

Airports Commission Discussion Paper 05: Aviation Noise

Heathrow Airport Limited response

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This document is Heathrow's response to the Airports Commission's fifth discussion paper on aviation noise. Our response follows the same structure to the Commission's own paper and we provide commentary on each of the Commission's main chapters. At the end of our document we provide a short table with summary responses to each of the Commission's specific questions, and a cross-reference to the sections of the document containing more detailed discussion.

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Overview

a. Introduction

Heathrow is a critical part of the local and national economy and is the quickest and cheapest way to deliver economic growth from increased hub airport capacity. Heathrow's activities reflect the need for a careful balance between the local and national benefits of a hub airport and the airport's impact on the local community, in particular in terms of noise. The Aviation Policy Framework published by the Government recognises that noise is a significant concern for some and sets out the Government's aspiration to "strike a fair balance between the negative impacts of noise and the positive economic impacts of flights"¹.

Heathrow is at the forefront of international efforts to tackle noise and has been successful in reducing the number of people exposed to noise by around 90% since the 1970s, even though the number of flights at the airport has almost doubled². We accept that if Heathrow is to grow, a comprehensive package of measures to tackle noise will need to be introduced. There will not need to be a choice between more flights or less noise – both will be delivered.

b. Our response to Airports Commission's discussion paper

How does noise affect people?

Noise around Heathrow needs to be put in context. The majority of those within Heathrow's noise footprint are also in London, where background noise is at typical urban levels. Noise from road traffic in London affects four times more people than noise from Heathrow. In choosing to live in a major city, people have made a judgement on whether the benefits (such as access to jobs and city amenities) outweigh the downsides (including a noisier environment). In contrast, proposals to establish a new hub airport in the Thames Estuary or at Stansted may have a disproportionate impact on what are relatively quiet, predominantly rural areas. There is evidence that quiet areas are of value to people, with 91% of respondents to a survey stating that such areas need protecting³. Heathrow is not unusual in having a noise footprint over a major city – the number of people in its footprint is similar to LAX (Los Angeles) and JFK (New York)⁴.

Although the 'noise footprint' (or average noise contour) is a well-recognised and comparable measure, not everyone within it is affected by noise. The Commission rightly notes that 'annoyance is subjective'; it is related not only to objectively measurable noise but to non-acoustic factors including an individual's sensitivity to noise, for example. Polling shows that noise is not an issue for the majority of people within the 'noise footprint', even those living closest to the airport. During the Operational Freedoms Trial, polling conducted by Populus showed that more than 80% of people around the airport did not feel that noise pollution impacted their daily life⁵ while 69% of local residents believed that the benefits of Heathrow outweighed the disadvantages to their local community⁶.

The property market provides further strong evidence that many are not concerned by noise, or feel that the benefits of living close to a major international hub outweigh the downsides. Additional properties continue to be developed within the airport's noise footprint: the number of households in Heathrow's 2010 noise contour was 16% higher than it had been in 1991⁷. Hounslow, the local authority most affected by Heathrow's noise footprint, has experienced a rapid rise in population. According to the 2011 census, Hounslow's population had increased by 20% or 42,000 people, in the ten years since 2001⁸. Furthermore, 70% of property owners within Heathrow's '55 Lden' noise contour have purchased their property within the last fifteen years⁹. This suggests that people are readily able to sell their houses and equally that others are willing to buy them. Thus individuals are able to make a choice in balancing their own priorities.

Health is another area where benefits and dis-benefits need to be balanced. In our submission to the Commission on long-term options, we set out how Heathrow currently employs 76,600 people on site, supports 114,000 jobs within the local area and with additional capacity could create between 70,000 and 150,000 additional jobs. A high-level assessment commissioned by Heathrow shows that by creating new jobs and raising income levels a new runway at Heathrow could have positive health

effects. Whilst we accept a new runway could also have some negative health effects, the evidence for many of these effects is not clear cut. We believe that by taking a balanced view neither noise nor health concerns should be obstacles to further development at Heathrow.

Measuring aviation noise

The Government has retained the 57 dB Leq contour as a core metric for aviation noise. We support that and, in our submission on long-term options, we demonstrated how we can add a third runway at Heathrow while reducing the population within that contour by 10 – 20% by 2030. We will continue to look for opportunities to improve this performance. All of our options have also sought to maximise periods of respite from noise, a direct response to feedback from local communities.

We agree that no single indicator can describe every aspect of noise to different stakeholders and that a ‘balanced scorecard’ is needed. Heathrow is already at the forefront developing this kind of scorecard. Following extensive research and stakeholder engagement we have developed a range of ‘supplementary metrics’ that complement traditional noise contours and that we use for our ‘Community Noise Monitoring Programme’. If a Heathrow option is shortlisted by the Commission, we will develop a balanced scorecard to complement the 57 Leq contour in describing the noise effects of additional capacity. Measures like the ‘Persons Events Index’ (PEI) and ‘Average Individual Exposure’ (AIE) used in Australia are likely to be helpful in describing how noise is shared around Heathrow. A balanced scorecard should also consider the change in noise from background levels as well as the absolute number affected.

Quantifying noise effects

In our long-term options submission, we estimated that the benefits to the UK economy of a new runway at Heathrow would be around £100bn. In our view, that figure will significantly outweigh the environmental and social costs of the development.

Monetising the noise impacts of aviation would allow costs to be recognised when making decisions on new capacity. However, there is no optimal approach for doing this. The most effective approach at this stage is to seek to minimise the impacts and consider them in context of the large and quantifiable benefits of hub capacity. We also recommend that an expert panel should be established which represents the interests of different stakeholders to report by mid-2014 on what methodology if any is appropriate to use in the Commission’s work at this stage.

Mitigation

Heathrow is at the forefront of international efforts to tackle noise and has significantly reduced the number of people affected by noise over the last four decades. Aircraft today are significantly quieter than they were at the start of the jet age. Two of the newest aircraft coming into operation are the A380 and B787. Based on figures from their respective manufacturers, the A380 generates at least 50 per cent less noise than its nearest competitor at take-off and on landing, while for the B787, the noise footprint is some 60% smaller than today’s similarly-sized aircraft¹⁰. The aircraft that airlines operate at Heathrow are on average around 15% quieter than the total global fleets of those airlines, influenced in part by our variable landing charges which penalise noisy planes and incentivise quieter planes¹¹. We are committed to further reducing the noise impact of Heathrow, balanced with the need to safeguard the connectivity that Heathrow provides. In our recent publication, ‘A Quieter Heathrow’ we outline the steps that Heathrow is taking to reduce noise. Our submission on short and medium-term measures also proposed a package of measures to maintain the competitiveness of the UK’s hub while reducing noise impacts for local communities.

If Heathrow is to grow, a comprehensive package of measures to tackle noise will need to be introduced. Our recent submission on long-term capacity options set out how continuing improvements in technology and operating procedures, along with on-going investment in noise insulation measures, mean that the airport can grow and yet still get quieter. We have listened to what local residents tell us are the most important steps we can take: quieter planes, providing respite, reducing night noise and offering insulation. We will continue to incentivise the quietest aircraft to use Heathrow and restrict the noisiest aircraft. We have maximised opportunities for respite in our future

plans, including at night. We have continued to limit night operations and recognised the need for a new approach on insulation. Much of what we proposed in our submission goes beyond current standards and practice, and sets out our ambition is to be the world-leading airport in tackling the impacts of noise – taking advantage of the latest aircraft and airspace technology. We believe that a noise envelope can be developed that recognises those future improvements and shares them appropriately between the airport and its local communities.

1. How does noise affect people?

How many people are affected by transport noise?

1.1. The Commission’s paper is correct to put aviation noise in context alongside other sources of noise in society including other transport sources. The majority of those within Heathrow’s noise footprint are also in London, where background noise is at typical urban levels. As Figure 1.1 below shows, within London over 3 million people are exposed to noise above 55 dBA Lden from road traffic – around four times more than the number exposed to the same level of aviation noise. As Figure 1.2 below shows, even allowing for the fact that more people report that they are highly annoyed by noise from aircraft than roads¹², the absolute number highly annoyed by road noise is still significantly greater.

1.2. This indicates that a level of 55dB does not properly reflect a threshold for acceptability in major urban areas. In choosing to live in a major city, people have made a judgement on whether the benefits (such as access to jobs and city amenities) outweigh some of the downsides (including a noisier environment). In contrast, proposals to establish a new hub airport in the Thames Estuary or at Stansted may have a disproportionate impact on what are relatively tranquil areas.

Figure 1.1: The population within London exposed to noise above 55 decibels from different forms of transport based on 2006 Strategic Noise Mapping¹³.

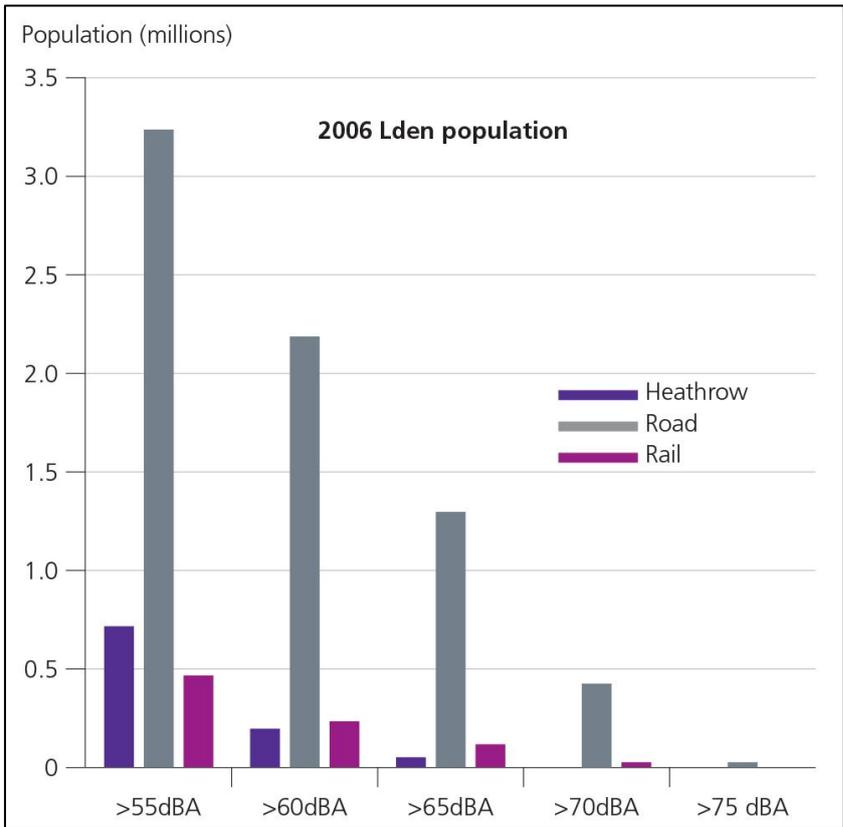
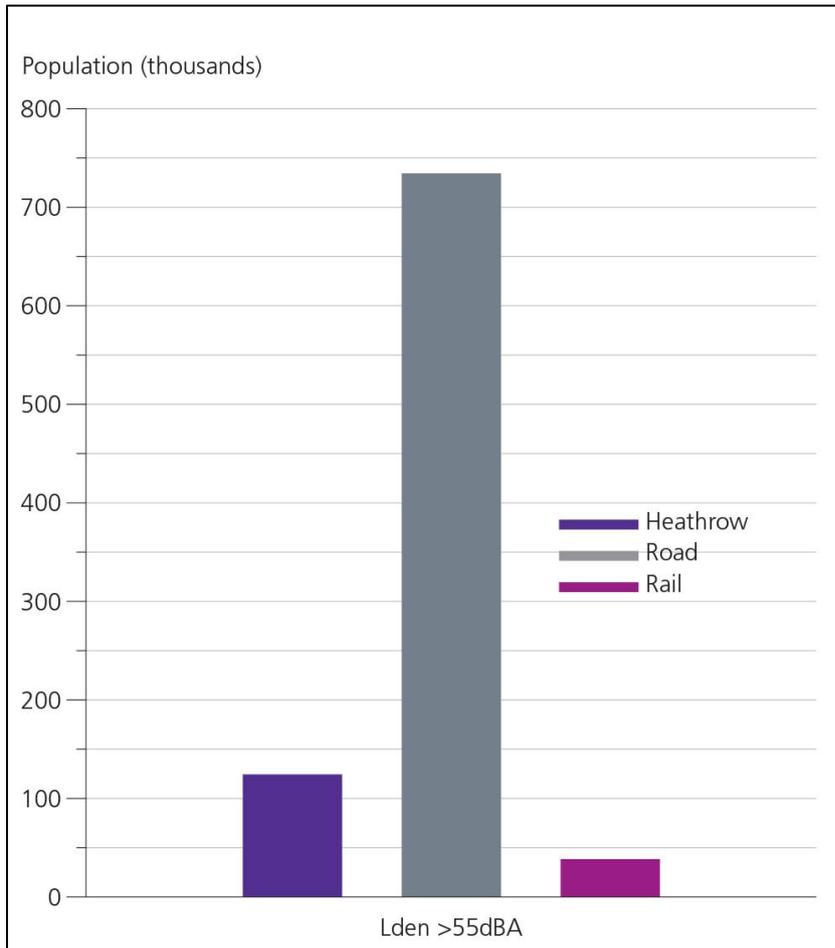


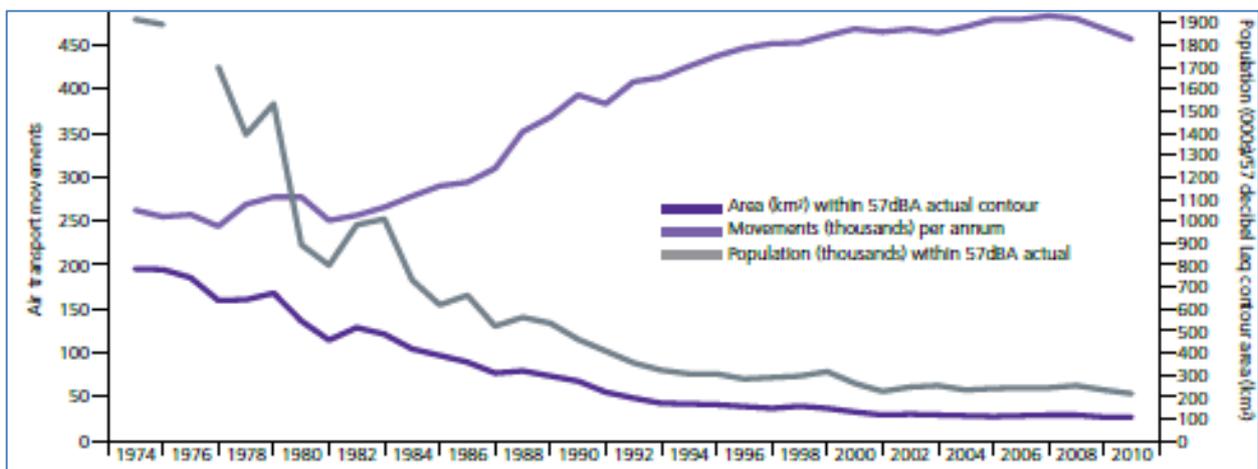
Figure 1.2: Number of Londoners and people around Heathrow highly annoyed by noise from different forms of transport based on 2006 Strategic Noise Mapping^{14 15}.



How many people are affected by aviation noise?

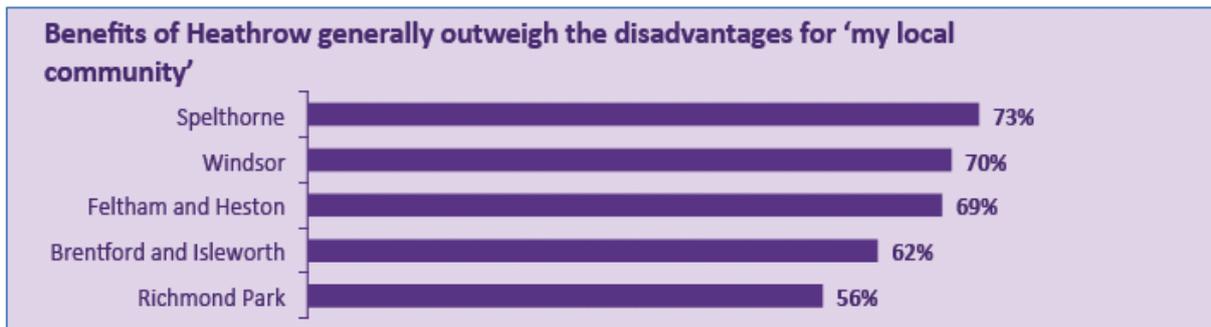
1.3. There are a number of ways to assess the number of people affected by aviation noise, of which average noise contours are one important method. The contour that the Government uses to measure significant effects from aviation noise is the 57 dB LAeq (16 hour) summer average noise contour. The Aviation Policy Framework recently published by the Government continues to use that measure. The area and population exposed to that contour have both fallen significantly over a number of decades, a result of quieter aircraft technology and operating procedures, as illustrated in Figure 1.3 below.

Figure 1.3: Area and population within the 57 dBA Leq (16 hour) contour around Heathrow¹⁶



- 1.4. The Aviation Policy Framework also identifies some of the limitations of noise contours. In relation to the 57dB contour, it notes that: '[it] 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 the contour will consider themselves annoyed by aircraft noise'¹⁷.
- 1.5. We concur with this view. Our polling shows that the majority of people, even in some of the communities experiencing the highest noise levels, do not regard noise as a concern to them. For example, over the course of the Operational Freedoms Trial period, polling conducted by independent specialists Populus showed that 69% of local residents believed that the benefits of Heathrow outweighed the disadvantages to their local community and more that 80% did not feel noise pollution impacted their daily life¹⁸. As Figure 1.4 shows these results were supported by supplementary polling conducted in 2013 in local boroughs around Heathrow.

Figure 1.4: Percentage of the local population feeling that the benefits of Heathrow generally outweigh the disadvantages¹⁹



- 1.6. Data on residential property development and transaction levels also suggests that, for many local residents, noise is not a significant concern. The number of households within the area of Heathrow's 2010 57 Leq noise contour was 16% higher than lived in that same area in 1991, as a result of the development of new properties or the subdivision of existing ones²⁰. Hounslow, the local authority most affected by Heathrow's noise footprint, has experienced a rapid rise in population. According to the 2011 census, Hounslow's population had increased by 20% or 42,000 people, in the ten years since 2001²¹. In addition, 70% of property owners within Heathrow's 55 Lden noise contour have purchased their property within the last fifteen years²². This suggests that people are readily able to sell their houses and equally that others are willing to buy them. Thus individuals are able to make a choice in balancing their own priorities.
- 1.7. We note the comparisons between airports in the Commission's paper. It is important that airports are compared on a like for like basis and that their noise impacts are put in their wider environmental, social and economic context. Figure 1.5 shows that Heathrow is not unusual in having its noise footprint partly over a major city. The number of people in its footprint is similar to New York's JFK or Los Angeles's LAX which have developed in a similar way to Heathrow and are relatively close to their respective city centres.

Figure 1.5: Population exposed to comparable noise levels around Heathrow and a selection of major US airports²³

Airport	Noise Exposure Contour	Population
Heathrow	65dBA Lden	42000
Los Angeles	65dBA DNL	>40000
Miami	65dBA DNL	38862
New York JFK	65dBA DNL	36000

- 1.8. While noise exposure around Heathrow is comparable to many leading US airports, Heathrow's hub competitors in Europe do benefit from lower absolute levels of population exposed to noise. The reasons for this include smaller overall population levels (Frankfurt, Amsterdam) and location relative to the city (Paris). However it is also important to compare the number of people affected by noise from those airports with the total populations of the cities they serve. For example, the 239,000 people within Frankfurt Airport's 55 Lden noise contour represents

around a third of the population of the city. That is a significantly higher proportion than London, where around 9% of the total city population fall within the noise contour of Heathrow. Even if the population of Frankfurt's broader urban area is used as a point of comparison, 9% of that population are still affected. This shows that other European cities have decided that the benefits of hosting a hub airport close to the city outweigh the local dis-benefits. As we set out in our long-term hub capacity submission we expect to be able to reduce the number of people within the 55dB Lden which would reduce further the proportion of Londoners affected.

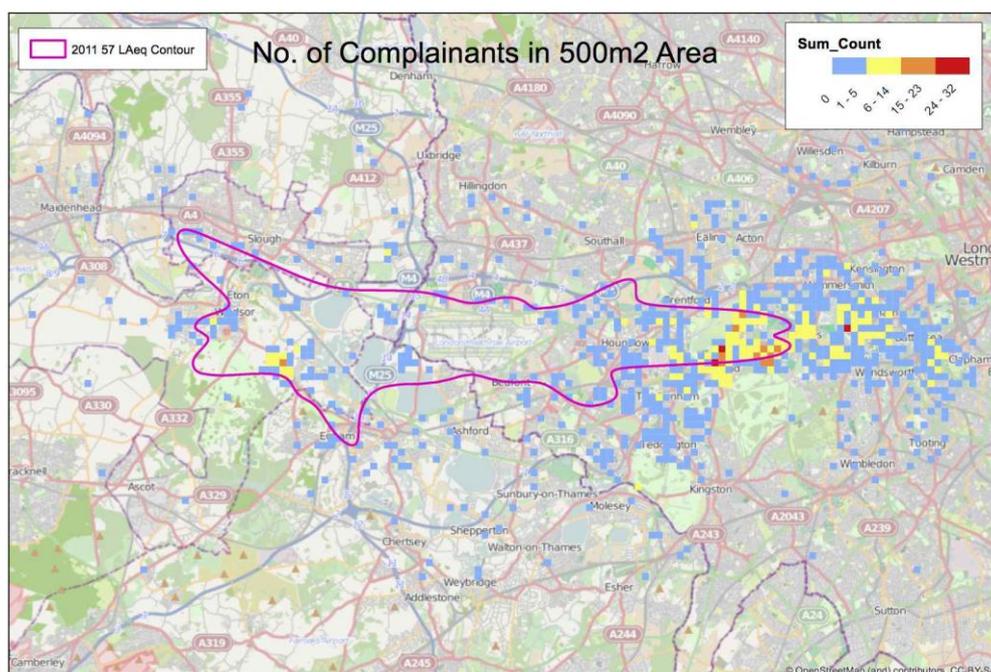
What are the effects of noise?

- 1.9. In the Commission's paper, the content of the chapters on the effects of noise and quantifying noise are closely related. We have included the majority of our response on those topics in this section. Section 3 – quantifying noise effects – deals exclusively with the monetisation of noise impacts.
- 1.10. The paper presents two key elements in any assessment of the effects of noise. The first is a measurement of the extent of exposure to noise, for example the size of the population that is affected by noise at a certain level. The second is a judgement as to the extent to which that exposure is having an adverse effect. Objective analysis of the effects of aviation noise is critical. In particular, it is essential to separate associations from causal relationships when analysing and presenting aircraft noise effects. As Berry and Flindell point out in their 2009 review, a thorough understanding of the origin of the dose-response relationships involved, the statistical uncertainties inherent in such relationships, and the assumptions underlying their practical use is vital in considering the issue of defining 'adverse' effects and thresholds²⁴.

Amenity & quality of life effects - annoyance

- 1.11. We agree that 'annoyance is the most commonly used outcome to evaluate the effect of noise on communities'²⁵. However annoyance is not only driven by objectively measurable noise but by non-acoustic factors, including, for example, individual sensitivity, a person's ability to habituate to noise, tolerance, trust, and general satisfaction with life. This is supported by the COSMA study which found that acoustic drivers could account for just 20% of the variation in annoyance levels²⁶.
- 1.12. This is also supported by complaints data in the area around Heathrow, which shows that complaints about noise are not well correlated with noise levels. The pattern of complainants indicates that most are from the Richmond, Fulham, Putney and Barnes areas in west London but relatively fewer are from Hounslow. Given the standard 'exposure-response' annoyance curves this is counter-intuitive since the higher noise levels in Hounslow would be expected to lead to higher annoyance and more complaints. It is clear that other factors play an important role in the response to noise. It is noticeable, for example, that complaint numbers have peaked during periods of debate over potential change (for example the Terminal 5 planning process to 2001; the development of the Air Transport White Paper in 2003 and the trial of Operational Freedoms in 2011/12)²⁷. This suggests that to some extent complaints may be an indicator of objection to proposed change rather than an indicator of annoyance. Indeed in some cases there is evidence that complaint numbers have peaked as a result of organised campaigns.
- 1.13. Given the extent to which non-acoustic factors potentially influence attitudes to noise, an effective management strategy needs to include actions which seek to build community trust. In recent years we have increased our engagement with local communities on noise, in order to set out the actions that we are taking, to better understand local views and to take them into account in developing our plans. In 2012 we worked together with HACAN, the main non-governmental organisation campaigning on noise at Heathrow, to trial new early morning arrival procedures to provide periods of respite. We are now discussing with local stakeholders the creation of a new 'Heathrow Noise Forum' to bring together aviation industry and local community stakeholders on a regular basis to review operating procedures at the airport and identify potential improvements.

Figure 1.7: Distribution of complaint data around Heathrow from 2002 to present day and the 2011 Leq 57 dBA daytime contour^{28 29}



Health effects

- 1.14. The potential health effects of development at Heathrow need to be put in context. In our submission to the Commission on long-term options, we set out how Heathrow currently employs 76,600 people on site, supports 114,000 jobs within the local area and how with additional capacity it could create between 70,000 and 150,000 additional jobs. A high-level assessment commissioned by Heathrow shows that by creating new jobs and raising income levels a new runway at Heathrow could have positive health effects. Whilst we accept that it could also have some negative effects, the evidence for many of these effects is not clear-cut. Although the positives and negatives cannot easily be compared directly, this is an area that merits further study.
- 1.15. Heathrow has taken independent expert advice on the effects of noise on health³⁰ and the following text reflects that advice.
- 1.16. Figure 1.8 below provides a summary of the health effects associated using standardised World Health Organisation (WHO) evidence categories and some brief comments on the limitations of this evidence.

Figure 1.8: Summary of amenity/quality of life and health effects associated with aircraft noise³¹

Health effect	Strength of evidence ^a	Comments & limitations
Annoyance	Sufficient	Complex interaction with other health effects and non-acoustic factors
Cardiovascular ³²	Sufficient	Importance of; <ul style="list-style-type: none"> • confounding factors, e.g air pollution • modifying factors , e.g. length of residence
Sleep - awakenings	Sufficient	A certain number of spontaneous awakenings is normal
Sleep – self reported disturbance	Sufficient	Subject to bias
Mental health, psychiatric disorders	Lacking, Inadequate	Some evidence of symptoms, but not of severe clinical disorders
Sleep - long term effects	Lacking, Inadequate	Complex mechanisms underlying long-term effects, many factors
Hearing impairment	None at noise levels < 75 dBA	

^aSource of definitions of strength of evidence –WHO International Agency for Research on Cancer (IARC)
<http://www.iarc.fr/>

Sufficient: a relationship has been observed between noise exposure and a specific health effect, chance, bias and confounding factors can be ruled out with reasonable confidence.

Limited: an association has been observed between noise exposure and a specific health effect, chance, bias and confounding factors cannot be ruled out with reasonable confidence.

Inadequate: the available studies are of insufficient quality, lack the consistency or statistical power to permit a conclusion regarding the presence of absence of a causal relationship.

Lacking: several adequate studies are mutually consistent in not showing a positive association between exposure and health effect.

1.17. Our review has in addition identified a range of important limitations and complexities which we believe require further research and study, outlined in the following sections. It should be noted that the above Figure 1.8 does not include information on the ‘robustness’ of exposure-response relationships or curves, or the extent to which such curves have become accepted by the scientific community. In general, the greater the strength of evidence, the more ‘robust’ the exposure-response relationship, but there are different degrees of confidence in the curves, for different health outcomes, even across those health effects where the evidence is classified as sufficient. This issue is discussed later in the section on uncertainty in exposure-response relationships.

a) Influence of non-acoustic factors and perception

1.18. Noise health effects are influenced by many non-acoustic factors besides noise exposure. For example, annoyance, which is part of the link to other physiological and psychological effects, is itself influenced by a range of non-acoustic factors (see paragraph 1.10 above).

1.19. Whilst figure 2.2 of the Commission’s paper identifies a simplified linear representation of the inter-relationship between different effects, our own review has identified previous research that indicates that the relationships are more complex and indirect. Key review studies that have investigated these effects include studies by ERCD³³, by the National Physical Laboratory for the DETR³⁴ and the previously cited review 2009 review for Defra by Berry and Flindell.

1.20. Our review of these studies indicates that the human response to noise is extremely complex and varies between people and places and is influenced by factors such as personal, attitudinal, and situational factors in addition to the amount of noise per se or its key characteristics. These factors can include adaptation and past experience, how the listener’s activity affects annoyance, season of the year and time of day, predictability of when a noise will occur, views on whether the noise is ‘necessary’, individual differences and personality, demography, other effects such as odour, air pollution and so on.

1.21. There are therefore many links and potential feedback paths. Thus an individual’s perception that they, or other family members, might personally be at risk of some health effect arising from their noise environment, could itself influence their annoyance.

b) Uncertainty in exposure-response relationships

1.22. There is a significant amount of literature examining the effects of noise on health. Our review has identified a wide range of reported outcomes but has put specific emphasis on the link between noise and hypertension and other cardiovascular effects. This range of results is well expressed by Dr Babisch who noted for example in the 2012 WHO report³⁵ that:

- *“Difficulties in pooling the results are due to the fact that different criteria for the determination of high blood pressure were used....”, [and]*
- *“Since the pooled effect estimate is based on different studies with different noise level ranges, no clear-cut level for the onset of the increase in risk can be given.”*

1.23. Additionally Laszlo, Berry, Hansell and Abbott in their 2012 Internoise paper, which considered several papers that list thresholds in relation to noise induced health effects, express the view that “the scientific evidence for exposure-response relationships that would provide the basis to

derive a threshold is inconclusive or lacking for most health outcomes as very few studies have examined a full range of noise exposures³⁶.

- 1.24. Any observational study is prone to bias and needs to make appropriate adjustment for confounding factors - risk factors that may influence the observed associations if differently distributed between exposed and unexposed (or greater and lesser exposed) individuals. Because of this, it is preferable to base decisions on a large number of studies of good quality – i.e. where bias is minimized and important confounders taken into account.
- 1.25. Furthermore there is still only a relatively small number of such studies investigating associations between noise and cardiovascular disease, in contrast to the position in relation to air pollution where there is a much larger number of studies and it has been possible to do more detailed investigations of exposure-response curves and threshold levels.

Our conclusion is that the scientific evidence for exposure-response relationships that would provide the basis to derive a threshold is inconclusive or lacking for many health outcomes as very few studies have examined a full range of noise exposures. This is important since the use of different thresholds in quantitative risk calculations can make significant differences to the overall results.

c) Research on aircraft noise

- 1.26. Our review has identified a range of literature linking transport noise with health outcomes. Whilst this is an important element of the overall knowledge base there is a need to continue researching exposure-response measures that are specific to aviation noise, rather than relying on interpreting studies that are more generic and involve other transport sources.

d) New and emerging studies

- 1.27. Our review has also identified that 'noise and health effects' is rapidly evolving area of research. It is important that the latest information is used to inform any future policy in this area. For example, we are aware that DEFRA have commissioned a new review looking at the exposure-response relationships for road and air noise in relation to hypertension³⁷. We understand that this will help quantify the effects of these different noise sources and will potentially have implications for efforts to monetise these effects. We agree with the Commission's view that it is important that the most up to date information, peer-reviewed, information is used. To support the Commission in this objective have provided in an appendix a list of the key studies that we would draw attention to.

Productivity and learning effects

- 1.28. We agree with the discussion paper's conclusion that 'The productivity effects of noise are mostly secondary and feed through from the [health] effects mentioned'³⁸. In relation to Figure 2.6, which sets out pathways linking noise to productivity, we consider that it is questionable whether it would be possible to quantify in a robust way what proportion of the productivity impacts is due to aircraft, as people will be affected by a wide variety of noise in their environment.
- 1.29. The discussion paper refers to the RANCH study on the effects of noise on learning. We consider it important to see in this context of the more recent follow-up study on the cohort of children in schools around Heathrow who were part of the original study. This more recent paper by Clark *et al* refers to a 'non-significant decrease in reading comprehension at follow-up'³⁹. This suggests that there is no real evidence that the effects observed in RANCH persist into later life. It also argues, however, that long-term impairment of reading skills 'might have been found' if the statistical power of the study had been higher⁴⁰. More thorough assessment and detailed interpretation of this new study is required in order to fully understand the implications.

2. Measuring aviation noise

Introduction

- 2.1. The Government has retained the 57 dB Leq contour as a core metric for aviation noise as it provides an objective measure of average noise exposure and has been tracked for several decades, enabling us to understand how the benefits of noise reduction are being shared. We support that and, in our submission on long-term options, we demonstrated how we can add a third runway at Heathrow while reducing the population within that contour by 10 – 20% by 2030. We will continue to look for opportunities to improve this performance. All of our options have also sought to maximise periods of respite from noise, a direct response to feedback from local communities.
- 2.2. We also agree with the Commission's conclusion that no single indicator can describe every aspect of noise. We agree that a 'balanced scorecard' of measures is needed. Heathrow has been at the forefront of developing supplementary ways of measuring and communicating noise. If a Heathrow option is shortlisted by the Commission, we will develop a balanced scorecard to complement the 57 Leq contour in describing the noise effects of additional capacity.
- 2.3. The Commission's paper provides a comprehensive overview of the different metrics that can be used to quantify noise from a single aircraft event and from longer periods of noise exposure. Figure 2.1 at the end of this section provides an overview of the advantages and disadvantages of these different metrics. The remainder of this section responds to some of the specific themes in the discussion paper.

Commentary on different noise metrics

- 2.4. The paper highlights the value of average sound level measures but also some of their limitations. Average noise contours are helpful in describing the overall noise impact of an airport, and showing area-wide changes over time. At Heathrow, for example, noise maps go back to the early 1970s. However, people struggle to understand how the concept of 'average noise over an average day in the summer' relates to their own individual experience. We recognise that noise contours do not reflect all aspects of the perception of noise. A strong theme of feedback from local residents around Heathrow is that there is a need to supplement noise exposure contours with more accessible measures⁴¹. These include, for example: the total number of flights over a particular location, the time of day of those flights, and the noise level of the loudest flight. This need for improvement in noise communications represents an area of common ground for both the industry and environmental/community groups⁴².
- 2.5. We are committed to improving the range and accessibility of this type of information. Following extensive research and stakeholder engagement we have developed a range of metrics that we use for our Community Noise Monitoring programme. This includes noise levels in a particular community but also information such as height and numbers of aircraft flying over that area presented in histogram form. We are currently developing a web-based tool to help make this information more readily available. Known as "My Neighbourhood", this will enable residents to access location-specific information by post-code. We expect the first version of this software to be available over the next 12 to 18 months. We believe that airports are better placed than the CAA to provide this information to local communities, although there is potentially a role for the CAA to develop appropriate standards and assurance for the information being provided.
- 2.6. The discussion paper asks about producing noise contour maps to a level lower than 57dB and whether new evidence or arguments can be brought to this debate. We are not aware of any new evidence or arguments since the Government published its Aviation Policy Framework earlier this year. The clear community feedback on the limitations of average noise contours reinforces that there is little to be gained from introducing another such measure. At Heathrow we already voluntarily map noise contours for levels other than the standard 57 dB contour on an annual basis. This includes producing Lden, Lday, Levening and Lnight contours. We also

publish an annual 48dBA Leq (6.5hr) Lnight contour which relates to the current night flight restrictions regime. It is also important to note that the historic focus on the 57dB contour does not mean that we have only focused on noise abatement measures within that area. While our efforts to manage noise have naturally focused on the highest noise areas closest to the airport, this has not been at the exclusion of actions which benefit those further away and outside the traditional noise contour area. Our long-standing commitment to the use of Continuous Descent Approach is one example that has noise benefits across a wide area of London.

- 2.7. We believe that efforts are better focused on supplementing contour metrics with other metrics which help describe noise impacts more accessibly for communities and potentially aid policy-makers. The next section provides our views on how a 'balanced scorecard' approach could be developed in future.

Further development of the 'balanced scorecard' approach in future

- 2.8. We agree that the Airports Commission's process 'provides opportunities to test additional approaches that might better reflect how aircraft noise is experienced'⁴³. We envisage that a balanced scorecard would be based on a combination of the metrics outlined in the Commission's discussion paper, including: average noise contours; number above (N) or frequency measures; Person Events Index and Average Exposure Indicator contours, and; location-specific measures. If a Heathrow option is shortlisted by the Commission, we will develop a balanced scorecard to complement the 57 Leq contour in describing the noise effects of additional capacity. It is critical that local stakeholders are engaged in this development process so that the information provided is meaningful for those who will use it. We offer our thoughts on some of the specific measures below.
- 2.9. We see merit in the approach taken to assessing noise impacts as part of airport developments at Sydney and Brisbane. In these cases a range of metrics were employed with different audiences and purposes in mind. These helped to ensure a common understanding across a variety of stakeholders. These measures included the Persons Events Index (PEI) and Average Individual Exposure (AIE) which we believe will be more accessible for many stakeholders. As the discussion paper notes, they are also useful in showing how noise is shared around a local population. This is likely to be important at Heathrow where some of the noise reduction measures we submitted to the Commission in our long-term options response involve distributing noise over a greater number of flight paths, but alternating operations between those flight paths in order to provide respite. Such an approach would increase the total PEI but decrease AIE.
- 2.10. One significant topic that needs further consideration is how to measure the provision of periods of 'respite' from noise. Feedback from some communities around Heathrow has identified that the current system of runway alternation – with the landing runway switching at 3pm to give residents under the final approach to Heathrow half a day's respite from overflight – is an important way to reduce the impacts of noise. Our 'Early Morning Respite Trial' mentioned in section 1 has tested how respite could be provided in the early morning, and our recent submission on long-term options set out how in developing plans for additional capacity at Heathrow we sought to maximise periods of respite. As part of our work in relation to the Operational Freedoms Trial we established a working group which included representatives from the DfT and CAA as well as social research experts to develop our understanding of respite. However further research and engagement with local communities is needed to better understand what is meant by respite and how best to measure and implement it.
- 2.11. A balanced scorecard should also consider the change in noise compared to existing background levels. The majority of those within Heathrow's noise footprint are in London, where background noise is at typical urban levels. In choosing to live in a major city, people have made a judgement on whether the benefits (such as access to jobs and city amenities) outweigh the downsides (including a noisier environment). In contrast, background noise near potential airport locations along the Thames Estuary or at Stansted is lower and this is likely to be a factor in people's choice to live in those areas. There is evidence that quiet areas are of value to people, with 91% of respondents to a survey stating that such areas need protecting.

As such, additional aircraft noise in those areas is likely to have a disproportionate impact on what are relatively quiet, predominantly rural areas.⁴⁴.

- 2.12. The concept of noise efficiency does provide a way of comparing the noise impacts of different airports, and also how individual airports have improved over time, however it needs further development. Defining 'productivity' solely in terms of ATMs or passengers has limitations as it does not take into account that the value of ATMs and passengers to the economy varies. As the UK's only hub airport, Heathrow accounts for 80% of the UK's long-haul traffic and is vital for connecting the UK economy to emerging markets around the world. A movement at Heathrow is of significantly greater value to the UK than a movement at Blackpool, which is the most noise efficient UK airport judged purely in terms of movements per person affected.
- 2.13. We plan to develop our approach to a balanced scorecard following engagement with local community groups. In the context of decisions on providing additional airport capacity, a balanced scorecard for noise needs to be part of a much broader balanced scorecard which takes into account the social and economic benefits of any particular option as well as its environmental impacts.

Table 2.1 Pros and cons of different noise metrics

Metric	Pros	Cons
<ul style="list-style-type: none"> • L_{Aeq}(16 hour) 92 day summer average (day) • L_{Aeq}(8 hour) 92 day summer average (night) 	<ul style="list-style-type: none"> • Used to describe total noise energy received. • Useful for monitoring historical trends • Traditionally related to annoyance and night-time disturbance 	<ul style="list-style-type: none"> • Does not reflect all aspects of community perception of noise • Using the average 57 dBA as the only arbiter of annoyance can annoy those outside the contour boundary • Insensitive to short-term changes which affect daily impacts such as runway use, targeted mitigation procedures etc • Does not give information about transient noise events.
<ul style="list-style-type: none"> • LDEN (annual average) 	<ul style="list-style-type: none"> • Used to describe total noise energy received over a 24 hour period, with weighting for day, evening and night to reflect time of day sensitivities. • Useful for monitoring historical trends and policy applications • Usually broadly associated with acceptability standards and EU Noise Directive. 	<ul style="list-style-type: none"> • Does not reflect all aspects of community perception of noise • Insensitive to short-term changes which affect daily impacts such as runway use, targeted mitigation procedures etc • Does not give information about transient noise events. • Criticised for lack of scientific evidence that supports the additional decibel weightings • Applying weightings into a combined measure over 24 hours means it is not sensitive to changes in airports' operation at different times of day, particularly at night.
<ul style="list-style-type: none"> • Number above N_{xx} 	<ul style="list-style-type: none"> • Useful in describing the number of noisy events over a given time period • Uses number rather than dB which is more easily understandable to lay person • More easily directly observable by community (more transparent and can be checked in field or using webtrak info) 	<ul style="list-style-type: none"> • It does not give any information on how noisy an aircraft noise event actually is, just that it exceeds a given threshold value (e.g. an event at 70 dBA max is counted the same as one at 90 dBA max). • It does not give any information on duration of event, assigns equal value to a short and long event. • Need for further research on the threshold level that best relates to key effects
<ul style="list-style-type: none"> • SEL and L_{max} 	<ul style="list-style-type: none"> • Useful in describing the impact of one aircraft event with footprints showing geographical extent of impact. 	<ul style="list-style-type: none"> • Only a single event metric so does not inform about impact of cumulative exposure to a number of events.
<ul style="list-style-type: none"> • PEI 	<ul style="list-style-type: none"> • Useful for communicating with public • Developed to show how many times an individual is exposed to an aircraft noise event above a given threshold value. • Arithmetic scale is easier for layperson to understand. 	<ul style="list-style-type: none"> • Does not give details on how this number is distributed across the surrounding population.
<ul style="list-style-type: none"> • AIE 	<ul style="list-style-type: none"> • Useful for communicating with public • Indicates extent to which noise is shared or concentrated 	<ul style="list-style-type: none"> • Complicated.
<ul style="list-style-type: none"> • Respite 	<ul style="list-style-type: none"> • Describes periods of respite from overflight • Useful in assessing mitigation options and presenting information to public • Provides data on runway alternation • Can provide information by time of day 	<ul style="list-style-type: none"> • Definition not yet fully developed and actual significance of respite not fully understood.
<ul style="list-style-type: none"> • Flight movement charts (non noise info) 	<ul style="list-style-type: none"> • Used as a 'surrogate' for noise information by informing public of where aircraft actually fly • Best to combine with noise exposure data 	<ul style="list-style-type: none"> • Same weight is given to all aircraft although each noise emission of an aircraft varies greatly • Meaningfulness of data dependent on time periods displayed

3. Quantifying noise effects

Introduction

- 3.1. In section 1 we commented on the Commission's assessment of the 'amenity/quality of life' 'health' and 'productivity/learning' effects of noise. Inevitably there is a close link between that assessment and this section's discussion of effects. In this section we have focused solely on the monetisation of noise impacts.
- 3.2. In our long-term options submission, we estimated that the benefits to the UK economy of a new runway at Heathrow would be around £100bn. In our view, figure will significantly outweigh the environmental and social costs of the development.
- 3.3. Monetising the noise impacts of aviation would allow costs to be recognised when making decisions on new capacity. However, there is no optimal approach for doing this. The most effective approach at this stage is to seek to minimise the impacts and consider them in context of the large and quantifiable benefits of hub capacity. We also recommend that an expert panel should be established which represents the interests of different stakeholders to report by mid-2014 on what methodology if any is appropriate to use in the Commission's work at this stage.

Monetising noise impacts

- 3.4. Whilst monetising the noise impacts of aviation would allow a more explicit cost-benefit analysis to be undertaken in relation to new airport capacity, it is not without difficulties as the Commission's discussion paper recognises. We are committed to developing our understanding of the possible approaches to, and value of, monetising noise impacts. To inform this submission we commissioned 'Europe Economics' to assist us with our response to the Commission's text on monetisation. The remainder of this section reflects the advice that we have received from Europe Economics.
- 3.5. The literature on the economic value of noise typically adopts one of two approaches. First, indirect approaches attempt to monetise the total cost of noise either through revealed or stated preference. Revealed preference valuation usually use hedonic pricing methods to monetise noise impacts based on market outcomes, such as housing prices. Stated preference valuation uses surveys to estimate consumers' willingness to pay to avoid noise pollution. Second, 'direct' methods might quantify noise and their specific impacts, such as the effect on sleep disturbance. Direct methods would then monetise this effect via a health index.
- 3.6. The key advantage of revealed preference methods is that the estimates are based on the outcome of actual choices made by consumers, e.g. the price of residential properties. Based on the assumption that property markets are relatively efficient, the method would provide a good indication of the willingness to pay for peace and quiet. Another advantage of the model is the availability of data: data on property prices and area characteristics are generally easily accessible. However, this method of valuation has a number of weaknesses. In reality, a housing market can be affected by outside influences, such as changes in taxes and interest rates, which lead the market to deviate from the equilibrium level predicted by the model. Estimates that do not account for this fact might contain biases. Another weakness of the method is its sensitivity to the choice of model specification, such as its functional form, and to the definition of the geographic boundaries of the housing market. Moreover, if the model does not include all the relevant attributes of residential properties, the estimates would suffer from selection bias. Also, the use of house prices can only reveal the full willingness to pay to avoid noise if prices fully reflect the externality differences caused by the existence of noise nuisance. However, in reality, prices only partly compensate for the externality relevant factors such as individual location preferences and transaction costs in moving house are not captured in market prices. Furthermore, in the UK in particular the use of house prices is highly problematic as house prices are widely believed to be subject to a significant degree of both general and relative distortion — general distortion associated with large "house price cycles"; and local distortion associated with problems arising from the planning system for authorising house-building.
- 3.7. Stated preference studies use individual respondents' statements about their preferences among a set of options to estimate their willingness to pay. The literature has used two

techniques to estimate willingness to pay through stated preference methods: contingent valuation and contingent choice. The contingent valuation (CV) approach uses surveys to identify individuals' willingness to pay for a change in the level of environment service flows. The contingent choice (CC) approach estimates willingness to pay from observations on the hypothetical choices and trade-offs that people make. The use of the stated preference approaches of CV and CC can help to provide an indication of the total cost of the externality. The CV method has the advantage of measuring both user (i.e. home owners) values and non-user (i.e. renters) values. The non-user value may be referred to the benefits of the existence of non-housing areas, such as natural reserves which could be affected by the air traffic. This impact cannot be measured under hedonic price method. However, the use of CV methods remains somewhat controversial due to the substantial risk of response bias. Individuals may overstate (or be unaware of or unable to express) their economic valuation of a good, such as noise externality absent a specific market transaction/choice. The risk of response bias is somewhat mitigated under the CC approach as consumers are required to select from a number of specified payment/noise level alternatives but the scope for response bias is not entirely eliminated.

- 3.8. If the intention is to monetise the impact of noise on a specific dimension, such as health or sleep disturbance, a 'direct' method is employed. The methodology to determine the impact of noise from aircraft or other sources such as road or rail traffic usually consists of quantifying the different levels of noise produced by the source and the number of people exposed to each; establishing the link between noise and health effects; and calculating the monetary value of the health impact either via a health index, such as QALY or DALY, or by estimating the value of medical costs, opportunity costs and disutility.
- 3.9. The advantage of the 'direct' methodology described above is that it isolates particular health endpoints from the total impacts of noise. However, the existing methods suffer from a number of disadvantages. First, most studies use the available estimates that link the various impacts to environmental noise or traffic noise, but not necessarily aircraft noise. Second, the use of a health index is controversial because of the associated measurement risk and because different conditions may be ranked similarly on the absolute scale but have very different associated costs. Third, the literature uses various definitions for health impacts. Therefore, applying previous estimations from more than one source might result in double counting or in identifying different health impacts than intended
- 3.10. In conclusion, the most effective approach at this stage is to seek to minimise the impacts and consider them in context of the large and quantifiable benefits of hub capacity. We also recommend that an expert panel should be established which represents the interests of different stakeholders to report by mid-2014 on what methodology if any is appropriate to use in the Commission's work at this stage.

4. Mitigation

Introduction

- 4.1. Heathrow has been at the forefront of efforts to tackle aircraft noise. Airlines are rewarded for flying quieter planes and penalised when they do not. New procedures for aircraft landing which reduce noise have been pioneered and the importance of serving Heathrow has driven innovation in the industry. As a result, even though the number of planes using the airport has nearly doubled, and Heathrow is now operating at full capacity, the number of people affected by noise from Heathrow today is around 90% lower than at the start of the 1970s.
- 4.2. Even though much progress has been made, we acknowledge that noise remains an issue for many local residents. We are committed to addressing it, balanced alongside the need to safeguard the connectivity that Heathrow provides. There are further steps that Heathrow will be taking to address noise as set out in our recent publication, 'A Quieter Heathrow'. Our submission on short and medium-term measures also proposed a package of measures to

maintain the competitiveness of the UK's hub while reducing noise impacts for local communities.

- 4.3. We also recognise that if Heathrow is to expand, a comprehensive package of measures to tackle noise will need to be introduced. Our recent response to the Airports Commission's call for long-term hub capacity options set out how Heathrow can be further developed as the UK's hub airport while continuing to reduce the number of people exposed to aircraft noise. We demonstrated how we can add a third runway at Heathrow while reducing the population within the airport's noise footprint by 10 – 20% by 2030. We will continue to explore opportunities to improve that performance. All of our options have also sought to maximise periods of respite from noise, a direct response to feedback from local communities. There will not be a choice between more flights or less noise – both will be delivered.
- 4.4. We have listened to what local residents tell us are the most important steps we can take: quieter planes, providing respite, reducing night noise and offering insulation. We will continue to incentivise the quietest aircraft to use Heathrow and restrict the noisiest aircraft. We have maximised opportunities for respite in our future plans, including at night. We have continued to limit night operations and recognised the need for a new approach on insulation. Much of what we proposed goes beyond current standards and practice, and sets out our ambition is to be the world-leading airport in tackling the impacts of noise – taking advantage of the latest aircraft and airspace technology and engaging actively with local communities. We believe that a noise envelope can be developed that recognises those future improvements and shares them appropriately between the airport and its local communities
- 4.5. In the remainder of this section we provide an overview of our approach to noise management to date and our plans for the future. This section should be read in conjunction with both 'A Quieter Heathrow' and our submission to the Commission on long-term hub capacity options.

The Noise Mitigation Framework – The ICAO 'Balanced Approach'

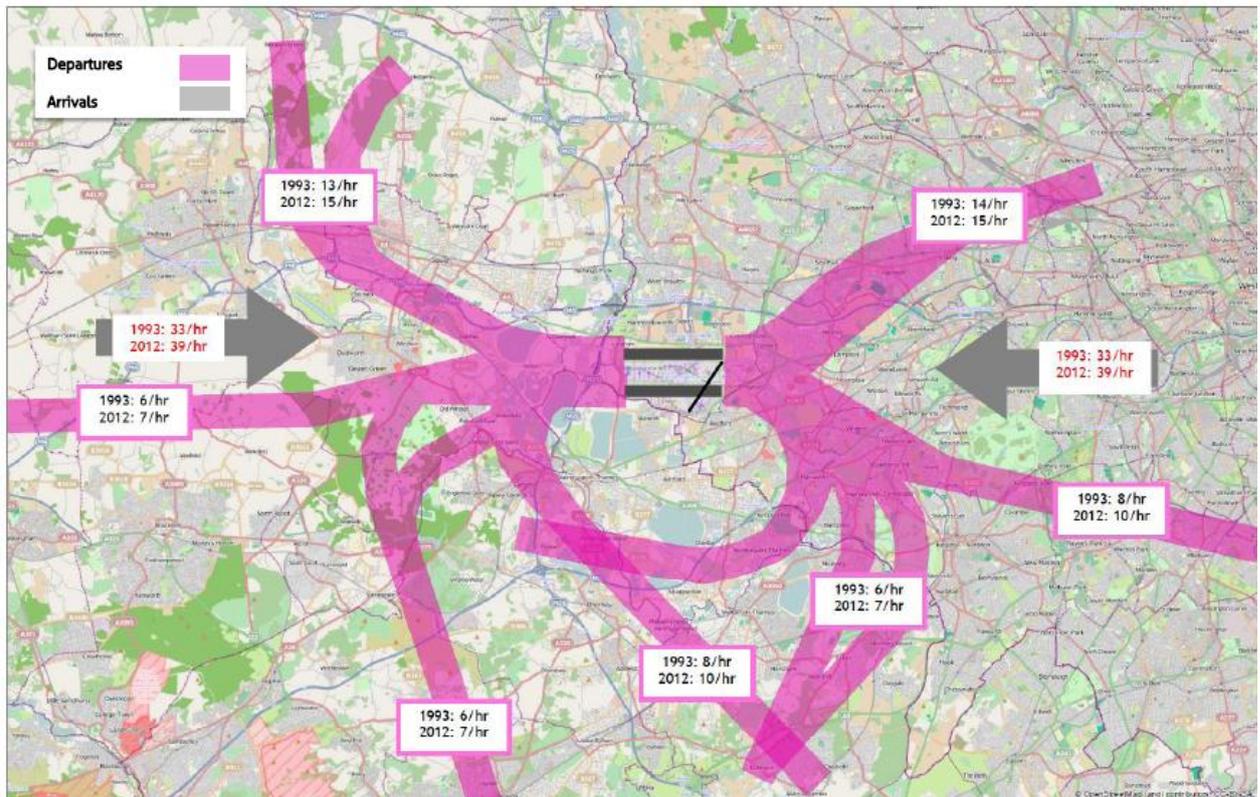
- 4.6. We fully support the ICAO 'Balanced Approach' and have set out our strategic approach to noise management on that basis. We have also made explicit in our noise strategy the role of community engagement, which we feel is a key part of any balanced approach to noise management.

Reduction of noise at source through technological improvements

- 4.7. Aircraft today are significantly quieter than they were at the start of the jet age, and aircraft and engine manufacturers have set long-term goals to continue reducing noise in the future. Heathrow's noise standards play a role in influencing future aircraft technology as they are among the strictest in the world. The new Airbus A380, for example, was designed specifically to fall into one of the quietest categories for night operations at Heathrow⁴⁵. The aircraft that airlines operate at Heathrow are on average around 15% quieter than the total global fleets of those airlines⁴⁶, influence in part by our variable landing charges to incentivise quieter planes. We apply three different charging categories for Chapter 4 aircraft. Aircraft in this chapter represent around 97% of all operations at Heathrow⁴⁷, so distinguishing between the noisier and quieter aircraft in this Chapter is important.
- 4.8. Some stakeholders have challenged Heathrow's performance in reducing noise on the basis that technological improvements have been eroded to a degree by the increased frequency of aircraft movements. HACAN, for example, has identified the possible issue of a 'tipping point' in movement numbers, above which people become significantly more annoyed even though individual aircraft are quieter.
- 4.9. We recognise from community feedback that frequency of movements is a concern to some local residents. However it is also important to consider the statistical evidence of the reduction in the airport's noise footprint and the changes in movements. In the last 20 years, there has been a gradual increase in movements, from around 410,000 per year to close to the airport's cap of 480,000 in recent years; an increase of around 17%. However that relatively modest

increase in movements over a 20 year period was achieved in the context of the 40% reduction in the 57 dB Leq contour in the same period. Figure 4.1 shows how average hourly movements have changed over the past 20 years.

Figure 4.1 Change in hourly overflight (for easterly and westerly operations) between 1993 and 2012



4.10. The benefits of new technology have been even more apparent during the night quota period. The number of movements permitted to operate during this period has remained constant since 1993 but the average quota count of the aircraft has fallen by around 25% and the 48dBA 6.5hr night contour has shrunk by 40%.

4.11. We expect the improvement in aircraft technology to continue to improve in the future, a view supported by the Sustainable Aviation Noise Road-map. Opportunities for growth will be an important driver for new quieter technology to come to Heathrow. The benefits of this reduction can be shared with surrounding communities whilst enabling the growth of Heathrow.

Mitigation through operational procedures

4.12. We have pioneered operational procedures to reduce noise such as Continuous Descent Approaches and departure procedures to improve track-keeping. We continue to drive performance improvements in this area and are currently working with industry and community stakeholders to trial and develop new procedures that address local community concerns.

4.13. The question of concentration versus dispersal is considered in the discussion paper. In our view what is currently in place is a mixture of the two, a form of 'concentrated dispersal'.

4.14. On departure, aircraft 'disperse' soon after take-off along one of several 'Noise Preferential Routes' (NPRs) thereby spreading the noise burden across several communities. They are however concentrated within the NPR 'swathes' until they reach 4000ft at which point they start to disperse. Improvements in aircraft technology also mean that aircraft typically reach 4000ft is much more quickly than in the past.

- 4.15. On arrival, aircraft are widely dispersed beyond around 10nm from touch-down as NATS seeks to tactically manage the flow of arriving aircraft. On the final approach to the runway aircraft become increasingly concentrated and from 7.5nm from touch-down are all following the same approach route. On westerly operations at Heathrow this arrival concentration is 'dispersed' through the alternation pattern whereby the runway used for landing is switched half way through the day.
- 4.16. Going forward, the use of precision based navigation offers an opportunity to provide greater levels of concentration, ensuring consistency in the track flown and thereby minimising the number of people overflown. It will also be possible to design routes to limit their impact on particular concentrations of population. By creating a number of these routes for arrivals and departures it will be possible to alternate the areas overflown and deliver predictable periods of respite. This will continue an approach of 'concentrated dispersal'.
- 4.17. We are committed to continuing to minimise the impact of aircraft noise through developing and trialling new procedures. In the coming years we expect those trials to include steeper approach angles, departure respite trials and further early morning arrival respite trials.
- 4.18. As we outlined in our submission on long-term options, adding a new runway at Heathrow would enable new procedures to reduce noise. In particular, departure and arrival routes would need to be redesigned and could be optimised to avoid areas of dense population and to alternate the areas overflown.

Mitigation through land-use planning

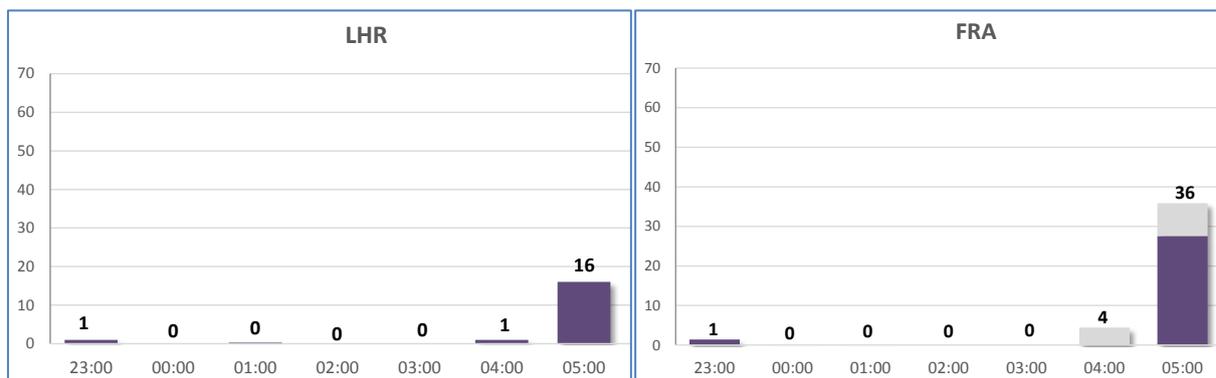
- 4.19. The past 20 years have seen on-going residential development and population growth within Heathrow's noise footprint, even as the area of that footprint has become smaller. The number of households within the airport's 2010 57dBA noise contour was 16% higher than lived in that same area in 1991. Similarly the number of households within the airport's 2011/12 48dBA 6.5hr night contour was 20% more than lived in that same area in 1991⁴⁸. Hounslow, the local authority most exposed to noise from Heathrow, has experienced a rapid increase in population. According to the 2011 census, Hounslow's population has increased by 20%, or 42,000 people, in the ten years since 2001⁴⁹. This pattern looks set to continue into the future. In Hounslow's long-term plan there are areas earmarked for residential development which could increase the number of households within Heathrow's noise footprint by a further 6%⁵⁰.
- 4.20. Land-use planning has historically sought to limit housing development in noisy areas so at face value this data could be seen as a failure of planning policy. However it is also evidence that many are not concerned by noise, or feel that the benefits of living close to a major international hub outweigh the downsides. 70% of property owners within Heathrow's '55 Lden' noise contour have purchased their property within the last fifteen years. This suggests that people are readily able to sell their houses and equally that others are willing to buy. Thus individuals are able to make a choice in balancing their own priorities.
- 4.21. The Commission's paper only briefly discusses land-use planning. It is important to fully debate how a longer-term strategic approach to land-use planning around airports could be used to reduce noise impacts. We are proactively seeking to engage with Local Authorities and Government on this issue. There is a need for clear government guidance to enable local authorities, working with airport operators, to establish robust policies which protect residents from high noise areas and ensure that the improvements in aircraft technology translate into lower levels of population exposure.

Mitigation through operational restrictions

- 4.22. We agree with the Commission that operational restrictions should not be applied as a first resort. We also agree that the London Airports Night Flying Restrictions are among the strictest in Europe. Those at Heathrow are particularly strict: despite strong demand less than half the number of flights are permitted at Heathrow compared with Gatwick and Stansted.

4.23. Indeed, our analysis of other international hubs shows that Heathrow has the lowest number of flights scheduled between 2300 and 0600 of any of the European hubs. Figure 4.2 shows the scheduled operation of Heathrow and Frankfurt for comparison.

Figure 4.2: Average scheduled flights per hour between 2300 and 0600 for Heathrow and Frankfurt⁵¹



Purple = scheduled arrivals; grey = scheduled departures

4.24. Landing charges should be considered as a tool to encourage the early adoption of new technology rather than an operating restriction in the purest sense as an airline could still operate any Chapter 3 aircraft but it would be more expensive. We have seen a number of airlines make conscious decisions on which aircraft in their fleet to operate to Heathrow based on the level of charge, and other airlines research which variant of a particular aircraft type to lease when starting a new service.

Noise Envelopes

4.25. A noise envelope can be developed that recognises future improvement in technology and shares them appropriately between the airport and its local communities. We look forward to the discussion paper expected from the CAA later this year. If a Heathrow option is short-listed we will identify a noise envelope approach(es) for local consultation.

Independent Noise Regulator

4.26. It is evident that some local residents around Heathrow need to have greater confidence that aircraft noise is being managed as effectively as possible. Our ongoing efforts to improve how we engage with our local communities aim to build that confidence. As a first step, we are planning to establish a 'Noise Forum' at Heathrow to bring together local authorities, community groups, national policy-makers and regulators and industry representatives. The group will focus initially on identifying operational procedures for further development and trial. We are starting to consult now on the terms of reference for the group with a view to convening it for the first time in late 2013 or early 2014.

Insulation and compensation

4.27. Heathrow currently provides a wide ranging set of compensation schemes for residential and community buildings as well as assistance with relocation. There are important elements in a noise management strategy. Over 41,000 residential properties and almost 70 community buildings are eligible for insulation.

4.28. At the start of 2013 we launched a pilot 'Quieter Homes' scheme to trial improvements to our residential noise insulation. Those improvements include an assessment process where each property is given a statement of need, providing a wider range of products, increasing the contribution offer and giving residents a choice of potential suppliers.

4.29. Other major airports fund their insulation schemes in a variety of ways. Many of the larger schemes are financed directly by the Government or via a specific passenger surcharge. These

schemes have typically been directly linked to additional capacity at the airport. At Heathrow, schemes are currently financed through our operating expenditure and meet or exceed the guidance set by the Government.

4.30. As part of an agreed solution to the UK's need for greater hub capacity, we would be pleased to work with the Commission and with Government to develop an appropriate insulation and compensation scheme.

5. Summary response to specific questions

The table below provides a summary response to the specific questions raised in the discussion paper and references the paragraph(s) in the full responses where more detailed discussion can be found.

Airports Commission questions	Summary of Heathrow's response to the questions	Reference to further discussion in main response
What is the most appropriate methodology to assess and compare different airport noise footprints?	The 57 dB LAeq contour has been retained by the Government as a core metric and we support that. However it should be supplemented by other metrics in a balanced scorecard. It is also important to consider changes in noise relative to background noise levels. More broadly any assessment of noise needs to be considered alongside other economic and social criteria in comparing options for new capacity.	Section 2.
What metrics or assessment method would an appropriate 'scorecard' be based on?	<p>It should be based on a combination including average noise contours; number above (N) or frequency measures; Person Events Index and Average Exposure Indicator contours, and; location-specific measures. It is also important to consider changes in noise relative to background noise levels. There are issues with noise efficiency metrics.</p> <p>Heathrow has been at the forefront of developing this kind of balanced scorecard. If a Heathrow option is shortlisted by the Commission, we will develop a balanced scorecard to complement the 57 Leq contour in describing the noise effects of additional capacity. It is important that local stakeholders are engaged in this development process so that the information provided is meaningful for those who will use it.</p>	Section 2
To what extent is it appropriate to use multiple metrics, and would there be any issues of contradiction if this were to occur?	It is appropriate to use a range of metrics to help assess and inform different stakeholders.	Section 2
Are there any additional relevant metrics to those discussed in Chapter 3 which the Commission should be aware of?	Not to our knowledge.	Section 2
What baseline should any noise assessment be based on? Should an assessment be based on absolute noise levels, or on changes relative to the existing noise environment?	Both are relevant, however it is important to consider the existing background levels of noise. Proposals to establish a new hub airport in the Thames Estuary or at Stansted may have a disproportionate impact on what are relatively tranquil areas.	Section 2
How should we characterize a noise environment currently unaffected by aircraft noise?	It is critical to consider the existing background levels of noise. Proposals to establish a new hub airport in the Thames Estuary or at Stansted may have a disproportionate impact on what are relatively tranquil areas.	Section 2
How could the assessment methods described in Chapter 4 be improved to better reflect noise impacts and effects?	<p>A balanced scorecard is needed – see response above.</p> <p>Annoyance is subjective and not everyone within noise contours is annoyed by noise. Local communities tell us that respite is also a significant issue. It is important that we improve our</p>	Section 2

	<p>understanding of how this is best delivered and tracked.</p> <p>Health effects need to be put in context. A high-level assessment commissioned by Heathrow shows that by creating new jobs and raising income levels a new runway at Heathrow could have positive health effects. Whilst we accept a new runway could also have some negative health effects, the evidence for many of these effects is not clear cut. We believe that by taking a balanced view neither noise nor health concerns should be obstacles to further development at Heathrow.</p>	
Is monetizing noise impacts and effects a sensible approach? If so which monetization methods described here hold most credibility, or are most pertinent to noise and its various effects?	Monetising the noise impacts of aviation would allow costs to be recognised when making decisions on new capacity. However, there is no optimal approach for doing this. The most effective approach at this stage is to seek to minimise the impacts and consider them in context of the large and quantifiable benefits of hub capacity. We also recommend that an expert panel should be established which represents the interests of different stakeholders to report by mid-2014 on what methodology if any is appropriate to use in the Commission's work at this stage.	Section 3
Are there any specific thresholds that significantly alter the nature of any noise assessment, e.g. a level or intermittency of noise beyond which the impact or effect significantly changes in nature?	Research has not been able to establish a uniform threshold. Non-acoustic factors play a significant role in how people respond to noise. The Government has retained the 57 Leq contour as a core measure of the impact of noise and we support that.	Section 1
To what extent does introducing noise at a previously unaffected area represent more or less of an impact than increasing noise in already affected areas?	The majority of those within Heathrow's noise footprint are also in London, where background noise is at typical urban levels. In choosing to live in a major city, people have made a judgement on whether the benefits outweigh some of the downsides. In contrast, proposals to establish a new hub airport in the Thames Estuary or at Stansted may have a disproportionate impact on what are relatively tranquil areas.	Section 1
To what extent is the use of a noise envelope approach appropriate, and which metrics could be used effectively in this regard?	We believe that a noise envelope can be developed that recognises those future improvements and shares them appropriately between the airport and its local communities.	Section 4
To what extent should noise concentration and noise dispersal be used in the UK? Where and how could these techniques be deployed most effectively?	There is no consensus about which should be used. In reality at Heathrow the situation is one of "concentrated dispersal". We support that approach. With the increased use of precision-based navigation it will be possible to concentrate tracks more than today and provide respite for communities by alternating (dispersing) which flight-paths are used. Dialogue with community stakeholders will be important in establishing how best to employ this approach.	Section 4
What constitutes best practice for noise compensation schemes abroad and how do these compare to current UK practice? What noise assessment could be effectively utilized when constructing compensation arrangements?	<p>Other major airports fund their insulation schemes in a variety of ways. Many of the larger schemes are financed directly by the Government or via a specific passenger surcharge. These schemes have typically been directly linked to additional capacity at the airport. At Heathrow, schemes are currently financed through our operating expenditure and meet or exceed the guidance set by the Government.</p> <p>As part of an agreed solution to the UK's need for greater hub capacity, we would be pleased to work with the Commission and with Government to develop an appropriate insulation and compensation scheme.</p>	

6. References

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- ¹ DfT *Aviation Policy Framework*, March 2013, paragraph 3.3.
- ² Based on data provided by the Environmental Research Consultancy Department (ERCD) of the CAA which shows that the 57dBA contour affected 2,004,000 people in 1974 and 243,350 in 2011.
- ³ Airports Commission, 2013, Discussion Paper 5 *Aviation Noise*, p. 15
- ⁴ Web based research conducted by Heathrow
- ⁵ Polling conducted by Populus <http://www.populus.co.uk/Poll/Heathrow>
- ⁶ Polling conducted by Populus <http://www.populus.co.uk/Poll/Heathrow>
- ⁷ Based on data provided by ERCD which compared the CACI population databases from 1991 and 2011 for the 2010 noise contour.
- ⁸ Hounslow Council Website:
http://search.hounslow.gov.uk/highlight.aspx?aid=418946&pckid=68946230&rn=1&sp_id=1916497123&lid=144628766&highlight=census+#firsthighlight
- ⁹ Heathrow commissioned research conducted by independent consultants CBRE
- ¹⁰ From Boeing website: 'The noise footprint of the 787 is more than 60 per cent smaller than today's similarly sized airplanes.' http://www.newairplane.com/787/design_highlights/#/environmental-performance/quieter-for-the-community/quieter-at-heathrow
- From the Airbus website 'The A380 carries 42% more passengers than the 747-400 but produces half the noise energy when taking off; and three to four times less noise energy when landing.'
http://www.airbus.com/fileadmin/media_gallery/files/brochures_publications/aircraft_families/A380_new_generation_new_experience_leaflet.pdf (p.8)
- ¹¹ Research commissioned by Heathrow and undertaken by McKinsey & Co. in 2012 compared the Heathrow fleet composition in with the global fleet composition and total fleet of airlines operating at Heathrow. The current charging structure is detailed in Schedule 5 of the Heathrow Conditions of Use 2013/14
<http://www.heathrowairport.com/about-us/partners-and-suppliers/conditions-of-use>
- ¹² EEA Technical Report 11/2010 and the EU Position Paper on dose-response relationships between transportation noise and annoyance (EC2002) provide information of the percentage "highly annoyed". The percentages provided in these papers have been used to derive the figures used in Figure 1.2.
- ¹³ The Government is responsible for producing London-wide strategic noise maps every five years showing the population exposed to noise from different forms of transport. Although maps for aviation noise for 2011 are available, as of 6 September 2013, comparative maps for road and rail noise for 2011 are not available. Consequently 2006 figures have been used.
- ¹⁴ Using dose response curves it is possible to estimate the number of people likely to describe themselves as highly annoyed. The figures presented for road and rail do not include people outside of the London Agglomeration but within the Heathrow Lden contour who may be highly annoyed by road or rail noise.
- ¹⁵ For aircraft noise the percentage of "highly annoyed" people has been based on both the EC2002 paper (10%) and the EEA Technical Report (28%). This range is indicated by the dotted line. The EEA percentages for road (6%) and rail (4%) have been used.
- ¹⁶ Based on CAA data presented to T5 Inquiry and supplemented by ERCD Report 1201 Noise Exposure Contours for Heathrow Airport 2011
- ¹⁷ DfT *Aviation Policy Framework*, March 2013, paragraph 3.17
- ¹⁸ Polling conducted by Populus <http://www.populus.co.uk/Poll/Heathrow>
- ¹⁹ Polling conducted by Populus <http://www.populus.co.uk/Poll/Heathrow>
- ²⁰ Based on data provided by ERCD which compared the CACI population databases from 1991 and 2011 for the 2010 noise contour.
- ²¹ Hounslow Council Website:
http://search.hounslow.gov.uk/highlight.aspx?aid=418946&pckid=68946230&rn=1&sp_id=1916497123&lid=144628766&highlight=census+#firsthighlight
- ²² Heathrow commissioned research conducted by independent consultants CBRE
- ²³ Web based research conducted by Heathrow
- ²⁴ B F Berry and I H Flindell, 2009, *Estimating Exposure-Response Relationships between Noise Exposure and Human Health Impacts in the UK*, BEL Technical Report 2009-2 Full Report
- ²⁵ Clark et al , 2007, *The effect of transportation noise on health and cognitive development: a review of recent evidenc*
- ²⁶ Noted by Ferenc Marki, *Outcomes of EU COSMA Project (Community Oriented Solutions to Minimize Aircraft Noise Annoyance)* (<http://fp7-cosma.eu/wp2>) presentation to the ANNA group meeting 23rd May 2013
Also to be found in Job, R. F. S., 1988, *Community response to noise: A review of factors influencing the relationship between noise exposure and reaction*, Journal of the Acoustical Society of America
- ²⁷ Heathrow Complaint Statistics
- ²⁸ Heathrow Complaint Statistics recorded in the ANOMS database.
- ²⁹ Normalising this data for population density shows a very similar pattern
- ³⁰ Bernard Berry
- ³¹ Summary Table provided by Bernard Berry.
- ³² Includes ischaemic heart disease (IHD), acute myocardial infarction (AMI) and hypertension

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- ³³ K. Jones, 2010, *Environmental Noise and Health: A Review*. CAA ERCD Report 0907.
- ³⁴ N D Porter, I H Flindell, and B F Berry. 1998. *Health effect based noise assessment methods – a review and feasibility study*. NPL Report CMAM 16. Sept. 1998.
- ³⁵ WHO 2012. *Methodological guidance for estimating the burden of disease from environmental noise*.
- ³⁶ E Laszlo, B F Berry, P Abbott and A L Hansell. 2012 *Environmental noise and cardiovascular disease – observations on a well known exposure-response relationship*. Proceedings of Internoise 2012 New York. Aug 2012.
- ³⁷ It is understood that the Interdepartmental Group on Costs and Benefits are currently reviewing source specific exposure response curves.
- ³⁸ Airports Commission, 2013, *Discussion Paper 05 Aviation Noise*. Paragraph 2.33
- ³⁹ C. Clark, J Head, S A Stansfield. 2013. “Longitudinal effect of aircraft noise exposure on childrens health and cognition: A six-year follow-up of the UK RANCH cohort. *Journal of Environmental Psychology* 35 (2013) 1-9.
- ⁴⁰ C. Clark, J Head, S A Stansfield. 2013. “Longitudinal effect of aircraft noise exposure on childrens health and cognition: A six-year follow-up of the UK RANCH cohort. *Journal of Environmental Psychology* 35 (2013) 1-9.
- ⁴¹ Focus Group research commissioned by Heathrow into supplementary metrics.
- ⁴² In 2011 the Aviation Environment Federation, British Airways, HACAN, Heathrow Airport and NATS entered into a dialogue process in to identify areas of common ground to feed into the Government’s scoping consultation on aviation policy. The group produced a joint submission which, while acknowledging that contours play an important role, also highlighted the need to develop supplementary metrics
- ⁴³ Airports Commission, 2013, *Discussion Paper 05 Aviation Noise*. Paragraph 1.5
- ⁴⁴ Airports Commission, 2013, *Discussion Paper 5 Aviation Noise*, p. 15
- ⁴⁵ Heathrow Airport, 2013, *A Quieter Heathrow - Airbus case study*, p19. The A380 was specifically designed to meet the Heathrow night restrictions which prohibited the scheduling of QC4 aircraft at night.
- ⁴⁶ Research commissioned by Heathrow and undertaken by McKinsey & Co. in 2012 compared the Heathrow fleet composition in with the global fleet composition and total fleet of airlines operating at Heathrow
- ⁴⁷ Based on Heathrow Traffic Charging System noise database and movements.
- ⁴⁸ Based on data provided by ERCD which compared the CACI population databases from 1991 and 2011 for the 2010 57dBA and 2011/12 48dBA 6.5hr noise contours
- ⁴⁹ Hounslow Council Website:
http://search.hounslow.gov.uk/highlight.aspx?aid=418946&pckid=68946230&rn=1&sp_id=1916497123&lid=144628766&highlight=census+#firsthighlight
- ⁵⁰ Research undertaken by Heathrow based on the “Local Plan Policy Options 2015-2030” issued by Hounslow Borough Council.
- ⁵¹ Research undertaken by Heathrow and based on published schedules in 2013.

Appendix – further references on health effects

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2	B F Berry. 2008. <i>Effect of Noise on Physical Health risk in London. Report on Phase 1 – Review of the Topic</i> . BEL Technical Report 2008-1. http://www.lcacc.org/noise/glanoisereport1008ph1.pdf
3	B F Berry. 2008. <i>Effect of Noise on Physical Health risk in London. Report on Phase 2 – Estimates of the numbers of people at risk</i> . BEL Technical Report 2008-2. 1. http://www.lcacc.org/noise/glanoisereport1008ph2.pdf
4	B F Berry and I H Flindell. 2010. <i>Using health effects of noise in economic valuation policies</i> Proceedings of Internoise 2010. Lisbon. June 2010.
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6	M. Sorensen.2011. <i>Exposure to road traffic and railway noise and associations with blood pressure and self reported hypertension: a cohort study</i> . <i>Environmental Health</i> 2011, 10:92.
7	S Fidell, V Mestre, P Schomer, B F Berry. 2011. <i>A first-principles model for estimating the prevalence of annoyance with aircraft noise exposure</i> . <i>J. Acoust. Soc. America</i> . 130(2). August 2011. http://asadl.org/jasa/resource/1/jasman/v130/i2/p791_s1?isAuthorized=no
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9	W Babisch et al. 2012. <i>Exposure modifiers of the relationships of transportation noise with high blood pressure and noise annoyance</i> . <i>J. Acoust. Soc. Am.</i> 132 (6), December 2012. 3788-3808.
10	H E Laszlo, B F Berry, P Abbott and A L Hansell. 2012. <i>Environmental noise and cardiovascular disease – observations on a well known exposure-response relationship</i> .Proceedings of Internoise 2012. New York. August 2012.
11	E. van Kempen and W Babisch. 2012. <i>The quantitative relationship between road traffic noise and hypertension: a meta-analysis</i> . <i>J Hypertens</i> 30:1075-86.
12	A. Evrard. 2012. <i>Health effects of aircraft noise near three French airports: results from a pilot epidemiological study of the DEBATS study</i> . Proceedings of Internoise 2012. http://debats-avions.ifsttar.fr/
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