}$	12,100			N60 >200	0
	>60 dB $L_{Aeq,8h}$	900			N60 >500	0
	>63 dB $L_{Aeq,8h}$	200				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	637,700		
			>60 dB L_{den}	205,700		
			>65 dB L_{den}	42,600		
			>70 dB L_{den}	1,000		
			>75 dB L_{den}	<50		

4.7 Assessment of 'Minimise Total' Option (Heathrow-NWR-T)

The predicted differences between the equivalent year DM and Heathrow-NWR-T (carbon capped) scenarios for each noise metric are considered in detail below. The Minimise Total option looks to limit the overall number of people affected by noise. The ATMs used in the noise modelling of these two scenarios are set out in Table 4.9 below.

Table 4.9 : Heathrow Airport – 'Minimise Total' Option ATMs

	Air Transport Movements		
	2030	2040	2050
Heathrow DM	483,856	484,517	471,132
Heathrow Heathrow-NWR-T	652,216	740,000	740,000

4.7.1 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 that may result from the development of Heathrow Airport Northwest Runway.

For convenience, extracts from the relevant 2030, 2040 and 2050 DM and Do-Something Assessmnet of Need carbon capped scenario $L_{Aeq,16h}$ contour plots are shown in Figure 4.7 to Figure 4.12, to provide visual context to the comparisons. The full contour plots are included in Appendix B.

The analysis below shows that the provision of a third runway at Heathrow could potentially lead to a reduction in the number of people in the $L_{Aeq,16h}$ 54 dB contour for the 2030 situation from the 2030 DM. However, net increases in population exposure over the DM scenarios are predicted for all metrics in 2040 and 2050.

Figure *4.7* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

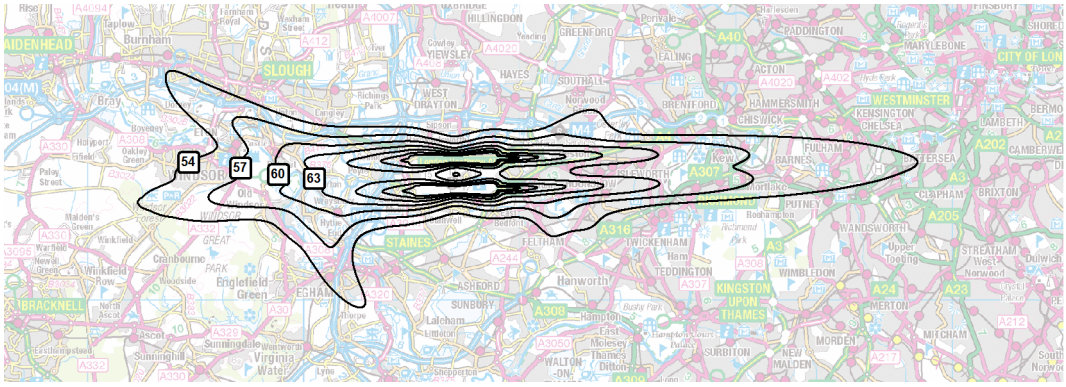
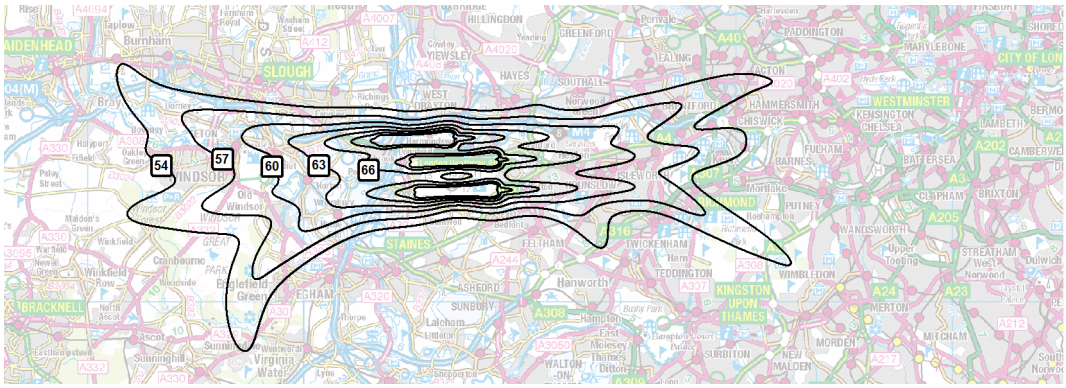


Figure *4.8* : 2030 Heathrow-NWR-T Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.10 below.

Table *4.10* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-Heathrow, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	32.1	(37,400)	(22,800)
>57	24.5	15,900	4,800
>60	18.3	19,200	7,700
>63	10.0	3,100	1,100
>66	5.7	4,100	1,300
>69	2.8	(1,200)	(500)
>72	2.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

It can be seen from Figure 4.7 and Figure 4.8 that the shape of the contours to the east of the Airport differ considerably between the DM and Do-Something scenarios. This is because with the third runway the routes would diverge to a greater extent, leading to three 'prongs' or 'horns' to the east as opposed to the single elongated protrusion that is evident in the DM situation. The effect is most pronounced in the lower noise exposure contours which are furthest from the airport, as the flight corridors are closer together near the airport.

This difference in the shape of the Do-Something noise contours means that a number of populous areas such as Barnes, Fulham, Putney and Battersea which are included in the DM contour are not included in the 54 dB Do-Something contour. Although the 'horns' cover new areas such as Brentford and part of Acton, the number of people covered by the 54 dB contour reduces by 37,400 (from 493,600 to 456,200) despite this contour having a greater area than the corresponding DM contour. However, closer to the airport where the routes converge to a greater extent, increases are predicted for the >57 to >66 dB contours as follows:

- *>57 dB an increase of 15,900 (from 221,200 to 237,100)*
- *>60 dB an increase of 19,200 (from 109,000 to 128,200)*
- *>63 dB an increase of 3,100 (from 35,200 to 38,300)*
- *>66 dB an increase of 4,100 (from 7,900 to 12,000)*

For the 69 dB contour a reduction of 1,200 (from 2,100 to 900) is predicted in comparison to the equivalent DM contour. This is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

There are no discernible difference in the number of people included within the 72 dB contour, as the extents of these contours are very limited in extent in both the DM and Do-Something scenarios.

For the Heathrow Northwest Runway 'Minimise Total' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2030 Do-Something scenario compared to the 2030 DM scenario is 57,700, and the number of people newly removed is 41,600. This results in a net increase in the number of people newly affected of 16,000.

Figure *4.9* : 2040 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

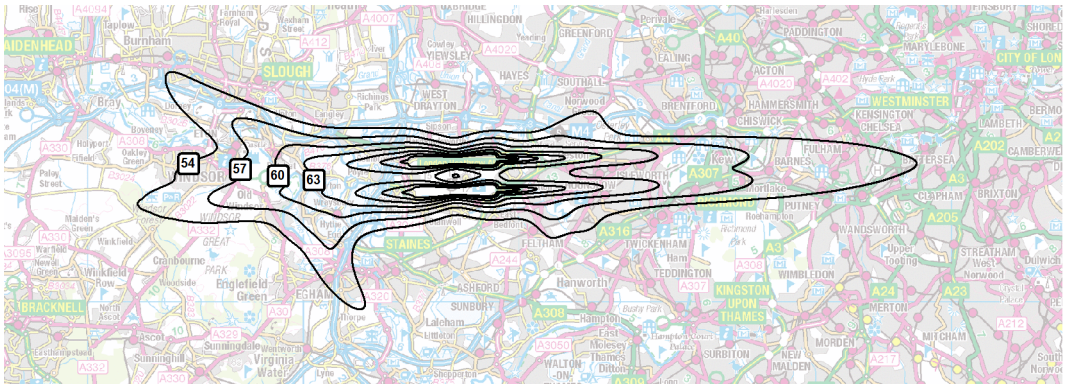
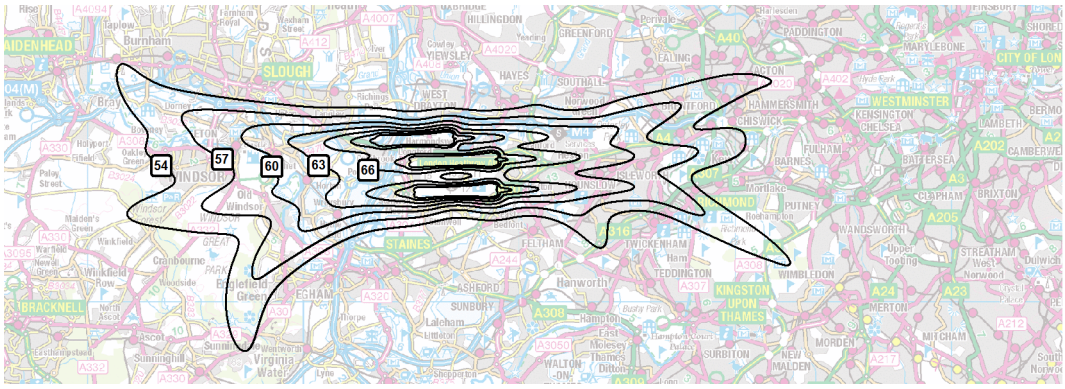


Figure *4.10* : 2040 Heathrow-NWR-T Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.11 below.

Table *4.11* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-Heathrow, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	39.8	28,000	4,400
>57	28.1	30,500	10,500
>60	20.3	33,200	13,200
>63	11.3	7,400	2,600
>66	6.2	4,700	1,700
>69	3.0	(1,200)	(500)
>72	2.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The difference in the shape of the Do-Something contours identified in the 2030 analysis is also evident in the 2040 analysis. However, the 2040 Do-Something contours are larger than the 2030 Do-Something contours as a result in increased ATMs, and they cover populous areas which are outside the 2030 contours. This results in a greater number of people within most of the 2040 Do-Something contours when compared to the equivalent DM contours, due to the increase in ATMs, and population growth in the areas enclosed within the contour. The exceptions are the 69 and 72 dB contours:

- *>54 dB an increase of 28,000 (from 460,600 to 488,600)*
- *>57 dB an increase of 30,500 (from 219,400 to 249,900)*
- *>60 dB an increase of 33,200 (from 103,800 to 137,000)*

- *>63 dB an increase of 7,400 (from 33,900 to 41,300)*
- *>66 dB an increase of 4,700 (from 7,100 to 11,800)*
- *>69 dB an reduction of 1,200 (from 2,100 to 900)*
- *>72 dB no discernible difference (from <50 to <50)*

For the 69 dB contour a reduction of 1,200 (from 2,100 to 900) is predicted in comparison to the equivalent DM contour. This is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

There are no discernible difference in the number of people included within the 72 dB contour, as the extents of these contours are very limited in both the DM and Do-Something scenarios.

For the Heathrow Northwest Runway 'Minimise Total' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2040 Do-Something scenario compared to the 2040 DM scenario is 65,800, and the number of people newly removed is 35,300. This results in a net increase in the number of people newly affected of 30,500.

Figure *4.11* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

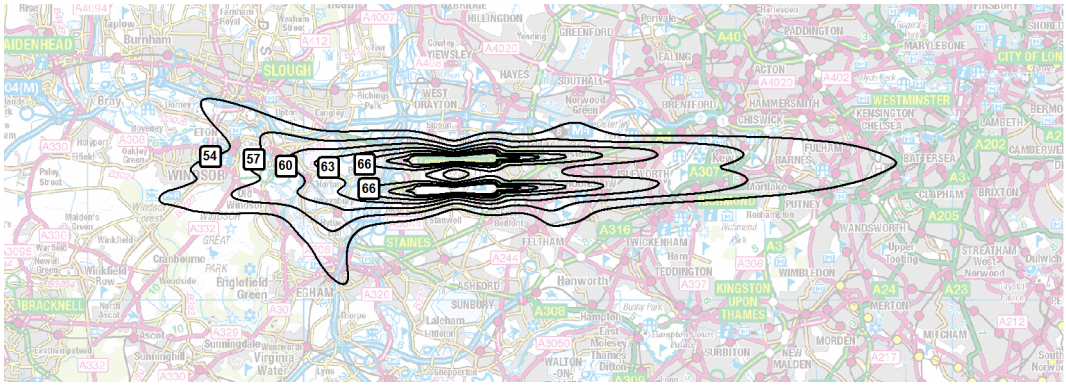
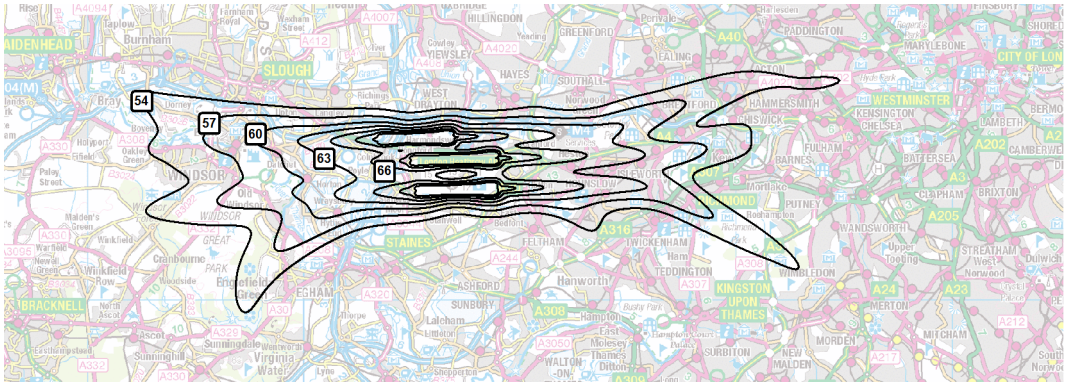


Figure *4.12* : 2050 Heathrow-NWR-T Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.12 below.

Table *4.12* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-Heathrow, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	41.7	56,100	16,500
>57	27.7	29,700	10,000
>60	20.1	36,800	14,600
>63	11.6	8,000	2,900
>66	6.5	3,200	1,100
>69	3.2	(1,300)	(500)
>72	2.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

As with the 2040 comparison, the difference in the shape of the Do-Something contours identified in the 2030 and 2040 analyses is also evident in the 2050 analysis. Like the 2040 comparison, there are increases in the number of people within most of the contours for the Do-Something situation in 2050, with the exceptions being the 69 and 72 dB contours:

- *>54 dB an increase of 56,100 (from 435,800 to 491,900)*
- *>57 dB an increase of 29,700 (from 219,600 to 249,300)*
- *>60 dB an increase of 36,800 (from 103,800 to 140,600)*
- *>63 dB an increase of 8,000 (from 34,900 to 42,900)*
- *>66 dB an increase of 3,200 (from 77,00 to 10,900)*
- *>69 dB an reduction of 1,300 (from 21,00 to 800)*
- *>72 dB no discernible difference (from <50 to <50)*

For the 69 dB contour a reduction of 1,200 (from 2,100 to 900) is predicted in comparison to the equivalent DM contour. This is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

There are no discernible difference in the number of people included within the 72 dB contour, as the extents of these contours are very limited in both the DM and Do-Something scenarios.

For the Heathrow Northwest Runway 'Minimise Total' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2050 Do-Something scenario compared to the 2050 DM scenario is 66,100, and the number of people newly removed is 35,300. This results in a net increase in the number of people newly affected of 30,800.

(b) N70 Supplementary Metric

This section considers predicted changes in terms of the N70 supplementary noise metric, which is a count of the number of people subject to more than 20, 50, 100, 200 or 500 events which exceed 70 dB $L_{AS,Max}$ in an average annual day.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N70 contour plots are shown in

Figure 4.13 to Figure 4.18 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The increases in daytime noise due to the third runway identified for the $L_{Aeq,16h}$ metric are generally reflected in the N70 metric, although the use of noise preferential routes can be seen to minimise the potential impacts.

Figure 4.13 : 2030 Do-Minimum Heathrow Airport N70 Contours

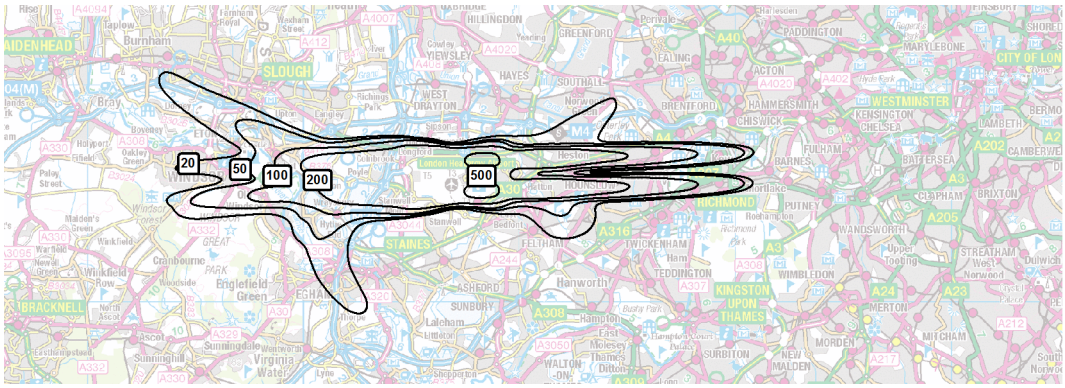
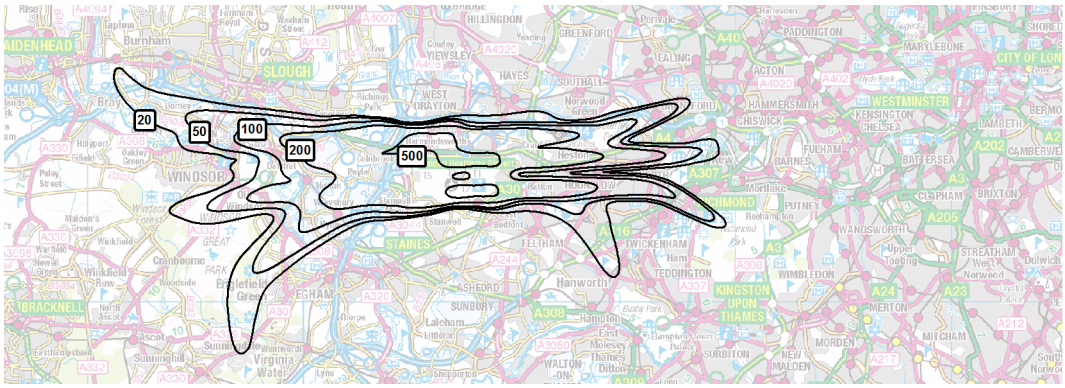


Figure 4.14 : 2030 Heathrow-NWR-T Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour are summarised in Table 4.13 below.

Table *4.13* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-Heathrow, N70

Contour	Area (km²)	Population	Households
>20	22.1	(14,200)	(6,200)
>50	20.6	11,900	3,400
>100	16.2	17,100	6,900
>200	9.7	1,300	500
>500	3.5	<50 to 200	<50 to 100

Note: Numbers in parentheses represent reductions

In all cases the areas enclosed by the Do-Something contours are greater than for the equivalent DM contours. However, whilst the >20 Do-Something contour is larger than the DM contour, the spurs of the Do-Something contour follows the 'minimise total' routes which diverge more widely, due to three runway spacing and design to avoid most populous areas. As a result, the Do-Something contour does not cover as much of Chiswick, Egham, Feltham, Richmond, Slough, Staines-upon-

Thames or Windsor as the DM contour, and encompasses 14,200 fewer people than the DM contour.

Closer to the airport, the Do-Something and DM routes converge to a greater extent, and the noise preferential routing has less effect. As the >50 to >500 Do-Something contours are all larger than the equivalent DM contours, this results in greater populations falling within the Do-Something contours.

For the comparison of the 2030 Do-Something with the 2030 DM situations, the following differences are predicted:

- *>20: A reduction of 14,200 (from 291,800 to 277,600)*
- *>50: An increase of 11,900 (from 184,100 to 196,000)*
- *>100: An increase of 17,100 (from 122,600 to 139,700)*
- *>200: An increase of 1,300 (from 63,300 to 64,600)*
- *>500: An increase from <50 to 200.*

Figure 4.15 : 2040 Do-Minimum Heathrow Airport N70 Contours

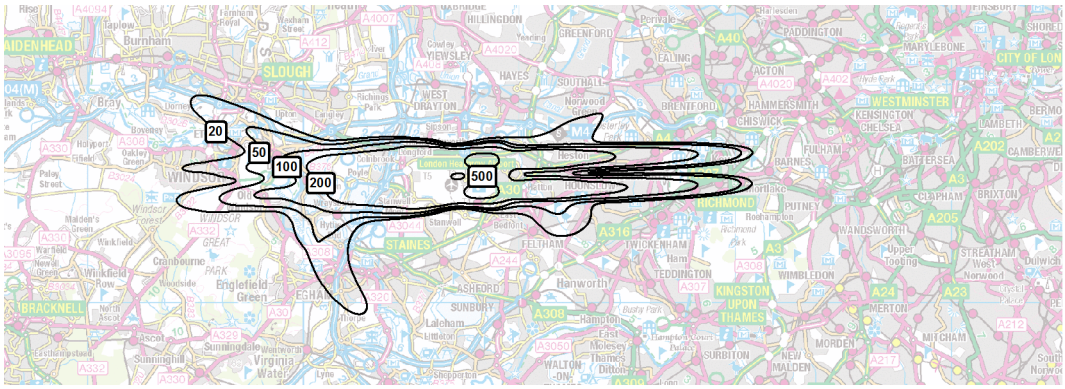
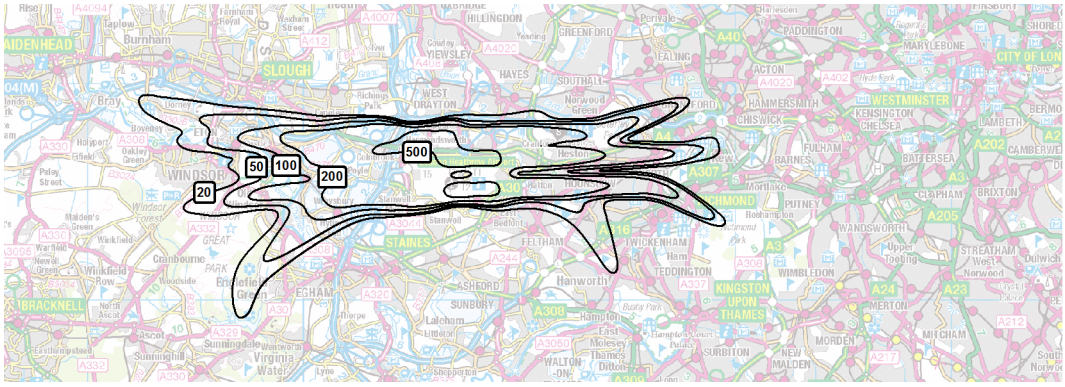


Figure 4.16 : 2040 Heathrow-NWR-T Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.14 below.

Table *4.14* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-Heathrow, N70

Contour	Area (km²)	Population	Households
>20	21.0	600	(600)
>50	21.1	15,900	5,100
>100	16.5	22,700	9,200
>200	12.3	14,500	5,500

>500	4.8	<50 to 1100	<50 to 400

Note: Numbers in parentheses represent reductions

A similar situation is observed between the 2040 Do-Something and DM predictions. Although the >20 Do-Something contour is 21 km^2 greater in area than the DM contour, the number of households affected is reduced and population affected increases by 0.2%. The result of the runway influenced separation and the route design avoiding populous areas is to affect a limited number of people further away from the airport.

However, for the >50 to >500 contours which are closer to the airport, the noise preferential routing has less effect, and the increase in size of these contours as a result of increased ATMs leads to larger increases in the population within each contour compared to the DM situation.

For the comparison of the 2040 Do-Something with the 2040 DM situations, the following changes in population noise exposure are predicted:

- *>20: An increase of 600 (from 278,300 to 278,900)*
- *>50: An increase of 15,900 (from 187,900 to 203,800)*
- *>100: An increase of 22,700 (from 124,700 to 147,400)*
- *>200: An increase of 14,500 (from 62,200 to 76,700)*
- *>500: An increase from <50 to 1,100*

Figure 4.17 : 2050 Do-Minimum Heathrow Airport N70 Contours

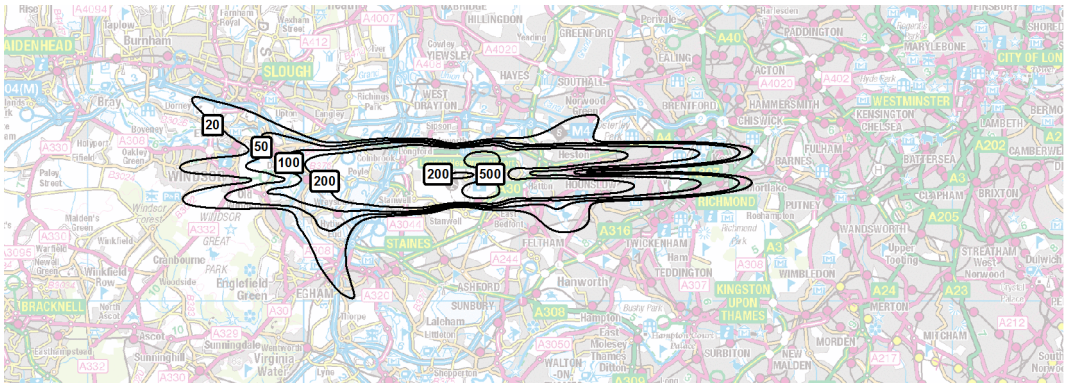
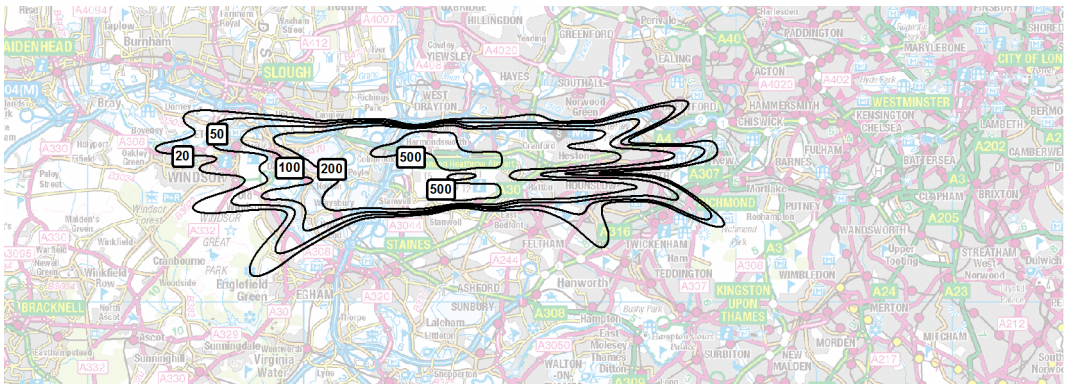


Figure 4.18 : 2050 Heathrow-NWR-T Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.15 below.

Table *4.15* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-Heathrow, N70

Contour	Area (km^2)	Population	Households
>20	16.6	1,700	100
>50	21.2	19,900	6,500
>100	17.9	25,600	10,300
>200	14.2	26,400	10,200
>500	5.2	<50 to 1700	<50 to 600

Note: Numbers in parentheses represent reductions

A similar situation is observed between the 2050 Do-Something and DM predictions as for 2030 and 2040. Although the >20 Do-Something contour is 16.6 km^2 greater in area than the DM contour (an increase of 18.5%), the population included only increases by 0.6% as the result of the runway influenced separation and the route design avoiding populous areas, despite the significant difference in ATMs between the Do-Minimum and So Something scenarios.

However, for the >50 to >500 contours which are closer to the airport, the noise preferential routing has less effect, and the increase in size of these contours as a result of increased ATMs leads to larger increases in the population within each contour compared to the DM situation.

For the comparison of the 2050 Do-Something with the 2050 DM situations, the following changes are predicted:

- *>20: An increase of 1,700 (from 274,100 to 275,800)*
- *>50: An increase of 19,900 (from 189,500 to 209,400)*
- *>100: An increase of 25,600 (from 129,400 to 155,000)*
- *>200: An increase of 26,400 (from 71,200 to 97,600)*
- *>500: An increase from <50 to 1,700*

4.7.2 Night Metrics

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

This section considers predicted changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario $L_{Aeq,16h}$ contour plots are shown in Figure 4.19 to Figure 4.24 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Both the 2030 and 2040 Do-Something scenarios show increases in the Do-Something areas compared to the DM contour areas, but reductions in the people exposed in the >48 dB $L_{Aeq,8h}$ contour due to the effects of Noise Preferential Routing (NPR). When considering louder noise contours, NPR bring fewer benefits and therefore higher population exposures are seen in the Do-Something contours. For the 2050 Do-Something scenario compared to the equivalent DM scenario, there are fewer people included in all contours, with the exception of the >72 dB contour where there is no change

Figure *4.19* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

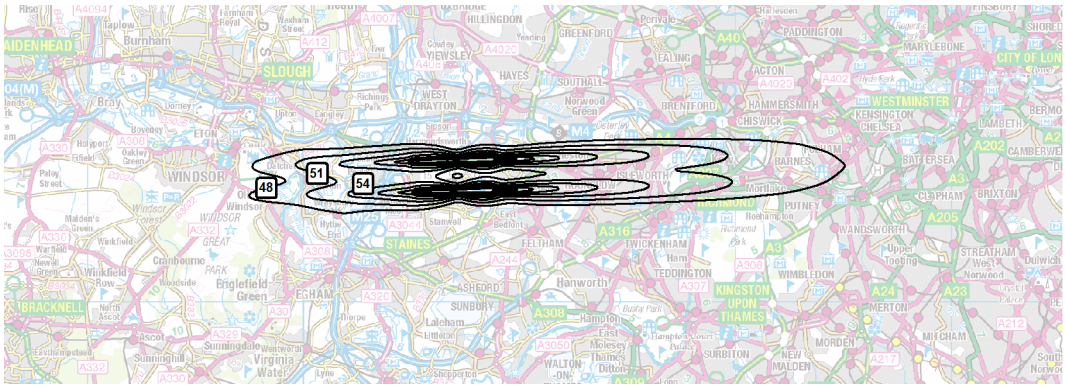
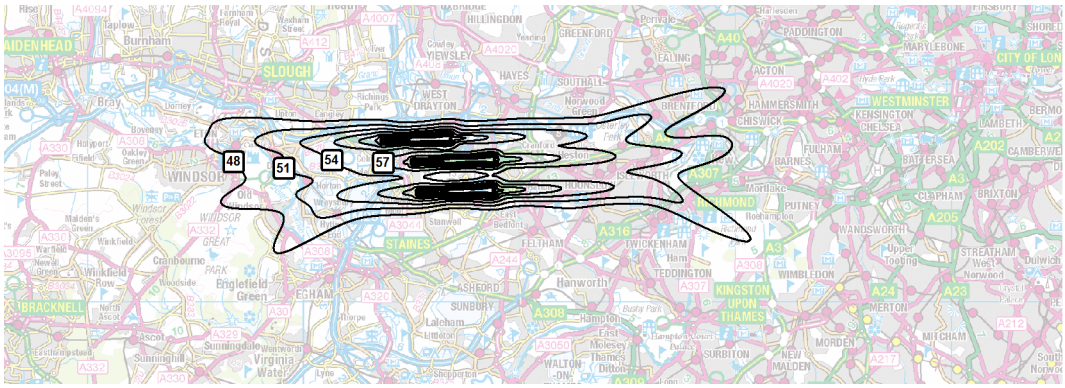


Figure *4.20* : 2030 Heathrow-NWR-T Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.16 below.

Table *4.16* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-Heathrow, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	30.4	(4,400)	(5,800)
>51	21.2	15,900	5,400
>54	16.2	11,100	4,300
>57	6.8	(10,300)	(3,900)
>60	3.4	(3,000)	(1,100)
>63	2.3	(1,100)	(400)
>66	1.6	<50 to <50	<50 to <50
>69	0.9	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

Compared to the DM contours, the Do-Something contours are shorter in the east-west axis, but wider in the north-south axis as a result of the additional runway and routes. In all cases the Do-Something contours cover a greater area than their DM counterparts as a result of increased ATMs, but due to the noise preferential routing, in many cases they encompass smaller populations than the DM contours.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour are as follows:

- *>48 dB a reduction of 4,400 (from 271,200 to 266,800)*
- *>51 dB an increase of 15,900 (from 151,300 to 167,200)*
- *>54 dB an increase of 11,100 (from 61,100 to 72,200)*
- *>57 dB a reduction of 10,300 (from 21,900 to 11,600)*
- *>60 dB a reduction 3,000 (from 3,900 to 900)*
- *>63 dB a reduction of 1,100 (from 1,300 to 200)*
- *>66 – 72 dB no discernible differences (all remain at <50 in both scenarios)*

The increased population in the >51 and >54 dB contours is due to the spread of these contours north of the airport in comparison to the DM contours; this causes populations in Brands Hill, Datchet, Harlington, Harmondsworth, Heston and Sipson to be included.

The reductions in the >57, >60 and >63 dB contours occur because the Do-Something contours do not extend as far east from the existing runways over densely populated areas, and the area covered by these contours around proposed north west runway are less populous.

Figure *4.21* : 2040 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

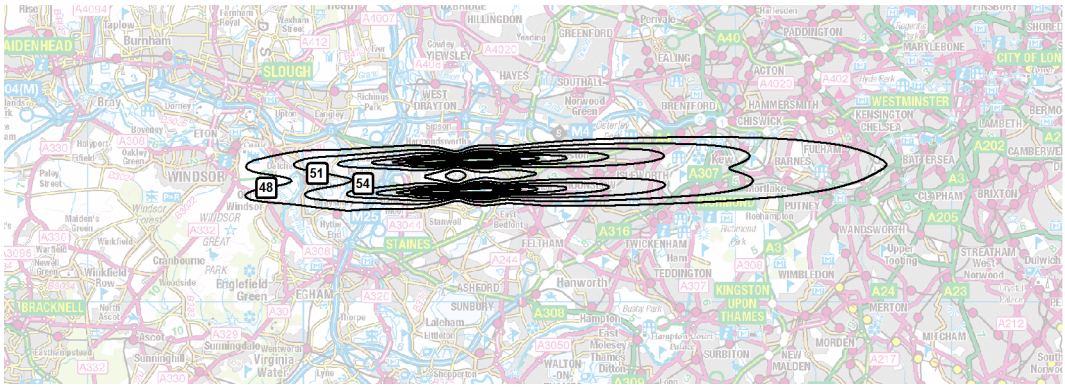
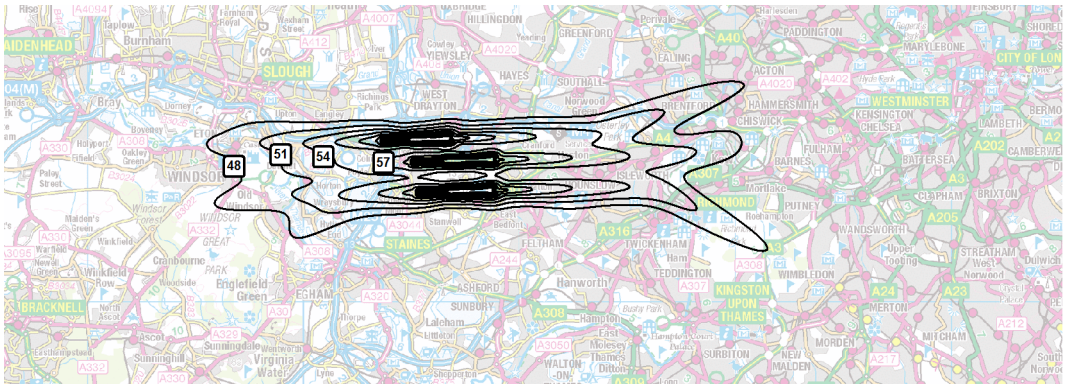


Figure *4.22* : 2040 Heathrow-NWR-T Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.17 below.

Table *4.17* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-Heathrow, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	28.6	(28,500)	(18,400)
>51	21.0	4,200	(100)
>54	16.8	14,400	5,500
>57	7.0	(13,300)	(5,200)
>60	3.4	(4,000)	(1,600)
>63	2.3	(2,200)	(800)
>66	1.6	<50 to <50	<50 to <50
>69	0.9	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

Compared to the DM contours, the Do-Something contours are shorter in the east-west axis, but wider in the north-south axis as a result of the additional runway and routes. In all cases the Do-Something contours cover a greater area than their DM counterparts as a result of increased ATMs, but due to the noise preferential routing, in many cases they encompass smaller populations than the DM contours.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- >48 dB a reduction of 28,500 (from 337,000 to 308,500)
- >51 dB an increase of 4,200 (from 184,600 to 188,800)
- >54 dB an increase of 14,400 (from 813,00 to 95,700)
- >57 dB a reduction of 13,300 (from 31,400 to 18,100)
- >60 dB a reduction of 4,000 (from 6,400 to 2,400)
- >63 dB a reduction of 2,200 (from 2,400 to 200)
- >66 – 72 dB no discernible differences (all remain at <50 in both scenarios)

The reduced population in the 48dB contour is mostly due to the change in shape to the east of the airport, which reduces the area of Barnes, Fulham and Putney included within the contour. The increased population in the >51 and >54 dB contours is due to the spread of these contours north of the airport in comparison to the DM contours; this causes populations in Brands Hill, Datchet, Harlington, Harmondsworth, Heston and Sipson to be included.

Figure *4.23* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

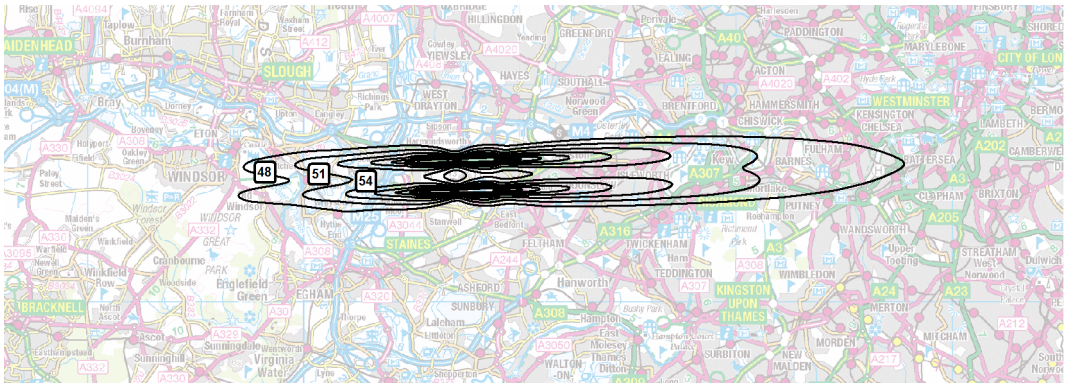
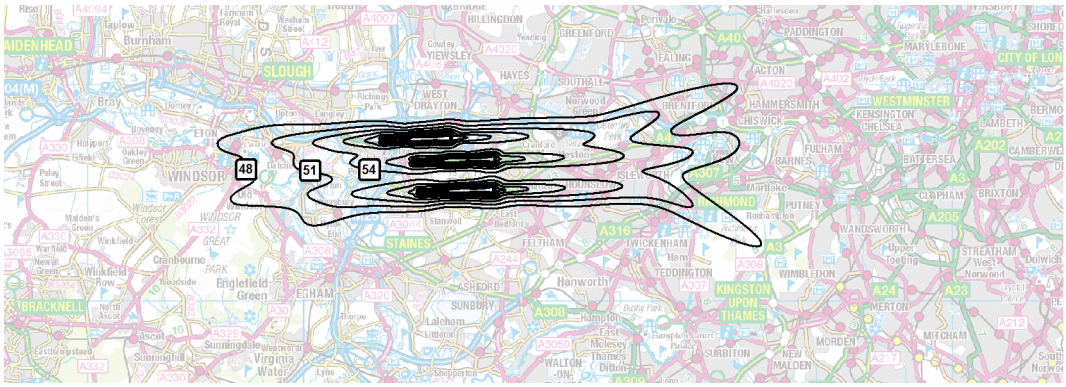


Figure *4.24* : 2050 Heathrow-NWR-T Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.18 below.

Table *4.18* : 2050 DM Heathrow vs 2050 Heathrow-NWR-Heathrow, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	17.8	(77,300)	(37,900)
>51	14.7	(11,800)	(6,600)
>54	11.4	(600)	(400)
>57	4.3	(21,800)	(8,400)
>60	2.4	(6,200)	(2,400)
>63	1.8	(2,400)	(800)
>66	1.3	<50 to <50	<50 to <50
>69	0.6	<50 to <50	<50 to <50
>72	0.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

Compared to the DM contours, the Do-Something contours are shorter in the east-west axis, but wider in the north-south axis as a result of the additional runway and routes. In all cases except >72 dB where there is no change, the Do-Something contours cover a greater area than their DM counterparts as a result of increased ATMs, but due to the wider runway spacing and the noise preferential routing, they include smaller populations than the DM contours.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- >48 dB a reduction of 7,730 (from 373,100 to 295,800)
- >51 dB a reduction of 11,800 (from 197,400 to 185,600)
- >54 dB a reduction of 600 (from 89,200 to 88,600)
- >57 dB a reduction of 21,800 (from 33,900 to 12,100)
- >60 dB a reduction of 6,200 (from 7,100 to 900)
- >63 dB a reduction of 2,400 (from 2,600 to 200)
- >66 – 72 dB no discernible differences (all remain at <50 in both scenarios)

(b) N60 Supplementary Metric

This section considers predicted changes in terms of the N60 supplementary noise metric, which is a count of the number of people subject to more than 25 50, 100 or 200 events which exceed 60 dB $L_{AS,Max}$ in an average annual night.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N60 contour plots are shown in Figure 4.25 to Figure 4.30 below to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The analysis in this section indicates that provision of a third runway at Heathrow Airport to the northwest of the existing airport is forecast to lead to a reduction in the number of people within the N60 >25 contours when compared to the DM option, for all years considered. However, there are some increases in population exposed within the N60 >50 contours when compared to the DM situations for the 2030 and 2040 years.

Figure 4.25 : 2030 Do-Minimum Heathrow Airport N60 Contours

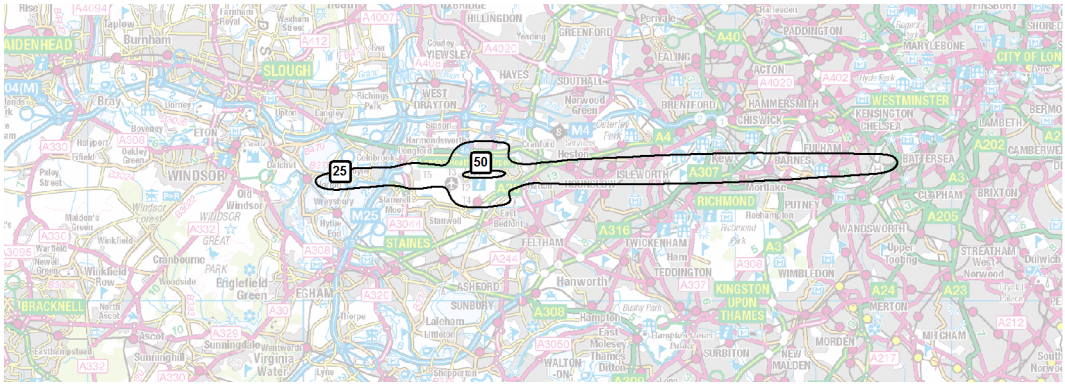
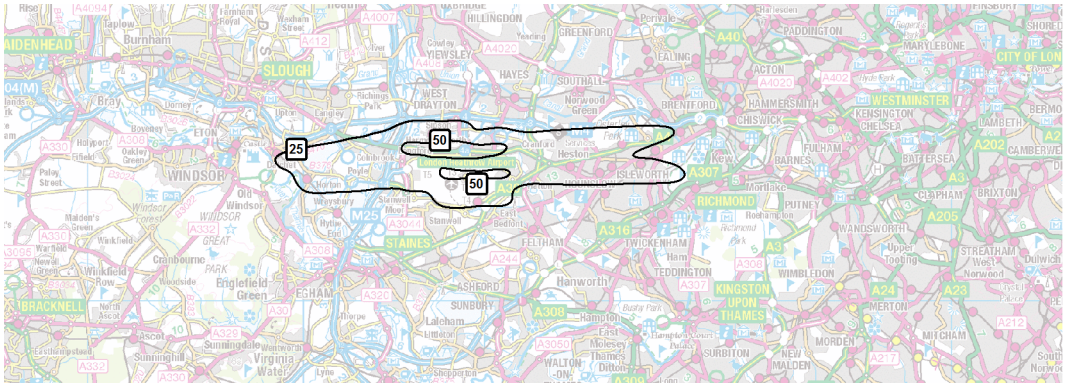


Figure 4.26 : 2030 Heathrow-NWR-T Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.19 below.

Table *4.19* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-Heathrow, N60

Contour	Area (km2)	Population	Households
>25	14.7	(21,900)	(12,800)
>50	3.7	<50 to 2600	<50 to 1000
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The N60 noise contours show the greatest difference in shape between the DM and Do-Something scenarios than any other metric for Heathrow Airport Northwest Runway scheme. As noted when discussing the $L_{Aeq,8h}$ noise results, these reductions are a result of the noise preferential routes to the east that would be associated with the third runway. The Do-Something routes shorten and widen the contour N60 >25 contour, so that it no longer covers areas such as Barnes, Putney, Fulham and Battersea. Overall a reduction of 21,900 people (from 150,500 to 128,600) within the N60 >25 contour is expected, with an increase in the number of people in the N60 >50 contour due to the inclusion of additional properties immediately to the north of the airport.

Figure 4.27 : 2040 Do-Minimum Heathrow Airport N60 Contours

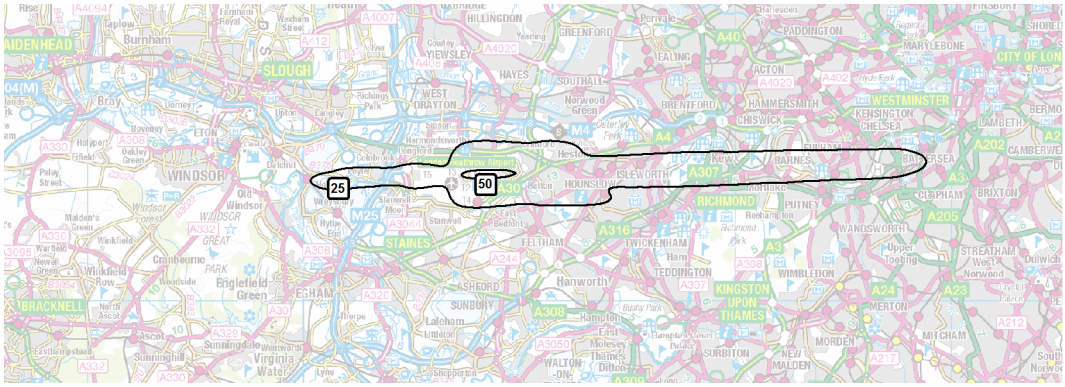
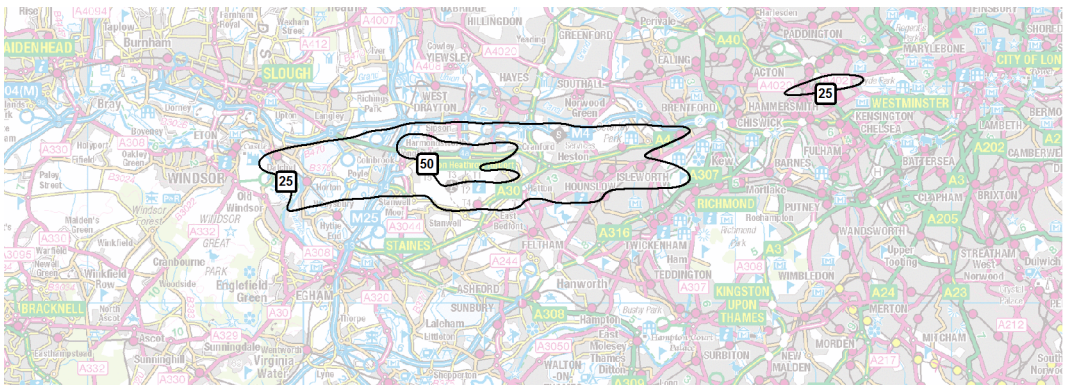


Figure 4.28 : 2040 Heathrow-NWR-T Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.20 below.

Table *4.20* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-Heathrow, N60

Contour	Area (km2)	Population	Households
>25	16.2	(61,100)	(28,200)
>50	7.4	<50 to 5400	<50 to 2000
>100	0 to	0 to	0 to
>200	0 to	0 to	0 to
>500	0 to	0 to	0 to

Note: Numbers in parentheses represent reductions

The trend identified above for the N60 metric in the 2030 comparison continues and strengthens in the 2040 situation, with 61,100 fewer people (from 258,300 to 197,200) within the >25 Do-Something contour than the DM contour. This arises because of the change in shape of the contour, as a result of the noise preferential routes which are over less populous areas. An additional >25 contour is observed over Windsor Castle and Shepherds Bush, as a result of turns in the northwest and centre runway approach routes which may require the use of throttle.

The population within the N60 >50 contour is predicted to increase from <50 to 5,400, due to the inclusion of additional properties immediately to the north of the airport.

Figure 4.29 : 2050 Do-Minimum Heathrow Airport N60 Contours

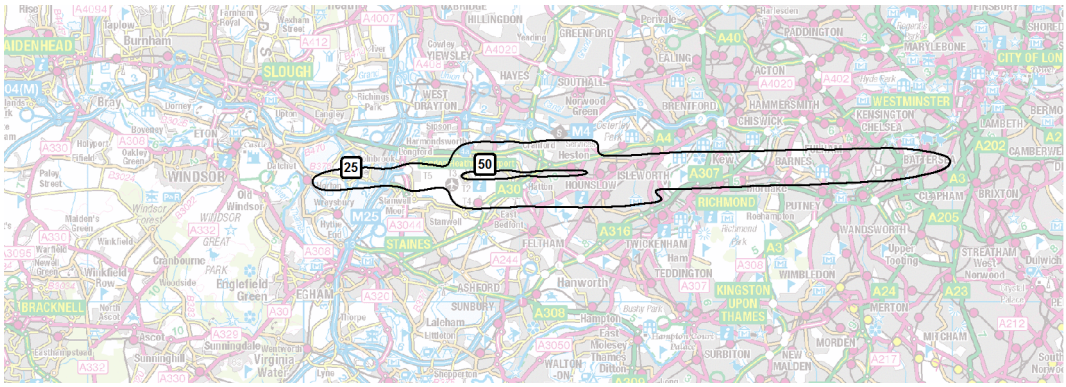
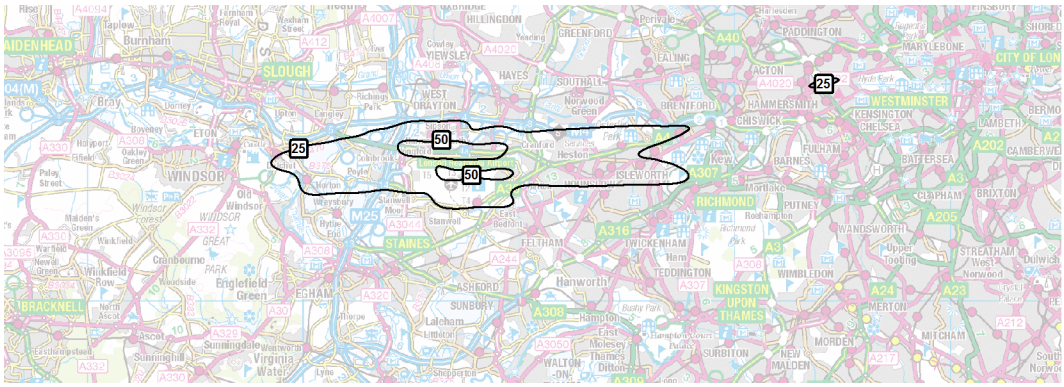


Figure 4.30 : 2050 Heathrow-NWR-T Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.21 below.

Table *4.21* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-Heathrow, N60

Contour	Area (km2)	Population	Households
>25	(1.8)	(173,400)	(75,900)
>50	3.6	(3,300)	(1,400)
>100	0 to	0 to	0 to
>200	0 to	0 to	0 to
>500	0 to	0 to	0 to

Note: Numbers in parentheses represent reductions

The comparison of the DM and Do-Something scenarios for 2050 shows the greatest benefits, with a large reduction of 173,400 people in the N60 >25 contour (from 320,700 to 147,300) as a result of the noise preferential routes, and a reduction of 3,300 (from 6,500 to 3,200) in the N60 >50 contour. The Do-Something N60 contour areas are not as large in the 2050 scenario as in 2030 and 2040 as a result of improvements in aircraft technology over this period.

4.7.3 24-Hour Metric

This section considers predicted changes in terms of the L_{den} day-evening-night noise exposure metric, calculated as an annual average.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario L_{den} contour plots are shown in Figure 3.31 to Figure 3.36 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

In all comparisons, the Do-Something >70 dB contour includes fewer people than the DM contour as it no longer extends over Cranford. At greater distances from the airport, the use of noise preferential routes will reduce the impact of the increased ATMs associated with the Do-Something scenario, and sometimes result in fewer people being included within a given contour compared to the DM scenario.

Figure *4.31* : 2030 Do=Minimum Heathrow Airport L_{den} Contours

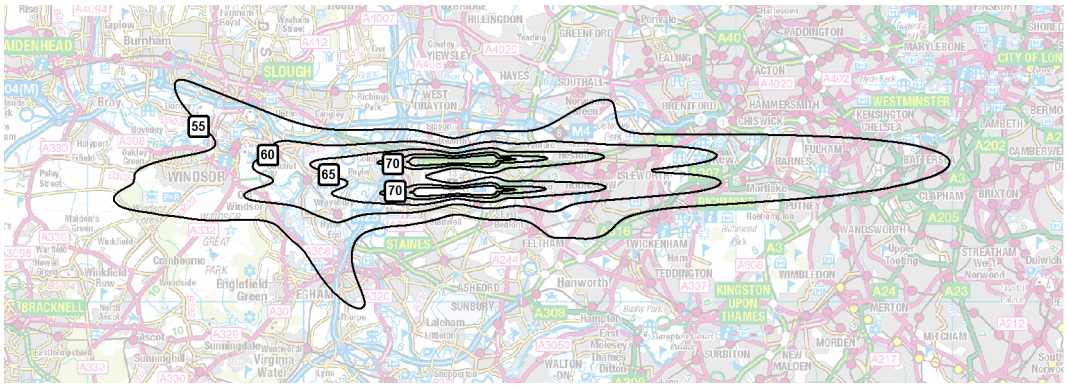
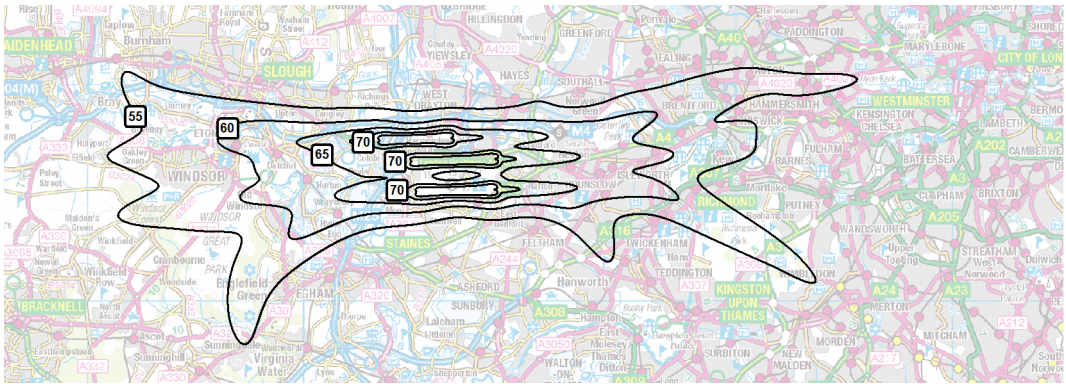


Figure *4.32* : 2030 Heathrow-NWR-T Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.22 below.

Table *4.22* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-Heathrow, L_{den}

Contour	Area (km^2)	Population	Households
>55	36.4	(24,300)	(18,400)
>60	20.4	15,600	5,600
>65	9.2	700	0
>70	3.0	(2,100)	(700)
>75	1.8	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

As a result of the noise preferential routes and the effect of the third runway wider spacing, the Do-Something L_{den} noise contours are shorter in the east-west axis, but wider in the north-south axis, than the equivalent DM contours.

The noise preferential routes have the greatest effect at distance from the airport, and therefore the benefit is seen in the >55 dB contour which includes 24,300 fewer people in the Do-Something scenario than in the DM scenario (largely due to the exclusion of Fulham and parts of Richmond from the Do-Something contour).

Increases are seen in the >60 and >65 dB contours as, in these cases, the effects of the noise preferential routes do not outweigh the competing effect of increased contour areas.

The Do-Something >70 dB contour includes 2,100 fewer people than the DM contour. This is because the contour extending east from the current northern

runway in the DM situation becomes shorter in the Do-Something situation, and will not include Cranford. A new >70 contour is formed around the proposed new runway, but this is not expected to affect as many properties as would be excluded in Cranford, leading to a net reduction in population enclosed within the contour. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- *>55 dB: A reduction of 24,300 (from 580,500 to 556,200)*
- *>60 dB: An increase of 15,600 (from 169,600 to 185,200)*
- *>65 dB: An increase of 700 (from 34,800 to 35,500)*
- *>70 dB: A reduction of 2,100 (from 3,000 to 900)*
- *>75 dB: No discernible difference from <50 to <50*

For the Heathrow Northwest Runway 'Minimise Total' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2030 Do-Something scenario compared to the 2030 DM scenario is 239,500, and the number of people newly removed is 262,800. This results in a net reduction in the number of people newly affected of 23,300.

Figure *4.33* : 2040 Do-Minimum Heathrow Airport L_{den} Contours

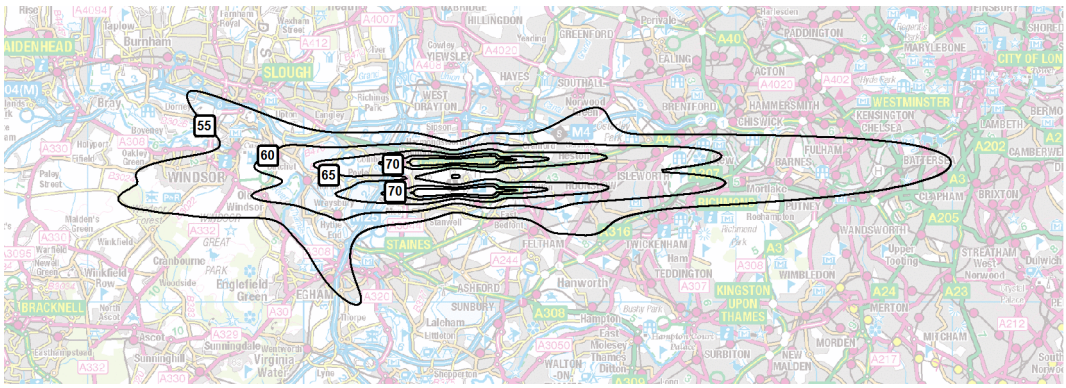
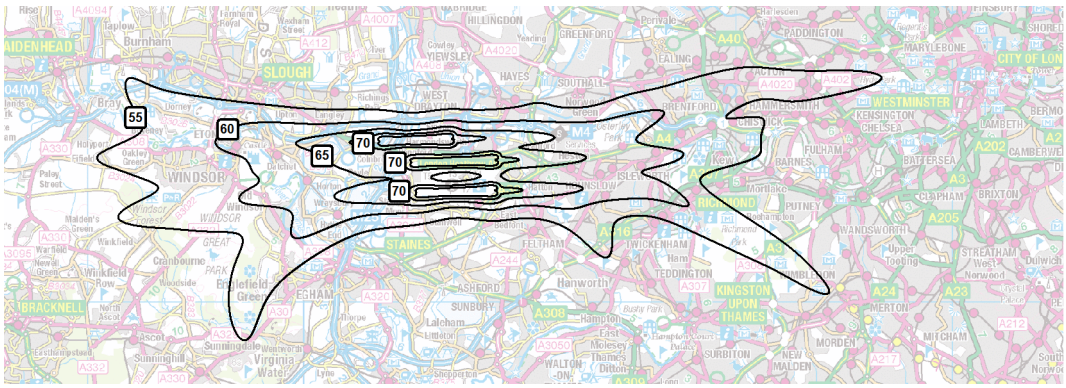


Figure *4.34* : 2040 Heathrow-NWR-T Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.23 below.

Table *4.23* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-Heathrow, L_{den}

Contour	Area (km^2)	Population	Households
>55	48.4	29,200	3,600
>60	24.1	20,900	7,700
>65	11.9	5,300	1,700
>70	3.5	(2,100)	(800)
>75	2.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In the 2040 Do-Something scenario, the areas of the contours are larger than in the 2030 DM scenario, due to the expected growth in ATMs. However, the 2040 DM contours are smaller than the 2030 contours, as the DM ATMs are broadly similar between the two assessment years but improvements in aircraft technology are anticipated which will result in quieter aircraft. Therefore despite the adoption of noise preferential routes, the 2040 comparison shows more people will be included in the >55 to >65 Do-Something contours than the equivalent DM contours.

However, as with the 2030 comparison, the Do-Something >70 dB contour includes 2,100 fewer people than the DM contour. This is because the contour extending east from current runway 27R in the DM situation becomes shorter in the Do-Something situation, and will not include Cranford. A new >70 contour is formed around the proposed new runway, but this is not expected to affect as many properties as would be excluded in Cranford, leading to a net reduction in population enclosed within the contour. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

For the Heathrow Northwest Runway 'Minimise Total' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2040 Do-Something scenario compared to the 2040 DM scenario is 292,400, and the number of people newly removed is 260,800. This results in a net increase in the number of people newly affected of 31,600.

Figure *4.35* : 2050 Do-Minimum Heathrow Airport L_{den} Contours

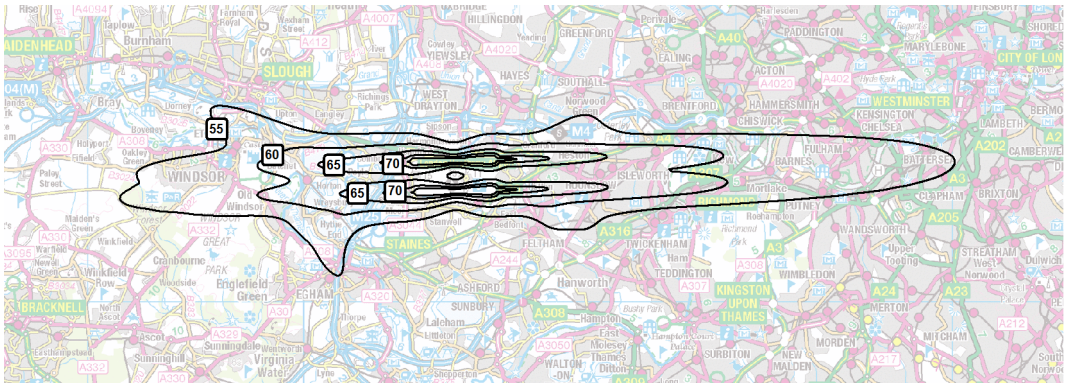
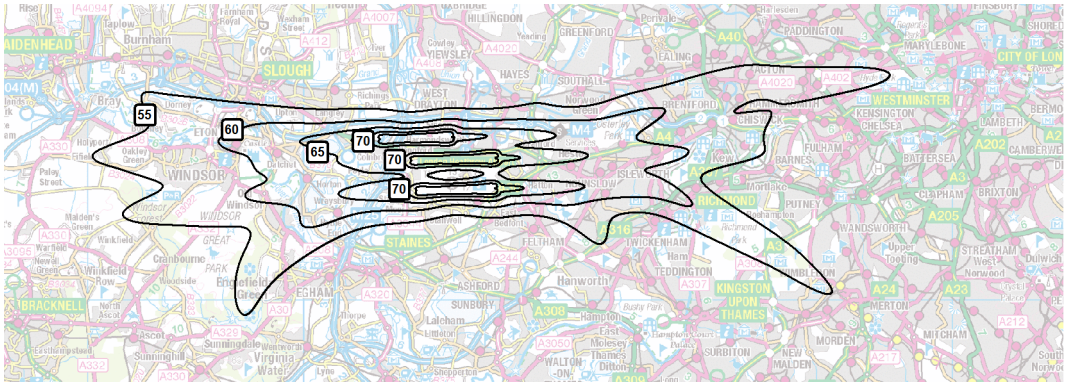


Figure 4.36 : 2050 Heathrow-NWR-T Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.24 below.

Table *4.24* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-Heathrow, L_{den}

Contour	Area (km²)	Population	Households
>55	50.9	54,200	14,400
>60	23.8	23,600	9,100
>65	12.1	6,200	2,100
>70	3.5	(2,100)	(800)
>75	2.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

Comparing the 2050 Do-Something contours with the equivalent DM contours shows that a greater number of people are expected to be affected by night-time noise in the Do-Something scenario.

The core reason for this is that the area of the DM contours is forecast to decrease over time. This occurs because the forecast DM ATMs remain relatively static, but it is expected that quieter aircraft will be brought into service over time. This results in a reduction in area of the DM contours of between 3.8% and 8.9% over the period 2040 to 2050.

There are also reductions predicted in the area of the 2050 Do-Something contours when compared to the 2040 situation as a result of improvements in aircraft technology. However, these reductions are partly limited by competing increases in ATMs, with the net result being that the Do-Something contours reduce by 2.2% to 5.0% in 2050 compared to 2040.

As the reductions in the DM contour areas are greater than the reductions in the Do-Something contour areas, the number of people affected by night-time noise levels in all contours apart from >70 dB are greater in the Do-Something scenario that the DM scenario. The >70 dB contours do not follow this trend because the shape of these contours changes significantly between the DM and Do-Something scenarios, and in the Do-Something situation they do not encroach over Cranford as outlined in the preceding sections of this report. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- *>55 dB: An increase of 54,200 (from 583,500 to 637,700)*
- *>60 dB: An increase of 23,600 (from 182,100 to 205,700)*
- *>65 dB: An increase of 6,200 (from 36,400 to 42,600)*
- *>70 dB: A reduction of 2,100 (from 3,100 to 1,000)*
- *>75 dB: No discernible difference (from <50 to <50)*

For the Heathrow Northwest Runway 'Minimise Total' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2050 Do-Something scenario compared to the 2050 DM scenario is 320,700, and the number of people newly removed is 264,200. This results in a net increase in the number of people newly affected of 56,500.

4.7.4 Sensitive Buildings

The change in number of sensitive buildings within each contour between the 2030 DM and 2030 Heathrow-NWR-T scenarios are set out in Table 4.25 below:

Table 4.25 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-T, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(49)	1	(24)	N70 >20	(2)	(1)	(3)
	>57 dB $L_{Aeq,16h}$	15	0	8	N70 >50	6	(1)	2
	>60 dB $L_{Aeq,16h}$	17	1	11	N70 >100	8	0	0
	>63 dB $L_{Aeq,16h}$	1	0	1	N70 >200	4	0	3
	>66 dB $L_{Aeq,16h}$	2	0	3	N70 >500	0	0	1
	>69 dB $L_{Aeq,16h}$	1	0	3		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(18)	(1)	(7)	N60 >25	(39)	(2)	(24)
	>51 dB $L_{Aeq,8h}$	2	(2)	1	N60 >50	0	0	1
	>54 dB $L_{Aeq,8h}$	6	0	3	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	0	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}	(40)	1	(21)				
	>60 dB L_{den}	12	(1)	6				
	>65 dB L_{den}	1	0	1				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

The change in number of sensitive buildings within each contour between the 2040 DM and 2040 Heathrow-NWR-T-C scenarios are set out in Table 4.26 below:

Table 4.26 : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-T, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	12	1	5	N70 >20	11	(1)	4
	>57 dB $L_{Aeq,16h}$	22	0	12	N70 >50	11	(1)	3
	>60 dB $L_{Aeq,16h}$	22	1	12	N70 >100	16	0	4
	>63 dB $L_{Aeq,16h}$	1	0	2	N70 >200	10	0	3
	>66 dB $L_{Aeq,16h}$	3	0	5	N70 >500	2	0	2
	>69 dB $L_{Aeq,16h}$	1	0	3		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(37)	1	(10)	N60 >25	(56)	0	(23)
	>51 dB $L_{Aeq,8h}$	(6)	0	(7)	N60 >50	0	0	0
	>54 dB $L_{Aeq,8h}$	6	0	(2)	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(3)	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}	14	1	8				
	>60 dB L_{den}	17	(1)	10				
	>65 dB L_{den}	2	0	2				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

The change in number of sensitive buildings within each contour between the 2050 DM and 2050 Heathrow-NWR-T-C scenarios are set out in Table 4.27 below:

Table 4.27 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	24	1	14	N70 >20	12	(1)	7
	>57 dB $L_{Aeq,16h}$	15	0	10	N70 >50	9	0	2
	>60 dB $L_{Aeq,16h}$	23	0	12	N70 >100	13	(1)	3
	>63 dB $L_{Aeq,16h}$	1	0	2	N70 >200	14	0	4
	>66 dB $L_{Aeq,16h}$	4	0	4	N70 >500	2	0	2
	>69 dB $L_{Aeq,16h}$	1	0	2		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(72)	0	(37)	N60 >25	(106)	(1)	(52)
	>51 dB $L_{Aeq,8h}$	(16)	(1)	(12)	N60 >50	(2)	0	0
	>54 dB $L_{Aeq,8h}$	(4)	0	(6)	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(4)	0	0	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	(1)	0	(1)	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}	38	1	17				
	>60 dB L_{den}	15	0	7				
	>65 dB L_{den}	4	0	4				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

4.8 Scorecards for 'Minimise Total Carbon Traded' Option (Heathrow-NWR-T-C)

Noise metrics have been produced for the Heathrow-NWR-T-C scenarios at Heathrow Airport for 2030, 2040 and 2050, and are presented below. The traded carbon option sees an increase in ATMs up until 2039, but then the airport reaches capacity as it does under the carbon capped scenario, so there are few ATM differences.

Table 4.28 : 2030 Heathrow-NWR-T-C Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB $L_{Aeq,16h}$	543,300			N70 >20	286,500
	>57 dB $L_{Aeq,16h}$	261,200			N70 >50	204,100
	>60 dB $L_{Aeq,16h}$	140,300			N70 >100	148,400
	>63 dB $L_{Aeq,16h}$	46,000			N70 >200	79,100
	>66 dB $L_{Aeq,16h}$	13,900			N70 >500	1,600
	>69 dB $L_{Aeq,16h}$	1,300				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	303,200			N60 >25	181,500
	>51 dB $L_{Aeq,8h}$	183,100			N60 >50	5,100
	>54 dB $L_{Aeq,8h}$	93,400			N60 >100	0
	>57 dB $L_{Aeq,8h}$	19,500			N60 >200	0
	>60 dB $L_{Aeq,8h}$	2,600			N60 >500	0
	>63 dB $L_{Aeq,8h}$	200				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	684,600		
			>60 dB L_{den}	205,900		
			>65 dB L_{den}	48,600		
			>70 dB L_{den}	2,100		
			>75 dB L_{den}	<50		

Table 4.29 : 2040 Heathrow-NWR-T-C Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>60 dB $L_{Aeq,16h}$	522,800			N70 >20	288,300
	>63 dB $L_{Aeq,16h}$	259,300			N70 >50	207,800
	>66 dB $L_{Aeq,16h}$	143,100			N70 >100	151,200
	>69 dB $L_{Aeq,16h}$	44,300			N70 >200	84,200
	>72 dB $L_{Aeq,16h}$	12,800			N70 >500	1,300
	>48 dB $L_{Aeq,8h}$	900				
	>51 dB $L_{Aeq,8h}$	<50				
Night	>54 dB $L_{Aeq,8h}$	309,700			N60 >25	179,100
	>57 dB $L_{Aeq,8h}$	189,800			N60 >50	5,300
	>60 dB $L_{Aeq,8h}$	97,300			N60 >100	0
	>63 dB $L_{Aeq,8h}$	20,900			N60 >200	0
	>66 dB $L_{Aeq,8h}$	2,800			N60 >500	0
	>69 dB $L_{Aeq,8h}$	200				
	>72 dB $L_{Aeq,8h}$	<50				
	>54 dB $L_{Aeq,16h}$	<50				
	>57 dB $L_{Aeq,16h}$	<50				
24-hour			>55 dB L_{den}	667,200		
			>60 dB L_{den}	209,600		
			>65 dB L_{den}	47,700		
			>70 dB L_{den}	1,500		
			>75 dB L_{den}	<50		

Table 4.30 : 2050 Heathrow-NWR-T-C Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB $L_{Aeq,16h}$	536,200			N70 >20	291,800
	>57 dB $L_{Aeq,16h}$	263,800			N70 >50	217,200
	>60 dB $L_{Aeq,16h}$	151,200			N70 >100	164,000
	>63 dB $L_{Aeq,16h}$	50,000			N70 >200	107,500
	>66 dB $L_{Aeq,16h}$	12,900			N70 >500	2,100
	>69 dB $L_{Aeq,16h}$	900				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	340,400			N60 >25	233,700
	>51 dB $L_{Aeq,8h}$	204,600			N60 >50	5,700
	>54 dB $L_{Aeq,8h}$	105,500			N60 >100	0
	>57 dB $L_{Aeq,8h}$	21,700			N60 >200	0
	>60 dB $L_{Aeq,8h}$	2,900			N60 >500	0
	>63 dB $L_{Aeq,8h}$	200				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	682,700		
			>60 dB L_{den}	215,500		
			>65 dB L_{den}	50,300		
			>70 dB L_{den}	1,500		
			>75 dB L_{den}	<50		

4.9 Assessment of 'Minimise Total Carbon Traded' Option (Heathrow-NWR-T-C)

The predicted differences between the equivalent year DM and Heathrow-NWR-T-C scenarios for each noise metric are considered in detail below. The ATMs used in the noise modelling of these two scenarios are set out in Table 4.31 below.

Table 4.31 : Heathrow Airport – 'Minimise Total Carbon Traded' Option ATMs

	Air Transport Movements		
	2030	2040	2050
Heathrow DM	483,856	484,517	471,132
Heathrow Heathrow-NWR-T-C	740,000	740,000	740,000

4.9.1 Day Metrics

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

Figure *4.37* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

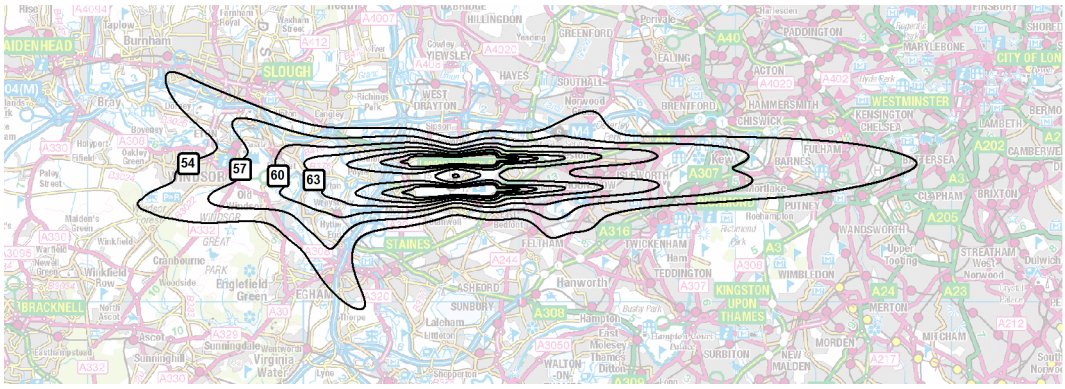
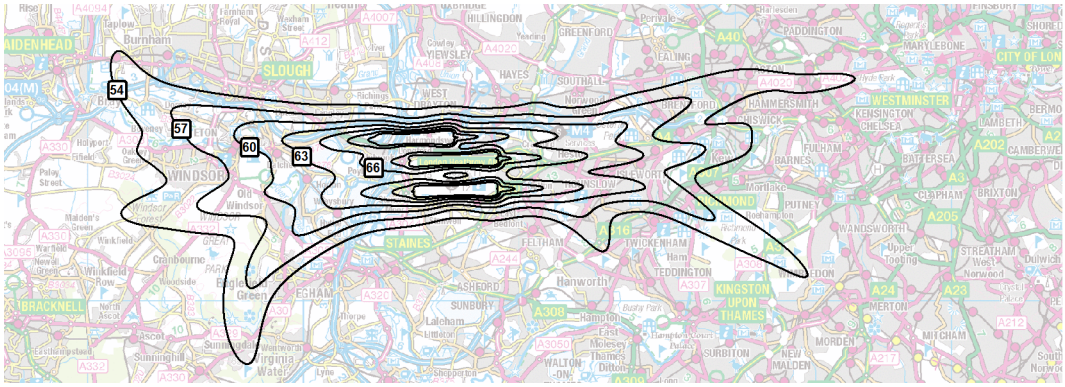


Figure *4.38* : 2030 Heathrow-NWR-T-C Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.32 below.

Table 4.32 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-T-C Heathrow, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	48.0	49,700	14,600
>57	31.9	40,000	14,200
>60	22.9	31,300	12,400
>63	12.9	10,800	4,100
>66	7.4	6,000	2,100
>69	3.5	(800)	(300)
>72	2.3	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In all cases the areas enclosed by the Do-Something contours are greater than for the equivalent DM contours.

Although the 'Minimise Total' routes are designed to avoid the most populous areas around the airport, in the carbon traded scenario the number of ATMs associated with the 2030 Do-Something scenario is around 13.5% greater than in the carbon capped scenario. Furthermore, the fleet mix assumptions differ, with 6% more current aircraft, and 6% less imminent aircraft expected in the carbon traded scenario in comparison to the carbon capped scenario. As a result of these

differences, the 2030 Do-Something contour areas in the carbon traded scenario are greater than in the carbon capped scenario, and in all cases except the >69 dB contour, they include a greater population than the 2030 DM situation.

For the 69 dB contour a reduction of 800 is predicted in comparison to the equivalent DM contour. This is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

There are no discernible difference in the number of people included within the 72 dB contour, as the extents of these contours are very limited in extent in both the DM and Do-Something scenarios.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- *>54 dB: An increase of 49,700 (from 493,600 to 543,300)*
- *>57 dB: An increase of 40,000 (from 221,200 to 261,200)*
- *>60 dB: An increase of 31,300 (from 109,000 to 140,300)*
- *>63 dB: An increase of 10,800 (from 35,200 to 46,000)*
- *>66 dB: An increase of 6,000 (from 7,900 to 13,900)*
- *>69 dB: A reduction of 800 (from 2,100 to 1,300)*
- *>72 dB: No discernible change (from <50 to <50)*

Figure *4.39* : 2040 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

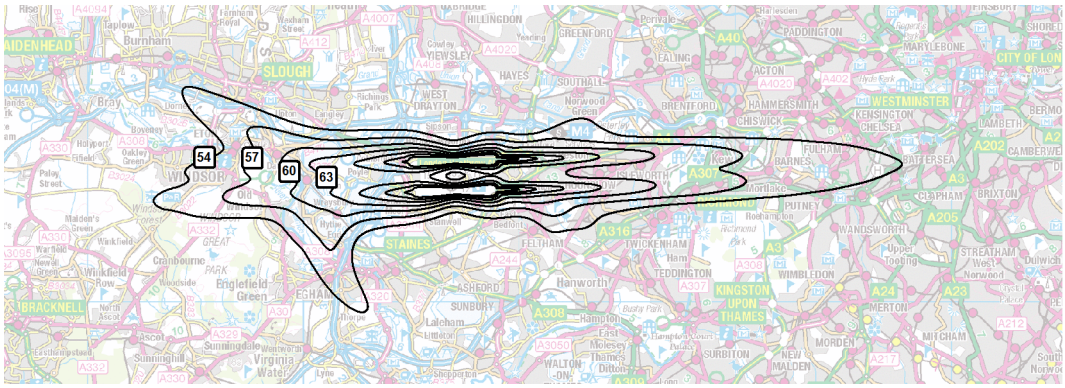


Figure *4.40* : 2040 Heathrow-NWR-T-C Heathrow Airport $L_{Aeq,16h}$ Contours

The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.33 below.

Table *4.33* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-T-C Heathrow, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	47.9	62,200	19,200
>57	31.9	39,900	14,300
>60	22.7	39,300	15,500
>63	12.8	10,400	3,800
>66	7.0	5,700	2,100
>69	3.4	(1,200)	(400)
>72	2.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In all cases the areas enclosed by the Do-Something contours are greater than for the equivalent DM contours.

Although the 'Minimise Total' routes are designed to avoid the most populous areas around the airport, in the carbon traded scenario fleet mix assumptions differ, with 3% more current aircraft, and 3% less imminent aircraft expected in the carbon traded scenario in comparison to the carbon capped scenario. As a result of the difference in fleet mixes the 2040 Do-Something contour areas in the carbon traded scenario are greater than in the carbon capped scenario, and in all cases except the >69 dB contour, they include a greater population than the 2040 DM situation.

For the 69 dB contour a reduction of 1,200 is predicted in comparison to the equivalent DM contour. This is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

There are no discernible difference in the number of people included within the 72 dB contour, as the extents of these contours are very limited in extent in both the DM and Do-Something scenarios.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- *>54 dB: An increase of 62,200 (from 460,600 to 522,800)*
- *>57 dB: An increase of 39,900 (from 219,400 to 259,300)*
- *>60 dB: An increase of 39,300 (from 103,800 to 143,100)*
- *>63 dB: An increase of 10,400 (from 33,900 to 44,300)*
- *>66 dB: An increase of 5,700 (from 7,100 to 12,800)*
- *>69 dB: A reduction of 1,200 (from 2,100 to 900)*
- *>72 dB: No discernible difference (from <50 to <50)*

Figure *4.41* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

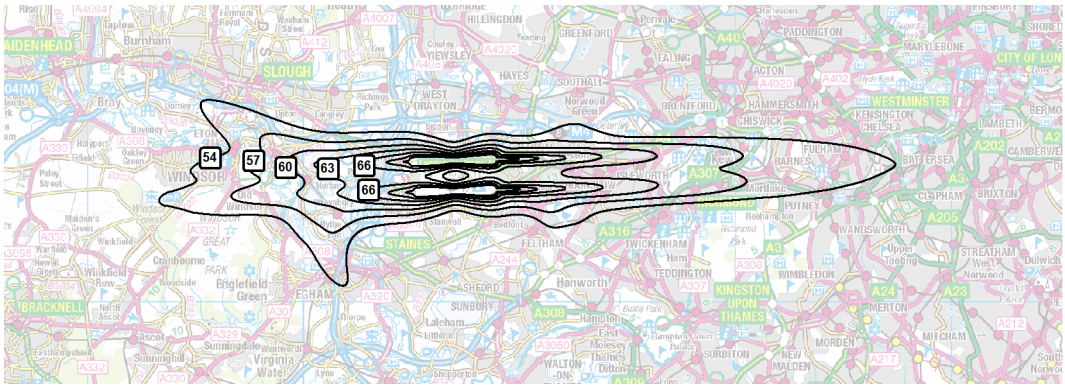
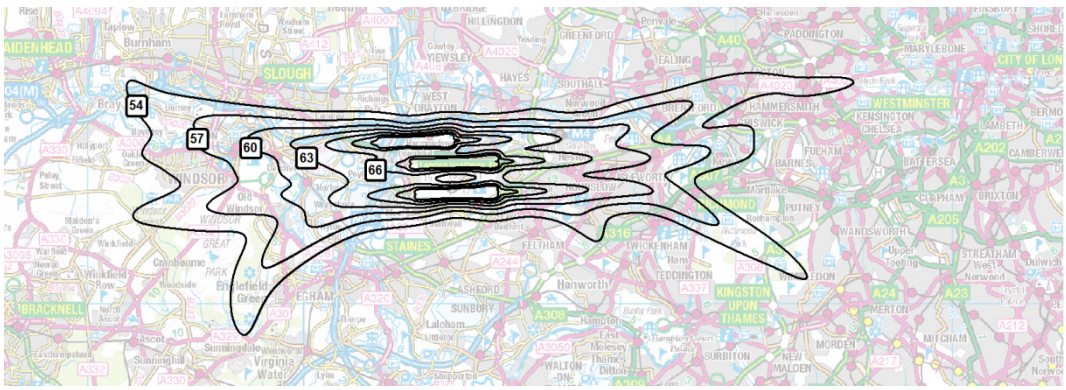


Figure *4.42* : 2050 Heathrow-NWR-T-C Heathrow Airport N $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.34 below.

Table *4.34* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-C Heathrow, $L_{Aeq,16h}$

Contour	Area (km^2)	Population	Households
>54	53.2	100,400	35,300
>57	33.6	44,200	15,900
>60	23.7	47,400	18,800
>63	13.8	15,100	5,600
>66	7.6	5,200	1,900
>69	3.6	(1,200)	(500)
>72	2.3	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In all cases the areas enclosed by the Do-Something contours are greater than for the equivalent DM contours.

Although the 'Minimise Total' routes are designed to avoid the most populous areas around the airport, in the carbon traded scenario fleet mix assumptions differ, with 3% more current aircraft, 3% more imminent aircraft, and 7% fewer future aircraft types expected in the carbon traded scenario in comparison to the carbon capped scenario. As a result of the difference in fleet mixes the 2050 Do-Something contour areas in the carbon traded scenario are greater than in the carbon capped scenario, and in all cases except the >69 dB contour, they include a greater population than the 2050 DM situation.

For the 69 dB contour a reduction of 1,200 is predicted in comparison to the equivalent DM contour. This is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

There are no discernible difference in the number of people included within the 72 dB contour, as the extents of these contours are very limited in extent in both the DM and Do-Something scenarios.

In summary, the differences in population included in the 2050 Do-Something contours compared with the 2050 DM contours are as follows:

- *>54 dB: An increase of 100,400 (from 435,800 to 536,200)*
- *>57 dB: An increase of 44,200 (from 219,600 to 263,800)*
- *>60 dB: An increase of 47,400 (from 103,800 to 151,200)*
- *>63 dB: An increase of 15,100 (from 34,900 to 50,000)*
- *>66 dB: An increase of 5,200 (from 7,700 to 12,900)*
- *>69 dB: A reduction of 1,200 (from 2,100 to 900)*
- *>72 dB: No discernible difference (from <50 to <50)*

(b) N70 Supplementary Metric

Figure 4.43 : 2030 Do-Minimum Heathrow Airport N70 Contours

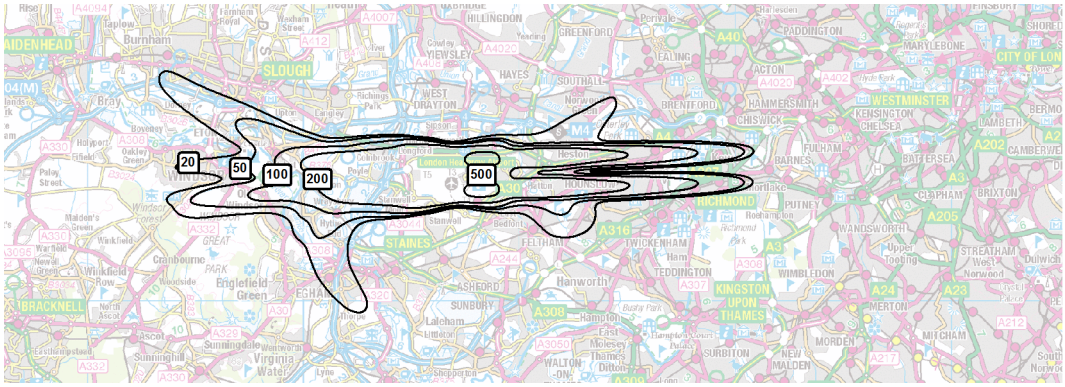
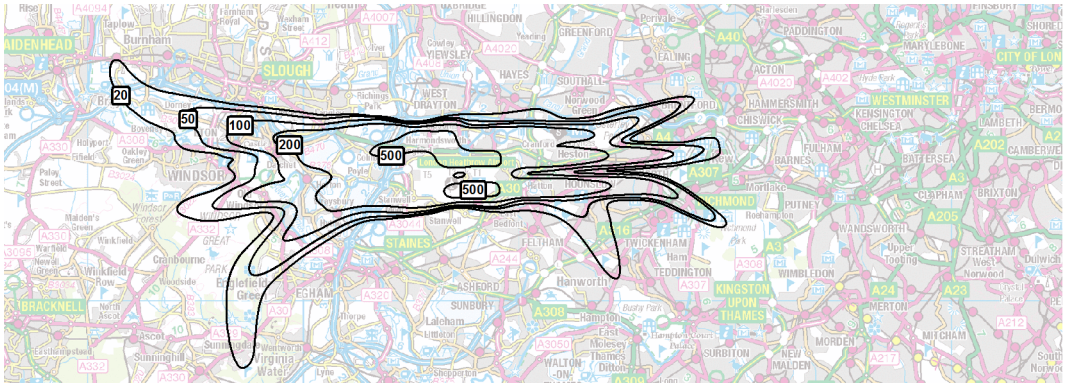


Figure 4.44 : 2030 Heathrow-NWR-T-C Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.35 below.

Table 4.35 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-T-C, N70

Contour	Area (km^2)	Population	Households
>20	25.2	(5,300)	(2,600)
>50	23.2	20,000	6,700
>100	19.7	25,800	9,900
>200	13.2	15,800	6,200
>500	5.1	<50 to 1600	<50 to 600

Note: Numbers in parentheses represent reductions

In all cases the areas enclosed by the Do-Something contours are greater than for the equivalent DM contours. However, whilst the >20 Do-Something contour is larger than the DM contour, the spurs of the Do-Something contour follows the 'minimise total' routes which diverge more widely, due to three runway spacing and design to avoid most populous areas. As a result, the Do-Something contour does not cover as much of Grove Park, East Sheen, Richmond and Windsor as the DM contour, and encompasses 5,300 fewer people than the DM contour.

Closer to the airport, the Do-Something and DM routes converge to a greater extent, and the noise preferential routing has less effect. As the >50 to >500 Do-Something contours are all larger than the equivalent DM contours, this results in greater populations falling within the Do-Something contours.

For the comparison of the 2030 Do-Something with the 2030 DM situations, the following differences are predicted:

- >20 dB: A reduction of 5,300 (from 291,800 to 286,500)
- >50 dB: An increase of 20,000 (from 184,100 to 204,100)
- >100 dB: An increase of 25,800 (from 122,600 to 148,400)
- >200 dB: An increase of 15,800 (from 63,300 to 79,100)
- >500 dB: An increase from <50 to 1600

Figure 4.45 : 2040 Do-Minimum Heathrow Airport N70 Contours

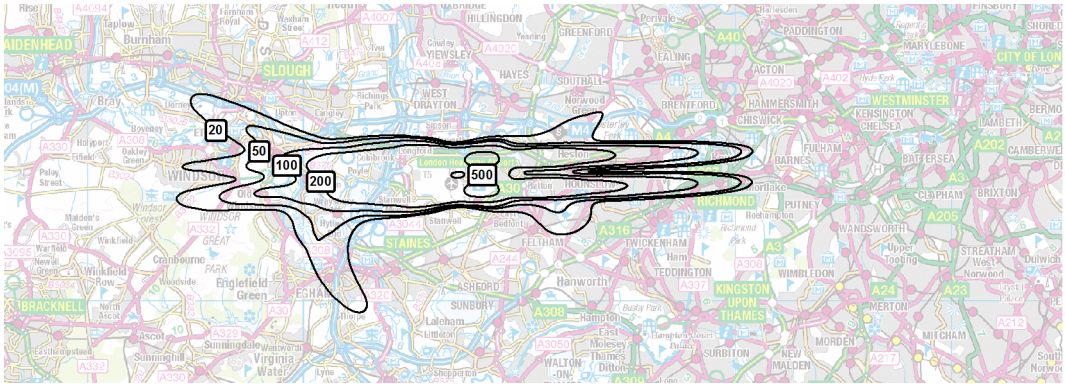
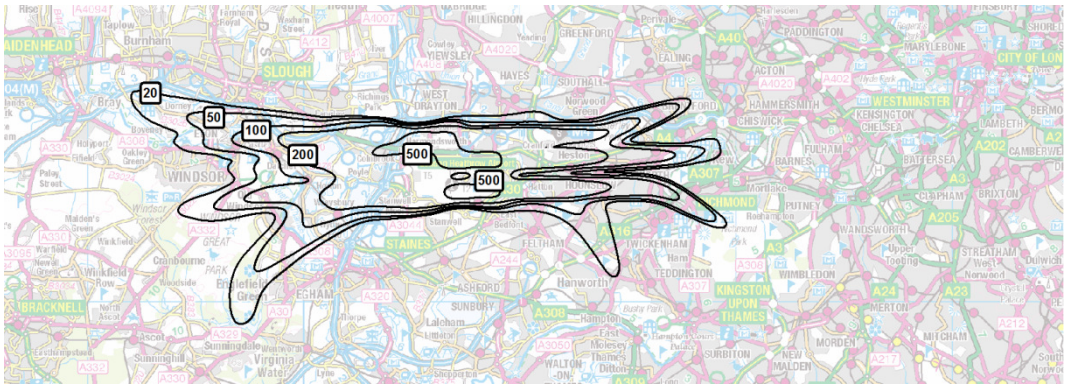


Figure 4.46 : 2040 Heathrow-NWR-T-C Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.36 below.

Table 4.36 : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-T-C, N70

Contour	Area (km^2)	Population	Households
>20	26.1	10,000	3,300
>50	24.9	19,900	6,700
>100	18.5	26,500	10,800
>200	13.8	22,000	8,400
>500	4.8	<50 to 1300	<50 to 400

Note: Numbers in parentheses represent reductions

The result of the runway influenced separation and the route design avoiding populous areas causes the different shape of the contours in the Do-Something situation compared with the DM situation.

In all cases the areas enclosed by the 'carbon traded' Do-Something contours are greater than for the equivalent 'carbon capped' Do-Something and DM contours. This is a result of the increase in ATMs in the Do-Something scenario (740,000) compared with the DM scenario (484,517).

For the comparison of the 2040 Do-Something with the 2040 DM situations, the following differences are predicted:

- >20 dB: An increase of 10,000 (from 278,300 to 288,300)
- >50 dB: An increase of 19,900 (from 187,900 to 207,800)
- >100 dB: An increase of 26,500 (from 124,700 to 151,200)
- >200 dB: An increase of 22,000 (from 62,200 to 84,200)
- >500 dB: A change from <50 to 1300

Figure 4.47 : 2050 Do-Minimum Heathrow Airport N70 Contours

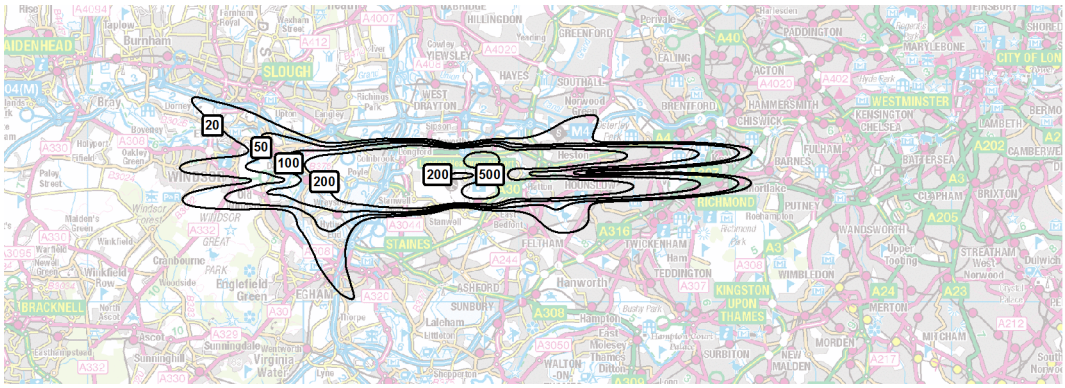
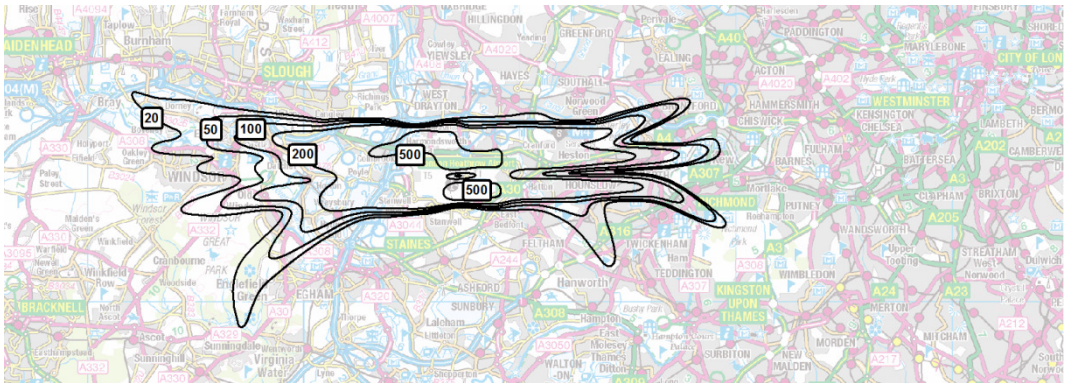


Figure 4.48 : 2050 Heathrow-NWR-T-C Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.37 below.

Table 4.37 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-C, N70

Contour	Area (km^2)	Population	Households
>20	28.1	17,700	6,600
>50	25.2	27,700	9,800
>100	21.3	34,600	13,900
>200	16.2	36,300	14,000
>500	5.4	<50 to 2100	<50 to 700

Note: Numbers in parentheses represent reductions

The result of the runway influenced separation and the route design avoiding populous areas causes the different shape of the contours in the Do-Something situation compared with the DM situation.

In all cases the areas enclosed by the 'carbon traded' Do-Something contours are greater than for the equivalent 'carbon capped' Do-Something and DM contours. This is a result of the increase in ATMs in the Do-Something scenario (740,000) compared with the DM scenario (471,123).

For the comparison of the 2040 Do-Something with the 2040 DM situations, the following differences are predicted:

- >20 dB: An increase of 17,700 (from 274,100 to 291,800)
- >50 dB: An increase of 27,700 (from 189,500 to 217,200)
- >100 dB: An increase of 34,600 (from 129,400 to 164,000)
- >200 dB: An increase of 36,300 (from 71,200 to 107,500)
- >500 dB: A change from <50 to 2100

4.9.2 Night Metrics

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

Figure *4.49* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

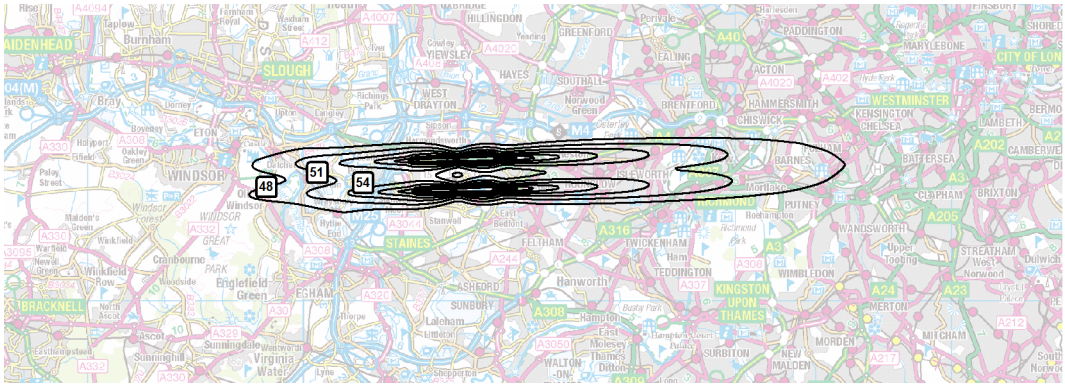
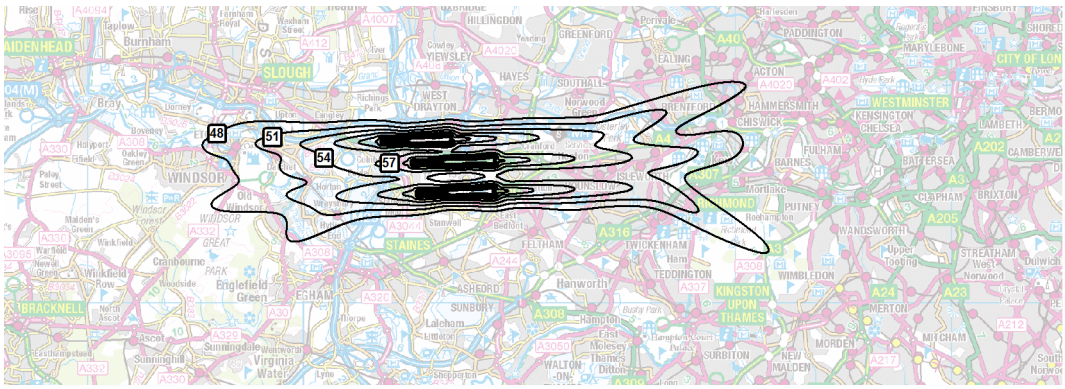


Figure *4.50* : 2030 Heathrow-NWR-T-C Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.38 below.

Table *4.38* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-T-C, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	35.9	32,000	8,000
>51	25.2	31,800	11,700
>54	19.5	32,300	12,400
>57	8.5	(2,400)	(1,000)
>60	4.0	(1,300)	(500)
>63	2.6	(1,100)	(400)
>66	1.7	<50 to <50	<50 to <50
>69	0.9	<50 to <50	<50 to <50
>72	0.3	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The result of the runway influenced separation and the route design avoiding populous areas causes the different shape of the contours in the Do-Something situation compared with the DM situation. In all cases the Do-Something contours are greater in area than the DM contours, as a result of a forecast 52.9% increase in ATMs in the Do-Something scenario. The 'carbon traded' Do-Something contours are also larger than the equivalent 'carbon capped' contours as a result of a forecast 13.5% increase ATMs and a less favourable fleet mix.

For the >48 to >54 dB contours, the increased areas of the Do-Something contours encapsulate greater populations than the DM contours, primarily because these contours extend further north and west to include parts of Brands Hill, Brentford, Datchet, Heston, Langley and North Hyde, in the Do-Something scenario. However for the >57, >60 and >63 dB contours there are fewer people within the Do-Something contours than the DM contours. This is because the Do-Something contours do not extend as far east from the existing runways over densly populated areas, and the area covered by these contours around proposed north west runway are less populous.

For the comparison of the 2030 Do-Something with the 2030 DM situations, the following differences are predicted:

- >48 dB: An increase of 32,000 (from 271,200 to 303,200)
- >51 dB: An increase of 31,800 (from 151,300 to 183,100)
- >54 dB: An increase of 32,300 (from 61,100 to 93,400)
- >57 dB: A reduction of 2,400 (from 21,900 to 19,500)
- >60 dB: A reduction of 1,300 (from 3,900 to 2,600)
- >63 dB: A reduction of 1,100 (from 1,300 to 200)
- >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)

Figure *4.51* : 2040 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

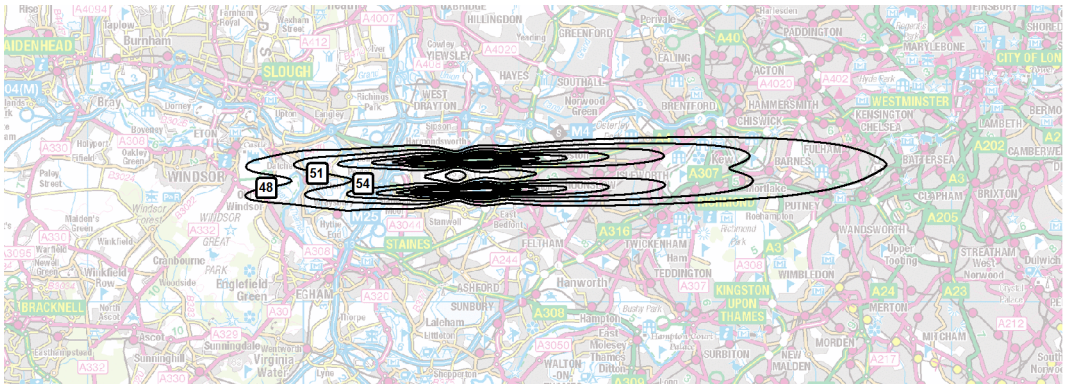
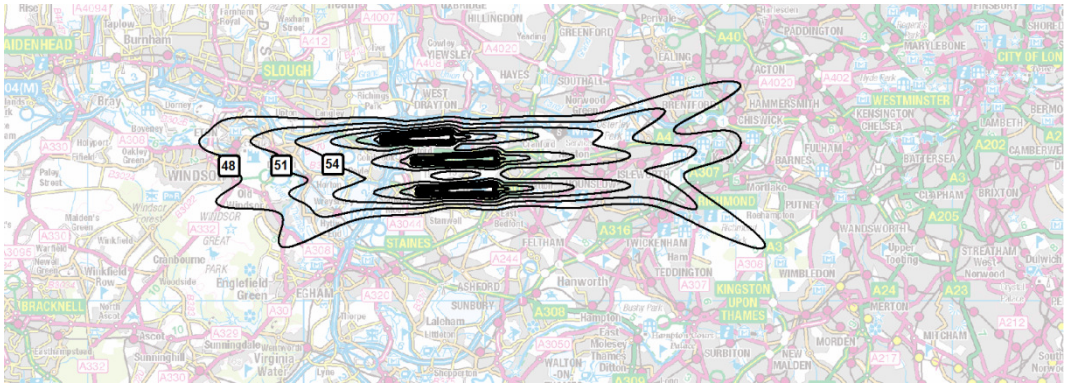


Figure *4.52* : 2040 Heathrow-NWR-T-C Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.39 below.

Table *4.39* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-T-C, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	32.0	(27,300)	(17,800)
>51	23.2	5,200	400
>54	19.6	16,000	6,100
>57	8.9	(10,500)	(4,200)
>60	4.2	(3,600)	(1,500)
>63	2.7	(2,200)	(800)
>66	1.9	<50 to <50	<50 to <50
>69	1.1	<50 to <50	<50 to <50
>72	0.4	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The result of the runway influenced separation and the route design avoiding populous areas causes the different shape of the contours in the Do-Something situation compared with the DM situation. In all cases the Do-Something contours are greater in area than the DM contours, as a result of a forecast 52.7% increase in ATMs in the Do-Something scenario. The 'carbon traded' Do-Something contours are also larger than the equivalent 'carbon capped' contours as a result of a less favourable fleet mix.

For the >48 contour, the Do-Something contour does not extend as far east as in the DM situation. Although this contour includes new populations associated with Brands Hill, Brentford, Datchet, Heston, Langley and North Hyde, it does not include Barnes, Fulham or parts of Putney which are covered by the DM contour. The result is a reduction in population included in the 48 dB contour in comparison to the DM scenario.

For the >51 and >54 dB contours there are more people within the Do-Something contours than the DM contours, primarily because they include populations around Colnbrook, Datchet, Harmondsworth, Harrington, Heston Longford, and Sipson, which offset the exclusion of populations to the east of the existing runways.

For the comparison of the 2040 Do-Something with the 2040 DM situations, the following differences are predicted:

- >48 dB: A reduction of 27,300 (from 337,000 to 309,700)
- >51 dB: An increase of 5,200 (from 184,600 to 189,800)
- >54 dB: An increase of 16,000 (from 81,300 to 97,300)
- >57 dB: A reduction of 10,500 (from 31,400 to 20,900)
- >60 dB: A reduction of 3,600 (from 6,400 to 2,800)
- >63 dB: A reduction of 2,200 (from 2,400 to 200)
- >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)

Figure *4.53* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

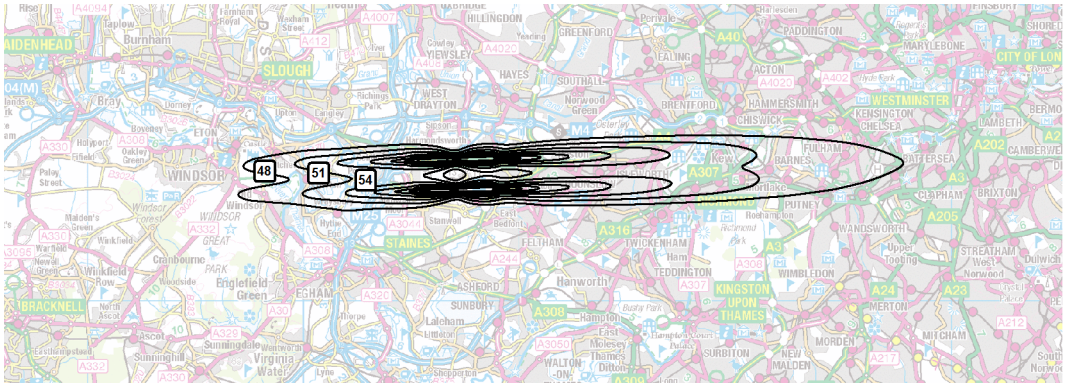
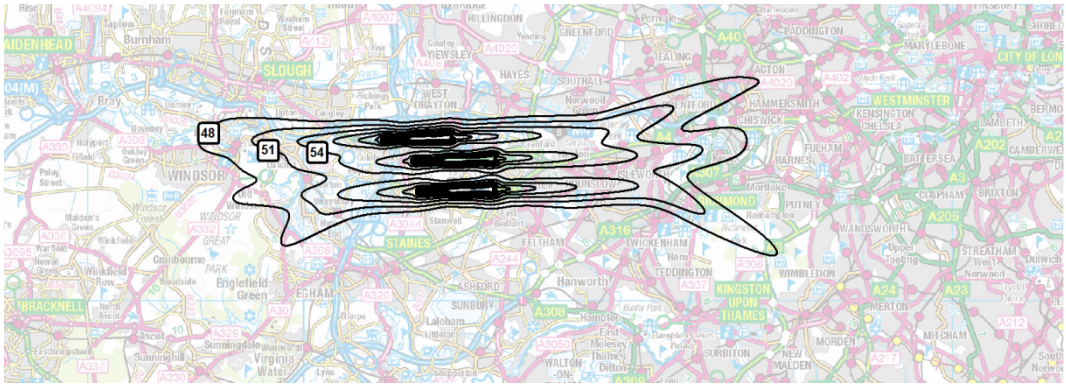


Figure *4.54* : 2050 Heathrow-NWR-T-C Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.40 below.

Table *4.40* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-C, $L_{Aeq,8h}$

Contour	Area (km^2)	Population	Households
>48	28.7	(32,700)	(21,200)
>51	20.7	7,200	900
>54	16.6	16,300	6,100
>57	6.8	(12,200)	(4,900)
>60	3.3	(4,200)	(1,600)
>63	2.1	(2,400)	(800)
>66	1.5	<50 to <50	<50 to <50
>69	0.8	<50 to <50	<50 to <50
>72	0.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The result of the runway influenced separation and the route design avoiding populous areas causes the different shape of the contours in the Do-Something situation compared with the DM situation. In all cases the Do-Something contours are greater in area than the DM contours, as a result of a forecast 52.7% increase in ATMs in the Do-Something scenario. The 'carbon traded' Do-Something contours are also larger than the equivalent 'carbon capped' contours as a result of a less favourable fleet mix.

For the >48 contour, the Do-Something contour does not extend as far east as in the DM situation. Although this contour includes new populations associated with Brands Hill, Brentford, Datchet, Heston, Langley and North Hyde, it does not include Barnes, Fulham or parts of Putney which are covered by the DM contour. The result is a reduction in population included in the 48 dB contour in comparison to the DM scenario.

For the >51 and >54 dB contours there are more people within the Do-Something contours than the DM contours, primarily because they include populations around Colnbrook, Datchet, Harmondsworth, Harrington, Heston Longford, and Sipson, which offset the exclusion of populations to the east of the existing runways.

For the comparison of the 2050 Do-Something with the 2050 DM situations, the following differences are predicted:

- >48 dB: A reduction of 32,700 (from 373,100 to 340,400)
- >51 dB: An increase of 7,200 (from 197,400 to 204,600)
- >54 dB: An increase of 16,300 (from 89,200 to 105,500)
- >57 dB: A reduction of 12,200 (from 33,900 to 21,700)
- >60 dB: A reduction of 4,200 (from 7,100 to 2,900)
- >63 dB: A reduction of 2,400 (from 2,600 to 200)
- >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

Figure 4.55 : 2030 Do-Minimum Heathrow Airport N60 Contours

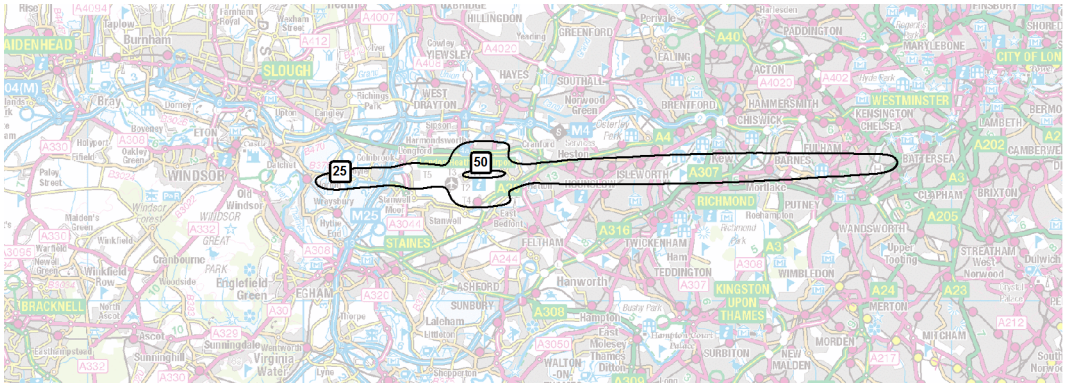
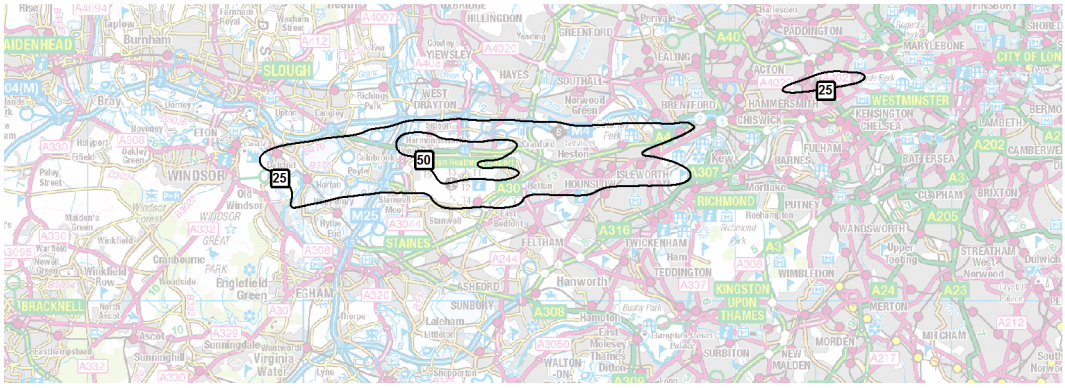


Figure 4.56 : 2030 Heathrow-NWR-T-C Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.41 below.

Table 4.41 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-T-C, N60

Contour	Area (km2)	Population	Households
>25	27.8	31,000	9,900
>50	7.7	<50 to 5100	<50 to 1900
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The 2030 Do-Something contours are greater in area than the DM contours, as a result of a forecast increase ATMs in the Do-Something scenario. The result of the runway influenced separation and the route design avoiding populous areas causes the different shape of the contours in the Do-Something situation compared with the DM situation.

Although new areas towards Brentford and Isleworth are included in the >25 Do-Something contour, it does not include areas such as Kew, Barns, Fulham and Battersea which are covered by the DM contour. A new >25 contour area is seen around Kensington as a result of a change in route direction at this position which may require the use of thrust.

An increase in the number of people enclosed within both Do-Something contours in comparison with the DM situation is predicted as a result of the increased contour areas, despite the fact that they cover some less populous areas than the DM contours.

For the comparison of the 2030 Do-Something with the 2030 DM situations, the following differences are predicted:

- *>25 dB: An increase of 31,000 (from 150,500 to 181,500)*
- *>50 dB: An increase from <50 to 5100*

Figure 4.57 : 2040 Do-Minimum Heathrow Airport N60 Contours

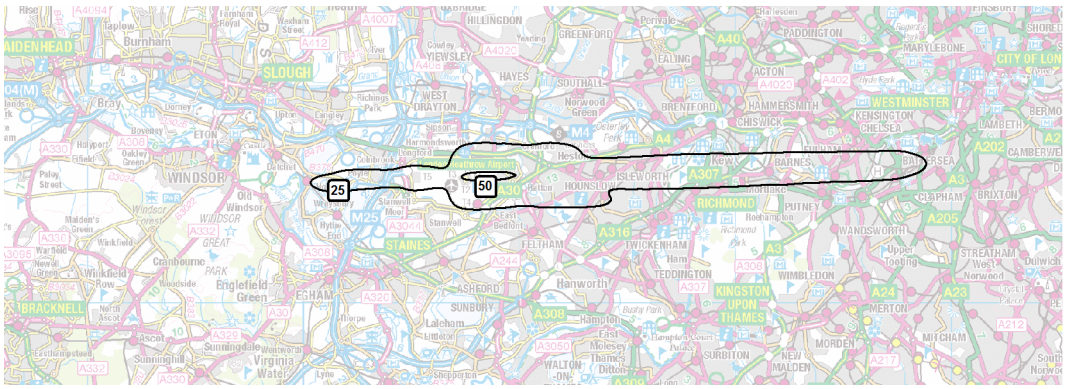
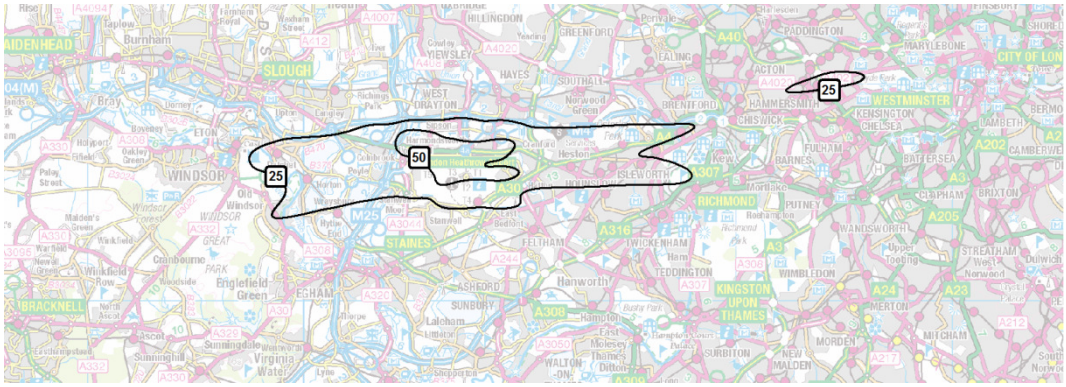


Figure 4.58 : 2040 Heathrow-NWR-T-C Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.42 below.

Table 4.42 : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-T-C, N60

Contour	Area (km2)	Population	Households
>25	17.3	(79,200)	(35,300)
>50	8.1	<50 to 5300	<50 to 1900
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The 2040 Do-Something contours are greater in area than the DM contours, as a result of a forecast increase ATMs in the Do-Something scenario. The result of the runway influenced separation and the route design avoiding populous areas causes

the different shape of the contours in the Do-Something situation compared with the DM situation.

Although new areas around Brentford and Shepherds Bush are included in the >25 Do-Something contour, it does not include areas such as Kew, Barns, Fulham and Battersea which are covered by the DM contour. The net result of this is a reduction of 79,200 people in the >25 contour in the Do-Something scenario.

However, for the Do-Something >50 contour, an increase of around 5,300 people is expected in comparison to the DM contour; this is because the area covered by the Do-Something contour is substantially larger than the DM contour, and although the area to the north of the airport is less densely populated than to the east, the net effect of the increase in contour area is an increase in the number of people enclosed.

For the comparison of the 2040 Do-Something with the 2040 DM situations, the following differences are predicted:

- *>25 dB: A reduction of 79,200 (from 258,300 to 179,100)*
- *>50 dB: An increase from <50 to 5,300*

Figure 4.59 : 2050 Do-Minimum Heathrow Airport N60 Contours

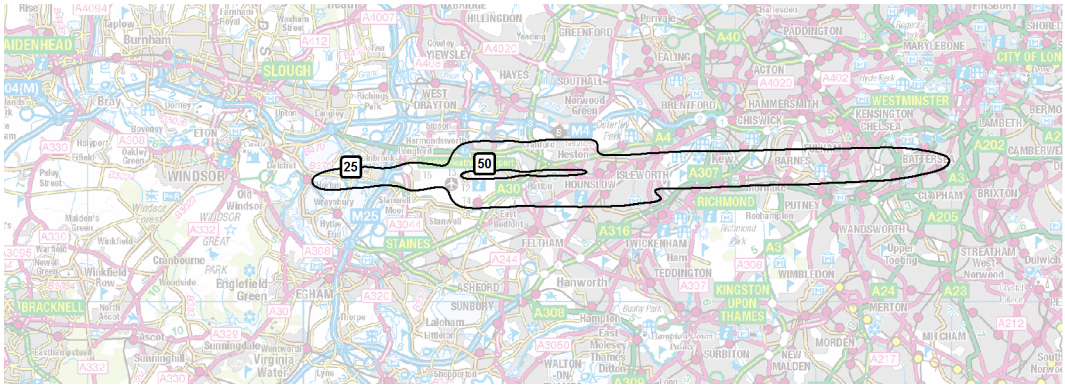
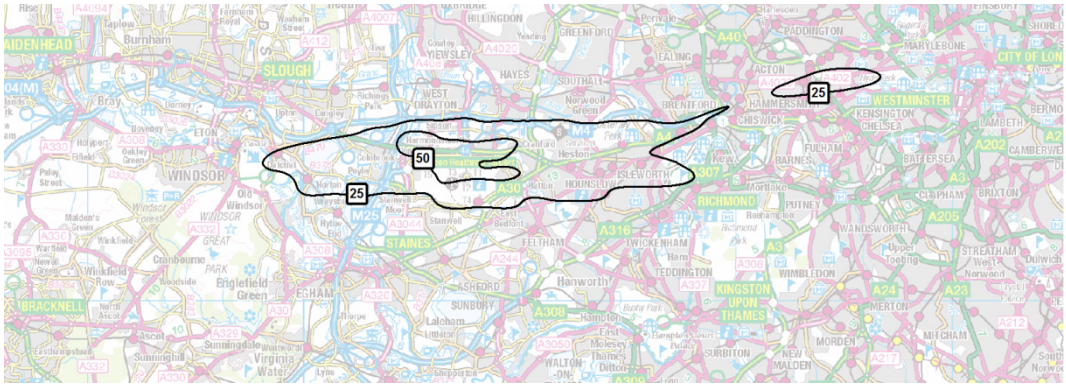


Figure 4.60 : 2050 Heathrow-NWR-T-C Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.43 below.

Table 4.43 : 2050 DM Heathrow vs 2050 Heathrow-NWR-T-C, N60

Contour	Area (km2)	Population	Households
>25	11.7	(87,000)	(38,300)
>50	6.7	(800)	(500)
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The 2050 Do-Something contours are greater in area than the DM contours, as a result of a forecast increase ATMs in the Do-Something scenario. The result of the runway influenced separation and the route design avoiding populous areas causes the different shape of the contours in the Do-Something situation compared with the DM situation.

Although new areas around Brentford and Shepherds Bush are included in the >25 Do-Something contour, it does not include areas such as Kew, Barns, Fulham and Battersea which are covered by the DM contour. The net result of this is a reduction of 87,000 people in the >25 contour in the Do-Something scenario.

A reduction in the number of people enclosed within the Do-Something >50 contour in comparison with the DM situation is also predicted; this is because while the Do-Something contour extends over new areas to the north of the proposed runway, it does not extend as far east of the existing runways. As the area to the east of the airport is more densely populated than to the north, the net result is a reduction in population enclosed by the Do-Something contour in comparison with the DM contour.

For the comparison of the 2050 Do-Something with the 2050 DM situations, the following differences are predicted:

- >25 dB: A reduction of 87,000 (from 320,700 to 233,700)
- >50 dB: A reduction of 800 (from 6,500 to 5,700)

4.9.3 24-Hour Metric

Figure *4.61* : 2030 Do-Minimum Heathrow Airport L_{den} Contours

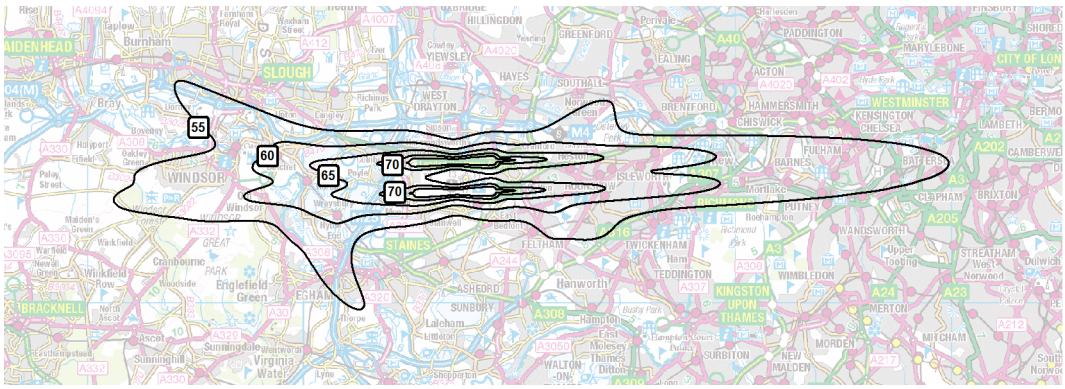
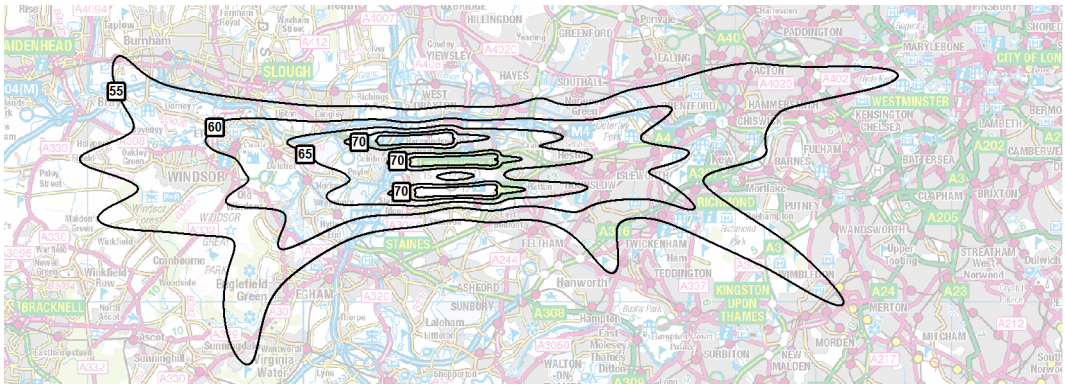


Figure *4.62* : 2030 Heathrow-NWR-T-C Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.44 below.

Table *4.44* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-T-C, L_{den}

Contour	Area (km²)	Population	Households
>55	64.9	104,100	35,100
>60	29.7	36,300	13,700
>65	14.1	13,800	5,000
>70	4.4	(900)	(200)
>75	2.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In the 2030 Do-Something scenario, the areas of the contours are larger than in the DM scenario, due to the expected 52.9% growth in ATMs

In most cases, the increased contour areas enclose greater populations, despite the use of noise preferential routes as a result of increased ATMs. However, the population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous.

For the comparison of the 2030 Do-Something with the 2030 DM situations, the following differences are predicted:

- >55 dB: An increase of 104,100 (from 580,500 to 684,600)
- >60 dB: An increase of 36,300 (from 169,600 to 205,900)
- >65 dB: An increase of 13,800 (from 34,800 to 48,600)
- >70 dB: A reduction of 900 (from 3,000 to 2,100)
- >75 dB: No discernible change (from <50 to <50)

Figure *4.63* : 2040 Do-Minimum Heathrow Airport L_{den} Contours

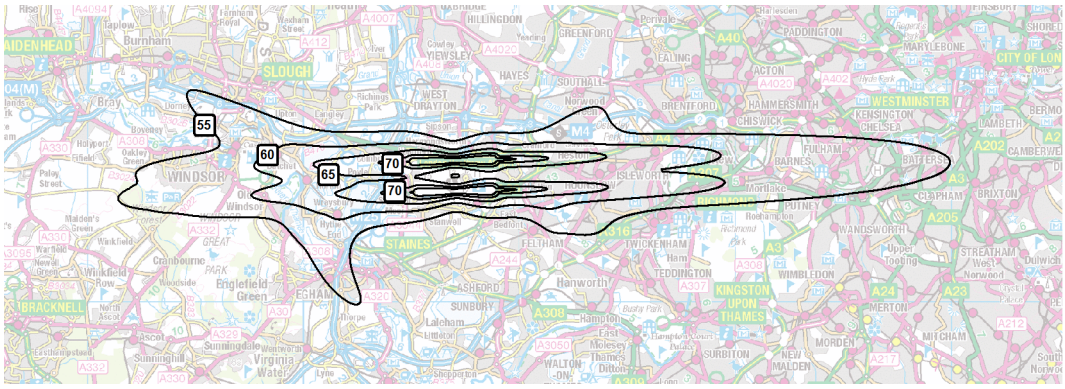
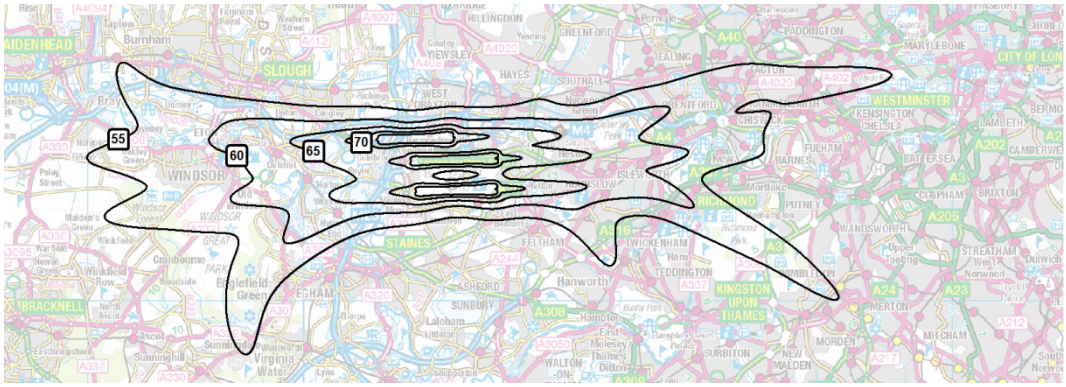


Figure *4.64* : 2040 Heathrow-NWR-T-C Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.45 below.

Table *4.45* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-T-C, L_{den}

Contour	Area (km^2)	Population	Households
>55	61.5	78,300	24,000
>60	28.7	30,100	11,200
>65	14.7	11,500	4,100
>70	4.3	(1,600)	(500)
>75	2.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In the 2040 Do-Something scenario, the areas of the contours are larger than in the DM scenario, due to the expected 52.7% growth in ATMs

In most cases, the increased contour areas enclose greater populations, despite the use of noise preferential routes as a result of increased ATMs. However, the population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous.

For the comparison of the 2040 Do-Something with the 2040 DM situations, the following differences are predicted:

- >55 dB: An increase of 78,300 (from 588,900 to 667,200)
- >60 dB: An increase of 30,100 (from 179,500 to 209,600)
- >65 dB: An increase of 11,500 (from 36,200 to 47,700)
- >70 dB: A reduction of 1,600 (from 3,100 to 1,500)
- >75 dB: No discernible change (from <50 to <50)

Figure *4.65* : 2050 Do-Minimum Heathrow Airport L_{den} Contours

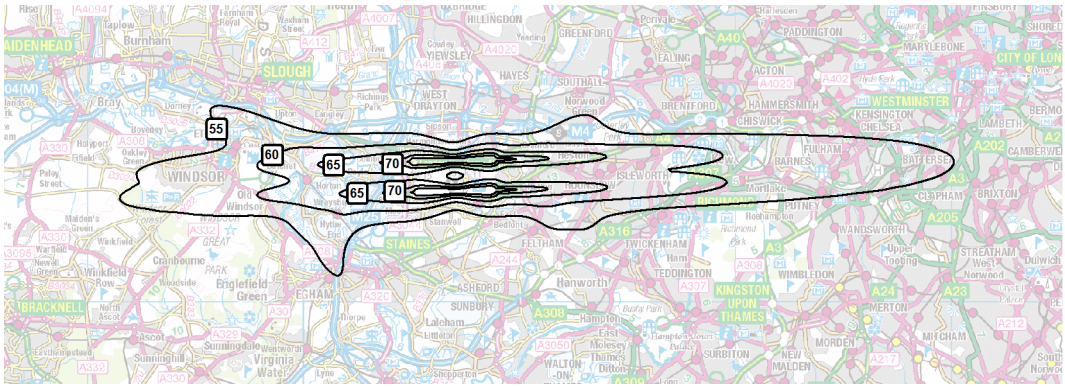
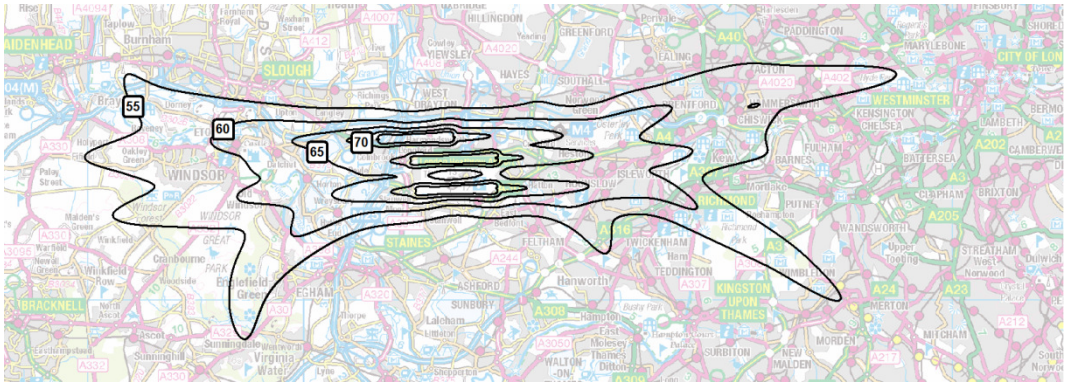


Figure *4.66* : 2050 Heathrow-NWR-T-C Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.46 below.

Table *4.46* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-C, L_{den}

Contour	Area (km²)	Population	Households
>55	64.4	99,200	32,900
>60	28.5	33,400	12,400
>65	15.0	13,900	5,100
>70	4.1	(1,600)	(600)
>75	2.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In the 2050 Do-Something scenario, the areas of the contours are larger than in the DM scenario, due to the expected 57.1% growth in ATMs

In most cases, the increased contour areas enclose greater populations, despite the use of noise preferential routes as a result of increased ATMs. However, the population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous.

For the comparison of the 2050 Do-Something with the 2050 DM situations, the following differences are predicted:

- *>55 dB: An increase of 78,300 (from 588,900 to 667,200)*
- *>60 dB: An increase of 30,100 (from 179,500 to 209,600)*

- *>65 dB: An increase of 11,500 (from 36,200 to 47,700)*
- *>70 dB: A reduction of 1,600 (from 3,100 to 1,500)*
- *>75 dB: No discernible change (from <50 to <50)*

4.10 Scorecards for 'Minimise New' Option (Heathrow-NWR-N)

Noise metrics have been produced for the Heathrow-NWR-N scenarios at Heathrow Airport for 2030, 2040 and 2050, and are presented below.

Table 4.47 : 2030 Heathrow-NWR-N Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency (based on above contour) measure	number
Day	>54 dB $L_{Aeq,16h}$	566,300			N70 >20	276,800
	>57 dB $L_{Aeq,16h}$	248,800			N70 >50	191,900
	>60 dB $L_{Aeq,16h}$	133,400			N70 >100	141,000
	>63 dB $L_{Aeq,16h}$	38,400			N70 >200	64,100
	>66 dB $L_{Aeq,16h}$	11,600			N70 >500	200
	>69 dB $L_{Aeq,16h}$	900				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	313,000			N60 >25	222,500
	>51 dB $L_{Aeq,8h}$	177,800			N60 >50	2,600
	>54 dB $L_{Aeq,8h}$	73,500			N60 >100	0
	>57 dB $L_{Aeq,8h}$	11,500			N60 >200	0
	>60 dB $L_{Aeq,8h}$	900			N60 >500	0
	>63 dB $L_{Aeq,8h}$	200				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	641,500		
			>60 dB L_{den}	191,600		
			>65 dB L_{den}	35,400		
			>70 dB L_{den}	900		
			>75 dB L_{den}	<50		

Table 4.48 : 2040 Heathrow-NWR-N Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB $L_{Aeq,16h}$	593,900			N70 >20	276,300
	>57 dB $L_{Aeq,16h}$	261,600			N70 >50	198,900
	>60 dB $L_{Aeq,16h}$	144,300			N70 >100	148,600
	>63 dB $L_{Aeq,16h}$	40,800			N70 >200	76,300
	>66 dB $L_{Aeq,16h}$	12,000			N70 >500	1,100
	>69 dB $L_{Aeq,16h}$	900				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	385,300			N60 >25	328,600
	>51 dB $L_{Aeq,8h}$	208,700			N60 >50	5,800
	>54 dB $L_{Aeq,8h}$	99,800			N60 >100	0
	>57 dB $L_{Aeq,8h}$	18,500			N60 >200	0
	>60 dB $L_{Aeq,8h}$	2,400			N60 >500	0
	>63 dB $L_{Aeq,8h}$	200				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	702,500		
			>60 dB L_{den}	209,800		
			>65 dB L_{den}	41,100		
			>70 dB L_{den}	1,000		
			>75 dB L_{den}	<50		

Table 4.49 : 2050 Heathrow-NWR-N Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB $L_{Aeq,16h}$	594,300			N70 >20	274,200
	>57 dB $L_{Aeq,16h}$	264,200			N70 >50	204,700
	>60 dB $L_{Aeq,16h}$	148,300			N70 >100	156,700
	>63 dB $L_{Aeq,16h}$	42,800			N70 >200	101,400
	>66 dB $L_{Aeq,16h}$	11,000			N70 >500	1,800
	>69 dB $L_{Aeq,16h}$	800				
	>72 dB $L_{Aeq,16h}$	<50				
Night	>48 dB $L_{Aeq,8h}$	373,000			N60 >25	294,000
	>51 dB $L_{Aeq,8h}$	204,900			N60 >50	3,400
	>54 dB $L_{Aeq,8h}$	92,300			N60 >100	0
	>57 dB $L_{Aeq,8h}$	12,300			N60 >200	0
	>60 dB $L_{Aeq,8h}$	900			N60 >500	0
	>63 dB $L_{Aeq,8h}$	200				
	>66 dB $L_{Aeq,8h}$	<50				
	>69 dB $L_{Aeq,8h}$	<50				
	>72 dB $L_{Aeq,8h}$	<50				
24-hour			>55 dB L_{den}	726,600		
			>60 dB L_{den}	218,300		
			>65 dB L_{den}	42,700		
			>70 dB L_{den}	1,000		
			>75 dB L_{den}	<50		

4.11 Assessment of 'Minimise New' Option (Heathrow-NWR-N)

The predicted differences between the equivalent year DM and Heathrow-NWR-N scenarios for each noise metric are considered in detail below. The ATMs used in the noise modelling of these two scenarios are set out in Table 4.50 below.

Table 4.50 : Heathrow Airport – 'Minimise New' Option ATMs

	Air Transport Movements		
	2030	2040	2050
Heathrow DM	483,856	484,517	471,132
Heathrow Heathrow-NWR-N	652,216	740,000	740,000

4.11.1 Day Metrics

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

Figure *4.67* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

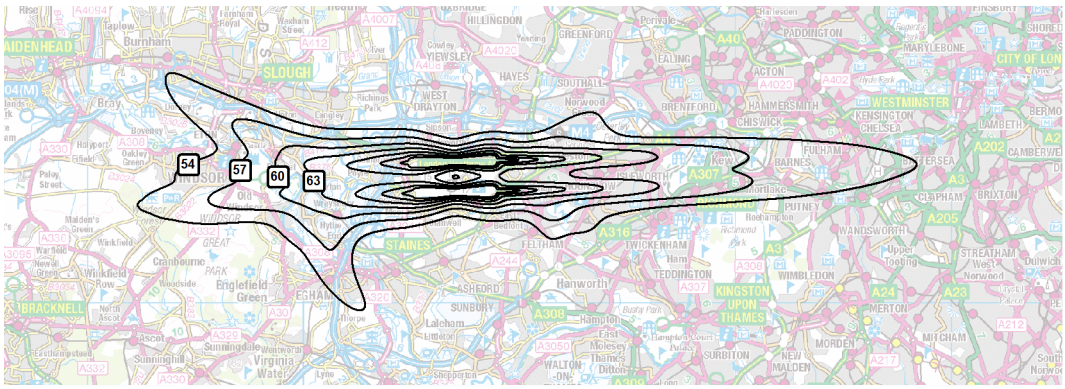
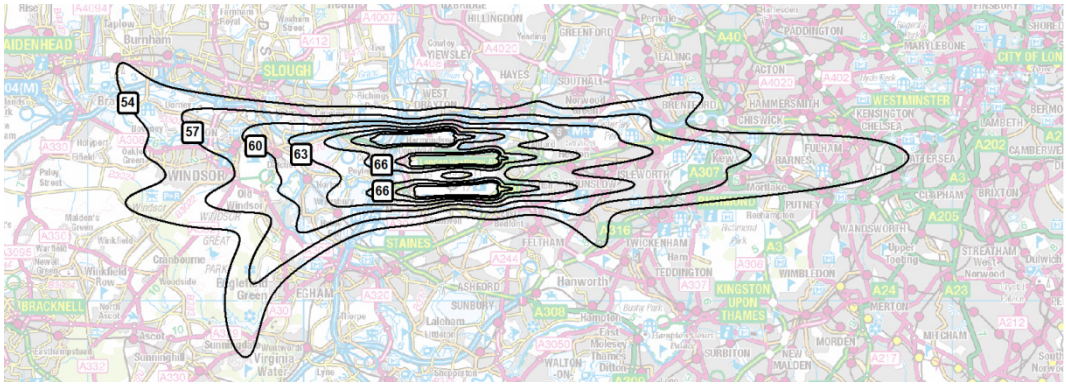


Figure *4.68* : 2030 Heathrow-NWR-N Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table *4.51* below.

Table 4.51 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-N, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	41.5	72,700	28,700
>57	27.9	27,600	10,100
>60	18.7	24,400	9,600
>63	9.9	3,200	1,100
>66	5.7	3,700	1,200
>69	2.8	(1,200)	(500)
>72	2.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something L_{den} noise contours cover a similar extent in the east-west axis, but are wider in the north-south axis, and have a greater spread at the two extents than the equivalent DM contours.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are generally greater for the Do-Something contours.

The populations enclosed are also generally greater than for the equivalent 'minimise total' Do-Something contours, which demonstrates the effects of the noise preferential routes employed in the 'minimise total' option.

The exception is the >69 dB Do-Something contour, where a reduction of 1,200 (from 2,100 to 900) is predicted in comparison to the equivalent DM contour. This is for the same reasons as identified in the 'minimise total' option; with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- >54 dB: An increase of 72,700 (from 493,600 to 566,300)
- >57 dB: An increase of 27,600 (from 221,200 to 248,800)
- >60 dB: An increase of 24,400 (from 109,000 to 133,400)
- >63 dB: An increase of 3,200 (from 35,200 to 38,400)
- >66 dB: An increase of 3,700 (from 7,900 to 11,600)
- >69 dB: A reduction of 1,200 (from 2,100 to 900)
- >72 dB: No discernible change (from <50 to <50)

For the Heathrow Northwest Runway 'Minimise New' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2030 Do-Something scenario compared to the 2030 DM scenario is 45,400, and the number of people newly removed is 18,000. This results in a net increase in the number of people newly affected of 27,400.

Figure *4.69* : 2040 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

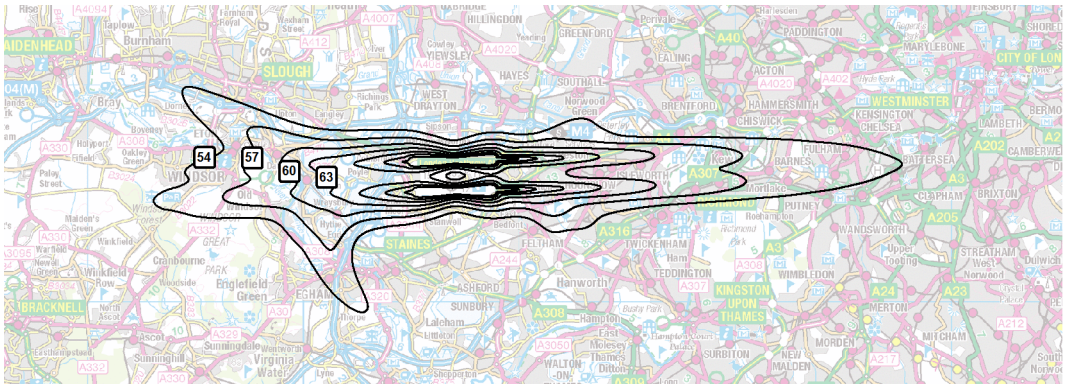
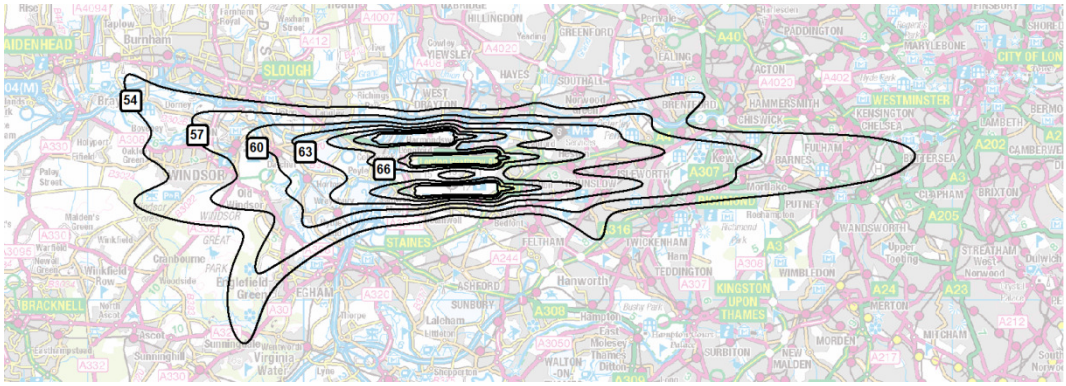


Figure *4.70* : 2040 Heathrow-NWR-N Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.52 below.

Table *4.52* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-N, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	48.0	133,300	53,900
>57	31.8	42,200	16,000
>60	20.9	40,500	16,000
>63	11.2	6,900	2,400
>66	6.2	4,900	1,800
>69	3.0	(1,200)	(500)
>72	2.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something L_{den} noise contours cover a similar extent in the east-west axis, but are wider in the north-south axis, and have a greater spread at the two extents than the equivalent DM contours.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are generally greater for the Do-Something contours.

The exception is the >69 dB Do-Something contour, where a reduction of 1,200 (from 2,100 to 900) is predicted in comparison to the equivalent DM contour. This is for the same reasons as identified in the 'minimise total' option; with aircraft movements split over three runways, there are three >69 dB contours, each limited

to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- >54 dB: An increase of 133,300 (from 460,600 to 593,900)
- >57 dB: An increase of 42,200 (from 219,400 to 261,600)
- >60 dB: An increase of 40,500 (from 103,800 to 144,300)
- >63 dB: An increase of 6,900 (from 33,900 to 40,800)
- >66 dB: An increase of 4,900 (from 7,100 to 12,000)
- >69 dB: A reduction of 1,200 (from 2,100 to 900)
- >72 dB: No perceptible change (from <50 to <50)

For the Heathrow Northwest Runway 'Minimise New' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2040 Do-Something scenario compared to the 2040 DM scenario is 51,600, and the number of people newly removed is 9,600. This results in a net increase in the number of people newly affected of 42,000.

Figure *4.71* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

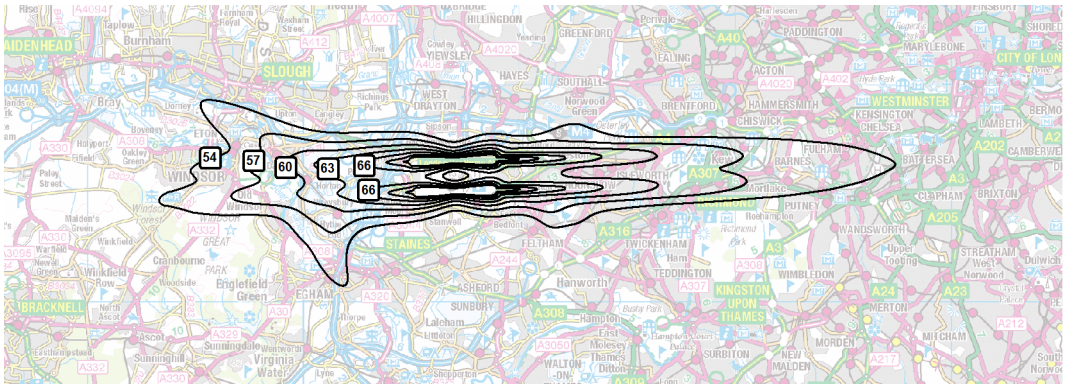


Figure *4.72* : 2050 Heathrow-NWR-N Heathrow Airport N $L_{Aeq,16h}$ Contours

The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.53 below.

Table 4.53 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-N, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	49.0	158,500	64,800
>57	31.7	44,600	17,000
>60	20.9	44,500	17,600
>63	11.5	7,900	2,900
>66	6.5	3,300	1,100
>69	3.2	(1,300)	(500)
>72	2.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something L_{den} noise contours cover a similar extent in the east-west axis, but are wider in the north-south axis, and have a greater spread at the two extents than the equivalent DM contours.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are generally greater for the Do-Something contours.

The exception is the >69 dB Do-Something contour, where a reduction of 1,200 (from 2,100 to 800) is predicted in comparison to the equivalent DM contour. This is for the same reasons as identified in the 'minimise total' option; with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

In summary, the differences in population included in the 2050 Do-Something contours compared with the 2050 DM contours are as follows:

- >54 dB: An increase of 158,500 (from 435,800 to 594,300)
- >57 dB: An increase of 44,600 (from 219,600 to 264,200)
- >60 dB: An increase of 44,500 (from 103,800 to 148,300)
- >63 dB: An increase of 7,900 (from 34,900 to 42,800)
- >66 dB: An increase of 3,300 (from 7,700 to 11,000)
- >69 dB: A reduction of 1,300 (from 2,100 to 800)
- >72 dB: No perceptible change (from <50 to <50)

For the Heathrow Northwest Runway 'Minimise New' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2050 Do-Something scenario compared to the 2050 DM scenario is 52,200, and the number of people newly removed is 6,400. This results in a net increase in the number of people newly affected of 45,800.

(b) N70 Supplementary Metric

Figure 4.73 : 2030 Do-Minimum Heathrow Airport N70 Contours

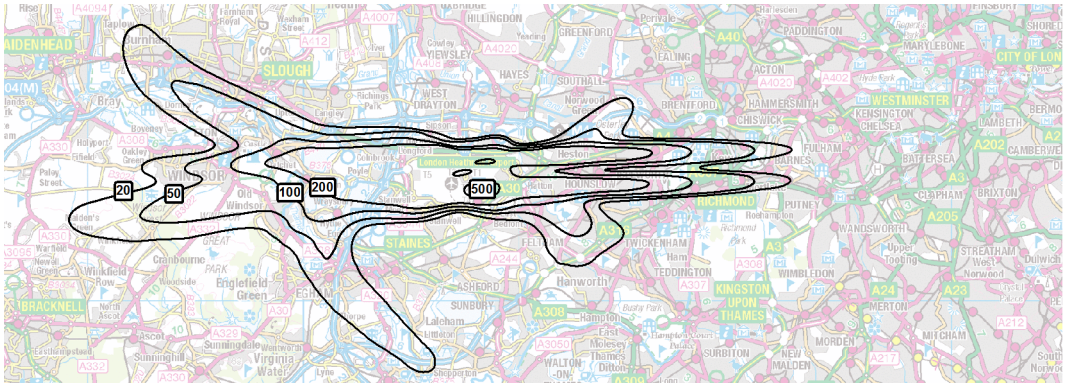
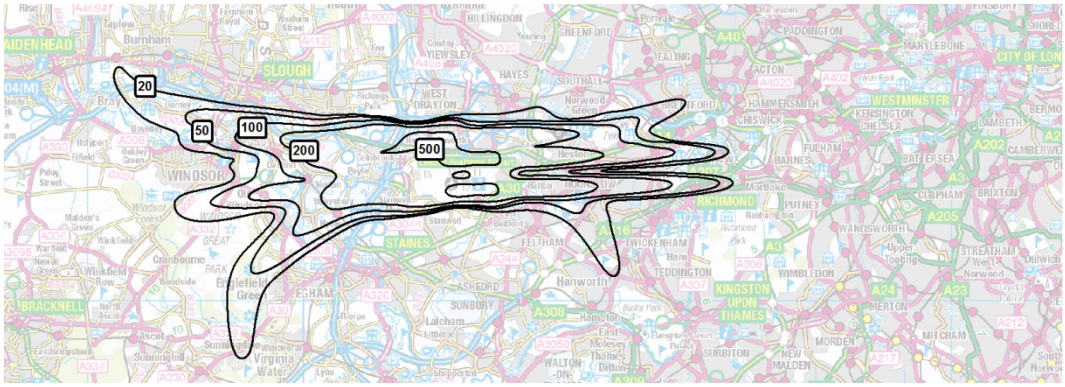


Figure 4.74 : 2030 Heathrow-NWR-N Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.54 below.

Table 4.54 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-N, N70

Contour	Area (km²)	Population	Households
>20	23.0	(15,000)	(6,000)
>50	19.8	7,800	1,900
>100	16.2	18,400	7,200
>200	9.6	800	300
>500	3.5	<50 to 200	<50 to 100

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something N70 noise contours differ considerably in shape from the DM contours, showing greater spread of the north and south 'horns' to the east, and less divergence to the west.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are generally greater for the Do-Something contours.

The exception is the >20 Do-Something contour, which encapsulates 15,000 fewer people than in the DM scenario. This is because the north-west 'horn' of this

contour does not extend over the densely populated areas of Burnham and Slough, and the horns mostly avoid Windsor.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- >20 dB: A reduction of 15,000 (from 291,800 to 276,800)
- >50 dB: An increase of 7,800 (from 184,100 to 191,900)
- >100 dB: An increase of 18,400 (from 122,600 to 141,000)
- >200 dB: An increase of 800 (from 63,300 to 64,100)
- >500 dB: A change from <50 to 200

Figure 4.75 : 2040 Do-Minimum Heathrow Airport N70 Contours

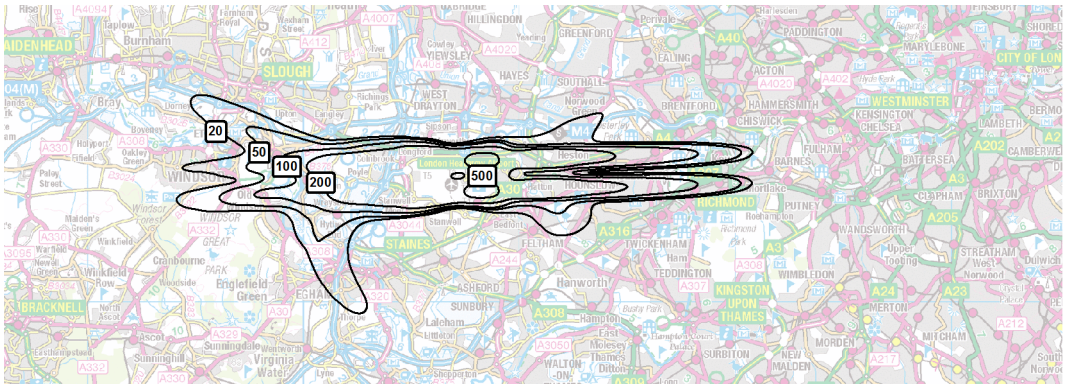
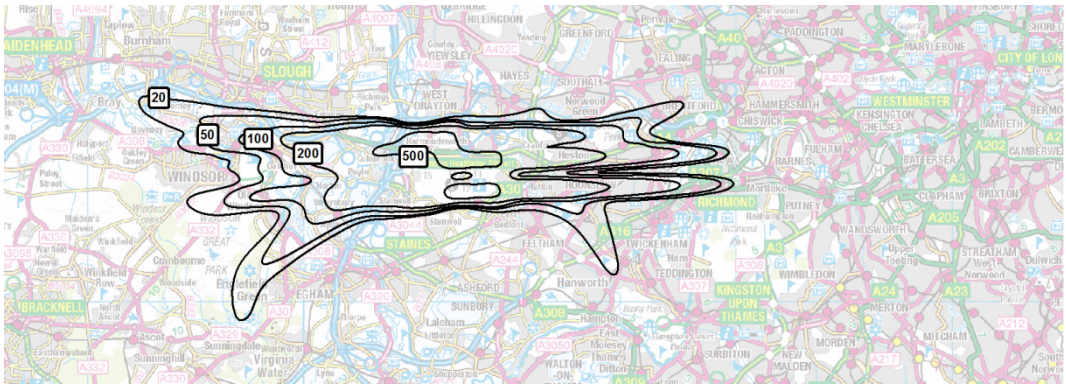


Figure 4.76 : 2040 Heathrow-NWR-N Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.55 below.

Table 4.55 : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-N, N70

Contour	Area (km²)	Population	Households
>20	21.3	(2,000)	(1,100)
>50	20.4	11,000	3,300
>100	16.5	23,900	9,700
>200	12.2	14,100	5,400
>500	4.8	<50 to 1100	<50 to 400

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something N70 noise contours differ in shape from the DM

contours, showing greater spread of the north and south 'horns' to the east, and less divergence to the west. However, these differences are less pronounced than is observed in the equivalent 2030 comparison.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are generally greater for the Do-Something contours.

The exception is the >20 Do-Something contour, which encapsulates 2,000 fewer people than in the DM scenario. This is because the north-west 'horn' of this contour does not extend over the densely populated area of Slough, and the horns avoid Windsor.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- >20 dB: A reduction of 2,000 (from 278,300 to 276,300)
- >50 dB: An increase of 11,000 (from 187,900 to 198,900)
- >100 dB: An increase of 23,900 (from 124,700 to 148,600)
- >200 dB: An increase of 14,100 (from 62,200 to 76,300)
- >500 dB: A change from <50 to 1100

Figure 4.77 : 2050 Do-Minimum Heathrow Airport N70 Contours

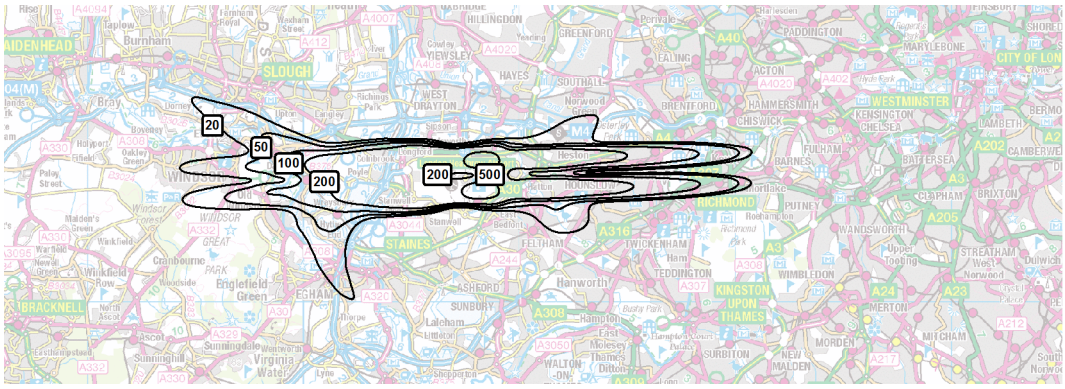
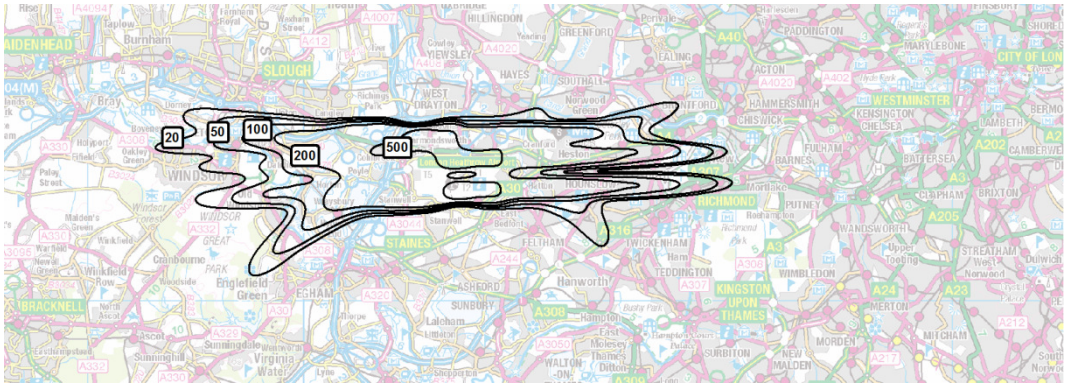


Figure 4.78 : 2050 Heathrow-NWR-N Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.56 below.

Table 4.56 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-N, N70

Contour	Area (km^2)	Population	Households
>20	16.9	100	(100)
>50	20.5	15,200	4,800
>100	18.1	27,300	10,900
>200	14.4	30,200	11,800
>500	5.2	<50 to 1800	<50 to 600

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something N70 noise contours differ in shape from the DM contours, showing greater spread of the north and south 'horns' to the east, and less divergence to the west. However, these differences are less pronounced than is observed in the equivalent 2030 and 2040 comparisons.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are all greater for the Do-Something contours.

In summary, the differences in population included in the 2050 Do-Something contours compared with the 2050 DM contours are as follows:

- >20 dB: An increase of 100 (from 274,100 to 274,200)
- >50 dB: An increase of 15,200 (from 189,500 to 204,700)
- >100 dB: An increase of 27,300 (from 129,400 to 156,700)
- >200 dB: An increase of 30,200 (from 71,200 to 101,400)
- >500 dB: An increase from <50 to 1800

4.11.2 Night Metrics

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

Figure *4.79* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

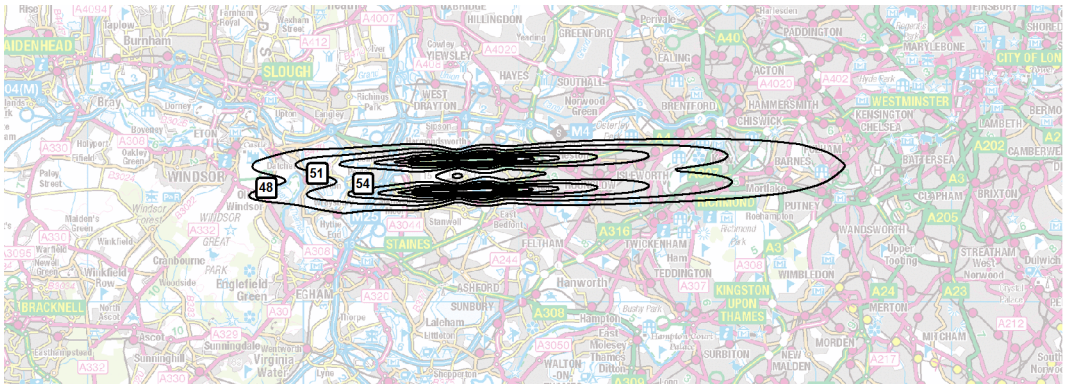
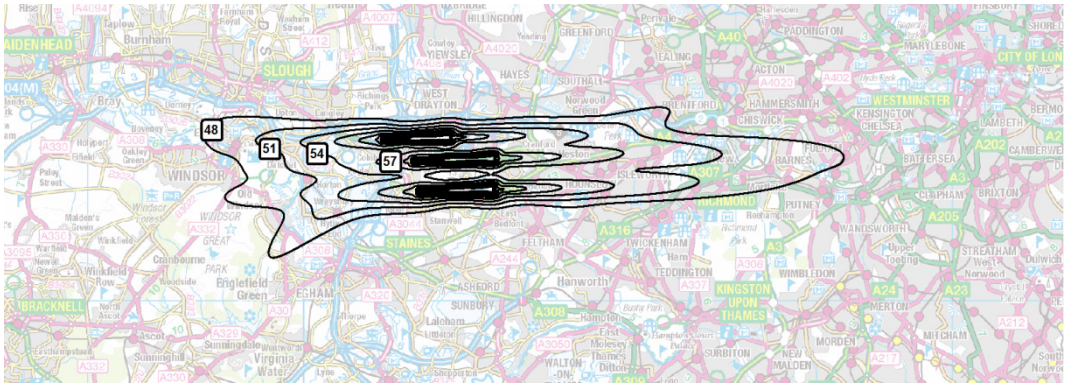


Figure *4.80* : 2030 Heathrow-NWR-N Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.57 below.

Table *4.57* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-N, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	36.9	41,800	15,700
>51	23.5	26,500	9,700
>54	16.3	12,400	4,800
>57	6.8	(10,400)	(4,000)
>60	3.4	(3,000)	(1,100)
>63	2.3	(1,100)	(400)
>66	1.6	<50 to <50	<50 to <50
>69	0.9	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something contours extend further to the west, are wider in the north-south axis, extend further and show a greater spread to the west than the DM contours. All of the Do-Something contours cover greater areas than the equivalent DM contours as a result of increased ATMs, and this results in an increase in the populations enclosed within the >48 to >54 dB contours.

The reductions in the >57, >60 and >63 dB contours occur because the Do-Something contours do not extend as far east from the existing runways over densely populated areas, and the area covered by these contours around proposed north west runway are less populous.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- *>48 dB: An increase of 41,800 (from 271,200 to 313,000)*
- *>51 dB: An increase of 26,500 (from 151,300 to 177,800)*
- *>54 dB: An increase of 12,400 (from 61,100 to 73,500)*
- *>57 dB: A reduction of 10,400 (from 21,900 to 11,500)*
- *>60 dB: A reduction of 3,000 (from 3,900 to 900)*
- *>63 dB: A reduction of 1,100 (from 1,300 to 200)*
- *>66 dB: No discernible difference (from <50 to <50)*
- *>69 dB: No discernible difference (from <50 to <50)*
- *>72 dB: No discernible difference (from <50 to <50)*

Figure 4.81 : 2040 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

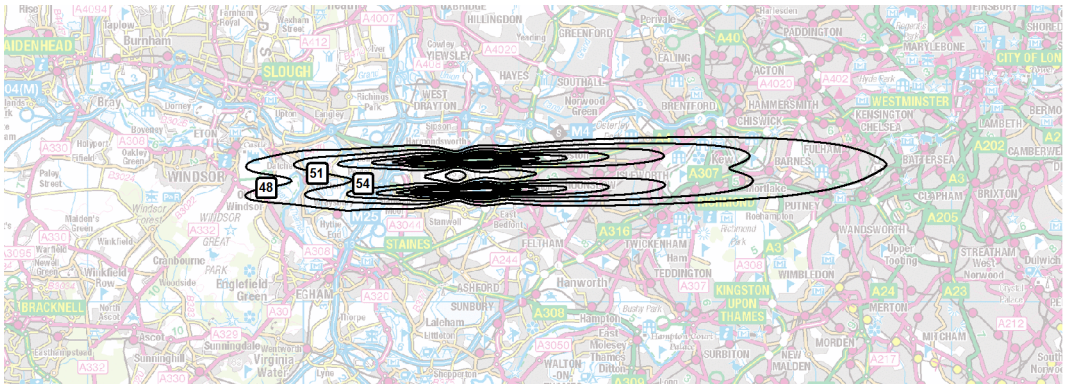
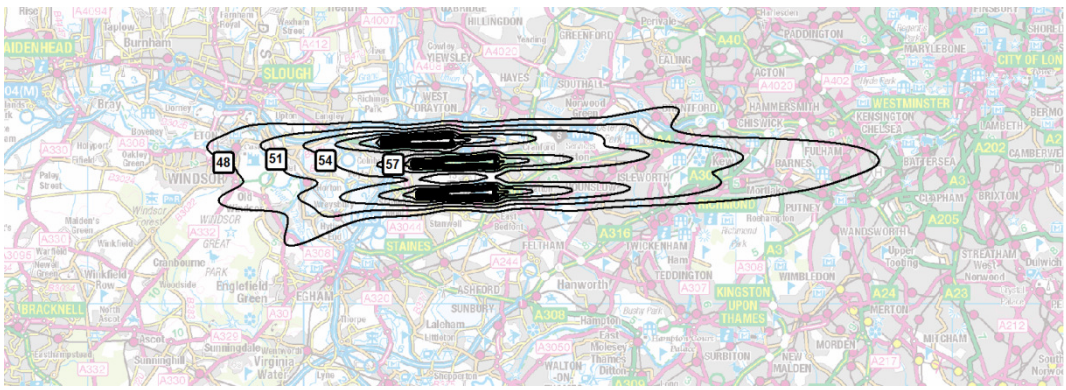


Figure *4.82* : 2040 Heathrow-NWR-N Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.58 below.

Table *4.58* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-N, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	36.2	48,300	18,400
>51	24.5	24,100	8,300
>54	17.5	18,500	7,100
>57	7.0	(12,900)	(5,100)
>60	3.4	(4,000)	(1,600)
>63	2.3	(2,200)	(800)
>66	1.6	<50 to <50	<50 to <50
>69	0.9	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something contours extend further to the west, are wider in the north-south axis, extend further and show a greater spread to the west than the DM contours. All of the Do-Something contours cover greater areas than the equivalent DM contours as a result of increased ATMs, and this results in an increase in the populations enclosed within the >48 to >54 dB contours.

The reductions in the >57, >60 and >63 dB contours occur because the Do-Something contours do not extend as far east from the existing runways over densely populated areas, and the area covered by these contours around proposed north west runway are less populous.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- >48 dB: An increase of 48,300 (from 337,000 to 385,300)
- >51 dB: An increase of 24,100 (from 184,600 to 208,700)
- >54 dB: An increase of 18,500 (from 81,300 to 99,800)
- >57 dB: A reduction of 12,900 (from 31,400 to 18,500)
- >60 dB: A reduction of 4,000 (from 6,400 to 2,400)
- >63 dB: A reduction of 2,200 (from 2,400 to 200)
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

Figure *4.83* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

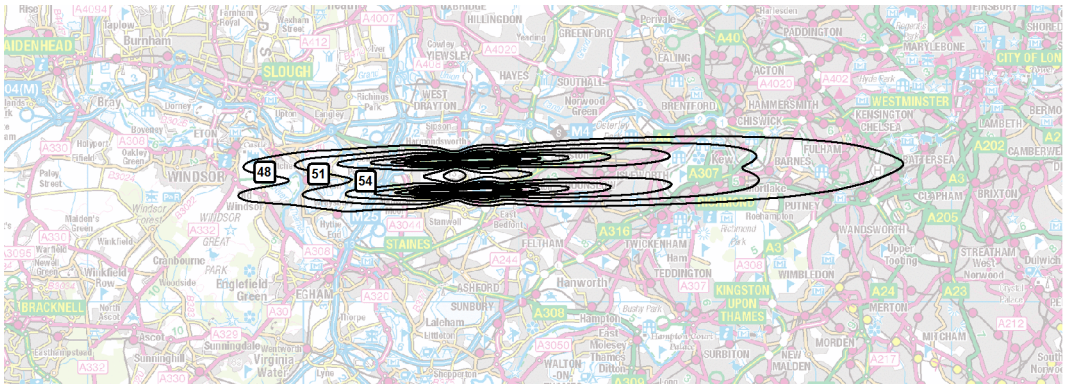
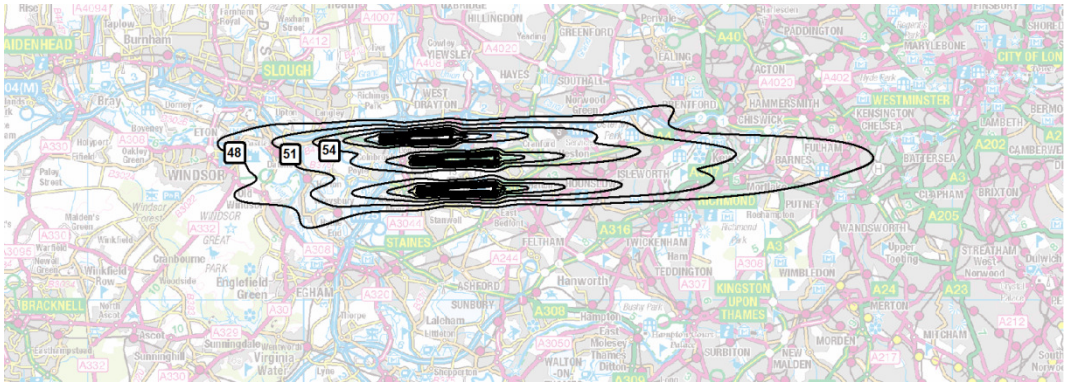


Figure *4.84* : 2050 Heathrow-NWR-N Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in *Table 4.59* below.

Table *4.59* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-N, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	25.4	(100)	(1,700)
>51	18.0	7,500	1,500
>54	12.0	3,100	1,100
>57	4.3	(21,600)	(8,400)
>60	2.4	(6,200)	(2,400)
>63	1.8	(2,400)	(800)
>66	1.3	<50 to <50	<50 to <50
>69	0.6	<50 to <50	<50 to <50
>72	0.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

As a result of the 'minimise new' routes and the effect of the third runway wider spacing, the Do-Something contours extend further to the west, are wider in the north-south axis, extend further and show a greater spread to the west than the DM contours. Most of the Do-Something contours cover greater areas than the equivalent DM contours as a result of increased ATMs, and this results in an increase in the populations enclosed within the >51 and >54 dB contours. The >72 dB contour shows no difference in area between scenarios.

The smaller populations in the >48, >57, >60 and >63 dB Do-Something contours than the DM contours occur because, despite increases in area, the Do-Something contours cover less populous areas than the corresponding DM contours.
In summary, the differences in population included in the 2050 Do-Something contours compared with the 2050 DM contours are as follows:

- >48 dB: A reduction of 100 (from 373,100 to 373,000)
- >51 dB: An increase of 7,500 (from 197,400 to 204,900)
- >54 dB: An increase of 3,100 (from 89,200 to 92,300)
- >57 dB: A reduction of 21,600 (from 33,900 to 12,300)
- >60 dB: A reduction of 6,200 (from 7,100 to 900)
- >63 dB: A reduction of 2,400 (from 2,600 to 200)
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

(b) N60 Supplementary Metric

Figure 4.85 : 2030 Do-Minimum Heathrow Airport N60 Contours

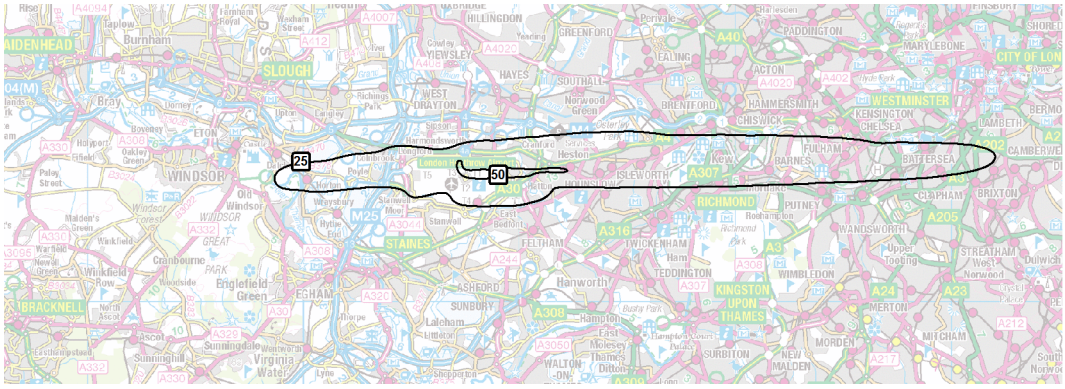
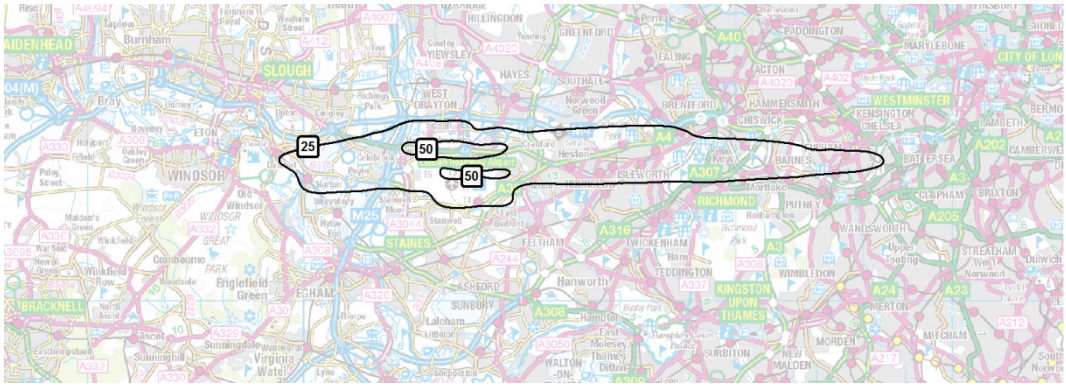


Figure 4.86 : 2030 Heathrow-NWR-N Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.60 below.

Table 4.60 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-N, N60

Contour	Area (km2)	Population	Households
>25	30.3	72,000	27,600
>50	3.7	<50 to 2600	<50 to 1000
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The Do-Something >25 contour does not extend as far west from Heathrow Airport as in the DM scenario, but is wider in the north-south axis, and covers a greater area. There are two >50 contours in the Do-Something scenario in response to the additional runway, and the combined area of these contours is greater than the DM contour. The Do-Something contours cover larger areas than the DM contours as a result of increased ATMs.

The resulting increases in populations enclosed in the Do-Something contours compared to the DM contours are a result of increased ATMs:

- *>25 dB: An increase of 72,000 (from 150,500 to 222,500)*
- *>50 dB: A change from <50 to 2600*

Figure 4.87 : 2040 Do-Minimum Heathrow Airport N60 Contours

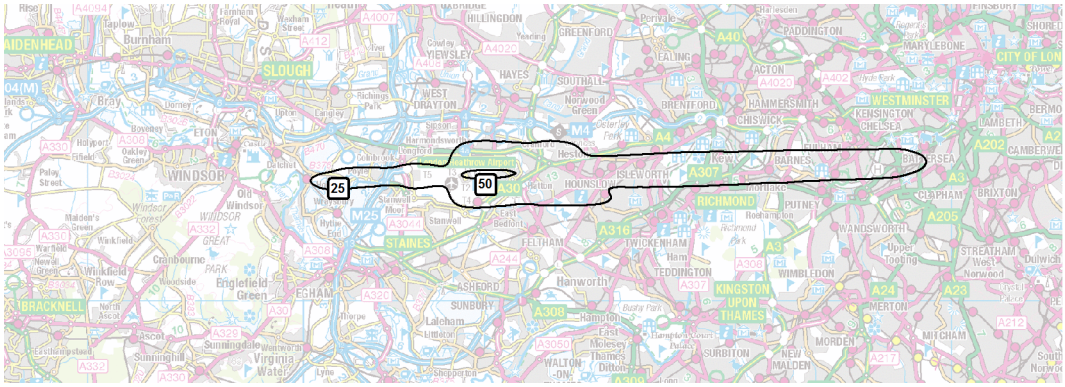
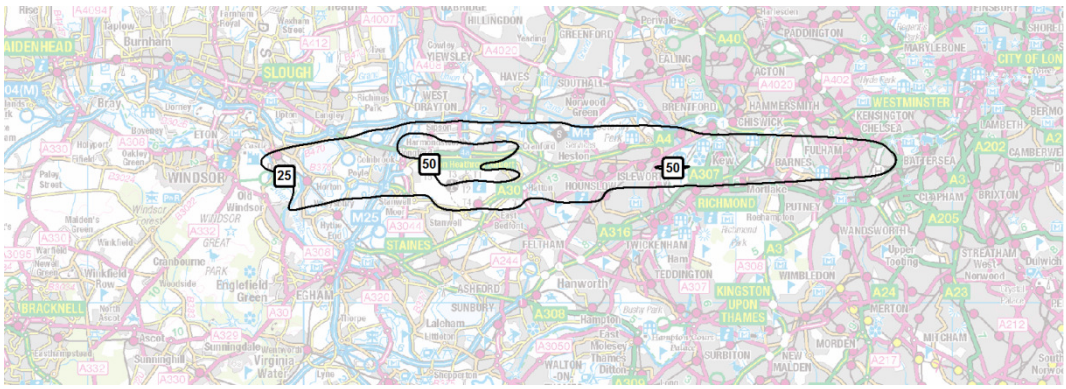


Figure 4.88 : 2040 Heathrow-NWR-N Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 5.61 below.

Table *4.61* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-N, N60

Contour	Area (km2)	Population	Households
>25	34.5	70,300	28,300
>50	7.6	<50 to 5800	<50 to 2100
>100	0 to	0 to	0 to
>200	0 to	0 to	0 to
>500	0 to	0 to	0 to

Note: Numbers in parentheses represent reductions

The Do-Something >25 contour does not extend as far west from Heathrow Airport as in the DM scenario, but is wider in the north-south axis, and covers a greater area. The two >50 contours seen in the 2030 Do-Something scenario join up in the 2040 Do-Something scenario, and the area of the resulting contour is greater than the DM contour.

The resulting increases in areas and populations enclosed in the Do-Something contours compared to the DM contours are a result of increased ATMs:

- *>25 dB: An increase of 70,300 (from 258,300 to 328,600)*
- *>50 dB: A change from <50 to 5800*

Figure 4.89 : 2050 Do-Minimum Heathrow Airport N60 Contours

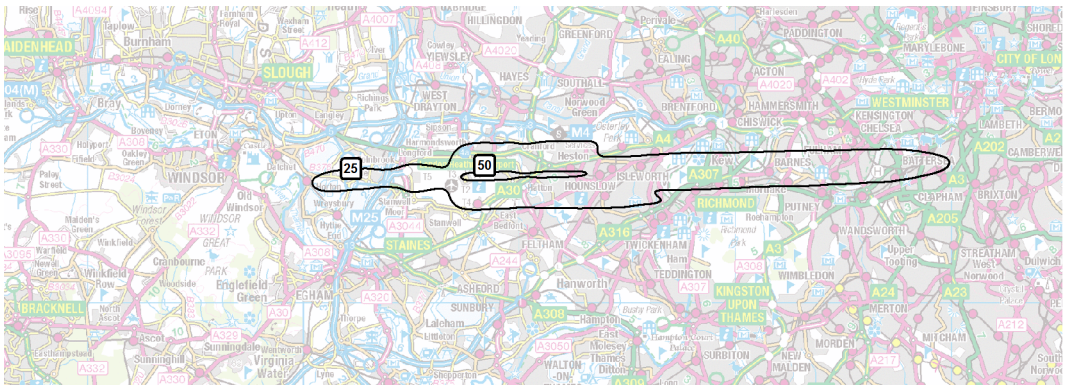
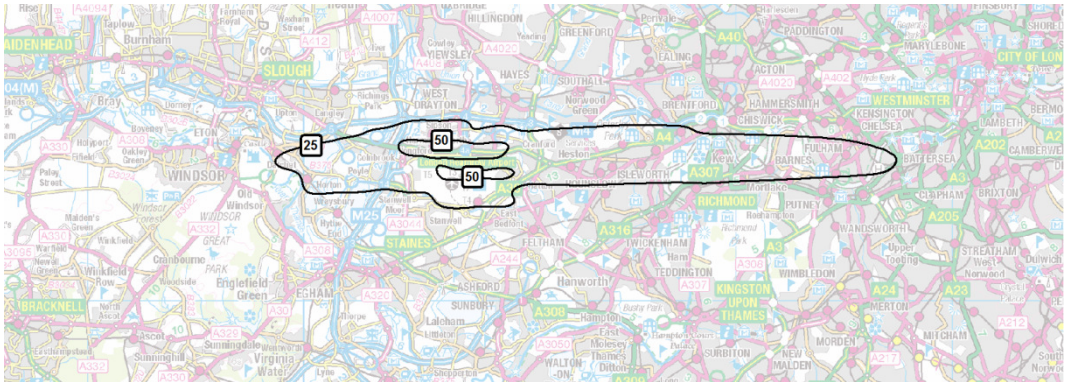


Figure 4.90 : 2050 Heathrow-NWR-N Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 6.62 below.

Table 4.62 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-N, N60

Contour	Area (km2)	Population	Households
>25	17.8	(26,700)	(12,000)
>50	3.6	(3,100)	(1,400)
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

In the 2050 Do-Something scenario, the contours are greater in area than the DM contours as a result of increased ATMs. However, the Do-Something contours do not extend as far west over densely populated parts of London as the DM contour, and the areas to the north and south of the DM contours that they occupy are not as densely populated. The net result is a smaller population within the Do-Something contours than the DM contours:

- *>25 dB: A reduction of 26,700 (from 320,700 to 294,000)*
- *>50 dB: A reduction of 3,100 (from 6,500 to 3,400)*

4.11.3 24-Hour Metric

Figure *4.91* : 2030 Do-Minimum Heathrow Airport L_{den} Contours

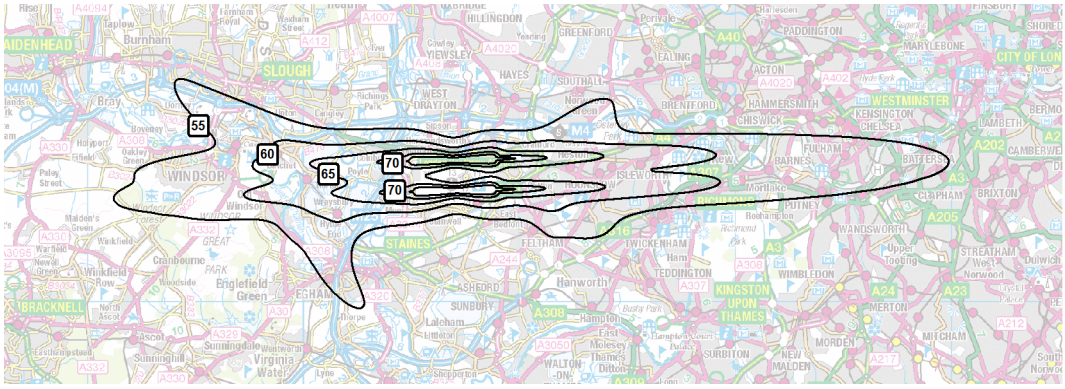
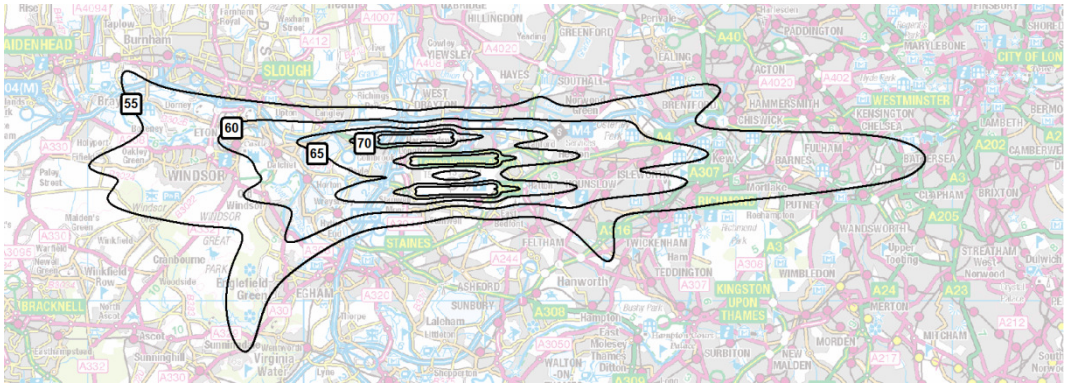


Figure *4.92* : 2030 Heathrow-NWR-N Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 5.63 below.

Table *4.63* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-N, L_{den}

Contour	Area (km²)	Population	Households
>55	43.2	61,000	21,700
>60	22.0	22,000	8,100
>65	9.1	600	0
>70	3.0	(2,100)	(700)
>75	1.8	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In the 2030 Do-Something scenario, the areas of the contours are larger than in the DM scenario, due to expected growth in ATMs.

In most cases, the increased contour areas enclose greater populations, as a result of increased ATMs despite the forecast improvements in aircraft technology and the use of noise preferential routes. However, the population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

For the comparison of the 2030 Do-Something with the 2030 DM situations, the following differences are predicted:

- >55 dB: An increase of 61,000 (from 580,500 to 641,500)
- >60 dB: An increase of 22,000 (from 169,600 to 191,600)
- >65 dB: An increase of 600 (from 34,800 to 35,400)
- >70 dB: A reduction of 2,100 (from 3,000 to 900)
- >75 dB: No discernible difference (from <50 to <50)

For the Heathrow Northwest Runway 'Minimise New' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2030 Do-Something scenario compared to the 2030 DM scenario is 123,300, and the number of people newly removed is 61,200. This results in a net increase in the number of people newly affected of 62,100.

Figure *4.93* : 2040 Do-Minimum Heathrow Airport L_{den} Contours

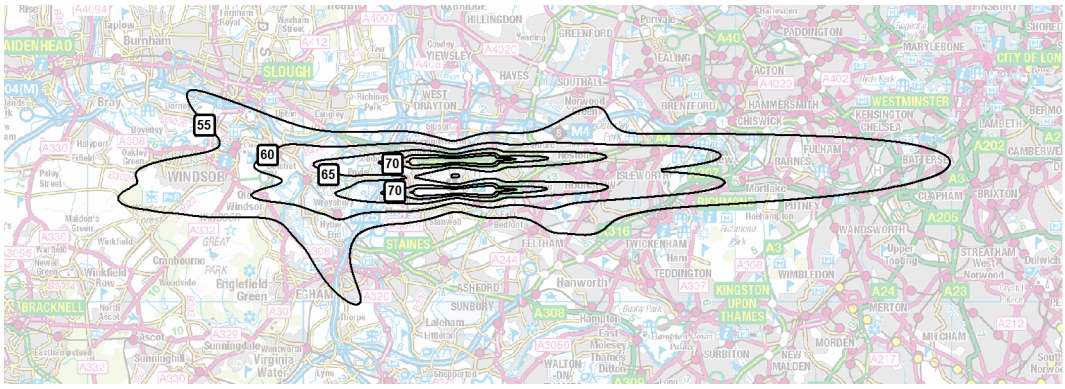
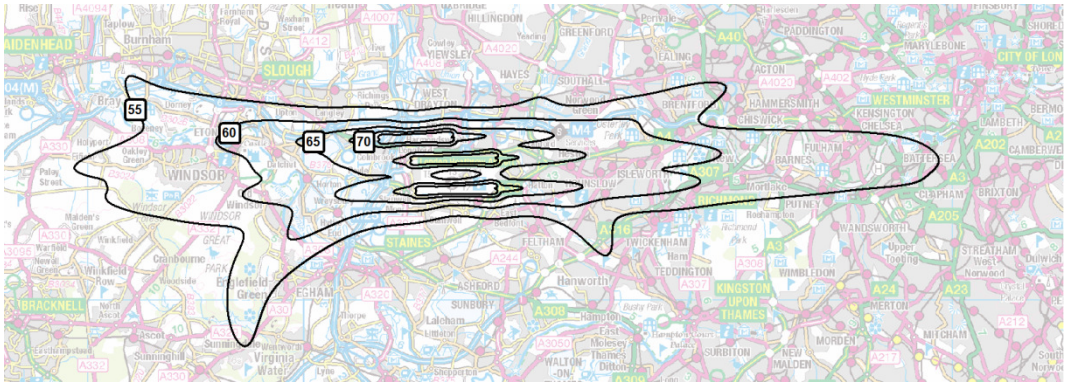


Figure *4.94* : 2040 Heathrow-NWR-N Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.64 below.

Table *4.64* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-N, L_{den}

Contour	Area (km²)	Population	Households
>55	53.7	113,600	43,900
>60	26.1	30,300	11,500
>65	11.8	4,900	1,500
>70	3.5	(2,100)	(800)
>75	2.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In the 2040 Do-Something scenario, the areas of the contours are larger than in the DM scenario, due to expected growth in ATMs.

In most cases, the increased contour areas enclose greater populations, as a result of increased ATMs despite the forecast improvements in aircraft technology and the use of noise preferential routes. However, the population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

For the comparison of the 2040 Do-Something with the 2040 DM situations, the following differences are predicted:

- >55 dB: An increase of 113,600 (from 588,900 to 702,500)
- >60 dB: An increase of 30,300 (from 179,500 to 209,800)
- >65 dB: An increase of 4,900 (from 36,200 to 41,100)
- >70 dB: A reduction of 2,100 (from 3,100 to 1,000)
- >75 dB: No discernible difference (from <50 to <50)

For the Heathrow Northwest Runway 'Minimise New' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2040 Do-Something scenario compared to the 2040 DM scenario is 146,700, and the number of people newly removed is 31,900. This results in a net increase in the number of people newly affected of 114,800.

Figure *4.95* : 2050 Do-Minimum Heathrow Airport L_{den} Contours

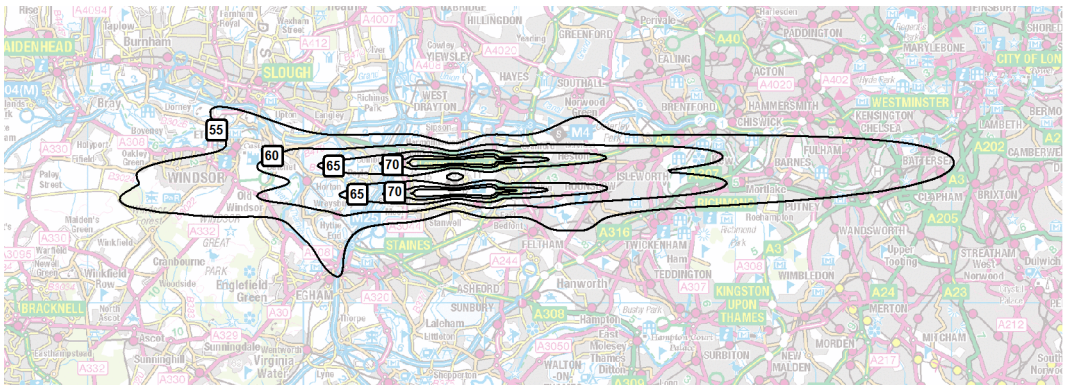
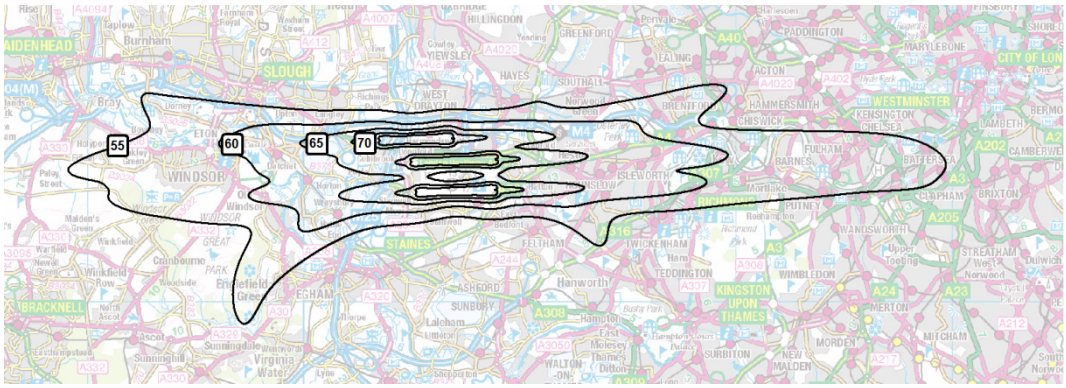


Figure *4.96* : 2050 Heathrow-NWR-N Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.65 below.

Table *4.65* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-N, L_{den}

Contour	Area (km²)	Population	Households
>55	55.4	143,100	56,800
>60	26.2	36,200	14,300
>65	12.0	6,300	2,100
>70	3.5	(2,100)	(800)
>75	2.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

In the 2050 Do-Something scenario, the areas of the contours are larger than in the DM scenario, due to expected growth in ATMs.

In most cases, the increased contour areas enclose greater populations, as a result of increased ATMs despite the forecast improvements in aircraft technology and the use of noise preferential routes. However, the population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

For the comparison of the 2050 Do-Something with the 2050 DM situations, the following differences are predicted:

- *>55 dB: An increase of 143,100 (from 583,500 to 726,600)*
- *>60 dB: An increase of 36,200 (from 182,100 to 218,300)*
- *>65 dB: An increase of 6,300 (from 36,400 to 42,700)*
- *>70 dB: A reduction of 2,100 (from 3,100 to 1,000)*
- *>75 dB: No discernible difference (from <50 to <50)*

For the Heathrow Northwest Runway 'Minimise New' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2050 Do-Something scenario compared to the 2050 DM scenario is 157,900, and the number of people newly removed is 14,100. This results in a net increase in the number of people newly affected of 143,800.

4.11.4 Sensitive Buildings

The change in number of sensitive buildings within each contour between the 2030 DM and 2030 Heathrow-NWR-N scenarios are set out in Table 4.66 below:

Table 4.66 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-N, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(113)	0	(50)	N70 >20	(90)	(3)	(50)
	>57 dB $L_{Aeq,16h}$	(32)	(2)	(17)	N70 >50	(35)	(2)	(22)
	>60 dB $L_{Aeq,16h}$	(7)	1	(9)	N70 >100	3	0	1
	>63 dB $L_{Aeq,16h}$	(2)	0	(5)	N70 >200	(2)	0	(2)
	>66 dB $L_{Aeq,16h}$	(3)	0	1	N70 >500	0	0	1
	>69 dB $L_{Aeq,16h}$	0	0	2		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(134)	(1)	(72)	N60 >25	(117)	1	(61)
	>51 dB $L_{Aeq,8h}$	(28)	0	(29)	N60 >50	(1)	0	1
	>54 dB $L_{Aeq,8h}$	(29)	0	(16)	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	(1)	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}	(164)	(8)	(100)				
	>60 dB L_{den}	(26)	(1)	(17)				
	>65 dB L_{den}	(9)	0	(3)				
	>70 dB L_{den}	0	0	1				
	>75 dB L_{den}	0	0	0				

The change in number of sensitive buildings within each contour between the 2040 DM and 2040 Heathrow-NWR-N scenarios are set out in Table 4.67 below:

Table 4.67 : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-N, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	97	2	60	N70 >20	12	0	7
	>57 dB $L_{Aeq,16h}$	31	1	28	N70 >50	12	0	5
	>60 dB $L_{Aeq,16h}$	28	1	14	N70 >100	15	0	8
	>63 dB $L_{Aeq,16h}$	1	0	1	N70 >200	9	0	3
	>66 dB $L_{Aeq,16h}$	3	0	5	N70 >500	2	0	2
	>69 dB $L_{Aeq,16h}$	1	0	3		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	34	2	27	N60 >25	37	2	36
	>51 dB $L_{Aeq,8h}$	9	1	6	N60 >50	0	1	0
	>54 dB $L_{Aeq,8h}$	8	0	0	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(3)	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}	71	4	42				
	>60 dB L_{den}	26	1	15				
	>65 dB L_{den}	2	0	2				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

The change in number of sensitive buildings within each contour between the 2050 DM and 2050 Heathrow-NWR-N scenarios are set out in Table 4.68 below:

Table 4.68 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-N, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	108	2	66	N70 >20	12	0	10
	>57 dB $L_{Aeq,16h}$	26	1	29	N70 >50	10	0	9
	>60 dB $L_{Aeq,16h}$	27	0	15	N70 >100	13	(1)	7
	>63 dB $L_{Aeq,16h}$	1	0	2	N70 >200	15	0	5
	>66 dB $L_{Aeq,16h}$	4	0	4	N70 >500	2	0	2
	>69 dB $L_{Aeq,16h}$	1	0	2		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(4)	2	5	N60 >25	(3)	1	12
	>51 dB $L_{Aeq,8h}$	(3)	0	0	N60 >50	(2)	0	0
	>54 dB $L_{Aeq,8h}$	(2)	0	(5)	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(4)	0	(1)	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	(1)	0	(1)	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}	88	5	51				
	>60 dB L_{den}	26	1	16				
	>65 dB L_{den}	4	0	3				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

4.12 Scorecards for 'Respite' Option (Heathrow-NWR-R)

Noise metrics have been produced for the Heathrow-NWR-R scenarios at Heathrow Airport for 2030, 2040 and 2050, and are presented below.

Table 4.69 : 2030 Heathrow-NWR-R Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	440,900			N70 >20	304,800
	>57 dB LAeq,16h	234,800			N70 >50	186,300
	>60 dB LAeq,16h	131,100			N70 >100	138,100
	>63 dB LAeq,16h	38,600			N70 >200	67,000
	>66 dB LAeq,16h	11,900			N70 >500	200
	>69 dB LAeq,16h	900				
	>72 dB LAeq,16h	<50				
Night	>48 dB LAeq,8h	272,600			N60 >25	141,200
	>51 dB LAeq,8h	173,000			N60 >50	2,600
	>54 dB LAeq,8h	73,400			N60 >100	0
	>57 dB LAeq,8h	11,600			N60 >200	0
	>60 dB LAeq,8h	900			N60 >500	0
	>63 dB LAeq,8h	200				
	>66 dB LAeq,8h	<50				
	>69 dB LAeq,8h	<50				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	482,800		
			>60 dB L_{den}	191,400		
			>65 dB L_{den}	35,800		
			>70 dB L_{den}	900		
			>75 dB L_{den}	<50		

Table 4.70 : 2040 Heathrow-NWR-R Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	455,700			N70 >20	297,400
	>57 dB LAeq,16h	243,200			N70 >50	192,500
	>60 dB LAeq,16h	141,200			N70 >100	146,700
	>63 dB LAeq,16h	42,100			N70 >200	77,800
	>66 dB LAeq,16h	11,900			N70 >500	1,400
	>69 dB LAeq,16h	900				
	>72 dB LAeq,16h	<50				
Night	>48 dB LAeq,8h	308,900			N60 >25	194,200
	>51 dB LAeq,8h	190,600			N60 >50	5,400
	>54 dB LAeq,8h	97,200			N60 >100	0
	>57 dB LAeq,8h	18,300			N60 >200	0
	>60 dB LAeq,8h	2,400			N60 >500	0
	>63 dB LAeq,8h	200				
	>66 dB LAeq,8h	<50				
	>69 dB LAeq,8h	<50				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	515,200		
			>60 dB L_{den}	205,900		
			>65 dB L_{den}	42,300		
			>70 dB L_{den}	1,000		
			>75 dB L_{den}	<50		

Table 4.71 : 2050 Heathrow-NWR-R Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	454,700			N70 >20	280,100
	>57 dB LAeq,16h	242,200			N70 >50	196,800
	>60 dB LAeq,16h	145,800			N70 >100	155,300
	>63 dB LAeq,16h	43,300			N70 >200	101,800
	>66 dB LAeq,16h	11,200			N70 >500	2,000
	>69 dB LAeq,16h	800				
	>72 dB LAeq,16h	<50				
Night	>48 dB LAeq,8h	297,400			N60 >25	165,100
	>51 dB LAeq,8h	189,600			N60 >50	3,400
	>54 dB LAeq,8h	89,700			N60 >100	0
	>57 dB LAeq,8h	12,500			N60 >200	0
	>60 dB LAeq,8h	900			N60 >500	0
	>63 dB LAeq,8h	200				
	>66 dB LAeq,8h	<50				
	>69 dB LAeq,8h	<50				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	516,700		
			>60 dB L_{den}	210,100		
			>65 dB L_{den}	43,100		
			>70 dB L_{den}	1,000		
			>75 dB L_{den}	<50		

4.13 Assessment of 'Respite' Option (Heathrow-NWR-R)

The predicted differences between the equivalent year DM and Heathrow-NWR-R scenarios for each noise metric are considered in detail below. The ATMs used in the noise modelling of these two scenarios are set out in Table 4.72 below.

Table 4.72 : Heathrow Airport – 'Respite' Option ATMs

	Air Transport Movements		
	2030	2040	2050
Heathrow DM	483,856	484,517	471,132
Heathrow Heathrow-NWR-R	652,216	740,000	740,000

4.13.1 Day Metrics

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

Figure *4.97* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

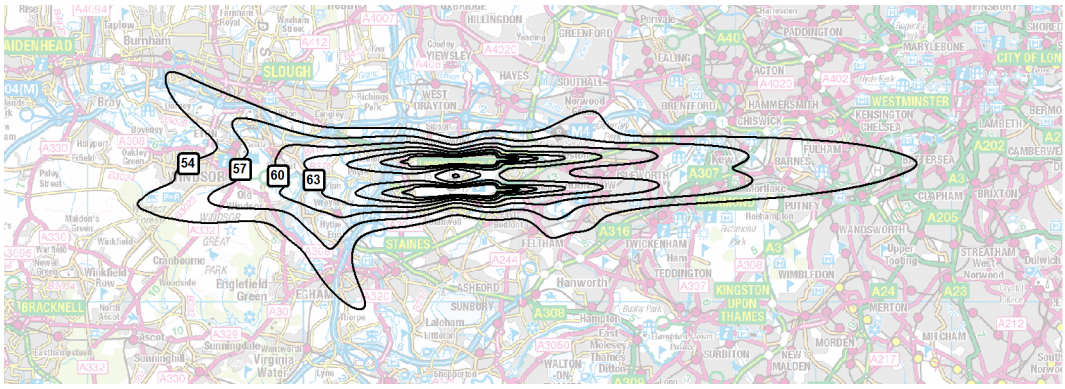
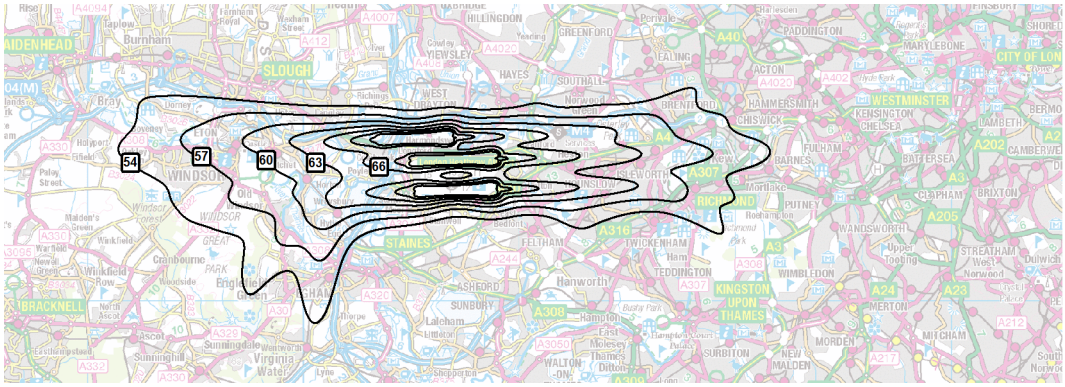


Figure *4.98* : 2030 Heathrow-NWR-R Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.73 below.

Table *4.73* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-R, $L_{Aeq,16h}$

Contour	Area (km^2)	Population	Households
>54	23.2	(52,700)	(27,700)
>57	21.9	13,600	3,700
>60	17.6	22,100	8,800
>63	9.9	3,400	1,200
>66	5.8	4,000	1,300
>69	2.8	(1,200)	(500)
>72	2.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The effect of the 'respite' routes on the Do-Something contours is clearly evident, with a significant reduction in extent along the east-west axis, but increase in extent along the north-south axis compared to the DM contours. The 'respite' routes also result in greater spread at the east and west extent of the contours, particularly to the south west.

In all cases, the Do-Something contours are larger in area than the DM contours. However as a result of the 'respite' routes overflying less populous areas at distance from the airport, there will be fewer people enclosed within the >54 dB Do-Something contour in comparison the DM contour.

There will also be a smaller population within the >69 dB Do-Something contour than the corresponding DM contour; this is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- >54 dB: A reduction of 52,700 (from 493,600 to 440,900)
- >57 dB: An increase of 13,600 (from 221,200 to 234,800)
- >60 dB: An increase of 22,100 (from 109,000 to 131,100)
- >63 dB: An increase of 3,400 (from 35,200 to 38,600)
- >66 dB: An increase of 4,000 (from 7,900 to 11,900)
- >69 dB: A reduction of 1,200 (from 2,100 to 900)
- >72 dB: No discernible difference (from <50 to <50)

For the Heathrow Northwest Runway 'Respite' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2030 Do-Something scenario compared to the 2030 DM scenario is 52,400, and the number of people newly removed is 39,400. This results in a net increase in the number of people newly affected of 13,000.

Figure *4.99* : 2040 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

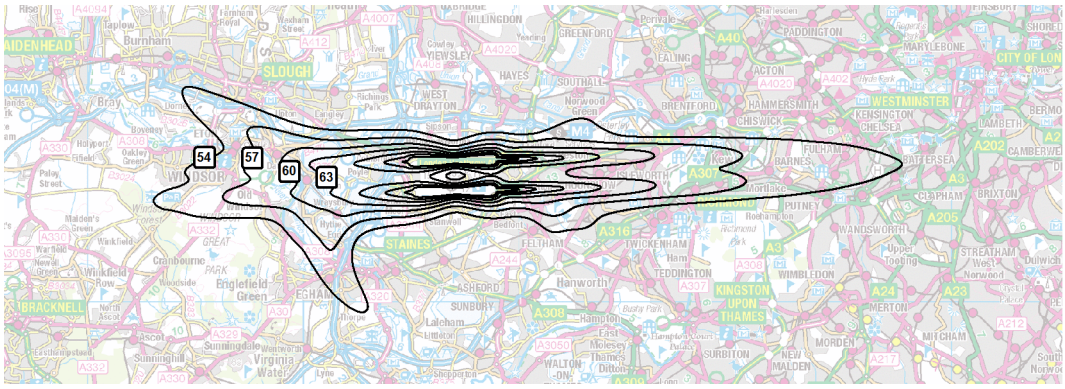
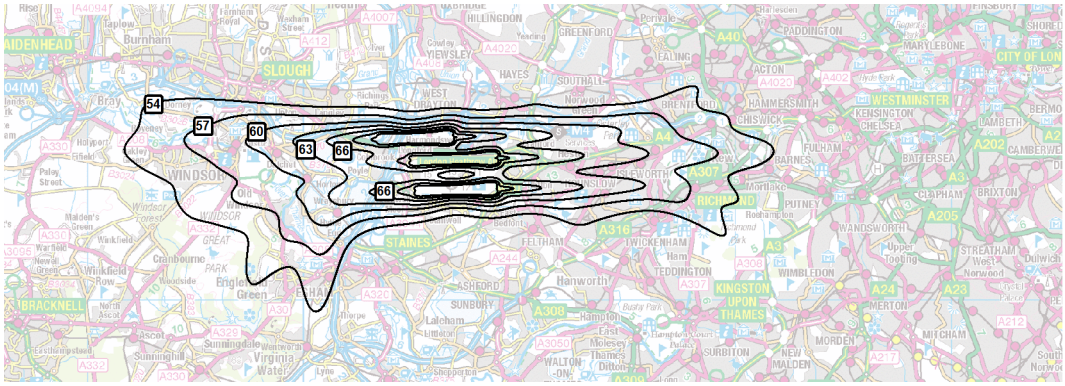


Figure *4.100* : 2040 Heathrow-NWR-R Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.74 below.

Table *4.74* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-R, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	29.5	(4,900)	(8,400)
>57	25.8	23,800	7,900
>60	19.9	37,400	14,700
>63	11.2	8,200	2,900
>66	6.2	4,800	1,700
>69	3.0	(1,200)	(500)
>72	2.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The effect of the 'respite' routes on the Do-Something contours is clearly evident, with a significant reduction in extent along the east-west axis, but increase in extent along the north-south axis compared to the DM contours. The 'respite' routes also result in greater spread at the east and west extent of the contours.

In all cases, the Do-Something contours are larger in area than the DM contours. However as a result of the 'respite' routes overflying less populous areas at distance from the airport, there will be fewer people enclosed within the >54 dB Do-Something contour in comparison the DM contour. There will also be a smaller population within the >69 dB Do-Something contour than the corresponding DM contour; this is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further

east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- >54 dB: A reduction of 4,900 (from 460,600 to 455,700)
- >57 dB: An increase of 23,800 (from 219,400 to 243,200)
- >60 dB: An increase of 37,400 (from 103,800 to 141,200)
- >63 dB: An increase of 8,200 (from 33,900 to 42,100)
- >66 dB: An increase of 4,800 (from 7,100 to 11,900)
- >69 dB: A reduction of 1,200 (from 2,100 to 900)
- >72 dB: No discernible difference (from <50 to <50)

For the Heathrow Northwest Runway 'Respite' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2040 Do-Something scenario compared to the 2040 DM scenario is 56,600, and the number of people newly removed is 33,100. This results in a net increase in the number of people newly affected of 23,500.

Figure *4.101* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

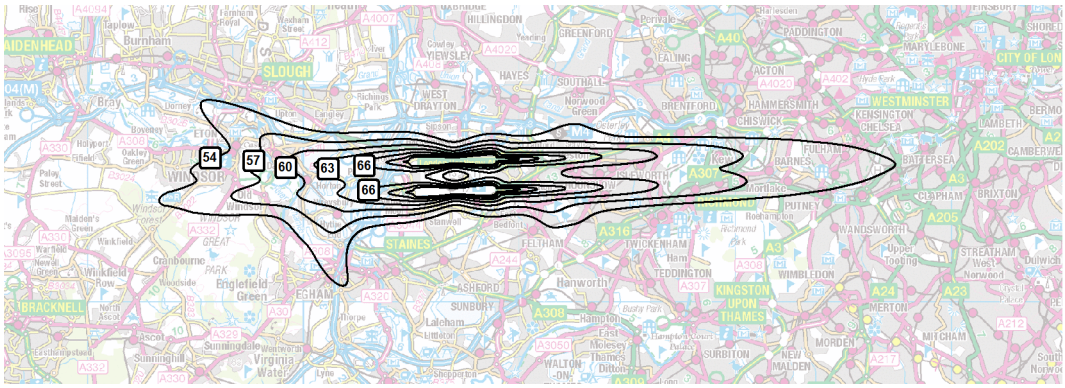
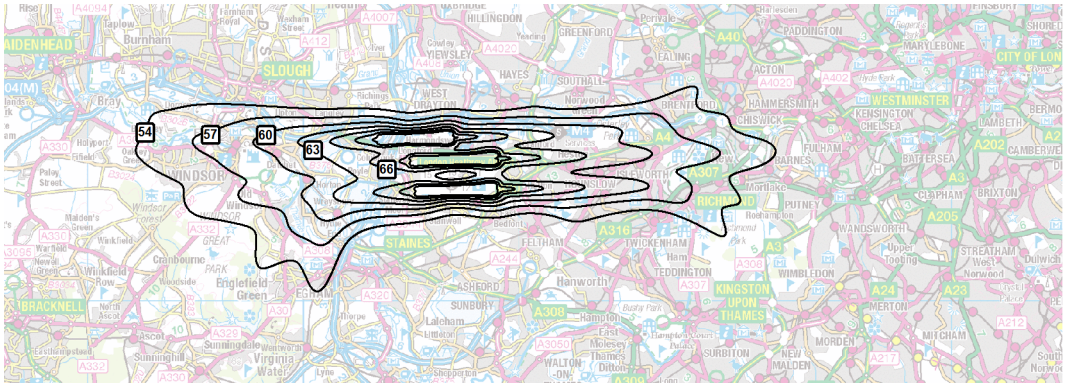


Figure *4.102* : 2050 Heathrow-NWR-R Heathrow Airport N $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.75 below.

Table *4.75* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-R, $L_{Aeq,16h}$

Contour	Area (km^2)	Population	Households
>54	31.1	18,900	1,500
>57	26.2	22,600	7,200
>60	20.0	42,000	16,600
>63	11.5	8,400	3,100
>66	6.5	3,500	1,200
>69	3.2	(1,300)	(500)
>72	2.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The effect of the 'respite' routes on the Do-Something contours is clearly evident, with a significant reduction in extent along the east-west axis, but increase in extent along the north-south axis compared to the DM contours. The 'respite' routes also result in greater spread at the east and west extent of the contours.

In all cases, the Do-Something contours are larger in area than the DM contours as a result of increased ATMs. Greater populations fall within most of the Do-Something contours compared to the equivalent DM contours, with the exception of the >69 dB contour. The >69 dB Do-Something contour contains fewer people than the DM equivalent because with aircraft movements split over three runways, there are three >69 dB Do-Something contours, each limited to the area immediately around each runway. Together these three contours enclose fewer people than the DM contours which extend further west of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

In summary, the differences in population included in the 2050 Do-Something contours compared with the 2050 DM contours are as follows:

- >54 dB: An increase of 18,900 (from 435,800 to 454,700)
- >57 dB: An increase of 22,600 (from 219,600 to 242,200)
- >60 dB: An increase of 42,000 (from 103,800 to 145,800)
- >63 dB: An increase of 8,400 (from 34,900 to 43,300)
- >66 dB: An increase of 3,500 (from 7,700 to 11,200)
- >69 dB: A reduction of 1,300 (from 2,100 to 800)
- >72 dB: No discernible difference (from <50 to <50)

For the Heathrow Northwest Runway 'Respite' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2050 Do-Something scenario compared to the 2050 DM scenario is 55,400, and the number of people newly removed is 32,400. This results in a net increase in the number of people newly affected of 23,100.

(b) N70 Supplementary Metric

Figure 4.103 : 2030 Do-Minimum Heathrow Airport N70 Contours

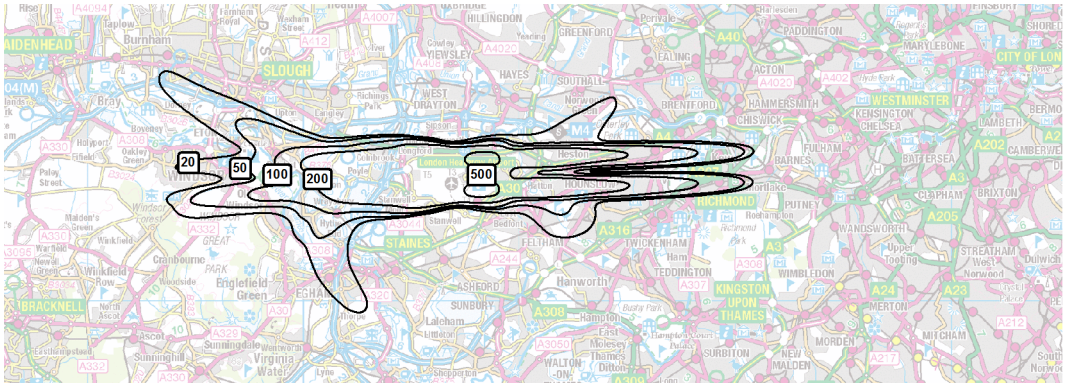
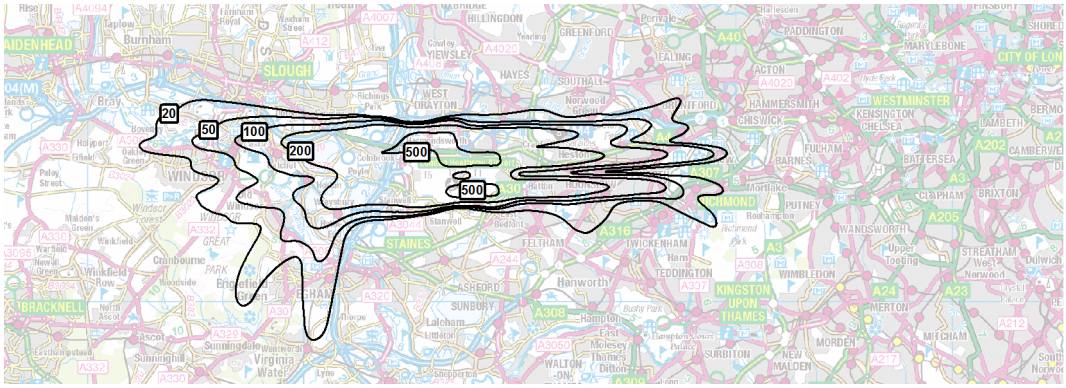


Figure 4.104 : 2030 Heathrow-NWR-R Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in *Table 4.76* below.

Table 4.76 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-R, N70

Contour	Area (km²)	Population	Households
>20	23.8	13,000	4,500
>50	15.2	2,200	(600)
>100	13.5	15,500	6,200
>200	9.7	3,700	1,500
>500	3.5	<50 to 200	<50 to 100

Note: Numbers in parentheses represent reductions

As a result of the 'respite' routes and the effect of the third runway wider spacing, the Do-Something N70 noise contours differ considerably in shape from the DM contours, with much greater spread to the south west, an absence of the north west 'horn', and increased spread to the east in response to the increased number of routes. Overall, the two sets of contours are similar in length along the east-west axis, but the Do-Something contours are wider in the north-south axis.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are greater for the Do-Something contours.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- >20: An increase of 13,000 (from 291,800 to 304,800)
- >50: An increase of 2,200 (from 184,100 to 186,300)
- >100: An increase of 15,500 (from 122,600 to 138,100)
- >200: An increase of 3,700 (from 63,300 to 67,000)
- >500: A change from <50 to 200

Figure 4.105 : 2040 Do-Minimum Heathrow Airport N70 Contours

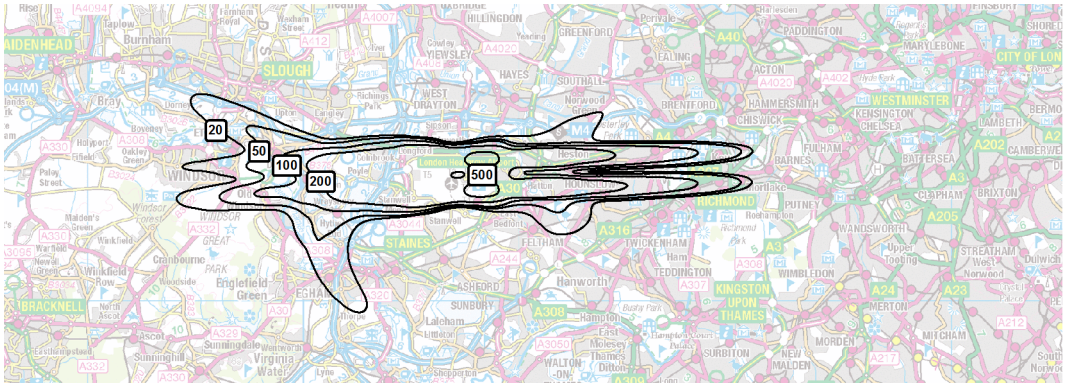
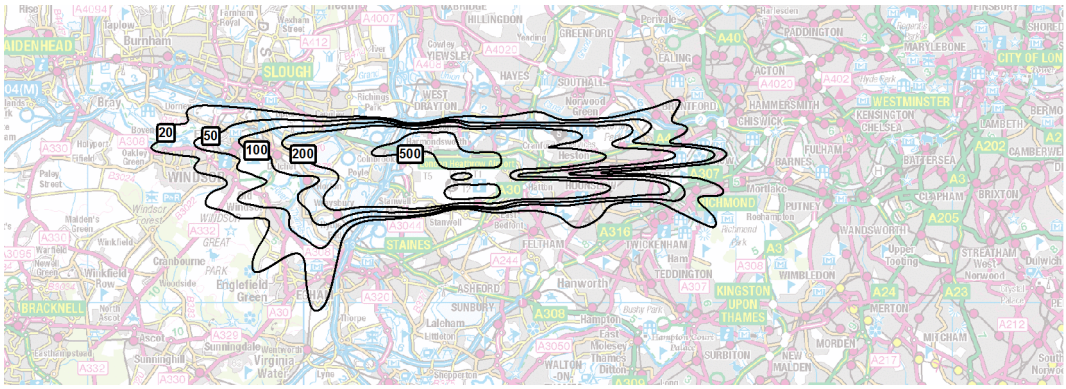


Figure 4.106 : 2040 Heathrow-NWR-R Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.77 below.

Table 4.77 : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-R, N70

Contour	Area (km²)	Population	Households
>20	21.3	19,100	6,700
>50	16.9	4,600	500
>100	14.9	22,000	8,900
>200	12.1	15,600	5,900
>500	4.8	<50 to 1400	<50 to 500

Note: Numbers in parentheses represent reductions

As a result of the 'respite' routes and the effect of the third runway wider spacing, the Do-Something N70 noise contours differ considerably in shape from the DM contours, with much greater spread to the south west, an absence of the north west 'horn', and increased spread to the east in response to the increased number of

routes. Overall, the two sets of contours are similar in length along the east-west axis, but the Do-Something contours are wider in the north-south axis.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are greater for the Do-Something contours.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- >20: An increase of 19,100 (from 278,300 to 297,400)
- >50: An increase of 4,600 (from 187,900 to 192,500)
- >100: An increase of 22,000 (from 124,700 to 146,700)
- >200: An increase of 15,600 (from 62,200 to 77,800)
- >500: An increase from <50 to 1400

Figure 4.107 : 2050 Do-Minimum Heathrow Airport N70 Contours

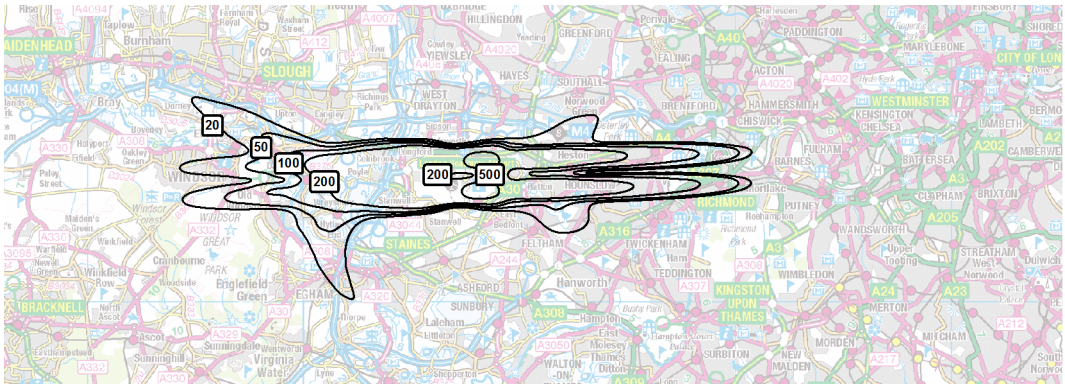
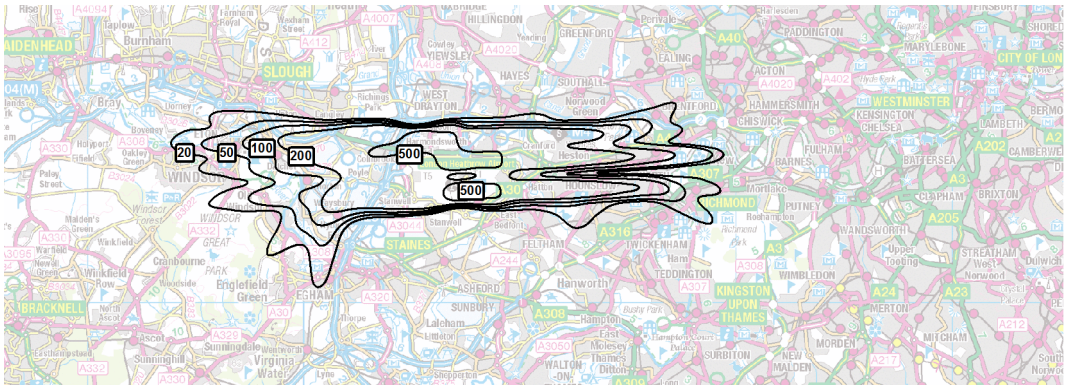


Figure 4.108 : 2050 Heathrow-NWR-R Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.78 below.

Table 4.78 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-R, N70

Contour	Area (km^2)	Population	Households
>20	16.6	6,000	1,500
>50	17.5	7,300	2,000
>100	16.1	25,900	10,400
>200	14.4	30,600	11,800
>500	5.2	<50 to 2000	<50 to 700

Note: Numbers in parentheses represent reductions

As a result of the 'respite' routes and the effect of the third runway wider spacing, the Do-Something N70 noise contours differ considerably in shape from the DM contours, with much greater spread to the south west, an absence of the north west 'horn', and increased spread to the east in response to the increased number of routes. Overall, the two sets of contours are similar in length along the east-west axis, but the Do-Something contours are wider in the north-south axis.

All of the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs, and this is reflected in the populations enclosed which are greater for the Do-Something contours.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- >20: An increase of 19,100 (from 278,300 to 297,400)
- >50: An increase of 4,600 (from 187,900 to 192,500)
- >100: An increase of 22,000 (from 124,700 to 146,700)
- >200: An increase of 15,600 (from 62,200 to 77,800)
- >500: An increase from <50 to 1400

4.13.2

4.13.3 Night Metrics

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

Figure *4.109* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

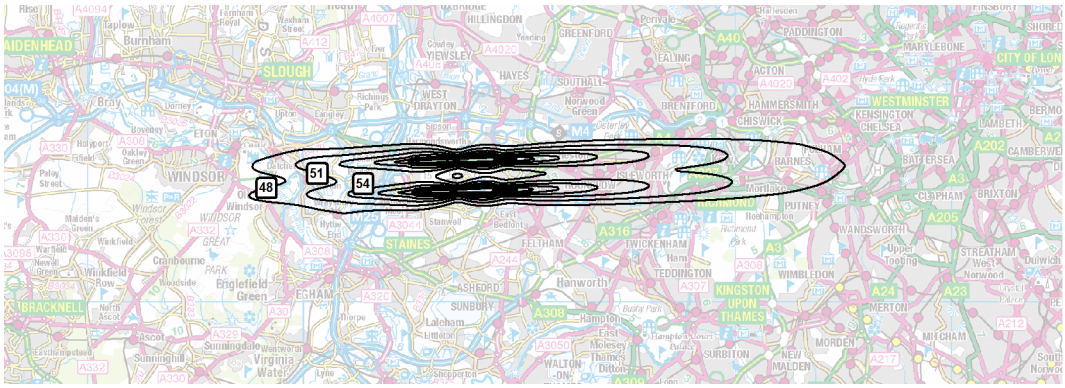
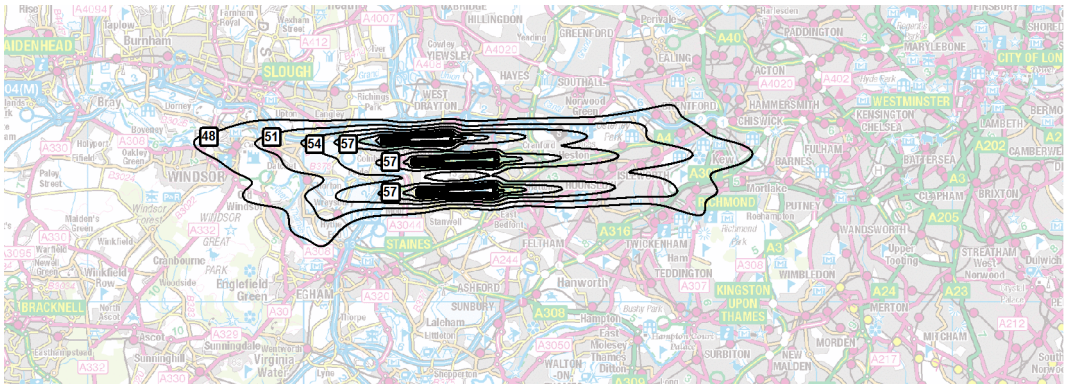


Figure *4.110* : 2030 Heathrow-NWR-R Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.79 below.

Table *4.79* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-R, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	27.5	1,400	(3,200)
>51	21.3	21,700	7,600
>54	16.2	12,300	4,700
>57	6.8	(10,300)	(3,900)
>60	3.4	(3,000)	(1,100)
>63	2.3	(1,100)	(400)
>66	1.6	<50 to <50	<50 to <50
>69	0.9	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

For the >48 to >54 dB contours, the increased areas of the Do-Something contours encapsulate greater populations than the DM contours, primarily because these contours extend further north and west to include parts of Brands Hill, Brentford, Datchet, Heston, Langley and North Hyde, in the Do-Something scenario. However

for the >57, >60 and >63 dB contours there are fewer people within the Do-Something contours than the DM contours. This is because the Do-Something contours do not extend as far east from the existing runways over densely populated areas, and the area covered by these contours around proposed north west runway are less populous.

For the comparison of the 2030 Do-Something with the 2030 DM situations, the following differences are predicted:

- >48 dB: An increase of 1,400 (from 271,200 to 272,600)
- >51 dB: An increase of 21,700 (from 151,300 to 173,000)
- >54 dB: An increase of 12,300 (from 61,100 to 73,400)
- >57 dB: A reduction of 10,300 (from 21,900 to 11,600)
- >60 dB: A reduction of 3,000 (from 3,900 to 900)
- >63 dB: A reduction of 1,100 (from 1,300 to 200)
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

Figure *4.111* : 2040 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

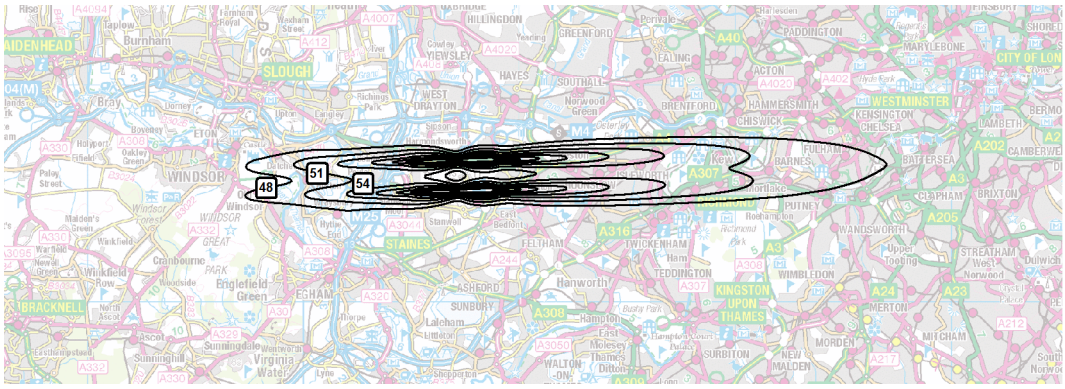
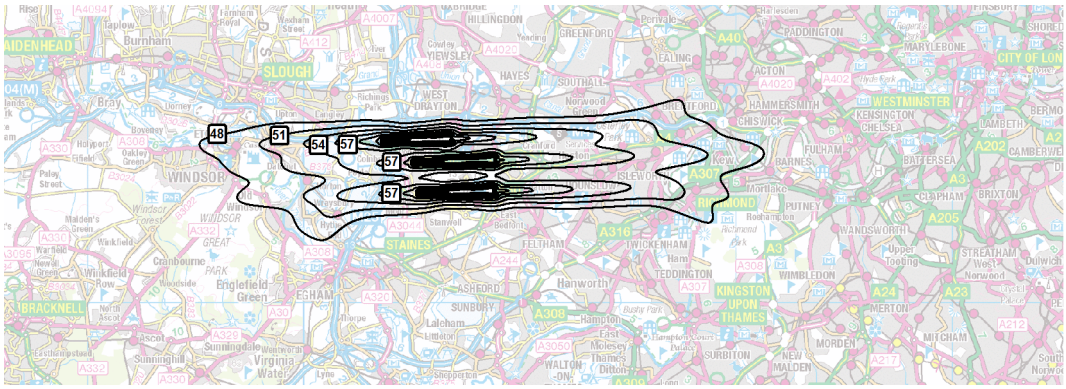


Figure *4.112* : 2040 Heathrow-NWR-R Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.80 below.

Table *4.80* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-R, $L_{Aeq,8h}$

Contour	Area (km^2)	Population	Households
>48	25.0	(28,100)	(16,700)
>51	21.0	6,000	500
>54	16.9	15,900	6,100
>57	7.0	(13,100)	(5,100)
>60	3.4	(4,000)	(1,600)
>63	2.3	(2,200)	(800)
>66	1.6	<50 to <50	<50 to <50
>69	0.9	<50 to <50	<50 to <50
>72	0.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The shape of the Do-Something contours differs from the DM contours as a result of the 'respite' routes and the effect of the third runway. In all cases the Do-Something contours cover greater extents than the corresponding DM contours due to a greater number of ATMs in the Do-Something scenario.

For the >51 and >54 dB contours, the increased areas of the Do-Something contours encapsulate greater populations than the DM contours, primarily because these contours extend further north and west to include parts of Brands Hill, Brentford, Datchet, Heston, Langley and North Hyde, in the Do-Something scenario.

The smaller populations in the >48, >57, >60 and >63 dB Do-Something contours than the DM contours occur because, despite increases in area, the Do-Something contours cover less populous areas than the corresponding DM contours which extend further west over London.

For the comparison of the 2040 Do-Something with the 2040 DM situations, the following differences are predicted:

- >48 dB: A reduction of 28,100 (from 337,000 to 308,900)
- >51 dB: An increase of 6,000 (from 184,600 to 190,600)
- >54 dB: An increase of 15,900 (from 81,300 to 97,200)
- >57 dB: A reduction of 13,100 (from 31,400 to 18,300)
- >60 dB: A reduction of 4,000 (from 6,400 to 2,400)
- >63 dB: A reduction of 2,200 (from 2,400 to 200)
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

Figure *4.113* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

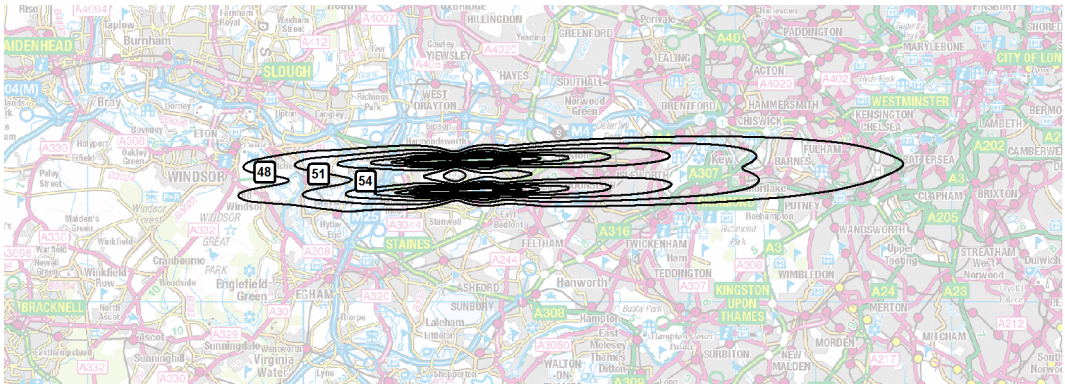
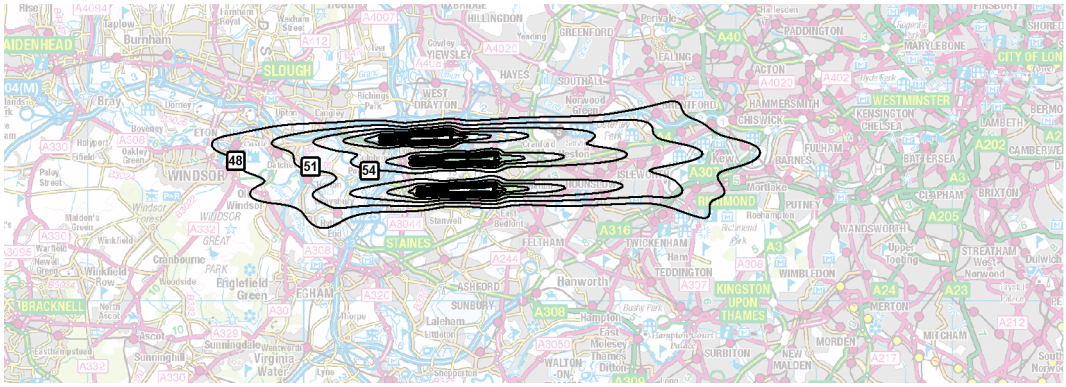


Figure *4.114* : 2050 Heathrow-NWR-R Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.81 below.

Table *4.81* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-R, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	15.0	(75,700)	(36,500)
>51	15.0	(7,800)	(5,100)
>54	11.5	500	100
>57	4.3	(21,400)	(8,300)
>60	2.4	(6,200)	(2,400)
>63	1.8	(2,400)	(800)
>66	1.3	<50 to <50	<50 to <50
>69	0.6	<50 to <50	<50 to <50
>72	0.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The shape of the Do-Something contours differs from the DM contours as a result of the 'respite' routes and the effect of the third runway. In all cases the Do-Something contours cover greater extents than the corresponding DM contours due to a greater number of ATMs in the Do-Something scenario.

The Do-Something >54 dB contour encapsulates a greater population than the DM contour, primarily because this contour extends further north and west in the Do-Something scenario.

The smaller populations in the >48, >51, >57, >60 and >63 dB Do-Something contours than the DM contours occur because, despite increases in area, the Do-Something contours cover less populous areas than the corresponding DM contours which extend further west over London.

For the comparison of the 2050 Do-Something with the 2050 DM situations, the following differences are predicted:

- >48 dB: A reduction of 75,700 (from 373,100 to 297,400)
- >51 dB: A reduction of 7,800 (from 197,400 to 189,600)
- >54 dB: An increase of 500 (from 89,200 to 89,700)
- >57 dB: A reduction of 21,400 (from 33,900 to 12,500)
- >60 dB: A reduction of 6,200 (from 7,100 to 900)
- >63 dB: A reduction of 2,400 (from 2,600 to 200)
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

(b) N60 Supplementary Metric

Figure 4.115 : 2030 Do-Minimum Heathrow Airport N60 Contours

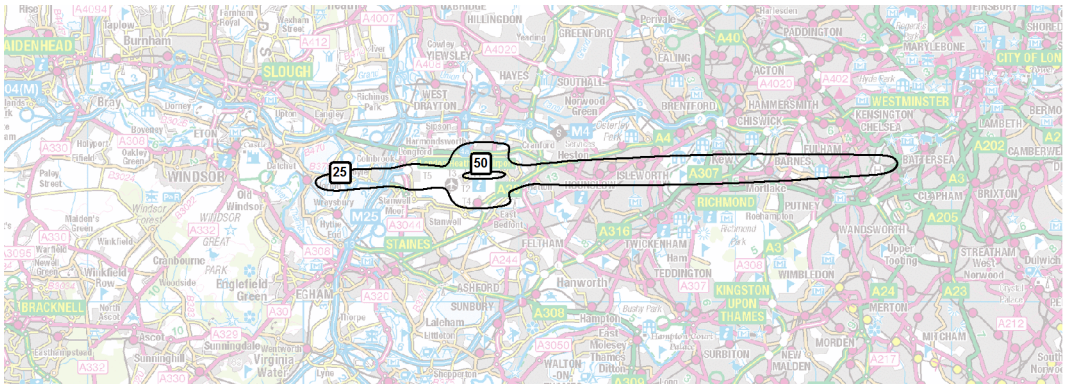
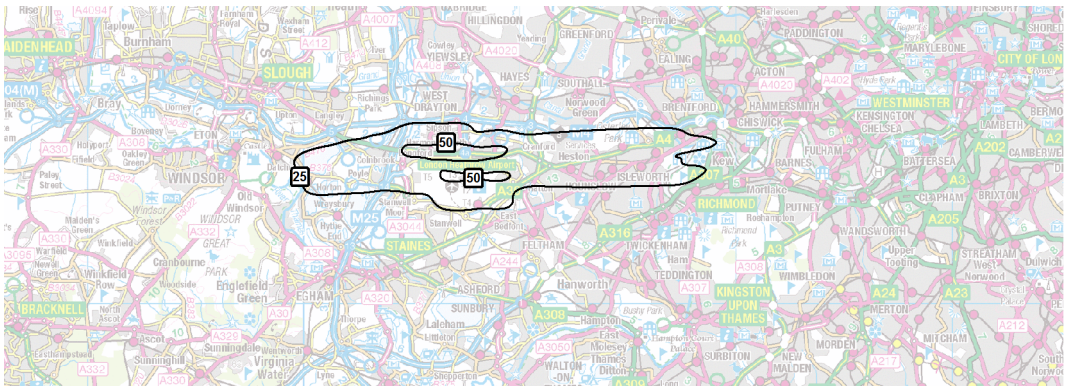


Figure 4.116 : 2030 Heathrow-NWR-R Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table *4.82* below.

Table 4.82 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-R, N60

Contour	Area (km^2)	Population	Households
>25	17.1	(9,300)	(7,900)
>50	3.7	<50 to 2600	<50 to 1000

Note: Numbers in parentheses represent reductions

The Do-Something >25 contour does not extend as far west from Heathrow Airport as in the DM scenario, but is wider in the north-south axis, and covers a greater area. There are two >50 contours in the Do-Something scenario in response to the additional runway, and the combined area of these contours is greater than the DM contour.

The Do-Something >25 contour does not extend as far to the west over London as the equivalent DM contour, and as a result it does not cover such a populous area. The effect of this is that the Do-Something >25 contour encompasses fewer people than the equivalent DM contour despite being of greater area.

The larger area of the >50 Do-Something contour results in an increase in population compared to the DM contour, as the increase in area is proportionally greater than for the >25 contour and includes some areas of dense population.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- >25: A reduction of 9,300 (from 150,500 to 141,200)
- >50: An increase from <50 to 2600

Figure 4.117 : 2040 Do-Minimum Heathrow Airport N60 Contours

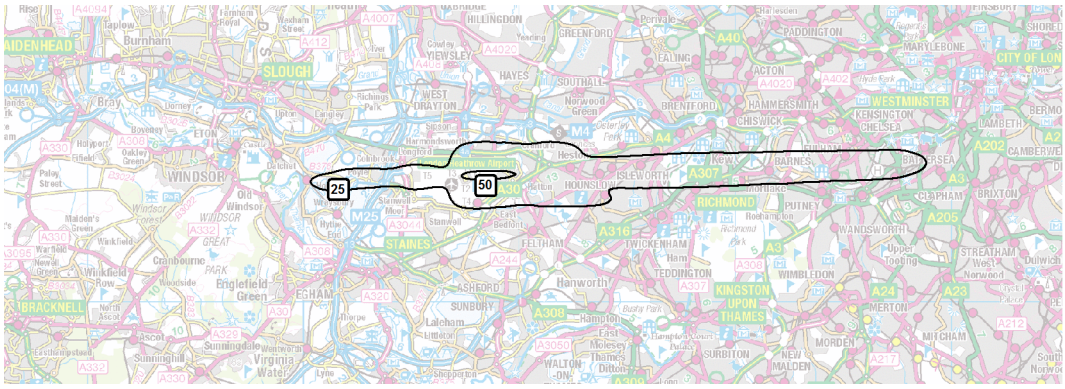
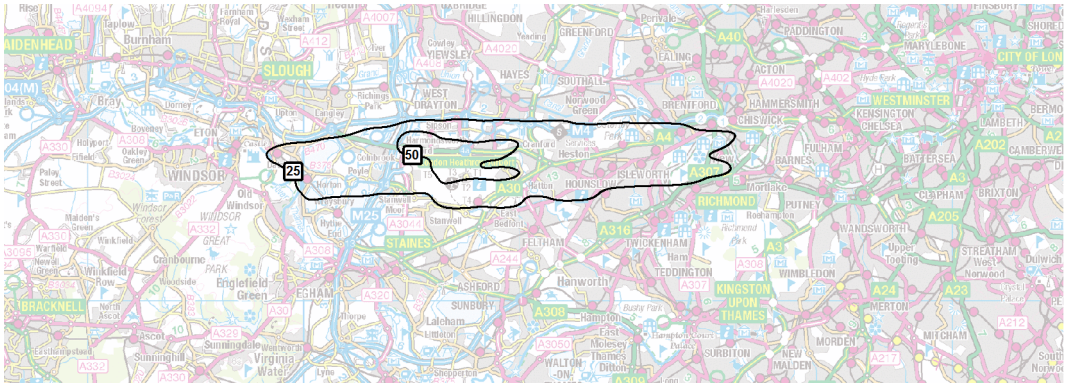


Figure 4.118 : 2040 Heathrow-NWR-R Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.83 below.

Table 4.83 : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-Heathrow, N60

Contour	Area (km2)	Population	Households
>25	18.0	(64,100)	(31,300)
>50	7.4	<50 to 5400	<50 to 2000

Note: Numbers in parentheses represent reductions

The Do-Something >25 contour does not extend as far west from Heathrow Airport as in the DM scenario, but is wider in the north-south axis, and covers a greater area as a result of increased ATMs in the Do-Something scenario. The two >50 contours seen in the 2030 Do-Something scenario merge in the 2040 Do-Something scenario and the area of the resulting contour is greater than the equivalent DM contour.

As the Do-Something >25 contour does not extend as far to the west over London as the equivalent DM contour, and as a result it does not cover such a populous area. The effect of this is that the Do-Something >25 contour encompasses fewer people than the equivalent DM contour despite being of greater area.

The larger area of the >50 Do-Something contour results in an increase in population compared to the DM contour, as the increase in area is proportionally greater than for the >25 contour and includes some areas of dense population.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- >25: A reduction of 64,100 (from 258,300 to 194,200)
- >50: An increase from <50 to 5,400

Figure 4.119 : 2050 Do-Minimum Heathrow Airport N60 Contours

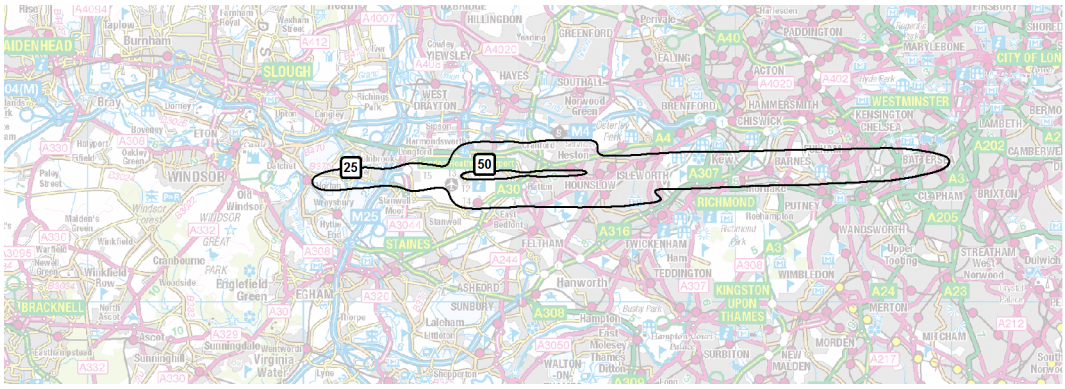
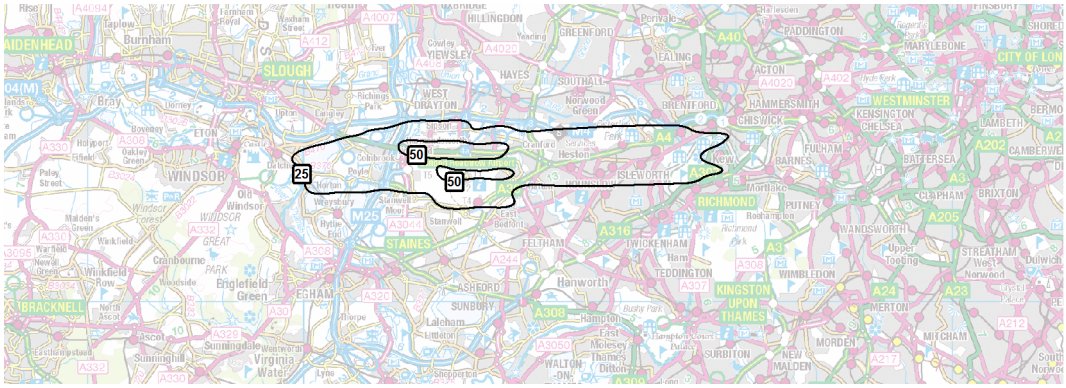


Figure 4.120 : 2050 Heathrow-NWR-R Heathrow Airport N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.84 below.

Table 4.84 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-Heathrow, N60

Contour	Area (km2)	Population	Households
>25	1.6	(155,600)	(68,800)
>50	3.6	(3,100)	(1,400)

Note: Numbers in parentheses represent reductions

The Do-Something >25 contour does not extend as far west from Heathrow Airport as in the DM scenario, but is wider in the north-south axis, and covers a greater area as a result of increased ATMs in the Do-Something scenario. The two >50 contour is also greater in area than the equivalent DM contour.

As the Do-Something >25 contour does not extend as far to the west over London as the equivalent DM contour, and as a result it does not cover such a populous area. The effect of this is that the Do-Something >25 contour encompasses fewer people than the equivalent DM contour despite being of greater area.

Similarly, the >50 contour does not extend as far to the west over London as the equivalent DM contour, and as a result it does not cover such a populous area. It also encompasses fewer people in the Do-Something scenario than the DM contour.

In summary, the differences in population included in the 2050 Do-Something contours compared with the 2050 DM contours are as follows:

- >25: A reduction of 155,600 (from 320,700 to 165,100)
- >50: A reduction of 3,100 (from 6,500 to 3,400)

4.13.4 24-Hour Metric

Figure *4.121* : 2030 Do-Minimum Heathrow Airport L_{den} Contours

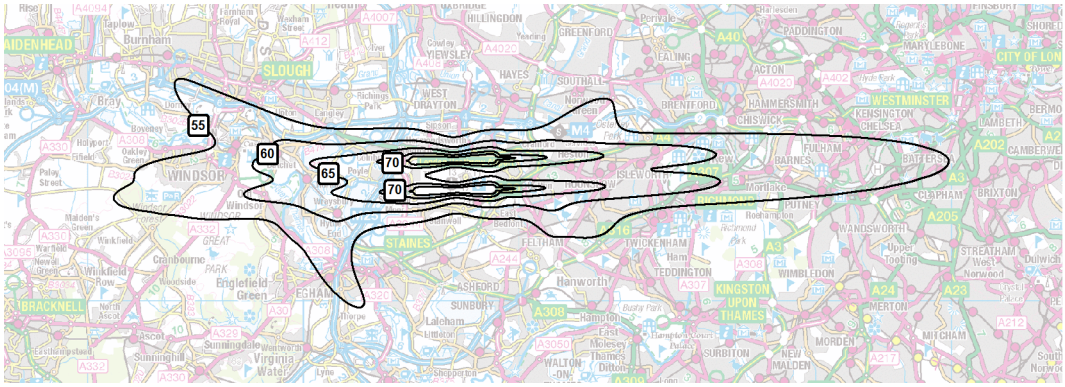
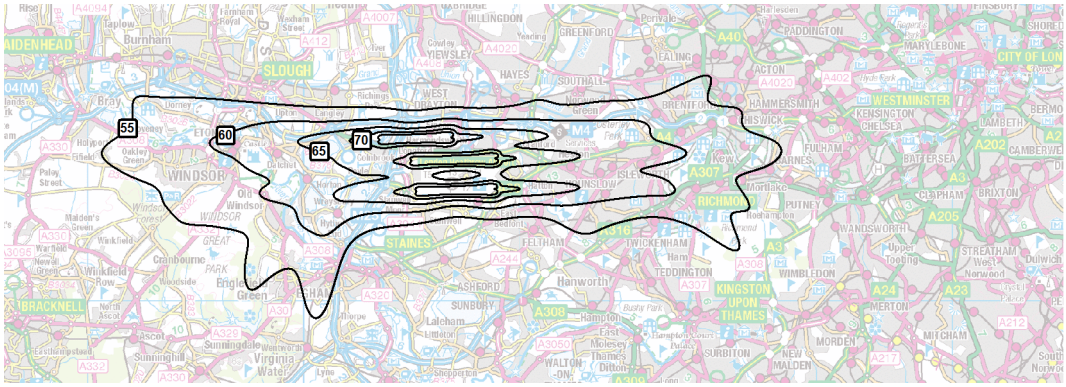


Figure *4.122* : 2030 Heathrow-NWR-R Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.85 below.

Table *4.85* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-Heathrow, L_{den}

Contour	Area (km²)	Population	Households
>55	22.0	(97,700)	(49,500)
>60	20.0	21,800	8,600
>65	9.1	1,000	200
>70	3.0	(2,100)	(700)
>75	1.8	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The effect of the 'respite' routes on the Do-Something contours is clearly evident, with a significant reduction in extent along the east-west axis, but increase in extent

along the north-south axis compared to the DM contours. The 'respite' routes also result in greater spread at the east and west extent of the contours, particularly to the south west. The 'horn' to the north-west in the DM contours is not evident in the Do-Something contours.

All of the Do-Something contours cover greater areas than the equivalent DM contours. However, a reduction in population enclosed is seen for the >55 dB contour, as it does not extend as far to the west as the DM contour, and therefore does not cover such a densely populated area.

The greater contour areas for the >60 and >65 Do-Something contours leads to increases in population enclosed compared to the DM scenario, as the disparity in population density for the areas covered is not as great as for the >55 contours.

The population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- *>55 dB: A reduction of 97,700 (from 580,500 to 482,800)*
- *>60 dB: An increase of 21,800 (from 169,600 to 191,400)*
- *>65 dB: An increase of 1,000 (from 34,800 to 35,800)*
- *>70 dB: A reduction of 2,100 (from 3,000 to 900)*
- *>75 dB: No discernible change (from <50 to <50)*

For the Heathrow Northwest Runway 'Respite' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2030 Do-Something scenario compared to the 2030 DM scenario is 133,400, and the number of people newly removed is 235,500. This results in a net reduction in the number of people newly affected of 102,100.

Figure *4.123* : 2040 Do-Minimu,m Heathrow Airport L_{den} Contours

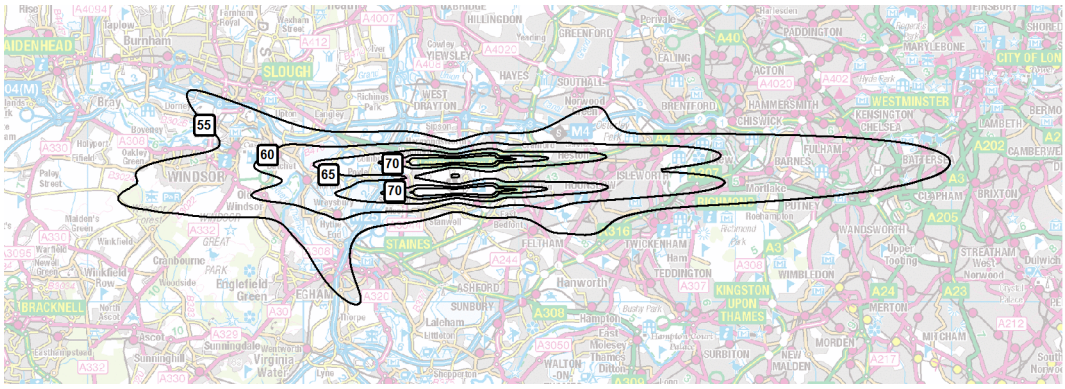
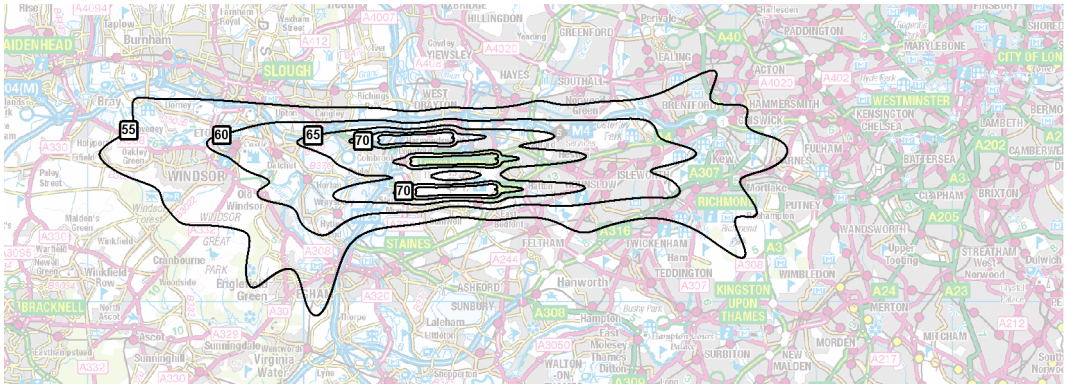


Figure *4.124* : 2040 Heathrow-NWR-R Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.86 below.

Table *4.86* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-Heathrow, L_{den}

Contour	Area (km²)	Population	Households
>55	31.3	(73,700)	(40,400)
>60	23.7	26,400	10,300
>65	11.9	6,100	2,000
>70	3.5	(2,100)	(800)
>75	2.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The effect of the 'respite' routes on the Do-Something contours is clearly evident, with a significant reduction in extent along the east-west axis, but increase in extent along the north-south axis compared to the DM contours. The 'respite' routes also result in greater spread at the east and west extent of the contours, particularly to the south west. The 'horn' to the north-west in the DM contours is not evident in the Do-Something contours.

All of the Do-Something contours cover greater areas than the equivalent DM contours. However, a reduction in population enclosed is seen for the >55 dB contour, as it does not extend as far to the west as the DM contour, and therefore does not cover such a densely populated area.

The greater contour areas for the >60 and >65 Do-Something contours leads to increases in population enclosed compared to the DM scenario, as the disparity in population density for the areas covered is not as great as for the >55 contours.

The population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

In summary, the differences in population included in the 2040 Do-Something contours compared with the 2040 DM contours are as follows:

- >55 dB: A reduction of 73,700 (from 588,900 to 515,200)
- >60 dB: An increase of 26,400 (from 179,500 to 205,900)
- >65 dB: An increase of 6,100 (from 36,200 to 42,300)
- >70 dB: A reduction of 2,100 (from 3,100 to 1,000)
- >75 dB: No discernible change (from <50 to <50)

For the Heathrow Northwest Runway 'Respite' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2040 Do-Something scenario compared to the 2040 DM scenario is 154,000, and the number of people newly removed is 229,600. This results in a net reduction in the number of people newly affected of 75,600.

Figure *4.125* : 2050 Do-Minimum Heathrow Airport L_{den} Contours

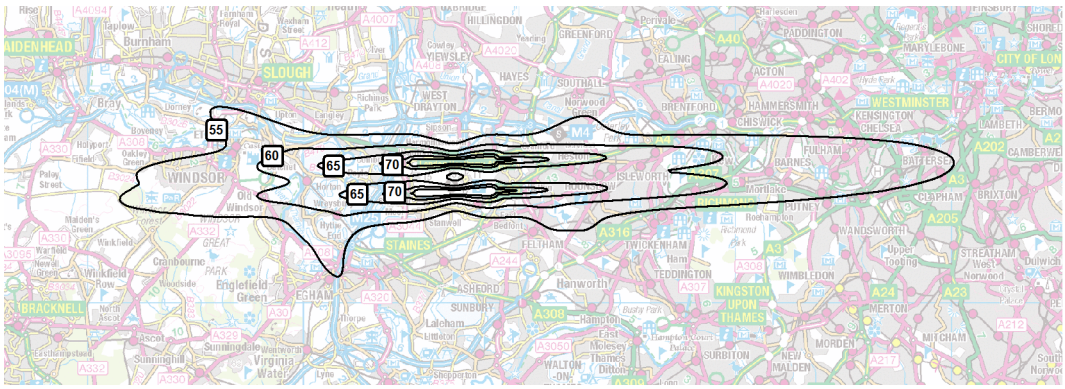
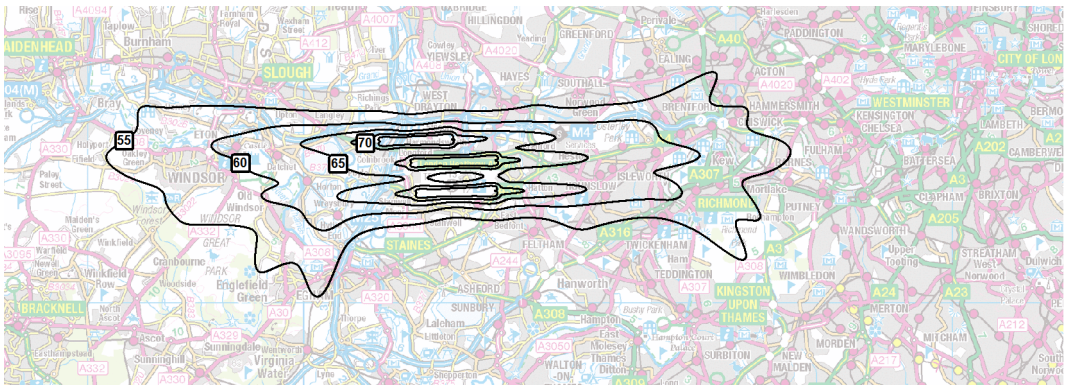


Figure *4.126* : 2050 Heathrow-NWR-R Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.87 below.

Table *4.87* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-Heathrow, L_{den}

Contour	Area (km^2)	Population	Households
>55	32.0	(66,800)	(37,700)
>60	23.6	28,000	10,700
>65	12.1	6,700	2,300
>70	3.5	(2,100)	(800)
>75	2.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The effect of the 'respite' routes on the Do-Something contours is clearly evident, with a significant reduction in extent along the east-west axis, but increase in extent along the north-south axis compared to the DM contours. The 'respite' routes also result in greater spread at the east and west extent of the contours, particularly to the south west. The 'horn' to the north-west in the DM contours is not evident in the Do-Something contours.

All of the Do-Something contours cover greater areas than the equivalent DM contours. However, a reduction in population enclosed is seen for the >55 dB contour, as it does not extend as far to the west as the DM contour, and therefore does not cover such a densely populated area.

The greater contour areas for the >60 and >65 Do-Something contours leads to increases in population enclosed compared to the DM scenario, as the disparity in population density for the areas covered is not as great as for the >55 contours.

The population enclosed by the 70 dB Do-Something contours is smaller than the equivalent DM contours, because they do not extend as far to the east of the existing runways, and the area covered to the north of the third runway in the Do-Something situation is less populous. Furthermore, a number of dwellings that are encompassed by the DM 70 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

In summary, the differences in population included in the 2050 Do-Something contours compared with the 2050 DM contours are as follows:

- *>55 dB: A reduction of 66,800 (from 583,500 to 516,700)*
- *>60 dB: An increase of 28,000 (from 182,100 to 210,100)*
- *>65 dB: An increase of 6,700 (from 36,400 to 43,100)*
- *>70 dB: A reduction of 2,100 (from 3,100 to 1,000)*
- *>75 dB: No discernible change (from <50 to <50)*

For the Heathrow Northwest Runway 'Respite' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2050 Do-Something scenario compared to the 2050 DM scenario is 160,400, and the number of people newly removed is 229,600. This results in a net reduction in the number of people newly affected of 69,200.

4.13.5 Sensitive Buildings

The change in number of sensitive buildings within each contour between the 2030 DM and 2030 Heathrow-NWR-R scenarios are set out in Table 4.88 below:

Table 4.88 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-NWR-R, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(62)	2	(24)	N70 >20	23	2	17
	>57 dB $L_{Aeq,16h}$	10	1	8	N70 >50	(1)	(1)	(3)
	>60 dB $L_{Aeq,16h}$	17	1	11	N70 >100	4	0	(5)
	>63 dB $L_{Aeq,16h}$	0	0	2	N70 >200	4	0	3
	>66 dB $L_{Aeq,16h}$	2	0	3	N70 >500	0	0	1
	>69 dB $L_{Aeq,16h}$	1	0	3		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(6)	1	8	N60 >25	(29)	(1)	(16)
	>51 dB $L_{Aeq,8h}$	5	(1)	2	N60 >50	0	0	1
	>54 dB $L_{Aeq,8h}$	8	0	3	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	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}	(103)	1	(42)				
	>60 dB L_{den}	15	(1)	5				
	>65 dB L_{den}	1	0	1				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

The change in number of sensitive buildings within each contour between the 2040 DM and 2040 Heathrow-NWR-R scenarios are set out in Table 4.89 below:

Table *4.89* : 2040 Do-Minimum Heathrow vs 2040 Heathrow-NWR-R, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(14)	2	(3)	N70 >20	23	1	18
	>57 dB $L_{Aeq,16h}$	20	0	12	N70 >50	2	(1)	(3)
	>60 dB $L_{Aeq,16h}$	25	1	11	N70 >100	11	0	5
	>63 dB $L_{Aeq,16h}$	1	0	2	N70 >200	7	0	4
	>66 dB $L_{Aeq,16h}$	3	0	5	N70 >500	2	0	2
	>69 dB $L_{Aeq,16h}$	1	0	3		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(34)	1	1	N60 >25	(59)	1	(19)
	>51 dB $L_{Aeq,8h}$	(5)	0	(5)	N60 >50	0	0	0
	>54 dB $L_{Aeq,8h}$	6	0	(2)	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(3)	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}	(80)	1	(28)				
	>60 dB L_{den}	20	0	13				
	>65 dB L_{den}	2	0	2				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

The change in number of sensitive buildings within each contour between the 2050 DM and 2050 Heathrow-NWR-R scenarios are set out in Table 4.90 below:

Table 4.90 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-R, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	(3)	2	2	N70 >20	11	1	12
	>57 dB $L_{Aeq,16h}$	16	0	16	N70 >50	1	0	(2)
	>60 dB $L_{Aeq,16h}$	23	0	14	N70 >100	10	(1)	3
	>63 dB $L_{Aeq,16h}$	1	0	2	N70 >200	18	0	5
	>66 dB $L_{Aeq,16h}$	4	0	4	N70 >500	2	0	2
	>69 dB $L_{Aeq,16h}$	1	0	2		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(70)	1	(26)	N60 >25	(100)	0	(44)
	>51 dB $L_{Aeq,8h}$	(12)	(1)	(9)	N60 >50	(2)	0	0
	>54 dB $L_{Aeq,8h}$	(4)	0	(6)	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(4)	0	0	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	(1)	0	(1)	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}	(78)	1	(32)				
	>60 dB L_{den}	18	0	8				
	>65 dB L_{den}	4	0	5				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

4.14 Scorecard for '3.5˚ Approach' Option (Heathrow-NWR-T-35)

Noise metrics have been produced for the Heathrow-NWR-T-35 option at Heathrow Airport for 2050. There are no metrics for 2030 or 2040 as it is not expected that the 3.5˚ approach slope could be implemented by these dates.

Table 4.91 : 2050 Heathrow-NWR-35 Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	448,100			N70 >20	253,300
	>57 dB LAeq,16h	239,200			N70 >50	195,000
	>60 dB LAeq,16h	136,500			N70 >100	146,400
	>63 dB LAeq,16h	39,600			N70 >200	91,300
	>66 dB LAeq,16h	10,400			N70 >500	1,700
	>69 dB LAeq,16h	800				
	>72 dB LAeq,16h	<50				
Night	>48 dB LAeq,8h	281,500			N60 >25	148,000
	>51 dB LAeq,8h	181,400			N60 >50	3,400
	>54 dB LAeq,8h	80,200			N60 >100	0
	>57 dB LAeq,8h	10,200			N60 >200	0
	>60 dB LAeq,8h	600			N60 >500	0
	>63 dB LAeq,8h	200				
	>66 dB LAeq,8h	<50				
	>69 dB LAeq,8h	<50				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	594,000		
			>60 dB L_{den}	200,500		
			>65 dB L_{den}	39,400		
			>70 dB L_{den}	900		
			>75 dB L_{den}	<50		

4.15 Assessment of '3.5˚ Approach' Option (Heathrow-NWR-T-35)

The predicted differences between the 2050 DM and Heathrow-NWR-T-35 scenarios for each noise metric are considered in detail below. The ATMs used in the noise modelling of these two scenarios are set out in Table 4.92 below.

Table 4.92 : Heathrow Airport – '3.5˚ Approach' Option ATMs

	Air Transport Movements		
	2030	2040	2050
Heathrow DM	483,856	484,517	471,132
Heathrow Heathrow-NWR-T35	652,216	740,000	740,000

4.15.1 Day Metrics

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

Figure *4.127* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

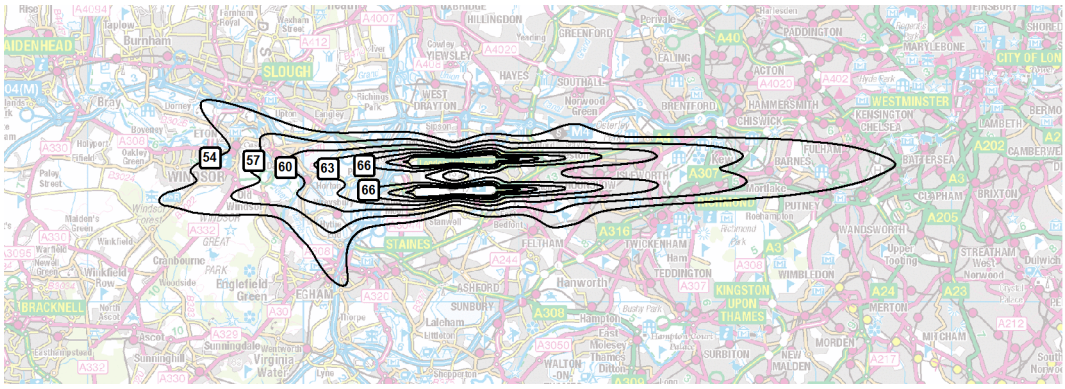
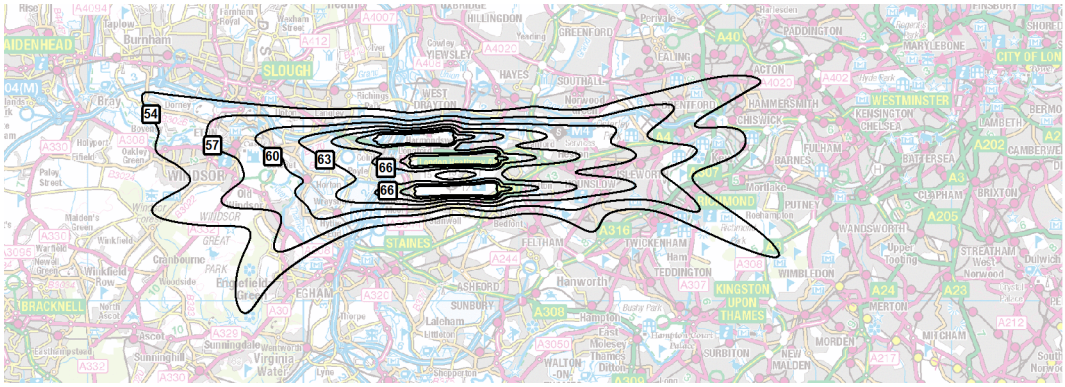


Figure *4.128* : 2050 Heathrow-NWR-T-35 Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.93 below.

Table *4.93* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-35, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	36.3	12,300	(2,500)
>57	25.7	19,600	6,000
>60	19.1	32,700	13,000
>63	11.1	4,700	1,700
>66	6.3	2,700	900
>69	3.1	(1,300)	(500)
>72	2.2	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

It can be seen that the shape of the contours to the east and west of the Airport differ considerably between the DM and Do-Something scenarios. This is because with the third runway the routes would diverge to a greater extent, leading to three 'prongs' or 'horns' to the east as opposed to the single elongated protrusion that is evident in the DM situation. A similar effect is observed to the west. The effect is most pronounced in the lower noise exposure contours which are furthest from the airport, as the flight corridors are closer together near the airport.

All of the contours cover greater areas in the Do-Something scenario than the DM scenario, as a result of increased ATMs. The greater contour areas leads to greater populations being enclosed in each contour in the Do-Something scenario than the DM scenario, with the exception of the >69 dB contour.

The reduction in people within the >69 dB contour in the Do-Something situation is because with aircraft movements split over three runways, there are three >69 dB contours, each limited to the area immediately around each runway; together these enclose fewer people than the DM contours which extend further east of the existing runways. Furthermore, there are a number of dwellings that fall within the >69 dB contours in the DM model, which are within the footprint of the development option and are therefore not included in the Do-Something model.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- >54 dB: An increase of 12,300 (from 435,800 to 448,100)
- >57 dB: An increase of 19,600 (from 219,600 to 239,200)
- >60 dB: An increase of 32,700 (from 103,800 to 136,500)
- >63 dB: An increase of 4,700 (from 34,900 to 39,600)
- >66 dB: An increase of 2,700 (from 7,700 to 10,400)
- >69 dB: A reduction of 1,300 (from 2,100 to 800)
- >72 dB: A change from <50 to <50

Comparing these results to those for the base Heathrow-NWR-T 'minimise total' scenario, it can be seen that the steeper 3.5˚ approach path reduces both the areas of the Do-Something contours, and the number of people enclosed by the following:

- >54 dB: A reduction in area of 5.4 km^2 and 43,800 people
- >57 dB: A reduction in area of 2.0 km^2 and 10,100 people
- >60 dB: A reduction in area of 1.0 km^2 and 4,100 people
- >63 dB: A reduction in area of 0.5 km^2 and 3,300 people
- >66 dB: A reduction in area of 0.2 km^2 and 500 people
- >69 dB: A reduction in area of 0.1 km^2 and 0 people
- >72 dB: No change.

(b) N70 Supplementary Metric

Figure 4.129 : 2050 Do-Minimum Heathrow Airport N70 Contours

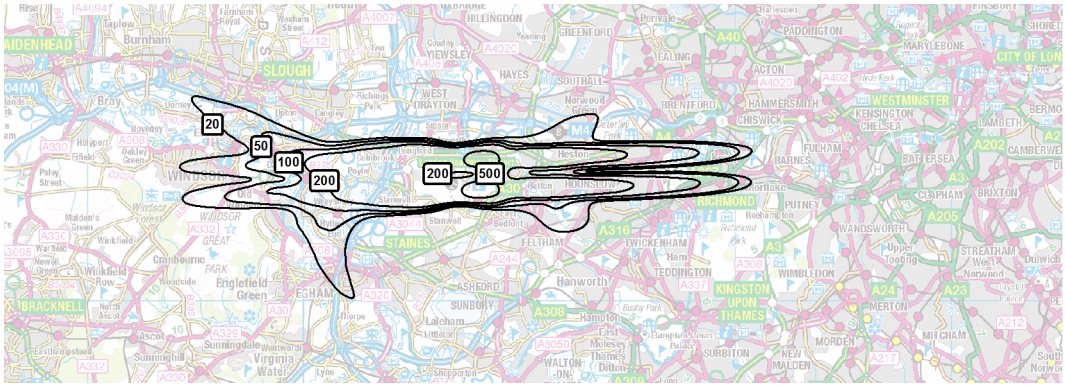
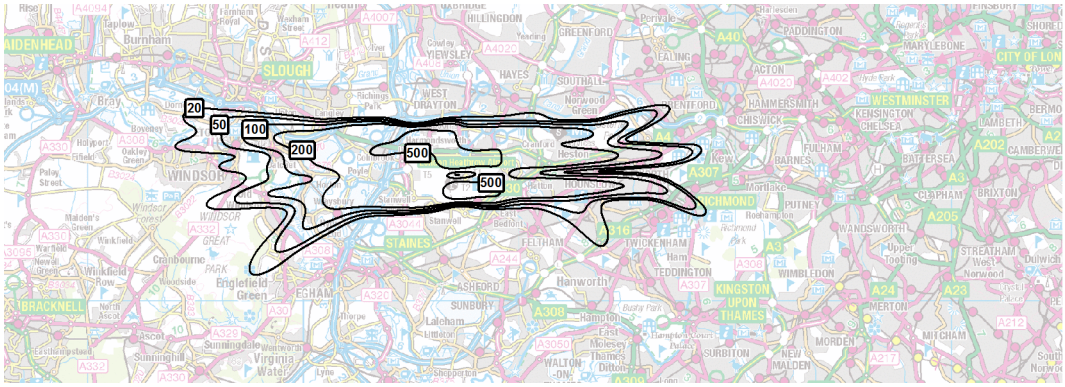


Figure 4.130 : 2050 Heathrow-NWR-T-35 Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 4.94 below.

Table 4.94 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-35, N70

Contour	Area (km²)	Population	Households
>20	11.3	(20,800)	(8,900)
>50	17.9	5,500	800
>100	16.0	17,000	6,800
>200	13.2	20,100	7,800
>500	5.2	<50 to 1700	<50 to 600

Note: Numbers in parentheses represent reductions

In all cases the areas enclosed by the Do-Something contours are greater than for the equivalent DM contours. However, whilst the >20 Do-Something contour is larger than the DM contour, the spurs of the Do-Something contour follows the 'minimise total' routes which diverge more widely, due to three runway spacing and design to avoid most populous areas. As a result, the Do-Something contour does not cover as many populous areas as the DM contour, and encompasses 20,800 fewer people than the DM contour.

Closer to the airport, the Do-Something and DM routes converge to a greater extent, and the noise preferential routing and steeper approach slope have less effect. As the >50 to >500 Do-Something contours are all larger than the equivalent DM

contours, this results in larger populations being included within the Do-Something contours:

- >20: A reduction of 20,800 (from 274,100 to 253,300)
- >50: An increase of 5,500 (from 189,500 to 195,000)
- >100: An increase of 17,000 (from 129,400 to 146,400)
- >200: An increase of 20,100 (from 71,200 to 91,300)
- >500: An increase from <50 to 1,700

Comparing these results to those for the base Heathrow-NWR-T 'minimise total' scenario, it can be seen that the steeper 3.5˚ approach path reduces both the areas of the Do-Something contours, and the number of people enclosed by the following:

- >20: A reduction in area of 5.3 km^2 and 22,500 people
- >50: A reduction in area of 3.3 km^2 and 14,400 people
- >100: A reduction in area of 1.9 km^2 and 8,600 people
- >200: A reduction in area of 1.0 km^2 and 6,300 people
- >500: No change.

4.15.2 Night Metrics

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

Figure *4.131* : 2050 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

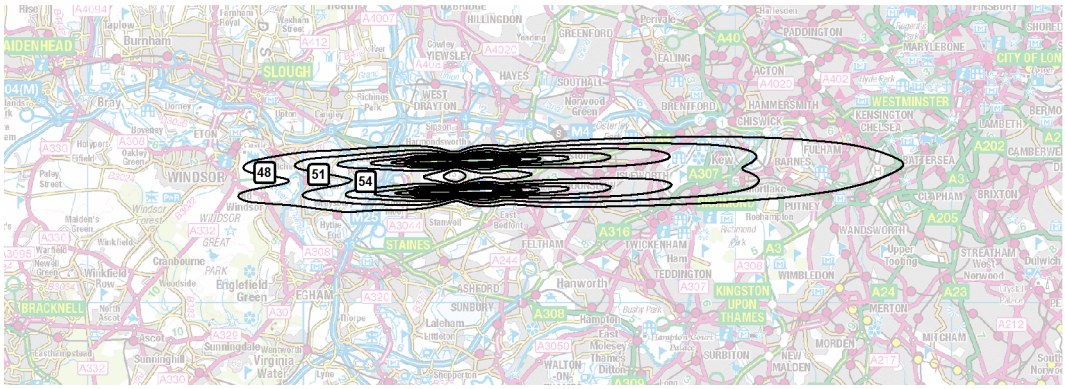
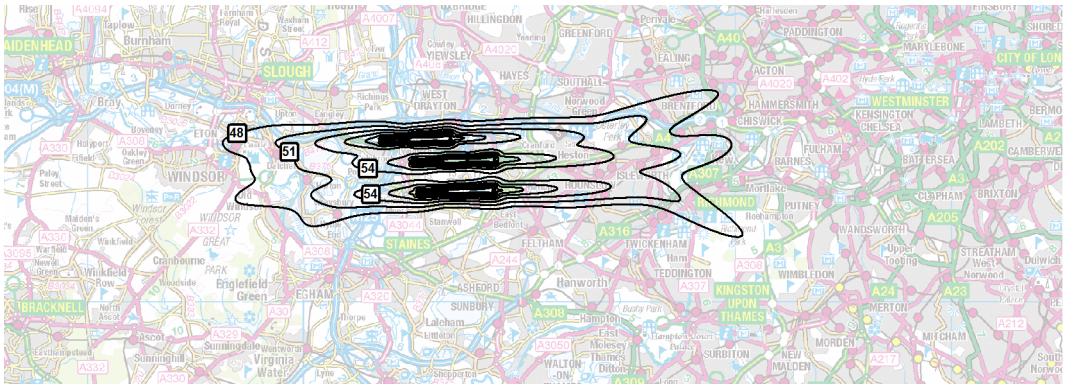


Figure *4.132* : 2050 Heathrow-NWR-T-35 Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 4.95 below.

Table *4.95* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-35, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	14.4	(91,600)	(43,300)
>51	12.9	(16,000)	(8,300)
>54	10.3	(9,000)	(3,600)
>57	3.8	(23,700)	(9,200)
>60	2.3	(6,500)	(2,500)
>63	1.7	(2,400)	(800)
>66	1.3	<50 to <50	<50 to <50
>69	0.6	<50 to <50	<50 to <50
>72	0.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

Compared to the DM contours, the Do-Something contours are shorter in the east-west axis, but wider in the north-south axis as a result of the additional runway and routes. In all cases the Do-Something contours cover a greater area than their DM counterparts as a result of increased ATMs, but due to the noise preferential routing, in most cases they encompass smaller populations than the DM contours.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- >48 dB: A reduction of 91,600 (from 373,100 to 281,500)
- >51 dB: A reduction of 16,000 (from 197,400 to 181,400)
- >54 dB: A reduction of 9,000 (from 89,200 to 80,200)
- >57 dB: A reduction of 23,700 (from 33,900 to 10,200)
- >60 dB: A reduction of 6,500 (from 7,100 to 600)
- >63 dB: A reduction of 2,400 (from 2,600 to 200)
- >66 dB: No discernible difference (from <50 to <50)
- >69 dB: No discernible difference (from <50 to <50)
- >72 dB: No discernible difference (from <50 to <50)

Comparing these results to those for the base Heathrow-NWR-T 'minimise total' scenario, it can be seen that the steeper 3.5˚ approach path reduces both the areas of the Do-Something contours, and the number of people enclosed by the following:

- >48: A reduction in area of 3.4 km² and 14,300 people
- >51: A reduction in area of 1.8 km² and 4,200 people
- >54: A reduction in area of 1.1 km² and 8,400 people
- >57: A reduction in area of 0.5 km² and 1,900 people
- >60: A reduction in area of 0.1 km² and 300 people
- >63: A reduction in area of 0.1 km² and 0 people
- >66 to >72: No change.

(b) N60 Supplementary Metric

Figure 4.133 : 2050 Do-Minimum Heathrow Airport N60 Contours

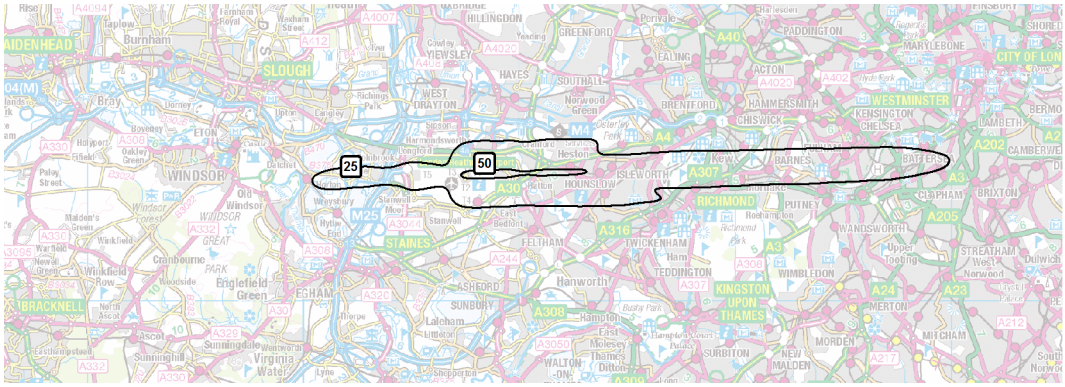
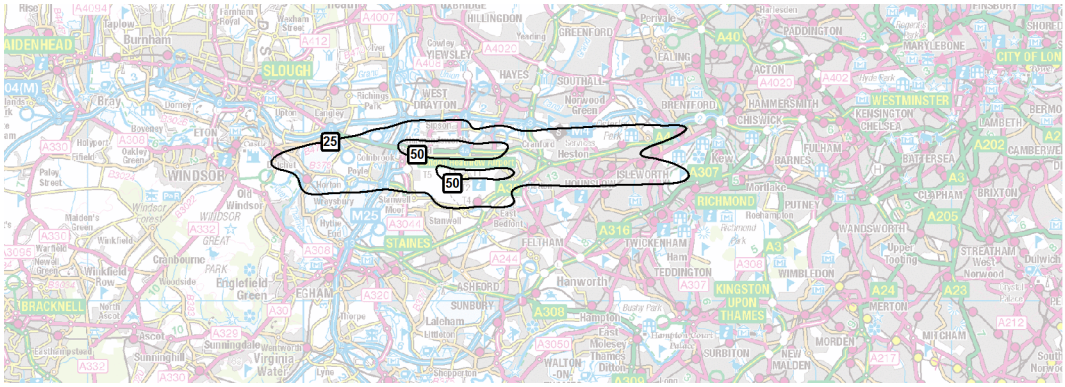


Figure 4.134 : 2050 Heathrow-NWR-T-35 N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 4.96 below.

Table 4.96 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-35, N60

Contour	Area (km2)	Population	Households
>25	(1.5)	(172,700)	(75,600)
>50	3.7	(3,100)	(1,400)
>25	0.0	0	0
>50	0.0	0	0
>25	0.0	0	0

Note: Numbers in parentheses represent reductions

The N60 noise contours show significant differences in shape between the DM and Do-Something scenarios. As noted when discussing the $L_{Aeq,8h}$ noise results, these reductions are a result of the noise preferential routes to the east that would be associated with the third runway. The Do-Something routes shorten and widen the contour N60 >25 contour, so that it no longer covers areas such as Barnes, Putney, Fulham and Battersea.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- *>25: A reduction of 172,700 (from 320,700 to 148,000)*
- *>50: A reduction of 3,100 (from 6,500 to 3,400)*

Comparing these results to those for the base Heathrow-NWR-T 'minimise total' scenario, it can be seen that the steeper 3.5˚ approach path increases both the areas of the Do-Something contours, and the number of people enclosed by the following:

- >25: An increase in area of 0.3 km^2 and 700 people
- >50: An increase in area of 0.1 km^2 and 200 people

This is because in most locations the greater height afforded by the 3.5˚ approach slope reduces noise on the ground, but for some locations to the side of the flight path the increase in height reduces the benefits of ground absorbtion which offsets this benefit.

4.15.3 24-Hour Metric

Figure *4.135* : 2050 Do-Minimum Heathrow Airport L_{den} Contours

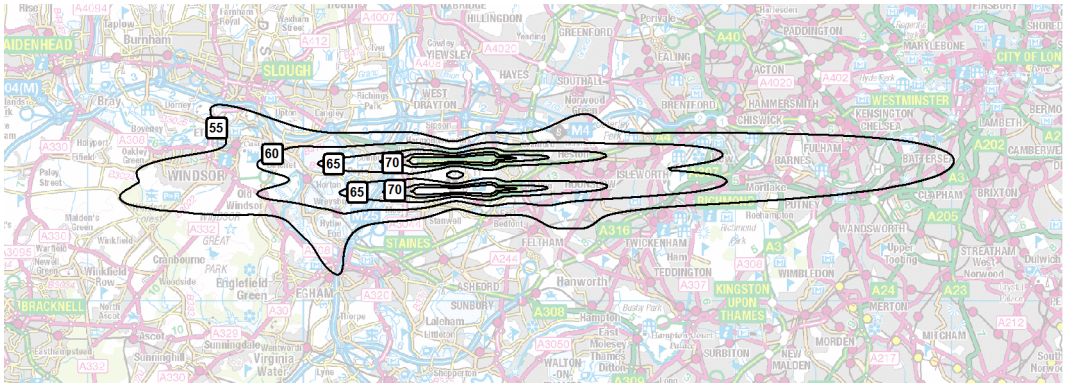
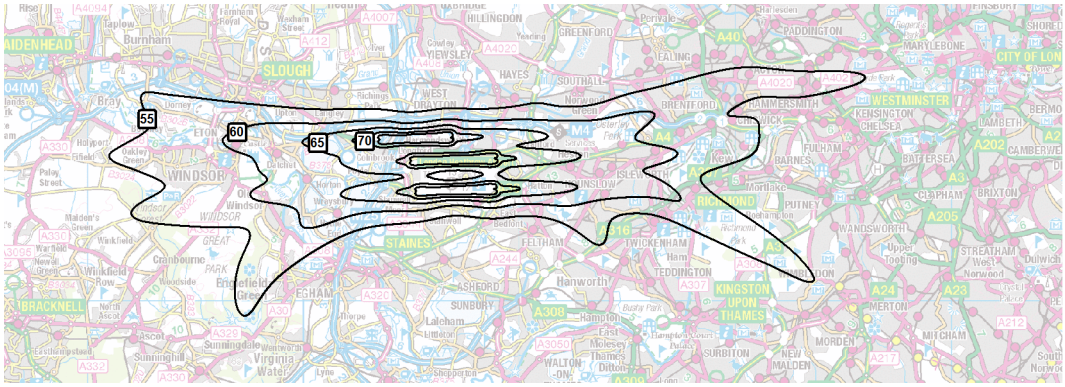


Figure *4.136* : 2050 Heathrow-NWR-T-35 Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 4.97 below.

Table *4.97* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-35, L_{den}

Contour	Area (km^2)	Population	Households
>55	43.7	10,500	(4,600)
>60	21.9	18,400	7,000
>65	11.5	3,000	900
>70	3.3	(2,200)	(800)
>75	2.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The Do-Something contours do not extend as far east as the DM contours, but are wider in the north-south axis. To the east, two well developed 'horns' are visible in the >55 dB contour, one to the north-eastern extent, and the other to the south-eastern extent of the contour. To the west, four less defined protrusions are seen centred on the departure routes. In all cases, the Do-Something contours are greater in area than the equivalent DM contours as a result of increased ATMs.

The larger contour areas in the Do-Something scenario also result in greater populations enclosed, for all contours apart from the >70 dB contours, which do not extend as far to the east as the DM contours. The new area around the proposed third runway covered by the >70 dB contour is not as populous as the area to the east of the current runways, and the net result is a smaller population within the >70 dB contour in the Do-Something situation than the DM situation.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- >55 dB: An increase of 10,500 (from 583,500 to 594,000)
- >60 dB: An increase of 18,400 (from 182,100 to 200,500)
- >65 dB: An increase of 3,000 (from 36,400 to 39,400)
- >70 dB: A reduction of 2,200 (from 3,100 to 900)
- >75 dB: No discernible difference (from <50 to <50)

Comparing these results to those for the base Heathrow-NWR-T 'minimise total' scenario, it can be seen that the steeper 3.5˚ approach path reduces both the areas of the Do-Something contours, and the number of people enclosed by the following:

- >55: A reduction in area of 7.2 km^2 and 43,700 people
- >60: A reduction in area of 1.9 km^2 and 5,200 people
- >65: A reduction in area of 0.6 km^2 and 3,200 people
- >70: A reduction in area of 0.2 km^2 and 100 people
- >75: No change.

4.15.4 Sensitive Buildings

The change in number of sensitive buildings within each contour between the 2050 DM and 2050 Heathrow-NWR-T-35 scenarios are set out in Table 4.98 below:

Table 4.98 : 2050 Do-Minimum Heathrow vs 2050 Heathrow-NWR-T-35, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	0	1	(2)	N70 >20	(6)	(1)	(8)
	>57 dB $L_{Aeq,16h}$	8	0	6	N70 >50	3	(1)	0
	>60 dB $L_{Aeq,16h}$	21	0	10	N70 >100	2	(1)	3
	>63 dB $L_{Aeq,16h}$	1	0	1	N70 >200	11	0	4
	>66 dB $L_{Aeq,16h}$	3	0	3	N70 >500	2	0	2
	>69 dB $L_{Aeq,16h}$	1	0	2		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	1		0	0	0
Night	>48 dB $L_{Aeq,8h}$	(81)	(1)	(42)	N60 >25	(109)	(2)	(55)
	>51 dB $L_{Aeq,8h}$	(19)	(1)	(13)	N60 >50	(2)	0	0
	>54 dB $L_{Aeq,8h}$	(8)	0	(6)	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	(4)	0	(2)	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	(1)	0	(1)	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	(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}	(10)	1	(7)				
	>60 dB L_{den}	13	(1)	4				
	>65 dB L_{den}	4	0	2				
	>70 dB L_{den}	0	0	2				
	>75 dB L_{den}	0	0	0				

4.16 Ground Noise

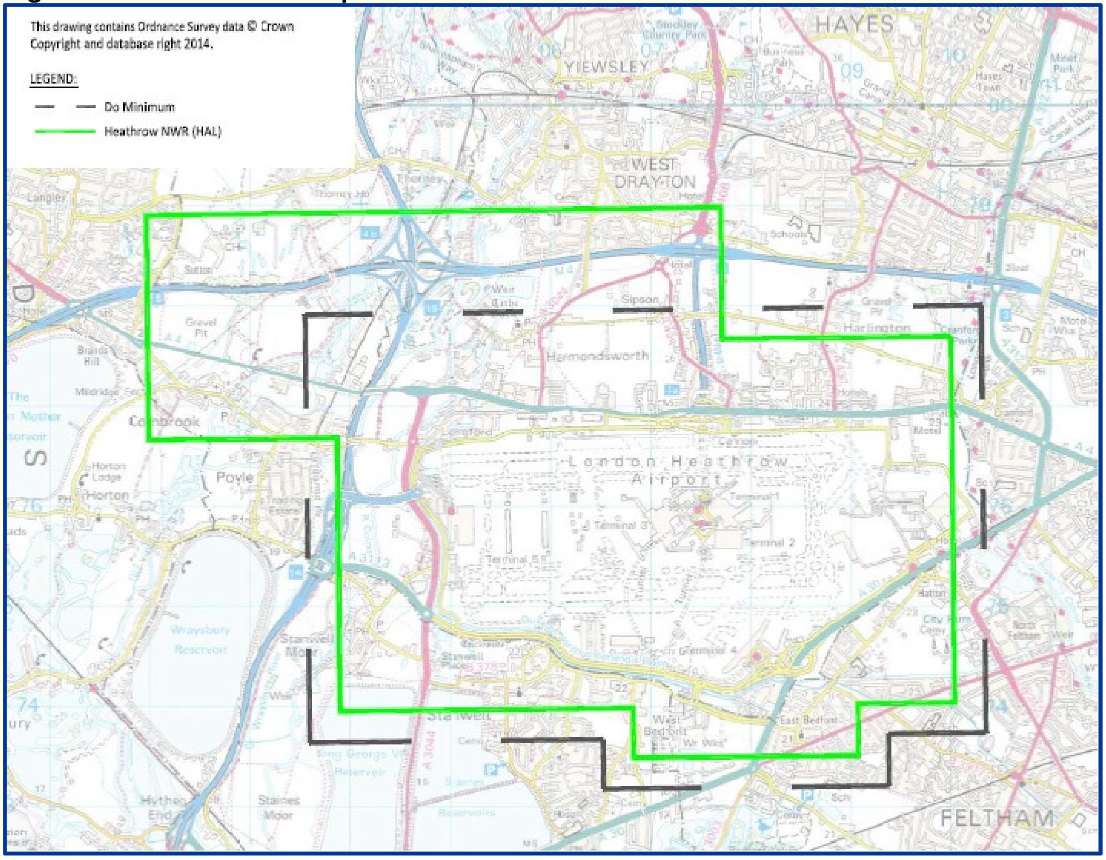
The results of the ground noise assessment for the Heathrow NWR scheme for 2030 are given in Table 4.97 and Figure 4.137 below. They include the resulting area predicted to be exposed to 57 dB $L_{Aeq,16h}$ and above, and the population contained within an equivalent area centred on the airport and allowing for the location of the runways and aprons.

Table 4.99 : Ground Noise Exposure at Heathrow Airport – Northwest Runway

	Current (2013)	2030 DM	2030 Heathrow-NWR-T
Exposed Area, km^2 (57 dB $L_{Aeq,16h}$)	29.3	30.5	37.4
Population within Exposed Area(1)	30,650	30,750	27,000

(1) Rounded to the nearest 50.

Figure 4.137: Heathrow Airport Do-Minimum v Heathrow NWR Ground Noise



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.

With the Heathrow NWR scheme the forecast amount of ground noise is more than the DM case due to the greater level of aircraft activity. However, 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 greater, and is due to the developed airport changing the location of some of the sources of ground noise. 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 estimated to be fewer than current and in the DM case in 2030.

4.17 Monetisation (Heathrow-NWR-T)

4.17.1 Introduction

This section will cover the monetisation results for annoyance, sleep disturbance, Health-AMI and Health-Hypertension

Costs are stated in £millions/assessment-year, or when considering totals, £billions/60-years.

4.17.2 Annoyance

The monetisation results for the Heathrow-NWR-T scenario for annoyance indicate that the costs will increase between 2030, 2040 and 2050, from £15.60, £25.70 and £29.90 in the low. From 2030 to 2050 in the mid and high respectively there is also

an increase from £31.20 to £51.40 to £59.90 in the mid and from £187.40 to £308.60 to £359.30 in the high.

The sensitivity analyses shows that an increase in cut–off level from 45dB to 48dB is predicted to result in a decrease in the monetisation values, starting at £5.30, £10.60 and £63.80 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs increase to £13.90, £27.90 and £167.30. There is a further increase in the 2050 low, mid and high scenario at £17.70, £35.30 and £212.00.

4.17.3 Sleep disturbance

For sleep disturbance, these costs decrease over time starting at £5.50, £9.60 and £13.80 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs decrease to £2.00, £3.40 and £4.90. There is a further decrease in the 2050 low, mid and high scenario at -£14.60, -£25.60 and -£36.60.

For the sensitivity case, increasing the threshold by 3 dB sees a similar pattern of costs, but starting at -£0.40, -£0.70 and -£1.00 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs decrease to -£5.50, -£9.50 and -£13.60. There is a further decrease in the 2050 low, mid and high scenario at -£17.10, -£30.00 and -£42.90.

4.17.4 AMI

The AMI costs do not vary with low, mid and high cost assumptions, but increase over time from £5.50 in 2030, to £10.50 in 2040 with a decrease in cost in the 2050 scenario to £9.40. The sensitivity analyses show no change in costs.

4.17.5 HT Strokes

The HT Stokes results increase from £0.50 to £0.90 in the period 2030-2040, before decreasing slightly to £0.80 in 2050 in low, mid and high, with no variation in the sensitivity case.

4.17.6 HT Dementia

Similarly the HT dementia result increase from £0.70 in 2030 to £1.30 in 2040, before decreasing again to £1.20 in 2050, with no variation in the sensitivity case.

4.17.7 Total

The total costs for the Heathrow-NWR-T scenario are £0.91, £1.50 and £25 billion/60 years for the low, mid and high cost scenarios respectively. The sensitivity case decreases costs by £0.49, £0.90 and £5.10 billion./60 years for the relevant cost assumption scenarios.

Annoyance is the greatest cost contributor in the low cost scenarios for all 3 assessment years, followed by sleep disturbance. HT stokes is the lowest cost contributor in all scenarios.

4.18 Monetisation (Heathrow-NWR-N)

4.18.1 Introduction

This section will cover the monetisation results for annoyance, sleep disturbance, Health-AMI and Health-Hypertension

Costs are stated in £millions/assessment-year, or when considering totals, £billions/60-years.

4.18.2 Annoyance

The monetisation results for the Heathrow-NWR-N scenario for annoyance indicate that the costs will increase between 2030, 2040 and 2050, from £25.20, £35.80 and £40.90 in the low. From 2030 to 2050 in the mid and high respectively there is also an increase from £50.50 to £71.70 to £81.90 in the mid and from £302.80 to £430.20 to £491.10 in the high.

The sensitivity analyses shows that an increase in cut–off level from 45dB to 48dB is predicted to result in a decrease in the monetisation values, starting at £24.50, £48.90 and £293.50 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs increase to £33.50, £67.10 and £402.50. There is a further increase in the 2050 low, mid and high scenario at £38.20, £76.40 and £458.50.

4.18.3 Sleep disturbance

For sleep disturbance, these costs increase in the low, mid and high for the 2030 and 2040 scenarios from £23.30 to £26.50 in low and from £40.20 to £46.40 in the mid and from £57.40 to £66.30 in the high. In the 2050 low, mid and high scenario these costs decreased to £10.00, £17.60 and £25.10.

For the sensitivity case, increasing the threshold by 3 dB sees a similar pattern of costs, but starting at £9.10, £15.90 and £22.70 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs decrease to -£10.00, £17.50 and £24.90. There is a further decrease in the 2050 low, mid and high scenario at -£1.70, -£3.00 and -£4.30.

4.18.4 AMI

The AMI costs do not vary with low, mid and high cost assumptions, but increase over time from £9.80 in 2030, to £18.20 in 2040 to £18.50 in 2050. The sensitivity analyses show no change in costs.

4.18.5 HT Strokes

The HT Stokes results increase from £0.70 to £1.30 in the 2030 to 2040 scenarios. There is no change from the 2040 to the 2050 scenario.

4.18.6 HT Dementia

The HT dementia result do not vary with low, mod and high cost assumptions but there is an increase from £1.10 in 2030 to £1.90 in 2040 to £2.00 in 2050, with no variation in the sensitivity case.

4.18.7 Total

The total costs for the Heathrow-NWR-N scenario are £0.91, £1.50 and £25 billion/60 years for the low, mid and high cost scenarios respectively. The sensitivity case decreases costs by £0.49, £0.90 and £5.1 billion/60 years for the relevant cost assumption scenarios. Annoyance is the greatest cost contributor for all 3 assessment years, followed closely by sleep disturbance, HT stokes is the lowest cost contributor in all scenarios.

4.19 Monetisation (Heathrow-NWR-R)

4.19.1 Introduction

This section will cover the monetisation results for annoyance, sleep disturbance, Health-AMI and Health-Hypertension for the Heathrow-NWR-R (respite) scenario.

Costs are stated in £millions/assessment-year, or when considering totals, £billions/60-years.

4.19.2 Annoyance

The monetisation results for the Heathrow-NWR-R scenario for annoyance indicate that costs will increase in 2030 for the low, mid and high from £14.30 to £28.60 to £171.40. Increasing again from £24.20 to £48.40 to £290.30 in the 2040 scenario and from £26.50 to £53.00 to £318.10 in the 2050 scenario.

The sensitivity analyses shows that an increase in cut–off level from 45dB to 48dB is predicted to result in a decrease in the monetisation values, starting at -£4.10, -£8.20 and -£49.40 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs increase to £3.20, £6.40 and £38.20. There is a further increase in the 2050 low, mid and high scenario at £5.10, £10.10 and £60.70.

4.19.3 Sleep disturbance

For sleep disturbance, these costs decrease over time. In 2030 scenario for low, mid and high costs decrease from -£16.80 to -£29.40 to -£42.10. The costs decrease again in the 2040 scenario from -£28.40 in the low decreasing to -£77.10 in the high and respectively from -£45.40 to -£113.50 in the 2050 scenario.

For the sensitivity case, increasing the threshold by 3 dB sees a similar pattern of costs, but starting at £0.70, £1.10 and £1.60 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs decrease to -£5.40, -£9.50 and -£13.60. There is a further decrease in the 2050 low, mid and high scenario at -£16.90, -£29.50 and -£42.20

4.19.4 AMI

The AMI costs do not vary with low, mid and high cost assumptions, but increase over time from 2030 to 2040 from £3.60 to £9.50 with a decrease in 2050 to £7.70. The sensitivity analyses show no change in costs.

4.19.5 HT Strokes

The HT Stokes results increase from £0.4 to £0.9 in the period 2030-2040, before decreasing slightly to £0.8 in 2050, with no variation in the sensitivity case.

4.19.6 HT Dementia

Similarly the HT dementia result increase from £0.70 in 2030 to £1.30 in 2040, before decreasing again to £1.20 in 2050, with no variation in the sensitivity case.

4.19.7 Total

The total costs for the Heathrow-NWR-R scenario are -£0.12, -£0.24 and £6.3 billion/60 years for the low, mid and high cost scenarios respectively. The sensitivity cases are £0.020, -£0.15, £0.55 billion/60 years for the low, mid and high cost assumption scenarios. Annoyance is the greatest cost contributor in all cost scenarios for all 3 assessment years. Sleep disturbance is the lowest cost contributor (negative) in all scenarios.

4.20 Promoter's Submission

This section of the assessment summarises the promoter's predicted noise impacts of the Scheme.

4.20.1 Information Provided

In relation to the 'scorecard' metrics, the promoter's submission for the Heathrow Airport 3RNW shortlist option is based on results from the ANCON noise model operated by ERCD, using input data specified by the promoter. However, the promoter has also developed models in the Federal Aviation Administration's (FAA) Integrated Noise Model (INM), which were initially used to refine the scheme modelled in ANCON, and latterly to provide the basis for further analysis to support the Health and quality of life, cost/benefit and difference in noise exposure studies.

The modelling is based on the assumption that with a third runway, Heathrow would achieve 570,000 air transport movements in 2030, and 740,000 air transport movements in 2040. The DM scenarios for 2030 and 2040 both assume the current level of capacity of 480,000 air transport movements.

In terms of fleet mix, the promoter assumes that "by 2030 around 95% of aircraft will be the latest and quietest, described by Sustainable Aviation as 'imminent' technology". By 2040 the fleet mix is predicted to be 78% 'imminent' and 21% 'future' generation aircraft (and 0.4% current aircraft).

A number of noise mitigation measures have been included in the noise modelling; these include steepening the approach glideslope from the current value of 3.0º to 3.2º in 2030 and 3.5º in 2040. There is a current commitment from the promoter to trial steeper glideslope angles.

The promoter's submission provides three modelling scenarios for each Do-Something case; these are based on minimising the total number of people overflown (Option T), minimising the number of new people overflown (Option N) and maximising the opportunities for respite (Option R). This assessment initially focuses on Option T, minimising the total number of people overflown.

The noise models produced using ANCON have been used to calculate the areas of land and populations exposed to the following noise metrics:

- *$L_{Aeq,16h}$ (average summers day) noise contours from 54 dB to 72 dB in 3 dB intervals*

- *$L_{Aeq,8h}$ (average annual night) 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 for greater than 25, 50, 100, 200, 300, 400 and 500 events*
- *N60 (8-hour average night) contours for greater than 25 and 50 events*

These metrics have been produced for:

- *the current baseline (2011/2012),*
- *2030 and 2040 DM scenarios, and*
- *2030 and 2040 Do-Something scenarios.*

The range of metrics, and the assessment scenarios provided by the promoter are in accordance with the requirements of the noise appraisal module.

4.20.2 Promoter's Noise Metrics

The full range of metrics calculated using ANCON presented by the Proposer for Option T are provided in Appendix B, whilst a summary of the absolute values and differences between scenarios are set out in Table 4.100 and Table 4.101 below. The figures used in HAL's assessment take into account both static and changing population. The forecast growth in population included in the figures below is from data provided by CACI although the exact allocation of growth to the ANCON contours generated by ERCD is not explicitly stated within the Air & Ground Noise report. .

Table *4.100* : Heathrow 3RNW Scorecard (Promoters Submission)

Metric		2030 DM (2R)	2040 DM (2R)	2030 DS (3R)	2040 DS (3R)
$L_{Aeq,16h}$ (average summer's day)	>54	438,600	405,600	355,700	439,250
	>57	203,900	195,800	204,700	240,150
	>69	1,150	450	250	800
$L_{Aeq,8h}$ (night)	>48	265,000	254,700	243,600	265,500
L_{den}	>55	468,450	468,450	428,100	408,450
N70	>50	210,750	210,750	236,100	242,250
N60	>25	205,300	205,300	55,750	174,450

Table 4.101 : Difference in Population Exposure between Scenarios

Metric		2030 DM vs 2040 DM	2030 DM vs 2030 DS	2040 DM vs 2040 DS
$L_{Aeq,16h}$ (average summer's day)	>54	(33,000)	(82,900)	33,650
	>57	(8,100)	800	44,350
	>69	(700)	(900)	350
$L_{Aeq,8h}$ (night)	>48	(10,300)	(21,400)	10,800
L_{den}	>55	0	(40,350)	(60,000)
N70	>50	0	25,350	31,500
N60	>25	0	(149,550)	(30,850)

Comparing the assessment base year 2030 DM situation with the 2040 DM, there is a clear reduction in all metrics. This is due to the promoter's assumptions in relation to transitioning to a quieter fleet mix over this period, and because there is no growth in aircraft movements forecast between these two scenarios (the airport is already operating at capacity in 2030).

Comparing the 2030 DM with the 2030 Do-Something scenario shows a 82,900 reduction in people exposed to average summer's day noise levels above 54 dB $L_{Aeq,16h}$. As identified in the assessment of the Heathrow NWR proposal earlier in this report, this is primarily because of the difference in shape between the two runway and three runway contours, with the two runway contour extending further over the densely populated area to the west of the airport.

For the 2030 DM vs 2030 DS comparison, the average summer's night metrics show reductions in the population exposed in all noise bands. The promoter also identifies a significant reduction (94,400) in the L_{den} >55 dB metric for the Do-Something scenario.

In terms of the 'number above' metrics, there is a significant increase forecast in the number of people that would be exposed to >20 events of 70 dB L_{ASmax} or over (308,000) as a result of an enlarged contour caused by southerly departures.

In contrast, the number of people affected by 25 or more events over 60 dB L_{ASmax} at night (N60 >25) is predicted to reduce by 165,250 with the addition of a third runway, due to a reduction in the densely populated area under the truncated contour to both east and west of the airport.

In terms of the 2040 DM versus 2040 Do-Something comparison, an increase of 33,650 people within the 54 dB $L_{Aeq,16h}$ contour is predicted (from 405,600 to 439,250). There are corresponding increases in all of the other bands for this metric, apart from the 72 dB $L_{Aeq,16h}$ contour where there is a very small reduction of 10 people forecast.

For the 2040 comparison there are increases for most noise metrics, with notable exceptions being a reduction of 60,000 in the number of people affected by noise levels of 55 dB L_{den} or greater, and a reduction of 30,850 in the number of people within the N60 >25 contour. Both of these reductions are as a result of the three runway scenario causing contours which are wider in the north-south axis but shorter in the east-west axis, and which do not extend as far east as Barnes and neighbouring areas.

4.21 Commentary on promoter's Submission

There are considerable differences in the noise exposure metrics calculated by the ERCD through ANCON models for the Proposer and for the Airports Commission. In the 2030 Do-Something situation for instance, the promoter's figure for population exposed to noise levels of 54 dB $L_{Aeq,16h}$ or greater is 100,500 fewer than the corresponding figure identified in the Airport Commission assessment (355,700 compared to 456,000). In almost all cases, the exposure metrics in the promoter's submission are substantially lower than the corresponding Airports Commission figure. Although it is likely that some subtleties in population data are seen in the results, this is not considered to be significant due to the shared origin of the data (from CACI Limited). It is considered, therefore, that the primary reason for this is the difference in the assumptions regarding ATMs and fleet mix that underpins the

two sets of predictions. Each of these differences would have a noticeable effect on contours, but together the effect is more pronounced.

Differences in fleet mix assumptions have a significant effect on the predicted noise contours. The promoter assumes that Heathrow will (be able to) attract a high proportion of quieter aircraft, so that in 2030 the fleet mix will be 5% 'current' and 95% 'imminent'. This differs from the Airport Commission assumed fleet mix of 32% 'current' and 67% 'imminent'.

A similar disparity in fleet mix exists for the 2040, with the promoter assuming (in Air and Ground Noise Assessment, p.16) that:

- <1% 'current',
- 78% 'imminent', and
- 21% 'future'.

For 2040 The Airports Commission assumes[6]

- 13% 'current',
- 76% 'imminent', and
- 10% 'future'.

The difference that these fleet mix assumptions make is summarised below:

Table 4.102 : Percentage changes in predicted noise contour areas and population exposure as a result of HAL fleet mix (compared to AC Fleet mix)

			Area		Population	
Metric	**Period**	**Value**	**2030**	**2040**	**2030**	**2040**
$L_{Aeq,16h}$	Summer average	>54	1.2%	2.1%	-1.9%	-4.5%
$L_{Aeq,16h}$	Summer average	>57	-1.4%	0.1%	-5.2%	-4.7%
$L_{Aeq,8h}$	Summer average	>48	-7.6%	-8.7%	-13.5%	-17.4%
L_{den}	Annual average	>55	-2.2%	-2.7%	-8.6%	-10.6%

The fleet mix assumed by HAL results in more optimistic predictions in both 2030 and 2040, with the most marked difference being a 17.4% reduction in population exposed to summers night noise levels of >48 dB $L_{Aeq,8h}$ compared to that calculated using the Airports Commission fleet mix.

It should also be noted that the scheme promoter has based their 2030 Do-Something noise contours on 570,000 ATM, while the Airport Commission assume 652,216 ATM. This is a 14.4% difference which will also have a significant effect on the predicted noise contours for this year. However, by 2040 the ATM forecasts align more closely, with the Airports Commission forecast only 1.4% greater.

Other differences in the input data used by the promoter which are expected to contribute to differences in the predicted contours include the use of 3.5º approach slope in 2040 and 2050, and displaced thresholds in 2030 and 2040. The sensitivity test undertaken by the Airport Commission into the effect of a 3 .5º approach slope in 2050 shows that the noise benefits are substantial for most metrics considered.

[6] The 1% discrepancy that arises when combining these to a total of 99% is due to rounding error.

4.22 Mitigation

The promoter's submission includes a detailed and extensive mitigation strategy, most aspects of which are embodied in the noise modelling. The promoter's noise predictions can therefore be considered to already represent a highly 'mitigated' situation.

The proposed mitigation strategy concentrates on:

- Reducing noise at source, through incentives to encourage the quietest possible fleet mix.
- Designing the airport infrastructure to be as quiet as possible, through the positioning of 27N[7] and threshold displacement of the runways.
- Reducing noise emissions by developing quieter operating procedures, most notably increased runway alternation, night fleet management and steeper approach slopes.
- Three airspace design options (minimising the total number of people overflown, minimising the number of new people overflown and maximising respite).
- Compensation and mitigation schemes. Heathrow has allocated a £250 million fund to pay for noise insulation and compensation in respect of dwellings and community buildings that are exposed to significant new noise. The potential allocation of this fund has not been determined, but there is on-going consultation with local community representatives on this issue.
- Providing Fixed Electrical Ground Power (FEGP) and Pre-Conditioned Air (PCA) at all aircraft stands to reduce further the use of APUs whilst aircraft are on-stand.
- Provision of Ground Power Units (GPUs), which are quieter than APUs, should FEGP not be available.
- Reducing taxi and holding times through improved decision making
- Use of modern airside equipment such as electric vehicles and clatter-resistant baggage trolleys.
- Enhanced maintenance procedures to ensure all airside equipment is suitably maintained to avoid excessive noise.

In particular, the promoter's mitigation strategy in respect of reducing noise at source through attracting quieter aircraft is ambitious. This shift to 'imminent' and 'future' aircraft types adopted by the promoter has a significant effect on the predicted population noise exposure metrics.

4.23 Conclusions

The key findings of the promoter's submission broadly in line with the findings from the ANCON noise modelling undertaken for the Airport Commission also:

- When compared to the 2030 DM option, the Heathrow NWR option results in a decrease in the number of people exposed to daytime noise at 54 dB $L_{Aeq,16h}$, although in the Airports Commission analysis this advantage is lost by 2040 and 2050.

[7] Currently Heathrow's runways are 09/27 L or R. The number refers to the compass bearing 09(0)/ 27(0) degrees, meaning the runway is due east-west. The L or R refers to left or right from approach or departure direction. In a three runway scenario, the runways would most likely be labelled 27/0 N,C or S for North, central and South. 27N thus refers to the northwest runway, westerly heading.

- Beyond the 54 dB contour in 2030, there are increases in the number of people exposed to higher levels of noise in the Heathrow NWR scenario compared to the Do-Minimum scenario. This is due to increased ATMs and changes to routes, which are most pronounced when aircraft are relatively distant from the airport.
- Night-time noise exposure will be reduced with the NWR option (although the promoter's and ERCD's modelling disagree about the assessment years in which these benefits will be seen due to differences in forecast ATM).

The promoter's assertion that the number of people affected by daytime aircraft noise in the 2030 and 2040 Do-Something scenarios would be lower than in the current situation is borne out by both sets of modelling.

However, this is not a comparison required by the noise appraisal module and it should be noted that far greater reductions in current daytime noise would be realised in the 2030 and 2040 DM options than the NWR options (e.g. a reduction of 184,450 people exposed to 54 dB $L_{Aeq,16h}$ or greater in 2040). These reductions are due to the forecast changes in fleet mix and the constrained growth forecasts for the DM scenarios.

5 Heathrow Extended Northern Runway (Heathrow-ENR)

This chapter focuses on the Heathrow Extended Northern Runway proposal and:

- *Summarises the key elements of the scheme, focusing on aspects which are relevant to noise*
- *Summarises the current baseline situation, and describes how it will change over time, in the absence of the scheme*
- *Describes the impacts of the scheme, based on noise modelling undertaken by ECRD using the ANCON model for the Airports Commission*
- *Considers the effects of ground noise*
- *Summarises the monetisation of annoyance and health effects from noise*
- *Reviews the promoter's submissions in respect of noise*
- *Describes the potential for noise mitigation*
- *Reaches conclusions on the likely noise impacts of the scheme*

5.1 Scheme description

The basic premise of the proposed Heathrow Airport Extended Northern Runway (Heathrow ENR)scheme is the extension of the existing northern runway at Heathrow Airport to approximately double its current length, and the introduction of a safety area mid-way along the extended runway, allowing it to operate as two runways.

Amongst the benefits of this scheme that the Proposer cites in their submission is the fact that the new runway capacity maintains the existing runway centrelines, so their assumption is there are no new people included in the noise footprint. The promoter also suggests that operational measures to reduce noise and improve respite are possible, with specific reductions to (or even removal of) noise impacts from early morning arrivals.

5.2 Baseline

The current baseline (2013) and future (2030, 2040 and 2050) DM noise levels that are calculated for Heathrow Airport are set out in the Noise Baseline Report.

The noise study area for the Heathrow ENR 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 5.1 : Heathrow Extended Northern Runway 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, Southwark
- 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:

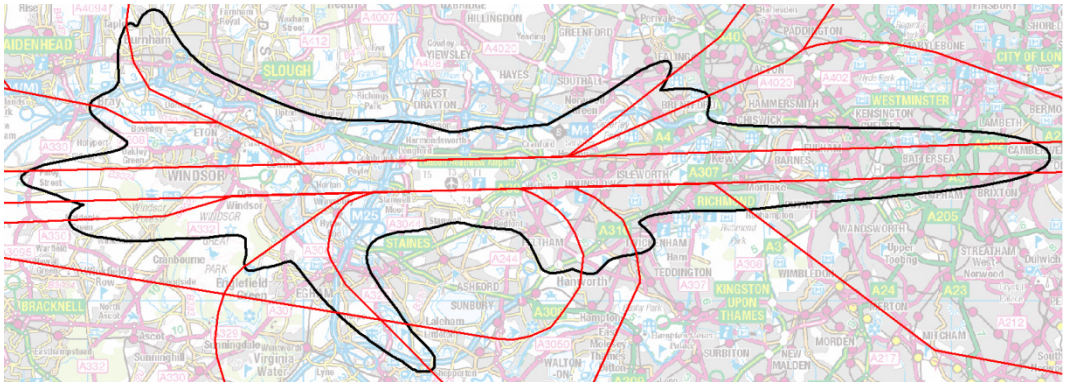
- Boveney, Buckinghamshire County
- Bray, Windsor and Maidenhead
- Burnham, Buckinghamshire County
- Colnbrook, Slough
- Cranbourne, Bracknell Forest
- Cranford, Hounslow
- Datchet, Windsor and Maidenhead
- Dorney, Buckinghamshire County
- East Bedfont, Hounslow
- Fifield, Windsor and Maidenhead
- Hanworth, 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

5.3 Routes

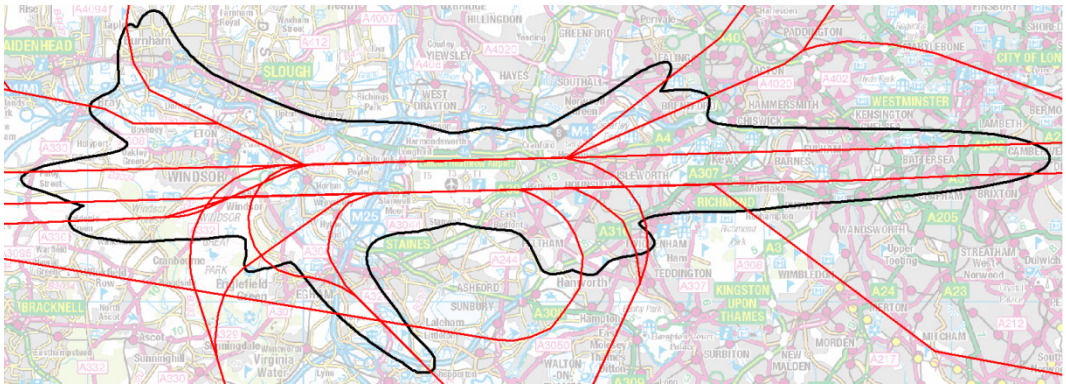
The proposed routes for the Heathrow ENR scheme are based on peak flow operation, shown in Figure 5.2 below. These routes have been developed for noise modelling purposes and should not be considered as the final routes of an expanded option.

Figure 5.2 : Heathrow-ENR (Peak Flow) Routes



A sensitivity test has also been conducted using proposed respite operating mode routes, shown in Figure 5.3 below.

Figure 5.3 : Heathrow-ENR-R (Respite) Routes



5.4 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 as shown in Figure 5.4 below.

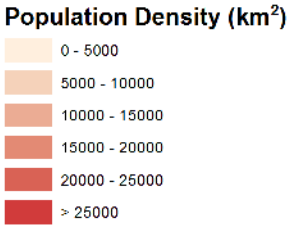
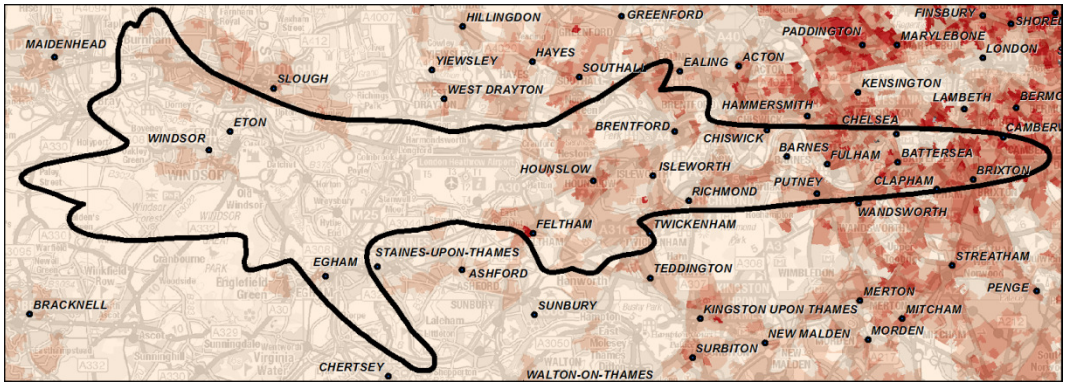


Figure 5.4 : Heathrow Extended Northern Runway Study Area Forecast Population Densities (2030)



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 4.6 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 result is explained by changes to a single postcode point associated with a population which is present in the 2030 forecast but not in the 2050 forecast; results should be treated with caution).

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.

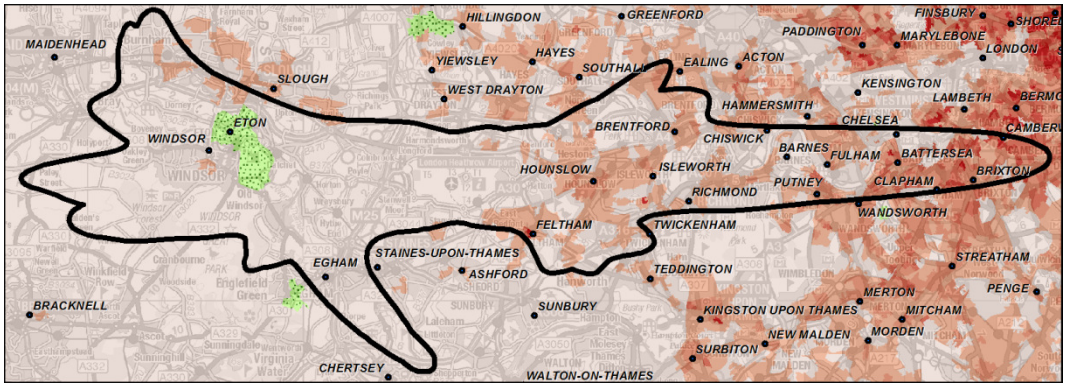


Figure 5.5 : 2030 vs 2050 Difference in Population Densities around Heathrow Airport

5.5 Baseline Noise Levels

As the Heathrow Extended Northern Runway scheme is situated at Heathrow Airport, the Current and future year DM noise levels for this airport are as presented in Section 4.5 above.

5.6 Scorecards for Heathrow Extended Northern Runway (Heathrow-ENR)

Noise metrics have been produced by ERCD on behalf of the Airport Commission for the Heathrow Airport Extended Northern Runway proposal for 2030, 2040 and 2050.

Table 5.1 : 2030 Heathrow-ENR Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	709,800			N70 >20	298,300
	>57 dB LAeq,16h	297,400			N70 >50	221,200
	>60 dB LAeq,16h	158,400			N70 >100	142,500
	>63 dB LAeq,16h	63,800			N70 >200	97,500
	>66 dB LAeq,16h	17,100			N70 >500	<50
	>69 dB LAeq,16h	3,900				
	>72 dB LAeq,16h	600				
Night	>48 dB LAeq,8h	392,700			N60 >25	348,200
	>51 dB LAeq,8h	201,900			N60 >50	24,500
	>54 dB LAeq,8h	96,200			N60 >100	0
	>57 dB LAeq,8h	34,900			N60 >200	0
	>60 dB LAeq,8h	6,700			N60 >500	0
	>63 dB LAeq,8h	2,200				
	>66 dB LAeq,8h	200				
	>69 dB LAeq,8h	<50				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	806,800		
			>60 dB L_{den}	232,700		
			>65 dB L_{den}	62,000		
			>70 dB L_{den}	5,000		
			>75 dB L_{den}	400		

Table 5.2 : 2040 Heathrow-ENR Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	726,000			N70 >20	306,800
	>57 dB LAeq,16h	305,700			N70 >50	231,900
	>60 dB LAeq,16h	167,100			N70 >100	149,900
	>63 dB LAeq,16h	66,900			N70 >200	105,800
	>66 dB LAeq,16h	17,600			N70 >500	<50
	>69 dB LAeq,16h	4,000				
	>72 dB LAeq,16h	700				
Night	>48 dB LAeq,8h	476,700			N60 >25	497,900
	>51 dB LAeq,8h	228,100			N60 >50	65,100
	>54 dB LAeq,8h	114,100			N60 >100	0
	>57 dB LAeq,8h	42,100			N60 >200	0
	>60 dB LAeq,8h	8,800			N60 >500	0
	>63 dB LAeq,8h	2,800				
	>66 dB LAeq,8h	300				
	>69 dB LAeq,8h	100				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	856,200		
			>60 dB L_{den}	248,100		
			>65 dB L_{den}	67,400		
			>70 dB L_{den}	5,600		
			>75 dB L_{den}	400		

Table 5.3 : 2050 Heathrow-ENR Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	702,600			N70 >20	288,400
	>57 dB LAeq,16h	303,900			N70 >50	230,000
	>60 dB LAeq,16h	167,800			N70 >100	169,300
	>63 dB LAeq,16h	67,000			N70 >200	110,400
	>66 dB LAeq,16h	17,700			N70 >500	<50
	>69 dB LAeq,16h	3,900				
	>72 dB LAeq,16h	600				
Night	>48 dB LAeq,8h	516,300			N60 >25	520,900
	>51 dB LAeq,8h	238,500			N60 >50	64,300
	>54 dB LAeq,8h	117,100			N60 >100	0
	>57 dB LAeq,8h	41,500			N60 >200	0
	>60 dB LAeq,8h	8,100			N60 >500	0
	>63 dB LAeq,8h	2,700				
	>66 dB LAeq,8h	300				
	>69 dB LAeq,8h	<50				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	852,500		
			>60 dB L_{den}	253,000		
			>65 dB L_{den}	67,200		
			>70 dB L_{den}	5,400		
			>75 dB L_{den}	500		

5.7 Assessment of Heathrow Airport Extended Northern Runway (Heathrow-ENR)

The predicted differences between the equivalent year DM and Heathrow-ENR scenarios for each noise metric are considered in detail below. The ATMs used in the noise modelling of these two scenarios are set out in Table 5.4 below.

Table 5.4 : Heathrow Airport – Extended Northern Runway Option ATMs

	Air Transport Movements		
	2030	2040	2050
Heathrow DM	483,856	484,517	471,132
Heathrow Heathrow-ENR	654,489	700,000	700,000

5.7.1 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 day, that may result from the development of the Heathrow Extended Northern Runway proposal.

For convenience, extracts from the relevant 2030, 2040 and 2050 DM and Do-Something scenario $L_{Aeq,16h}$ contour plots are shown in Figure 5.6 to Figure 5.11 to provide visual context to the comparisons. The full contour plots are included in Appendix B.

The analysis in this section indicates that significant noise increases are expected for the Heathrow Airport Extended Northern Runway option in comparison to the corresponding DM situation. No reductions in noise are predicted in any contour, for any year.

Figure *5.6* : 2030 Do-Minimum Heathrow Extended Northern Runway $L_{Aeq,16h}$ Contours

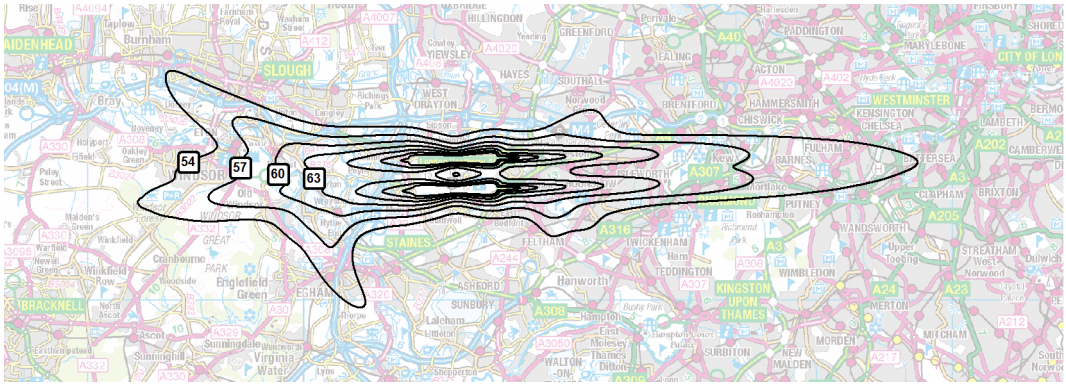
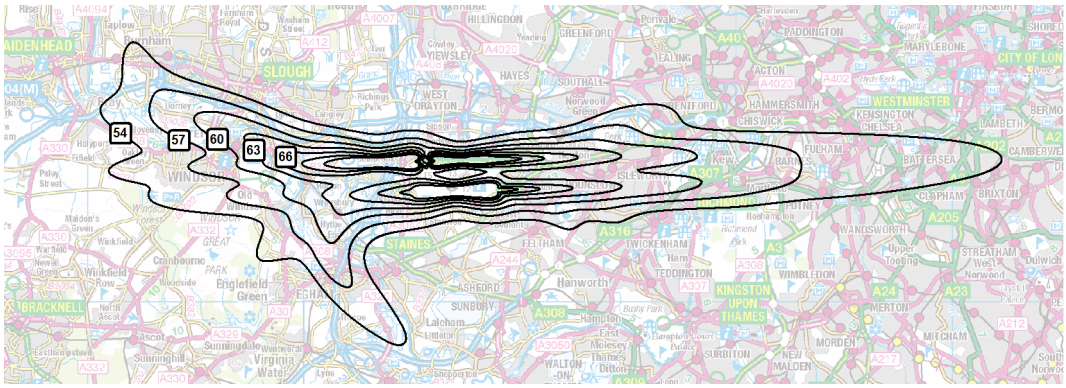


Figure *5.7* : 2030 Do Something Heathrow Extended Northern Runway $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.5 below.

Table *5.5* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-ENR, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	43.9	216,200	94,400
>57	24.6	76,200	31,100
>60	17.0	49,400	19,200
>63	8.3	28,600	11,400
>66	5.0	9,200	3,500
>69	3.2	1,800	700
>72	2.0	<50 to 600	<50 to 300

Note: Numbers in parentheses represent reductions

For the Do-Something scenario, the proposed routes overfly many of the same areas as the current and DM routes for Heathrow Airport. To the east of the airport, the DM and Do-Something contours are similar in shape, although there is a significant extension of the 54 dB contour in the Do-Something over Battersea. To the west, the introduction of an additional westerly departure route in the Do-Something scenario causes additional protrusions in the contours (particularly visible in the outer contour).

With the predicted increase in aircraft movements not fully offset by the forecast introduction of quieter aircraft in the fleet mixes, the result is increased areas covered by the noise contours and corresponding significant increases in population exposure:

- >54 dB an increase of 216,200 (from 493,600 to 709,800)
- >57 dB an increase of 76,200 (from 221,200 to 297,400)
- >60 dB an increase of 49,400 (from 109,000 to 158,400)
- >63 dB an increase of 28,600 (from 35,200 to 63,800)
- >66 dB an increase of 9,200 (from 7,900 to 17,100)
- >69 dB an increase of 1,800 (from 2,100 to 3,900)
- >72 dB an increase from <50 to 600

For the Heathrow Extended Northern Runway (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2030 Do-Something scenario compared to the 2030 DM scenario is 81,400, and the number of people newly removed is 4,300. This results in a net increase in the number of people newly affected of 77,100.

Figure *5.8* : 2040 Do-Minimum Heathrow Extended Northern Runway $L_{Aeq,16h}$ Contours

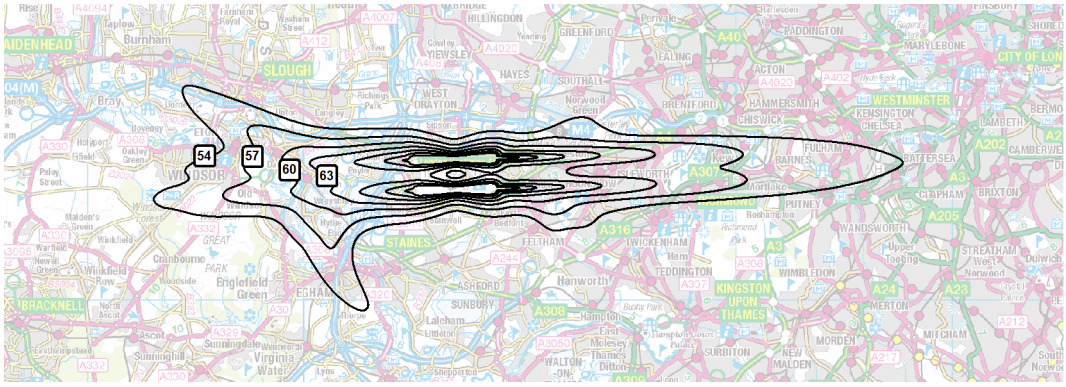
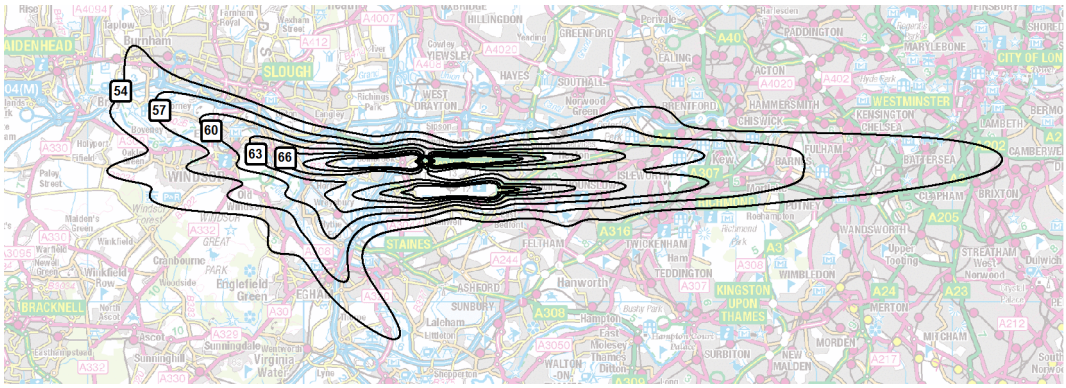


Figure *5.9* : 2040 Do Something Heathrow Extended Northern Runway $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.6 below.

Table *5.6* : 2040 Do-Minimum Heathrow vs 2030 Heathrow-ENR, $L_{Aeq,16h}$

Contour	Area (km^2)	Population	Households
>54	48.3	265,400	114,800
>57	27.5	86,300	35,300
>60	18.7	63,300	24,600
>63	8.8	33,000	12,900
>66	5.3	10,500	4,100
>69	3.3	1,900	800
>72	2.0	<50 to 700	<50 to 300

Note: Numbers in parentheses represent reductions

The comparison for 2040 is similar to that for 2030; the effects of the predicted increase in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes. As the routes are similar to the Do-Something scenario, this results in increased areas covered by the noise contours and corresponding increases in population exposure compared to the DM scenario:

- >54 dB an increase of 265,400 (from 460,600 to 726,000)
- >57 dB an increase of 86,300 (from 219,400 to 305,700)
- >60 dB an increase of 63,300 (from 103,800 to 167,100)
- >63 dB an increase of 33,000 (from 33,900 to 66,900)
- >66 dB an increase of 10,500 (from 7,100 to 17,600)
- >69 dB an increase of 1,900 (from 2,100 to 4,000)
- >72 dB an increase from <50 to 700

For the Heathrow Extended Northern Runway (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2040 Do-Something scenario compared to the 2040 DM scenario is 89,400, and the number of people newly removed is 2,900. This results in a net increase in the number of people newly affected of 86,500.

Figure *5.10* : 2050 Do-Minimum Heathrow Extended Northern Runway $L_{Aeq,16h}$ Contours

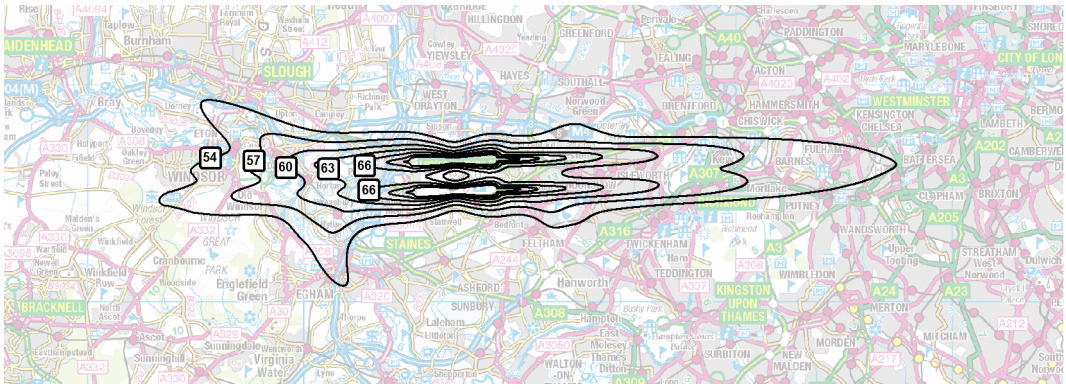
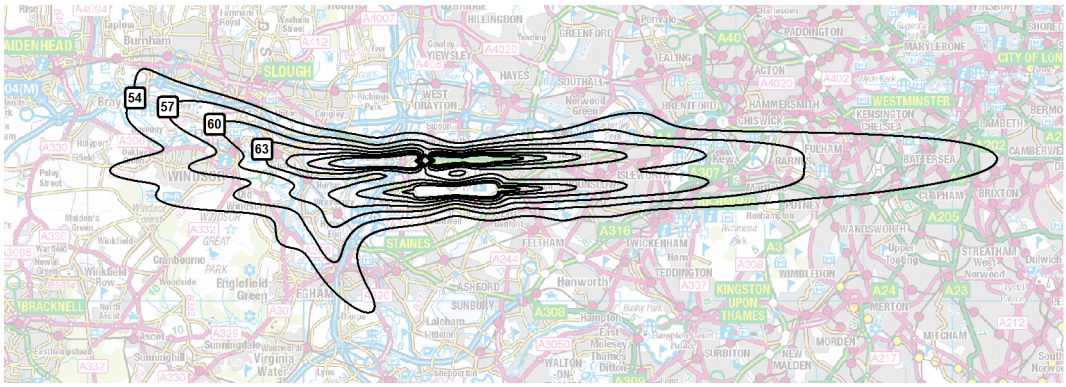


Figure *5.11* : 2050 Do Something Heathrow Extended Northern Runway $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.7 below.

Table *5.7* : 2050 Do-Minimum Heathrow vs 2030 Heathrow-ENR, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	44.6	266,800	115,900
>57	25.3	84,300	34,400
>60	17.1	64,000	25,000
>63	7.8	32,100	12,700
>66	5.2	10,000	3,900
>69	3.2	1,800	700
>72	1.9	<50 to 600	<50 to 300

Note: Numbers in parentheses represent reductions

The comparison for 2050 shows a similar trend to those for 2030 and 2040; the effects of the predicted increase in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes. As the routes are similar to the Do-Something scenario, this results in increased areas covered by the noise contours and corresponding increases in population exposure compared to the DM scenario:

- >54 dB an increase of 266,800 (from 435,800 to 702,600)
- >57 dB an increase of 84,300 (from 219,600 to 303900)
- >60 dB an increase of 64,000 (from 103,800 to 167,800)
- >63 dB an increase of 32,100 (from 34,900 to 67,000)
- >66 dB an increase of 10,000 (from 7,700 to 17,700)

- >69 dB an increase of 1,800 (from 2,100 to 3,900)
- >72 dB an increase from <50 to 600

For the Heathrow Extended Northern Runway (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2050 Do-Something scenario compared to the 2050 DM scenario is 87,200, and the number of people newly removed is 2,100. This results in a net increase in the number of people newly affected of 85,100.

(b) N70 Supplementary Metric

This section considers predicted changes in terms of the N70 supplementary noise metric, which is a count of the number of people subject to more than 20, 50, 100, 200 or 500 events which exceed 70 dB $L_{AS,Max}$ in an average annual day.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N70 contour plots are shown in below Figure 5.12 to Figure 5.17 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The analysis in this section indicates that the number of people within the N70 contour bands will increase substantially as a result of the Heathrow Airport Extended Northern Runway proposal (when compared to the DM situation), for all of the assessment years considered. The largest increases are expected for the 2050 assessment year. No reductions in noise are predicted in any contour, for any year.

Contours Figure 5.12 : 2030 Do-Minimum Heathrow Extended Northern Runway N70

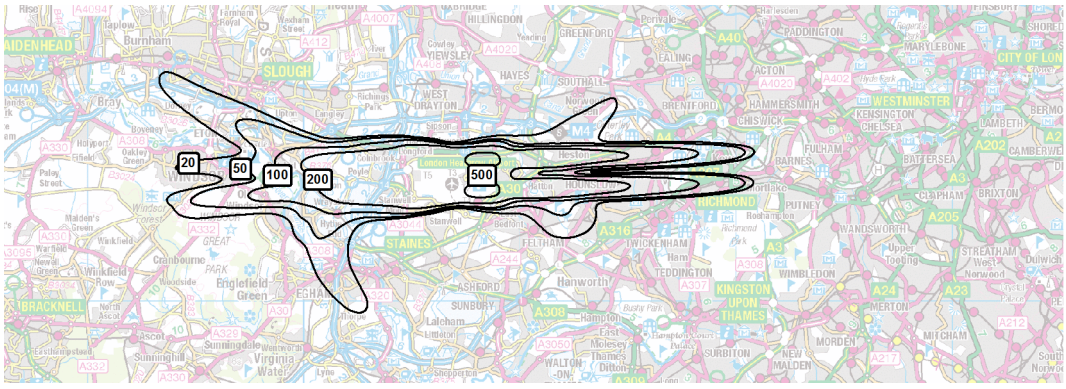
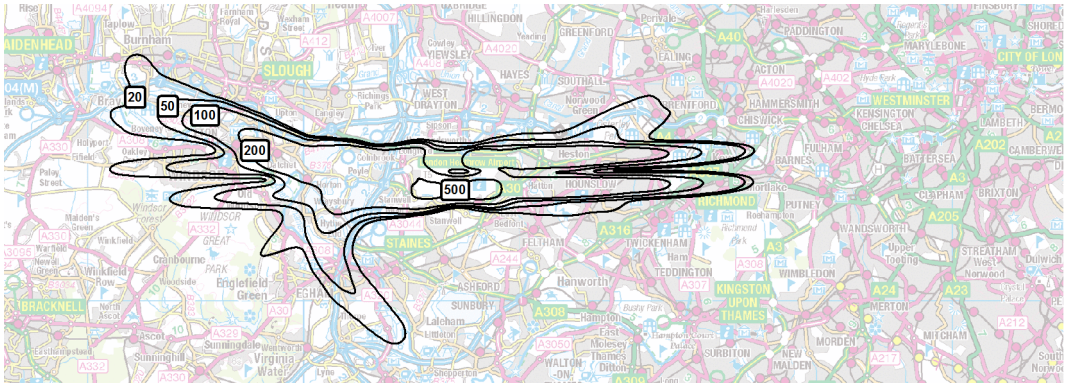


Figure 5.13 : 2030 Do Something Heathrow Extended Northern Runway N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 5.8 below.

Table *5.8* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-ENR, N70

Contour	Area (km^2)	Population	Households
>20	16.6	6,500	3,100
>50	12.9	37,100	14,700
>100	10.7	19,900	7,600
>200	7.6	34,200	13,500
>500	0.8	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The introduction of an additional westerly departure route in the Do-Something scenario causes additional protrusions to the west extent of the contours, while the eastern end of the contours remain quite similar in shape to the DM scenario.

In all cases, the predicted increases in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes, and the result is increased areas covered by the noise contours.

For most contours, there is a corresponding increase in the population enclosed in the Do-Something scenario compared to the DM scenario. However, the >500 is contained entirely within the footprint of the airport and therefore there is no difference in the population contained in this contour between the scenarios.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- >20: An increase of 6,500 (from 291,800 to 298,300)
- >50: An increase of 37,100 (from 184,100 to 221,200)
- >100: An increase of 19,900 (from 122,600 to 142,500)
- >200: An increase of 34,200 (from 63,300 to 97,500)
- >500: No distinguishable difference (from <50 to <50)

Figure 5.14 : 2040 Do-Minimum Heathrow Extended Northern Runway N70 Contours

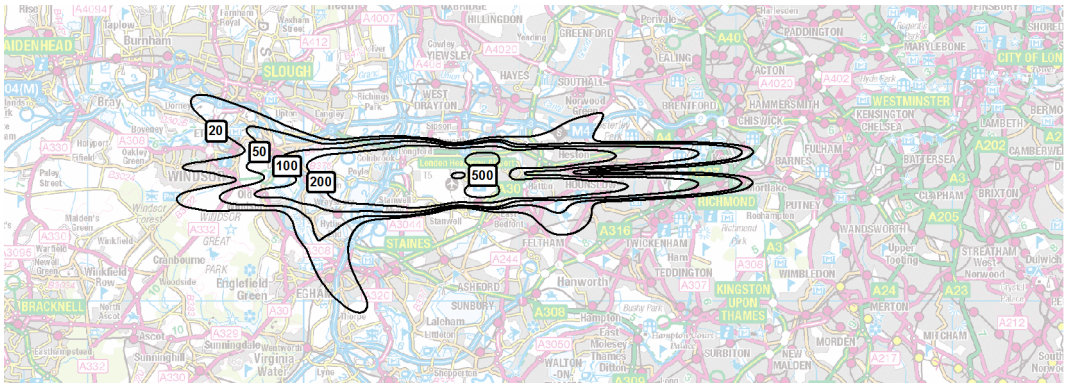
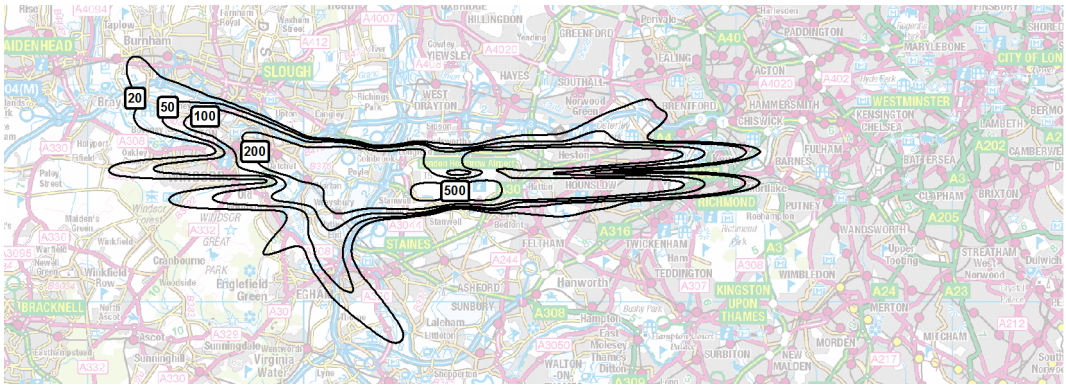


Figure 5.15 : 2040 Do Something Heathrow Extended Northern Runway N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 5.9 below.

Table *5.9* : 2040 Do-Minimum Heathrow vs 2030 Heathrow-ENR, N70

Contour	Area (km²)	Population	Households
>20	20.8	28,500	11,700
>50	15.7	44,000	17,700
>100	12.0	25,200	9,800
>200	9.1	43,600	17,000
>500	0.9	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The introduction of an additional westerly departure route in the Do-Something scenario causes additional protrusions to the west extent of the contours, while the eastern end of the contours remain quite similar to the DM scenario.

In all cases, the predicted increases in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes, and the result is increased areas covered by the noise contours.

For most contours, there is a corresponding increase in the population enclosed in the Do-Something scenario compared to the DM scenario. However, the >500 is contained entirely within the footprint of the airport and therefore there is no difference in the population contained in this contour between the scenarios.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- N70 >20 an increase of 28,500 (from 278,300 to 306,800)
- N70 >50 an increase of 44,000 (from 187,900 to 231,900)
- N70 >100 an increase of 25,200 (from 124,700 to 149,900)
- N70 >200 an increase of 43,600 (from 62,200 to 105,800)
- N70 >500 no distinguishable change (from <50 to <50)

Figure 5.16 : 2050 Do-Minimum Heathrow Extended Northern Runway N70 Contours

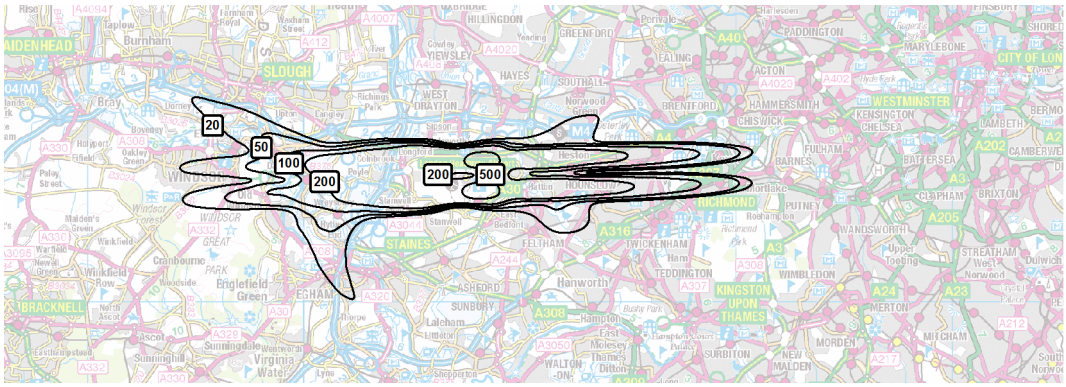
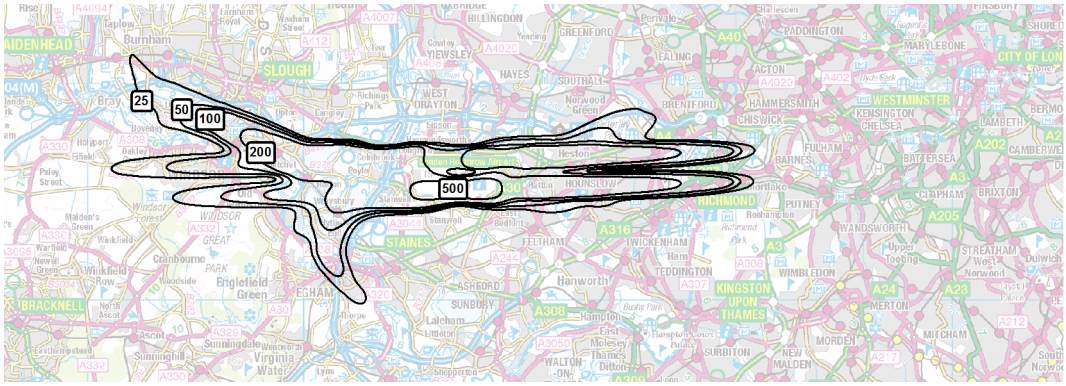


Figure 5.17 : 2050 Do Something Heathrow Extended Northern Runway N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 5.10 below.

Table *5.10* : 2050 Do-Minimum Heathrow vs 2050 Heathrow-ENR, N70

Contour	Area (km^2)	Population	Households
>20	11.6	14,300	6,100
>50	13.8	40,500	16,000
>100	13.2	39,900	16,100
>200	8.2	39,200	15,400
>500	0.8	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The introduction of an additional westerly departure route in the Do-Something scenario causes additional protrusions to the west extent of the contours, while the eastern end of the contours remain quite similar to the DM scenario.

In all cases, the predicted increases in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes, and the result is increased areas covered by the noise contours.

For most contours, there is a corresponding increase in the population enclosed in the Do-Something scenario compared to the DM scenario. However, the >500 is contained entirely within the footprint of the airport and therefore there is no difference in the population contained in this contour between the scenarios.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- *>20 an increase of 14,300 (from 274,100 to 288,400)*
- *>50 an increase of 40,500 (from 189,500 to 230,000)*
- *>100 an increase of 39,900 (from 129,400 to 169,300)*
- *>200 an increase of 39,200 (from 71,200 to 110,400)*
- *>500 no distinguishable change (from <50 to <50)*

5.7.2 Night Metrics

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

This section considers predicted changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario $L_{Aeq,8h}$ contour plots are shown in Figure 5.18 to Figure 5.23 provide visual context to the comparisons. Full contour plots are included in Appendix B.

The analysis in this section indicates that the number of people exposed to night-time noise will increase as a result of the Heathrow Airport Extended Northern Runway proposal (when compared to the DM situation), for all of the assessment years considered. The largest increases are expected for the 2050 assessment year. No reductions in noise are predicted in any contour, for any year.

Figure 5.18 : 2030 DM Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours

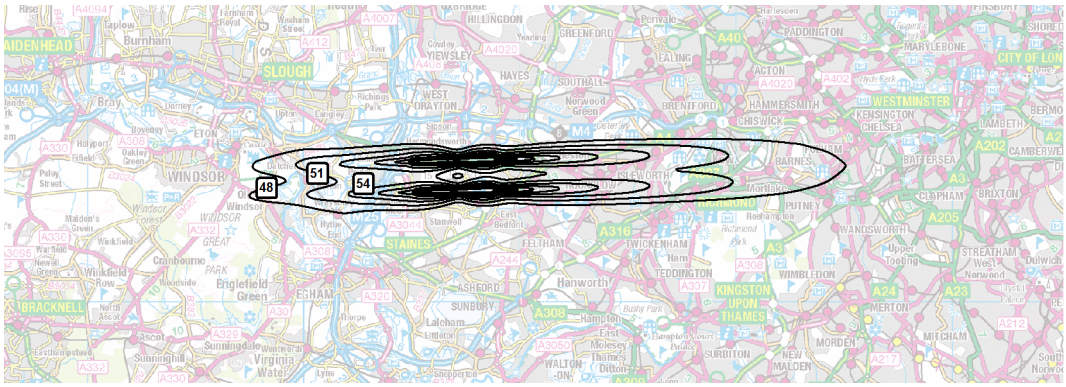
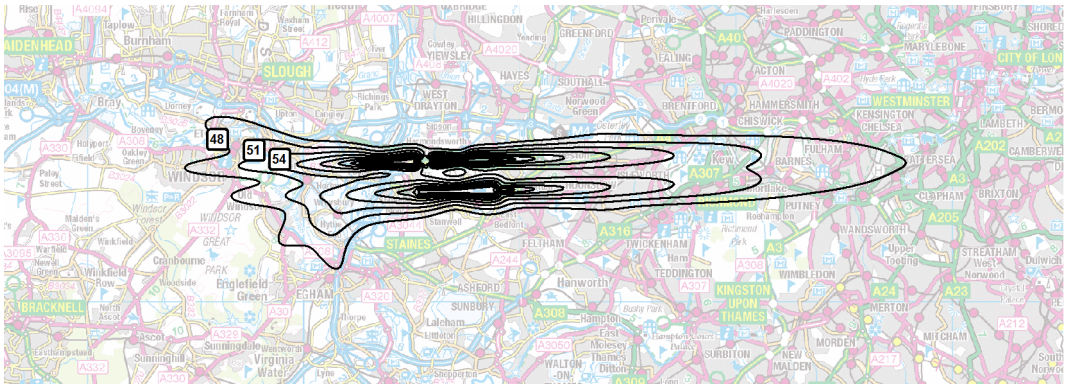


Figure 5.19 : 2030 DS Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.11 below.

Table 5.11 : 2030 DM Heathrow vs 2030 Heathrow-ENR, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	30.9	121,500	51,000
>51	19.3	50,600	21,100
>54	14.5	35,100	13,700
>57	7.9	13,000	5,100
>60	4.2	2,800	1,100
>63	2.5	900	300
>66	1.3	<50 to 200	<50 to 100
>69	0.6	<50 to <50	<50 to <50
>72	0.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00). The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the Do-Something contours are larger than the equivalent DM contours, due to predicted increases in aircraft movements. Apart from the highest noise level contours, which are largely contained within the airport boundary, the increases in

contour areas in the Do-Something scenarios correspond to greater populations enclosed than in the DM scenarios as detailed below:

- *>48 an increase of 121,500 (from 271,200 to 392,700)*
- *>51 an increase of 50,600 (from 151,300 to 201,900)*
- *>54 an increase of 35,100 (from 61,100 to 96,200)*
- *>57 an increase of 13,000 (from 21,900 to 34,900)*
- *>60 an increase of 2,800 (from 3,900 to 6,700)*
- *>63 an increase of 900 (from 1,300 to 2,200)*
- *>66 an increase from <50 to 200*
- *>69 – 72 no discernible difference (both from <50 to <50)*

Figure 5.20 : 2040 DM Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours

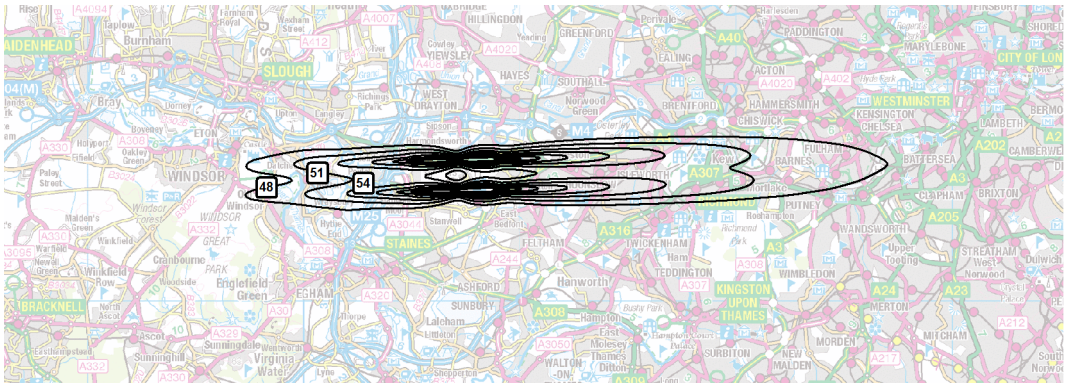
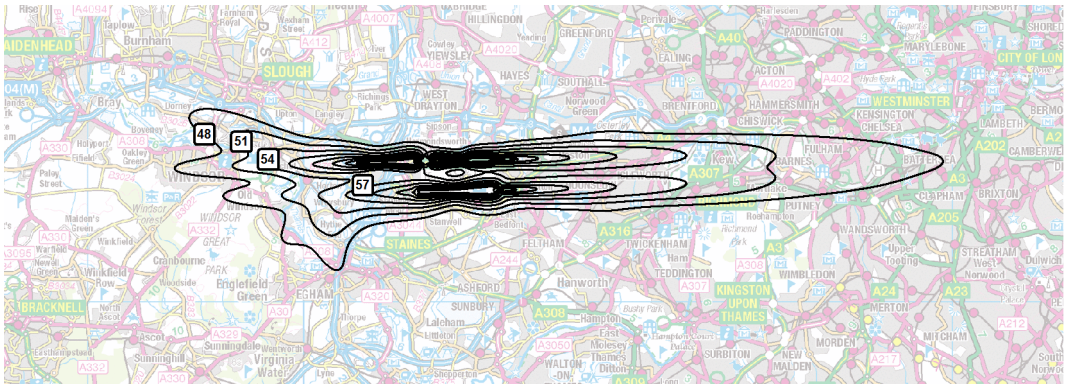


Figure 5.21 : 2040 DS Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.12 below.

Table 5.12 : 2040 DM Heathrow vs 2040 Heathrow-ENR, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	36.1	139,700	58,600
>51	21.7	43,500	17,800
>54	17.1	32,800	13,000
>57	8.8	10,700	4,200
>60	4.9	2,400	1,000
>63	3.0	400	200
>66	1.7	<50 to 300	<50 to 100
>69	0.8	<50 to 100	<50 to <50
>72	0.3	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00). The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the Do-Something contours are larger than the equivalent DM contours, as the predicted increases in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes. Apart from the >72 dB contour, which is largely contained within the airport boundary, the increases in contour areas in the Do-Something scenarios correspond to greater populations enclosed than in the DM scenarios as detailed below:

- *>48 dB: An increase of 139,700 (from 337,000 to 476,700)*
- *>51 dB: An increase of 43,500 (from 184,600 to 228,100)*
- *>54 dB: An increase of 32,800 (from 81,300 to 114,100)*
- *>57 dB: An increase of 10,700 (from 31,400 to 42,100)*
- *>60 dB: An increase of 2,400 (from 6,400 to 8,800)*
- *>63 dB: An increase of 400 (from 2,400 to 2,800)*
- *>66 dB: An increase from <50 to 300*
- *>69 dB: An increase from <50 to 100*
- *>72 dB: No discernible difference (from <50 to <50)*

Figure 5.22 : 2050 DM Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours

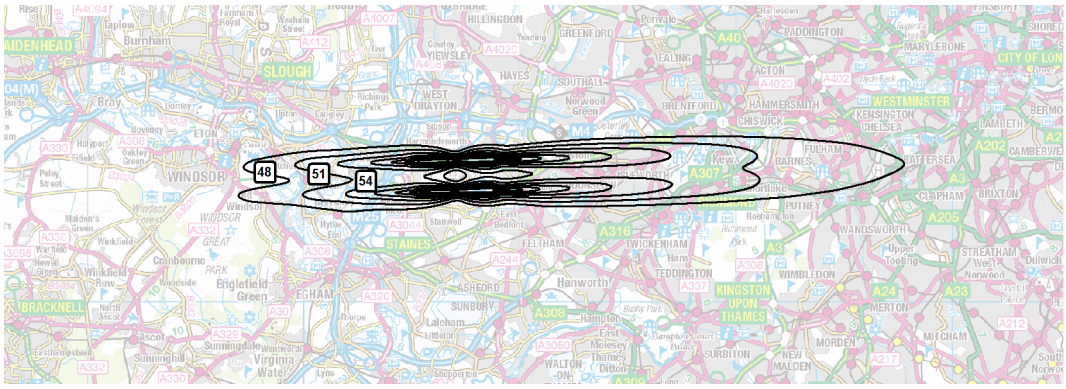
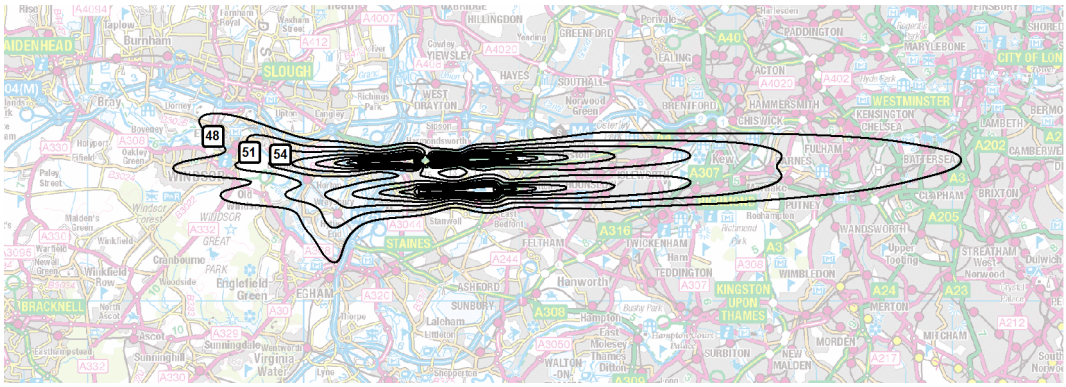


Figure 5.23 : 2050 DS Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.13 below.

Table 5.13 : 2050 DM Heathrow vs 2050 Heathrow-ENR, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	30.5	143,200	60,900
>51	17.6	41,100	16,800
>54	13.6	27,900	10,900
>57	6.7	7,600	2,900
>60	3.8	1,000	500
>63	2.3	100	100
>66	1.3	<50 to 300	<50 to 100
>69	0.5	<50 to <50	<50 to <50
>72	0.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00). The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the Do-Something contours are larger than the equivalent DM contours, as the predicted increases in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes. Apart from the highest noise level

contours, which are largely contained within the airport boundary, the increases in contour areas in the Do-Something scenarios correspond to greater populations enclosed than in the DM scenarios as detailed below:

- *>48 an increase of 143,200 (from 373,100 to 516,300)*
- *>51 an increase of 41,100 (from 197,400 to 238,500)*
- *>54 an increase of 27,900 (from 89,200 to 117,100)*
- *>57 an increase of 7,600 (from 33,900 to 41,500)*
- *>60 an increase of 1,000 (from 7,100 to 8,100)*
- *>63 an increase of 1,00 (from 2,600 to 2,700)*
- *>66 an increase from <50 to 300*
- *>69 – 72 no discernible difference (both from <50 to <50)*

(b) N60 Supplementary Metric

This section considers predicted changes in terms of the N60 supplementary noise metric, which is a count of the number of people subject to more than 25 50, 100 or 200 events which exceed 60 dB $L_{AS,Max}$ in an average annual night.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N60 contour plots are shown in Figure 5.24 to Figure 5.29 below to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The analysis in this section indicates that the number of people exposed to night-time noise will increase as a result of the Heathrow Airport Extended Northern Runway proposal (when compared to the DM situations), for all of the assessment years considered. The largest increases are expected for the 2040 assessment year. No reductions in noise are predicted in any contour, for any year.

Figure 5.24 : 2030 DM Heathrow Extended Northern Runway N60 Contours

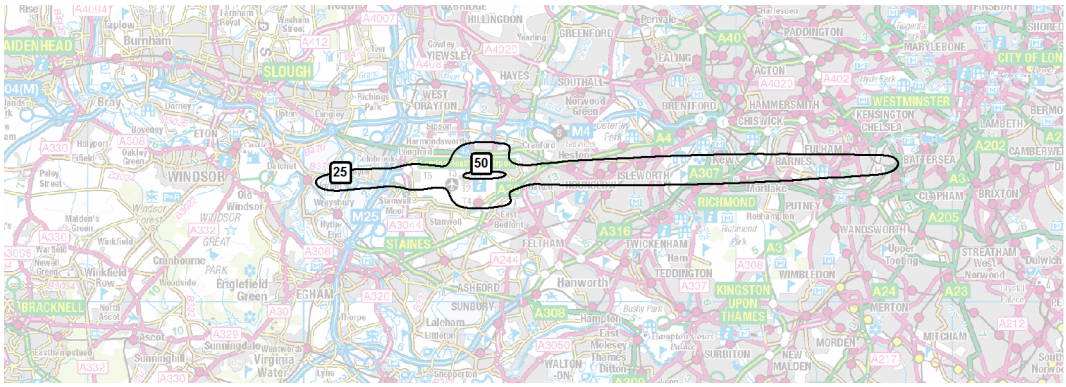
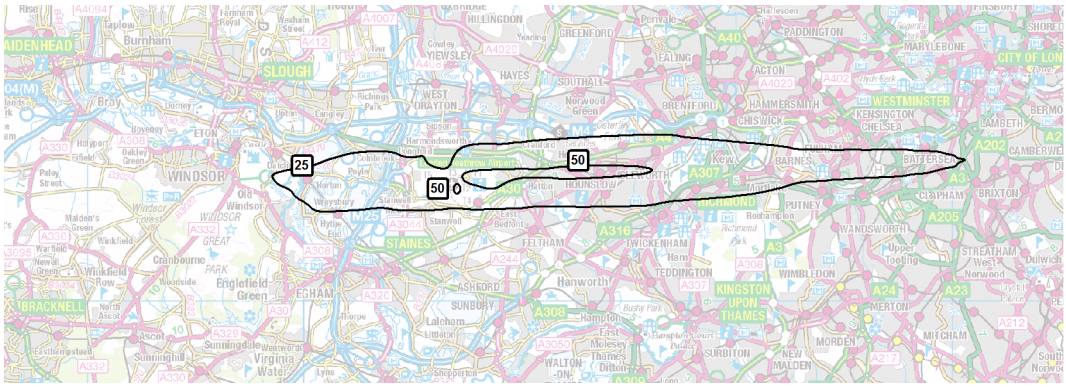


Figure 5.25 : 2030 DS Heathrow Extended Northern Runway N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 5.14 below.

Table 5.14 : 2030 DM Heathrow vs 2030 Heathrow-ENR, N60

Contour	Area (km2)	Population	Households
>25	38.0	197,700	81,200
>50	4.2	<50 to 24500	<50 to 9500

Note: Numbers in parentheses represent reductions

Comparing the N60 contours in Figure 5.24 and Figure 5.25 above, a difference in shape and size is evident, with the Do-Something contours being longer and wider than the DM contours as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00) using similar routes to the DM situation. No changes to the current night Quota Count system are assumed. This results in an increase in the population contained within the N60 contours for the Do-Something scenario. The increased area of the >25 contour to the east of the airport in the Do-Something is significant as the area between Heathrow and Battersea is densely populated.

The predicted differences in the populations within the Do-Something contours compared to the DM contours are detailed below:

- *N60 >25 an increase of 197,700 (from 150,500 to 348,200)*
- *N60 >50 an increase of at least 24,450 (from <50 to 24,500).*

Figure 5.26 : 2040 DM Heathrow Extended Northern Runway N60 Contours

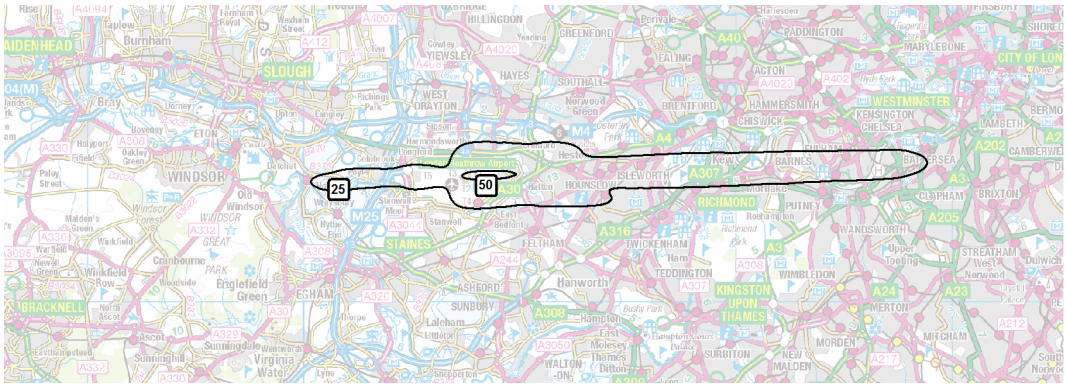
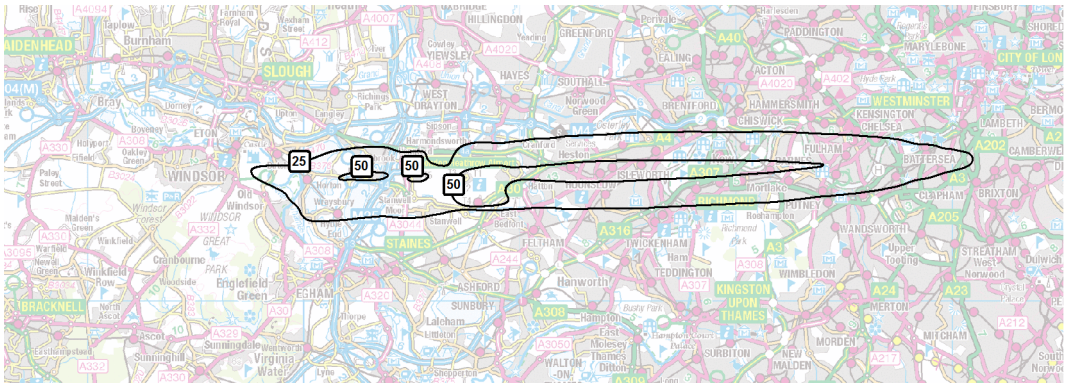


Figure 5.27 : 2040 DS Heathrow Extended Northern Runway N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 5.15 below.

Table 5.15 : 2040 DM Heathrow vs 2040 Heathrow-ENR, N60

Contour	Area (km2)	Population	Households
>25	46.1	239,600	101,800
>50	14.9	<50 to 65100	<50 to 25700

Note: Numbers in parentheses represent reductions

Comparing the DM and Do-Something N60 contours for 2040, a difference in shape and size is evident, with the Do-Something contours being longer and wider than the DM contours as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00) over similar routes to the DM situation. No changes to the current night Quota Count system are assumed. This results in an increase in the population contained within the N60 contours for the Do-Something scenario. The increased area of the >25 contour to the east of the airport in the Do-Something is significant as the area between Heathrow and Battersea is densely populated.

The predicted differences in the populations within the Do-Something contours compared to the DM contours are detailed below:

- *N60 >25 an increase of 239,600 (from 258,300 to 497,900)*
- *N60 >50 an increase of at least 65,050 (from <50 to 65,100)*

Figure 5.28 : 2050 DM Heathrow Extended Northern Runway N60 Contours

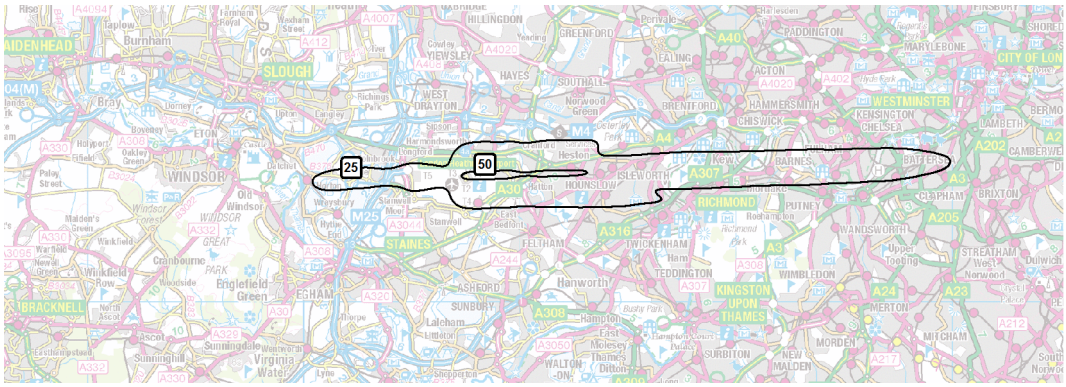
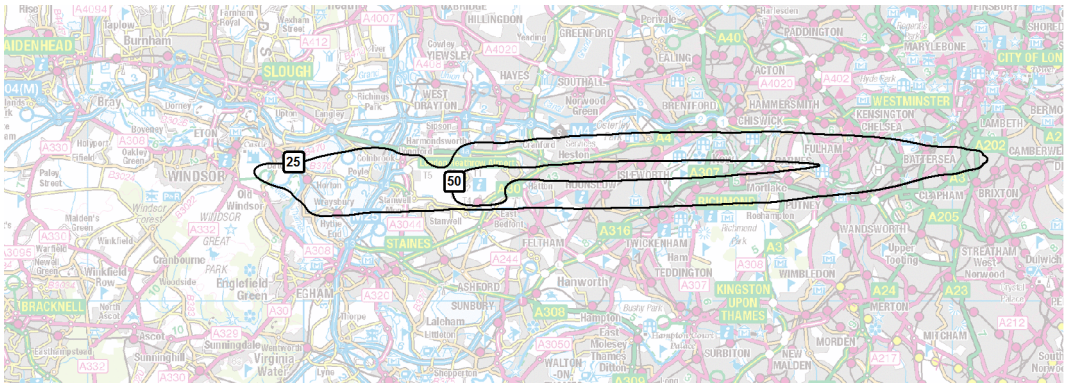


Figure 5.29 : 2050 DS Heathrow Extended Northern Runway N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 5.16 below.

Table 5.16 : 2050 DM Heathrow vs 2030 Heathrow-ENR, N60

Contour	Area (km2)	Population	Households
>25	37.5	200,200	86,200
>50	12.4	57,800	22,800

Note: Numbers in parentheses represent reductions

Comparing the DM and Do-Something N60 contours for 2050, a difference in shape and size is evident, with the Do-Something contours being longer and wider than the DM contours as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00) over similar routes to the DM situation. No changes to the current night Quota Count system are assumed. This results in an increase in the population contained within the N60 contours for the Do-Something scenario. The increased area of the >25 contour to the east of the airport in the Do-Something is significant as the area between Heathrow and Battersea is densely populated.

As with the other assessment years, there is an increase associated with the Do-Something scenario in comparison to the DM scenario in 2050:

- *>25 an increase of 200,200 (from 320,700 to 520,900)*
- *>50 an increase of 57,800 (from 6,500 to 64,300)*

5.7.3 24-hour Metric

This section considers predicted changes in terms of the L_{den} day-evening-night noise exposure metric, calculated as an annual average.

For convenience, extracts from the 2030, 2040 and 2050 DM and Do-Something scenario L_{den} contour plots are shown in Figure 5.30 to Figure 5.35 to provide visual context to the comparisons. The full contour plots are included in Appendix B.

The populations contained within the L_{den} contours shows significant increases for the Heathrow Airport Extended Northern Runway option when compared to the DM situations for each year.

Figure 5.30 : 2030 DM Heathrow Extended Northern Runway *L_{den}* Contours

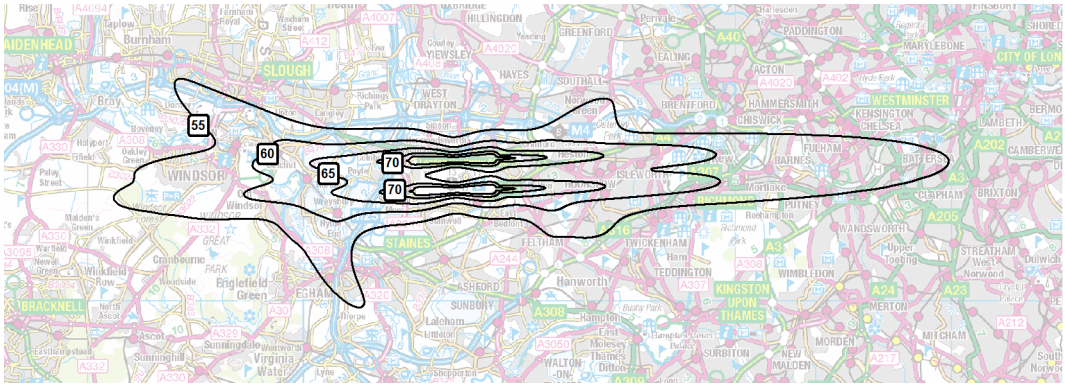
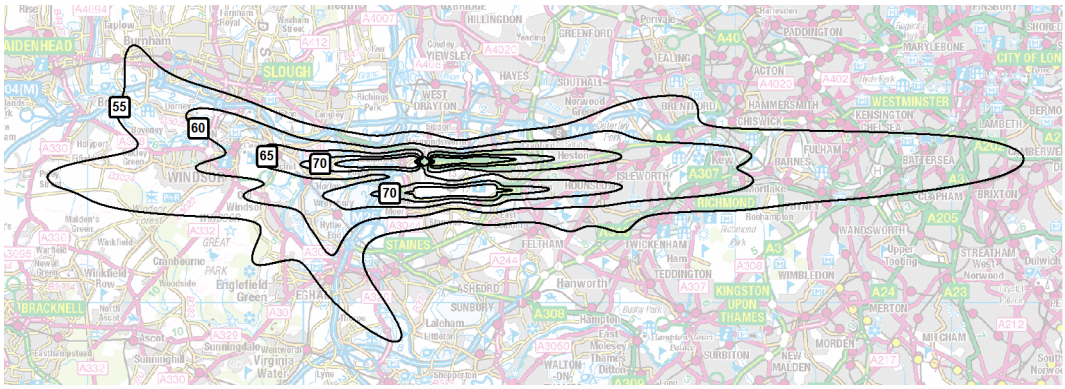


Figure 5.31 : 2030 DS Heathrow Extended Northern Runway *L_{den}* Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 5.17 below.

Table 5.17 : 2030 DM Heathrow vs 2030 Heathrow-ENR, *L_{den}*

Contour	Area (km²)	Population	Households
>55	48.6	226,300	97,700
>60	20.4	63,100	25,900
>65	7.6	27,200	10,700
>70	3.7	2,000	900
>75	1.6	<50 to 400	<50 to 200

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but are larger and extend further east as a result of increased aircraft movements. The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours, and the contours extend further north, south and west than in the DM situation.

All of the Do-Something contours are larger than the equivalent DM contours, as the predicted increases in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes. The increases in contour areas in the Do-Something scenarios correspond to greater populations enclosed than in the DM scenarios as detailed below:

- *>55 dB an increase of 226,300 (from 580,500 to 806,800)*
- *>60 dB an increase of 63,100 (from 169,600 to 232,700)*
- *>65 dB an increase of 27,200 (from 34,800 to 62,000)*
- *>70 dB an increase of 2,000 (from 3,000 to 5,000)*
- *>75 dB an increase of from <50 to 400.*

For the Heathrow Extended Northern Runway (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2030 Do-Something scenario compared to the 2030 DM scenario is 245,400, and the number of people newly removed is 18,000. This results in a net increase in the number of people newly affected of 227,400.

Figure 5.32 : 2040 DM Heathrow Extended Northern Runway *L_{den}* Contours

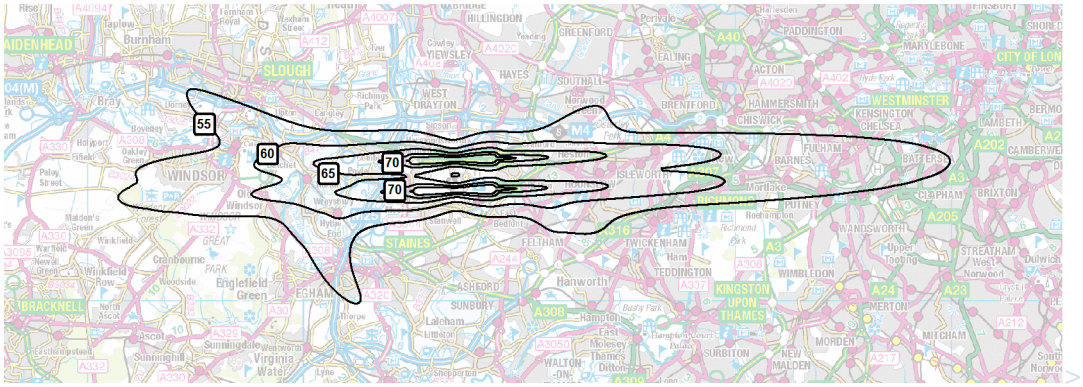
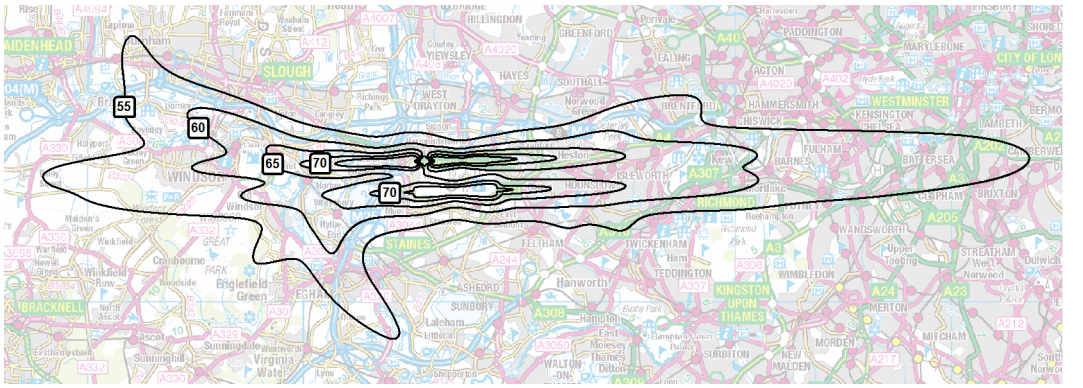


Figure 5.33 : 2040 DS Heathrow Extended Northern Runway *L_{den}* Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 5.18 below.

Table 5.18 : 2040 DM Heathrow vs 2040 Heathrow-ENR, L_{den}

Contour	Area (km^2)	Population	Households
>55	56.2	267,300	115,000
>60	22.7	68,600	28,200
>65	9.3	31,200	12,100
>70	4.1	2,500	1,000
>75	1.7	<50 to 400	<50 to 200

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but are larger and extend further east as a result of increased aircraft movements. The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours, and the contours extend further north, south and west than in the DM situation.

All of the Do-Something contours are larger than the equivalent DM contours, as the predicted increases in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes. The increases in contour areas in the Do-Something scenarios correspond to greater populations enclosed than in the DM scenarios as detailed below:

- *>55 dB an increase of 267,300 (from 588,900 to 856,200)*
- *>60 dB an increase of 68,600 (from 179,500 to 248,100)*
- *>65 dB an increase of 31,200 (from 36,200 to 67,400)*
- *>70 dB an increase of 2,500 (from 3,100 to 5,600)*
- *>75 dB an increase from <50 to 400.*

For the Heathrow Extended Northern Runway (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2040 Do-Something scenario compared to the 2040 DM scenario is 281,200, and the number of people newly removed is 11,300. This results in a net increase in the number of people newly affected of 269,900.

Figure 5.34 : 2050 DM Heathrow Extended Northern Runway L_{den} Contours

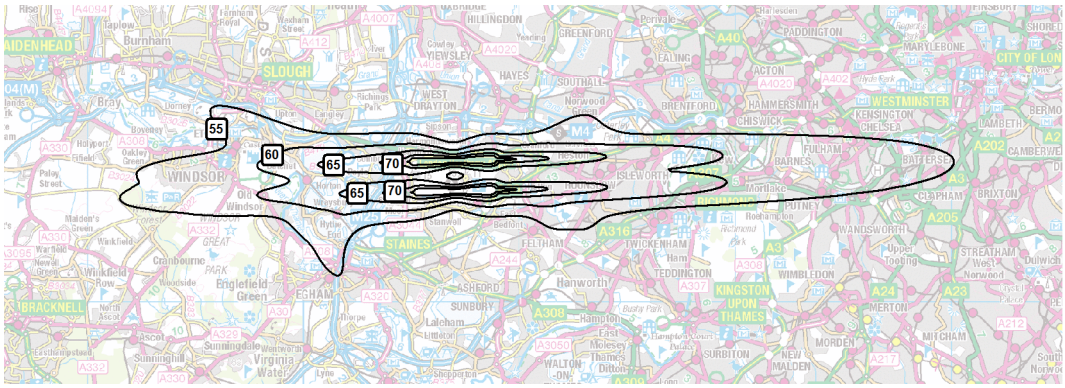
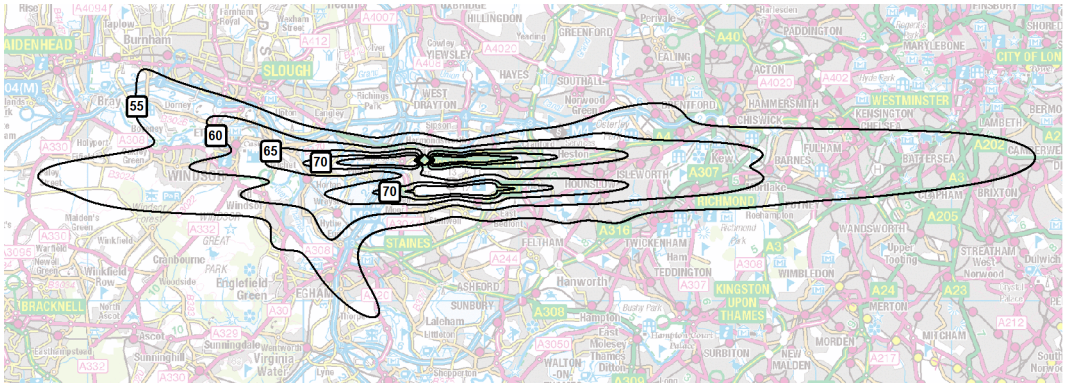


Figure 5.35 : 2050 DS Heathrow Extended Northern Runway L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 5.19 below.

Table 5.19 : 2050 DM Heathrow vs 2050 Heathrow-ENR, L_{den}

Contour	Area (km²)	Population	Households
>55	51.7	269,000	117,300
>60	20.8	70,900	29,100
>65	9.0	30,800	12,000
>70	3.7	2,300	900
>75	1.6	<50 to 500	<50 to 200

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but are larger and extend further east as a result of increased aircraft movements. The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours, and the contours extend further north, south and west than in the DM situation.

All of the Do-Something contours are larger than the equivalent DM contours, as the predicted increases in aircraft movements are not fully offset by the forecast introduction of quieter aircraft in the fleet mixes. The increases in contour areas in the Do-Something scenarios correspond to greater populations enclosed than in the DM scenarios as detailed below:

- *>55 dB an increase of 269,000 (from 583,500 to 852,500)*

- *>60 dB an increase of 70,900 (from 182,100 to 253,000)*
- *>65 dB an increase of 30,800 (from 36,400 to 67,200)*
- *>70 dB an increase of 2,300 (from 3,100 to 5,400)*
- *>75 dB an increase from <50 to 500.*

For the Heathrow Extended Northern Runway (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2050 Do-Something scenario compared to the 2050 DM scenario is 278,300, and the number of people newly removed is 8,000. This results in a net increase in the number of people newly affected of 270,300.

5.7.1 Sensitive Buildings

The change in number of sensitive buildings within each contour between the 2030 DM and 2030 Heathrow-ENR scenarios are set out in Table 5.20 below:

Table 5.20 : 2030 DM Heathrow vs 2030 Heathrow-ENR, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	158	4	98	N70 >20	8	1	13
	>57 dB $L_{Aeq,16h}$	53	2	42	N70 >50	30	1	23
	>60 dB $L_{Aeq,16h}$	41	2	25	N70 >100	12	1	12
	>63 dB $L_{Aeq,16h}$	11	0	7	N70 >200	23	0	14
	>66 dB $L_{Aeq,16h}$	3	0	2	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	2	0	1		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	0		0	0	0
Night	>48 dB $L_{Aeq,8h}$	96	1	63	N60 >25	117	0	59
	>51 dB $L_{Aeq,8h}$	30	0	25	N60 >50	11	0	7
	>54 dB $L_{Aeq,8h}$	26	0	13	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	4	0	1	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	0	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}	155	8	108				
	>60 dB L_{den}	54	1	40				
	>65 dB L_{den}	11	0	5				
	>70 dB L_{den}	1	0	0				
	>75 dB L_{den}	0	0	0				

The change in number of sensitive buildings within each contour between the 2040 DM and 2040 Heathrow-ENR scenarios are set out in Table 5.21 below:

Table 5.21 : 2040 DM Heathrow vs 2040 Heathrow-ENR, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	200	4	112	N70 >20	22	1	17
	>57 dB $L_{Aeq,16h}$	63	2	48	N70 >50	36	1	24
	>60 dB $L_{Aeq,16h}$	47	2	27	N70 >100	17	1	17
	>63 dB $L_{Aeq,16h}$	12	0	6	N70 >200	27	0	14
	>66 dB $L_{Aeq,16h}$	2	0	3	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	2	0	1		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	0		0	0	0
Night	>48 dB $L_{Aeq,8h}$	99	3	67	N60 >25	160	1	94
	>51 dB $L_{Aeq,8h}$	27	1	21	N60 >50	40	1	30
	>54 dB $L_{Aeq,8h}$	22	0	11	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	2	0	1	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	0	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}	177	8	119				
	>60 dB L_{den}	56	1	44				
	>65 dB L_{den}	11	0	4				
	>70 dB L_{den}	1	0	0				
	>75 dB L_{den}	0	0	0				

The change in number of sensitive buildings within each contour between the 2050 DM and 2050 Heathrow-ENR scenarios are set out in Table 5.22 below:

Table 5.22 : 2050 DM Heathrow vs 2050 Heathrow-ENR, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	183	3	110	N70 >20	14	1	9
	>57 dB $L_{Aeq,16h}$	62	2	48	N70 >50	29	1	23
	>60 dB $L_{Aeq,16h}$	45	2	27	N70 >100	23	0	23
	>63 dB $L_{Aeq,16h}$	12	0	6	N70 >200	27	0	15
	>66 dB $L_{Aeq,16h}$	3	0	2	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	2	0	1		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	0		0	0	0
Night	>48 dB $L_{Aeq,8h}$	109	3	70	N60 >25	140	1	84
	>51 dB $L_{Aeq,8h}$	19	1	17	N60 >50	34	1	30
	>54 dB $L_{Aeq,8h}$	21	0	9	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	1	0	1	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}	181	7	111				
	>60 dB L_{den}	55	2	41				
	>65 dB L_{den}	14	0	7				
	>70 dB L_{den}	1	0	0				
	>75 dB L_{den}	0	0	0				

5.8 Scorecards for 'Carbon Traded' Option (Heathrow-ENR-X-C)

Noise metrics have been produced for the Heathrow-ENR-X-C scenarios at Heathrow Airport for 2030, 2040 and 2050, and are presented below.

Table 5.23 : 2030 Heathrow-ENR-X-C Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	740,100			N70 >20	312,100
	>57 dB LAeq,16h	310,800			N70 >50	231,800
	>60 dB LAeq,16h	166,600			N70 >100	148,600
	>63 dB LAeq,16h	68,900			N70 >200	103,000
	>66 dB LAeq,16h	20,600			N70 >500	<50
	>69 dB LAeq,16h	4,300				
	>72 dB LAeq,16h	700				
Night	>48 dB LAeq,8h	517,000			N60 >25	503,300
	>51 dB LAeq,8h	238,400			N60 >50	84,500
	>54 dB LAeq,8h	121,100			N60 >100	0
	>57 dB LAeq,8h	46,600			N60 >200	0
	>60 dB LAeq,8h	11,600			N60 >500	0
	>63 dB LAeq,8h	3,100				
	>66 dB LAeq,8h	200				
	>69 dB LAeq,8h	100				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	899,800		
			>60 dB L_{den}	258,300		
			>65 dB L_{den}	73,800		
			>70 dB L_{den}	6,500		
			>75 dB L_{den}	500		

Table 5.24 : 2040 Heathrow-ENR-X-C Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	737,400			N70 >20	310,600
	>57 dB LAeq,16h	312,100			N70 >50	237,300
	>60 dB LAeq,16h	171,100			N70 >100	155,700
	>63 dB LAeq,16h	69,700			N70 >200	107,300
	>66 dB LAeq,16h	19,400			N70 >500	<50
	>69 dB LAeq,16h	4,300				
	>72 dB LAeq,16h	700				
Night	>48 dB LAeq,8h	531,000			N60 >25	577,700
	>51 dB LAeq,8h	248,600			N60 >50	90,700
	>54 dB LAeq,8h	130,100			N60 >100	0
	>57 dB LAeq,8h	51,200			N60 >200	0
	>60 dB LAeq,8h	13,200			N60 >500	0
	>63 dB LAeq,8h	3,300				
	>66 dB LAeq,8h	300				
	>69 dB LAeq,8h	100				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	901,500		
			>60 dB L_{den}	263,700		
			>65 dB L_{den}	75,300		
			>70 dB L_{den}	6,600		
			>75 dB L_{den}	500		

Table 5.25 : 2050 Heathrow-ENR-X-C Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency measure (based on above contour)	number
Day	>54 dB LAeq,16h	732,200			N70 >20	304,600
	>57 dB LAeq,16h	317,300			N70 >50	240,900
	>60 dB LAeq,16h	175,800			N70 >100	179,700
	>63 dB LAeq,16h	74,500			N70 >200	116,300
	>66 dB LAeq,16h	20,100			N70 >500	<50
	>69 dB LAeq,16h	4,400				
	>72 dB LAeq,16h	600				
Night	>48 dB LAeq,8h	641,800			N60 >25	644,000
	>51 dB LAeq,8h	271,300			N60 >50	113,900
	>54 dB LAeq,8h	154,400			N60 >100	0
	>57 dB LAeq,8h	56,200			N60 >200	0
	>60 dB LAeq,8h	14,100			N60 >500	0
	>63 dB LAeq,8h	3,500				
	>66 dB LAeq,8h	400				
	>69 dB LAeq,8h	100				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	936,200		
			>60 dB L_{den}	273,900		
			>65 dB L_{den}	78,600		
			>70 dB L_{den}	7,000		
			>75 dB L_{den}	500		

5.9 Assessment of 'Carbon Traded' Option (Heathrow-ENR-X-C)

The predicted differences between the equivalent year DM and Heathrow-ENR-X-C scenarios for each noise metric are considered in detail below. The ATMs used in the noise modelling of these two scenarios are set out in Table 5.26 below.

Table 5.26 : Heathrow Airport – Extended Northern Runway 'Carbon Traded' Option ATMs

	Air Transport Movements		
	2030	2040	2050
Heathrow DM	483,856	484,517	471,132
Heathrow Heathrow-ENR-X-C	482,035	700,000	700,000

5.9.1 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 day, that may result from the development of the Heathrow Extended Northern Runway 'Carbon Traded' option.

For convenience, extracts from the relevant 2030, 2040 and 2050 DM and Do-Something scenario $L_{Aeq,16h}$ contour plots are shown in Figure 5.36 to Figure 5.41 to provide visual context to the comparisons. The full contour plots are included in Appendix B.

The analysis in this section indicates that significant noise increases are expected for the Heathrow Airport Extended Northern Runway option in comparison to the corresponding DM situation. No reductions in noise are predicted in any contour, for any year.

Figure 5.36 : 2030 DM Heathrow Airport $L_{Aeq,16h}$ Contours

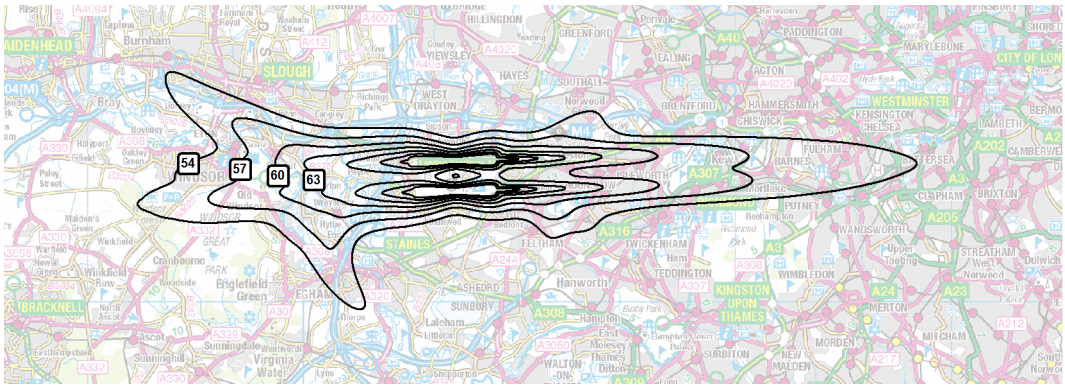
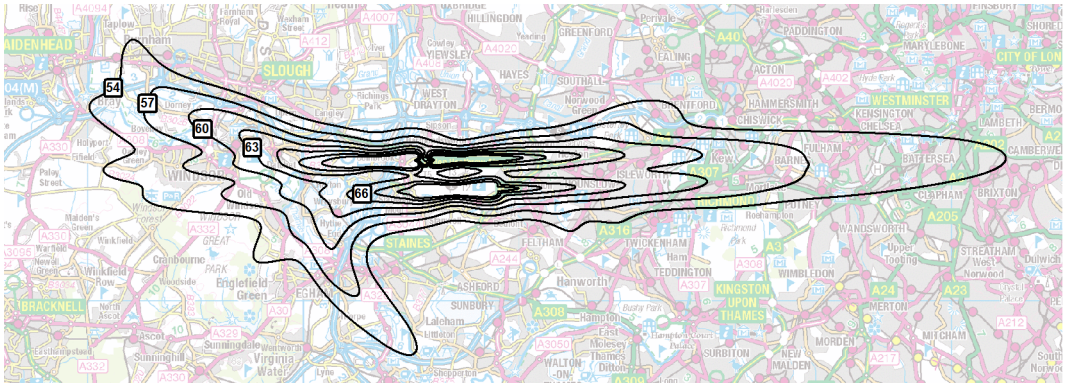


Figure 5.37 : 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.27 below.

Table 5.27 : 2030 DM Heathrow vs 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway , $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	52.3	246,500	107,100
>57	29.6	89,600	36,500
>60	19.9	57,600	22,400
>63	10.4	33,700	13,300
>66	6.3	12,700	4,900
>69	3.8	2,200	900
>72	2.3	<50 to 700	<50 to 300

Note: Numbers in parentheses represent reductions

To the east of Heathrow Airport, the Do-Something contours are similar in shape to the DM contours, but extend further east. To the west, the contours spread to the north and south more, as a result of additional routes.

All of the Do-Something contours are larger than the equivalent DM contours, due to increased ATMs, and contain greater populations as a result.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour is as follows:

- *>54 dB: An increase of 246,500 (from 493,600 to 740,100)*
- *>57 dB: An increase of 89,600 (from 221,200 to 310,800)*
- *>60 dB: An increase of 57,600 (from 109,000 to 166,600)*
- *>63 dB: An increase of 33,700 (from 35,200 to 68,900)*
- *>66 dB: An increase of 12,700 (from 7,900 to 20,600)*
- *>69 dB: An increase of 2,200 (from 2,100 to 4,300)*
- *>72 dB: A change from <50 to 700*

Figure 5.38 : 2040 DM Heathrow Airport $L_{Aeq,16h}$ Contours

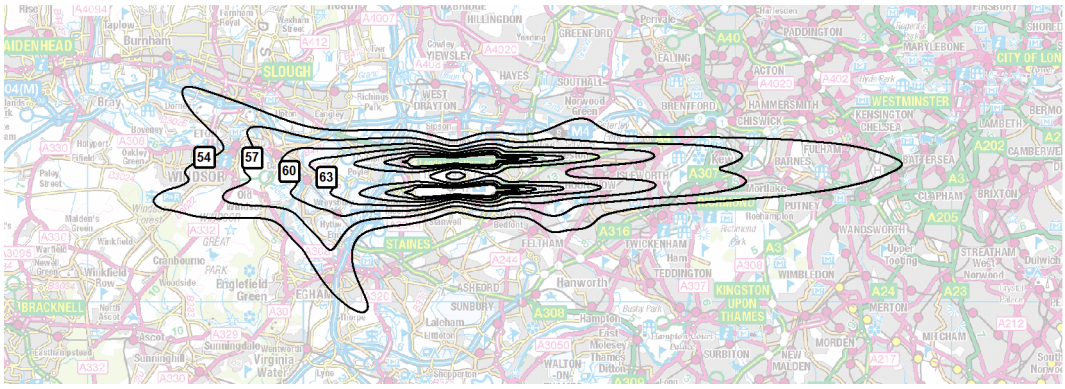
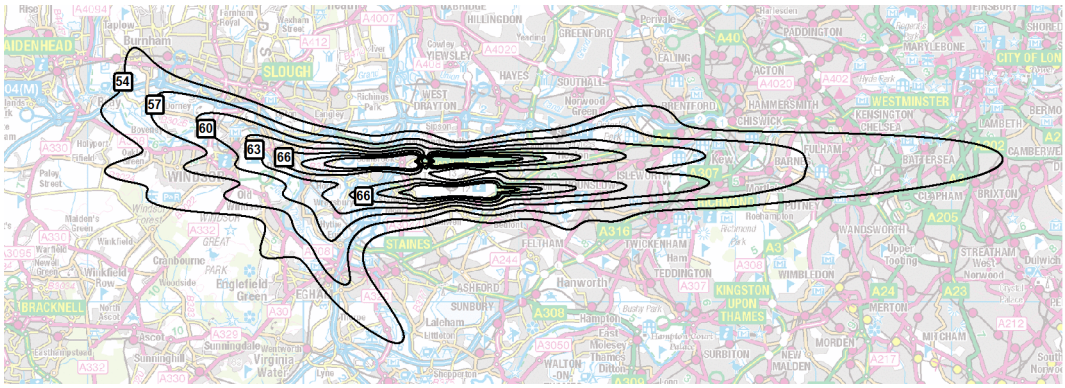


Figure 5.39 : 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.28 below.

Table 5.28 : 2040 DM Heathrow vs 2040 Heathrow-ENR-X-C Heathrow, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	52.7	276,800	119,600
>57	30.0	92,700	37,800
>60	20.1	67,300	26,300
>63	10.1	35,800	14,000
>66	6.1	12,300	4,800
>69	3.8	2,200	900
>72	2.2	<50 to 700	<50 to 300

Note: Numbers in parentheses represent reductions

To the east of Heathrow Airport, the Do-Something contours are similar in shape to the DM contours, but extend further east. To the west, the contours spread to the north and south more, as a result of additional routes.

In all cases the Do-Something contours cover greater areas than the equivalent DM contours. This is also reflected in population exposure, with the Do-Something contours encompassing greater numbers of people than in the equivalent DM contours. The increases in population exposure are as a result of combined effects of the Do-Something contours being larger, and extending further to the east:

- *>54 dB: An increase of 276,800 (from 460,600 to 737,400)*
- *>57 dB: An increase of 92,700 (from 219,400 to 312,100)*
- *>60 dB: An increase of 67,300 (from 103,800 to 171,100)*
- *>63 dB: An increase of 35,800 (from 33,900 to 69,700)*
- *>66 dB: An increase of 12,300 (from 7,100 to 19,400)*
- *>69 dB: An increase of 2,200 (from 2,100 to 4,300)*
- *>72 dB: An increase from <50 to 700*

Figure 5.40 : 2050 DM Heathrow Airport $L_{Aeq,16h}$ Contours

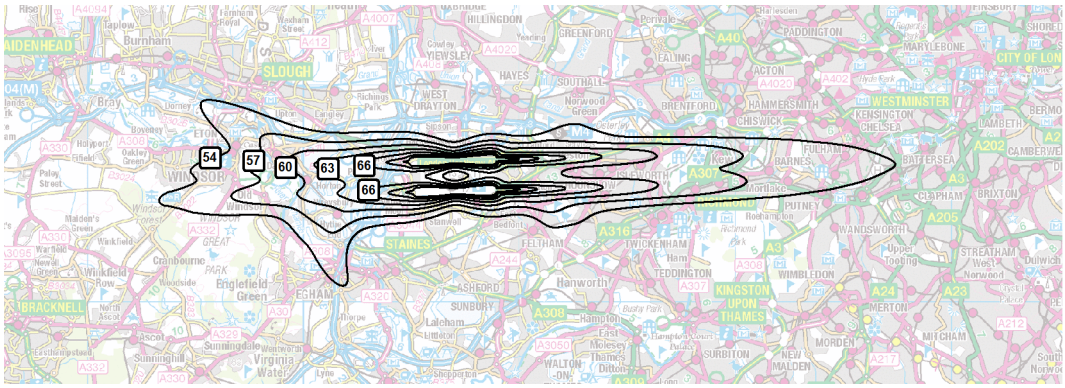
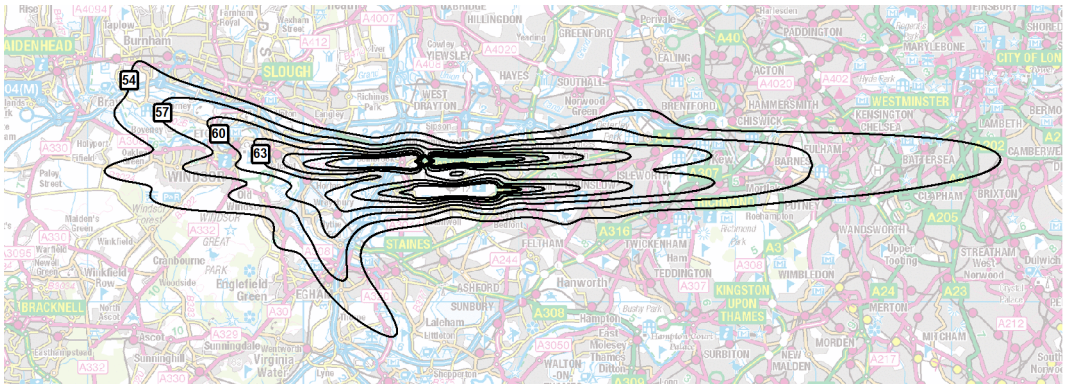


Figure 5.41 : 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway N $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.29 below.

Table 5.29 : 2050 DM Heathrow vs 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway , $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	54.2	296,400	128,000
>57	30.6	97,700	39,900
>60	20.4	72,000	28,200
>63	9.9	39,600	15,500
>66	6.3	12,400	4,800
>69	3.8	2,300	900
>72	2.2	<50 to 600	<50 to 300

Note: Numbers in parentheses represent reductions

To the east of Heathrow Airport, the Do-Something contours are similar in shape to the DM contours, but extend further east. To the west, the contours spread to the north and south more, as a result of additional routes.

In all cases the Do-Something contours cover greater areas than the equivalent DM contours. This is also reflected in population exposure, with the Do-Something contours encompassing greater numbers of people than in the equivalent DM contours. The increases in population exposure are as a result of combined effects of the Do-Something contours being larger, and extending further to the east:

- *>54 dB: An increase of 296,400 (from 435,800 to 732,200)*
- *>57 dB: An increase of 97,700 (from 219,600 to 317,300)*
- *>60 dB: An increase of 72,000 (from 103,800 to 175,800)*
- *>63 dB: An increase of 39,600 (from 34,900 to 74,500)*
- *>66 dB: An increase of 12,400 (from 7,700 to 20,100)*
- *>69 dB: An increase of 2,300 (from 2,100 to 4,400)*
- *>72 dB: A change from <50 to 600*

(b) N70 Supplementary Metric

This section considers predicted changes in terms of the N70 supplementary noise metric, which is a count of the number of people subject to more than 20, 50, 100, 200 or 500 events which exceed 70 dB $L_{AS,Max}$ in an average annual day.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N70 contour plots are shown in below Figure 5.42 to Figure 5.47 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The analysis in this section indicates that the number of people within the N70 contour bands will increase substantially as a result of the Heathrow Airport Extended Northern Runway 'Carbon Traded' option (when compared to the DM situation), for all of the assessment years considered. The largest increases are expected for the 2050 assessment year. No reductions in noise are predicted in any contour, for any year.

Figure 5.42 : 2030 DM Heathrow Airport N70 Contours

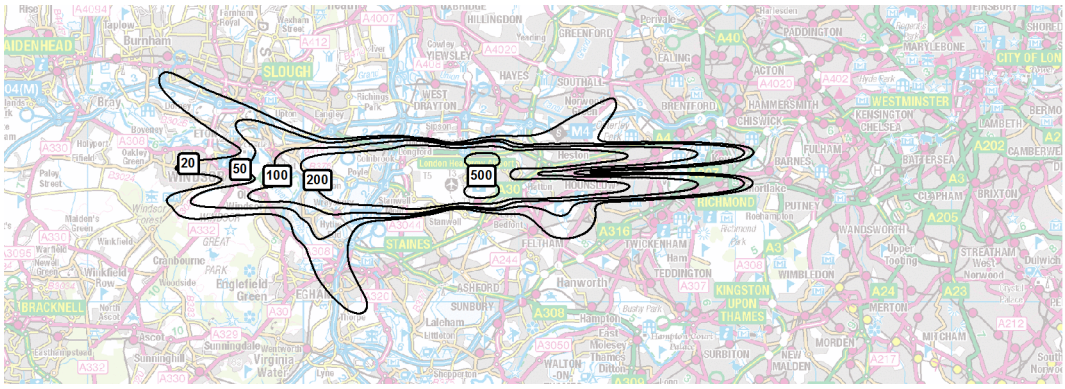
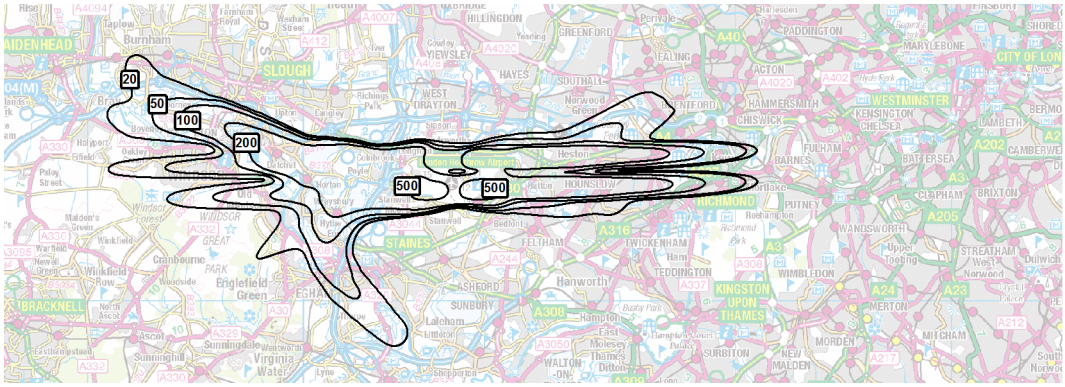


Figure 5.43 : 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 5.30 below.

Table 5.30 : 2030 DM Heathrow vs 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway , N70

Contour	Area (km²)	Population	Households
>20	20.5	20,300	8,600
>50	16.4	47,700	18,900
>100	13.4	26,000	10,000
>200	10.0	39,700	15,200
>500	1.3	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

To the east the Do-Something contours are broadly similar in shape to the DM contours, although the north-eastern spur is more pronounced. To the west the contours extend further and show a greater spread as a result of the increased number of routes. All of the Do-Something contours are greater in area than the DM contours due to increased ATMs.

The resulting differences in population enclosed within each contour between the DM and Do-Something scenarios are forecast to be:

- *>20: An increase of 20,300 (from 291,800 to 312,100)*
- *>50: An increase of 47,700 (from 184,100 to 231,800)*
- *>100: An increase of 26,000 (from 122,600 to 148,600)*
- *>200: An increase of 39,700 (from 63,300 to 103,000)*

- *>500: A change from <50 to <50*

Figure 5.44 : 2040 DM Heathrow Airport N70 Contours

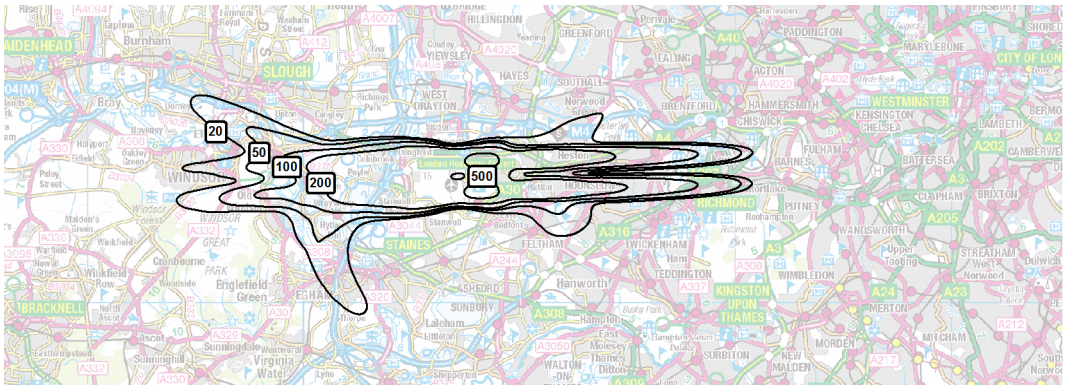
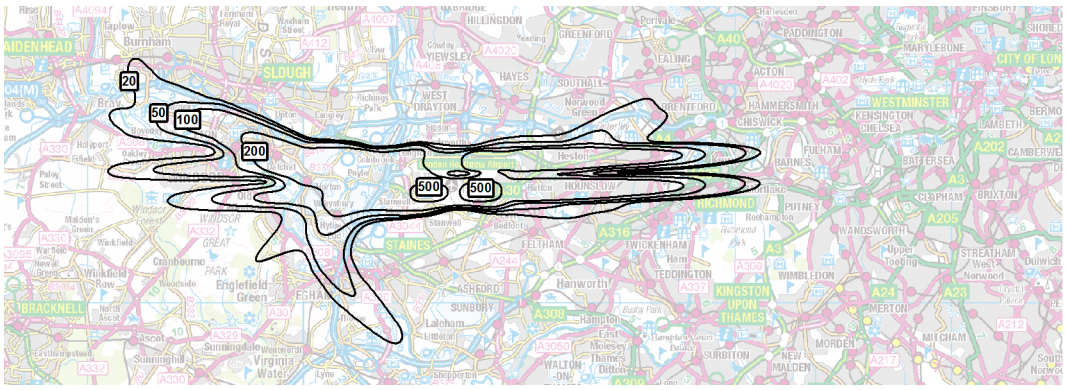


Figure 5.45 : 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 5.31 below.

Table 5.31 : 2040 DM Heathrow vs 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway , N70

Contour	Area (km²)	Population	Households
>20	24.1	32,300	13,300
>50	18.0	49,400	19,800
>100	14.2	31,000	12,200
>200	10.2	45,100	17,600
>500	1.0	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

To the east the Do-Something contours are broadly similar in shape to the DM contours, although the north-eastern spur is more pronounced. To the west the contours extend further and show a greater spread as a result of the increased number of routes.

All of the contours are larger in area in the Do-Something scenario compared to the DM scenario as a result of increased ATMs. As a result the Do-Something contours contain greater populations than the equivalent DM contours.

The differences in population enclosed within each contour between the DM and Do-Something scenarios are summarised below:

- *>20: An increase of 32,300 (from 278,300 to 310,600)*
- *>50: An increase of 49,400 (from 187,900 to 237,300)*
- *>100: An increase of 31,000 (from 124,700 to 155,700)*
- *>200: An increase of 45,100 (from 62,200 to 107,300)*
- *>500: No discernible difference (from <50 to <50)*

Figure 5.46 : 2050 DM Heathrow Airport N70 Contours

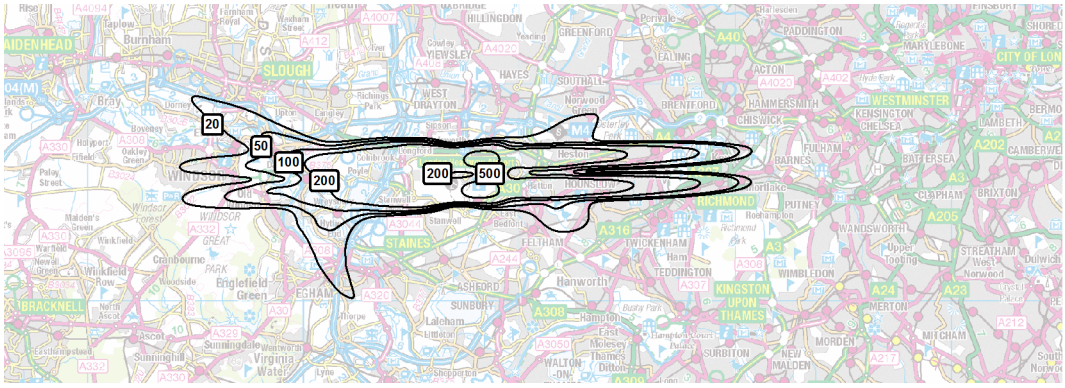
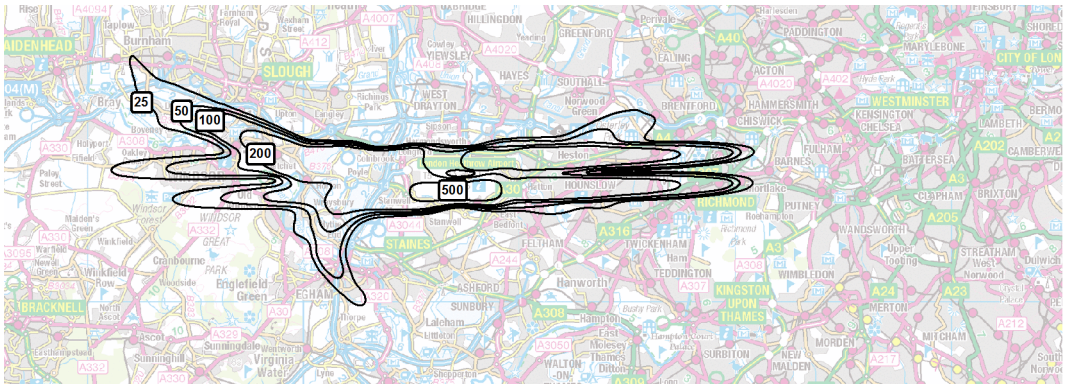


Figure 5.47 : 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 5.32 below.

Table 5.32 : 2050 DM Heathrow vs 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway , N70

Contour	Area (km²)	Population	Households
>20	21.4	30,500	12,700
>50	17.9	51,400	20,300
>100	16.5	50,300	20,400
>200	10.3	45,100	17,200
>500	0.9	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

To the east the Do-Something contours are broadly similar in shape to the DM contours, although the north-eastern spur is more pronounced. To the west the

contours extend further and show a greater spread as a result of the increased number of routes.

All of the contours are larger in area in the Do-Something scenario compared to the DM scenario as a result of increased ATMs. As a result the Do-Something contours contain greater populations than the equivalent DM contours.

The differences in population enclosed within each contour between the DM and Do-Something scenarios are summarised below:

- *>20: An increase of 30,500 (from 274,100 to 304,600)*
- *>50: An increase of 51,400 (from 189,500 to 240,900)*
- *>100: An increase of 50,300 (from 129,400 to 179,700)*
- *>200: An increase of 45,100 (from 71,200 to 116,300)*
- *>500: No discernible difference (from <50 to <50)*

5.9.2 Night Metrics

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

This section considers predicted changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario $L_{Aeq,16h}$ contour plots are shown in Figure 5.48 to Figure 5.53 provide visual context to the comparisons. Full contour plots are included in Appendix B.

The analysis in this section indicates that the number of people exposed to night-time noise will increase as a result of the Heathrow Airport Extended Northern Runway 'Carbon Traded' option (when compared to the DM situation), for all of the assessment years considered. The largest increases are expected for the 2050 assessment year. No reductions in noise are predicted in any contour, for any year.

Figure 5.48 : 2030 DM Heathrow Airport $L_{Aeq,8h}$ Contours

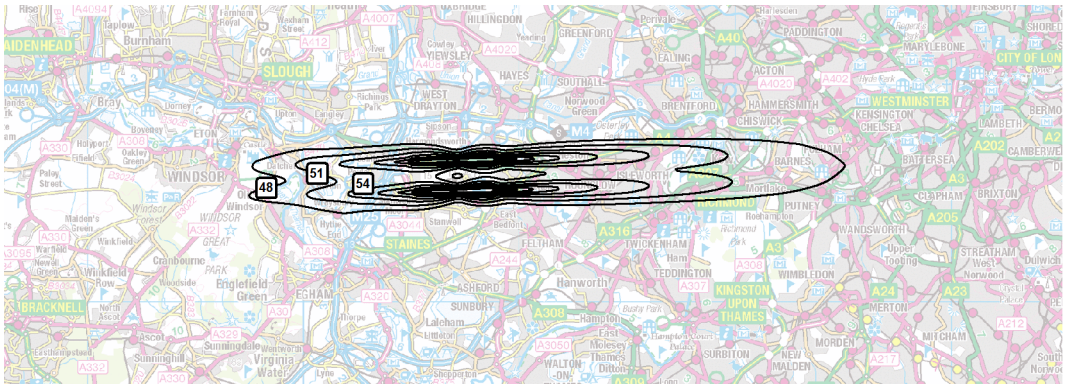
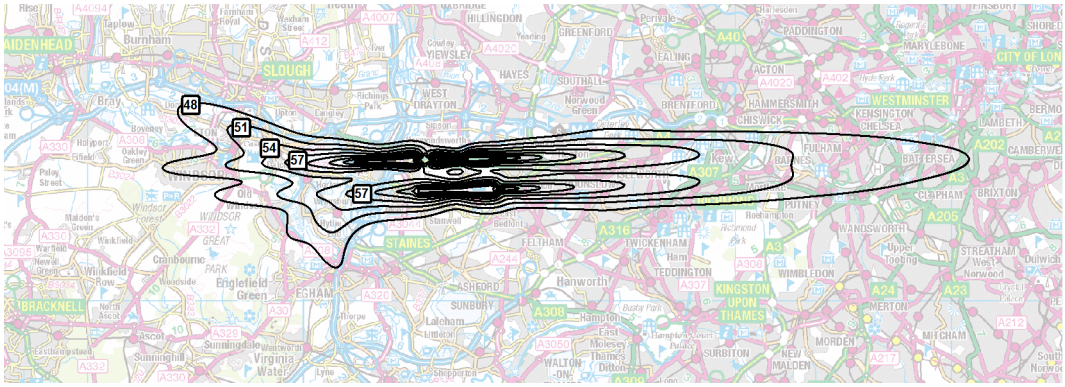


Figure 5.49 : 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours



The difference in LAeq,8h contour areas, population exposures and number of households included in each contour is summarised in Table 5.33 below.

Table 5.33 : 2030 DM Heathrow vs 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway , $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	47.9	245,800	105,400
>51	28.3	87,100	35,600
>54	21.3	60,000	23,500
>57	10.5	24,700	9,700
>60	5.6	7,700	2,900
>63	3.3	1,800	700
>66	1.8	<50 to 200	<50 to 100
>69	0.9	<50 to 100	<50 to <50
>72	0.3	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00). The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the contours are larger in area in the Do-Something scenario compared to the DM scenario as a result of increased ATMs. As a result the Do-Something contours contain greater populations than the equivalent DM contours.

The differences in population enclosed within each contour between the DM and Do-Something scenarios are summarised below:

- *>48 dB: An increase of 95,700 (from 421,300 to 517,000)*
- *>51 dB: An increase of 47,600 (from 190,800 to 238,400)*
- *>54 dB: An increase of 17,900 (from 103,200 to 121,100)*
- *>57 dB: A reduction of 1,600 (from 48,200 to 46,600)*
- *>60 dB: A reduction of 5,100 (from 16,700 to 11,600)*
- *>63 dB: A reduction of 1,400 (from 4,500 to 3,100)*
- *>66 dB: A reduction of 1,000 (from 1,200 to 200)*
- *>69 dB: An increase from <50 to 100*
- *>72 dB: No discernible difference (from <50 to <50)*

Figure 5.50 : 2040 DM Heathrow Airport $L_{Aeq,8h}$ Contours

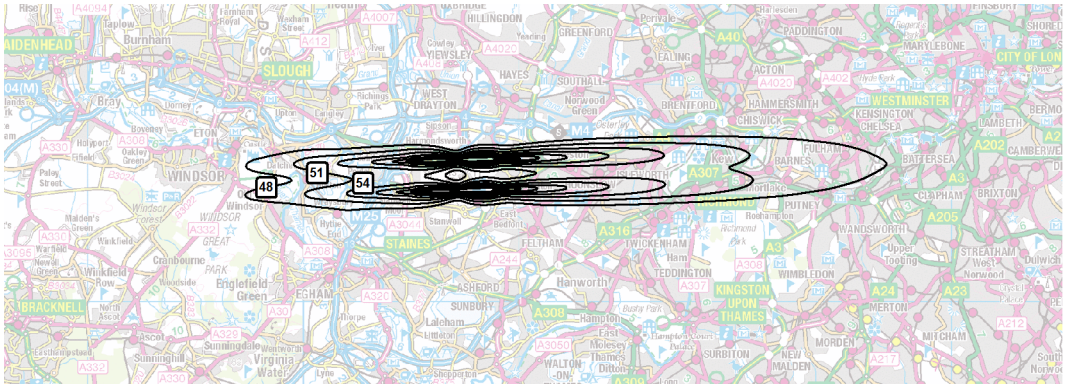
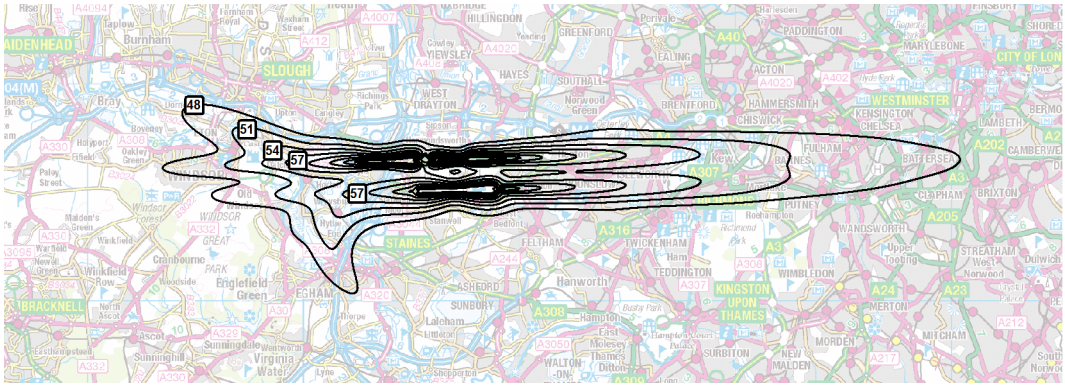


Figure 5.51 : 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.34 below.

Table 5.34 : 2040 DM Heathrow vs 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway , $L_{Aeq,8h}$

Contour	Area (km^2)	Population	Households
>48	44.9	194,000	82,200
>51	27.0	64,000	26,100
>54	21.6	48,800	19,200
>57	11.0	19,800	7,800
>60	6.1	6,800	2,600
>63	3.5	900	400
>66	2.0	<50 to 300	<50 to 100
>69	1.0	<50 to 100	<50 to <50
>72	0.4	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00). The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the contours are larger in area in the Do-Something scenario compared to the DM scenario as a result of increased ATMs. As a result the Do-Something contours contain greater populations than the equivalent DM contours.

The differences in population enclosed within each contour between the DM and Do-Something scenarios are summarised below:

- *>48 dB: An increase of 194,000 (from 337,000 to 531,000)*
- *>51 dB: An increase of 64,000 (from 184,600 to 248,600)*
- *>54 dB: An increase of 48,800 (from 81,300 to 130,100)*
- *>57 dB: An increase of 19,800 (from 31,400 to 51,200)*
- *>60 dB: An increase of 6,800 (from 6,400 to 13,200)*
- *>63 dB: An increase of 900 (from 2,400 to 3,300)*
- *>66 dB: An increase from <50 to 300*
- *>69 dB: An increase from <50 to 100*
- *>72 dB: No discernible difference (from <50 to <50)*

Figure 5.52 : 2050 DM Heathrow Airport $L_{Aeq,8h}$ Contours

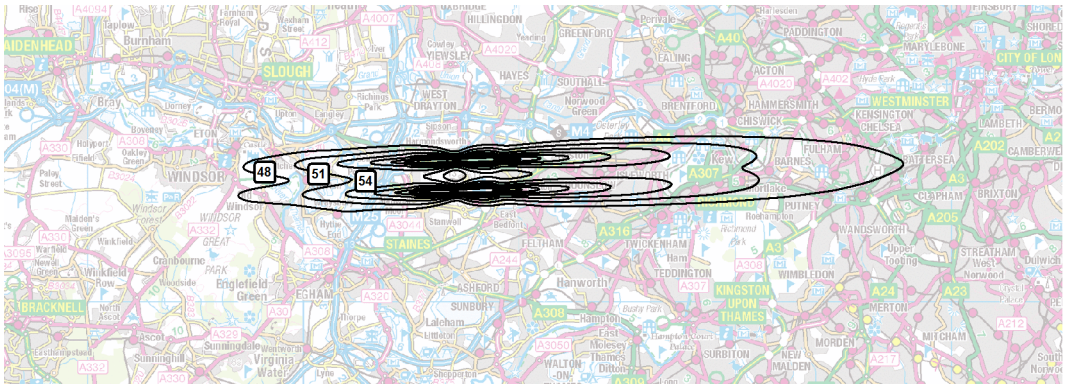
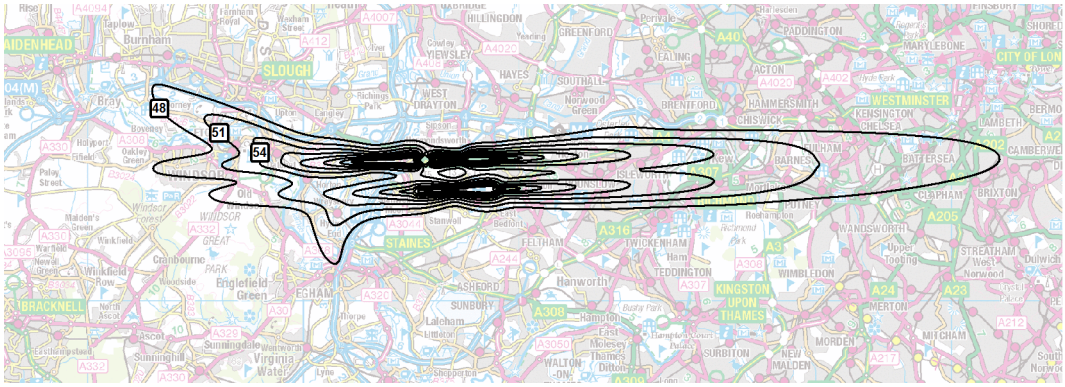


Figure 5.53 : 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.35 below.

Table 5.35 : 2050 DM Heathrow vs 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway , $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	47.0	268,700	116,200
>51	26.6	73,900	29,800
>54	20.2	65,200	25,900
>57	9.2	22,300	8,700
>60	5.0	7,000	2,700
>63	2.9	900	400
>66	1.6	<50 to 400	<50 to 200
>69	0.7	<50 to 100	<50 to <50
>72	0.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00). The additional westerly departure route causes additional protrusions to the western extent of the Do-Something contours compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the contours are larger in area in the Do-Something scenario compared to the DM scenario as a result of increased ATMs. As a result the Do-Something contours contain greater populations than the equivalent DM contours.

The differences in population enclosed within each contour between the DM and Do-Something scenarios are summarised below:

- *>48 dB: An increase of 268,700 (from 373,100 to 641,800)*
- *>51 dB: An increase of 73,900 (from 197,400 to 271,300)*
- *>54 dB: An increase of 65,200 (from 89,200 to 154,400)*
- *>57 dB: An increase of 22,300 (from 33,900 to 56,200)*
- *>60 dB: An increase of 7,000 (from 7,100 to 14,100)*
- *>63 dB: An increase of 900 (from 2,600 to 3,500)*
- *>66 dB: An increase from <50 to 400*
- *>69 dB: An increase from <50 to 100*
- *>72 dB: No discernible difference (from <50 to <50)*

(b) N60 Supplementary Metric

This section considers predicted changes in terms of the N60 supplementary noise metric, which is a count of the number of people subject to more than 25 50, 100 or 200 events which exceed 60 dB $L_{AS,Max}$ in an average annual night.

Extracts from the 2030, 2040 and 2050 DM and Do-Something scenario N60 contour plots are shown in Figure 5.54 to Figure 5.59 below to provide visual context to the comparisons. Full contour plots are included in Appendix B.

The analysis in this section indicates that the number of people exposed to night-time noise will increase as a result of the Heathrow Airport Extended Northern Runway 'Carbon Traded' option (when compared to the DM situations), for all of the assessment years considered. The largest increases are expected for the 2040 assessment year. No reductions in noise are predicted in any contour, for any year.

Figure 5.54 : 2030 DM Heathrow Airport N60 Contours

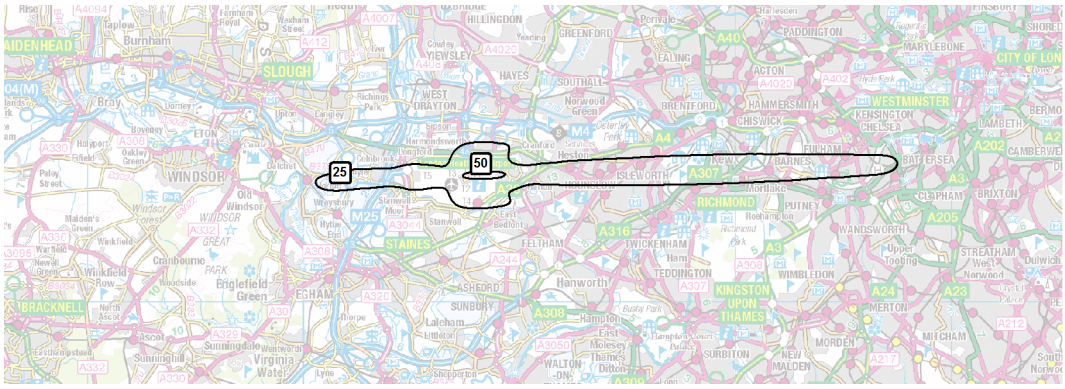
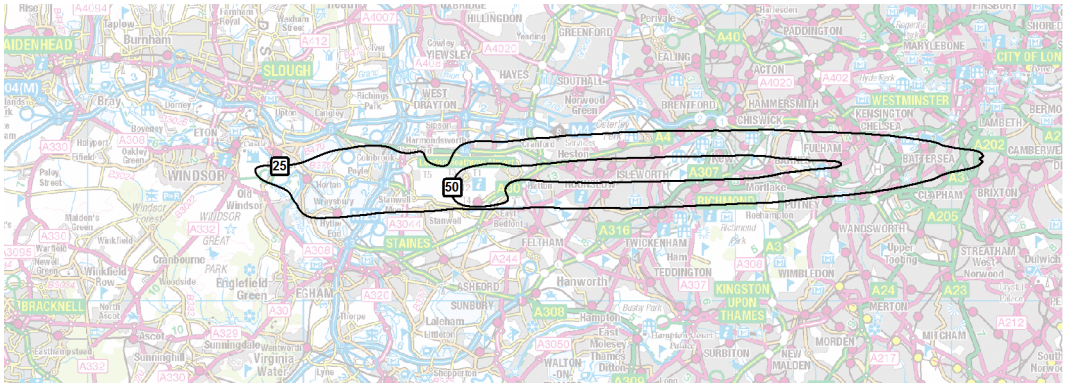


Figure 5.55 : 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 5.36 below.

Table 5.36 : 2030 DM Heathrow vs 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway , N60

Contour	Area (km2)	Population	Households
>25	59.4	352,800	149,200
>50	17.9	<50 to 84500	<50 to 34000
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00), and is much wider in the north-south axis. The additional westerly departure routes cause the western extent of the Do-Something contours to spread compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the contours are larger in area in the Do-Something scenario compared to the DM scenario as a result of increased ATMs. As a result the Do-Something contours contain greater populations than the equivalent DM contours.

The differences in population enclosed within each contour between the DM and Do-Something scenarios are summarised below:

- *>25: An increase of 352,800 (from 150,500 to 503,300)*
- *>50: An increase from <50 to 84,500*

Figure 5.56 : 2040 DM Heathrow Airport N60 Contours

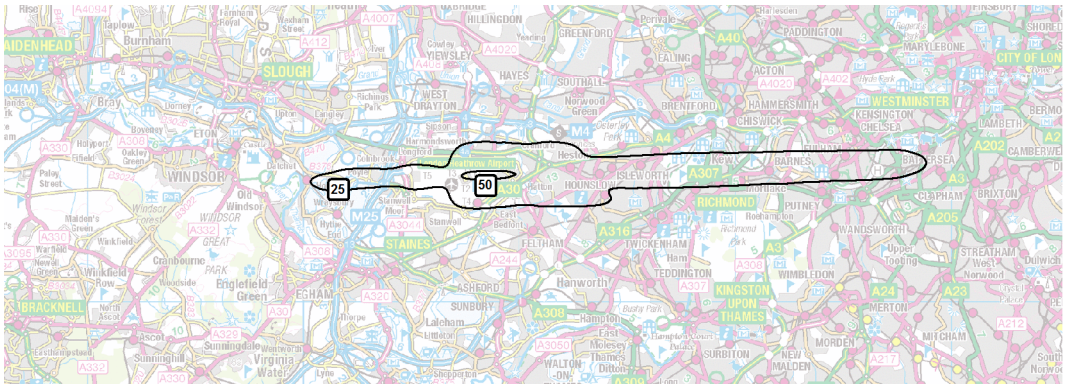
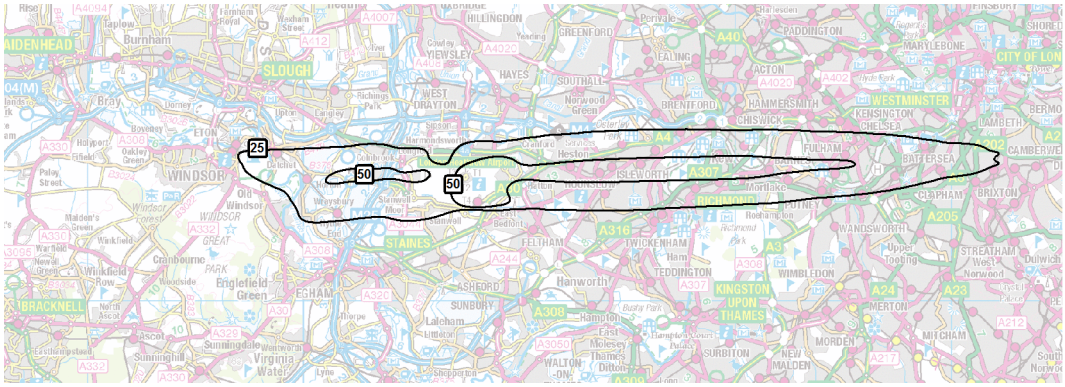


Figure 5.57 : 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 5.37 below.

Table 5.37 : 2040 DM Heathrow vs 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway , N60

Contour	Area (km2)	Population	Households
>25	56.3	319,400	136,900
>50	20.9	<50 to 90,700	<50 to 36,800
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft movements during the shoulder periods (23.00-23.30 and 06.00-07.00), and is much wider in the north-south axis. The additional westerly departure routes cause the western extent of the Do-Something contours to spread compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the contours are larger in area in the Do-Something scenario compared to the DM scenario as a result of increased ATMs. As a result the Do-Something contours contain greater populations than the equivalent DM contours.

The differences in population enclosed within each contour between the DM and Do-Something scenarios are summarised below:

- *>25: An increase of 319,400 (from 258,300 to 577,700)*
- *>50: An increase from <50 to 90,700*

Figure 5.58 : 2050 DM Heathrow Airport N60 Contours

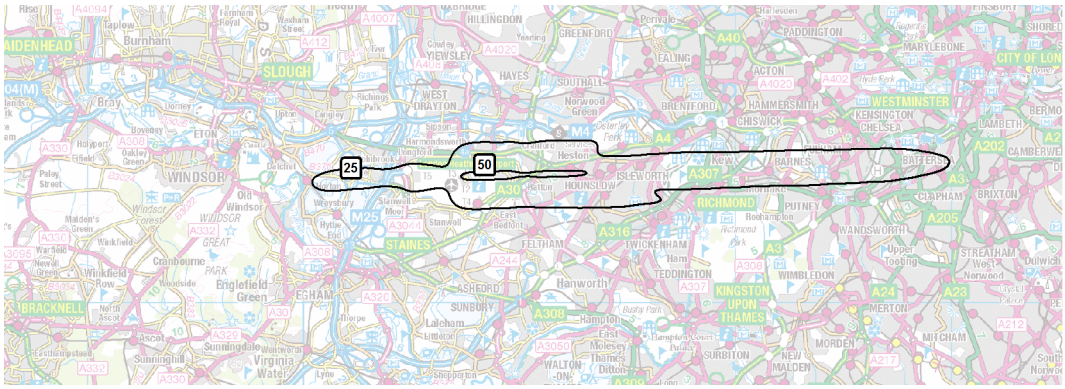
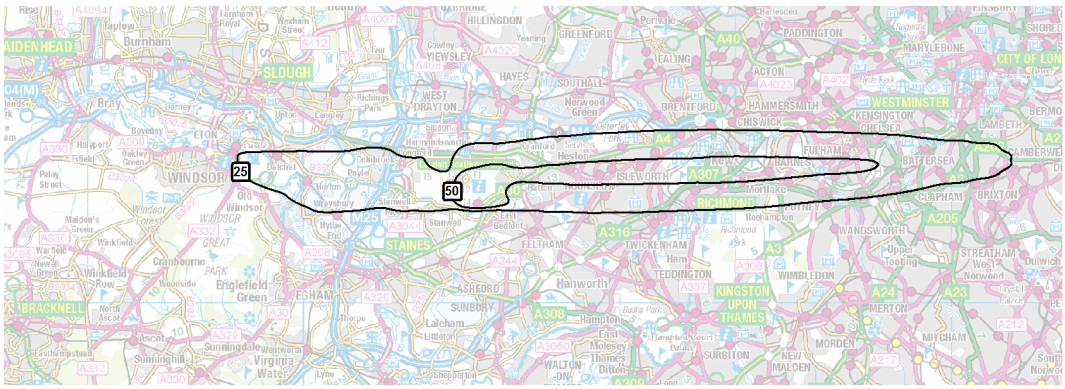


Figure 5.59 : 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 5.38 below.

Table 5.38 : 2050 DM Heathrow vs 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway , N60

Contour	Area (km2)	Population	Households
>25	49.5	323,300	140,100
>50	19.3	107,400	44,300
>100	0.0	0	0
>200	0.0	0	0
>500	0.0	0	0

Note: Numbers in parentheses represent reductions

The eastern extent of the Do-Something contours are similar in shape to the DM contours, but extend further east towards Battersea as a result of increased aircraft

movements during the shoulder periods (23.00-23.30 and 06.00-07.00), and is much wider in the north-south axis. The additional westerly departure routes cause the western extent of the Do-Something contours to spread compared to the DM contours. No changes to the current night Quota Count system are assumed.

All of the contours are larger in area in the Do-Something scenario compared to the DM scenario as a result of increased ATMs. As a result the Do-Something contours contain greater populations than the equivalent DM contours.

The differences in population enclosed within each contour between the DM and Do-Something scenarios are summarised below:

- *>25: An increase of 323,300 (from 320,700 to 644,000)*
- *>50: An increase of 107,400 (from 6,500 to 113,900)*

5.9.3 24-Hour Metric

This section considers predicted changes in terms of the L_{den} day-evening-night noise exposure metric, calculated as an annual average.

For convenience, extracts from the 2030, 2040 and 2050 DM and Do-Something scenario L_{den} contour plots are shown in Figure 5.30 to Figure 5.35 to provide visual context to the comparisons. The full contour plots are included in Appendix B.

The populations contained within the L_{den} contours shows significant increases for the Heathrow Airport Extended Northern Runway 'Carbon Traded' option when compared to the DM situations for each year.

Figure 5.60 : 2030 DM Heathrow Airport L_{den} Contours

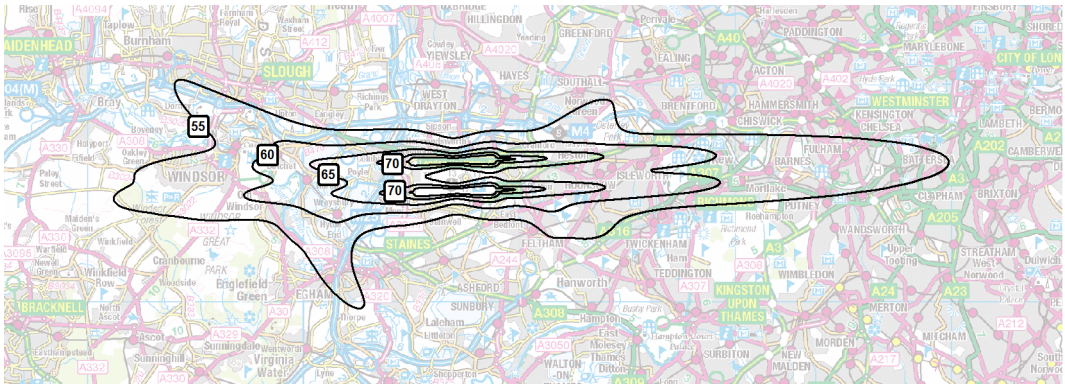
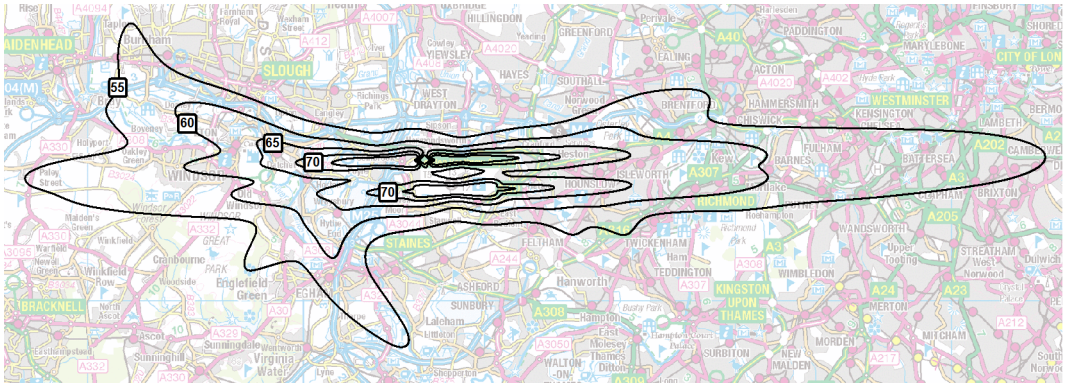


Figure 5.61 : 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 5.39 below.

Table 5.39 : 2030 DM Heathrow vs 2030 Heathrow-ENR-X-C Heathrow Extended Northern Runway , L_{den}

Contour	Area (km²)	Population	Households
>55	(1.4)	133,700	47,800
>60	6.8	66,800	28,600
>65	1.9	21,100	10,300
>70	0.8	(100)	300
>75	0.9	400	<100 to 200

Note: Numbers in parentheses represent reductions

The Do-Something contours are broadly the same shape as the DM contours, except for covering larger areas and having a greater spread to the west as a result of the extended northern runway and increased number of routes.

All of the Do-Something contours are larger than the equivalent DM contours, due to increased ATMs, and encompass greater populations:

- *>55 dB: An increase of 133,700 (from 766,100 to 899,800)*
- *>60 dB: An increase of 66,800 (from 191,500 to 258,300)*
- *>65 dB: An increase of 21,100 (from 52,700 to 73,800)*
- *>70 dB: A reduction of 100 (from 6,600 to 6,500)*
- *>75 dB: An increase of 400 (from 100 to 500)*

Figure 5.62 : 2040 DM Heathrow Airport L_{den} Contours

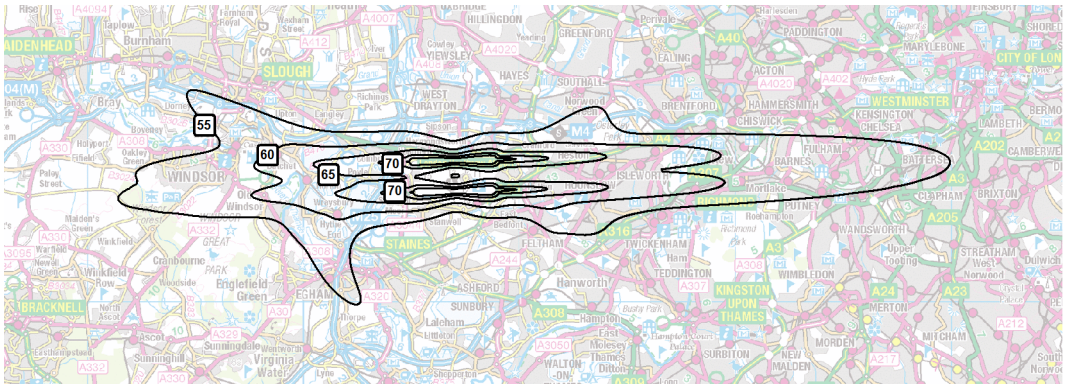
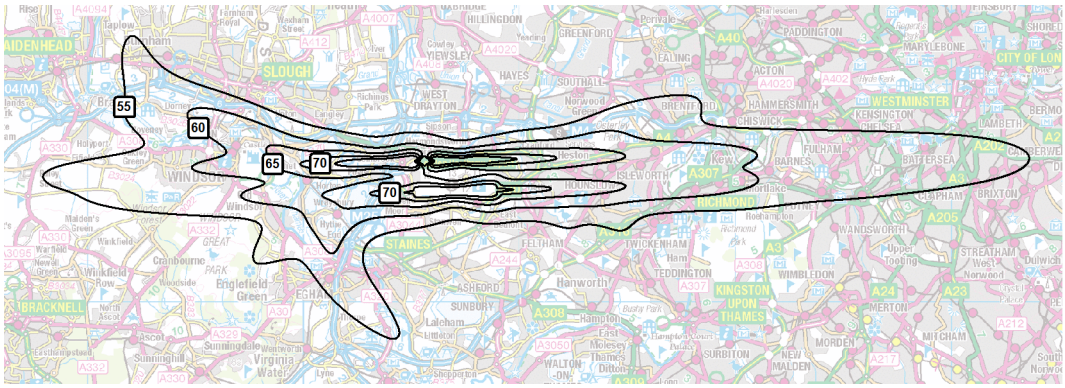


Figure 5.63 : 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 5.40 below.

Table 5.40 : 2040 DM Heathrow vs 2040 Heathrow-ENR-X-C Heathrow Extended Northern Runway , L_{den}

Contour	Area (km²)	Population	Households
>55	67.4	312,600	134,600
>60	27.3	84,200	34,600
>65	11.8	39,100	15,100
>70	4.9	3,500	1,400
>75	2.0	<50 to 500	<50 to 200

Note: Numbers in parentheses represent reductions

The Do-Something contours are broadly the same shape as the DM contours, except for covering much larger areas and having a greater spread to the west as a result of the extended northern runway and increased number of routes.

All of the Do-Something contours are larger than the equivalent DM contours, due to increased ATMs, and encompass greater populations:

- *>55 dB: An increase of 312,600 (from 588,900 to 901,500)*
- *>60 dB: An increase of 84,200 (from 179,500 to 263,700)*
- *>65 dB: An increase of 39,100 (from 36,200 to 75,300)*
- *>70 dB: An increase of 3,500 (from 3,100 to 6,600)*

- *>75 dB: An increase from <50 to 500*

Figure 5.64 : 2050 DM Heathrow Airport L_{den} Contours

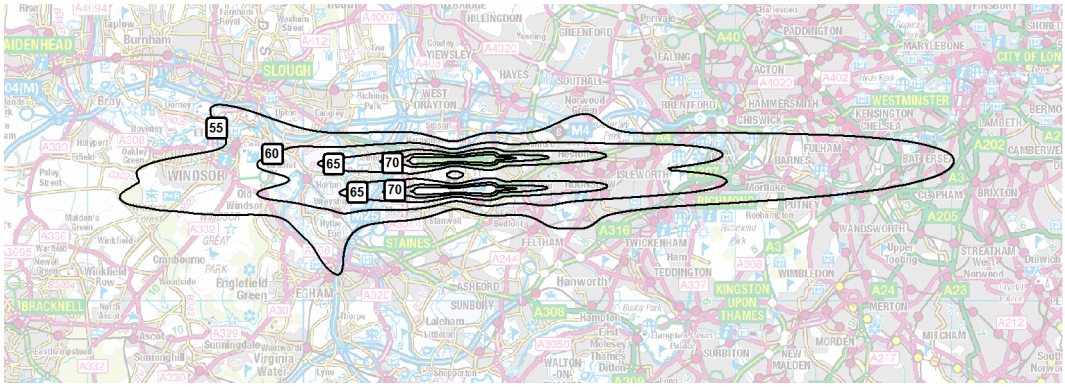
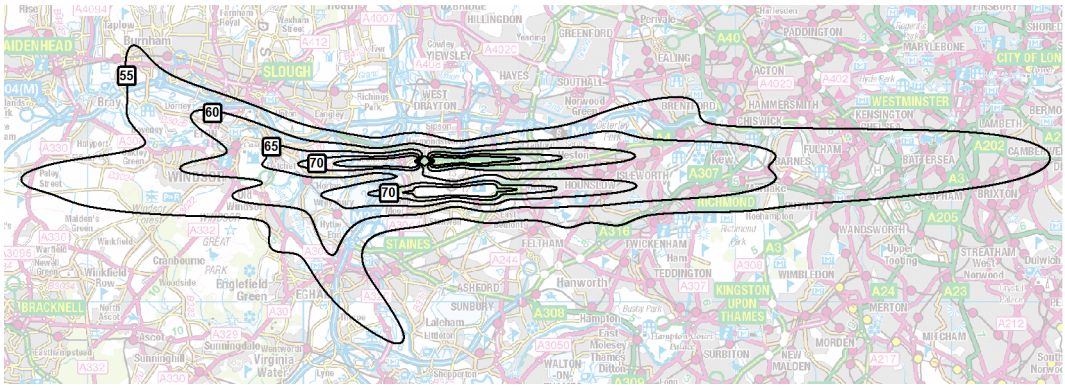


Figure 5.65 : 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 5.41 below.

Table 5.41 : 2050 DM Heathrow vs 2050 Heathrow-ENR-X-C Heathrow Extended Northern Runway , L_{den}

Contour	Area (km²)	Population	Households
>55	68.7	352,700	152,600
>60	27.3	91,800	37,800
>65	11.8	42,200	16,400
>70	4.6	3,900	1,600
>75	1.9	<50 to 500	<50 to 200

Note: Numbers in parentheses represent reductions

The Do-Something contours are broadly the same shape as the DM contours, except for covering much larger areas and having a greater spread to the west as a result of the extended northern runway and increased number of routes.

All of the Do-Something contours are larger than the equivalent DM contours, due to increased ATMs, and encompass greater populations:

- *>55 dB: An increase of 352,700 (from 583,500 to 936,200)*
- *>60 dB: An increase of 91,800 (from 182,100 to 273,900)*
- *>65 dB: An increase of 42,200 (from 36,400 to 78,600)*

- *>70 dB: An increase of 3,900 (from 3,100 to 7,000)*
- *>75 dB: A change from <50 to 500*

5.10 Scorecard for 'Respite' Option (Heathrow-ENR-R)

Noise metrics have been produced for the Heathrow-ENR-R option at Heathrow Airport for 2030 as a sensitivity test. This sensitivity test has only been conducted for 2030.

Table 5.42 : 2030 Heathrow-ENR-R Heathrow Airport Scorecard

Period	Population Noise Exposure UK measure		EU measure		Frequency (based on above contour) measure	number
Day	>54 dB LAeq,16h	689,300			N70 >20	253,300
	>57 dB LAeq,16h	289,900			N70 >50	168,500
	>60 dB LAeq,16h	155,500			N70 >100	112,900
	>63 dB LAeq,16h	62,400			N70 >200	44,100
	>66 dB LAeq,16h	17,000			N70 >500	0
	>69 dB LAeq,16h	4,300				
	>72 dB LAeq,16h	700				
Night	>48 dB LAeq,8h	371,100			N60 >25	336,400
	>51 dB LAeq,8h	198,300			N60 >50	24,400
	>54 dB LAeq,8h	89,600			N60 >100	0
	>57 dB LAeq,8h	31,000			N60 >200	0
	>60 dB LAeq,8h	4,900			N60 >500	0
	>63 dB LAeq,8h	800				
	>66 dB LAeq,8h	200				
	>69 dB LAeq,8h	<50				
	>72 dB LAeq,8h	<50				
24-hour			>55 dB L_{den}	780,100		
			>60 dB L_{den}	225,600		
			>65 dB L_{den}	59,000		
			>70 dB L_{den}	4,700		
			>75 dB L_{den}	400		

5.11 Assessment of 'Respite' Option (Heathrow-ENR-R)

The predicted differences between the 2030 DM and Heathrow-ENR-R scenarios for each noise metric are considered in detail below. The ATMs used in the noise modelling of these two scenarios are set out in *Table 5.43* below.

Table 5.43 : Heathrow Airport – 'Respite' Option ATMs

	Air Transport Movements		
	2030	2040	2030
Heathrow DM	483,856	484,517	471,132
Heathrow Heathrow-NWR-T35	482,035	700,000	700,000

5.11.1 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 day, that may result from the development of the Heathrow Extended Northern Runway 'Respite' option.

For convenience, extracts from the relevant 2030 DM and Do-Something scenario $L_{Aeq,16h}$ contour plots are shown in Figure 5.66 and Figure 5.67 to provide visual context to the comparisons. The full contour plots are included in Appendix B.

Figure *5.66* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,16h}$ Contours

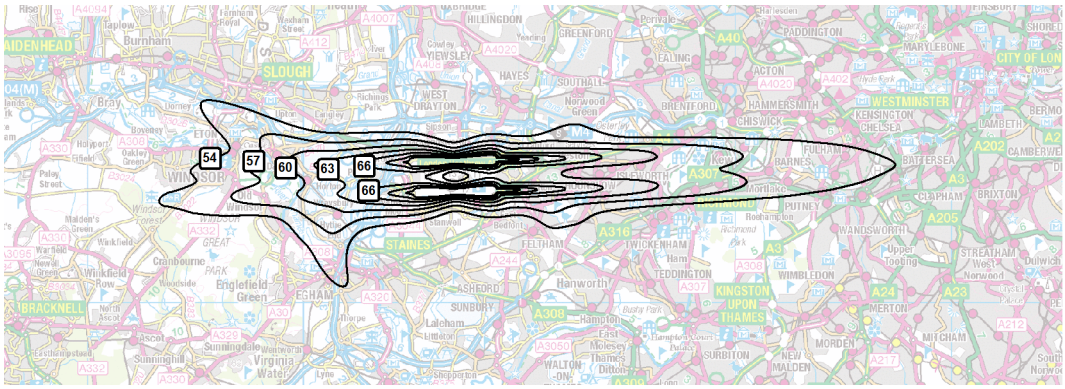
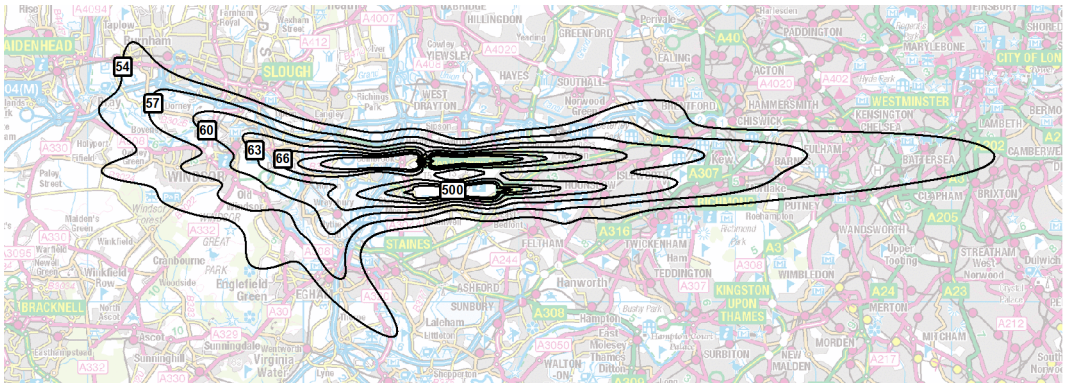


Figure *5.67* : 2030 Heathrow-ENR-R Heathrow Airport $L_{Aeq,16h}$ Contours



The difference in $L_{Aeq,16h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.44 below.

Table *5.44* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-ENR-R, $L_{Aeq,16h}$

Contour	Area (km²)	Population	Households
>54	44.4	195,700	85,000
>57	24.4	68,700	27,700
>60	16.6	46,500	17,800
>63	8.3	27,200	10,800
>66	5.0	9,100	3,500
>69	3.3	2,200	900
>72	2.1	<50 to 700	<50 to 300

Note: Numbers in parentheses represent reductions

The Do-Something contours extend further to the east and west than the equivalent DM contours, with the east tip of the >54 dB being over Camberwell. To the west of the airport, the Do-Something contours show a greater spread north and south, as a result of a greater number of routes.

Despite the effects of forecast introduction of quieter aircraft in the fleet mixes, the increase in ATMs results in larger contours in the Do-Something scenario. In combination with population growth, this results in increases in population exposure in all contours.

In summary, the differences in population included in the 2030 Do-Something contours compared with the 2030 DM contours are as follows:

- *>54 dB: An increase of 195,700 (from 493,600 to 689,300)*
- *>57 dB: An increase of 68,700 (from 221,200 to 289,900)*
- *>60 dB: An increase of 46,500 (from 109,000 to 155,500)*
- *>63 dB: An increase of 27,200 (from 35,200 to 62,400)*
- *>66 dB: An increase of 9,100 (from 7,900 to 17,000)*
- *>69 dB: An increase of 2,200 (from 2,100 to 4,300)*
- *>72 dB: A change from <50 to 700*

Comparing the population noise exposures to those for the base Heathrow-ENR scenario, it can be seen that the 'Respite' option results in decreases in the number of people in the >57 and >60 contours, little change in the >60 to >66 and a small increase in the >69 contour:

- *>54: An increae in area of 0.5 km^2 but a reduction of 20,500 people*
- *>57: A reduction in area of 0.2 km^2 and 7,500 people*
- *>60: A reduction in area of 0.4 km^2 and 2,900 people*
- *>63: No change in area but a reduction of 1,400 people*
- *>66: No change in area but a reduction of 100 people*
- *>69: An increase in area of 0.1 km^2 and 400 people*
- *>72: An increase in area of 0.1 km^2 but no change in people*

For the Heathrow Extended Northern Runway 'Respite' (carbon capped) option, the number of people newly affected by noise levels of 57 dB $L_{Aeq,16h}$ in the 2030 Do-Something scenario compared to the 2030 DM scenario is 73,400, and the number of people newly removed is 4,500. This results in a net increase in the number of people newly affected of 68,900, which is 8,200 less than for the base Heathrow-ENR option.

(b) N70 Supplementary Metric

This section considers predicted changes in terms of the N70 supplementary noise metric, which is a count of the number of people subject to more than 20, 50, 100, 200 or 500 events which exceed 70 dB $L_{AS,Max}$ in an average annual day.

Extracts from the 2030 DM and Do-Something scenario N70 contour plots are shown in below Figure 5.68 and Figure 5.69 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure 5.68 : 2030 Do-Minimum Heathrow Airport N70 Contours

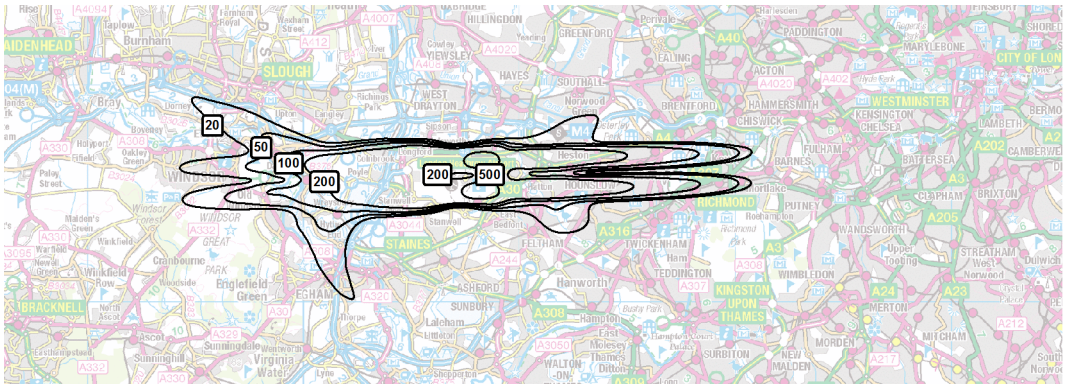
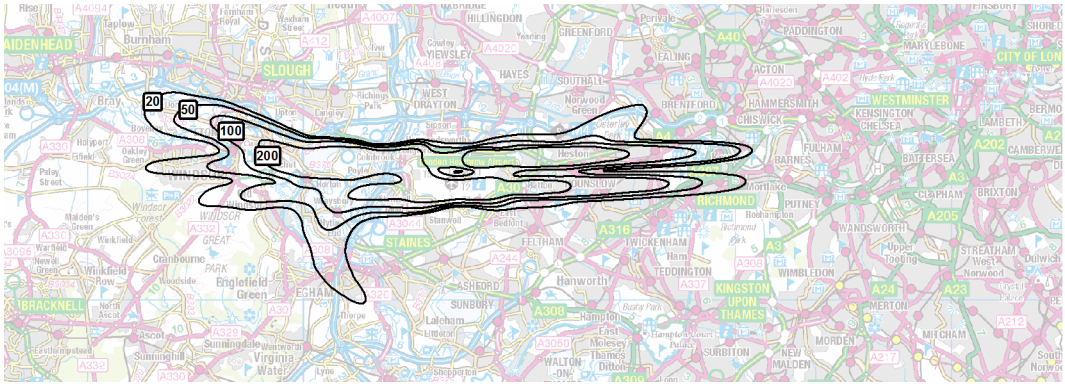


Figure *5.69* : 2030 Heathrow-ENR-R Heathrow Airport N70 Contours



The difference in N70 contour areas, population exposures and number of households included in each contour is summarised in Table 5.45 below.

Table 5.45 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-ENR-R, N70

Contour	Area (km²)	Population	Households
>20	(7.7)	(38,500)	(14,900)
>50	(3.7)	(15,600)	(7,200)
>100	(2.5)	(9,700)	(4,400)
>200	(7.3)	(19,200)	(7,000)
>500	(1.8)	(<50)	(<50)

Note: Numbers in parentheses represent reductions

It can be seen that the Do-Something contours cover a similar extent, and are quite similar in shape, to the DM contours. To the west of the airport, the contours are shown to affect less of Slough, although a greater proportion of Windsor, Dorney and Eton Wick may be included in the largest contours. To the east, the lobe seen in the DM contours over Southall/Norwood Green is predicted to move further west over Osterly Park. The far eastern extents of the Do-Something contours are very similar to those in the DM situation. Due to improvements in aircraft technology which will offset the increased number of ATMs, the Do-Something contours are gernerally about 5-7% less in area than the corresponding DM contour, with the exception of the >200 contour which is 23% smaller.

As a result of being smaller, and covering less populous areas, the Do-Something contours contain fewer people than the equivalent DM contours:

- *>20: A reduction of 38,500 (from 291,800 to 253,300)*
- *>50: A reduction of 15,600 (from 184,100 to 168,500)*
- *>100: A reduction of 9,700 (from 122,600 to 112,900)*
- *>200: A reduction of 19,200 (from 63,300 to 44,100)*
- >500: A reduction of less than 50

Comparing these results to those for the base Heathrow-ENR scenario, it can be seen that the 'Respite' option results in decreases in both the areas of the Do-Something contours, and the number of people enclosed by the following:

- *>20: A reduction in area of 24.3 km^2 and 45,000 people*
- *>50: A reduction in area of 16.6 km^2 and 52,700 people*
- *>100: A reduction in area of 13.2 km^2 and 29,600 people*
- *>200: A reduction in area of 14.9 km^2 and 53,400 people*
- *>500: A reduction in area of 1.8 km^2 and less than 50 people.*

5.11.2 Night Metrics

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

This section considers predicted changes in terms of the $L_{Aeq,8h}$ noise exposure metric, calculated for an average summer's night.

Extracts from the 2030 DM and Do-Something scenario $L_{Aeq,8h}$ contour plots are shown in Figure 5.70 and Figure 5.71 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure *5.70* : 2030 Do-Minimum Heathrow Airport $L_{Aeq,8h}$ Contours

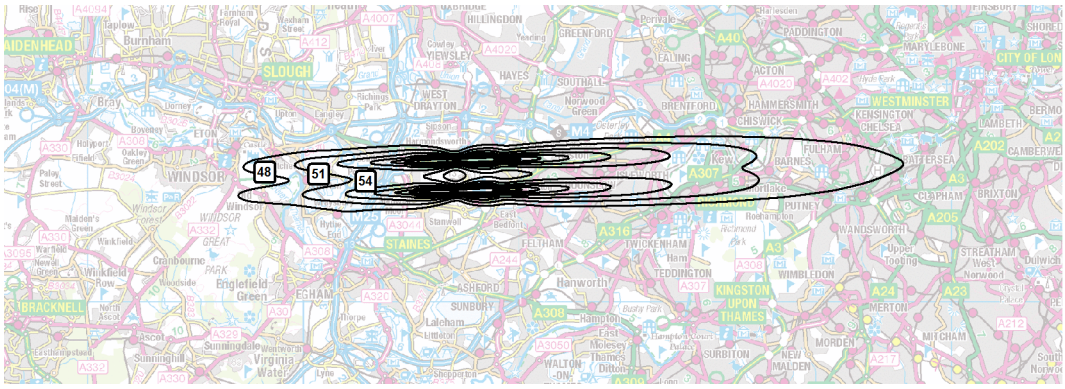
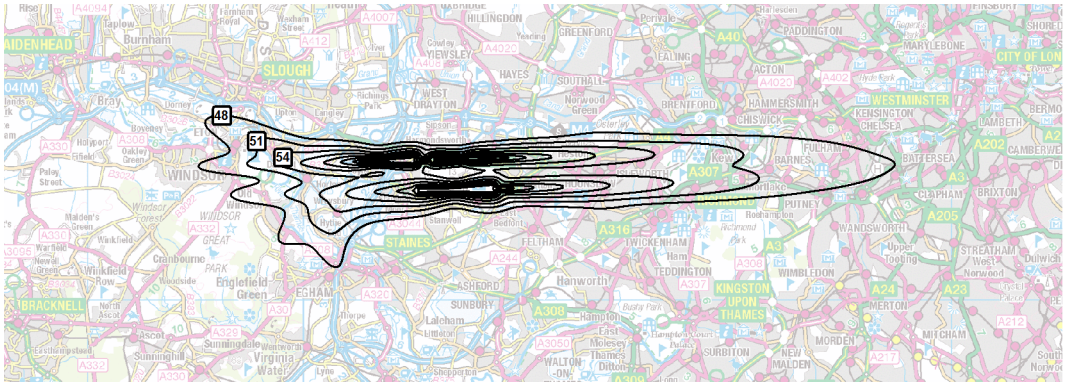


Figure *5.71* : 2030 Heathrow-ENR-R Heathrow Airport $L_{Aeq,8h}$ Contours



The difference in $L_{Aeq,8h}$ contour areas, population exposures and number of households included in each contour is summarised in Table 5.46 below.

Table *5.46* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-ENR-R, $L_{Aeq,8h}$

Contour	Area (km²)	Population	Households
>48	29.5	99,900	41,500
>51	18.8	47,000	19,500
>54	14.6	28,500	11,100
>57	7.8	9,100	3,600
>60	4.3	1,000	400
>63	2.6	(500)	(200)
>66	1.3	<50 to 200	<50 to 100
>69	0.6	<50 to <50	<50 to <50
>72	0.1	<50 to <50	<50 to <50

Note: Numbers in parentheses represent reductions

The Do-Something contours are substantially larger than the DM contours, as a result of increased ATMs during the shoulder period (23.00-23.30 and 06.00-07.00), and extend further to the east and west than the equivalent DM contours. No changes to the current night Quota Count system are assumed. The Do-Something contours also show a greater north-south spread to the west of the airport. To the east, the >48 dB Do-Something contour includes Fulham, and to the west it includes Eaton, parts of Windsor, parts of Old Windsor, Wraybury and the northern extent of Egham.

The increased area of the Do-Something contours results in greater populations being enclosed than in the equivalent DM contours, with the exception of the >63 dB contour which shows a reuction of 500 people. This is because a number of dwellings that are encompassed by the DM >63 dB contour will be relocated out of the study area as a result of the increased airport footprint in the Do-Something scenario.

In comparison to the DM scenario, the difference in populations contained in the Do-Something contour are as follows:

- *>48 dB: An increase of 99,900 (from 271,200 to 371,100)*
- *>51 dB: An increase of 47,000 (from 151,300 to 198,300)*
- *>54 dB: An increase of 28,500 (from 61,100 to 89,600)*
- *>57 dB: An increase of 9,100 (from 21,900 to 31,000)*
- *>60 dB: An increase of 1,000 (from 3,900 to 4,900)*
- *>63 dB: A reduction of 500 (from 1,300 to 800)*
- *>66 dB: An increase from <50 to 200*
- *>69 dB: No discernible change (from <50 to <50)*
- *>72 dB: No discernible change (from <50 to <50)*

Comparing these results to those for the base Heathrow-ENR scenario, it can be seen that the 'Respite' option results in substantial reductions in the number of people enclosed by the Do-Something contours:

- *>48: A reduction in area of 1.4 km^2 and 21,600 people*
- *>51: A reduction in area of 0.5 km^2 and 3,600 people*
- *>54: An increase in area of 0.1 km^2 but reduction of 6,600 people*
- *>60: A reduction in area of 0.1 km^2 and 3,900 people*
- *>63: An increase in area of 0.1 km^2 but reduction of 1,800 people*
- *>66: An increase in area of 0.1 km^2 but reduction of 1,400 people*
- *>69: No discernible changes.*
- *>72: No discernible changes.*

(b) N60 Supplementary Metric

This section considers predicted changes in terms of the N60 supplimentary noise metric, calculated for an average summer's night.

Extracts from the 2030 DM and Do-Something scenario N60 contour plots are shown in Figure 5.72 and Figure 5.73 to provide visual context to the comparisons. Full contour plots are included in Appendix B.

Figure *5.72* : 2030 Do-Minimum Heathrow Airport N60 Contours

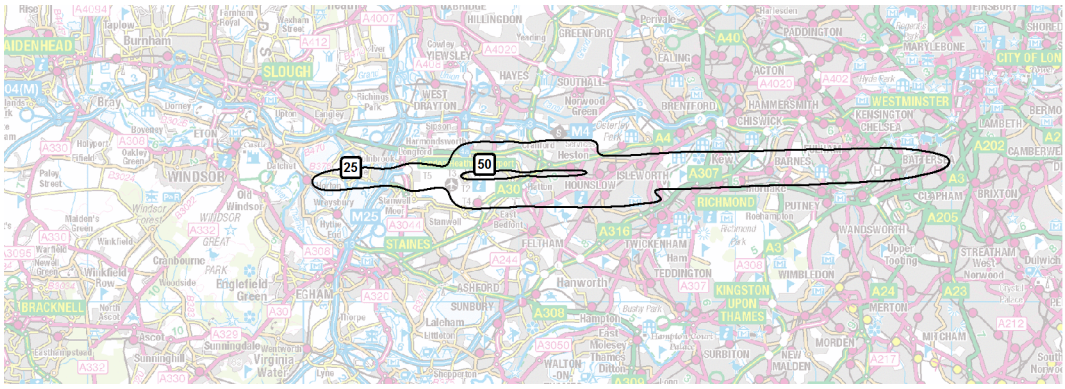
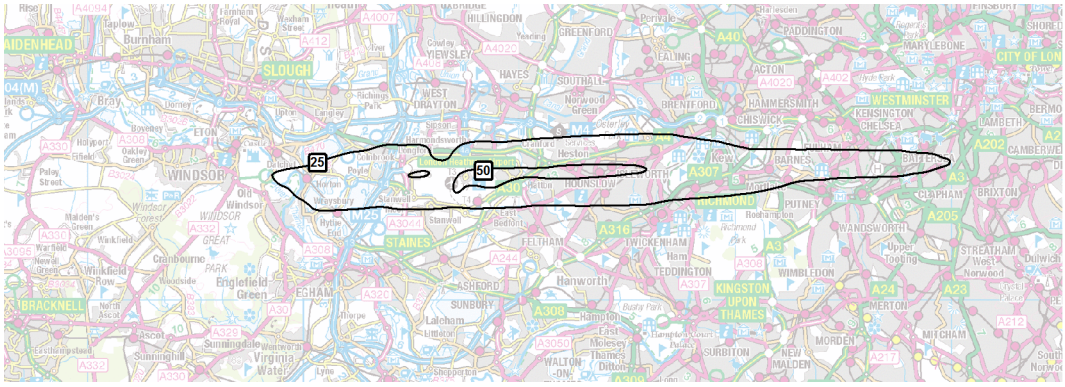


Figure *5.73* : 2030 Heathrow-ENR-R N60 Contours



The difference in N60 contour areas, population exposures and number of households included in each contour is summarised in Table 5.47 below.

Table 5.47 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-ENR-R, N60

Contour	Area (km2)	Population	Households
>25	38.0	185,900	76,100
>50	4.9	<50 to 24,400	<50 to 9,400
>25	0.0	0	0
>50	0.0	0	0
>25	0.0	0	0

Note: Numbers in parentheses represent reductions

The N60 contours for the Do-Something scenario extend further in both the east-west axis, and the north-south axis, than the DM contours. The area encompassed by both Do-Something contours is greater than the DM contours, as a result of increased ATMs during the shoulder period (23.00-23.30 and 06.00-07.00), which are not offset by improvements in aircraft technology. No changes to the current night Quota Count system are assumed.

The increased areas covered by the Do-Something contours result in greater populations encapsulated than in the DM scenario, as follows:

- *>25: An increase of 185,900 (from 150,500 to 336,400)*
- *>50: An increase from <50 to 24,400*

Comparing these results to those for the base Heathrow-ENR scenario, it can be seen that the 'Respite' option results in an increase in the number of people enclosed by the Do-Something contours:

- *>25: A reduction in area of 0.0 km^2 and 11,800 people*
- *>50: A reduction in area of -0.7 km^2 and 100 people*

5.11.3 24-Hour Metric

This section considers predicted changes in terms of the L_{den} day-evening-night noise exposure metric, calculated as an annual average.

For convenience, extracts from the 2030 DM and Do-Something scenario L_{den} contour plots are shown in Figure 5.74 and Figure 5.75 to provide visual context to the comparisons. The full contour plots are included in Appendix B

Figure *5.74* : 2030 Do-Minimum Heathrow Airport L_{den} Contours

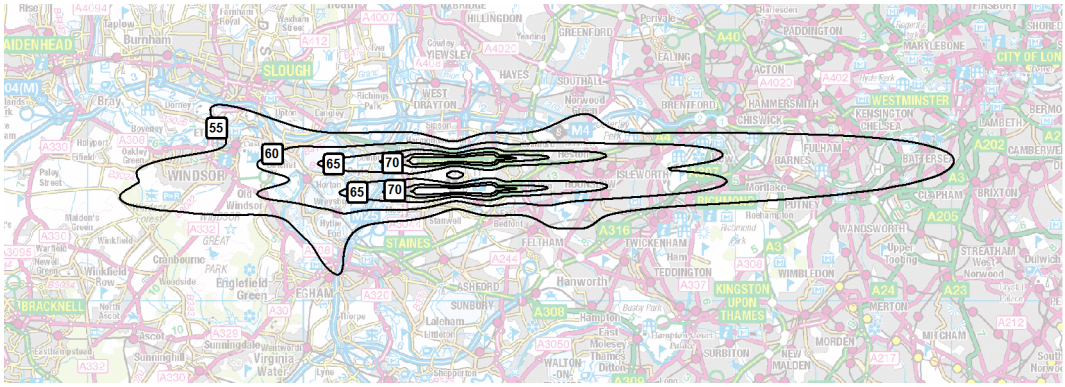
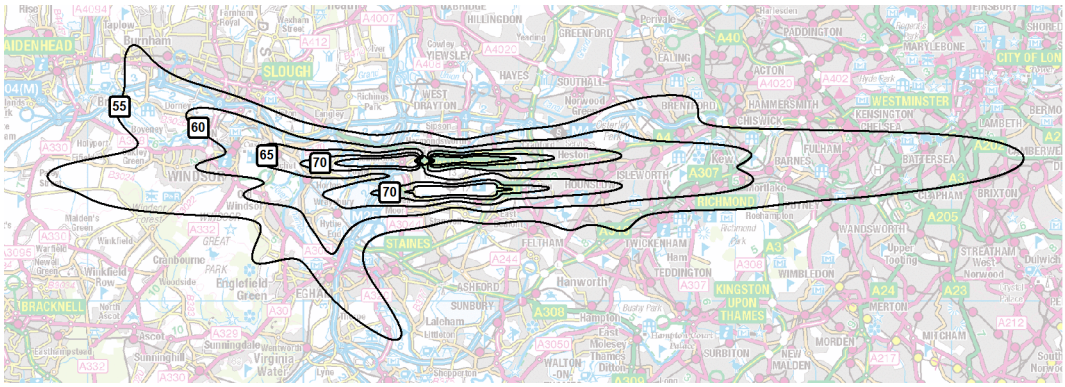


Figure *5.75* : 2030 Heathrow-ENR-R Heathrow Airport L_{den} Contours



The difference in L_{den} contour areas, population exposures and number of households included in each contour is summarised in Table 5.48 below.

Table *5.48* : 2030 Do-Minimum Heathrow vs 2030 Heathrow-ENR-R, L_{den}

Contour	Area (km²)	Population	Households
>55	46.7	199,600	85,000
>60	19.6	56,000	22,700
>65	7.9	24,200	9,500
>70	3.8	1,700	800
>75	1.6	<50 to 400	<50 to 200

Note: Numbers in parentheses represent reductions

The Do-Something contours extend further to the east and west than the equivalent DM contours, with the east tip of the >54 dB being over Camberwell. To the west of the airport, the Do-Something contours show a greater spread north and south, as a result of a greater number of routes.

Despite the effects of forecast introduction of quieter aircraft in the fleet mixes, the increase in ATMs results in larger contours in the Do-Something scenario. In combination with population growth, this results in gerater population exposure for all contours in comparison to the DM scenario as summarised below:

- *>55 dB: An increase of 199,600 (from 580,500 to 780,100)*
- *>60 dB: An increase of 56,000 (from 169,600 to 225,600)*
- *>65 dB: An increase of 24,200 (from 34,800 to 59,000)*
- *>70 dB: An increase of 1,700 (from 3,000 to 4,700)*
- *>75 dB: An increase from <50 to 400*

Comparing these results to those for the base Heathrow-ENR scenario, it can be seen that the 'Respite' option results in an reduction in the number of people enclosed by the Do-Something contours:

- *>55 dB: A reduction in area of 1.9 km² and 26,700 people*
- *>60 dB: A reduction in area of 0.8 km² and 7,100 people*
- *>65 dB: An increase in area of 0.3 km² but a reduction of 3,000 people*
- *>70 dB: An increase in area of 0.1 km² but a reduction of 300 people*
- *>75 dB: No change*.

For the Heathrow Extended Northern Runway 'Respite' (carbon capped) option, the number of people newly affected by noise levels over 55 dB L_{den} in the 2030 Do-Something scenario compared to the 2030 DM scenario is 218,900, and the number of people newly removed is 18,300. This results in a net increase in the number of people newly affected of 200,600. This is less than for the base Heathrow-ENR scenario, where a net increase of 227,400 is predicted.

5.11.4 Sensitive Buildings

The change in number of sensitive buildings within each contour between the 2030 DM and 2030 Heathrow-ENR-R scenarios are set out in Table 5.49 below:

Table 5.49 : 2030 Do-Minimum Heathrow vs 2030 Heathrow-ENR-R, Sensitive Buildings

Period	Metric	Schools	Hospitals	Places of Worship	Metric	Schools	Hospitals	Places of Worship
Day	>54 dB $L_{Aeq,16h}$	210	4	124	N70 >20	7	1	5
	>57 dB $L_{Aeq,16h}$	69	3	51	N70 >50	11	0	2
	>60 dB $L_{Aeq,16h}$	45	1	27	N70 >100	(1)	(1)	3
	>63 dB $L_{Aeq,16h}$	10	0	5	N70 >200	(7)	0	(8)
	>66 dB $L_{Aeq,16h}$	4	0	3	N70 >500	0	0	0
	>69 dB $L_{Aeq,16h}$	2	0	1		0	0	0
	>72 dB $L_{Aeq,16h}$	0	0	0		0	0	0
Night	>48 dB $L_{Aeq,8h}$	14	1	21	N60 >25	32	0	14
	>51 dB $L_{Aeq,8h}$	8	0	8	N60 >50	9	0	6
	>54 dB $L_{Aeq,8h}$	4	0	2	N60 >100	0	0	0
	>57 dB $L_{Aeq,8h}$	1	0	0	N60 >200	0	0	0
	>60 dB $L_{Aeq,8h}$	0	0	(1)	N60 >500	0	0	0
	>63 dB $L_{Aeq,8h}$	(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}	161	6	99				
	>60 dB L_{den}	47	0	34				
	>65 dB L_{den}	14	0	6				
	>70 dB L_{den}	1	0	0				
	>75 dB L_{den}	0	0	0				

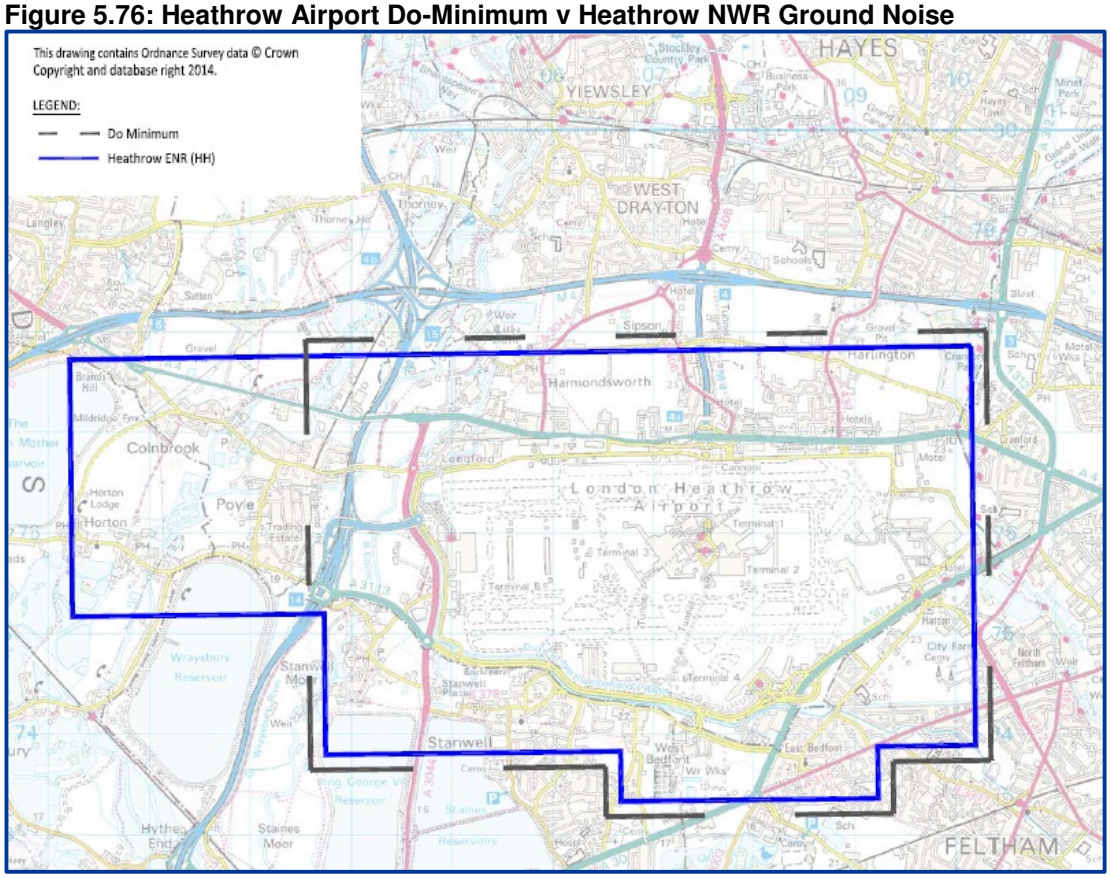
5.12 Ground Noise

The results of the assessment for the Heathrow ENR scheme are given in Table 5.50 and Figure 5.76 below. 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.

Table 5.50 : Ground Noise Exposure at Heathrow Airport – Extended Northern Runway

	Current (2013)	2030 DM	2030 Gatwick-2R-X
Exposed Area, km^2 (57 dB $L_{Aeq,16h}$)	29.3	30.5	33.5
Population within Exposed Area	30,650	30,750	29,300

Figure 5.76: Heathrow Airport Do-Minimum v Heathrow NWR Ground Noise



Compared to the current situation there is little change expected in the amount of ground noise in 2030 under the DM case.

With the Heathrow ENR scheme the forecast amount of ground noise is slightly higher than the DM 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 / receptors of ground noise.

5.13 Monetisation (Heathrow-ENR)

5.13.1 Introduction

This section will cover the monetisation results for annoyance, sleep disturbance, Health-AMI and Health-Hypertension for the Heathrow-ENR scenario.

Costs are stated in £millions/assessment-year, or when considering totals, £billions/60-years.

5.13.2 Annoyance

The monetisation results for the Heathrow-ENR scenario for annoyance indicate that costs will increase between 2030, 2040 and 2050, from £48.8, £97.6 and £585.7 in the low, mid and high cost 2030 scenarios respectively to £52.8, £105.7 and £634.0 in the 2050 low, mid and high cost scenarios.

The sensitivity analyses shows that an increase in cut–off level from 45dB to 48dB is predicted to result in a decrease in the monetisation values, starting at £44.50, £89.10 and £534.4 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs increase to £50.20, £100.40 and £602.60. There is a slight decrease in the 2050 low, mid and high scenario at £48.70, £55.70 and £584.00.

5.13.3 Sleep disturbance

For sleep disturbance, these costs again increase over time and vary with the low, mid and high cost assumptions, starting at £49.9, £87.4 and £124.8 for the low mid and high costs in 2030 and ranging to £57.4, £100.4 and £143.5 for the three cost assumptions in 2050.

For the sensitivity case, increasing the threshold by 3 dB sees a similar pattern of costs, but starting at £28.50, £49.90 and £71.20 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs increase to £31.90, £55.90 and £79.80. There is a slight decrease in the 2050 low, mid and high scenario at £31.80, £55.70 and £79.60.

5.13.4 AMI

The AMI costs do not vary with low, mid and high cost assumptions, but increase over time from £30.4 in 2030, to £37.5 in 2040 and £35.7 in 2050. The sensitivity analyses show no change in costs.

5.13.5 HT Strokes

The HT Stokes results increase from £2.2 to £2.7 in the period 2030-2040, before decreasing slightly to £2.6 in 2050, with no variation in the sensitivity case.

5.13.6 HT Dementia

Similarly the HT dementia result increase from £3.3 in 2030 to £4.0 in 2040, before decreasing again to £3.9 in 2050, with no variation in the sensitivity case.

5.13.7 Total

The total costs for the Heathrow-ENR scenario are £4.6, £7.5 and £25 billion/60 years for the low, mid and high cost scenarios respectively. The sensitivity case decreases costs by £0.9, £1.6 and £4.0 billion/60 years for the relevant cost assumption scenarios. Annoyance is the greatest cost contributor in all cost scenarios for all 3 assessment years, followed closely by sleep disturbance, where as in the mid and high cost assumption scenarios, annoyance is responsible for more cost that sleep disturbance, markedly so in the high cost case. HT stokes is the lowest cost contributor in all scenarios.

5.14 Monetisation (Heathrow-ENR-R)

5.14.1 Introduction

This section will cover the monetisation results for annoyance, sleep disturbance, Health-AMI and Health-Hypertension for the Heathrow-ENR-R scenario.

Costs are stated in £millions/assessment-year, or when considering totals, £billions/60-years.

5.14.2 Annoyance

The monetisation results for the Heathrow-ENR-R scenario for annoyance indicate that costs will increase between 2030 and 2040 from £50.9 to £55.3 and show a decrease in 2050 at £52.8 in the low. From 2030 to 2040 in the mid and high respectively there is also an increase from £101.8 to £110.7 in the mid, £610.8 to £664.1 in the high decreasing in the 2050 scenario to £105.7 in the mid and £634.0 in the high.

The sensitivity analyses shows that an increase in cut–off level from 45dB to 48dB is predicted to result in a decrease in the monetisation values, starting at £44.50, £89.00 and £534.20 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs increase to £50.20, £100.40 and £602.60. There is a further increase in the 2050 low, mid and high scenario at £48.70, £97.30 and £584.00.

5.14.3 Sleep disturbance

For sleep disturbance, these costs increase over time starting at £43.50, £76.1 and £108.8 for the low mid and high costs in 2030 and ranging to £57.4, £100.4 and £143.5 for the three cost assumptions in 2050.

For the sensitivity case, increasing the threshold by 3 dB sees a similar pattern of costs, but starting at £23.40, £40.90 and £58.40 for the low mid and high costs in 2030. In the 2040 low, mid and high scenarios these costs increase to £31.90, £55.90 and £79.80. There is a slight decrease in the 2050 low, mid and high scenario at £31.80, £55.70 and £79.60.

5.14.4 AMI

The AMI costs do not vary with low, mid and high cost assumptions, but increase over time from £26.5 in 2030, to £37.5 in 2040 and £35.7 in 2050. The sensitivity analyses show no change in costs.

5.14.5 HT Strokes

The HT Stokes results increase from £2.0 to £2.7 in the period 2030-2040, before decreasing slightly to £2.6 in 2050, with no variation in the sensitivity case.

5.14.6 HT Dementia

Similarly the HT dementia result increase from £2.9 in 2030 to £4.0 in 2040, before decreasing again to £3.9 in 2050, with no variation in the sensitivity case.

5.14.7 Total

The total costs for the Heathrow-ENR-R scenario are £4.6, £7.4 and £25 billion/60 years for the low, mid and high cost scenarios respectively. The sensitivity case decreases costs by £0.9, £1.6 and £4.0 billion/60 years for the relevant cost assumption scenarios. Annoyance is the greatest cost contributor in the low cost scenarios for 2030 and 2040, whilst sleep disturbance is for 2050. For the mid and high cost assumptions, annoyance is the greatest cost contributor (markedly so in

the high cost case) in all assessment years, followed by sleep disturbance. HT stokes is the lowest cost contributor in all scenarios.

5.15 Promoter's Submission

5.15.1 Information Provided

The promoter's submission provides a comparison of the 2012 baseline situation with the future year (2023) Do-Something scenario, and considers three different fleet mixes (40%, 60% and 90% next generation aircraft).

The basis of the assessment set out in the noise appraisal module is a comparison of the future Do-Nothing situation in the noise assessment base year (2030) with the Do-Something scenario for the same year. This assessment is then repeated for the assessment end year, which is the latest year within a 60 year period for which forecasts are considered reasonably accurate. Typically this will be 10 to 20 years after the base year, as the forecasts on which noise models are based have short time-horizons.

The promoters submission has based the assessment on a comparison of the 2012 current situation with the 2023 Do-Something scenario. This differs from the approach within this report, as do the calculation method and modelling inputs.

For the scenarios considered, the promoter has provided population exposures for the $L_{Aeq,16h}$ metric in the submission, and noise levels have been considered at 15 discrete locations using the $L_{Aeq,16h}$ (average summer's day), $L_{Aeq,8h}$ (average summer's night) and L_{den} indicators. However, no population exposures have been provided for the $L_{Aeq,16h}$, $L_{Aeq,8h}$ or L_{den} metrics, and neither have data for the 'number above' N70 and N60 metrics. The assessment provided does not present a noise scorecard for any scenario.

The majority of the noise metrics reported in the submission are calculated using the INM noise model. With appropriate modifications to input parameters, this model can give results which are similar to that produced by the CAA noise model ANCON. Only the baseline noise exposure metrics in Table 5.1 are calculated in line with ANCON model, and therefore the outputs cannot be compared on a methodological basis with the Airports Commission ANCON model outputs.

The promoter has used 2011 Census data from CACI for the population exposure calculations for 2023, without applying forecast growth factors. As these dates are only separated by 12 years it is likely that the expected population growth over this period would be fairly small; however, it reduces the comparability of assuming 2023 can be taken as a 2030 effective date for the most basic of comparisons between promoter's and Airport Commission assessments.

5.15.2 Promoter's Noise Metrics

This section summarises the predicted changes in the $L_{Aeq,16h}$ noise metric calculated by the promoter using the INM noise model, adjusted as far as possible for consistency with the ANCON noise model, and utilising the modified flight tracks developed with NATS and the Airports Commission.

The 40% "imminent" fleet mix scenario shows the following increases in population exposure when compared to the 2023 baseline situation:

- *>54 dB an increase of 56,623 from (439,028 to 495,651)*
- *>57 dB an increase of 21,275 from (231,939 to 253,214)*
- *>60 dB an increase of 33,984 from (112,507 to 146,491)*
- *>63 dB an increase of 23,180 from (53,948 to 77,128)*
- *>66 dB an increase of 14,866 from (1,9181 to 34,047)*
- *>69 dB an increase of 6,564 from (4,225 to 10,789)*
- *>72 dB an increase of 1,821 from (739 to 2,560)*

The 60% "imminent" fleet mix scenario shows the following increases in population exposure when compared to the 2023 baseline situation:

- *>54 dB an increase of 33,393 from (439,028 to 472,421)*
- *>57 dB an increase of 5,918 from (231,939 to 237,857)*
- *>60 dB an increase of 28,132 from (112,507 to 140,639)*
- *>63 dB an increase of 19,255 from (53,948 to 73,203)*
- *>66 dB an increase of 12,509 from (19,181 to 31,690)*
- *>69 dB an increase of 5,105 from (4,225 to 9,330)*
- *>72 dB an increase of 1,518 from (739 to 2,257)*

The 90% "imminent" fleet mix scenario shows the following increases in population exposure when compared to the 2023 baseline situation:

- *>54 dB a reduction of 23,648 from (439,028 to 4153,80)*
- *>57 dB an increase of 2,994 from (231,939 to 234,933)*
- *>60 dB an increase of 29,477 from (112,507 to 141,984)*
- *>63 dB an increase of 13,752 from (53,948 to 67,700)*
- *>66 dB an increase of 7,139 from (19,181 to 26,320)*
- *>69 dB an increase of 2,947 from (4,225 to 7,172)*
- *>72 dB an increase of 1,201 from (739 to 1,940)*

The promoter has not provided any night-time noise contours or population exposures. The reason for this, as stated by the promoter the "scheme does not contain any aircraft movements between 23.30 and 06.00 therefore there will be no aircraft noise during this period". This contrasts with the ATM analysis that underpins the Airports Commission analysis.

5.16 Commentary on promoter's Submission

The promoter predicts an increase in the number of people exposed to daytime noise. However, these increases are much smaller than calculated by ERCD for the closest year (2030).

The reasons for this are not clear, as the initial promoter's noise submission received does not explicitly state the following input data for the noise predictions:

- *the number of aircraft movements assumed for the 2023 Do-Something scenario,*
- *it is unclear from the submission whether the predictions for the three different fleet mixes are all based on the forecast aircraft movements for the 2023 assessment year, or whether they represent later assessment years with different aircraft movements.*
- *the promoter's clarification indicates that the ultimate capacity of the scheme is approximately 690,000 ATMs, but does not detail what proportion of this capacity will be reached in 2023.*

There is a significant difference in assumptions regarding the night time situation, with the promoter stating that there will be no movements between 23.30 and 06.00. However, air traffic analysis carried out by LeighFisher suggests that in order to serve the required markets and to allow for the required number of air traffic movements indicates that there is a need for limited night-time operations for the Heathrow Airport Extended Northern Runway proposal. If this is a possibility, this could be applied to any scheme and would be a consideration of a noise arbiter if one came into being. In any case, movements in the periods 23.00-23.30 and 06.00-07.00 are considered to contribute to night-time noise, so there would not be a total absence of night-time noise should movements cease between 23.30 and 06.00.

5.17 Mitigation

The promoter's submission notes that offset, curved and angled approaches are being considered as means of reducing population noise exposure during the daytime. It is considered that the benefits of noise preferential routing could be significant, reducing noise over west London, Slough, Windsor, Englefield Green and Egham in particular. The promoter is not advocating night-time operation of the Heathrow Airport Extended Northern Runway and this in itself is the ultimate mitigation of aviation noise from Heathrow at night, although this is currently considered incompatible with the scheduling required for departures to and arrivals from all destinations that Heathrow currently serves.

5.18 Conclusions

The noise modelling undertaken by ERCD indicates that there are likely to be significant increases in noise exposure due to the Heathrow Airport Extended Northern Runway proposal. However, the promoter's noise assessment indicates that the impacts will be much smaller. The reasons for this discrepancy are unclear, as the promoter's assumed key input data for the noise modelling is not stated.

A significant difference regarding the night time situation has been identified, with the promoter stating that there will be no movements between 23.30 and 06.00. However, air traffic analysis carried out by LeighFisher suggests that in order to serve the required markets and to allow for the required number of air traffic movements indicates that there is a need for limited night-time operations for the Heathrow Airport Extended Northern Runway proposal, due to the scheduling required for departures to and arrivals from all destinations that Heathrow currently serves. No changes to the current night Quota Count system are assumed.

Glossary

The following table lists and explains key technical terms used in this report.

AC	Airports Commission
AMI	Acute Myocardial Infarction
AoN	Assessment of Need
ATM	Air Transport Movements
CAA	Civil Aviation Authority
dB(A)	Decibel, normal unit of measurement of sound pressure levels
DM	Do-Minimum
ERCD	Environmental Research and consultancy Department of the CAA
GAL	Gatwick Airport Ltd
HAL	Heathrow Airport Ltd
HH	Heathrow Hub
HT	Hyper Tension
Hz	Hertz, measure of sound frequency, that is the number of pressure fluctuations per second
L_{AeqT}	A-weighted equivalent continuous sound pressure measured over a certain time period (T).
Gatwick-1R	Gatwick DM (1 runway)
Gatwick-2R-X	Gatwick Second Runway (capped)
Gatwick-2R-X-C	Gatwick Second Runway (traded)
Heathrow-ENR	Heathrow Extended Northern Runway (capped)
Heathrow-ENR-X-C	Heathrow Extended Northern Runway (traded)
Heathrow-2R	Heathrow DM (2 runways)
Heathrow-NWR-T	Heathrow North West Runway Minimise Total (capped)
Heathrow-NWR-T-C	Heathrow North West Runway Minimise Total (traded)
Heathrow-NWR-N	Heathrow North West Runway Minimise New(capped)
Heathrow-NWR-R	Heathrow North West Runway Respite (capped)
Heathrow-NWR-T-35	Heathrow North West Runway 3.5 deg app (capped)
LSOA	Low Super Output Area
N60 and N70	Number of times a threshold level (in this case 60 or 70 dB) are exceeded within a time period of interest.
NATS	National Air Traffic Service
SOAEL	Significant Observed Adverse Effect Level

References

ANASE - Attitudes to Noise from Aviation Sources in England

Civil Aviation Authority, 1990,The Use of L_{Aeq} as an Aircraft Noise Index, DORA Report 9023

ICAO, 2010. International Civil Aviation Organisation Environmental Report 2010 ; http://www.icao.int/environmental-protection/Pages/EnvReport10.aspx .

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

Sustainable Aviation, 2013, The Sustainable Aviation Noise Road Map, www.sustainableaviation.co.uk

A1. Methodology

The noise appraisal module determines the impact of aviation noise levels due to the schemes (referred to as the 'Do-Something' options), at the assessment base and end years, by comparison with the noise immission[8] for the corresponding DM scenarios.

The Appraisal Framework indicates that a 60 year period should be adopted between the base and end years for appraisals. However, it also notes that the time-horizons for the datasets supporting some assessment modules, including noise, are much shorter. Therefore the scheme promoters have selected earlier end years for their submissions, for which reasonable assumptions can be made in respect of input data. These provide a basis to which the Commission can apply logic and best practice to estimate future benefits and dis-benefits to be fed into the wider appraisal.

Estimates of population noise exposure are very sensitive to input data such as:

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

The scheme promoters have based their noise assessments on their forecasts of ATMs, fleet mixes and population. ERCD has calculated noise contours and population exposure for the Airports Commission based on DM and Assessment of Need (carbon capped) forecasts (Passengers and ATMs), conservative fleet mix assumptions for each airport (Appendix A.1) and population data supplied by CACI Limited[9].

Population data used for the current scenarios (described in Chapter 3) are the 2013 update of the latest 2011 Census. Population data used for the 2030, 2040 and 2050 are forecasts for these respective years also supplied by CACI Limited.

Taken together, the ERCD and promoter's predictions provide the Commission with a view of the potential impacts of each scheme based on alternative forecasts.

The promoter's submissions have been reviewed in relation to:

- The requirements of appraisal module 5 'Noise';
- Their stated aviation noise impacts associated with the scheme as determined by comparison to the baselines, using a scorecard approach;
- Comparison to ERCD modelled aviation noise impacts for each proposal, and,
- Measures undertaken to control and mitigate ground noise.

[8] 'immission' refers to sound that a receptor – listener – hears. It is used e.g. in Noise Immission Level (NIL) used to assess workplace hearing risk, http://www.hse.gov.uk/research/rrpdf/rr669.pdf
[9] CACI is a professional services and information technology company, providing market intelligence, including population forecasts based on census and other data www.caci.co.uk

This noise assessment of the schemes adopts 2030 as the base year. For each scheme, ERCD has provided future year noise contours for 2030, 2040 and 2050 which is the upper end of the time-horizon that assumptions about input data can be realistically made. This range of results is sufficient for comparison with the assessment years selected in all of the promoter's submissions, but as noted above, does not enable a quantitative assessment for the appraisal end year.

The full range of noise metrics that have been considered in this assessment are:

- $L_{Aeq,16h}$ (average summers day) contours from 54 dB to 72 dB in 3 dB intervals
- $L_{Aeq,8h}$ (average summers night) contours from 48 dB to 72 dB in 3 dB intervals
- L_{den} (Day-Evening-Night level) contours from 55 dB to 75 dB in 5 dB intervals
- N70 (16-hour average day) contours (no levels specified)
- N60 (8-hour average night) contours (no levels specified)

For convenience, these metrics are presented using the 'scorecard' approach in the body of this report.

A.1.1 Inputs to the Local Assessment

The following information, submissions and guidance have been considered by this assessment.

(a) Promoters Submissions

The following submissions received from GAL:

- Gatwick Airport Submission to Airport Commission: Air Noise Assessment for 95mppa Case (July, 2014)

The following submissions received from HAL:

- Heathrow's North-West Runway, Air and Ground Noise Assessment (18 June 2014)

The following submissions received from HH:

- Updated scheme design - Attachment 5-1 Addendum 2 (Noise) (July 2014)
- Noise figures 1.1 – 1.22
- Clarification response noise figures 1.23 – 1.35

The noise metrics presented in the promoters submissions for the noise appraisal module scorecards are based on the outputs of ANCON noise models, which have been developed by ECRD using promoters input data (GAL and HAL) and INM noise model validated against current ANCON outputs (HH) .

(b) ERCD Noise Model Outputs

The ERCD noise models are based on the Assessment of Need (AoN) carbon capped forecasts together with scenarios based on the Low Cost is King (for Gatwick Second Runway and Heathrow Northwest Runway) and Global Growth (for Heathrow Extended Northern Runway) carbon traded forecasts. These carbon traded scenarios have been determined to generate worst case noise impacts for each option. Fleet mixes are based on assumptions regarding the current, imminent (Generation 1) and future (Generation 2) aircraft as detailed in Table A.2 of this Appendix. These passenger, ATM and fleet mix assumptions differ from those made by the scheme promoters, and the effects of the noise metrics as a result of these differences are explored in detail in the Analysis section of this report.

The outputs of the ANCON noise models developed by ERCD for the Airports Commission for the schemes and operational scenarios have been used as a basis for this assessment, as shown in Table A.1 below:

Table A.1 ANCON Model Scenarios

Airport	Scheme	Scheme Notation
Gatwick	DM (1 Runway) Second Runway (capped) Second Runway (traded)	Gatwick-1R Gatwick-2R-X Gatwick-2R-X-C
Heathrow	DM (2 Runways) Northwest Runway Minimise Total (capped) Northwest Runway Minimise Total (traded) Northwest Runway Minimise New (capped) Northwest Runway Respite (capped) Northwest Runway 3.5 deg app (capped)	Heathrow-2R Heathrow-NWR-T Heathrow-NWR-T-C Heathrow-NWR-N Heathrow-NWR-R Heathrow-NWR-T-35
Heathrow	Extended Northern Runway (capped) Extended Northern Runway (traded) Extended Northern Runway Respite (cappred)	Heathrow-ENR Heathrow-ENR-X-C Heathrow-ENR-R

For each scenario predictions have been undertaken for 2030, 2040 and 2050.

A.1.2 Noise Modelling

In this 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. The methodology used by ERCD is set out in detail in Appendix A, and summarised below.

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[10] (ATMs) and associated aircraft fleet mix
- Arrival and departure flight paths, threshold displacements[11], approach path angles, take-off power and climb rates
- The allocation of ATMs to runways and flight tracks
- The future noise characteristics of new and re-engined aircraft
- Runway modal split[12] assumptions

[10] Also referred to as Air Traffic Movements

[11] 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.

- 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 the following sections of this report.

A.1.3 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.

For 2030 and beyond, the noise models are based on the ATMs arising from the Airport Commission Demand Forecast 2014 for 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 A.2.

A.1.4 Fleet Mix

As a result of technological advances, aircraft produced today are considerably quieter than those of 50 years ago, and this trend is expected to continue. The Sustainable Aviation Noise Road-Map (Sustainable Aviation 2013) defines three generations of aircraft and sets out assumptions concerning the noise emissions of each generation:

- *'**Current**' Aircraft represent 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.*
- *'**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, an assumed 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 'Current' to 'Imminent' and 'Future', as used by ERCD in noise modelling for the Local assessment, are set out in Table A.2 overleaf.

This shows the movement from existing aircraft fleet mixes (predominantly 'Current' generation) to higher proportions of Generation 1 and Generation 2 aircraft.

It should be noted that production schedules and market conditions can impact the introduction dates of new aircraft within fleets, and the Table presents our best

[12] Runway modal split refers to the proportion of use for landing or take off, or both.

understanding of the likely fleet mixes based on ATMs, passenger demand and destinations served. Variation in these proportions can have a noticeable effect on noise model outputs.

Table A.2 : Aircraft fleet mixes used in Local noise models

Option	Scenario	Aircraft Generation	Year 2011	2030	2040	2050
Gatwick Airport	DM	Current	100%	27%	8%	5%
		Imminent	0%	72%	86%	53%
		Future	0%	0%	5%	42%
	Gatwick-2R-X	Current	-	29%	11%	9%
		Imminent	-	70%	83%	50%
		Future	-	0%	6%	40%
	Gatwick-2R-X-C	Current	-	38%	16%	7%
		Imminent	-	61%	73%	36%
		Future	-	0%	10%	56%
Heathrow North West Runway	DM	Current	100%	35%	15%	3%
		Imminent	0%	65%	73%	31%
		Future	0%	0%	12%	66%
	Heathrow-NWR-T	Current	-	32%	13%	4%
	Heathrow-NWR-N	Imminent	-	67%	76%	33%
	Heathrow-NWR-R	Future	-	0%	10%	63%
	Heathrow-NWR-T-C	Current	-	38%	16%	7%
		Imminent	-	61%	73%	36%
		Future	-	0%	10%	56%
Heathrow Extended North Runway	DM	Current	-	35%	15%	3%
		Imminent	-	65%	73%	31%
		Future	-	0%	12%	66%
	Heathrow-ENR	Current	-	32%	12%	4%
		Imminent	-	67%	77%	33%
		Future	-	0%	11%	63%
	Heathrow-ENR-X-C	Current	-	32%	13%	3%
		Imminent	-	68%	75%	32%
		Future	-	0%	11%	65%

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

A.1.5 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 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. For the purposes of this ground noise assessment, 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 & LAeq: The ground noise emission for each airport has been calculated in terms of dB LAeq 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 LAeq,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).

A.1.6 Monetisation

It is noted in the Appraisal Framework that there is no commonly agreed methodology for monetising aviation noise. However, the Appraisal Framework notes the guiding documents are the World Health Organisation (WHO 2011), *Burden of disease from environmental noise* and ERCD 1209 *Proposed methodology for estimating the cost of sleep disturbance from aircraft noise*.

Therefore this report monetises amenity, sleep and health impacts as follows:

- Amenity or annoyance impacts are monetised on a WHO (2011) disability-adjusted life-years (DALY) approach, based on population changes within relevant levels of $L_{Aeq,16h}$ exposure.
- Sleep disturbance impacts are monetised using the WHO (2011) recommended methodology. This is based on population changes within relevant levels of $L_{Aeq,8h}$ exposure.
- Health impacts (specifically acute myocardial infarction (AMI), and hypertension stoke and dementia effects) are monetised as presented in ERCD Report 1209 based on population changes within relevant levels of an un-weighted L_{Aeq24h} exposure. The impact is calculated in a stepped process that identifies the odds ratio (OR) of the impact, calculates the number of people affected within a population and then for hypertension further calculates years lost due to disability (YLD).

Costs are stated in £millions/assessment-year, or when considering totals, £billions/60-years.

Further detail on the methodology employed may be found the WHO 2011 and ERCD 1209 documents.

A.2 LeighFisher Methodology

Leigh | Fisher

APPRAISAL MODULE 5: NOISE

AVERAGE DAY FORECASTING METHODOLOGY

Prepared for

29th October 2014

Leigh|Fisher

Document control sheet

Client: Airports Commission
Document Title: Average Day Forecasting Methodology

	Originated by	Checked by	Reviewed by	Approved by
ORIGINAL **10 October 2014**	NAME **Stijn Dewulf**	NAME **Rob Rushmer**	NAME	NAME
Document status: Draft				

	Originated by	Checked by	Reviewed by	Approved by
REVISION **16 October 2014**	NAME **Stijn Dewulf**	NAME **Rob Rushmer**	NAME	NAME
Document status: Draft				

	Originated by	Checked by	Reviewed by	Approved by
REVISION **29 October 2014**	NAME **Stijn Dewulf**	NAME **Rob Rushmer**	NAME **Rob Rushmer**	NAME **Rob Rushmer**
Document status: Final				

TABLE OF CONTENTS

1. INTRODUCTION 2

2. OVERVIEW OF TRAFFIC FORECASTS 3

3. METHODOLOGY 4

3.1 Overview 4

3.2 Daily Forecast 5

3.3 Schedule Development 7

3.4 Average Day Forecast 10

LIST OF FIGURES

Figure 1 - General principles and major steps behind the methodology. 4
Figure 2 - 2011 daily movements for London Heathrow (LHR) and London Gatwick (LGW)[3] 6

LIST OF TABLES

Table 1 - Overview of traffic forecast scenarios 3
Table 2 - Daily capacity limits split by day, evening and night for the different scenarios. 5
Table 3 - 2011 schedule days as submitted by GAL and HAL. 7
Table 4 - Seat classes as defined by the ECRD. 9
Table 5 - Operation modes of HH allocated to day/evening/night periods 10

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

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

*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.

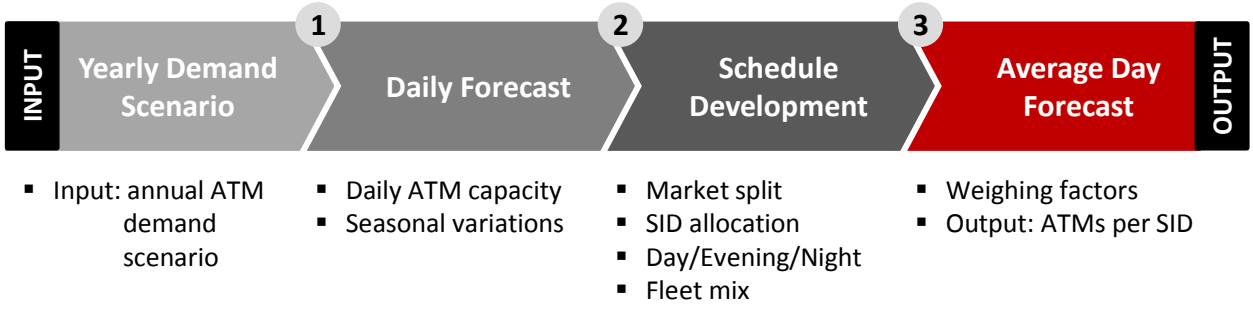


Figure 1 - General principles and major steps behind the methodology.

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.

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

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.

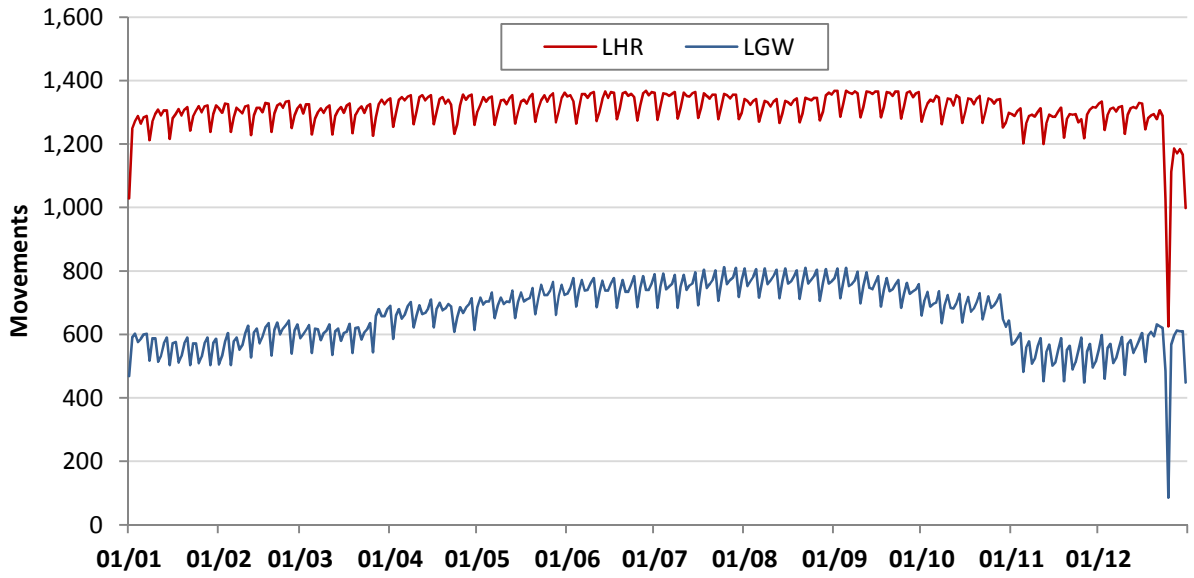


Figure 2 - 2011 daily movements for London Heathrow (LHR) and London Gatwick (LGW)[3].

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

LONDON

65 Chandos Place
London, WC2N 4HG
UK
+44 (0)20 7420 1770

SAN FRANCISCO

555 Airport Boulevard, Suite 300
Burlingame, California 94010
USA
+1 650 579 7722

TORONTO

90 Adelaide Street
Suite 802
Toronto, ON M5H 3V9.
Canada
+1 416 642 1659

BOLOGNA

Via De' Pignattari, 1
Palazzo dei Notai
40124 Bologna BO.
Italy
+30 (0)51 223 061

AMSTERDAM

Keizersgracht 62-64
1015 CS Amsterdam.
Netherlands
+31 205 207 455

A.3 ERCD Methodology

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:

[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.

[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