Proof of Evidence - Noise

Enabling works to allow implementation of full runway alternation during easterly operations at Heathrow Airport



Date: 5 May 2015

Prepared by: **Rupert Thornely-Taylor**

Appeal Ref: APP/R5510/A/14/2225774

Doc. Ref: HAL/RTT/P/01

RUPERT TAYLOR
Acoustics - Noise - Vibration

Quod

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Heathrow
Making every journey better

Report for

Stephen Allen
Planning Manager
Heathrow Airport Limited (HAL)
The Compass Centre
Nelson Road
Hounslow
Middlesex
TW6 2GW

Prepared by

.....
Rupert Thornely-Taylor

Rupert Taylor Limited

Saxtead Hall
Saxtead, Woodbridge
Suffolk, IP13 9QT
United Kingdom
Tel +44 (0) 1728 727 424

Doc Ref. HAL/RTT/P/01

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1. Introduction

1.1 Qualifications and Experience

1.1.1 I am a Fellow and a founder member of, the Institute of Acoustics. I am also a Member of the Institute of Noise Control Engineering of the USA and a Member of the International Institute of Acoustics and Vibration. I have specialised exclusively in the subjects of noise, vibration and acoustics for more than 50 years. I have been the head of the Rupert Taylor Ltd consultancy practice, as well as an independent consultant in these areas for the past forty-six years.

1.1.2 I am also a past President and Honorary Member of the Association of Noise Consultants and the Director of the International Institute of Acoustics and Vibration. I was, for ten years, a member of the Noise Advisory Council chaired by the Secretary of State for the Environment, and I was chairman and deputy chairman of two of its working groups; I was a member of the Scott Committee, which drafted the basis of the noise section of the Control of Pollution Act 1974.

1.1.3 I am the author of the Pelican book NOISE, and editor or co-author of many other books.

1.1.4 I have been consultant to the planning authorities for promoters of and objectors to many airport development schemes. I was the expert witness in the House of Lords select committee on the Maplin Development Bill on behalf of objectors the Defenders of Essex, for whom I also appeared as expert witness at the Airports Inquiries 1981-3. I was consultant to the London Docklands Development Corporation at the time London City Airport was first promoted, and at the time of the subsequent expansion scheme. I was also a consultant to the then Northavon District Council in connection with British Aerospace's proposals to develop a civil aerodrome at Filton, and appeared as the expert witness at the public inquiry. I subsequently advised South Gloucestershire District Council on Concorde noise levels at Filton. I carried out a study of ground noise at the former Hong Kong Kai Tak airport, and was part of the team which produced the environmental statement for the new Nanjing Airport. I was consultant to Crawley Borough Council, the planning authority for Gatwick Airport and to North West Leicestershire District Council, the planning authority for East Midlands Airport in connection with which I am also consultant to Leicestershire County Council. I was expert witness for objectors in the public inquiry into Robin Hood airport. Furthermore, I have been expert witness in many planning inquiries relating to heliports and general aviation airfields. I carried out noise assessment work at Luton Airport, have also recently been advising on noise matters with respect to planning applications for Rochester Airport and London City Airport. Since 2007 I have been consultant to the former BAA and subsequently to HAL.

1.2 Noise Issues in the Reasons for Refusal

1.2.1 The planning application for the enabling works to allow implementation of full runway alternation during easterly operations at Heathrow Airport was submitted to the LBH on 25 March 2013.

1.2.2 The application was considered by the LBH Major Applications Planning Committee on 11th February 2014, which resolved to refuse planning permission for five reasons which include two (1 and 3) relating to noise. Reason 4 relates to the assessment of cumulative effects and for reasons given in the evidence of Mr John Rhodes and the appended report by Mr Toby Gibbs is outside the scope of my evidence.

1.2.3 *"1. The scheme would facilitate the altered aircraft movements/operations (including queuing), and the application fails to demonstrate that these would not result in significant adverse noise impacts on the health and wellbeing of residential populations, users of schools and community facilities. The scheme would also fail to provide adequate and sufficient mitigation measures to affected residents, schools and community facility users to offset the resultant negative noise and associated health and wellbeing impacts. As such the scheme is considered contrary to Paragraph 123 of the National Planning Policy Framework, London Plan (July 2011) Policies 2.6, 3.2, 5.3, 6.6, and 7.15, Hillingdon Part 1 Local Plan Policies EM8 and T4, Hillingdon Local Plan Part 2 Saved*

UDP Policies (November 2012) Policies A1, A2, OE1, and OE3, the Noise Policy Statement for England (March 2010) and paragraph 3.12 of the Aviation Policy Framework (March 2013).

1.2.4 *3. The Environmental Statement fails to comply with relevant Environmental Impact Assessment Regulation 2011 (including the requirements of Schedule 4 Part 1 – 'Information for inclusion in Environmental Statements') in that it does not adequately:*

1.2.5 *a. Describe the likely significant effects from noise impacts or*

1.2.6 *b. Set out the measures to prevent, reduce and where possible offset any significant adverse effects on the environment.*

1.2.7 With respect to noise, the reasons for refusal can be summarised as follows:

1.2.8 Reason (1) has two parts:

- Firstly it states that the application fails to demonstrate that altered aircraft movements/operations (including queuing) would not result in significant adverse noise impacts on the health and wellbeing of residential populations, users of schools and community facilities.
- The second part of Reason (1) is an allegation that the scheme would fail to provide adequate and sufficient mitigation measures to affected residents, schools and community facility users to offset the resultant negative noise and associated health and wellbeing impacts. Mitigation is discussed in my evidence at Section 9 below.

1.2.9 Reason (3) is also about mitigation, but it also states that the description of likely significant effects is inadequate. I discuss the description of likely significant effects in Section 8 below.

1.3 Scope of Evidence

1.3.1 My evidence deals with the effects of noise from aircraft both on the ground and airborne as a consequence of implementing works to enable full runway alternation during easterly operations

1.3.2 My evidence concentrates on the issues that are in dispute in the Reasons for Refusal and the Statement of Case.

1.3.3 My evidence takes account of the following matters:

- Conformity of the proposals with Government Policy;
- Description of noise and vibration effects of the use of the proposals including the effect of the proposed development on the living conditions of local residents (including users of local institutions such as schools/libraries) having regard to both air and ground noise;
- Consideration of significant effects; and
- Mitigation of the effects described.

1.3.4 A glossary of terms used in this Proof can be found at Section 10 of this document.

2. Policy Context

2.1 Introduction

2.1.1 This section will outline the relevant aspects of Government and local Government policy relating to noise and airport developments.

2.2 The Cranford Agreement

2.2.1 In November 2007, the then Secretary of State for Transport consulted on the prospect of ending the Cranford Agreement in the *"Adding Capacity at Heathrow Airport"* document (CD/01/24). This consultation was informed by technical reports by the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) which advised on the implications of ending the Cranford Agreement (among other operational changes) in terms of both noise and air quality redistribution around Heathrow Airport.

2.2.2 The noise assessment demonstrating the implications of ending the Cranford Agreement was published in ERCD Report 0705 (CD/02/05). The results of the noise exposure assessment presented in the report using the $L_{Aeq,\ 16hr}$ metric are reproduced in Table 2.1 below.

Table 2.1 Change in Population and Areas reported by ERCD (Report 0705)

Noise Level, $L_{Aeq,\ 16hr}$	**2015 480,000 ATMs base case without the Cranford Agreement – change relative to with Cranford Agreement**		
	Area	**Dwellings**	**Population**
≥57	+0.3	-4900	-10500
≥60	+0.7	+300	+1500
≥63	+0.7	+1100	+3300
≥66	+0.2	+1000	+2600
≥69	-0.1	+200	+600
≥72	0	-100	-100

2.2.3 ERCD Report 0705 also provides some description of the changes in noise exposure as result of ending the Agreement in Paragraphs 5.2.2 and 5.2.3:

2.2.4 *"5.2.2 Comparing the contours in Figure 5.1 with those for the same scenario with the Cranford agreement (Figure 3.2), shows that to the east of the airport the 57dBA Leq contour area moves north covering more of Harlington and Heston, noise levels in some areas increasing by more than 3dB, this being associated with the introduction of easterly departures on the northern runway. To the southeast of the airport, however, the contours contract, due to the removal of half of the departure operations from the southern runway. Around Hounslow Heath noise exposure levels reduce by approximately 1-1.5dB."*

2.2.5 *"5.2.3 To the west of the airport, the transfer of half of the arrival operations from the northern to the southern runway during easterly operations, reduces noise exposure ERCD Report 0705 Revised Future Aircraft Noise Exposure Estimates for Heathrow Airport November 2007 Page 30 in the vicinity of Windsor, whilst increasing noise exposure to the south over Old Windsor."*

2.2.6 Following the consideration of the responses to the consultation, the Secretary of State decided that the Cranford Agreement should end and confirmed this as a formal Government policy decision in a ministerial statement made in January 2009. Paragraphs 74 and 75 of the Department for Transport document *"Adding Capacity to Heathrow: Decisions Following Consultation"* (CD/01/25) state:

2.2.7 *"74. On the matter of the Cranford agreement, the Secretary of State has considered the responses to the consultation in the light of the analysis in the consultation document. Ending the Cranford agreement would redistribute noise more fairly around the airport and remove around 10,500 people from the 57dBA contour, albeit at the expense of exposing smaller numbers (around 3,300) to higher levels of noise. In the light of the Secretary of State's decision not to support the implementation of mixed mode and to retain runway alternation, ending the Cranford agreement would also have the benefit of providing periods of respite during the day for all areas affected on both westerly and easterly operations."*

2.2.8 *"75. The Secretary of State has therefore decided in the interests of equity to confirm the provisional view set out in the consultation document. Therefore the operating practice which implements the Cranford agreement should end as soon as practicably possible. He notes that this would also enable runway alternation to be introduced when the airport is operating on easterlies, giving affected communities predictable periods of relief from airport noise."*

2.2.9 The decision to end the Cranford Agreement was reviewed by the Government and reaffirmed in a Ministerial Statement on the 7th September 2010 made by the (then) Aviation Minister Theresa Villiers. The decision was later reaffirmed as Government policy within the Aviation Policy Framework (APF) (March 2013) (CD/01/17). Paragraph 1.63 of the APF states:

2.2.10 *"To further improve operations and resilience at Heathrow we confirmed the ending of the Cranford agreement.[43] This is an informal but long-standing agreement not to use the northern runway for departures when the wind was in from the east (roughly 30% of the time).This decision needs to be implemented by Heathrow Airport Ltd and a planning application will shortly be submitted for the necessary changes to airport infrastructure. Following implementation, noise will be distributed more fairly around the airport, extending the benefits of runway alternation to communities under the flight paths during periods of easterly winds, and delivering operational benefits by letting the airport operate consistently whether there are easterly or westerly winds."*

2.2.11 The ending of the Cranford Agreement allows full runway alternation during easterly operations and Government has made clear that this results in a fairer distribution of aircraft noise around Heathrow Airport. In order to achieve full runway alternation on easterly operations, HAL now needs to carry out various minor works to the taxiway system at the western end of the northern runway to allow sufficient aircraft to access that runway (and be correctly sequenced) so that the full easterly schedule could be operated. Without this additional taxiway infrastructure it would not be possible to accommodate the scheduled easterly aircraft departures from the northern runway, such that the implementation of Government policy would be frustrated.

2.3 National Policy and Guidance

National Planning Policy Framework

2.3.1 The National Planning Policy Framework (NPPF) (CD/01/16) was published in March 2012 and replaced Planning Policy Guidance Note 24: 'Planning and Noise' (PPG24).

2.3.2 The NPPF paragraph 109 states that the planning system should contribute to and enhance the natural and local environment by:

2.3.3 *"preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land instability".*

2.3.4 The NPPF does not define what it considers to be an ‘unacceptable risk’ or an ‘unacceptable level’. To this end, it is the role of assessors and decision makers to determine what is and is not acceptable in each case.

Noise Policy Statement for England

2.3.5 The Noise Policy Statement for England (NPSE) (CD/02/03) published in 2010 sets out the long term vision of Government noise policy. The Noise Policy Vision is to:

2.3.6 *“Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development”*

2.3.7 The Noise Policy Statement for England contains the following aims:

2.3.8 *“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development::*

2.3.9 *1. Avoid significant adverse impacts on health and quality of life;*

2.3.10 *2. Mitigate and minimise adverse impacts on heath and quality of life; and*

2.3.11 *3. Where possible, contribute to the improvement of health and quality of life.”*

2.3.12 The Statement refers to two established concepts from toxicology that are currently being applied to noise impacts, for example by the World Health Organization, namely the *“No Observed Effect Level”* (NOEL) and the *“Lowest Observed Adverse Effect Level”* (LOAEL). This is the level above which adverse effects on health and quality of life can be detected. It also introduces the concept of *“Significant Observed Adverse Effect Level”* (SOAEL). This is the level above which significant adverse effects on health and quality of life occur.

2.3.13 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development. The second aim of the NPSE refers to the situation where the impact lies somewhere between the Lowest Observed Adverse Effect Level (LOAEL) and the Significant Observed Adverse Effect Level (SOAEL). It requires that all reasonable steps should be taken to mitigate and minimise adverse effects in health and quality of life while together taking into account the guiding principles of sustainable development. This does not mean that adverse effects cannot occur but that effort should be focused on minimising such effects. The third aim seeks, where possible, to improve health and quality of life through the proactive management of noise, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society.

2.3.14 The NPSE observes (para 2.22) that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently the SOAEL is likely to be different for different noise sources, and for different receptors and at different times.

2.3.15 The NPSE is directly referenced by the Aviation Policy Framework discussed below. The Aviation Policy Framework considers that its objective with respect to noise is consistent with the aims and objectives of the NPSE.

Planning Practice Guidance

2.3.16 The Planning Practice Guidance (PPG) (CD/01/23) was issued in March 2014 by the Department for Communities and Local Government (DCLG) and updated in December 2014.

2.3.17 This guidance introduced the concepts of OEL (Observed Effect Level), and UAEL (Unacceptable Adverse Effect Level). OEL differs from LOAEL in that it represents a situation where the acoustic character is affected such that there is a perceived change in the quality of life. UAEL represents a situation where noise is ‘noticeable and very disruptive’ and should be ‘prevented’ (as opposed to SOAEL, which represents a situation where noise is ‘noticeable’ and ‘disruptive’, and should be ‘avoided’).

2.3.18 The guidance explains in paragraph 009 that the management of the noise associated with aircraft and airports is considered specifically by the Aviation Policy Framework (APF) (CD/01/17).

2.4 The Aviation Policy Framework

2.4.1 The Aviation Policy Framework sets out the Government's overall policy on aviation noise which is:

2.4.2 *"3.12 to limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise"*

2.4.3 The policy states (Paragraph 3.13) that this is consistent with the Government's Noise Policy as set out in the NPSE.

2.4.4 Along with the its overall objectives, the APF also sets out the Government's policy and position with respect to aircraft noise quantification, management and mitigation measures, including sound insulation and compensation schemes.

2.4.5 It makes clear recommendations as to what the Government expects airport operators to provide with respect to mitigation and insulation, and provides advice and guidance on what other measures can be used to minimise aircraft noise.

Assessment and Quantification of Aircraft Noise

2.4.6 With regard to the assessment of aircraft noise, the APF reaffirms the use of the $L_{Aeq, 16hr}$ metric and the value of 57 dB as the *"approximate onset of significant community annoyance"*. The APF states (3.17)

2.4.7 *"We will continue to treat the 57dB $L_{Aeq,16\ hour}$ contour as the average level of daytime aircraft noise marking the approximate onset of significant community annoyance. However, this does not mean that all people within this contour will experience significant adverse effects from aircraft noise. Nor does it mean that no-one outside of this contour will consider themselves annoyed by aircraft noise."*

2.4.8 The APF adds at 3.19 that:

2.4.9 *"Average noise exposure contours are a well established measure of annoyance and are important to show historic trends in total noise around airports. However, the Government recognises that people do not experience noise in an averaged manner and that the value of the L_{Aeq} indicator does not necessarily reflect all aspects of the perception of aircraft noise. For this reason we recommend that average noise contours should not be the only measure used when airports seek to explain how locations under flight paths are affected by aircraft noise. Instead the Government encourages airport operators to use alternative measures which better reflect how aircraft noise is experienced in different localities[96] developing these measures in consultation with their consultative committee and local communities. The objective should be to ensure a better understanding of noise impacts and to inform the development of targeted noise mitigation measures."*

2.4.10 Footnote 96 states:

2.4.11 *"Examples include frequency and pattern of movements and highest noise levels which can be expected."*

Noise Insulation Schemes

2.4.12 With regard to noise insulation schemes, the APF is clear on what the Government expects Airport operators to provide as a minimum for residential and community buildings.

2.4.13 Paragraph 3.37 of the APF states that:

2.4.14 *"The Government also expects airport operators to offer acoustic insulation to noise-sensitive buildings, such as schools and hospitals, exposed to levels of noise of 63 dB $L_{Aeq,16h}$ or more. Where acoustic insulation cannot provide an appropriate or cost-effective solution, alternative mitigation measures should be offered."*

2.4.15 It goes on to state in Paragraph 3.39 that where airports are considering development that would result in an increase in noise, airports should:

2.4.16 *"… review their compensation schemes to ensure that they offer appropriate compensation to those potentially affected. As a minimum, the Government would expect airport operators to offer financial assistance towards acoustic insulation to residential properties which experience an increase in noise of 3dB or more which leaves them exposed to levels of noise of 63 dB $L_{Aeq,16h}$ or more."*

2.4.17 The APF is clear that any proposals for a nationally significant airport development, such as airport expansion would require specific consideration with respect to noise insulation schemes. Paragraph 3.40 states:

2.4.18 *"Any potential proposals for new nationally significant airport development projects following any Government decision on future recommendation(s) from the Airports Commission would need to consider tailored compensation schemes where appropriate, which would be subject to separate consultation."*

2.4.19 With respect to night noise insulation the APF states that airports may wish to use alternative criteria or have additional schemes where night flights are an issue. It recommends in Paragraph 3.41 that Airport Consultative Committees should be involved in reviewing these schemes and be invited to give views on the criterion that should be used.

2.4.20 Finally, the APF does not provide any statement or clarification on the level of assistance that airport operators should provide with respect to the provision of noise insulation.

Relocation Assistance Compensation

2.4.21 The APF indicates that there are levels of aircraft noise exposure that are sufficient to warrant assistance to those that are exposed. Paragraph 3.36 of the APF states that:

2.4.22 *"The Government continues to expect airport operators to offer households exposed to levels of noise of 69 dB $L_{Aeq,16h}$ or more, assistance with the costs of moving."*

2.4.23 The APF does not however clarify how much financial assistance should be offered.

Airspace Use and Respite Provision

2.4.24 The APF acknowledges that the use of airspace, the routes flown by aircraft and the locations are overflown directly influence the Government's policy objective *"to reduce limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise"*

2.4.25 Paragraphs 3.31 and 3.32 of the APF discuss the relative merits of concentrating aircraft movements as opposed to providing respite respectively. Paragraph 3.31 states, with respect to concentration:

2.4.26 *"3.31 The routes used by aircraft and the height at which they fly are two significant factors that affect the noise experienced by people on the ground. Consistent with its overall policy to limit and where possible reduce the number of people adversely affected by aircraft noise, the Government believes that, in most circumstances, it is desirable to concentrate aircraft along the fewest possible number of specified routes in the vicinity of airports and that these routes should avoid densely populated areas as far as possible. This is consistent with the long-standing concept of noise preferential routes which departing aircraft are required to follow at many airports, including the noise-designated airports. Within the countryside, in common with other relevant authorities, the CAA has legal duties to have regard to the purposes of National Parks and Areas of Outstanding Natural Beauty and must therefore take these into account when assessing airspace changes."*

2.4.27 Paragraph 3.32 discusses the considerations that should be made in providing noise respite to communities:

2.4.28 *"3.32 However, in certain circumstances, such as where there is intensive use of certain routes, and following engagement with local communities, it may be appropriate to explore options for respite which share noise between communities on an equitable basis, provided this does not lead to significant numbers of people newly affected by noise. Whether concentration or respite is the preferred option, those responsible for planning how airspace is used should ensure that predictability is afforded to local communities, to the extent that this is within their control. Further guidance on these airspace matters will be provided when the Department for Transport updates its guidance to the CAA on environmental objectives relating to the exercise of its air navigation functions."*

2.4.29 The key points made in Paragraph 3.32 of the APF with regard to respite provision are therefore:

- Respite may be appropriate where there is intensive use of certain routes;
- It should not lead to significant numbers of people newly affected by noise; and
- Respite should be predictable, to the extent that it is within control.

2.4.30 Noise issues were debated at length at a number of public inquiries relating to airport developments, including Heathrow Terminal 5, Stansted G1 and Farnborough. These Inquiries, and the decisions made following them, all pre-dated the publication of the Aviation Policy Framework and therefore informed the statements in the APF about how noise should be assessed.

2.5 Regional Planning Policy

2.5.1 The relevant policies of the London Plan (2011) (CD/01/19) were identified in the Stage 1 report issued by the Greater London Authority (GLA) and are referred to in the reasons for refusal. Specifically with regard to noise, the following policy is set out in the evidence of Mr. John Rhodes (HAL/JR/P/01):

- 7.15 – Reducing Noise and Enhancing Soundscapes

2.5.2 This policy requires noise to be considered at a number of levels including when making planning decisions and strategically such as during the preparation of Local Development Frameworks (LDF).

2.5.3 As part of planning decisions the policy advises that:

2.5.4 *"Development proposals should seek to reduce noise by: (a) minimising the existing and potential adverse impacts of noise on, from, within, or in the vicinity of, development proposals; (b) separating new noise sensitive development from major noise sources wherever practicable through the use of distance, screening, or internal layout in preference to sole reliance on sound insulation; (c) promoting new technologies and improved practices to reduce noise at source."*

2.5.5 The policy also recognises the responsibility of airport operators, including Heathrow, to prepare noise action plans under the transposed requirements of Directive 2002/49/EC.

2.6 Local Planning Policy

2.6.1 The Hillingdon Local Plan: Part 1 – Strategic Policies (CD/01/20) was adopted in November 2012. Among the Part 1 or Part 2 (CD/01/22) policies that have been listed in the reasons for refusal two relate to noise which are set out in the evidence of Mr John Rhodes (HAL/JR/P/01) :

- EM8 – Land, Water, Air and Noise
- OE3 – Noise

2.6.2 Policy EM8 relates to environmental improvement and considers the issue of the *".. need to control, reduce and mitigate noise, especially around Heathrow and the major road network"*.

2.6.3 Saved UDP policy OE3 states that:

2.6.4 *"Buildings or uses which have the potential to cause noise annoyance will only be permitted if the impact is mitigated within acceptable levels by engineering, layout or administrative measures"*.

2.7 Themes Emerging from a Review of Noise Policy

2.7.1 The discussion of relevant policy provided in this Section of my evidence highlights a number of themes. I outline these in the following sections.

Ending of the Cranford Agreement

2.7.2 The decision to end the Cranford Agreement has been taken and affirmed by successive Governments. This decision was made with the assistance of a noise assessment prepared by the CAA and was taken following consultation.

2.7.3 The decision to end the Cranford Agreement itself complies with various aspects of Government policy. For example, the CAA report shows that ending the Agreement results in a reduction in the number of people exposed to at least 57 dB $L_{Aeq, 16hr}$ thus complying with the Government's overall policy objective to "*to limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise"*

2.7.4 The ending of the Agreement also aligns with Government policy set in the APF with regard to the provision of respite. With the Cranford Agreement, those located under final approaches and initial departures on Runway 09L and Runway 09R are intensively overflown during easterly operations. In line with Paragraph 3.32 of the APF, the ending of the Cranford Agreement would allow predictable respite to be provided to those who are currently overflown even if this is at the expense of increasing noise exposure within other communities around the airport. The Government's decision to end the Agreement makes direct reference to the extending the *'benefits of respite'* during easterly operations.

Assessment and Quantification of Aircraft Noise

2.7.5 The Aviation Policy Framework (APF) reaffirms the use of the 57 dB $L_{Aeq, 16hr}$ metric as the approximate onset of community annoyance. The Government's decision to reaffirm the use of this metric was made in full knowledge of the criticisms made of the 57 dB $L_{Aeq, 16hr}$ metric at other Public Inquiries.

2.7.6 As well as the $L_{Aeq, 16hr}$, the APF also encourages the use of 'alternative measures' to help provide a better understanding of noise impacts and to inform development of targeted mitigation measures.

Insulation and Compensation

2.7.7 There are minimum standards that the Government expects airport operators to comply with on noise insulation and compensation schemes. In summary, as a minimum, the Government expects airport operators to provide financial contribution towards:

- Acoustic insulation where a development results in an increase in noise of 3dB or more which leaves them exposed to levels of noise of 63 dB $L_{Aeq,16hr}$ or more; and
- Assistance towards the costs of moving for households exposed to levels of noise of 69 dB $L_{Aeq,16hr}$ or more

2.7.8 With respect to community buildings, the Government expects noise insulation to be provided where a community building such as a school or hospital is exposed to aircraft noise of at least 63 dB $L_{Aeq, 16hr}$.

2.7.9 The Government does not state what level of assistance should be afforded to residential dwellings or what measures comprise acoustic insulation.

Provision of Respite

2.7.10 The Government considers aircraft noise respite as a noise mitigation measure where there is intensive use of a particular route providing predictability can be afforded and providing that it does not lead to significant numbers of people newly affected by noise.

2.7.11 As is discussed in Section 3 of my proof, the Government has instructed a system of runway alternation during westerly operations since the 1970s providing respite to communities under westerly arrivals and departures. The Government's decision to end the Cranford Agreement directly considers the benefit of respite that would be afforded to communities during easterly operations.

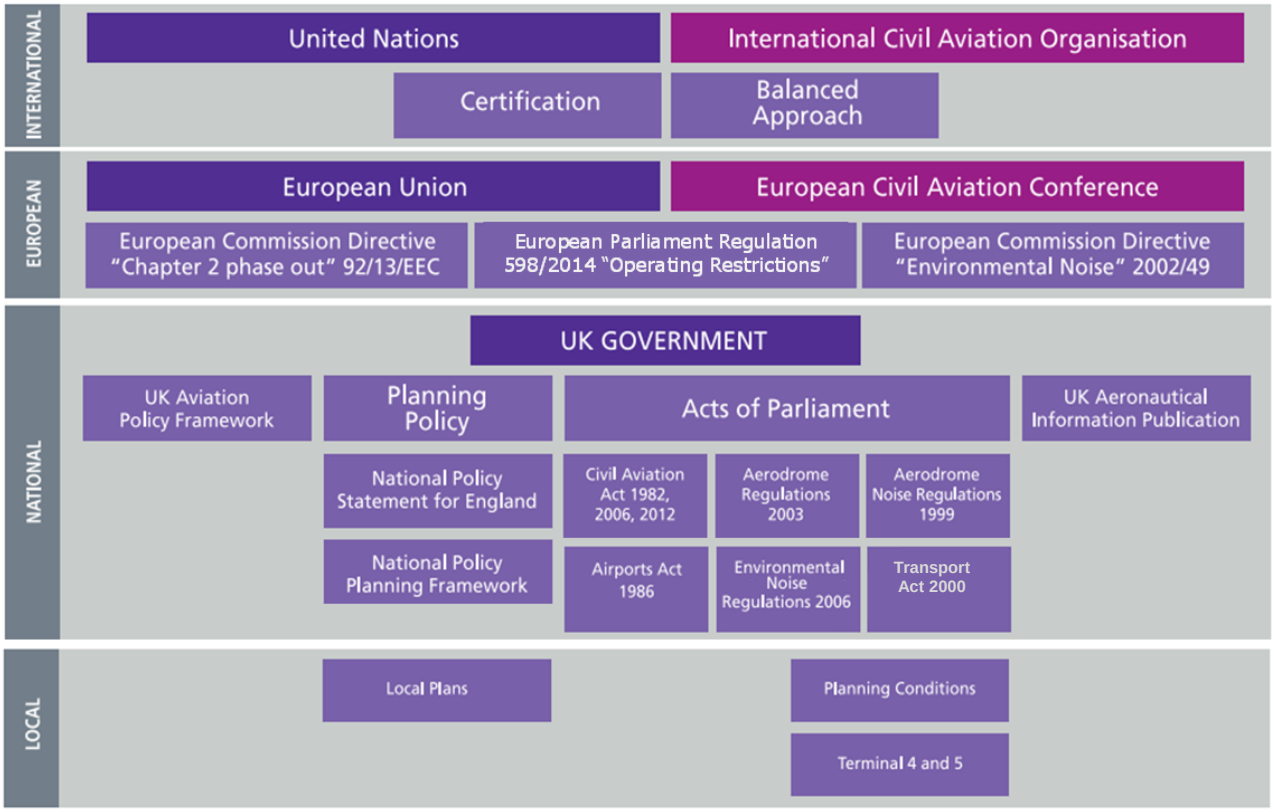
3. Noise Regulation and Existing Mitigation at the Airport

3.1 Regulatory Framework

3.1.1 The regulatory framework of aircraft noise in the UK is carefully considered within Heathrow's Noise Action Plan for 2013-2018 (CD/02/06) which was approved by the Secretary of State of Environment, Food and Rural Affairs in August 2014.

3.1.2 The extract below demonstrates the various layers of regulation within which noise from Heathrow is controlled. This includes International and European requirements, as well as national legislation, policy, and local legal agreements.

Figure 3.1 Layers of Noise Regulation relevant to Heathrow Airport



International and European Regulation

Restrictions on Aircraft Noise Emissions

3.1.3 At International level, the International Civil Aviation Organization (ICAO) sets standards relating to noise emissions from civil aircraft. These standards, referred to as Chapters, have over time become progressively tighter. Since 2002, unless in specific circumstances, Chapter 2 aircraft have been banned from operating in the EU. The vast majority of aircraft now operating fall within Chapter 3 (1978) and Chapter 4 (2006) of the ICAO standards. The latest ICAO standard, Chapter 14 was introduced in 2014. From December 2017 all new aircraft must comply with this standard.

3.1.4 Under EU legislation, Directive 2002/30/EC provides member states with discretionary powers to restrict the operation of aircraft that are *'marginally compliant'* with Chapter 3 of the ICAO standard. Aircraft considered 'marginally compliant' achieve the Chapter 3 standard through certification by a margin of 5 dB or less. This Directive was repealed by Regulation (EU) No 598/2014 in April 2014. This Regulation redefines 'marginally compliant' aircraft as those with a cumulative margin, relative to the limits at the three noise certification points, of 8 EPNdB or less for a transitional period ending on 14 June 2020, and 10 EPNdB or less thereafter.

The 'Balanced Approach'

3.1.5 Since 2001, ICAO has required member nations to adopt a *'balanced approach'* to aircraft noise management. The approach consists of exploring various measures to reduce noise through

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

3.1.6 ICAO has developed policies on each of these elements, as well as on noise charges.

National Regulation

3.1.7 Within England, aircraft noise is subject to a number of legislative controls and regulations. Much of this legislation reciprocates the requirements of International and European legislation.

3.1.8 The Department for Transport (DfT) and the Department for Environment, Food and Rural Affairs (Defra) are responsible for regulating certain environmental aspects of aviation, including aircraft noise. The Civil Aviation Authority (CAA) also has powers as a regulator and certifying authority. It also provides specialist aviation advice to the Government including noise.

3.1.9 The key legislation relating to the aircraft noise within England includes:

- The Civil Aviation Act (1982, 2006, 2012);
- The Aerodromes (Noise Restrictions) (Rules and Procedures) Regulations 2003 (CD/02/02);
- The Airports Act (1986);
- The Transport Act (2000); and
- The Environmental Noise (England) Regulations 2006 (CD/02/01),

3.1.10 Aircraft noise at Heathrow is considered in all of the above. Under these regulations, there are a number of noise management and abatement measures which Heathrow must comply with.

Noise Designation

3.1.11 The Civil Aviation Act grants the Government powers to introduce noise control measures to limit or mitigate the effect of noise and vibration connected with taking off or landing aircraft at designated airports. At this time, the Secretary of State has designated Heathrow, Gatwick and Stansted. Airports under these measures are usually referred to as *'noise designated'* airports. These powers are held by the Secretary of State (SoS) for the Department of Transport (DfT).

3.1.12 These powers include enforcement measures on the use of airspace, the implementation of noise insulation schemes and grants, and aircraft noise emissions. These powers effectively enable the Government to determine how noise from a 'noise designated' airport should be managed.

3.1.13 The 2006 explanatory notes to the Civil Aviation Act 2006 provide an example of the abatement measures that could be instructed by the SoS using these powers. The notes state that:

3.1.14 *'…The manager [i.e. the airport operator] is placed under a duty to comply with any such directions. New section 78(6A) will allow directions under subsection (6) to be given for the purposes of avoiding, limiting or mitigating the effect of noise and vibration either generally or in any particular area, for example arising from use of a particular runway. So directions could be used to move noise from one area to another, even if this does not limit or mitigate the total amount of noise suffered generally, so long as it avoids, limits or mitigates the amount of noise in a particular area.'*

3.1.15 *'For example, Heathrow has two main independently operable runways, as may other airports designated under section 78 in future. The power to direct the aerodrome manager to use a particular runway would provide local residents with predictable periods of relief from aircraft noise. Requiring aircraft to take off or land in a given direction at a given time could also reduce the numbers of people subjected to the most severe aircraft noise.'*

3.1.16 The example offered by the 2006 explanatory note is consistent with the Government's policy of ending the Cranford Agreement and thus allowing full runway alternation during easterly operations. This is an example of the type of control which the Secretary of State has over operations at the designated airports.

3.1.17 The Civil Aviation Act also allows noise designated airports to levy financial penalties on aircraft who beach the abatement measures introduced by the SoS, and permits airports to introduce differential landing charges to incentivise the use of quieter aircraft. Any fines received must then be paid for the benefit of the people who living the vicinity of the airport.

Night Flight Restrictions

3.1.18 As a noise designated airport, DfT has direct control over noise at Heathrow and is responsible for setting night flight restrictions. These restrictions are reviewed and subject to consultation every 5 years or so.

3.1.19 The restrictions prohibit the noisiest aircraft being schedule to take off or land during the night (2300 to 0700hrs). In addition, during the night quota period (2330 – 0600hrs), aircraft movements are restricted by movements and noise quotas. During the night quota period, the restrictions are managed using the 'Quota Count' (QC) system.

3.1.20 DfT set both the number of permitted night-time movements and the noise quota at the noise designated airports. Through consultation, DfT can also consider making changes to further restrict which aircraft can operate during the night.

3.1.21 DfT night flight restrictions have been a key consideration by aircraft manufacturers in the design of new aircraft. For example, during the development of the Airbus A380, the Government were considering a ban on scheduling QC/4 aircraft on departure during the night quota periods at the London airports. This ban subsequently came into effect in 2006. Anticipating that the ban may be extended throughout the night period, Airbus's launch customer for the A380, Singapore Airlines, stipulated that the aircraft must meet a design criterion of QC/2 on departure. Other aircraft such as the Airbus A340-500/600 have also been designed to meet the QC/2 departure requirement.

3.1.22 The night restrictions at Heathrow have therefore driven aircraft manufacturers to reduce noise emissions from new aircraft.

Implementing the Balanced Approach

3.1.23 Under The Aerodromes (Noise Restrictions) (Rules and Procedures) Regulations 2003 (CD/02/02), Heathrow is required as a major airport (i.e. above 50,000 aircraft movements of civil sub-sonic jet aeroplanes per yet) to conform to the ICAO 'balanced approach'. This requirement is transposed from European Directive 2002/30/EC.

3.1.24 This requires that major airports take into consideration the key principles of the ICAO 'balanced approach' when managing noise. These are namely:

- Reduction of noise at source – through, for example, the use of quieter aircraft;

- Land-use Planning and Management – for example, ensuring developments around airports are compatible for the noise they are or would become exposed to;
- Noise Abatement Operational Procedures – such as the use of Noise Preferential Routes (NPRs); and
- Operating restrictions – which may include restrictions on the type of aircraft that may operate at night or restrictions on aircraft movements.

Noise Action Plan

3.1.25 Under the Environmental Noise (England) Regulations 2006 (CD/02/01), major airports with more than 50,000 movements per year are required to produce strategic noise maps and associated noise action plans every 5 years. This requirement is transposed from Directive 2002/49/EC. Heathrow's Noise Action Plan for the period 2013 – 2018 was approved by the Secretary of State for Environment, Food and Rural Affairs (Defra) in August 2014.

3.1.26 The noise action plan contains the following commitments:

- Quieter Planes

  "As aircraft and engine technology improves and planes become quieter, we will continue to work to ensure that residents share in the benefits. We are committed to continuing to provide a strong financial incentive for airlines to use the quietest planes currently available, including in the early morning period, through the use of variable landing charges."

- Quieter Procedures

  "We are committed to take full advantage of opportunities to manage airspace differently, working with local communities to identify changes that could benefit them. This will include trialing new airspace management procedures to test the concept of providing predictable periods of respite from early morning arrivals and for some of our departure routes"

- Land-use Planning and Mitigation

  "We are committed to continuing to help with noise insulation and mitigation through a range of schemes. We will also continue to press the Government to provide more detailed guidance on planning around airports, and to restrict noise sensitive development in high noise areas."

- Operating Restrictions

  "We do not see restrictions as a first resort and are committed to developing collaborative approaches which are often quicker to implement and more effective. For example the voluntary agreement with airlines not to schedule marginally compliant aircraft [as defined by Directive 2002/30/EC]*. Where restrictions are in place we are focused on ensuring that they are adhered to fully. For example in our administration of the night flying restrictions."*

- Working with Local Communities

  "Underpinning all of our work to tackle aircraft noise, we are committed to engaging openly and constructively with local communities to understand their concerns and to provide accessible information and an on-going dialogue"

National Policy Requirements

3.1.27 Although not a legal or regulatory requirement, national policy sets out to airport operators the Government's expectations with regards to insulation and compensation schemes.

Insulation and Compensation Schemes

3.1.28 The Aviation Policy Framework (APF) confirms that the Government continues to expect airport operators to:

- Offer households exposed to levels of noise of 69 dB $L_{Aeq, 16hr}$ or more, assistance with the costs of moving;
- Offer acoustic insulation to noise-sensitive buildings, such as schools and hospitals, exposed to levels of noise of 63 dB $L_{Aeq\ 16hr}$ or more; and
- Where acoustic insulation cannot provide an appropriate cost-effective solution, to offer alternative mitigation measures.

3.1.29 With respect to airport developments, the APF also expects airport operators to:

- Offer households exposed to levels of noise of 69 dB $L_{Aeq\ 16hr}$ or more, assistance with the costs of moving; and
- To offer financial assistance towards acoustic insulation to residential properties which experience an increase in noise of 3dB or more which leaves them exposed to level of noise of 63 dB $L_{Aeq\ 16hr}$ or more.

3.1.30 The APF does not state what it considers to be financial assistance or what should comprise acoustic insulation.

Local Planning Conditions

3.1.31 As part of planning conditions attached to Terminal 4 and Terminal 5, Heathrow are legally required to comply with a number of noise measurement measures. These are set out in full in the Operations Proof of Evidence by Mr. Mark Burgess (HAL/MB/P/01) and are summarised in the paragraphs below**.**

3.1.32 For Terminal 4, planning conditions require Heathrow to restrict the use of certain stands and taxiways at Terminal 4 between the hours of 23:30 and 06:00hrs. No aircraft engine ground running is permitted at Terminal 4 at any time.

3.1.33 For Terminal 5, there are a number of planning conditions that are intended to mitigate and manage noise from Heathrow's operations. These include:

- A limit on the annual number of air transport movements at the airport of 480,000 per year;
- A limit on the area enclosed within the 57 dB L_{eq} (0700-2300hrs) contour of 145 km^2 by 1 January 2016;
- Restrictions on the duration and composition of engine ground running at all of the Airport's terminals; and
- Restrictions and procedures on the use of certain stands and the Airport's inner taxiways during the night quota period.

3.2 Government Imposed Operating Practices

3.2.1 There are a number of operational practices used at Heathrow to help reduce and manage aircraft noise. Most of these controls have been introduced by the Government as a result of Heathrow's status as a 'noise designated' airport. These controls are mandatory and are therefore listed as specific noise abatement procedures within the Airport's Aeronautical Information Publication (AIP).

3.2.2 These are set out in full in the Operations Proof of Evidence by Mr. Mark Burgess (HAL/MB/P/01) and are summarised in the sections below**.**

Westerly Runway Alternation

3.2.3 Runway alternation is a system used at Heathrow to provide respite for local residents to the east of the airport who are affected by aircraft arriving on the final approach path. Because aircraft cannot depart in an easterly direction from the northern runway (previously because of the Cranford Agreement and currently due to a lack of appropriate infrastructure), runway alternation occurs only on westerly operations. It is possible, however, to use alternation after the last departure at night and before the first departure the following morning, thereby spreading the flights arriving in the early morning (that arrive before the first departures) between the two final approach paths.

3.2.4 Runway alternation at the airport was formally introduced on a trial basis in January 1972. At the time the northern runway was the preferred runway for westerly landings between 07:00 and 15:00 local time; and the southern runway was the preferred runway for westerly landings from 15:00 to 23:00 local time. This was subsequently modified in 1973 to the current arrangement whereby the arrival runways are alternated between the northern and southern runways at 15:00 local time on a weekly basis from Monday to Sunday.

3.2.5 The runway alternation arrangements in place during daytime hours at Heathrow for westerly operations now means that one of the westerly runways (either runway 27R or runway 27L) is designated as the arrival runway and used for the majority of landings from 06:00 to 15:00 local time; and the other from 15:00 local time until after the last departure for the day's schedule.

3.2.6 As an example, if runway 27L is designated as the arrival runway from 06:00 to 15:00 local time then runway 27R will be used from 15:00 until after the last departure. This arrangement will then run for one week at which time the pattern will change so that runway 27R becomes the designated arrival runway from 06:00 to 15:00; and runway 27L is used from 15:00 until after the last departure. The runway alternation schedule is published in advance allowing predictability.

3.2.7 After the last departure there is a distinct night period until 06:00 local time. During this period, as noted above, if weather conditions permit, there is a weekly rotation between westerly and easterly operations.

3.2.8 Runway alternation is not a measure required by way of a notice under section 78 of the 1982 Act. It is an established operational aspect of the airspace arrangements and has associated Air Traffic Control (ATC) procedures. It cannot therefore be modified or abandoned without the approval of the SoS under the directions given to the CAA.

Westerly Preference

3.2.9 For safety reasons, aircraft normally take off and land into the wind. The prevailing wind at Heathrow is westerly, so for most of the time the wind comes from the west.

3.2.10 Heathrow operates a 'westerly preference'. This dictates that, during the day and unless the wind is too strong, aircraft should always take off towards the west and consequently arrive from the east. The preference can only be operated when the tailwind for landing aircraft is less than five knots, the runways are dry and there are no strong crosswinds.

3.2.11 Westerly preference has been in operation at Heathrow since 1962. When it was introduced it operated twenty-four hours a day because the noise emitted by aircraft on departure was considered by the Government at the time to be the predominant issue. The aim was, and remains, to reduce the number of departing aircraft which would otherwise take off over the more densely populated areas to the east of the airport.

3.2.12 Westerly preference is not a measure specified by the Secretary of State (SoS) for Transport under Section 78 of the 1982 Act, but it has become part of the accepted airspace arrangements for Heathrow and so cannot be modified or abandoned without the approval of the SoS under the directions given to the CAA.

3.2.13 In 2001 following a consultation on the preference for the direction of operation of the airport at night, the Secretary of State for Transport decided that westerly preference should be replaced, at

night, by a weekly rotation between westerly and easterly operations whenever weather conditions permitted.

3.2.14 Westerly preference was reviewed by the Noise Initiatives sub-group of the Heathrow Airport Consultative Committee (HACC) in 1996 and by the Government in 2009. Neither the HACC nor the Government has published any recommendations or plans to review the operation of the westerly preference. However, the Airports Commission in its December 2013 interim report has recommended that the Government should review the need for a westerly preference with a view to introducing a 'no preference' policy.

The '1000ft rule'

3.2.15 After take-off pilots are required to climb their aircraft to a height of not less than 1,000 feet above by 6.5km from the start of the take-off roll. Thereafter the aircraft is required to maintain a gradient of climb not less than 4% until reaching an altitude of not less than 4,000 feet. The primary purpose of the 1000ft requirement is to encourage flight crew to apply an optimum take-off power and rate of climb profile to avoid infringing the above noise limits and to minimise the aircraft's noise at the position of the monitor.

Noise Preferential Routes (NPRs)

3.2.16 Aircraft departing Heathrow are required to follow specific paths. These paths are referred to as Noise Preferential Routes (NPRs) and must be followed up to an altitude of 4000 ft.

3.2.17 Since the 1960s it has been the policy of successive Governments to concentrate departing aircraft along the fewest possible number of departure routes that is consistent with airspace management considerations and the overriding need for safety. This approach has been confirmed in the Department for Transport's guidance to the Civil Aviation Authority on environmental objectives relating to the exercise of its Air Navigation Functions and can be referenced in Section 7 Page 27. It has also been confirmed more recently in the Government's consultation document on developing a sustainable framework for UK Aviation (March 2011).

3.2.18 Heathrow continually monitor how well aircraft adhere to the NPRs.

Noise Monitoring and Aircraft Noise Limits

3.2.19 Noise monitoring at fixed noise monitors around Heathrow is a mandatory requirement. The Government has set noise limits at each of the fixed noise monitors for departing aircraft. Fines are enforced for breaches. The purpose of the monitoring and fines is to penalise those who exceed the limits and to encourage the use of quieter aircraft and best operating practices.

3.3 Heathrow's Response to the Regulatory Framework

3.3.1 In the previous sections I have set out the regulatory framework within which noise is managed and controlled at Heathrow. Whilst Heathrow must comply with the requirements of these regulations and measures, it often goes beyond what is required by Government. Within this context, Heathrow has implemented a number of voluntary strategies which reinforces its commitment to tackling the challenge of aircraft noise.

3.3.2 Heathrow's noise strategy is presented within its Noise Action Plan and reiterated in the *'A quieter Heathrow'* publication. The strategy has been supported by initiatives such as Heathrow's *'Blueprint for noise reduction'*.

3.3.3 These documents set out a range of measures and actions that the airport has implemented through consultation with industry and community stakeholders. In many instances these measures exceed the regulatory requirements and are encapsulated under the following themes:

Quieter Planes

3.3.4 Heathrow has continued to offer financial incentives to airlines to promote the use of the latest quietest aircraft technology through variable landing charges. In 2011, Heathrow updated its charging system to expand the categories of aircraft accommodated.

3.3.5 These charges promote the use of best in class aircraft technology in relation to the ICAO noise standards. For example, operators pay around 10 times more to fly the oldest and noisiest Chapter 3 aircraft compared to the quietest aircraft. Furthermore, voluntary agreements with airlines mean that the airlines no longer schedules marginally compliant aircraft as defined by Directive 2002/30/EC. These measures have been successful in that Chapter 3 aircraft now only account for about 1% of all movements at Heathrow. Heathrow's current Noise Action Plan aims to remove all of these aircraft by 2020.

3.3.6 Heathrow wants to be the first large European airport to be completely free of Chapter 3 aircraft and has introduced a target aiming for a 100% Chapter 4 aircraft fleet by 2020. As part of its *"Blueprint for Noise Reduction"*, Heathrow is currently engaging with airlines to encourage the early phase-out of Chapter 3 aircraft. This initiative is reinforced by a round of consultations in 2015 on incentives such as further increases in Chapter 3 landing charges.

3.3.7 Heathrow is also actively encouraging airlines operating the A320 family of aircraft to retrofit components to markedly reduce whistling from these aircraft during landing. Since these aircraft account for around 55-60% of the fleet, Heathrow is exploring what incentives it can offer airlines to have this retrofit installed.

Quieter Operating Procedures

3.3.8 A range of operational procedures are already in force at Heathrow which aim to control and mitigate noise. As outlined in Section 3.2, a number of these have been implemented by the Government. However, some are the result of voluntary incentives brought forward by Heathrow, the CAA, the airlines, and National Air Traffic Service (NATS) working collaboratively. These include:

Continuous Decent Approach (CDA)

3.3.9 Continuous Decent Approach is a noise abatement technique of flight during which a pilot descends at a rate with the intention of achieving a continuous descent to join the glide-path at the correct height for the distance. This procedure thereby avoids the need for extended periods of level flight. The intention of a CDA is to keep aircraft higher for longer, using reduced thrust and thereby reducing arrival noise.

3.3.10 Heathrow are pioneers of CDA and have developed a voluntary code of practice with its industry stakeholders including the airlines, NATS, the CAA and DfT. The code encourages air traffic controllers and pilots to facilitate CDA.

3.3.11 Heathrow continually monitors airlines compliance with CDA and reports this compliance as part of its FlyQuiet programme.

Consistent Deployment of Landing Gear

3.3.12 Lowering of landing gear increases noise as engine power must be raised to compensate drag. Additional noise is also generated due to airflow around the landing gear itself. The lowering of landing gear does not happen at the same time or place. This is at the pilot's discretion. Heathrow are working collaboratively with airlines to encourage quieter landings through consistent and delayed deployment of landing gear without compromising safety.

Exploring Steeper Angles of Decent

3.3.13 The angle at which an aircraft lands affects the noise received by communities below. The steeper the angle, the less time aircraft spend at low altitudes. At Heathrow, as at most airports, aircraft

arrive at an angle of 3 degrees. Heathrow believe this could be 3.2 degrees which would be safe but quieter. To demonstrate this, in 2015, Heathrow will work with airlines to trial steeper decent angles.

Better Distribution of Night-time Landing Noise

3.3.14 Heathrow is actively working with NATS to further explore how night-time noise could be better distributed building on the principles of runway alternation.

Improving Navigation Equipment

3.3.15 Heathrow is working with NATS and the airlines to take advantage of continuous improvements in navigational equipment to explore greater predictability in flight tracks and respite.

Working with Local Communities

3.3.16 Heathrow has worked with noise-stakeholders such as HACAN, British Airways and NATS to explore opportunities to improve noise management. This led to establishing the Community Noise Forum and work has included trials on different ways to provide respite from early morning departures.

Noise Insulation, Relocation and Land-use Planning

3.3.17 Heathrow has offered help with noise insulation and mitigation measures to schools and over 40,000 households around the airport. These measures have included the installation of improved glazing. Heathrow is working with local planning authorities to help address and fully consider aircraft noise through the planning system.

3.3.18 Heathrow operates five noise insulation and relocation schemes. These schemes meet with and in some instances exceed beyond Government requirements as stipulated by the APF, for example, by meeting the total costs rather than just providing financial assistance which is the minimum requirement of the policy.

3.3.19 These schemes have been introduced at different times over the last 20 years and as a result there are now a number of overlaps. These schemes are summarised in Table 3.1. The geographic extent of these schemes is presented in Figure 3.2 as presented in Heathrow's Noise Action Plan.

Table 3.1 Existing Schemes at Heathrow

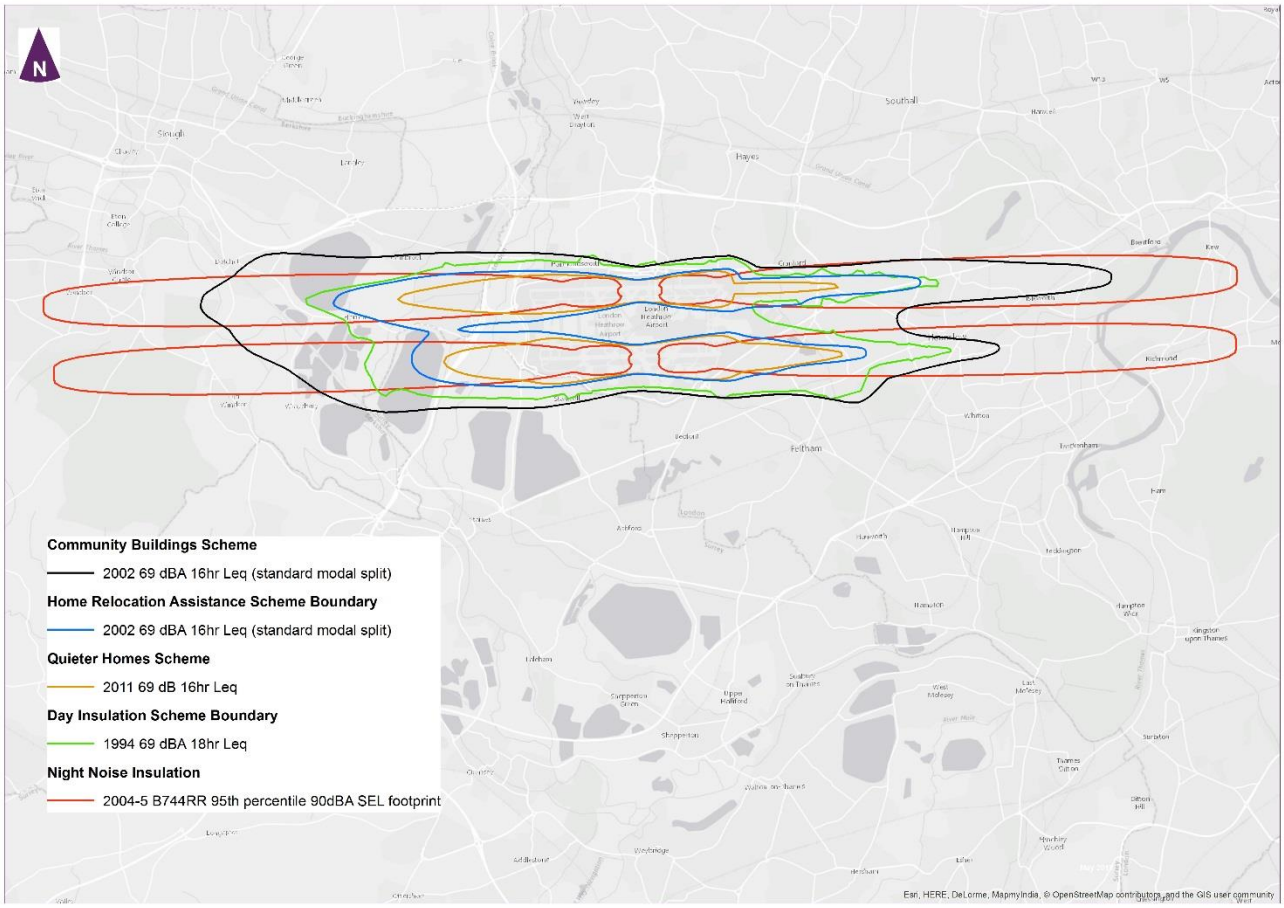
Scheme	Details
Community Buildings Noise Insulation Scheme	For eligible community buildings that fall within the 2002 63dB L_{Aeq} noise contour, this scheme offers acoustic insulation to noise-sensitive buildings in the community – hospitals, schools and colleges, nurseries attached to schools and hospices, nursing homes, registered nurseries, libraries and community halls. The scheme provides noise mitigation to the buildings which can extend to window replacement, mechanical ventilation or any other activity related to provision of noise insulation.
Home relocation assistance scheme	For properties that fall within the 2002 69dB L_{Aeq} noise contour at Heathrow, this scheme provides eligible home-owners with financial assistance with the costs of moving away from areas of high levels of airport noise.
Night noise insulation scheme	Any resident of a property within the scheme boundary – based on the noise 'footprint' of the noisiest aircraft regularly scheduled to operate between 11.30pm–6.00am in 2007 – is eligible. Since the scheme is intended to mitigate the impact of night flights, rooms eligible for insulation are bedrooms or bedsitting rooms only (which are used as bedrooms on most days of the year). The scheme provides noise insulation for all bedrooms or bed-sitting areas in approximately 41,000 homes around Heathrow.
Residential day noise insulation scheme	This scheme provides acoustic insulation to residential buildings in the community. This includes free secondary glazing or half price double glazing plus loft insulation to external windows and doors only. It is restricted to the 18 hour 1994 69dB $L_{Aeq\ 18h}$ noise contour, enhanced to take account of early morning arrival noise.
Quieter Homes	Heathrow's Quieter Homes scheme aims to reduce the impact of noise on homes around the airport. Heathrow contribute 100% of any home improvements recommended in a statement of need following an assessment. Measures include loft insulation, ceiling overboarding, external doors, double glazing and ventilation systems. The scheme covers approximately 1,200 homes located close to Heathrow who experience the highest levels of aircraft noise.

3.3.20 Heathrow has identified 71 community buildings within its Community Buildings Noise Insulation Scheme that qualify for free double glazing. This scheme was completed in April 2015 and means that 44 schools will have much better insulation as a result of the Scheme.

3.3.21 In 2011, Heathrow consulted its local communities on a range of possible improvements to its noise insulation schemes based on examples from around the world. In 2013, Heathrow launched a pilot to test a number of new options and aspects around noise insulation. This led to the introduction of a new Quieter Homes Initiative Scheme, offering 100% of the costs of acoustic glazing, passive ventilation, ceiling overboarding and loft insulation for dwellings in the 69 dB $L_{Aeq\ 16hr}$ noise contour.

3.3.22 In 2014, Heathrow launched a programme to provide quiet outdoor learning spaces for 21 primary schools within areas of higher aircraft noise. These Adobe buildings accommodate around 30 pupils in a single space. They help children learn outdoors in a quiet environment whilst retaining the sense of outdoors. Heathrow has so far funded the installation of Adobe buildings at five primary schools, with a further five planned for completion in 2015. The scheme is available to all of the 21 primary schools.

Figure 3.2 Geographical Extent of Heathrow's Existing Noise Insulation Schemes



Operating Restrictions

3.3.23 Whilst Government and local planning conditions are responsible for many of the operating restrictions at Heathrow, the airport has been responsible for a number of initiatives to help manage these restrictions.

Campaign to Reduce Late Departures

3.3.24 For a variety of reasons the last departures often leave the airport later and result in movements during the night. Sometimes this is unavoidable, for example, due to bad weather or technical issues. Heathrow are working with NATS to reduce operational constraints and routinely review the airlines punctuality. Heathrow has used its ability to refuse aircraft to depart should their delay result in departures past 2330hrs.

Voluntary agreement on arrivals scheduled between 0430 and 0600hrs not to arrive before 0430hrs

3.3.25 Whilst night movements are regulated, Heathrow has responded to feedback from communities to introduce a voluntary curfew on arrivals scheduled between 0430-0600hrs not to arrive prior to 0430.This voluntary curfew is commended by Government in the APF which states in Paragraph 3.35 that:

3.3.26 *"In recognising these higher costs upon local communities, we expect the aviation industry to make extra efforts to reduce and mitigate noise from night flights through use of best-in-class aircraft, best practice operating procedures, seeking ways to provide respite wherever possible and minimising the demand for night flights where alternatives are available. We commend voluntary approaches such as the curfew at Heathrow which ensures that early morning arrivals do not land before 4.30am. "*

Voluntary ban on scheduled cargo departures between 2330hrs and 0600hrs

3.3.27 Heathrow has introduced a voluntary ban on scheduled cargo departures between 2300 and 0600hrs. This goes beyond Government night restrictions.

Voluntary ban on Chapter 3 aircraft

3.3.28 Heathrow is seeking a voluntary ban on the category of aircraft known as Chapter 3. Heathrow have already been successful in achieving a similar ban on 'marginally compliant' Chapter 3 aircraft as defined by Directive 2002/30/EC. Heathrow aim to have a fleet mix that comprises of 100% Chapter 4 aircraft by 2020.

Working with Local Communities and Industry Stakeholders

3.3.29 In direct response to the APF, which promotes the theme of working closely in partnership with noise-stakeholders, Heathrow has been active in developing a number of tools and forums where noise issues can be discussed and considered.

Engagement Groups

3.3.30 Heathrow is stakeholder in a number of engagement groups. Some of these groups have been instigated by Heathrow and other partners, whilst other groups are a requirement of Government. These are outlined in Table 4.2 below.

3.3.31 It is as part of these groups that many of the voluntary measures implemented by Heathrow and its industry stakeholders are discussed and agreed.

Figure 3.3 Heathrow Noise Forum Membership and Stakeholder Groups

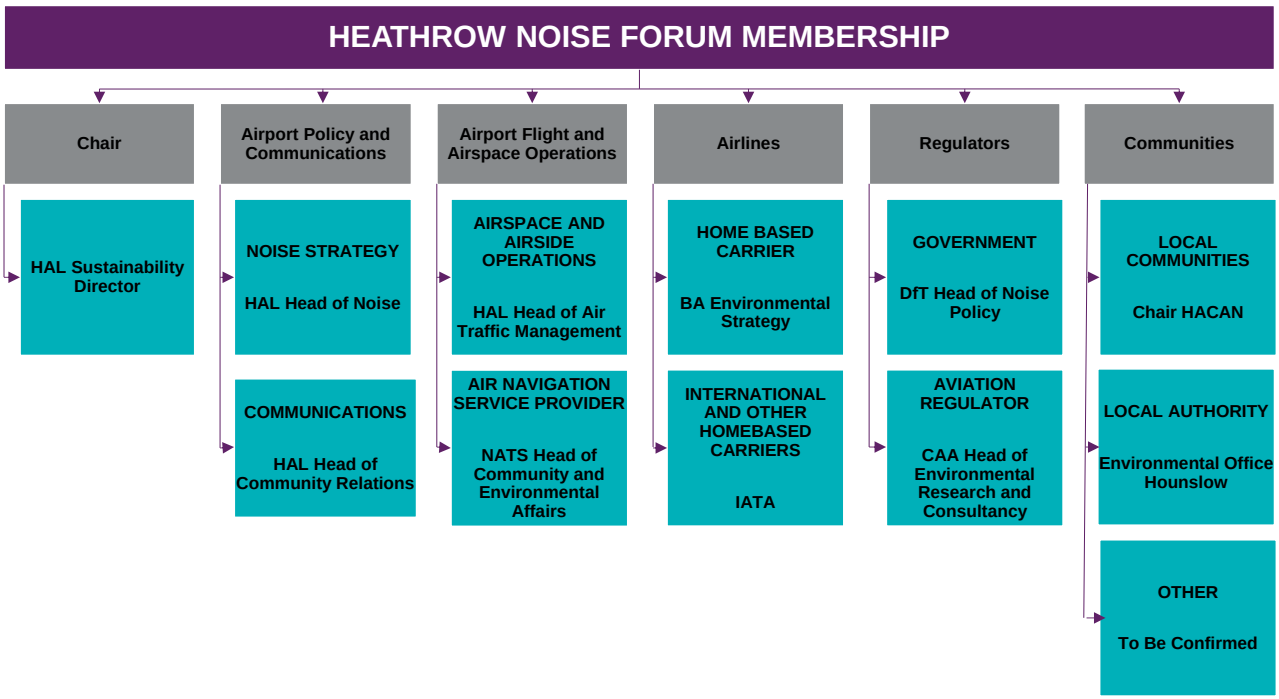


Table 3.2 Engagement Groups

Group	Details
Heathrow Airport Consultative Committee (HACC)	The HACC is an independent committee which includes representatives of airport users, local authorities and other bodies concerned with the locality. HAL meets a statutory obligation by consulting with the committee. The HACC is a public forum
Aircraft Noise Monitoring Advisory Committee (ANMAC)	ANMAC was set up by the Government in the early 1990's to advise them on the operation of the noise monitoring equipment which HAL had been required to install by the DfT under the Civil Aviation Act 1982. Since then the committee has been used as an advisory body on various noise issues. Membership includes representatives from NATS, the Environmental Research and Consultancy Division (ERCD) of the CAA, the Scheduling Committees and their technical advisors, representatives from Heathrow, Stansted, and Gatwick as well as a representative and technical adviser from the Consultative Committees of the three airports. The committee is chaired by the Head of the Aviation Environment Division at the DfT.
Flight Operations Performance Committee (FLOPC)	FLOPC is a committee of HAL. Its membership comprises pilots, NATS and HAL's Airside Operations team. It reviews noise, track and CDA performance, shares best practice and also advises on noise abatement procedures.
Local Focus Forum (LFF)	The LFF is a quarterly meeting hosted by Heathrow made up of resident associations and local councillors from those villages bordering Heathrow. At the forum, Heathrow share information about pending developments and operational impacts that might affect the local area.
Heathrow Community Noise Forum	The Heathrow Community Noise Forum was set up in 2015 and is made up of representative of 12 local authorities around Heathrow, NATS, British Airways, DfT, CAA and Heathrow. The forum was set up in response to local concerns regarding future changes in airspace as a result of the Government's Future Airspace Strategy. The forum aims to: • keep community representatives and local authority stakeholders informed and seek their input in preparing for and consulting on future airspace modernisation as part of the Government's Future Airspace Strategy; • improve understanding of members on Heathrow's operations and airspace issues; • seek input from members to inform the communications approach to trials and public consultations regarding potential airspace changes; and • build trust in the data through members involvement in the independent verification of the data and analysis of data.
Heathrow Noise Forum	The Heathrow Noise Forum is a group of stakeholders aiming to collaborate to reduce aircraft noise around Heathrow. The objectives of the forum are: • Be a focal point for stakeholder involvement in the management of aircraft noise. • Communicate and clarify the role and responsibilities of each member in the management of aircraft noise. • Establish a common level of understanding between different stakeholders of opportunities to reduce aircraft noise and of local community priorities. • Review and challenge the performance of HAL, airlines, air navigation service providers and other stakeholders in managing aircraft noise. • Foster collaboration to identify and agree improvements to reduce aircraft noise, including the development of new solutions. • Propose actions to HAL's management (through the company's internal 'Noise Steering Group') and to other stakeholders where appropriate. The composition of the noise forum and the various stakeholders included within its membership are presented in Figure 3.3

Communication Tools and Monitoring Reports

3.3.32 Heathrow has made a number of significant improvements and developments to their noise communication tools.

3.3.33 Heathrow's online tools include Webtrak and My Neighbourhood. These tools allow people within the community to identify aircraft events and to find out what airport traffic was like in the vicinity of their homes over time. The tool can be used to understand how noise has changed over time and what the causes may be. Other online tools include Heathrow's noise Twitter feed which provides updates on changes in runway direction or use.

3.3.34 As part of Heathrow's FlyQuiet programme and other initiatives, the airport produces quarterly reports setting out noise performance and other noise metrics. The FlyQuiet reports include a system of scoring each airlines performance against six key metrics including late running and CDA compliance. These reports supplement annual noise contouring reports produced by the CAA which demonstrate year-on-year trends in noise exposure. Heathrow also commission the CAA to produce annual reports that supplement those which are prepared and published by DfT.

Community Funds

3.3.35 Heathrow runs a community fund that makes donations to community projects local to the airport. The Heathrow Community Fund is part of an independently run grant-making charity. The charity, LHR Airport Communities Trust aims to help create significant and positive social change.

3.3.36 In 2014, the trust distributed £900,000 in grants through three programmes:

- Communities For Youth – providing grants of up to £25,000 to support young people in their development in both education and skills development. This fund is eligible for the boroughs of Ealing, Hillingdon, Hounslow, Slough and Spelthorne
- Communities For Tomorrow – providing grants of up to £25,000 that help protect the environment or encourage sustainable development and eco education. This programme is funded directly by aircraft noise fines and is eligible for the boroughs of Ealing, Hillingdon, Hounslow, Richmond, Runnymede, South Bucks, Slough, Spelthorne, Windsor, and Maidenhead
- Communities Together – providing grants of up to £25,000 for a wider range of smaller community focussed projects. This programme is funded by donations made by passengers at Heathrow Airport and is eligible for the boroughs of Ealing, Hillingdon, Hounslow, Richmond, Runnymede, South Bucks, Slough, Spelthorne, Windsor, and Maidenhead

3.4 Summary of Existing Mitigation and Heathrow's Response

3.4.1 The previous sections demonstrate the degree to which the control and mitigation of aircraft noise at Heathrow is regulated by a number of international, national, regional and local rules. I have also demonstrated the work and measures that Heathrow has taken along with its industry partners and local communities to introduce further voluntary measures going beyond legal and policy requirements to improve noise at the Airport.

4. The Changing Noise Climate at the Airport over time

4.1 Changes in Noise Exposure at Heathrow

4.1.1 As outlined in Section 4 of my proof, a number of measures to limit and reduce the impact of noise from Heathrow have been in place since the 1950s. These comprise of a number of layers of regulation, policy, legal agreements and voluntary measures. These measures have resulted in a number of changes in exposure and the character of the noise experienced by communities around Heathrow.

4.1.2 Following the Second World War, as jet aircraft technology became more commonplace, and as civil aviation became more popular, concerns emerged regarding the impacts of aircraft noise on communities located around airports. In its infancy, jet aircraft had the potential to impact upon communities significant distances from the airport, particularly during departures. For those located near to the airport, aircraft departures resulted in extremely high levels of noise during overflight.

4.1.3 These concerns spawned the first aircraft noise management measures at Heathrow, including the introduction of the Cranford Agreement. Further measures that followed, amongst others, included the 'westerly preference' and noise preferential routes.

4.1.4 Owing to public concerns about environmental noise, the Government commissioned the Wilson Committee Report on Noise. This report considered, amongst others, the problems of aircraft noise and in 1963 made a number of recommendations that eventually led to the first social surveys and corresponding metric (the Noise and Number Index) for community annoyance. This resulted in the first noise insulation schemes and noise contours to measure noise exposure at Heathrow.

4.1.5 At the International level, the first standards limiting aircraft noise emissions (ICAO Chapter 2) were introduced in 1972. This was followed by the stricter ICAO Chapter 3 standards in 1978. As part of International agreements associated with these standards, timetables were set for phase-out of older noisier aircraft. ICAO Chapter 2 phase-out was adopted by the EU in the early 1990s.

4.1.6 Under the ICAO Chapter 2 and Chapter 3 standards, aircraft and aircraft engine manufacturers placed focus on reducing noise from engines and sought to improve aircraft's rate of climb. These standards resulted in significant reductions in the noise produced by aircraft on departure.

4.1.7 Further improved standards on aircraft noise emissions were introduced in 2006 (Chapter 4) and in 2014 (Chapter 14). These standards mean that today's aircraft are 75% quieter than those operating 50 years ago.

4.1.8 Around 1980, the Government reconsidered the Noise and Number Index as a measure of aircraft annoyance. This resulted in the Aircraft Noise Index Study (ANIS) study which led to the measure of 57 dB $L_{Aeq,\ 16hr}$ as the approximate onset of community annoyance. This measure remains established within Government policy through the APF and can be reviewed historically to understand how noise exposure around Heathrow has changed.

4.1.9 Figure 4.1 presents the trend in noise exposure at Heathrow over the period 1974 to 2010. At its peak in the 1970's the 57 dB $L_{Aeq\ 16h}$ air noise contour included a population of approximately 2 million. In 2013 the population was 264,250. Figure 4.1 is accompanied by Figure 4.2 which demonstrates the contraction of the 57 dB contour over the period 1974 to 2012. The changing contour shapes illustrate the reduction in departure noise achieved over this period.

4.1.10 Figure 4.1 also shows that the size of the 57 dB $L_{Aeq,\ 16hr}$ contour is in substantial compliance with the 145 km^2 limit to be achieved by 1 January 2016 as required under conditions attached to the Terminal 5 planning consent.

4.1.11 Over the past 50 years, aircraft movements have increased alongside improvements in aircraft noise emissions. Owing to the measures described in Section 4 the noise contour areas has reduced by approximately 90% since the early 1970s.

Figure 4.1 Historic Trend in Aircraft Noise Exposure at Heathrow

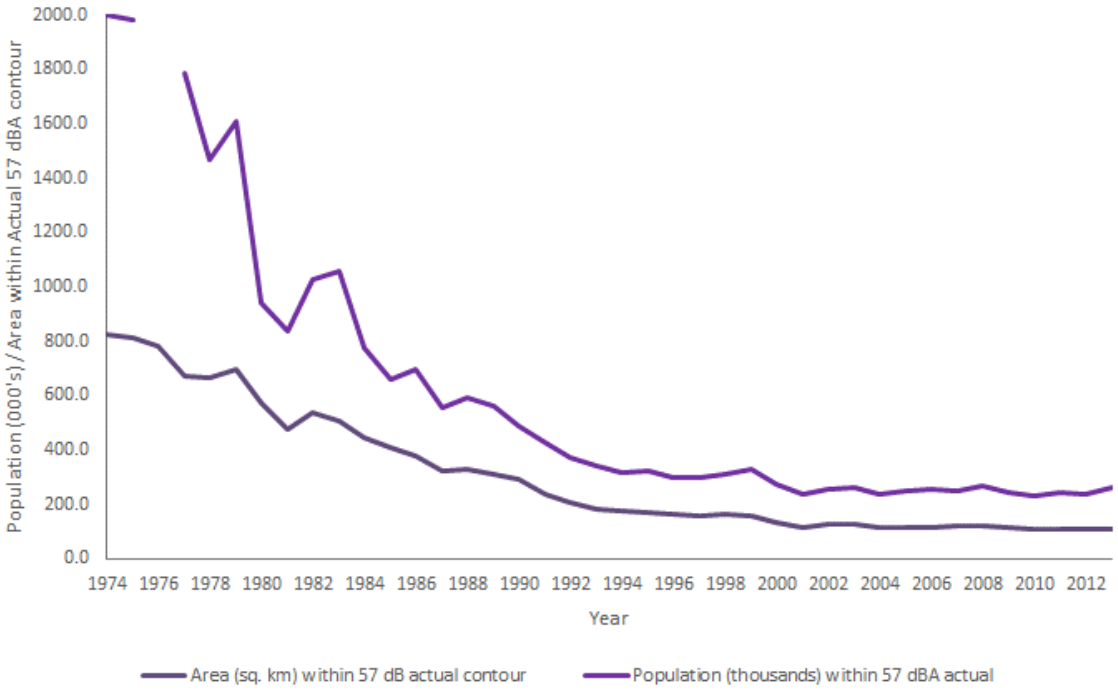
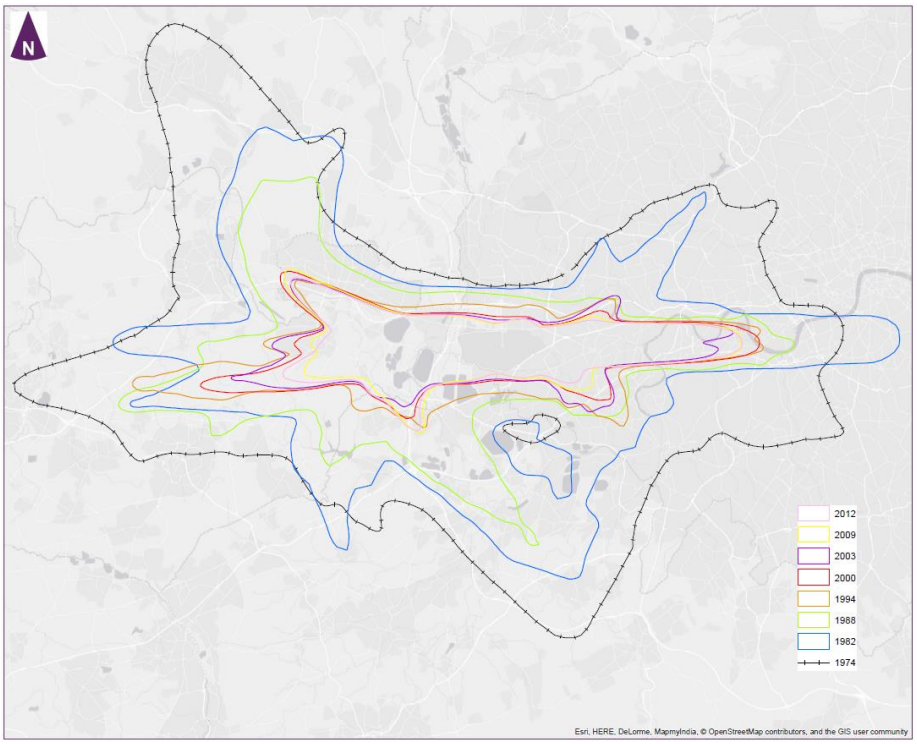


Figure 4.2 Selection of 'Actual Mode' 57 dB $L_{Aeq, 16hr}$ Noise Contours since 1974



4.2 The Original Need for the Cranford Agreement

4.2.1 In 1952, when the Cranford Agreement first came into effect, the first civil jet aircraft began to operate at Heathrow. This was when departures were considered to be more disruptive than arrivals to local communities. As outlined in Section 4.1, a number of International standards governing aircraft noise emissions have since been introduced.

4.2.2 Early jet aircraft were powered by pure jet engines, in which all the thrust was provided by the high velocity combustion exhaust of the engine. The modern B737-800 is about 25 dB quieter than the B707-100. As a rule of thumb, a 10dB drop in sound is about a halving of loudness. By today's standards the aircraft operating at the time of the Cranford Agreement caused very high noise levels, particularly on departure. Table 4.2 presents noise certification levels at the certification points from a range of aircraft since 1958. Where ranges are provided this reflects differences due take-off and landing weights, as well as variations in airframes and engines. Single values are based on historic reference material.

4.2.3 Table 4.2 shows that shows that over the years, noise from aircraft has reduced significantly, particularly during departure, which is represented by the 'Flyover' and 'Lateral' measurement locations.

Table 4.2 Example of the reduction in certified noise levels of time

Year first Introduced	Aircraft	ICAO Noise Chapter	Effective Perceived Noise Level (EPNL) dB		
			Lateral	Flyover	Approach
1976	Concorde	n/a	116	110	116
1958	Boeing 707	n/a	112	112	115
1959	Douglas DC8-60	n/a	108	115	115
1966	Boeing 747-100	n/a	103	110	114
1971	Boeing 747-200/300	2	99 – 107	99 -107	103 – 108
1971	Douglas DC10-30	2	97 – 99	96 – 103	105 -107
1972	Boeing 727-200	2	103	100	103
1981	Boeing 737-300	2	102	95	102
1981	Boeing 767-200	3	91 - 98	82 - 96	96 – 103
1981	Boeing 757-200	3	93 - 96	79 - 91	95 – 100
1989	Boeing 747-400	3	98 – 101	87 – 102	101 – 105
1992	Airbus A330-200	4	97 – 98	87 – 100	99 – 100
1994	Boeing 777-200	3	93 – 100	81 – 96	98 – 100
1996	Airbus A319-131	4	91	80 - 86	94
1998	Boeing 737-800	4	92 – 96	80 – 89	95 – 97
2005	Boeing 747-800	4	94 - 95	95 - 95	100
2007	Airbus A380	4	94 – 95	90 – 96	97 – 98
2015	Airbus A350-941	4	92	81 - 86	97

4.2.4 In 1952, Cranford was the nearest and largest centre of population to the airport's runways. This is illustrated in Figure 4.3 below, which highlights the community of Cranford in purple in 1945 with respect to Heathrow.

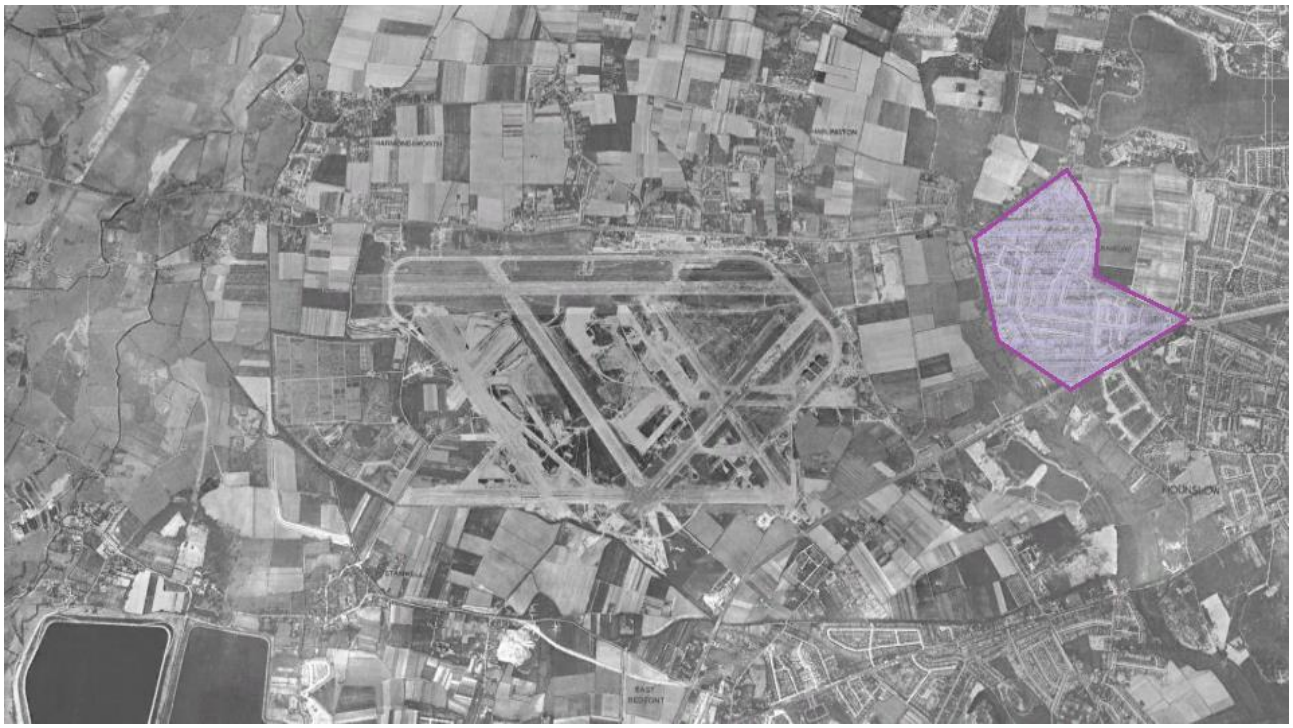
4.2.5 At this time, the airport's runways had not been extended to the west taking them nearer to the residential areas of Stanwell Moor, Colnbrook and Poyle. Compared to the extended runway, most aircraft would depart closer to communities to the east meaning that they would be overfly these communities at lower height than they would if they departed further to the west using the extended runway. The Cranford Agreement was introduced as an oral undertaking by the Government prohibiting aircraft from departing over Cranford except in exceptional circumstances. The Agreement was therefore an early noise abatement measure intended to avoid exposing the nearest population centre to the highest levels of aircraft noise.

4.2.6 In 1952, there were no noise restrictions at Heathrow. Departure noise limits were not introduced until 1959. There were no Standard Instrument Departure Routes (SIDs) nor Noise Preferential Routes (formerly called Minimum Noise Routes) until the 1960s. No night flight restrictions were in place until 1962. The Cranford Agreement served to mitigate the impact of night-time operations.

4.2.7 Between 1976 and 2003 Concorde operated from Heathrow, and it was exempt from the ICAO Annex 16 noise limits and produced very high noise levels on departure. The operation of Concorde and the noise levels during overflight would have been similar to the conditions resulting in the Cranford Agreement in 1952.

4.2.8 Today, no aircraft operating at Heathrow produce noise levels during overflight that correspond to those experienced by communities in 1952 or by Concorde and night flight restrictions as outlined in Section 4 serve to prohibit movements of the noisiest aircraft during the night.

Figure 4.3 Historic Aerial Image of Heathrow (c. 1945)



4.3 The introduction of other relevant measures

The 'Westerly Preference'

4.3.1 In addition to the Cranford Agreement, a 'westerly preference' has been operated at Heathrow since the 1960s. As outlined in Section 4, this measure was also introduced by the Government and serves to reduce the numbers of aircraft taking off in an easterly direction over London, i.e. over the most heavily populated side of the airport. This measure was again introduced when aircraft departures were considered to be more disruptive than arrivals.

4.3.2 The 'westerly preference' means that during periods of light easterly winds (up to 5 knots) aircraft will continue to land in a westerly direction making their final approach over London. The westerly preference increases the number of westerly movements by around 5% however this varies month by month depending upon variance in wind direction.

4.3.3 The Airports Commission in its Interim Report (December 2013) said that the Government should review the need for a westerly preference with a view to introducing a 'no preference' policy.

4.3.4 The westerly preference coupled with the prevailing westerly wind direction, means that most operations involve landings from the east and departures to the west. The summer average varies each year and can range from approximately 90:10 to 60:40. As of 2013, the 20-year average modal split was 77:23. In recent years, the summer average modal split has been at above 80:20 to the west.

4.3.5 Historic modal splits were provided in Tables G.2 and G.3 of Appendix G of the ES for the summer and annual periods.

Westerly Runway Alternation

4.3.6 A system of runway alternation was introduced in 1972-73 for aircraft landing during westerly operations (i.e. when arriving aircraft make their final approach over London) to provide predictable periods of relief from the noise of landing aircraft for communities under the final approach tracks to the east of the airport. This system of runway alternation means that, wherever practical, the arrival and departure runways are alternated according to a published schedule.

4.3.7 The pattern of alternation has been modified several times since the 1970s and in 1999 was extended to the night period. The present pattern provides for one runway to be used by landing aircraft from 0600 hours until 1500 hours and the other runway to be used from 1500 hours until after the last departure (therefore normally starting with the midnight hour), after which landing aircraft use the first runway again until 0600 hours. However, on Sunday each week the runway used before midnight continues to be used for landings until 0600 hours. This means early morning arrivals before 0600 hours use a different runway on successive weeks and that the runways used by landing aircraft before and after 1500 hours also alternate on a weekly basis. Aircraft taking off during westerly operations can use either runway, but most use the runway that is not in use for arrivals.

4.3.8 The Cranford Agreement had the effect that aircraft depart to the east using the southern runway and arrive from the west using the northern runway. With the Cranford Agreement runway alternation could not operate in the daytime during easterly operations.

4.3.9 The system of runway alternation during westerly operations is considered important to those who experience aircraft noise. The effect of alternation is to provide 'respite' from aircraft noise. Heathrow's consultations with communities show that most people in a ratio of 3:1 favour respite rather than concentration.

4.3.10 In an article in the Daily Mail of 24 April 2013, the head teacher of Hounslow Heath Infant School, which is located under the approach to Runway 27L was quoted:

4.3.11 *"Having quiet time is absolutely critical. To lose runway alternation would be a disaster"*

4.3.12 Government policy is in favour of providing respite and the sharing of noise between communities. The APF states (Paragraph 3.32):

4.3.13 *"However, in certain circumstances, such as where there is intensive use of certain routes, and following engagement with local communities, it may be appropriate to explore options for respite which share noise between communities on an equitable basis, provided this does not lead to significant numbers of people newly affected by noise. Whether concentration or respite is the preferred option, those responsible for planning how airspace is used should ensure that predictability is afforded to local communities, to the extent that this is within their control.*

4.4 Summary of the changes since the Cranford Agreement

4.4.1 As outlined above, there have been a number of important changes in aircraft noise at Heathrow since the introduction of the Cranford Agreement. These changes help provide some of further context behind the Government's decision to end the Agreement.

- Aircraft noise emissions have reduced significantly since the 1950s;
- There have been considerable reductions in departure noise from jet aircraft since the 1950s and approach noise is now usually greater than departure noise;
- Individual aircraft producing noise levels akin to 1950s aircraft no longer operate at Heathrow, following the retirement of Concorde in 2003;
- Heathrow's runways have been extended to the west since the start of the Cranford Agreement and aircraft now have much increased climb rates. Today, most aircraft therefore depart over Cranford at much greater height than in the 1950s;
- Night flight restrictions have been introduced at Heathrow prohibiting the noisiest aircraft operating at night;
- Noise insulation schemes now exist to help protect those most affected by aircraft noise; and
- Predictable runway alternation has been introduced during westerly operations and this proved popular with local communities that benefit from it.

5. The Application Proposals

5.1 Introduction

5.1.1 This section describes the components of the application proposals particularly relevant to consideration of the noise topic.

5.2 Outline of the proposals

5.2.1 The application seeks permission for physical works on land next to the north and south runways at Heathrow Airport. The works include the creation of a new 'hold area', new access and exit taxiways and a noise barrier (acoustic fence) on land adjacent to the airport.

5.2.2 The purpose of the works is to enable easterly arrivals and departures to be alternated between the north and south runways in the same manner is takes place for westerly operations. Under the former Cranford Agreement, easterly departures were confined to the southern runway (09R) and easterly arrivals to the northern runway (09L) with no possibility of alternation due to the agreement that aircraft would not normally depart over Cranford, which is closer to the eastern end of the northern runway than to the southern runway. The application proposals will facilitate the use of the northern runway for easterly departures and the southern runway for easterly arrivals.

5.2.3 In order to give effect to the Government's policy Heathrow needs to carry out various minor works to the taxiway system at the western end of the northern runway to allow sufficient aircraft to access that runway (and be correctly sequenced) so that the full easterly schedule could be operated. Without this additional taxiway infrastructure it would not be possible to accommodate the scheduled easterly aircraft departures from the northern runway, such that the implementation of Government policy would be frustrated.

5.3 Physical features of the proposals that affect noise

5.3.1 The proposed development includes new taxiways at the western end of the northern runway that will result in increased ground noise from aircraft using the new taxiways, and holding before entry to Runway 09L. This has been taken into account in the assessment of ground noise impacts provided in the Environmental Statement. It consists of noise from aircraft taxiing to the western end of runway 09L, being held in that vicinity on occasions and then applying power before brake release, at which point the noise become part of the air noise contours.

5.3.2 In order to help mitigate these ground noise effects, the proposals include a 593m long and 5m high noise barrier that is to be constructed at the airfield boundary between Longford.

5.4 Operational features of the proposals that affect noise

5.4.1 The operational features of the proposal that affect noise are confined to times when the direction and speed of the wind necessitates easterly operations. They cause an increase in the number of easterly departures on Runway 09L, an equivalent decrease in the number of departures on Runway 09R, with a corresponding decrease in arrivals on 09L and an equivalent increase in arrivals on Runway 09R.

5.4.2 The overall movement numbers, the airport fleet mix and the proportion of easterly to westerly operations does not change as a result of the proposals.

5.4.3 The Standard Instrument Departure (SID) route for 09L departures involves a left turn towards the north soon after take-off. As a consequence, the noise contours acquire a new lobe towards the north a short distance east of the runway end, and as aircraft did not, under the Cranford

Agreement, fly directly over this locality, the newly introduced departure noise results in new exposure to take-off noise for residents and receptors just to the north east of the runway end.

The Introduction of Scheduled Alternation during Easterlies

5.4.4 The proposals allow Heathrow to operate scheduled easterly departures from the northern runway as part of a pattern of runway alternation. The pattern of runway alternation proposed will reflect the current system operated during westerly operations as outlined in Sections 3.2.3 – 3.2.8 of my proof.

5.4.5 Runway alternation will provide communities living under initial departures and final approaches from Runway 09R and Runway 09L respectively, predictable periods of respite from aircraft noise according to the alternation schedule during the 20-30% of the time Heathrow operates on easterlies.

5.4.6 The operation of the airport and how alternation is scheduled is set out in the evidence of Mr Mark Burgess (HAL/MB/P/01).

5.4.7 For those communities that will become overflown during easterlies, the introduction of scheduled runway alternation will mean that while they will be overflown for half day period, they will therefore also be provided with predictable respite from aircraft noise.

5.5 The principles of the proposed mitigation

Respite Provision

5.5.1 The proposals allow Heathrow to operate full runway alternation during easterly operations. Whilst this would result in operational changes that affect noise, the principle of introducing runway alternation is to provide respite from aircraft noise. The introduction and provision of respite forms a key part of Heathrow's noise management procedures during westerly operations and this would be extended to easterly operations.

Noise Insulation and Compensation

5.5.2 Heathrow's proposed noise insulation scheme for these proposals is compliant with and exceeds Government requirements as set out within the APF.

5.5.3 Residential dwellings subject to an increase in noise of 3dB or more which leaves them exposed to levels of noise of 63 dB $L_{Aeq,16hr}$ or more will be offered 100% contribution towards the costs of acoustic mitigation. HAL will pay the costs on the following terms:

- Those homes eligible for acoustic mitigation will be notified in writing by HAL and be invited to register for the scheme;
- Residents will have three months following the programmed start of easterly alternation to register. HAL will inform them of when easterly operation is to begin;
- Following registration to the scheme, an independent noise assessor will survey the property to determine what measures are to be installed;
- The mitigation measures will be limited to:
    - Loft insulation;
    - Ceiling insulation;
    - Double Glazing;
    - External doors; and
    - Ventilation systems.

- Property owners will have a choice of three providers nominated by Heathrow to install the works.

5.5.4 Heathrow's proposed relocation assistance package also meets Government policy requirements of the APF. Affected dwellings will be offered financial assistance towards relocation where they become exposed to noise levels of 69 dB $L_{Aeq, 16hr}$ or more as a result of easterly runway alternation. HAL will pay the costs of home owners having to relocate, up to a reasonable cap of £12,500 per dwelling in line with Heathrow's existing scheme.

5.5.5 For community buildings that become exposed to noise levels of at least 63 dB $L_{Aeq, 16hr}$, Heathrow will provide sound insulation measures. These proposals again reflect the requirements of the APF. HAL will pay the costs of mitigation. As outlined in Section 9 of my proof, 10 schools have been identified as likely to be eligible for sound insulation measures.

5.5.6 Acknowledging the potential for effects that cannot necessarily be predicted, Heathrow also propose to offer a financial contribution to dwellings within 500m of Runway 09L with light-weight constructions that may be affected by noise-induced vibration from aircraft runway activities.

6. Assessment Methodology

6.1 Introduction

6.1.1 The reasons for refusal that relate to noise assert that the application fails to demonstrate that the scheme would not result in significant adverse noise impacts on residents, schools and community facilities and fails to demonstrate that adequate and sufficient mitigation measures have been proposed; the Environmental Statement fails to comply with the Environmental Impact Assessment (EIA) Regulations 2011 in that it does not describe the likely significant effects from noise impacts and does not set out measures to prevent, reduce and offset significant adverse effects.

6.1.2 In essence, the reasons for refusal are making two points: (1) the description of likely significant effects is deficient and (2) inadequate mitigation is proposed.

6.1.3 Proposed mitigation is discussed in Section 8 below. This section considers the description of likely significant effects.

6.1.4 At the core of the topic of description of noise effects is the matter of noise scales and indices. As set out in Section 2 above, this matter is the subject of policy set out in the Aviation Policy Framework, which says that the Government will continue to treat the 57dB $L_{Aeq,16hr}$ contour as the average level of daytime aircraft noise marking the approximate onset of significant community annoyance. Both the metric and value of $L_{Aeq, 16hr}$ defining annoyance levels are the result of social surveys. These surveys, like many contemporary and more recent studies, consider average conditions which in turn consider the proportion to which an airport is operating in a certain direction.

6.1.5 The Government recognises that people do not experience noise in an averaged manner and that the value of the L_{Aeq} indicator does not necessarily reflect all aspects of the perception of aircraft noise. For this reason the Government recommends that average noise contours should not be the only measure used when airports seek to explain how locations under flight paths or close to the airport are affected by aircraft noise. Instead the Government encourages airport operators to use alternative measures in addition to the $L_{Aeq, 16hr}$, particular where these measures better reflect how aircraft noise is experienced in different localities citing examples of frequency and pattern of movements and highest noise levels which can be expected.

6.2 Scoping

6.2.1 The assessment scoping was undertaken over a period where UK aviation policy was being developed and consulted upon. Throughout 2012, the Aviation Policy Framework was in draft form and subject to consultation. This consultation sought views on whether the Government should or should not reaffirm the 57 dB $L_{Aeq, 16hr}$ metric as marking the approximate onset of significant community annoyance from aircraft noise. Alternatives to not reaffirming 57 dB $L_{Aeq, 16hr}$ included the lowering of the value to 54 dB $L_{Aeq, 16hr}$ or instead the adoption of the 55 dB L_{den} metric.

6.2.2 In this context, much of the ES scoping was undertaken with no firm understanding of how Government policy on aircraft noise would be finalised.

6.2.3 Copies of the documents referenced in this section can be found in Appendix HAL/RTT/A/1.

Scoping opinion

6.2.4 In response to a scoping opinion request by HAL, the LBH gave a scoping opinion on 22 August 2011 (CD/01/28)**.** The opinion contained 12 pre-ES recommendations specifically related to air and ground noise. The majority of these recommendations requested consideration of additional noise metrics to those being proposed by HAL, and/or challenges to HAL's proposed significance criterion. These included:

- A statement that the use of average mode contours and methods was inadequate for the purposes of assessing significance;
- That the assessment should consider non-ATMs;
- Presentation of $L_{Aeq, 1hr}$ and $L_{Aeq, 16hr}$ noise contours for each runway mode from a value of 50 dB;
- Noise difference contours presenting changes from absolute values of at least 50 dB $L_{Aeq, 1hr}$ or $L_{Aeq, 16hr}$; and
- Clarification on the use of L_{Amax} noise levels for assessment purposes and how educational establishments will be assessed.

6.2.5 During scoping LBH also provided a number of recommendations in relation to the assessment of cumulative effects and noise. The issue of cumulative assessment is addressed in the Planning Proof of Evidence by Mr. John Rhodes (HAL/JR/P/01) and the Report by Mr. Toby Gibbs.

6.2.6 Following a delay to the project while the Operational Freedom trials were completed, HAL completed its response to the scoping opinion and the pre-ES recommendations on 4 December 2012. In responding, HAL sought to respond to the LBH's recommendations and in places put forward a compromise. Areas of agreement and compromise were made on the following matters:

- Inclusion of 6,000 non-ATMs within the noise modelling;
- Presentation of single-mode $L_{Aeq, 8hr}$ contours to reflect the alternation periods on each runway instead of single mode $L_{Aeq, 1hr}$ contours; and
- Commitment to use noise monitoring data to assist with short-term and maximum noise level assessments where possible;

6.2.7 HAL did not agree to requests on matters such as the use of $L_{Aeq, 1hr}$ single mode contours and the presentation of noise contours from 50 dB L_{Aeq}. The response also set out HAL's significance criterion.

6.2.8 LBH provided a response to HAL's position on 6 February 2013. This response reiterated LBH's position regarding assessment metrics and criterion whilst recognising that HAL had agreed to compromise on certain requests from the 2011 scoping opinion.

6.2.9 LBH again raised concerns over HAL's approach to significance. The letter stated that the approach to assessing educational establishments should reflect criteria advocated in the now withdrawn (and subsequently reissued) Department for Education and Skills publication 'Building Bulletin 93'. The response again stated that $L_{Aeq, 1hr}$ contours should be produced and that absolute noise levels be produced down to 50 dB.

6.2.10 With regards to significance, the response also clarified that LBH consider:

6.2.11 *"that noise changes of 1 dB in air noise and ground noise indices should be regarded as significant. We therefore regard changes of 1 to 3 dB in the air noise indices $L_{Aeq,16h}$ and L_{den} of Table 4.5 as "significant", rather than "not significant" as indicated. Similarly, we believe significant changes in the noise indices $L_{Aeq,16h}$, $L_{Aeq,T}$ and L_{den} of Table 4.6 should be 1 dB, rather than 3 dB as indicated. It is not clear whether Table 4.6 applies to ground noise as well as air noise."*

6.2.12 The Aviation Policy Framework (APF) was published on 22 March 2013. As outlined in Section 2, as well as confirming the Government's decision to end the Cranford Agreement, the policy reaffirmed the Government's use of the 57 dB $L_{Aeq, 16hr}$ metric as the approximate onset of significant community annoyance from aircraft noise and set out its expectations on airport operators in providing sound insulation and compensation. The policy also retained the use of a 3 dB change in $L_{Aeq, 16h}$ noise exposure as part of the Government's expectations and requirements for residential noise insulation eligibility.

The Environmental Statement

6.2.13 The noise effects of implementing Government policy were examined in the ES submitted with the planning application on 25th March 2013.

6.2.14 The air noise effects presented within the ES were consistent with those demonstrated by ERCD in the *"Adding Capacity at Heathrow Airport"* document, as used by the previous Government when carrying out its consultation on the future of the Cranford Agreement and identified in Section 2.1 of my proof. The characteristics of these effects, therefore, were fully taken into account by both the previous and the current Government when reaching their decisions on the Cranford Agreement.

6.2.15 Whilst the ERCD document considered the effects of ending the Cranford Agreement in terms of the $L_{Aeq, 16hr}$ metric, the ES considered a number of other receptors groups such as education establishments and healthcare facilities, and other alternative noise metrics in order to present the effects of easterly runway alternation. These included overall values and changes in:

- L_{den};
- L_{night};
- Aircraft movements by track;
- Respite percentages; and
- L_{Amax}

Request for Clarification

6.2.16 On 16 August 2013 LBH wrote to HAL seeking clarification on a number of points (CD/01/29). HAL responded on 18 September 2013 (CD/01/30) attaching a technical note on noise. This note reiterated many of the requests raised during scoping, including the point that a 1 dB change in the $L_{Aeq, 16hr}$ metric be considered significant.

Regulation 22 Consultation

6.2.17 On 11 December 2013 LBH emailed HAL to request further information. These requests included: noise maps for the $L_{Aeq, 16hr}$ and $L_{Aeq, 8hr}$ contours be prepared on more detailed base mapping; locations identifying all schools around the airport; and maps showing properties eligible for the Relocation Assistance Scheme. HAL provided this information to LBH as part of a letter dated 13 January 2014.

Conclusions of scope of the Environmental Statement in relation to noise effects

6.2.18 The overall scope of the Environmental Statement in relation to noise effects, particularly the significance methodology was not in agreement with LBH throughout the scoping process.

6.2.19 Throughout the process, HAL did not agree to certain requests for information that it believed were not appropriate for the assessment of effects. Similarly, HAL did not agree to significance criterion implied by LBH that it believed could not be justified by relevant policy, standards or guidance.

6.2.20 The ES has justified its position with regard to the selection of assessment criterion and methodologies in line with relevant policy and guidance on effects and mitigation.

Other Correspondence

6.2.21 On 28 April 2015 LBH wrote to HAL seeking to clarify a number of points in response to a letter from HAL on 8 April 2015, and a meeting between HAL and LBH on 15 April 2015. The letter sought to clarify what LBH considers appropriate significance criteria assuming the use of the $L_{Aeq, 16hr}$, L_{den} and $L_{Aeq, 8hr}$ metrics. The criteria were presented with reference to 3 dB and 1 dB changes above and below a value. In addition the letter discussed other aspects of the noise assessment presented within the ES including the L_{Amax} information and the absence of N70 contours.

6.2.22 The letter states that *"The local authorities case is that the mitigation proposed fails to address the significant adverse impacts cause by the development proposal"*. The letter sets out the mitigation and compensation the local authorities consider appropriate based on the use of the $L_{Aeq, 16hr}$ metric and at values of $L_{Aeq, 16hr}$ this mitigation, in the form of noise insulation measures, should be provided on a fully funded basis. The letter also request that mitigation be provided to schools identified with significant adverse noise impacts and requests clarity on the assessment of other community facilities and open spaces.

6.2.23 This letter and its content was received too late to be addressed within this proof. The content will therefore be addressed through rebuttal evidence, once I have considered the noise evidence to be provided by LBH in support of the position set out in its letter of 28 April.

6.3 ES Assessment Metrics and Significance

6.3.1 The ES considered a number of assessment metrics and effects and associated significance to changes in these. The assessment metrics considered a number of receptors types. This section outlines the ES's approach to assessment metrics and their significance.

Air Noise

Daytime Annoyance

6.3.2 In accordance with Government policy (APF paragraph 3.17), the ES includes an assessment of noise with and without full easterly runway alteration in terms of the $L_{Aeq\ 16h}$ metric.

6.3.3 Consideration of the importance to be attached to changes in the value of the $L_{Aeq\ 16h}$ index is a matter of judgement that can be informed through consideration in changes in annoyance rates due to a given change in the $L_{Aeq, 16hr}$ index. This approach was adopted and discussed at length within paragraphs 6.7.4 to 6.7.10 of the ES. Criterion was adopted and applied to clearly identify what level and change in $L_{Aeq, 16hr}$ were considered significant EIA effects.

6.3.4 Significant effects were considered where receptors are exposed to at least 57 dB $L_{Aeq, 16hr}$ and experience a change of at least 3 dBA in overall noise exposure. This change was considered 'high' and therefore 'significant'. A change of 1-3 dB in $L_{Aeq, 16hr}$ was considered of 'medium' magnitude but was considered 'not significant'.

6.3.5 The ES presents the location, area, number of households and associated populations exposed to various levels of $L_{Aeq, 16hr}$ and change therein within the assessments presented in Section 6.8. Noise exposure changes were considered in 1 dB bands. The total number of beneficial and adverse changes in $L_{Aeq, 16hr}$ of at least 1 dB were presented. If the view is taken that most weight should be attached to changes of 1 dB, the necessary information to assess the impact of the proposals in those terms is provided in the ES throughout Section 6.8.

6.3.6 For reasons set out in the ES, I consider that changes of 3 dB or more are the most logical method of assessing the significant impacts of the proposals. Indeed an increase of 3 dB resulting in aircraft noise exposure of 63 dB $L_{Aeq, 16hr}$ or more under the APF triggers the requirement to provide noise insulation.

6.3.7 In addition to the assessment of daytime annoyance using the $L_{Aeq, 16hr}$ metric, the ES also provided a 'secondary' assessment using the L_{den} metric within Appendix G. This was provided in response to early requests during scoping by LBH. A similar method for the assessment of effects was undertaken applying a 3 dB change criterion for 'significant effects' where noise exposure was found to be at least 55 dB L_{den}. As for the $L_{Aeq, 16hr}$ metric, changes in noise levels were presented from at least 1 dB in response to LBH.

Educational Establishments

6.3.8 For educational establishments, the ES assessment methodology considered guidance provided in of the Department for Education and the Education Funding Agency publication Building Bulletin 93. This guidance is applicable to new buildings.

6.3.9 This guidance requires consideration of internal L_{Aeq} and L_{A01} noise levels in short-term periods of 30-minutes. The ES made a worst case assumption that these establishments would have their windows open and interpreted the BB93 criterion to reflect this. The L_{A01} criterion was assumed to be akin to an L_{Amax}. The thresholds for effects selected for assessment were interpreted by the guidance as 50 dB $L_{Aeq, 30min}$ and 70 dB L_{Amax}.

6.3.10 Due to the practicality of computing $L_{Aeq, 30min}$ noise levels and the associated uncertainty, noise monitoring data was analysed to understand how $L_{Aeq, 30min}$ noise levels vary around the average $L_{Aeq, 16hr}$ value in order facilitate assessment using calculated average noise levels. This yielded a transfer function between short-term $L_{Aeq, 30min}$ noise levels and the calculated average mode $L_{Aeq, 16hr}$.

6.3.11 A 3 dB change criterion was also applied denote significant changes along with consideration in exposure the various $L_{Aeq, 30min}$ and L_{Amax} values. The L_{Amax} was considered through modelling of 09L departures by Boeing 747-400 aircraft, the noisiest in Heathrow's fleet.

Healthcare Facilities

6.3.12 The assessment of noise effects upon healthcare facilities was based on guidance that can be found in Health Technical Memorandum 08-01: Acoustics (HTM 08-01 Acoustics). This guidance is for new healthcare facilities and sets out criteria in terms of indoor noise levels in terms of $L_{Aeq, 1hr}$ and L_{Amax}.

6.3.13 Assuming that it is unlikely that healthcare facilities would have windows open, the criterion from HTM 08-01 was increased by 25 dB to account for the effect of having a closed window. Based upon this guidance and assumption, it was concluded that no further consideration need be given to healthcare facilities where the outdoor noise levels are not above 55 dB $L_{Aeq\ 1hr}$ during the day, and 50 dB $L_{Aeq, 1hr}$ and 70 dB L_{Amax} at night.

6.3.14 As with educational establishments, due to the practicality of computing $L_{Aeq, 1hr}$ noise levels and the associated uncertainty, noise monitoring data was analysed to understand how $L_{Aeq, 1hr}$ noise levels vary around the average $L_{Aeq, 16hr}$ value in order facilitate assessment. This yielded a transfer function between short-term $L_{Aeq, 1hr}$ noise levels and the calculated average mode $L_{Aeq, 16hr}$.

6.3.15 A 3 dB change criterion was also applied to denote significant changes in noise exposure.

Community Facilities and Places of Worship

6.3.16 The assessment of community facilities and places of worship was undertaken for all uses exposed to levels of at least 57 dB $L_{Aeq, 16hr}$. A 3 dB change criterion was also applied to denote significant changes in noise exposure.

Night-time Noise

6.3.17 The night-time noise assessment considered changes in night-time noise exposure above a threshold of 45 dB L_{night}, and exposure to aircraft events of at least 90 dB SEL. The consideration of 90 dB SEL adopted the Boeing 747-400 aircraft which is one of the noisiest aircraft that operates during the night and therefore considered a worst case. These metrics can be aligned to both long and short-terms sleep disturbance. A 3 dB change criterion was also applied to the significance criterion in order to account for change resulting from the proposals.

Ground Noise

6.3.18 Unlike air noise, there is no assessment methodology or social surveys that are specific to the assessment of ground noise. In the absence of any specific guidance, the criterion applied to the assessment of the effects within the ES for air noise, as set out above, was also applied to the assessment of ground noise with the exception of respite percentages.

6.3.19 Where values of SEL or L_{Amax} were required, the ground noise assessment adopted values associated with air noise events.

Construction Noise

6.3.20 The construction noise assessment methodology is presented at paragraphs 6.7.52 to 6.7.58 of the ES. The adopted assessment methodology corresponds with the guidance provided in British Standard BS5228:2009-1:2009+A1:2014 *'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise'*.

Noise Induced Vibration

6.3.21 The ES highlights the potential for noise-induced vibration effects at receptors in Longford with light-weight constructions such as conservatories as a result of low frequency start-of-roll noise. The potential for these effects was identified through investigations made at residential dwellings around Runway 27L. These investigations were undertaken with reference to vibration measurements undertaken and assessed against guidance within British Standard BS 6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting'*. These measurements show that vibration levels due to aircraft start-of-roll noise within a conservatory at Myrtle Avenue around 475m from Runway 27L were at levels that would result in *"Adverse comment possible"* as defined by BS6472-1:2008.

6.3.22 A qualitative assessment of noise-induced vibration was undertaken within the ES by means of comparing the circumstances such as the general proximity of receptors to the start-of-roll in Longford with those around Runway 27L.

6.4 Alternative Metrics considered within the ES

6.4.1 As outlined above, the APF expects airport operators not to rely solely on average noise contours when seeking to explain how locations under flight paths are affected by aircraft noise. To assist in communicating the effects of introducing runway alternation, the ES presents information in terms of movements by track and respite percentages.

Movements by Track

6.4.2 In order to describe the effects of easterly runway alternation, the ES presents a series of figures illustrating the location of flight tracks with respect to communities and how movements along these tracks will change as a result of enabling easterly runway alternation. The figures essentially present flyover frequency by track each side of the alternation period.

Respite Percentages

6.4.3 Tables 6.14 and 6.15 of the ES present respite percentages during easterly operations with and without full easterly runway alternation. The respite percentage reflects the proportion of the day where respite is likely. Where a respite percentage approaches 100%, this reflects 'relief' i.e. a community is more or less free from overflight. Where a respect percentage approaches 0%, this indicates that a location is continually overflown. A respite percentage of 50% indicates that a community is overflown for half of the day. Where this 50% occurs at a planned and scheduled period of the day, then respite is provided.

6.4.4 The ES uses respite percentage and corresponding figures to illustrate exactly which community would receive planned periods of respite. The information is used to clearly demonstrate that even for those that become overflown as a result of enabling easterly runway alternation, that respite can be provided.

Single Mode $L_{Aeq, 8hr}$ Noise Contours

6.4.5 To provide further information on noise levels each side of runway alteration, the ES presents single mode $L_{Aeq, 8hr}$ noise contours. These contours present average noise levels each side of alternation and the number of dwellings and population exposed to noise in 3 dB bands from 54 dB and considered easterly and westerly conditions. The contours provide some understanding of noise levels during and outside of alteration periods.

6.5 Metrics and matters not considered within the ES

6.5.1 A number of noise assessment metrics were recommended by LBH for the assessment of effects during consultation which not considered within the ES. These are outlined in the following sections. No request has been made by LBH under Regulation 22 of the EIA Regulations indicating that the Environmental Statement was insufficient without the various noise metrics and indicators described below.

Cumulative Assessment

6.5.2 Within pre and post-application correspondence, LBH asserted that the proposals must be assessed cumulatively with other potential proposals outside the scope of this application. The consideration of cumulative assessment is given in the Planning Proof of Evidence by Mr John Rhodes (HAL/JR/P/01) and appended Report by Mr Toby Gibbs.

1 dB Change and Significance

6.5.3 Despite the requests from LBH, the ES does not associate a 1 dB change in noise exposure with a significant effect. Although the 1 dB change metric is not classed as significant, the ES does present the number of households and dwellings that would receive such changes in noise exposure above relevant assessed noise exposure thresholds. Because that environmental information has been made available, should significant effects be attributed to a 1 dB change, the information provided within the ES would allow the decision-maker to consider the environmental effects on that basis.

N70 and N60 Metrics

6.5.4 Post-application consultation responses from LBH requested the effects of the proposals be presented using the N70 and N60 metrics.

6.5.5 There is discussion of the use of these metrics in the Airports Commission's July 2013 discussion paper *"Discussion Paper 05: Aviation Noise"*. This document post-dated the submission of the planning application.

6.5.6 The Commission explains that it believes this noise metric is useful for describing aircraft flyover frequency, citing its origin and use in Australia at Sydney Airport. It concludes by recommending the use of the N70 and N60 metrics (i.e. the number of noise events above 70 dB and 60 dB L_{Amax} respectively) but cautions that the metric does not consider event duration or time-above that level.

6.5.7 There are no social survey relationships developed against the N70 or any other 'number-above' metrics. To this end, the general consensus is that metrics of this nature provide a means of developing an understanding of the impact rather than a conclusion regarding the effects. The Airports Commission state in Paragraph 3.29 of *"Discussion Paper 05: Aviation Noise"*:

6.5.8 *"In Australia, N70 metrics do not replace the Australian ANEF (their version of LAeq) system, which remains the metric for use in Australian policy making. The Australian position is that N70 contours are a supplementary method to LAeq; this is also the position of the CAA in the UK"* [emphasis added]

6.5.9 The Airports Commission has made use of the "number above" indicators N70 (for day) and N60 (for night) in their assessment of expansion options at Heathrow and Gatwick. This indicator is a simple count of the average number of aircraft noise events above L_{Amax} levels of 70 dB and 60 dB respectively. In considering the N70, the Airports Commission have used average conditions.

6.5.10 In the Heathrow context, flyover frequency is closely linked to respite and relief, because with full runway alternation, regardless of wind direction it is possible to know that any particular morning or afternoon (after 15:00) will be free of aircraft overflights. With the Cranford Agreement this has not been possible, because while runway alternation took place on westerly operations, should the wind change, a community which was enjoying an absence of overflights to the west of the northern runway or the east of the southern runway would find they were being fully overflown. This situation is set out in terms of numbers of overflights in Tables 6.14 and 6.15 of the ES in a more clearly understandable way than would be the case if the same information were translated into N60 and N70.

Hourly L_{Aeq}, Single Mode Noise Contours

6.5.11 Throughout scoping LBH requested that noise contours be produced for each hour during single mode operations. These contours were not produced within the ES and instead HAL agreed to produced single mode 8-hour noise contours instead which were presented. Appendix G of the ES provided information on average hourly trends based on information taken from Heathrow's noise monitors.

6.5.12 Single mode contours can be helpful in understanding how noise is distributed and what levels of noise can be expected during a specific period or set of operating circumstances. This was acknowledged by the inspector at the Stansted G1 public inquiry however the inspector stated (paragraph 14.112) that:

6.5.13 *"They are of interest, but in my view add little to the assessment. I accept BAA's point that they represent an extreme case in which the Airport operated in the same mode all summer, a most unlikely eventuality as I understand it."*

6.5.14 Single mode contours of any time period are not supported by social survey data against which an assessment of effects can be undertaken.

Average Noise Contours below 57 dB $L_{Aeq, 16hr}$

6.5.15 Throughout scoping and consultations LBH reiterated that $L_{Aeq, 16hr}$ noise levels should be produced and presented down to 50 dB. The lowest any noise contour is presented for the $L_{Aeq, 16hr}$ metric within the ES is 54 dB. Below this value, the contours are not considered as sufficiently accurate.

6.5.16 In 2008, ERCD was asked by the Aircraft Noise Monitoring Advisory Committee (ANMAC) to investigate and potentially improve the accuracy of aircraft noise monitoring at locations outside of the 54 dB $L_{Aeq\ 16hr\ contours}$, and to consider issues related to modelling at these lower contour levels. The study was conducted and reported in ERCD Report 1006. ERCD report 1006 states that:

6.5.17 *"Contours below 54 dBA Leq 16hr are not produced because it has been considered that the results will not be sufficiently accurate. This is principally because at lower noise exposure levels aircraft are at higher altitudes and hence quieter, and their flight paths typically more scattered, making it more difficult and costly to collect large enough samples of data that will yield statistically reliable results."*

6.5.18 The ERCD report concluded that calculating noise contours accurately at levels below 54 dB $L_{Aeq, 16hr}$ would be difficult without more detailed modelling of aircraft tracks and an expansion of the fixed noise monitoring network.

6.5.19 It should also be noted that the value of 50 dB $L_{Aeq, 16hr}$ cannot be aligned to any confirmed or adopted guidance regarding community annoyance effects.

6.6 Effects of Re-fleeting

6.6.1 The revised air quality information for the proposals considers two future years of 2017 and 2020. The assessment of noise effects presented in the ES are against a 2015 assessment year. The future years considered in the air quality evidence are intended to consider expected changes in the airport's fleet mix as air traffic movements in the future assessment years will be consistent to those in 2015.

6.6.2 For noise, effects are the result of changes in the use of runways and airspace rather than the mix of aircraft and number of movements. The aircraft mix and number of movements in any given year would be the same with or without easterly runway alternation.

6.6.3 An example of this can be taken by comparing the outcomes of the 2008/9 noise assessment undertaken by ERCD in the consultations around ending the Cranford Agreement with the outcome of the 2015 assessment presented in the ES. These separate assessments, with different fleet mixes demonstrate consistent effects and outcomes.

6.6.4 A different fleet mix may result in some changes to the overall number of people exposed to different levels of noise. However, the 2020 fleet mix adopted in the air quality assessment is generally quieter than the 2015 and 2017 fleet mix assessed in the ES. For example, one of the noisiest aircraft in the 2015 fleet mix, the Boeing 747-400 (denoted by the 744 and 74D types), is reduced in number in the 2017 and 2020 mixes. Table 6.1 presents a comparison of the fleet mixes by aircraft type and movements. Appendix HAL/RTT/A/2 provides descriptions of the aircraft types denoted in Table 7.1.

6.6.5 An analysis of this has been undertaken by comparing the amount of noise produced by aircraft within the 2015, 2017 and 2020 fleet mixes through the use of their corresponding quota points. This is summarised in Table 6.2 and shows that for 2017 the aircraft fleet will produce a similar level of noise emissions as the quota points are comparable with the 2015 fleet mix. In 2020, the total number of quota points is lower than for 2015 and therefore it is reasonable to expect that the extent of the $L_{Aeq, 16hr}$ contours would be smaller in 2020 than in 2015 or 2017.

Table 6.1 2015, 2017 and 2020 Forecast Fleet Mixes and Movements

Aircraft Type	2015	2017	2020	Aircraft Type	2015	2017	2020
318	4	2	2	**74D**	0	10	0
319	249	224	172	**74H**	0	24	22
320	397	99	79	**74V**	0	23	15
320neo	0	17	136	**752**	2	0	0
321	162	159	126	**75T**	2	0	0
321neo	0	0	43	**75W**	18	6	4
32A	0	223	223	**763**	63	12	8
32C	0	30	30	**764**	18	18	16
32J	0	14	0	**767**	0	24	0
32S	2	6	6	**772**	109	30	20
330	0	4	4	**773**	6	4	2
332	16	14	16	**77A**	0	2	2
333	22	31	23	**77G**	0	17	17
343	10	3	3	**77J**	0	13	0
345	2	0	0	**77W**	64	64	48
346	18	14	2	**77X**	0	6	6
351	0	0	20	**77Y**	0	25	25
359	0	14	32	**77Z**	0	12	12
380	8	0	0	**781**	0	0	17
388	34	46	48	**787**	0	2	2
38A	0	17	17	**788**	28	38	44
733	4	0	0	**789**	8	49	79
734	4	0	0	**78B**	0	16	16
738	24	10	10	**AR1**	2	0	0
73H	20	31	2	**AR8**	2	0	0
73J	4	8	8	**E90**	0	4	4
73W	4	10	10	**E95**	2	0	0
744	77	3	1				

Table 6.2 2015, 2017 and 2020 Quota Points and Movements

	2015	2017	2020
Quota Points	1522.4	1473.8	1370.8
Movements	1385	1378	1372

7. Assessment of Effects

7.1 Introduction

7.1.1 This section sets out the effects of the proposals, as assessed and reported in the ES. The assessments presented in the ES demonstrated the following effects.

7.2 Air Noise

Daytime Annoyance

7.2.1 Tables 6.11 and 6.12 of the ES present the principal assessment of significance for daytime community annoyance using the $L_{Aeq, 16hr}$ metric. In accordance with the significance criterion presented in Table 6.10 of the ES, Table 6.12 of the ES presents the population with various magnitudes of change in average noise exposure above 57 dB $L_{Aeq, 16hr}$. Tables 6.11 and 6.12 of the ES are reproduced in Tables 7.1 and 7.2 below.

7.2.2 The assessment shows according to the $L_{Aeq, 16hr}$ metric that:

- More people will experience beneficial effects in terms of air noise exposure than adverse effects by a factor of around 2:1;
- Around 10,500 people will no longer be exposed to air noise of at least 57 dB $L_{Aeq, 16h}$;
- There will be an increase in the number of dwellings exposed to higher noise levels bands above 60 dB $L_{Aeq, 16hr}$;
- Around 1,700 households will experience significant adverse effects due to a 3 dB increase in noise exposure. These effects occur over Cranford; and
- Around 15,300 households will experience a reduction in aircraft noise of at least 1 dB compared to 7,050 households that will experience an increase of at least 1 dB.

7.2.3 Noise difference contours provided in Figures 6.8 of the ES show the increases in noise exposure occur at the western end of Runway 09L and under the initial stages of departure from Runway 09L. Increases of at least 3 dB are shown to occur in areas of Cranford.

7.2.4 Noise difference contours provided in Figure 6.9 of the ES show that decreases in noise exposure are would occur under final approach to Runway 09L, under initial departures from Runway 09R and at the western end of Runway 09R however these are in the region of 1 dB to 3 dB.

7.2.5 The assessment shows in Table 6.13 that 175 residential dwellings would be newly exposed to air noise levels of 69 dB $L_{Aeq, 16hr}$ and would therefore be eligible for assistance in the costs of moving under Heathrow's Home Relocation Assistance Scheme. Table 6.13 of the ES also shows that around 350 residential dwellings would be exposed to noise levels of 63 dB $L_{Aeq, 16hr}$ and be subject to at least a 3 dB increase in noise exposure. These dwellings would be eligible for full financial assistance towards the costs of noise insulation under Heathrow's Residential Insulation Schemes. This is discussed further in Section 8 of my proof.

Table 7.1 Assessment of Residential Population Exposure, Air Noise, $L_{Aeq, 16hr}$

Noise Level $L_{Aeq, 16hr}$	2015 Baseline			2015 with Full Runway Alternation on Easterlies			Change		
	Area (km^2)	Dwellings	Population	Area (km^2)	Dwellings	Population	Area (km^2)	Dwellings	Population
≥ 57	108.9	104500	251600	109.5	99700	241100	+0.6	-4800	-10500
≥ 60	59.3	42500	106900	59.7	43100	109250	+0.4	600	2350
≥ 63	34.2	17150	43550	35.4	18050	48600	+1.2	900	5050
≥ 66	20.1	5300	14400	20.3	5700	15400	+0.2	400	1000
≥ 69	9.9	1350	3550	9.9	1350	3500	0	0	-50
≥ 72	5.4	350	900	5.4	400	1100	0	50	200

Table 7.2 Noise Magnitude and Significance of Changes in $L_{Aeq, 16h}$ where $L_{Aeq, 16hr}$ is at least 57 dB

Increase / Decrease		Magnitude	Dwellings	Population	Significance
Increase	≥5 and <6 dB	High	350	1050	**Significant - Adverse**
	≥4 and <5 dB	High	800	2000	**Significant - Adverse**
	≥3 and <4 dB	High	550	1400	**Significant – Adverse**
	≥2 and <3 dB	Medium	1100	3000	Not Significant - Adverse
	≥1 and <2 dB	Medium	4250	11100	Not Significant – Adverse
Decrease	≥1 and <2 dB	Medium	14400	33950	Not Significant - Beneficial
	≥2 and <3 dB	Medium	900	2150	Not Significant – Beneficial
	≥3 and <4 dB	High	0	0	**Significant - Beneficial**
	≥4 and <5 dB	High	0	0	**Significant - Beneficial**
	≥5 and <6 dB	High	0	0	**Significant - Beneficial**
Total Increase (≥1 dB)			7050	18550	Adverse
Total Decreases (≥1 dB)			15300	36100	Beneficial
Total Significant Adverse Effects (≥3 dB)			1700	4450	Significant Adverse
Total Significant Beneficial Effects (≥3 dB)			0	0	Significant Beneficial

Comparison with ERCD Report 0705

7.2.6 Section 2.1 of my proof recaps the $L_{Aeq, 16hr}$ assessment undertaken by ERCD that informed the Government in making the decision to end the Cranford Agreement.

7.2.7 When considering the information provided in the ES, reproduced in Table 7.1 above with the information prepared by ERCD, as reproduced in Table 2.1 of my evidence, it can be seen that similar trends appear.

7.2.8 Both assessments show an almost identical net reduction in the number of people exposed to 57 dB $L_{Aeq, 16hr}$ at the cost of more people becoming exposed to higher levels of aircraft noise above 60 dB $L_{Aeq, 16hr}$.

7.2.9 With respect to the location and changes in the magnitude of noise exposure reported by ERCD, the ES also presents similar conclusions such as a 1-2 dB reduction in $L_{Aeq, 16hr}$ in locations under the final approach to Runway 09L and initial departures from Runway 09R.

7.2.10 The results of the $L_{Aeq, 16hr}$ assessment presented in the ES may therefore be considered to be entirely consistent with the information prepared by ERCD that informed Government policy.

Respite Provision

7.2.11 The ES presents respite percentages in Tables 6.14 and 6.15 of the ES for a selection of communities. The respite percentages are supplemented by Figures 6.10 - 6.17 of the ES. These figures illustrate the areas that are overflown during easterly operations with and without full runway alternation, the numbers of movements on each track and the corresponding respite percentage.

7.2.12 The figures show that by introducing full easterly runway alternation, the concentration of movements on existing tracks reduces. For communities under the easterly approaches and within the 57 dB $L_{Aeq, 16hr}$ and 55 dB L_{den} contours, respite percentages become 50% with full runway alternation. This compares to a respite percentage of less than 10% on approach to Runway 09L and around 95% on approach to Runway 09R.

7.2.13 For the communities under easterly approaches, the respite percentage of 50%, coupled to the proposals to operate runway alternation by schedule in the same manner as during westerly operations means that the respite provided would be planned and predictable by means of the alternation schedule.

7.2.14 Table 6.15 of the ES shows that for communities such as Windsor and Hatton, without easterly runway alternation, people are overflown continually throughout the day with around 630 overflights. With easterly runway alternation, this reduces to around 328 overflights, and for only half the day.

7.2.15 For communities such as Old Windsor, during easterly operations, these communities are rarely overflown in the absence of easterly runway alternation. The ES shows that with full runway alternation, these communities would be overflown for half a day according the runway alternation schedule. Although they would become overflown, they would be provided with half a day of predictable respite from aircraft noise.

7.2.16 For communities located under easterly departure routes, the provision of respite is less profound due to the overlapping of the dispersed departure routes. However, Figure 6.13 of the ES clearly shows the locations that would become overflown by easterly departures as a result of full easterly runway alternation. This figure identifies the number of aircraft movements expected on each route at location both inside and outside the 57 dB $L_{Aeq, 16hr}$ and 55 dB L_{den} contours.

7.2.17 When comparing the location of the significant adverse effects identified in Figure 6.8 of the ES with the locations that would become overflown by easterly departures from Runway 09L, it is apparent that these locations correspond to locations directly under the initial departure tracks of Runway 09L. Since Figure 6.11 shows that these locations are not overflown by dispersed departure tracks from Runway 09R, it can be reasonably concluded locations with significant adverse noise effects would also receive the benefit of predicable respite from departure noise for half a day during easterly operations.

Night Noise

7.2.18 The assessment of night-time air noise effects is provided in Paragraphs 6.8.46 – 6.8.50 of the ES.

7.2.19 Table 6.17 of the ES shows that the number of people exposed to 45 dB L_{night} would reduce by around 3,900 with increases in the number of people exposed to more than 50 dB L_{night}. (Note that in Table 6.17 of the ES the first column should be headed L_{night} and not L_{den})

7.2.20 Table 6.18 of the ES shows that around 18,100 people would experience decreases in noise exposure of at least 1 dB, as opposed to around 7,700 people that would experience an increase in noise exposure where L_{night} is at least 45 dB. The table therefore shows that more people would benefit from the proposals than dis-benefit.

7.2.21 Table 6.18 shows that there are no locations that would experience changes of at least 3 dB in night-time noise exposure above 45 dB L_{night}. The ES notes that the 90 dB SEL footprint from B747-400 departures from the northern runway is much greater than the 45 dB L_{night} contour to the east but falls within the extents of the L_{night} contour to the west. Cranford is therefore considered to be worst effected by easterly departures from the northern runway however since no noise level exposure changes were identified above 3 dB, no adverse significant effects are concluded.

7.2.22 The relatively low number of departures at Heathrow during the night compared to arrivals is reflected in the shape of the L_{night} contours presented in Figure 6.18 and 6.19 of the ES. These contours are elongated and thin thus indicating a dominance of arrival noise.

Education Establishments

7.2.23 The assessment of air noise effects upon educational establishments is provided in Paragraphs 6.8.51 – 6.8.56 of the ES.

7.2.24 Based on an analysis of noise monitoring data taken from noise monitors around Heathrow and presented in Appendix G of the ES, the ES aligned short-term noise exposure of 50 dB $L_{Aeq, 30min,}$ as taken from the BB93 guidelines for new schools, with an average daytime noise level of 44.5 dB $L_{Aeq, 16hr}$. This is significantly below the threshold level of 63 dB $L_{Aeq, 16hr}$ for the acoustic insulation of community buildings such as schools as defined in the APF.

7.2.25 The assessment within the ES identified 15 education establishments likely to be exposed to levels above 50 dB $L_{Aeq, 30min}$, 70 dB L_{Amax} and receive a 3 dB increase in noise exposure and therefore may receive likely significant effects.

7.2.26 The ES reports that none of these education establishments would be eligible for noise insulation under the Extended Community Buildings Scheme which is based on policy in the APF. The ES assessed this eligibility as exposure to 63 dB $L_{Aeq, 16hr}$ with a 3 dB increase in exposure. This approach was inconsistent with the APF and Heathrow have since reassessed eligibility to the scheme based on exposure to 63 dB $L_{Aeq, 16hr}$. This has identified a number of schools that are likely to be eligible for sound insulation measures as they are exposed to aircraft noise above a level that is considered significant to warrant the provision of insulation under Government policy. Details of these schools were provided in a letter to London Borough of Hounslow dated 1 October 2014. This is discussed further in Section 8 of my proof and a copy of this letter is provided in Appendix HAL/RTT/A/1.

Healthcare Facilities

7.2.27 The assessment of air noise effects upon healthcare facilities is provided in Paragraphs 6.8.57 – 6.8.62 of the ES.

7.2.28 Based on an analysis of noise monitoring data presented in Appendix G of the ES, the ES aligned a short-term noise exposure of 55 dB $L_{Aeq, 1hr}$ for daytime periods and 50 dB $L_{Aeq, 1hr}$ for night-time periods based on the HTM08-01 guidelines average noise exposure levels of 50 dB $L_{Aeq, 16hr}$ and 44.5 dB L_{night}.

7.2.29 The assessment identified that 5 healthcare facilities would experience an increase in exposure of 3 dB and were likely to be exposed to levels above 50 dB $L_{Aeq, 1hr}$ during daytime periods as a result of the proposals. Significant effects were concluded for these facilities however none of these were found to be located within either the 57 dB $L_{Aeq, 16hr}$ or 63 dB $L_{Aeq, 16hr}$ noise contours. No significant effects were identified at night.

Places of Worship and Community Buildings

7.2.30 The assessment of air noise effects upon places of worship and other community buildings is provided in Paragraphs 6.8.63 – 6.8.66 of the ES.

7.2.31 Table 6.19 of the ES shows that the number of places of worship and community facilities exposed to 57 dB $L_{Aeq, 16hr}$ would reduce as a result of the proposals and that a further 3 facilities would become exposed to 60 dB $L_{Aeq, 16hr}$.

7.2.32 Table 6.20 of the ES shows that three facilities would experience an increase of at least 3 dB as a result of the proposals and would be subject to significant adverse effects. The ES states that these facilities would be exposed to air noise levels of less than 63 dB $L_{Aeq, 16hr}$ but no more than 60 dB $L_{Aeq, 16hr}$ as a result of the proposals.

Assessments using other Metrics and Sensitivity Tests

7.2.33 Appendix G of the ES presents a number of air noise assessments using other metrics. The results of these assessments are outlined below.

L_{den}

7.2.34 As assessment of air noise effects using the L_{den} metric is presented in Appendix G. The assessment adopts the criterion that a change of 3 dB in exposure above a threshold level of 55 dB L_{den} is significant. In keeping the approach adopted for $L_{Aeq, 16hr}$ as described in Section 7.3 my proof, Appendix G presents noise level changes of at least 1 dB.

7.2.35 Table G.6 of the ES shows that full runway alternation during easterlies would result in an increase of 2,400 people being exposed to at least 55 dB L_{den}, but would reduce the number of people exposed to levels of at least 60 dB L_{den} by 4,650. The table shows increases in the number of people exposed to levels of at least 65 dB L_{den}.

7.2.36 When considering changes in noise exposure above 55 dB L_{den}, Table G.7 of Appendix G shows that 56,400 people would experience decreases of at least 1 dB in L_{den} opposed to 40,500 experiencing increases of at least 1 dB in L_{den}. Table G.7 shows that 12,850 people would observe a significant 3 dB increase in L_{den} and that nobody would receive a significant 3 dB decrease in L_{den}.

7.2.37 Whilst the population and magnitude of the changes presented for the L_{den} assessment are different to those concluded for the $L_{Aeq, 16hr}$ assessment, the L_{den} assessment arrives at similar conclusions i.e. more people would benefit from the proposals than dis-benefit however there would be significant adverse effects and no significant beneficial effects.

7.2.38 Noise difference contours presented in Figures G.11 and G.12 of Appendix G show the location of noise exposure increases and decreases respectively. With the exception of the larger extent considered by the 55 dB L_{den} contour, Figures G.11 and G.12 show the effects occurring in similar localities to those described for the $L_{Aeq, 16hr}$ in Paragraph 8.2.3 – 8.2.5 of my proof.

$L_{Aeq, 16hr}$ Sensitivity Tests

7.2.39 Appendix G of the ES provides a sensitivity test for the $L_{Aeq, 16hr}$ metric comparing the results provided in the Section 6.8 of the ES for the assessed modal split of 74%W/24%E with two westerly and easterly cases, 89%W/11%E and 60%W/40%E respectively.

7.2.40 The purpose of these tests was to show the potential implications of full runway alternation during easterly across a range of proportionate operating directions.

7.2.41 The results of the sensitivity test are provided in the same manner as the significance tests provided in Table 6.11 and 6.12 of the ES. The results of the sensitivity tests are provided in Table G.12 and Table G.13 of Appendix G and are reproduced in Table 7.2 and Table 7.3 below.

Table 7.2 Assessment of Residential Population Exposure, Air Noise, $L_{Aeq, 16hr}$

Noise Level $L_{Aeq, 16hr}$	Westerly (89W/11E)			Assessed Mode (76W/24E)			Easterly (60W/40E)		
	2015 Base	2015 WERA	Change	2015 Base	2015 WERA	Change	2015 Base	2015 WERA	Change
≥ 57	248150	245050	-3100	249250	239000	-10250	246700	239700	-7000
≥ 60	102650	106150	+3500	106000	108700	+2700	112950	109450	-3500
≥ 63	44500	45750	+1250	43150	47900	+4750	44850	48450	+3600
≥ 66	15200	15700	+500	14250	15100	+850	12450	14800	+2350
≥ 69	4100	4000	-100	3550	3400	-150	3000	3200	+200
≥ 72	1300	1100	-200	850	1100	+250	400	1050	+650

WERA (With Easterly Runway Alteration)

7.2.42 The sensitivity tests show that regardless of the modal split applied, the number of people exposed to levels of 57 dB $L_{Aeq, 16hr}$ or more reduces as a result of implementing full easterly runway alternation as shown in Table 7.2.

7.2.43 When considering changes in noise exposure and significance, each modal split shows that more people would experience a 1 dB reduction in noise exposure than a 1 dB increase.

7.2.44 The sensitivity test provided in Appendix G therefore demonstrate that over a range of modal splits the effects of full easterly runway alternation are consistent with those presented in Section 6.8 of the ES.

$L_{Aeq, 8hr}$ Single Mode Contours

7.2.45 Tables G.18 to G.22 of Appendix G provide $L_{Aeq, 8hr}$ noise exposure information representing each operating direction and each side of runway alternation.

7.2.46 The information presented in Table G.19 and Table G.20 represents single mode conditions during easterly operations with departures from Runway 09L and Runway 09R respectively.

7.2.47 A comparison of the tables shows $L_{Aeq, 8hr}$ noise exposure above 57 dB is lower when departures operate from the northern runway, 09L as opposed to the southern runway, 09R. Conversely, the tables also show that $L_{Aeq, 8hr}$ noise exposure to noise level bands above 66 dB $L_{Aeq, 8hr}$ is higher when departures operate from the northern runway, 09L as opposed to the southern runway, 09R.

7.2.48 Whilst providing an understanding of the noise exposure during the various modes of alternation, no significance can be drawn from these contours. Individually, the information does do not consider longer term exposure to aircraft noise which will comprise a mixture of runway modes, periods of respite and over flying, over a complete 16-hour day. To this end, it is incorrect to associate the level of exposure presented by this information with any research that underpins the use of the 57 dB $L_{Aeq, 16h}$ metric.

Table 7.3 Noise Magnitude and Significance of Changes in $L_{Aeq, 16h}$ where $L_{Aeq, 16hr}$ is at least 57 dB

Increase / Decrease		Westerly (89W/11E)	Assessed Mode (76W/24E)	Easterly (60W/40E)	Significance
Increase	≥6 dB	0	0	550	
	≥5 and <6 dB	0	350	650	**Significant - Adverse**
	≥4 and <5 dB	0	800	550	**Significant - Adverse**
	≥3 and <4 dB	350	550	2400	**Significant – Adverse**
	≥2 and <3 dB	550	1100	3450	Not Significant - Adverse
	≥1 and <2 dB	1000	4250	9900	Not Significant – Adverse
Decrease	≥1 and <2 dB	3050	14400	26350	Not Significant - Beneficial
	≥2 and <3 dB	25	900	1600	Not Significant – Beneficial
	≥3 and <4 dB	0	0	0	**Significant - Beneficial**
	≥4 and <5 dB	0	0	0	**Significant - Beneficial**
	≥5 and <6 dB	0	0	0	**Significant - Beneficial**
	≥6 dB	0	0	0	**Significant - Beneficial**
Total Increase (≥1 dB)		1900	7050	17500	Adverse
Total Decreases (≥1 dB)		3075	15300	27950	Beneficial
Total Significant Adverse Effects (≥3 dB)		350	1700	4150	Significant Adverse
Total Significant Beneficial Effects (≥3 dB)		0	0	0	Significant Beneficial

7.3 Ground Noise

7.3.1 The assessment of effects from ground noise sources was considered within Section 6.9 of the ES. In general, the results of the ground noise assessment resulted in a much lower number of people and receptors affected by the proposals than for the air noise assessment.

7.3.2 The ground noise effects presented within the ES include the introduction of the noise barrier at Longford.

Daytime Annoyance

7.3.3 Tables 6.21 and 6.22 of the ES present the assessment of significance for daytime community annoyance using the $L_{Aeq, 16hr}$ metric. In accordance with the significance criterion presented in Table 6.10 of the ES, Table 6.22 of the ES presents the population with various magnitudes of change in average noise exposure above 57 dB $L_{Aeq, 16hr}$. Tables 6.21 and 6.22 of the ES are reproduced in Tables 8.3 and 8.4 below.

7.3.4 The assessment shows that according to the $L_{Aeq, 16hr}$ metric:

- Above 57 dB $L_{Aeq, 16hr}$, the proposals only result in increases in ground noise exposure;
- Around 370 people will experience increases of at least 1 dB as a result of the proposals; and
- Around 60 dwellings would experience significant adverse effects as a result of a 3 dB increase in noise exposure.

7.3.5 Noise difference contours provided in Figures 6.24 of the ES show that increased noise exposure would occur around the western end of Runway 09L. These increases are confined to Longford. The contours indicate that those worst affected by the proposals are located to the south of Bath Road. Despite the increases in exposure, the modelling shows that no dwellings within the Longford area would be exposed to ground noise levels of at least 63 dB $L_{Aeq, 16hr}$. In contrast, air noise exposure with full easterly runway alternation within Longford is show in Figure 6.6 of the ES to be at least 69 dB $L_{Aeq, 16hr}$.

7.3.6 Figure 6.25 presents noise difference contours presenting decreases in average noise exposure. These contours show that the decreases in exposure occur around the western end of Runway 09R and do not coincide with the location of any receptors.

7.3.7 As the change in noise exposure as a result of full easterly runway alternation does not result in any dwellings becoming exposed to 63 dB $L_{Aeq, 16hr}$ as a result of a 3 dB increase in ground noise, no dwellings within Longford will newly qualify for insulation under Heathrow's Residential Insulation Scheme.

Table 7.4 Assessment of Residential Population Exposure, Ground Noise, $L_{Aeq, 16hr}$

Noise Level $L_{Aeq, 16hr}$	**2015 Baseline**			**2015 with Full Runway Alternation on Easterlies**			**Change**		
	Area (km^2)	**Dwellings**	**Population**	**Area (km^2)**	**Dwellings**	**Population**	**Area (km^2)**	**Dwellings**	**Population**
≥ 57	11.0	800	1950	11.3	950	2200	+0.3	+150	+250
≥ 60	8.4	50	150	8.7	100	200	+0.3	+50	+50
≥ 63	6.8	50	100	6.8	50	100	0	0	0
≥ 66	5.1	50	100	5.2	50	100	+0.1	0	0
≥ 69	3.4	60	100	3.6	50	100	+0.2	0	0
≥ 72	2.0	00	0	2.0	0	0	+	0	0

Table 7.5 Noise Magnitude and Significance of Changes in $L_{Aeq, 16h}$ where $L_{Aeq, 16hr}$ is at least 57 dB

Increase / Decrease		Magnitude	Dwellings	Population	Significance
Increase	≥5 and <6 dB	High	0	0	**Significant - Adverse**
	≥4 and <5 dB	High	10	20	**Significant - Adverse**
	≥3 and <4 dB	High	50	150	**Significant – Adverse**
	≥2 and <3 dB	Medium	100	200	Not Significant - Adverse
	≥1 and <2 dB	Medium	0	0	Not Significant – Adverse
Decrease	≥1 and <2 dB	Medium	0	0	Not Significant - Beneficial
	≥2 and <3 dB	Medium	0	0	Not Significant – Beneficial
	≥3 and <4 dB	High	0	0	**Significant - Beneficial**
	≥4 and <5 dB	High	0	0	**Significant - Beneficial**
	≥5 and <6 dB	High	0	0	**Significant - Beneficial**
Total Increase (≥1 dB)			160	370	Adverse
Total Decreases (≥1 dB)			0	0	Beneficial
Total Significant Adverse Effects (≥3 dB)			60	170	Significant Adverse
Total Significant Beneficial Effects (≥3 dB)			0	0	Significant Beneficial

Night Time Effects

7.3.8 The assessment of night-time ground noise effects is provided in Paragraphs 6.9.11 – 6.9.16 of the ES.

7.3.9 Table 6.23 of the ES shows that the number of people exposed to 45 dB L_{night} would increase by around 40 and above 50 dB L_{night} the numbers of people exposed would increase by 70 as a result of the proposals. Table 6.24 of the ES shows that no residential receptors would experience a 3 dB increase in L_{night} as a result of ground noise sources.

7.3.10 No significant night-time ground noise effects were identified.

Other Noise Sensitive Receptors

7.3.11 For all other noise sensitive receptors the ES does not identify any other significant ground noise effects.

7.4 Noise Induced Vibration

7.4.1 Section 6.12 of the ES provides a qualitative assessment of likely noise induced vibration effects based on Heathrow's studies undertaken at residential dwellings around Runway 27L.

7.4.2 The assessment provided in the ES demonstrates that the circumstances around Runway 09L are similar to those where noise induced vibration was identified around Runway 27L in terms of proximity to aircraft start-of-roll. The assessment concludes that significant noise induced vibration effect at receptors in Longford cannot be ruled out and there is a likelihood of significant adverse effects for properties with lightweight constructions.

7.4.3 For residential dwellings with light-weight constructions where noise-induced vibration effects are reported to have occurred, Heathrow will assess these effects and if possible they will be mitigated. Heathrow's mitigation proposals for noise-induced vibration effects are outlined in Section 9.

7.5 Challenges to the Assessment

7.5.1 The reasons for refusal challenge the adequacy of the description of environmental effects. This is driven by an opinion that incorrect metrics have been used and that the significance attached to changes in the value of the metrics is incorrect.

7.5.2 In the case of air noise, the assessments show very similar outcomes regardless of metric. All metrics and sensitivity tests show a reduction in aircraft noise for those communities under approach to Runway 09L and under initial departure routes from Runway 09R. The metrics show a corresponding increase in noise exposure for those located under the under the initial departure routes from Runway 09L, around the western end of Runway 09L and under the final approaches to Runway 09R.

7.5.3 In most cases, above relevant thresholds aligned with policy and guidance such as the 57 dB $L_{Aeq, 16hr}$ and 55 dB L_{den} the ES shows that more people would experience 1 dB decreases in noise exposure than 1 dB increases. Table 7.6 below summarises the populations with increases and decreases of at least 1 dB above these thresholds below along with the location within the ES where the information is presented.

Table 7.6 Populations with changes of at least 1 dB – Air Noise

Assessment / Metric	ES Reference	Increase of at least 1 dB(A)	Decrease of at least 1 dB(A)
57 dB $L_{Aeq, 16hr}$ assessed mode	Chapter 6 Table 6.12	18550	36100
55 dB L_{den} assessed mode	Appendix G Table G.11	39900	43950
45 dB L_{night} assessed mode	Chapter 6 Table 6.18	7700	18100

7.5.4 When considering the sensitivity tests for the westerly and easterly modal splits, the assessment also shows that in terms of dwellings, the numbers experiencing decreases of at least 1 dB in exposure are more than those experiencing an increase in noise exposure as illustrated in Table 7.7 below.

7.5.5 Should the view be taken that a 1 dB change in exposure is "significant" such as expressed by LBH in a number of correspondence then the information as identified and summarised in Table 7.6 and Table 7.7 is provided within the ES.

7.5.6 From the point of view of the requirement to describe likely significant effects, all noise effects are presented in great detail, and if a decision maker chooses to attach significance to noise effects smaller than those to which the label "significant" has been attached within the ES, the information necessary to make that judgement is given in the ES.

Table 7.7 Dwellings with changes of at least 1 dB – Air Noise Sensitivity Tests

Assessment / Metric	ES Reference	Increase of at least 1 dB(A)	Decrease of at least 1 dB(A)
57 dB $L_{Aeq, 16hr}$ westerly mode (89W/11E)	Appendix G Table G.13	1900	3075
57 dB $L_{Aeq, 16hr}$ easterly mode (60W/40E)	Appendix G Table G.13	17500	27950
55 dB L_{den} westerly mode (89W/11E)	Appendix G Table G.15	3900	13300
55 dB L_{den} easterly mode (60W/40E)	Appendix G Table G.15	22700	30850

7.5.7 The ES has adopted alternative metrics to communicate the effects of introducing full runway alternation. The use of respite percentages and associated figures, and the presentation of changes in the number movements by track and the areas overflown all help demonstrate that where adverse and beneficial effects are concluded predictable respite will be afforded to those communities. This approach complements the use of the $L_{Aeq, 16hr}$ and other average mode metrics by demonstrating changes to the operation of the airport and by highlighting that the proposals achieve the objective of extending the benefit of respite to communities overflown during easterly operations.

8. Proposed Mitigation

8.1 Introduction

8.1.1 Section 3 of my proof identifies the existing regulatory framework and mitigation that is already in place to control and manage noise at Heathrow. This section considers specific mitigation incorporated within Heathrow's proposals. There would be no change in existing mitigation as outlined in Section 3 as a result of enabling easterly runway alternation.

8.2 Operational Mitigation

Runway Alternation

8.2.1 The decision to end the Cranford Agreement has been made and confirmed by successive Governments so as to extend the benefits of runway alternation to communities under flight paths during easterly operations in the same way as has been offered as a form of mitigation since 1972 during westerly operations.

8.2.2 Runway alternation is itself an important noise mitigation measure and Heathrow's proposals seek to enable it during easterly operations.

8.2.3 At present during easterly operations, departures always occur from the southern runway with arrivals occurring on the northern runway. There is no scheduled runway alternation pattern which means for communities under final approaches such as those within Windsor or Colnbrook and for communities under initial departures such as Hatton, there is no respite from aircraft overflights. This means that when operating direction changes due to prevailing weather conditions, communities such as Windsor and Hatton become overflown without any scheduled period of respite. However, for communities such as Cranford and Stanwell Moor, these are no longer overflown and therefore experience relief from aircraft overflight.

8.2.4 The introduction of scheduled runway alternation during easterlies means that at a scheduled time, i.e. 1500hrs, departures and arrivals will switch runway providing communities such as Windsor with predictable respite from aircraft overflight and noise for half a day. This means that when there is a change in operating direction, these communities will no longer be overflown throughout the day and will receive a predictable period of respite for half a day according to the Airport's runway alternation schedule.

8.2.5 Feedback from Heathrow's own public consultations carried out in 2014, reported in the Heathrow report *"Taking Britain Further"* highlighted the importance of respite for local communities.

8.2.6 The results of the consultation showed that 62% of respondents felt that providing respite is more important than minimising the number of communities overflown. Heathrow therefore believes that respite is an important and valued method of mitigating the impacts of aircraft noise.

8.2.7 Whilst the introduction of runway alternation benefits those communities that are currently most affected by aircraft noise during easterly operations, its introduction will result in communities such as Old Windsor and Cranford becoming overflown. However, since the proposals are to introduce runway alternation, these communities will be overflown for half a day according to the alternation schedule and would therefore receive predictable periods of respite thus helping to mitigate the effects of becoming overflown.

8.2.8 Many of the communities that are overflown during easterly operations are also overflown when the Airport is operating in a westerly direction. For example, Old Windsor would become overflown by easterly arrivals as a result of enabling easterly runway alternation; however this community is already overflown by westerly departures. Likewise, areas to the south of Cranford are also already overflown during westerly arrivals to the northern runway.

8.2.9 The significant air noise effects identified by the Environmental Statement are principally located under departure routes from the northern runway in Cranford. These effects occur as this location is not currently overflown by either arrivals or departures.

8.2.10 Although significant effects are identified in these areas, aircraft overflights will occur for half a day during easterly operations thus providing some mitigation through respite. Since easterly conditions occur around 20-30% of the time (the extremes over the past 20 years are 11% and 46%), these locations would be overflown in total for around 10-15% of the year for most years. Although these areas become overflown, they would still receive the benefit of predictable periods of respite.

8.3 Physical Mitigation

Noise Barrier

8.3.1 The scheduled introduction of departures from the northern runway will increase and introduce aircraft ground activity in the region of the Runway 09L runway threshold. This activity will result in increased in noise at the closest receptors in the area of Longford. The ground noise assessment presented in Section 6.8 of the ES includes the noise barrier proposed in Longford. The significant effects identified are therefore residual.

8.3.2 In order to help mitigate ground noise from aircraft taxiing and holding prior to departure on Runway 09L, and in order to help reduce the effects of noise from aircraft start of roll, a 5m high, 593m long noise barrier is proposed on land at the Airport boundary between the airfield and receptors in Longford.

8.3.3 The noise barrier principally benefits receptors located to the south of Bath Road. In total, approximately 70 residential dwellings are located behind the proposed barrier to the south of Bath Road. These dwellings have rear facades and gardens that overlook the airport. Around 50 of these dwellings are not screened by an existing road traffic noise fence which is located between the T5 business car park and the Bath Road roundabout.

8.3.4 Whilst the erection of the barrier does not remedy all the significant ground effects identified within the ES, calculations show that the noise barrier will provide an average attenuation of 3 dB from ground activity around Runway 09L and at certain locations it would provide up to 5 dB of attenuation.

8.3.5 The overall noise climate within Longford is dominated by air noise. The noise contours presented in Figure 6.7 and Figure 6.22 show that overall average air and ground noise levels are around 69 dB $L_{Aeq, 16hr}$ and 60 dB $L_{Aeq, 16hr}$ respectively. Air noise is therefore a much more dominant component of the overall noise climate in Longford compared to ground noise. Indeed the combined air and ground noise assessment presented in Section 6.10 of the ES indicates that within Longford combined air and ground noise increases by 1-3 dB as a result of full easterly runway alternation thus corresponding with the identified air noise effects.

8.3.6 Due to the high levels of air noise within Longford, these properties have qualified for insulation or relocation assistance under Heathrow's existing schemes. It is understood from information provided by Heathrow's Property Team that most of the dwellings within Longford have already been provided with insulation.

8.3.7 Whilst the noise barrier would help reduce overall levels of noise, it does afford protection from the highest levels of ground noise by providing a physical screen between receptors in Longford and ground activity around Runway 09L. The construction of the barrier therefore provides a beneficial effect.

8.3.8 The construction of the noise barrier has a number of secondary effects. The increased height of the barrier compared to the existing length of traffic noise barrier between the T5 business car park and the Bath Road roundabout will help further reduce road traffic noise from the Northern Perimeter Road for those located behind the existing barrier. In addition, the barrier will be erected

around the T5 business car park. This will help reduce noise from car parking activities at the car park.

8.4 Insulation and Compensation

8.4.1 For some locations and receptors, the effects of enabling easterly runway alternation would result in overall noise exposure making a number of receptors eligible for noise insulation or compensation under enhancements of Heathrow's existing schemes. All of these schemes are fully compliant with the Government's expectations of airport operators as set out in the APF.

8.4.2 In addition to these schemes, Heathrow is also proposing a specific assessment and if possible, financial assistance towards addressing noise induced vibration effects from aircraft start of roll.

Residential Insulation Scheme

8.4.3 350 newly affected residential dwellings would be eligible for noise insulation under Heathrow's daytime residential insulation scheme. Eligibility to this scheme is based on the requirements of the APF as outlined in Paragraph 3.39 which states:

8.4.4 "Where airport operators are considering developments which result in an increase in noise, they should review their compensation schemes to ensure that they offer appropriate compensation to those potentially affected. As a minimum, the Government would expect airport operators to offer financial assistance towards acoustic insulation to residential properties which experience an increase in noise of 3dB or more which leaves them exposed to levels of noise of 63 dB LAeq,16h or more."

8.4.5 Heathrow's scheme exceeds the requirements of the APF by providing more than just assistance towards the cost of acoustic insulation. Heathrow's proposed scheme involves a free assessment to determine statement of need, and 100% contribution towards to the financial costs of any insulation and/or ventilation measures required to fulfil the statement of need.

8.4.6 This is a more generous offer compared to Heathrow's existing residential day noise insulation scheme which provides free secondary glazing or half price double glazing. This more generous offer is considered appropriate as the properties that are eligible will be those worst affected by the proposals as they are newly overflown by aircraft.

8.4.7 Only a relatively small proportion of the 350 newly affected residential dwellings have been eligible for noise insulation under Heathrow's existing residential day noise scheme, which is based on the 1994 69dBA $L_{Aeq\ 18hr}$. Analysis shows that fewer than 10 of the newly affected residential dwellings have been eligible for relocation assistance under Heathrow's home relocation assistance scheme which is based on the 2002 69 dB $L_{Aeq,\ 16hr}$ contour.

8.4.8 In summary, Heathrow's insulation offer is more generous than its existing schemes and goes beyond the minimum requirements of Government policy. On the whole, it will apply to residential dwellings that have not previously had the opportunity to benefit from Heathrow's schemes.

Home Relocation Assistance Scheme

8.4.9 Based on changes in the extent of the 2015 69 dB $L_{Aeq,\ 16hr}$ contour, due to introduction of easterly runway alternation, 175 residential dwellings become exposed to this level of noise and are therefore eligible for home relocation assistance under Heathrow's Home Relocation Assistance Scheme. These residential dwellings are already to some degree overflown by aircraft and experience some of the highest levels of aircraft noise around Heathrow. In most cases these dwellings become exposed to levels of at least 69 dB $L_{Aeq,\ 16hr}$ as a result of small (less than 1 dB) changes in aircraft noise exposure as a result of full easterly runway alternation.

8.4.10 Heathrow's scheme meets the requirements of the APF as set out in Paragraph 3.36 which states:

8.4.11 *"The Government continues to expect airport operators to offer households exposed to levels of noise of 69 dB LAeq,16h or more, assistance with the costs of moving"*

8.4.12 Heathrow's Home Relocation Assistance Scheme is based on the extent of the 2002 69 dB $L_{Aeq, 16hr}$ contour. This contour is larger than and encompasses the 'with easterly runway alternation' 2015 69 $L_{Aeq, 16hr}$ contour assessed within the Environmental Statement. Some of the 175 residential dwellings have therefore already been offered home relocation assistance under Heathrow's existing schemes.

8.4.13 Under this scheme, eligible properties receive financial assistance towards the costs of moving amounting up to a reasonable cap of £12,500 per dwelling.

Community Buildings Insulation Scheme

8.4.14 Under the APF, the Government expects airport operators to (Paragraph 3.37):

8.4.15 *"offer acoustic insulation to noise-sensitive buildings, such as schools and hospitals, exposed to levels of noise of 63 dB $L_{Aeq,16h}$ or more. Where acoustic insulation cannot provide an appropriate or cost-effective solution, alternative mitigation measures should be offered."*

8.4.16 Heathrow's community buildings insulation scheme complies with these requirements.

8.4.17 Since the Environmental Statement, Heathrow has commissioned a review of potential improvements to the noise conditions at nine schools located in Hounslow. These schools are likely to be eligible for noise insulation under Heathrow's scheme. These are outlined in Table 9.1 below along with details regarding the potential improvements that can be made, options that are available and where further investigation and testing is required. Table 9.1 also shows calculated noise exposure levels with and without full easterly runway alternation.

8.4.18 Table 9.1 shows that all of the nine schools have already been subject to insulation and measures under Heathrow's existing schemes. However, further improvements may be possible and under Heathrow's proposals further mitigation such as ceiling over boarding and mechanical ventilation will be provided. Heathrow will pay the costs of this further mitigation.

8.4.19 Table 9.1 shows that Cranford Junior and Primary Schools will experience the greatest increase in noise exposure as a result of full easterly runway alternation. This is due to the proximity of these schools to the end of Runway 09L. They would therefore become exposed to departure noise and would also experience an increase in the number of aircraft overflights as a result of the proposals. These schools are already affected by aircraft arrival noise onto Runway 27R.

8.4.20 Both Cranford Junior and Cranford Primary school have already received noise insulation measures under Heathrow's existing scheme but would become exposed to overall levels of aircraft noise of around 65 dB $L_{Aeq, 16hr}$. This level of exposure is similar to what is already experienced at Grove Road Primary and Hounslow Heath Infant and Nursery School which have also been afforded noise insulation under Heathrow's schemes.

8.4.21 Heathrow has commissioned pre and post insulation acoustic surveys within teaching rooms at Grove Road Primary and Hounslow Heath Infant and Nursery Schools. In the case of Grove Road Primary, noise insulation measures undertaken in 2005 in the form of acoustic glazing was found to improve the noise insulation of teaching areas by a further 6 dB. This was found to result in internal noise levels being within 3 dB of the internal noise level requirement for general classrooms for new schools of 35 dB as defined by the performance standards provided in the 2003 version of BB93. In the case of Hounslow Heath Primary School, replacement glazing was found to reduce noise levels to below 30 dB L_{Aeq} within Classroom No. 2. Copies of the acoustic survey reports for these schools post insulation are provided in Appendix HAL/RTT/A/3.

8.4.22 Acoustic testing reports for Cranford Infant School and Cranford Primary School are also provided in Appendix HAL/RTT/A/3. These reports show that noise insulation measures have reduced internal noise levels to 5 dB of the BB93 guidance.

8.4.23 The acoustics reports demonstrate that acoustic insulation of schools can be effective, even where overall noise exposure levels are above 63 dB $L_{Aeq, 16hr}$.

8.4.24 For most of the schools presented in Table 8.1, noise exposure levels as a result of full easterly runway alternation would change by less than 1 dB. These changes are likely to be due to increases in overflight rather than new noise exposure such is the case with Cranford Junior and Primary Schools. It is therefore considered that further improvements of the noise insulation of these schools would improve upon current conditions at these schools.

Table 8.1 Progress and Options for Schools Identified for Possible Insulation Works

School	Noise Exposure ($L_{Aeq, 16hr}$)			Details
	2015 Without Easterly Runway Alternation	2015 with Easterly Runway Alternation	Considered under existing scheme and already subject to insulation measures	
• **Cranford Junior School**	62.5	64.9	✓	Due to its proximity to the airport, Cranford Junior and Primary Schools have already benefited from some acoustic insulation. However, these works were undertaken approximately ten years ago and it is considered that new double glazing and other works will improve the internal noise environment. These works could include double glazing, acoustic porches around external door and installation of dense ceiling boards.
• **Cranford Primary School**			✓	
• **Orchard School**	62.6	63.1	✓	Orchard School has recently had acoustic glazing installed. However, ceiling overboarding may be appropriate, subject to internal noise testing.
• **Beavers Community Primary School**	63.6	63.7	✓	The change in noise level here is very low therefore an independent assessment is required to establish what mitigation measures can be installed that will be of actual benefit to the internal noise environment.
• **St Michaels &St Martins RC School**	62.4	63.0	✓	Glazing has recently been installed, therefore is has been assumed that mitigation will be limited to ceiling upgrades. Mechanical ventilation has already been provided.
• **Hounslow Heath Infant and Nursery School**	62.4	63.3	✓	These schools have recently had new double glazing and in part had the ceilings upgraded. They have also been part of a pilot project for mechanical ventilation.
• **Hounslow Heath Primary School**	63.9	64.5	✓	
• **Grove Road Primary**	65.2	65.5	✓	These schools have not undergone an initial assessment, however considering the low increase in noise levels, no mitigation has been assumed. Further work will be subject to individual noise testing.
• **Chatsworth Infants School**	63.4	63.4	✓	
• **Chatsworth Junior School**	63.3	63.5		

Noise Induced Vibration

8.4.25 The Environmental Statement highlighted the residual risk of noise induced vibration from aircraft departure start of roll on Runway 09L within lightweight structures and conservatories within 500m of the runway. This corresponds with distances where these effects have been observed at other locations around Heathrow.

8.4.26 Heathrow will assess any such structures within 500m of the runway in the area of Longford to assess what action may be taken to mitigate any of the effects of from noise induced vibration. Where it is considered that mitigation is possible, Heathrow will provide financial assistance of up to £10,000 towards remediation.

8.5 Mitigation in the context of the NPSE

8.5.1 The first aim of the NPSE is to avoid significant adverse effects on health and quality of life. The NPSE aligns this aim with SOAEL.

8.5.2 Clarification of the way in which the NPSE aims are to be met has been given in the recent decision of the Secretaries of State on the DCO application for the Thames Tideway Tunnel. This makes clear that SOAELs are avoided by the provision of noise insulation at established trigger levels. The APF provides guidance and policy on when noise insulation should be provided to residential and community buildings as a result of increases or exposure to aircraft noise.

- For residential dwellings, the APF requires financial assistance be provided towards acoustic insulation where there is an increase in noise exposure of 3dB or more resulting in exposure of 63 dB $L_{Aeq\ 16hr}$ or more; and
- For community buildings, the APF requires acoustic insulation should be provided where these buildings are exposed to aircraft noise 63 dB $L_{Aeq\ 16hr}$ or more.

8.5.3 These levels and criteria are therefore aligned to the definition of SOAEL (Significant Observed Adverse Effect Level) for airport operations in the context of the NPSE. Heathrow's mitigation offer complies with the requirements of the APF and therefore complies with the requirements of the NPSE.

8.5.4 The second aim of the NPSE, namely to mitigate and minimise adverse impacts on health and quality of life, is also met. The introduction of easterly runway alternation provides mitigation 'at source' along with the range of noise management measures already in place at Heathrow as outlined Section 4 of my proof. All of these actions and measures are directed at mitigating and minimising the adverse impacts of noise in a fair and proportionate way. The application proposals themselves promote alternation, which is itself an important method of mitigating the noise effects for communities located around Heathrow. Heathrow's other mitigation proposals including the noise barrier at Longford will also help mitigate the effects of the proposals.

8.6 Appropriateness of Providing Noise Insulation from 63 dB $L_{Aeq,\ 16hr}$

8.6.1 As outlined above, under Government policy, noise insulation may be provided to residential or community buildings where aircraft noise exposure is at least 63 dB $L_{Aeq,\ 16hr}$.

8.6.2 Noise insulation has long been a mitigation measure used to counter the effects of transportation noise. When first introduced for highway noise over 30 years ago, residential buildings had poorly sealed single-glazed windows, and improvements to their sound insulation involved the installation of secondary glazing with a large depth of airspace between the secondary and primary panes. Most modern houses now have double glazing, using sealed units in well-fitting frames which give a substantially greater noise reduction than was the case in the 1970s when the first noise insulation schemes were designed. On the other hand, trigger levels for noise insulation schemes remain at figures approximately equivalent to 63 dB $L_{Aeq\ 16hr}$ free-field, even though the uninsulated noise effect at these levels for closed windows is not as great as it was when the schemes were set up. Noise insulation packages are accompanied by provision of noise-attenuated ventilators since secondary glazing is only fully effective with closed windows.

8.6.3 In considering the appropriateness of the noise insulation threshold there are a number of considerations. Although secondary glazing and alternative ventilation reduces internal noise levels, it is not always wanted by householders, and there is a significant proportion who do not take up offers of noise insulation. Lowering the threshold can be expected to result in a still lower take-up rate. About 10% of the UK population are exposed to noise broadly equivalent to 63 dB $L_{Aeq\ 16hr}$ and the figure is about 40% for 57 dB $L_{Aeq\ 16hr}$. As far as daytime health effects of noise are concerned, and specifically aircraft noise effects, Hansell et al. in the British Medical Journal article *"Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study"* [BMJ 2013; 347 doi: http://dx.doi.org/10.1136/bmj.f5432 (Published 8 October 2013)] present results

indicating that cardiovascular disease not rise materially up to the highest 3dB band considered, namely >63 dBA.

8.6.4 The Health Impact Assessment produced for the current planning application evaluates the health effects under the noise heading with respect to annoyance, sleep disturbance, cognitive effects on schoolchildren, and cardiovascular disease. For annoyance its test is the percentage highly annoyed calculated using the formula provided in the 2002 EU Position Paper on Annoyance.

8.6.5 The EEA Technical Report 11/2010 *"Good practice guide on noise exposure and potential health effects"* points out that the 2002 EU Position Paper on Annoyance has been overtaken by, for example, the HYENA work, and recommends the use of more recent data in impact assessment. The HYENA findings are notable in showing an increase in the gradient of the curve relating percentage highly annoyed during the day to L_{den} in the range 60-65 L_{den}. At Heathrow, L_{den} is about two units greater than $L_{Aeq\ 16hr}$.

8.6.6 Although the relationship between L_{night} and $L_{Aeq\ 16hr}$ depends on location and modal split, a noise insulation threshold of 63 dB $L_{Aeq\ 16h}$ also broadly achieves mitigation at 55 dB L_{night}, the interim target of the Night Noise Guidelines for Europe. Although only expressly identifying LOAEL (40 dB L_{night}), because SOAEL is a creation of the NPSE the description attaching to 55 dB L_{night} accords with the definition of SOAEL.

8.6.7 Where a noise insulation threshold is applied to a change such as the introduction of full alternation on easterly operations, the threshold has to be accompanied by a noise change. The main reason for selecting an appropriate noise change trigger is uncertainty, both in terms of accuracy of prediction and measurements, and interpretation in terms of noise and social survey results. The uncertainty associated with noise measurement is at least 1 dB, and noise prediction at least as great. There is also uncertainty in predicting public response to noise. Based on the ANIS and ANASE results, for any social survey location:

- If two different noise environments differ by 1 dB on the $L_{Aeq\ 16h}$ index there is approximately a 20% probability that a social survey would show no change in annoyance.
- If two different noise environments differ by 2 dB on the $L_{Aeq\ 16h}$ index there is approximately a 16% probability that a social survey would show no change in annoyance.
- If two different noise environments differ by 3 dB on the $L_{Aeq\ 16h}$ index there is approximately a 12% probability that a social survey would show no change in annoyance.

8.6.8 A 3 dB change has been widely used in environmental statements as the point at which a change in the noise environment becomes significant. The considerations set out above suggest that this threshold is appropriate.

8.7 Addressing Potential Criticisms of the proposed mitigation

8.7.1 In seeking to enable Government policy of introducing runway alternation during easterly operations, Heathrow has proposed pragmatic, proportionate and policy-compliant mitigation as outlined above.

8.7.2 There is however likely to be criticism that the mitigation provided is insufficient by measures and significance criterion applied within the ES or requested by the local authorities at points throughout scoping and following the application.

Proposed Third Runway Sound Insulation Scheme

8.7.3 In January 2015, Heathrow announced an improved sound insulation scheme that would be offered should the Airport's third runway proposals be supported by Government. The announcement was made in Heathrow's consultation response to the Airports Commission's initial assessments.

8.7.4 The proposed compensation scheme comprises of two-tiers, encapsulating dwellings falling within the 55 dB L_{den} and 60 dB $L_{Aeq,\ 16hr}$ contours. For dwellings within the 55 dB L_{den} contour, the Airport

proposes a £3,000 contribution towards acoustic insulation. Within the 60 dB $L_{Aeq, 16hr}$ contour, the Airport proposes to provide the full costs acoustic insulation.

8.7.5 Whilst this scheme goes well beyond current UK policy requirements of the APF, the requirement to develop a new scheme in the event of any Government decision on nationally significant airport expansion is itself current Government policy. Paragraph 3.41 of the APF states:

8.7.6 *"Any potential proposals for new nationally significant airport development projects following any Government decision on future recommendation(s) from the Airports Commission would need to consider tailored compensation schemes where appropriate, which would be subject to separate consultation."*

8.7.7 Heathrow's proposals for this scheme are therefore in the context of capacity expansion and in this context, comply with the APF. With respect to enabling easterly runway alternation, the APF is clear on what mitigation and compensation airport operators should be provided. Heathrow's mitigation schemes are fully compliant with the requirements of the APF.

Mitigating Significant Effects

8.7.8 The Environmental Statement identifies a number significant adverse air noise effects. These significant effects occur principally within Cranford which would become overflown by departures as a result of enabling easterly runway alternation. These effects are identified within the 57 dB $L_{Aeq, 16hr}$ contour.

8.7.9 Not all of the receptors identified with significant adverse effects are eligible for noise insulation or compensation under Heathrow's schemes but would, as outlined in Section 9.2, receive the benefit of runway alteration and predictable periods of respite from aircraft overflight. In context, overflight of these communities would be for 10-15% of the time, when the airport is operating on easterlies.

8.7.10 Should a targeted insulation scheme be provided to all receptors with significant adverse effects as a result of easterly operation, this would result in insulation being provided to those that are overflown for less than 15% of the time. This would result in a situation in which other receptors around Heathrow are exposed to higher levels of aircraft noise, but are not eligible for help with the costs of insulation.

8.7.11 Aircraft noise policy in the APF is clear on what is expected of airport operators with regards to noise insulation and compensation. The thresholds set by Government in policy, based on overall levels of average noise exposure, provide a measure of priority and fairness. Heathrow's insulation and compensation offer fully complies with this policy.

8.7.12 Whilst sound insulation schemes allow internal noise levels to be reduced, they do not help mitigate the effect of aircraft noise on outdoor amenity spaces. Respite is one measure that can provide for periods of time in outdoor spaces absent of aircraft overflight. Those experiencing significant adverse effects from the proposals would be provided predictable respite.

9. Conclusions

9.1.1 Successive Governments have decided to end the Cranford Agreement and the appeal proposals are required in order to implement that policy decision.

9.1.2 As outlined in Section 2 of my proof, the Government's policy on aviation is set out in the Aviation Policy Framework, which as well as reaffirming the decision on the Cranford Agreement sets out the Government's approach and thinking on airport noise management and mitigation.

9.1.3 The Cranford Agreement was made after taking into account the noise effects identified by the CAA and set out in detail in ERCD Report 0705. As I outlined in Section 8, while this assessment differs in detail from the ES findings, the overall picture is similar and leads to the same conclusions.

9.1.4 Both the ES and ERCD report show that ending the Cranford Agreement and implementing full easterly runway alternation would remove around 10,500 people from the 57 dB $L_{Aeq, 16hr}$ contour. This corresponds with the Government's policy objective on aircraft noise to *"limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise"*.

9.1.5 Full runway alternation on easterlies would result in more people experiencing 1 dB decreases in noise exposure than 1 dB increases in noise exposure where exposure is at least 57 dB $L_{Aeq, 16hr}$. By the 3 dB measure of significance set out in the ES, there would however be significant adverse air noise effects associated with the proposals and no significant beneficial effects. This should not however detract away from the fact that more people would benefit from easterly runway alternation than would become disadvantaged.

9.1.6 In addition to assessment against the 57 dB $L_{Aeq, 16hr}$ metric, the ES has considered a number of alternative measures to assess the impacts of easterly runway alternation. These measures included L_{den}, respite percentages, and movements by track. This approach meets the requirements of the APF. These assessments do not replace and are not in substitution of the $L_{Aeq, 16hr}$ assessment which underpins the assessment of significant effects.

9.1.7 Using alternative measures, the ES has demonstrated that the proposals would extend the benefits of predictable respite to those located under final approaches and initial departures on Runway 09L and Runway 09R respectively. It also demonstrates that for communities which would become overflown during easterly operations and which would experience an increase in noise as a result, respite would also be provided helping to mitigate the impacts of the proposals.

9.1.8 The Government's decision to end the Cranford Agreement directly considers the benefit of respite that would be afforded to communities during easterly operations, a practice as demonstrated in Section 4 of my proof, which has been implemented since the 1970s during westerly operations.

9.1.9 The Government's decision also makes reference to distributing noise more fairly around the airport. This is supported by the APF which promotes the provision of predictable respite where communities are intensively overflown as is currently the case during easterly operations at Heathrow.

9.1.10 Recognising that there will be increases in noise exposure, particularly for those exposed to higher levels of aircraft noise, the proposals also include mitigation in the form of noise insulation and compensation. This was understood by the Government in making the decision to end the Cranford Agreement. Heathrow's proposed compensation and noise insulation schemes under the proposals therefore comply with, and in some respects exceed, the requirements of the APF.

9.1.11 Heathrow's noise insulation and compensation schemes are not available to all receptors identified with significant adverse effects within the ES. As demonstrated in Section 9.6 of my proof, this does not mean these effects will not be mitigated. The proposals themselves are to introduce respite and the ES demonstrates that where significant adverse effects occur, respite will be provided.

9.1.12 Other specific mitigation included within Heathrow's proposals includes a noise barrier for the community of Longford that would help reduce exposure to the highest levels of ground noise and proposals to provide financial assistance towards addressing the impact of noise-induced vibration within lightweight structures within Longford.

9.1.13 As demonstrated in Section 4 of my evidence, Heathrow is subject to an extensive regulatory framework of noise management and mitigation. This framework applies to all of Heathrow's operations including those under these proposals.

9.1.14 The APF, of course, is consistent with other national policy, including the policy aims of the NPSE, and the guidance of the NPPG. Heathrow's compliance with the APF therefore ensure compliance and consistency with other relevant national policy and guidance on aircraft noise. As I outline in Section 9.5 of my proof, this includes mitigation.

9.1.15 Finally, in Section 4 of my proof I have demonstrated that the circumstances that led to the introduction of the Cranford Agreement in 1952 no longer apply.

10. Glossary

Term	Description
09L/27R	The northern runway on easterly / westerly operations
09R/27L	The southern runway on easterly
AIP	Aeronautical Information Publication
ANIS	Aircraft Noise Index Study
ANMAC	Airport Noise Monitoring Advisory Committee
APF	Aviation Policy Framework
ATMs	Air Traffic Movements
BAA	British Airports Authority
CAA	Civil Aviation Authority
CDA	Continuous Decent Approach
dB	Decibel (A-weighted Sound Pressure Level)
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfES	Department for Education and Skills
DfT	Department for Transport
EIA	Environmental Impact Assessment
EPNL	Effective Perceived Noise Level
ERCD	Environmental Research and Consultancy Department
ERCD	Environmental Research and Consultancy Division
ES	Environmental Statement
GLA	Greater London Authority
HACC	Heathrow Airport Consultative Committee
HAL	Heathrow Airport Limited
HNF	Heathrow Noise Forum
HTM	Health Technical Memorandum
ICAO	International Civil Aviation Organisation
L_{Aeq}	A-weighted equivalent continuous sound level
$L_{Aeq, T}$	A-weighted equivalent continuous sound level as measured over the time period, T
$L_{Aeq, 16hr}$	Equivalent continuous sound level of aircraft noise in dB. For conventional historical contours this is based on the daily average movements that take place in the 16 hour period (0700-2259 hrs local time) during the 92 day period between the 16 June and 15 September inclusive.

Term	Description
$L_{Aeq, 1hr}$	Equivalent continuous sound level of aircraft noise in dB. For conventional historical contours this is based on the daily average movements that take place in 1 hour period (0700-2259 hrs local time) during the 92 day period between the 16 June and 15 September inclusive.
$L_{Aeq, 30min}$	Equivalent continuous sound level of aircraft noise in dB. For the assessment, the indicator has been used to present the daily average movements that take place in 30 minutes period (0700-2259 hrs local time) during the 92 day period between the 16 June and 15 September inclusive.
$L_{Aeq, 8hr}$	Equivalent continuous sound level of aircraft noise in dB. For the assessment, the indicator has been used to present the daily average movements that take place in the 8 hour period (0700-2259 hrs local time) during the 92 day period between the 16 June and 15 September inclusive.
L_{Amax}	The maximum recorded noise level. For aircraft noise the results usually use the 's' time weighting.
LBH	London Borough of Hillingdon
L_{den}	The day, evening, night level, L_{den} is a logarithmic composite of the L_{day}, $L_{evening}$, and L_{night} levels but with 5 dB being added to the $L_{evening}$ value and 10 dB being added to the L_{night} value.
L_{eq}	Equivalent continuous sound level
$L_{evening}$	The A-weighted equivalent continuous sound level calculated using the annual average of aircraft movements over the 4 hour evening period of 1900- 2259 hrs local time.
LDF	Local Development Framework
LFF	Local Focus Forum
L_{night}	The A-weighted equivalent continuous sound level calculated using the annual average of aircraft movements over the 8 hour night period of 2300 – 0659 hrs local time.
LOAEL	Lowest Observed Adverse Effect Level
N_{60}	Number of noise events above L_{Amax} of 60 dB
N_{70}	Number of noise events above L_{Amax} of 70 dB
NATS	National Air Traffic Service
NOEL	No Observed Effect Level
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPRs	Noise Preferential Routes
NPSE	National Policy Statement for England
QC	Quota Count
RCD	Research and Consultancy Department
SEL	Sound Exposure Level
SID	Standard Instrument Departure Route

Term	Description
SoCG	Statement of Common Ground
SOAEL	Significant Observed Adverse Effect Level
SoS	Secretary of State
UAEL	Unacceptable Adverse Effect Level
UDB	Unitary Development Plan

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