

Crawley

Local Plan

**Crawley Borough Local Plan Topic Paper 7:
Development and Noise Technical
Appendix**



Page Intentionally Left Blank

Contents

1.	Introduction	5
2.	Local Aviation Context	6
3.	Policy Overview.....	6
4.	The Effects of Noise	9
5.	Effects on Amenity and Quality of Life	10
6.	Effects on Physical and Psychological Health.....	11
7.	Productivity and Learning Effects.....	12
8.	Noise from Aviation Transport Sources.....	13
9.	Government Policy on SOAEL	17
10.	Night Noise as a Specific Consideration	19
11	Secondary Metrics	21
12.	Interpretation of the Exposure Response Functions	21
13.	Interpretation of Noise Contours	21
14.	Need to Consider Future Noise.....	22

Page Intentionally Left Blank

1. Introduction

- 1.1 The Crawley Borough Local Plan, through Policy EP4 and the accompanying Noise Annex, seeks to manage the relationship between development and noise in order to protect people's quality of life and health.
- 1.2 As exposure to noise increases it will have increasingly adverse effects on people. Individuals who are affected may not be aware that the adverse effects are occurring, particularly for health and cognitive effects, whereas annoyance is something that an individual can clearly perceive.
- 1.3 Furthermore, as the effects are progressive, they can, at their worst, result in impacts that are far-reaching, fundamentally affecting quality of life and potentially resulting in serious health and stress related problems, amenity issues, and negative impacts on productivity and learning.
- 1.4 Noise is often considered in isolation. However, exposure to noise is also influenced by other factors such as overheating in properties, the need to ventilate to maintain good indoor air quality, and financial costs associated with the operation and maintenance of mechanical ventilation systems intended to replace the reliance on openable windows.
- 1.5 For these reasons, it is fundamental that the relationship between noise sensitive development and noise sources is effectively and appropriately managed through the Local Plan.
- 1.6 Local Plan Policy EP4 is consistent with the Noise Policy Statement for England (2010)¹, National Planning Policy Framework², Planning Practice Guidance³ and where appropriate national policy in relation to the consideration of the needs of aviation.
- 1.7 This Topic Paper summarises the current evidence in relation to the effects associated with noise, setting out the rationale for the noise policy and standards relating to noise from transport sources that are set out in the Local Plan. The Paper also sets out a more detailed commentary on the justification for the approach taken by the Local Plan in relation to noise from aviation sources.
- 1.8 Having numerical thresholds within the policy is advantageous as, amongst other things, they provide certainty to:
 - decision makers and thereby facilitate an efficient local planning system
 - land owners in making decisions about the potential use of land for development
 - existing lawful uses and protecting them from encroachment by inappropriate uses
 - future occupiers of any residential development ensuring that development is sustainable and well designed

¹ <https://assets.publishing.service.gov.uk/media/5a7956e0ed915d0422067947/pb13750-noise-policy.pdf>

² [National Planning Policy Framework - 15. Conserving and enhancing the natural environment - Guidance - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/collections/planning-practice-guidance)

³ <https://www.gov.uk/government/collections/planning-practice-guidance>

1.8 While the numerical thresholds are considered appropriate for local policy decision making, they do not always sufficiently describe the impact of the noise on individuals and therefore may underplay the impacts.

2. Local Aviation Context

2.1 Whilst Gatwick Airport brings many benefits to the region and the UK economy as a whole it is nonetheless an intrinsically noisy operation that operates 24 hours per day. The airport has the second largest number of air transport movements in the UK but these are not spread equally during the day or night or throughout the year. The nature of the operation at Gatwick means that the noise is worse during the summer period for both day and night compared to the winter period.

2.2 As a result of the airport operations the road network has unusual localised traffic patterns and flows with extended day periods of higher traffic levels with shorter periods of lower traffic flows than compared to an area without an airport.

3. Policy Overview

3.1 The Noise Policy Statement for England (2010) provides overarching policy in relation to noise. It has a stated vision:

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

It states that this is a long term desired policy outcome and it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources in all circumstances.

3.2 It makes it clear that:

“There is a need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focussing solely on the noise impact without taking into account other related factors.”

3.3 And:

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

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.”

3.4 These are to be interpreted within the context of the guiding principles of sustainable development: Ensuring a Strong Healthy and Just Society; Using Sound Science Responsibly; Living Within Environmental Limits; Achieving A Sustainable Economy; Promoting Good Governance.

- 3.5 The Explanatory Note to the Policy provides further information on this. It makes it clear that it is impractical to have no noise at all but in achieving the balance *“the NPSE aims to provide the necessary clarity and direction to enable decisions to be made about what is an acceptable noise burden to place on society.”*
- 3.6 It also states that it should *“allow noise to be considered alongside other relevant issues and not to be considered in isolation.”*

3.7 The NPSE introduces three adverse effect levels, these being the:

- **NOEL (No Observed Effect Level)** the level below which no effect can be detected
- **LOAEL (Lowest Observable Effect Level)** the level above which effects on health and quality of life can be detected
- **SOAEL (Significant Observed Adverse Effect Level)** the level above which significant adverse effects on health and quality of life occur.

(Note the NOEL and LOAEL are based in principles of toxicology that are currently being applied by the World Health Organisation. The SOAEL is a UK extension of these concepts.)

3.8 A fourth threshold of the Unacceptable Exposure Level is introduced by virtue of Paragraph 174 of the National Planning Policy Framework: *“Planning policies and decisions should contribute to and enhance the natural and local environment by:...*

(e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;”

3.9 In describing the SOAEL the NPSE policy seeks to clarify 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, for different receptors and at different times.

“It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.”

Aviation Policy

- 3.10 The Aviation Policy Framework 2013⁴ framework sets out the detailed approach to aviation, so that benefits of aviation can be realised whilst managing the unwanted aspects. The foreword to the policy concludes:
- “The Government believes that aviation needs to grow, delivering the benefits essential to our economic wellbeing, whilst respecting the environment and protecting quality of life. The way ahead will be challenging as we work together to strike the right balance. But it is critical that we do so in order to safeguard our long-term economic prosperity.”*
- 3.11 The Aviation Policy Framework is written from the perspective of continuing growth of air transport, allowing the expansion of a vibrant industry. This in contrast to the consideration of new development encroaching upon airports. Whilst it made recommendations on the minimum levels at which the airports should offer mitigation for their activities, it did not consider new noise sensitive development encroaching on the airport and a specific policy for this.
- 3.12 In the Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace⁵, the government acknowledged that annoyance had increased to aircraft noise and that it had previously been underestimated. It also noted the need to consider other metrics as noise could not be easily represented by a single metric with the LAeq, and the Civil Aviation Authority (CAA) has looked at overflights, N above levels (Number of events a specific noise value).
- 3.13 The *Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England*⁶ (ANPS) provided a confirmation of the policy decision for the development of Heathrow. However, the Gatwick case was seen as a strong one and potentially it remains a viable option despite the recent Development Consent Order (DCO) application in relation to Gatwick’s Northern Runway Project. The ANPS emphasised the economic case for growth in this sector, without which the cost to the UK would be between £30 and 45 billion over 60 years. The ANPS is about expanding the airports, and not addressing the issue of encroachment by sensitive development and generating specific guidance for decision making in this aspect.
- 3.14 In 2018, *Beyond the Horizon: The Future of UK Aviation*⁷ signalled that expansion would be entertained through the policy of “making the best use” of existing runway capacity, which subsequently led Gatwick Airport Limited (GAL) to make the DCO application for the Northern Runway Project.
- 3.15 Despite the government preference for a third runway at Heathrow and the 2018 Beyond the Horizon paper creating opportunities for the use of the

⁴ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/153776/aviation-policy-framework.pdf

⁵ <https://assets.publishing.service.gov.uk/media/5e95c85e90e071a1b83a22d/consultation-response-on-uk-airspace-policy-print-version-document.pdf>

⁶ [Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England \(publishing.service.gov.uk\)](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/681111/Airports_National_Policy_Statement_new_runway_capacity_and_infrastructure_at_airports_in_the_South_East_of_England.pdf)

⁷ [Beyond the horizon the future of UK aviation \(publishing.service.gov.uk\)](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/681111/Beyond_the_horizon_the_future_of_UK_aviation.pdf)

northern runway at Gatwick, Crawley Borough Council is still being required to safeguard land for a wide spaced Southern runway.

- 3.16 In Aviation 2050: The Future of UK Aviation (2018)⁸ it was acknowledged that *“There is also evidence that the public is becoming more sensitive to aircraft noise, to a greater extent than noise from other transport sources, and that there are health costs associated from exposure to this noise.”*
- 3.17 The paper added: *“Avoiding people being exposed to aircraft noise in the first place is preferable to taking action through mitigation. The CAA’s forecasts show that the number of people exposed to levels of noise with potential health costs will continue to grow despite aircraft noise reducing. However, given the government’s priority to provide new homes, it is unrealistic to expect that new homes will not be built in areas affected by aircraft noise to some extent”.*
- 3.18 *Flightpath to the Future*⁹ (2018) confirmed the Government’s stance following the 2018 consultation including the need to set a clearer aviation noise policy framework.
- 3.19 In March 2023 and in advance of the full policy the revised Overarching Noise Policy¹⁰ statement was published. This sets out:

“The government’s overall policy on aviation noise is to balance the economic and consumer benefits of aviation against their social and health implications in line with the International Civil Aviation Organisation’s Balanced Approach to Aircraft Noise Management. This should take into account the local and national context of both passenger and freight operations, and recognise the additional health impacts of night flights”.

“The impact of aviation noise must be mitigated as much as is practicable and realistic to do so, limiting, and where possible reducing, the total adverse impacts on health and quality of life from aviation noise.”

- 3.20 Although the full text is yet to be published it is clear in setting out that the: *“total adverse effects may be offset by an increase in economic and consumer benefits”*. The implication is that if aviation continues to grow, and if these benefits continue to outweigh the impacts of noise, then within this policy and provided it is *“mitigated as much as is practicable to do so”* then aviation growth can continue.

4. The Effects of Noise

- 4.1 There is a growing amount of research relating to the health impacts of noise, and on the dose response (reaction to increasing noise exposure) relationship between noise and health. The original evidence cited in previous versions of this paper for causal links between noise exposure and health impacts were the:

⁸ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/769695/aviation-2050-web.pdf

⁹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1079042/flightpath-to-the-future.pdf

¹⁰ <https://www.gov.uk/government/publications/aviation-noise-policy-statement/overarching-aviation-noise-policy>

- The Health Protection Agency (HPA) summary document *Environment Noise and Health in the UK* (2010) (now within ERCD 0907)¹¹
- the work of the government-appointed Airports Commission in *Discussion Paper 5: Aviation Noise* (2013)¹²
- *Aircraft Noise Effects on Health* by Dr. Charlotte Clarke, Queen Mary, University of London, for the Airports Commission (2015)¹³

In addition, more recently published work includes:

- Environmental Noise Guidelines for the European Region (2018), WHO¹⁴
- CAP 2161 Survey of Noise Attitudes 2014: Aircraft Noise and Sleep Disturbance¹⁵
- Environmental Noise and Effects on Sleep: An Update to the WHO Systematic Review and Meta-Analysis, Smith et al (2022)¹⁶

4.2 Through these documents, it is possible to identify three specific areas in which adverse effects of noise exposure can impact on populations and individuals, these being Amenity and Quality of Life; Health; and Learning.

4.3 The evidence for these effects is continuing to increase and this Topic Paper highlights some of these changes, which has informed the approach of Local Plan Policy EP4 and the Local Plan Noise Annex.

5. **Effects on Amenity and Quality of Life**

5.1 This form of noise impact may typically affect people in two ways: annoyance, and sleep disturbance.

5.2 Annoyance is considered to manifest itself when noise impact disturbs a person's daily life, for example, through interrupting a conversation or causing distraction whilst resting (Airports Commission, 2013). Annoyance will typically increase as noise exposure increases, though changes in pitch and intermittency can also increase annoyance.

5.3 The *Aviation White Paper* (2003) found the onset of community annoyance to occur at 57dB L_{Aeq16hr}, a figure that originates from the 1982 Aircraft Noise Index Study (ANIS).

5.4 Over time, individual aircraft have become quieter, but have increased in number. The *Attitudes to Noise from Aviation Sources in England* study (ANASE), DfT, 2007) demonstrated that the number of aircraft had a greater impact on annoyance than increasing average noise levels¹⁷. This suggests that the level for the onset of community annoyance may actually occur below 57dB L_{Aeq16hr}, and that the impact of higher levels of noise may be greater than previously thought. This follows research published by the European Commission with the Environmental Noise Directive (END) in 2002 which

¹¹ <https://publicapps.caa.co.uk/docs/33/ERCD0907.pdf>

¹² <https://assets.publishing.service.gov.uk/media/5a7cac80e5274a38e57560e7/airports-commission-noise.pdf>

¹³ <https://assets.publishing.service.gov.uk/media/5a819b09e5274a2e87dbe879/noise-aircraft-noise-effects-on-health.pdf>

¹⁴ [Environmental noise guidelines for the European Region \(who.int\)](https://www.who.int/publications/m/item/environmental-noise-guidelines-for-the-european-region)

¹⁵ [CAP2161: Survey of Noise Attitudes 2014: Aircraft Noise and Sleep Disturbance \(caa.co.uk\)](https://assets.publishing.service.gov.uk/media/5a7cac80e5274a38e57560e7/cap2161-survey-of-noise-attitudes-2014-aircraft-noise-and-sleep-disturbance-cao-co-uk)

¹⁶ [Environmental Noise and Effects on Sleep: An Update to the WHO Systematic Review and Meta-Analysis - PubMed \(nih.gov\)](https://pubmed.ncbi.nlm.nih.gov/39888888/)

¹⁷ Some aspects of the ANASE methodology have been questioned at peer review.

showed that equivalent levels of Aircraft Noise created greater annoyance than other modes of transport.

- 5.5 More recent research (*ERCD CAP1506 Survey of noise attitudes 2014; Aircraft*) shows that the same percentage that was highly annoyed at 57dB $L_{Aeq16hr}$ in the 1982 ANIS study is now highly annoyed at 54dB $L_{Aeq16hr}$.
- 5.6 The UK Airspace Policy: *A framework for balanced decisions on the design and use of airspace: Moving Britain Ahead*¹⁸ (2017) reflected these findings. It also aligned UK standards for night exposure with World Health Organisation (WHO) proposals of 45 L_{night} .
- 5.7 Sleep disturbance is one of the most common impacts described by people living with high levels of noise exposure. It can have a significant impact on quality of life as people are tired the following day and can typically feel a strong resentment where it is felt that their sleep has been disturbed.
- 5.8 The Airports Commission (2013) cited a well-established evidence base which has found noise-induced awakenings to have an adverse effect on people's quality of life. However, it is less clear as to what extent and level of noise exposure can result in a harmful loss of sleep, and whether lesser reactions to noise that do not involve awakening, can affect well-being. It does appear that even though some adaptation to night noise does occur, complete habituation does not occur, particularly for heart rate (Section 6 on Physiological Health refers). It also appears that children are less likely to wake but their physiological reaction is greater.
- 5.9 In 2011, the WHO published the *Burden of Disease from environmental noise – quantification of healthy life years lost in Europe*. The report estimated that between 1 and 1.6 million life years were lost each year across Europe, which, when using the Department of Health guidance on valuing life years, places the social cost at between £60 and £100 billion per annum¹⁹. Within this, sleep disturbance was the single highest health impact. To put this in perspective, the total budget for the National Health Service (NHS) in 2018/19 was £114.6bn.

6. Effects on Physical and Psychological Health

- 6.1 Noise can have a significant impact on health through cardiovascular effects (including hypertension, ischaemic heart disease and stroke), brain disorders (as a result of sleep awakenings) and mental health. These are the principal effects considered, although there are others where new evidence is emerging.
- 6.2 The link between noise and cardiovascular disease is established, with research finding that exposure to noise events can place the body under stress, even if there is no conscious reaction to the noise. When stressed, the body releases hormones that may to varying degrees increase heart rate and blood pressure, with the link between high blood pressure and cardiovascular diseases, strokes, chronic renal failure, and heart attack, already well-

18

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918784/consultation-response-on-uk-airspace-policy-web.pdf

¹⁹ Environmental Noise: Valuing impacts on Sleep Disturbance, annoyance, productivity and quiet (2014) DEFRA

established. Acute noise exposure has also been linked to other forms of physiological activation including peripheral vasoconstriction with relative withdrawal of blood from the skin and increased peripheral vascular resistance.

- 6.3 The European-wide *Hypertension and Exposure to Noise Near Airports* study (HYENA, 2008) examined links between noise from aircraft and road traffic and hypertension, finding there to be direct links between increased noise exposure and increased hypertension.
- 6.4 Other research has shown that increased noise may have an exacerbating effect on existing coronary heart disease conditions²⁰. Dose-response relationship data has found that risk of myocardial infarction increases above 60dBA and is significant at 70dBA, with an increased risk of coronary heart disease associated with sound levels above 65-70dBA.
- 6.5 Links between noise exposure annoyance and mental health have also been hypothesised, with studies identifying anxiety and depression as the most likely psychological symptoms²¹. However, it is acknowledged that further research is needed in this area.
- 6.6 In October 2017, the *New Scientist* published an article, *Sleep the Good Sleep*, by Matthew Walker (Director of the Centre of Human Sleep Science, University of California, Berkeley) from his book *Why We Sleep*. The book links the build-up of toxic amyloid proteins in the brain with Alzheimer's disease and the loss of deep NREM sleep. It is during these periods of deep sleep that the body removes the amyloid protein build-ups. However, it is also known that repeated noise events during the night reduces the quality of sleep, including the deep NREM stage. The paper, therefore, shows the mechanism by which sleep loss caused by noise events could lead to an increased risk to Alzheimer's disease.

7. Productivity and Learning Effects

- 7.1 Noise has been linked to impacts in two particular ways; cognitive impairment in children, and loss of productivity.
- 7.2 The most consistent observed effects of noise on children (particularly for children at primary school age) are recognised as being cognitive impairments.
- 7.3 Research has established a number of negative impacts in this regard, and tasks which involve central processing and language comprehension, such as reading, attention, problem solving and memory appear to be most affected by noise exposure. Links between chronic noise exposure and children's cognition have also been suggested, including teacher and pupil frustration, learned helplessness, impaired attention, increased arousal, indiscriminate filtering out of noise during cognitive activities resulting in loss of attention, noise annoyance, and sleep disturbance²².

²⁰ Noise: Babish, 2006; Smoking: Prescott et al. (1998); and lack of exercise: Hu et al. (2005) and Li et al. (2006).

²¹ Stansfeld, et al. (1993). Road traffic noise, noise sensitivity and psychological disorder; Hiramatsu, K., et al. (1997). A survey on health effects due to aircraft noise on residents living around Kadena airport in the Ryukyus'; Hardoy, M.C., et al. (2005). Exposure to aircraft noise and risk of psychiatric disorders.

²² Airports Commission (2013)

- 7.4 It has been shown that there is an association between high noise exposure and poor long-term memory and reading comprehension amongst children living around airports. Research has also suggested that the source of noise may be a factor, with the European RANCH²³ study finding road traffic to have no observed effect on children's reading or memory, whilst observing impaired reading comprehension and recognition memory in children exposed to aircraft noise.
- 7.5 The Airports Commission (2013) notes that the productivity impacts of noise are more secondary in nature, and are linked to effects previously discussed, including sleep disturbance, health impact, links between academic performance and noise, and impacts in terms of workplace distraction.
- 7.6 There is also a significant financial cost to noise and, in November 2014, DEFRA published *Environmental Noise: Valuing impacts on Sleep Disturbance, annoyance, productivity and quiet*. This estimated the cost alone of the loss of productivity due to noise in England as being between £2 billion and £6 billion per annum in England.
- 8. Noise from Aviation Transport Sources**
- 8.1 The Airports Commission (2013) observes that the metrics used to measure the long-term impact of aircraft noise has become a subject of particular discussion. UK policy has historically identified $57L_{Aeq16h}$ as the threshold at which daytime noise marks the onset of significant community annoyance. This was based on the research carried out in 1982 and published in the Aircraft Noise Index Study (ANIS) paper. However, it has been argued that the 57_{Aeq16h} contour does not necessarily reflect the day-to-day experience of people living within the contour, who will tend to experience short bursts of intense sound, rather than a constant sound.
- 8.2 Further, it has been noted that significant annoyance may be experienced outside of the $57 L_{Aeq16h}$ contour, as acknowledged in the Department of Transport's 2012 Draft Aviation Policy Framework (APF). Despite this, in responding to comments on the draft APF the Government decided against using a lower value to mark the onset of significant community annoyance (Airports Commission, 2013).
- 8.3 The Aviation Policy Framework (2013) sets out the Government's policy in relation to aviation noise, this being: '*to limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise...*' The document confirms that $57dB L_{Aeq,16h}$ is the approximate '*onset of significant community annoyance*'. Therefore even at 60dB there are sections of the community which will suffer significant annoyance.
- 8.4 In 2014 the CAA published CAP1506 - Survey of Noise Attitudes 2014: Aircraft (SoNA). This showed that since ANIS in 1982 the same percentage of 'highly annoyed' people now occurred at 54dB rather than $57dB L_{Aeq16h}$, suggesting that the '*onset of significant community annoyance*' should be lowered from 57dB to $54dB L_{Aeq16h}$.

²³ Road traffic noise and Aircraft Noise exposure and children's Cognition and Health

8.5 In 2019 the CAA published CAP1841 – Aircraft Noise and Health Effects: A six-month update (April 2019 – September 2019). This reviews recent research of the impacts of noise and it referenced a Swiss study by Brinks et al, on the exposure-response relationship for road, rail and aircraft noise and the percentage of 'highly annoyed'. As shown below, it used the metrics of L_{DEN} and shows that aircraft noise annoyance scores are higher than those given in response to railway and road traffic noise.

3.29 The results indicated that for all noise sources there were significant associations between L_{den} and %HA after controlling for confounders and independent predictors such as IR (measured over 24 h), exposure to other transportation noise sources, sex and age, language, home ownership, education level, living duration, temperature, and access to a quiet side of the dwelling. These results are shown in Figure 4.

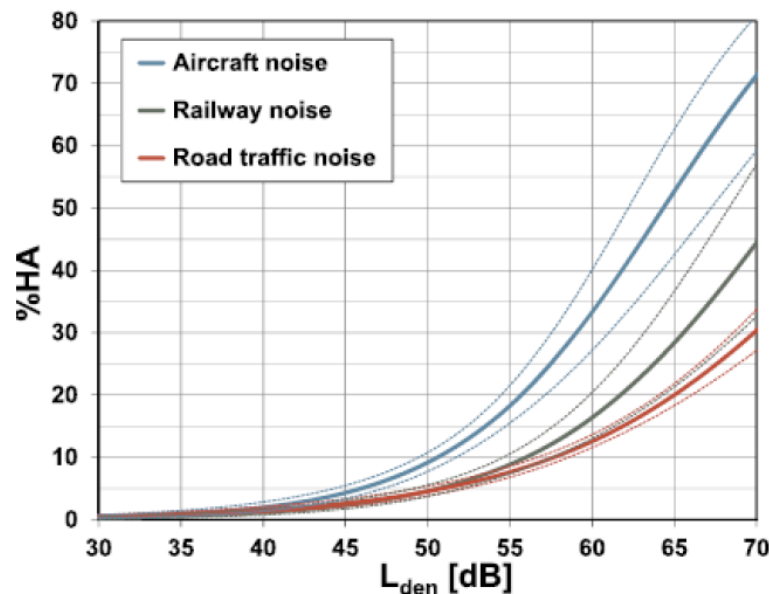


Figure 4: Exposure-response curves for the percentage highly annoyed (%HA) by road, rail, and aircraft noise, including 95% CI.

Source: CAA CAP1841

8.6 The original Planning Policy Guidance 24 (1994) had already recognised that aviation noise required a lower noise standard and stated that '60 Leq dB(A) should be regarded as a desirable upper limit for major new noise-sensitive development.' Road and rail were set at higher levels (63dB & 66dB) respectively. The reasoning for having a lower noise level for aircraft noise than for other transport sources was due to the fact that road and rail noise generally only affects the façades facing the source, with the buildings acting as a noise barrier and so shielding the far side of the dwelling, creating lower noise levels for that façade and any external amenity space. In the case of aircraft noise, all façades of a dwelling, its external living space and the whole surrounding neighbourhood are affected by the high levels of noise. There is ultimately no escaping the noise, apart from inside the dwelling with the windows closed.

- 8.7 As new housing will be in situ for possibly 100 years then reducing the ceiling to exposure to 60dB_{L_{Aeq}} is the first step in achieving that target. If the current approach to airport expansion is pursued then it is likely that an increase in noise levels are only likely to increase with contours extending further.
- 8.8 The WHO published new Environmental Guidelines for the European Region in 2018, which state that for aircraft noise they strongly recommend reducing levels of noise to below 45dB L_{den} or 40dB L_{night} as levels above these are associated with adverse health effects. This is a year after the proposals in Airspace change (see 3.12) proposals concurred with the WHO standard of 45dB L_{night}. The WHO underlying methodology for updating the proposals was contested but the criticism was robustly rebutted by the WHO.
- 8.9 In Environmental Noise and Effects on Sleep: An Update to the WHO Systematic Review and Meta-Analysis, by Smith *et al* (2022), a wider meta-analysis of all evidence was performed including the WHO evidence for the Environmental Noise Guidelines for the European Region 2018 together with numerous other datasets. This again demonstrated that air transportation causes significant increased sleep disturbance from aviation noise compared to road and rail noise. Furthermore, it found the WHO 2018 work to have underestimated the effects of aircraft noise at night, with the exposure response worse than previously identified.
- 8.10 The following table figure shows the percentage of respondents who were highly sleep disturbed (HSD) at varying noise levels. The graphs demonstrate that all stages of sleep there is a significant increase of sleep disturbance. This supports the position taken in the Crawley Local Plan that Aviation Noise must have a lower Unacceptable Adverse Effect Level (UAEL) than both Road and Rail Noise, and at lower levels than previously considered:
- 8.11 The need for quieter outdoor space is also recognised in the British Standard BS8233:2014. Section 7.7.3.2 (Design criteria for external noise) states '*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB L_{Aeq,T}, with an upper guideline value of 55 dB L_{Aeq,T} which would be acceptable in noisier environments*'. These levels are also supported by the Professional Practice Guidance on Planning & Noise for New Residential Developments, produced by the ANC (Acoustics and Noise Consultants, IOA (institute of Acoustics) and the CIEH (Chartered Institute of Environmental Health).
- 8.12 Planning Practice Guidance: Noise (July 2019) makes the following points on external amenity spaces '*where external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.*' It continues to recognise that not all locations are able to achieve this standard and recommends potential alternatives:
- *a relatively quiet façades (containing windows to habitable rooms) as part of their dwelling;*
 - *a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced if this area is exposed to noise levels that result in significant adverse effects;*

- a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
- a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minute walking distance).

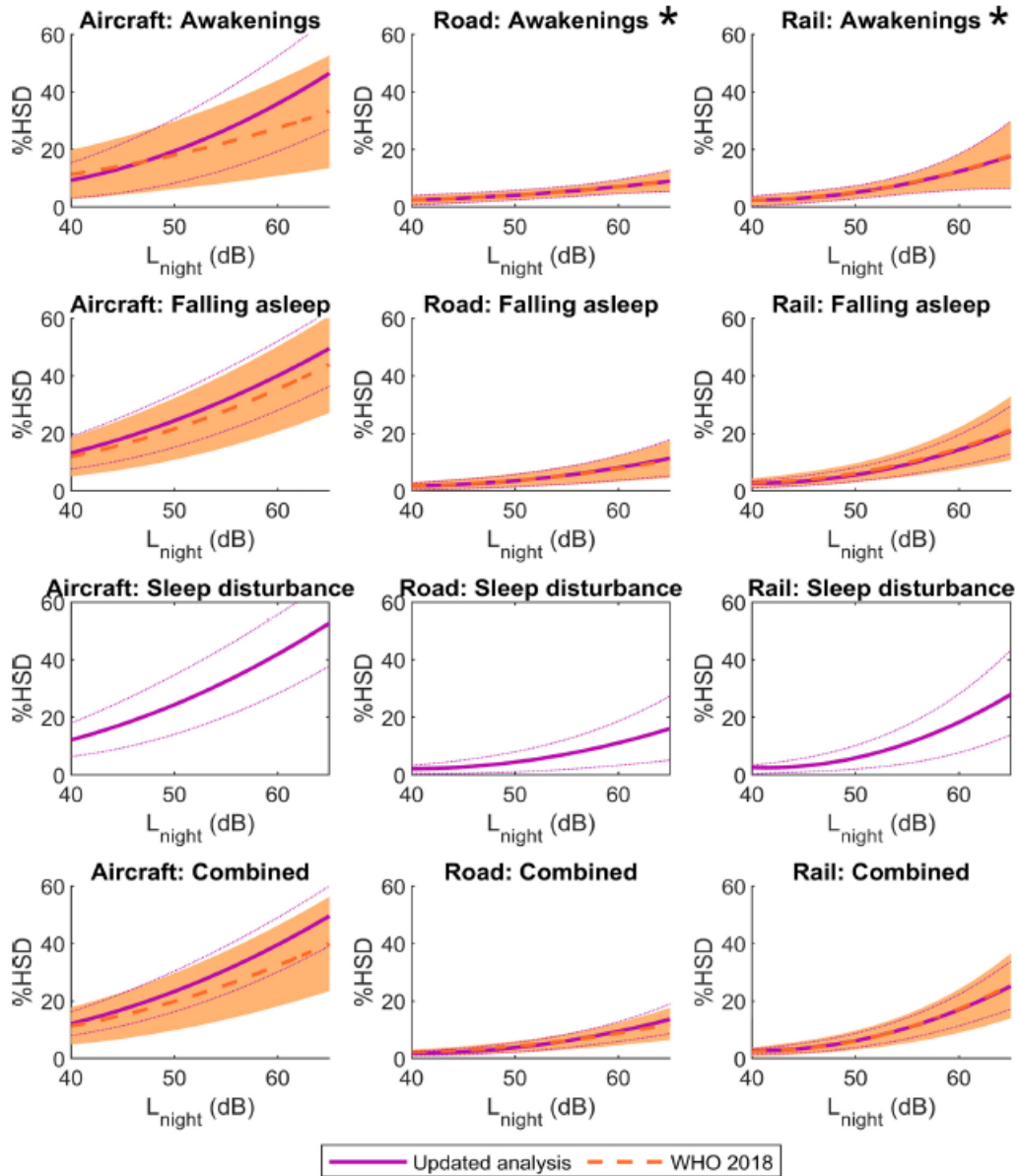


Figure 6. Probability of being highly sleep disturbed (%HSD) by nighttime noise, determined via questions that mention noise as the source of disturbance, stratified by disturbance question and traffic mode. Exposure–response relationships were derived using all available data, from the original WHO review¹⁹ and the 11 newly identified studies. Results of the present updated analysis (solid purple lines with dotted 95% CIs) are compared against results of the 2018 WHO review²⁰ (dashed orange lines with shaded 95% CIs). Relationships for the sleep disturbance questions were not calculated previously. Asterisks (*) indicate sleep outcomes for which no new studies have been published since the WHO review. Parameter estimates were calculated in logistic regression models with L_{night} included as the only fixed effect and study included as a random effect, restricted to the noise exposure range 40–65 dB L_{night} . Models were run separately for each traffic mode and disturbance question. The combined estimate was calculated using average responses of the awakening, falling asleep, and sleep disturbance questions within studies. Note: CI, confidence interval; L_{night} , nighttime noise; WHO, World Health Organization.

Source: *Environmental Noise and Effects on Sleep: An Update to the WHO Systematic Review and Meta-Analysis (2022)*

- 8.13 With aviation noise, none of these options are usually available. This is because the noise descends from above and the use of barriers has only limited effect. The only option with residential developments is to restrict the whole development to the 60dB $L_{Aeq,16hr}$ contour so that residents are not exposed to excessive levels of noise whilst carrying out external activities in their gardens, in the street, at the local shops or waiting for the bus. Neighbourhoods exposed to higher levels of noise may ultimately result in residents travelling to 'quieter' locations by bus or car which becomes unsustainable.
- 8.14 The Consultation Response on UK Aviation Policy: A framework for balanced decisions on the design and use of airspace, October 2017, set up the government's policy of LOAEL as 51dB $L_{Aeq,16h}$ and 45dB $L_{Aeq,8h}$. These levels are higher than those proposed by the WHO, and there are many residents around airports that complain about noise outside these contours due to the frequency of overflight.

9. Government Policy on SOAEL

- 9.1 There is presently no formal government policy on the SOAEL for new residential development near existing noisy transport sources. All recent publications by the government have focused more on airport expansion and the relative impacts on residents.
- 9.2 The UK Airspace Policy Consultation: *A framework for balanced decisions on the design and use of airspace* was prepared by the Department of Transport and looks to balance the need for increasing airport capacity with the impact experienced by 'existing' residents on the ground. When expanding airports there are opportunities within the planning process for compensation for residents and additional controls to protect them. Within this process it is useful to have a clear policy on noise and agreed noise levels for LOAELs & SOAELs so that impact can be clearly quantified economically using the government's Transport Appraisal Process (WebTag).
- 9.3 However, the consultation document only mentions land-use planning in passing. The clearest statement in relation to Land-use Planning is made on page 73 (see extract below) where the document states that the government approach is in line with the principles of International Civil Aviation Organization's (ICAO) Balanced Approach, which states:
- "Land-use planning: Land-use planning and management is an effective means to ensure that the activities nearby airports are compatible with aviation. Its main goal is to minimize the population affected by aircraft noise by introducing land-use zoning around airports. Compatible land-use planning and management is also a vital instrument in ensuring that the gains achieved by the reduced noise of the latest generation of aircraft are not offset by inappropriate residential development around airports."***



Balanced Approach

Source: UK Airspace Policy: A framework for balanced decisions on the design and use of airspace

- 9.4 This is also the approach that the Local Plan has applied in developing its own SOAEL and UAEL table for new noise-sensitive developments. By prohibiting developments nearer Gatwick Airport where noise exposure is greatest, it is therefore minimizing the population affect by any future growth by of the airport.
- 9.5 There have been a number of Public Inquiries and decisions by the Secretary of State in relation to the development of new transport noise sources and expanding existing transport noise sources, including new airport infrastructure. This has included:
 - *London City Airport Development Plan, 2015-2016; and*

- *Cranford Agreement Secretary of State's Decision, February 2017.*

These decisions relate to the expansion of an existing noise source. Such developments can be of national economic importance and these factors may often be viewed by decision makers as outweighing the adverse impact on individuals that are affected by increased noise. This is especially the case with aviation, where expansion of existing airports is the only realistic option where it is determined that increased capacity is required and appropriate. (Airports Commission in 2014).

- 9.6 However, with new housing development there is no absolute requirement to build in such high noise locations which have a detrimental and negative effect on the health and welfare of future residents and ultimately on the economy of the UK.
- 9.7 It is therefore more appropriate to look at recent Planning Inspectorate decisions for an acceptable noise level. There has been a recent planning appeal decision on the development of new housing near Manchester Airport (case reference: APP/R0660/W/15/3027388). The housing was proposed to be located in the 60dB (73%) & 63dB (27%) contours. In dismissing the appeal, the Inspector stated the following:
- “The external noise environment would not be positive but would have a significant adverse impact on the quality of life of future residents. Whilst noting that an acceptable internal acoustic environment would technically be achievable, the sealed box solution would further detract from future residents’ quality of life and is an additional factor weighing against permission.”*
- 9.8 This decision reflects the fact that even though the internal environment can be technically protected, the external environment, when exposed to levels exceeding 60dB L_{Aeq16h} would be unacceptable. The Inspector correctly differentiated the expansion of existing airports with the introduction of new residents to a noisy location.

10. Night Noise as a Specific Consideration

- 10.1 The greatest health and annoyance impacts from living near an airport occur due to night noise (this is defined as the period 23:00 to 07:00). Night flights at Gatwick are controlled by the DfT and despite years of protest by residents and growing evidence of the negative health impacts there has been negligible change.
- 10.2 It is important to note that for the night flight scheme during the summer Gatwick has the greatest number of night flights of any UK airport with 3.5 times the number of flights and double the total noise burden (as measured by noise quota) compared to the same period for Heathrow. It is essential to the dominant carriers at Gatwick Airport (e.g. EasyJet, Ryanair) that they can achieve multiple turnarounds of their aircraft to maintain their low cost business model.
- 10.3 The Night Quota Period restricts the total number of flights allowed in both the summer and winter but only applies from 23:30 to 06:00, therefore allowing Airlines to make maximum use of the Shoulder Periods (23:00-23:30 and 06:00-07:00) for their first and final turnarounds respectively. The 06:00 to 07:00, whilst still in the night period, is the period of greatest activity.

- 10.4 The impacts on health of night flights are well documented and the evidence base is growing that even low levels of night noise can adversely affect the sleep of residents. Basner and Samel (2006) at the DLR Institute for Aerospace in Germany found that the probability of an awakening increased with increasing indoor maximum noise level, L_{ASmax} , and could be approximated to a second-order polynomial with first reactions occurring at an L_{ASmax} of 32.7 dB. In short, the louder the individual external aircraft noise event, the fewer the number of events required to cause awakening.
- 10.5 The results of the DLR sleep study were subsequently reflected in the WHO publication of Night Noise Guidelines (NNG) for Europe (2009). The NNG summarise the relationship between night noise and health effects into four ranges of continuous outside sound level at night (L_{night}).
- <30 dB - Although individual sensitivities and circumstances differ, it appears that up to this level no substantial biological effects are observed.
 - 30-40 dB - A number of effects on sleep are observed from this range: Body movements, awakening, self-reported sleep disturbance, and arousals. The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (e.g., children, the chronically ill and the elderly) are more susceptible. However, even in the worst cases the effects seem modest.
 - 40-55 dB - Adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.
 - >55 dB - The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep disturbed. There is evidence that the risk of cardiovascular disease increases.
- 10.6 It was recommended that the 55dB L_{night} should be the 'Interim Level', but this was dropped in 2018 The WHO Environmental Noise Guidelines for the European Region (2018) and now recommends the following:
- “For night noise exposure, the Guideline Development Group strongly recommends reducing noise levels produced by aircraft during night time below 40 dB L_{night} , as aircraft noise above this level is associated with adverse effects on sleep.”*
- 10.7 This supports the Policy EP4 approach of a UAEL of 57dB $L_{Aeq,8hr}$. The L_{night} is an 8-hour average of all nights across the year. The $L_{Aeq,8hr}$ is a 92-day summer night contour, so it is slightly higher. A comparison of the two sets of contours for 2019 shows that they are almost exactly the same, suggesting that the summer period has a dominant effect on the noise levels for the remainder of the year. It also suggests that there is a greater noise dose during the summer period when there is likely to be greatest exposure.
- 10.8 The CAA report, CAP 2161 Survey of Noise Attitudes 2014: Aircraft Noise and Sleep Disturbance (SoNA 21) re-examined the data from the 2014 study and analysed the night time data in relation to sleep disturbance. This report is particularly relevant as it studied attitudes around Heathrow, Gatwick and

Stansted. The analysis showed that above 48dB $L_{Aeq,8hr}$ there was a significant increase in people being highly sleep disturbed, as summarised in table 14 of that report. The Crawley Borough Local Plan SOAEL for the night period is therefore set on that basis: 48dB $L_{Aeq,night}$.

11 Secondary Metrics

- 11.1 The N above metric (Number of events above a specified sound level) is now recognised as a secondary metric that helps to explain how noise is experienced. For night noise the number of events above 60 dB is relevant. The N60 contour relates to a level of over 60dB L_{ASmax} outside and exposure response, which with the windows open relates to a minimum of 45dB L_{ASmax} inside
- 11.2 Although not explicitly stated in aviation noise policy, the SoNA work allows thresholds to be identified for N above:
- LOAEL of 1 event
 - SOAEL of 30 events (due to a sharp increase in annoyance)
 - Unacceptable Exposure Level of 40 events (this is the limit of the SoNA work)
- 11.3 When studying the contour maps on ERCD2002 (Noise Exposure Contours for Gatwick Airport 2019), Antlands Lane is on the 54dB $L_{Aeq,night}$ contour and the N60 was approximately 60, twice the recommended level for the SOAEL. Therefore, at the predicted higher levels of the policy average exposure, the exposure to noise events will be an order greater than this.
- 11.4 N65 is the equivalent metric for daytime and this would be substantially higher than the night period due to the controls over part of the night period.

12. Interpretation of the Exposure Response Functions

- 12.1 All the standards that are presently applied are based on limited studies and with exposure response functions (ERF) reflecting where an airport is operating in a steady state. If a wide spaced runway is built, those ERFs will not be appropriate as the affected people will be more sensitive in anticipation and as a result of the new exposure. Thus, the threshold at which effects occur will be lower; that is, more people will be more badly affected than would otherwise be expected due to the change.

13. Interpretation of Noise Contours

- 13.1 Noise contours are produced on actual and standardised modal splits. Modal split refers to how much a runway is used in a particular direction each year due to changes in wind direction. Typically for Gatwick this can be a 76%:24% percentage split Westerly to Easterly operations.
- 13.2 As noise from arriving (dominant airframe noise) and departing (dominant engine noise) aircraft have different footprints, showing averaged modal split averages out the impact of the noise. However, on any given day this is not how the noise is experienced in real terms.
- 13.3 Therefore, in interpreting effects on individuals this should be borne in mind. Heathrow already produce contours for 100% Easterly and Westerly operations and Gatwick is being encouraged to do so. When they become

available then planning decisions should be based on operations in complete Westerly or Easterly direction for typical summer day and night for the 16hr L_{Aeq} , 8hr L_{Aeq} and N above events. The effect of this is likely to extend the contour area slightly.

14. Need to Consider Future Noise

- 14.1 Aviation noise policy has been centred around the expansion of Heathrow airport with a third runway. With the exception of Inner London, the south west corner of London is arguably the singularly worst location for an Airport in Britain. With a prevailing South-west wind, 70% of all flights descend in a long line over London and in Easterly winds they all depart over South-west London. The total number of people affected by 54dB $L_{Aeq,16hr}$ or above exceeds the combined totals for all other major international airports in Europe.
- 14.2 It is with this background that a SOAEL of 63dB $L_{Aeq,16hr}$ (now reducing down to 60) was adopted by the government for Airport Expansion, as anything less would have stopped Heathrow Expansion. This policy has gained traction with regards expansion but sadly also on occasions for new development.
- 14.3 Crawley Borough is a relatively small and largely urban settlement based in a wider rural area. It has successfully maintained a healthy gap between Gatwick Airport and residents. When the 2004 White Paper introduced the potential of a wide-spaced Southern Runway at Gatwick Airport, this healthy divide was placed under threat.
- 14.4 It is still Government Policy to safeguard land for a wide-spaced runway, though Gatwick Airport is currently focussing on the upgrade of its northern 'standby' runway to full operational standard. Heathrow is looking to build a third runway.
- 14.5 If the land between the 60-66dB contours is developed and a wide-spaced southern runway is built, then potentially there will thousands of residents affected by levels of noise which, as shown above, will result in sleep loss, an increased risk of heart attacks, myocardial infarctions, strokes, hypertension and high levels of annoyance. This would be reflected in an increase in hospital admission and a significant cost to the NHS and the tax payer, who gained nothing from the initial development.
- 14.6 This would be exacerbated by the fact that most of the residents when moving into their properties would be unaware of the potential wide-spaced runway and living in relative quiet for years. They are likely to be impacted by construction noise and upon completion experience a high frequency of overflight during the day and the night and be more badly affected as explained in Section 12 above.
- 14.7 Considering the above, the precautionary principle should be applied as it is not appropriate to allow the development of areas that could be affected by unacceptable noise, now or in the future.