

An investigation into the influence of background ambient noise levels on attitudes to aircraft noise

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Executive Summary

It is suggested that attitudes to aircraft noise may be influenced by non-aircraft background or ambient noise levels, i.e. in quieter areas, aircraft noise may be more intrusive leading to a higher risk of being highly annoyed, and conversely, in areas experiencing high non-aircraft noise, aircraft noise may be masked, reducing the risk of being highly annoyed.

For areas in the vicinity of airports, non-aircraft background ambient noise levels are dominated by road traffic and railway noise. Both road traffic and railway sources are mapped every five years as required under the Environmental Noise Directive (END).

This report covers the development of a process to estimate background ambient noise from road traffic and railway noise estimates undertaken for Defra. These estimates were then compared against background ambient noise levels measured near London Heathrow and Gatwick airports, utilising data from the airports' noise monitoring systems when specific noise monitors were not being overflown by aircraft. The results show that road traffic and railway noise estimates show good agreement with measured levels, where the background ambient noise levels are at least 50 dB L_{Aeq16h} and dominated by road traffic noise from A-roads, but under predict noise in quieter locations where local noise levels are dominated by minor roads that are not included in the mapping for the END.

Estimated background ambient noise exposure levels were mapped to residents whose attitudes to aircraft noise exposure were recorded in the 2014 Survey of Noise Attitudes (SoNA). Analysis found no association between background ambient noise level and mean annoyance score for those residents exposed to aircraft noise levels between 51 and 54 dB L_{Aeq16h} , suggesting that further work to refine the estimation of background ambient noise levels might not be worthwhile.

However, a more complex statistical analysis using logistic regression over the full range of aircraft noise levels between 48 and 69dB L_{Aeq16h} found a weak, but statistically significant association between background ambient noise levels and the likelihood of being highly annoyed, with the likelihood increasing as background ambient noise levels decreased. However, the association weakened when noise sensitivity was taken into account and weakened further when noise sensitivity and socio-economic status were included in the regression model to the extent that the influence of background ambient noise was no longer statistically significant. This suggests some degree of confounding association between noise sensitivity, socio-economic status and background ambient noise levels, which is not unexpected. Disentangling these from each other and other non-acoustic factors would require a much larger study sample and more careful sampling.

Chapter 1

Introduction

The 2014 Survey of Noise Attitudes¹ (SoNA) generated an updated dataset of attitudes to aircraft noise, which were analysed in relation to aircraft noise exposure and non-acoustic factors. The report highlighted a number of non-acoustic factors that were found to be associated with attitudes to aircraft noise as well the level of aircraft noise. These included factors such as age, personal sensitivity and socio-economic status.

It is also suggested that attitudes to aircraft noise may be influenced by non-aircraft background or ambient noise levels, i.e. in quieter areas, aircraft noise may be more intrusive leading to a higher risk of being highly annoyed, and conversely, in areas experiencing high non-aircraft noise, aircraft noise may be masked, reducing the risk of being highly annoyed.

Throughout this report, the residual non-aircraft noise is referred to as background ambient noise. The challenge in taking background ambient noise into account is that it is made up of a wide variety of non-aircraft noise sources that vary considerably over even quite short distances. Mostly, background ambient noise will be made up of other transport noise sources, i.e. road traffic noise and railway noise, but it also includes neighbourhood noise and entertainment noise amongst other sources of noise.

In support of its work to develop a new Aviation Strategy for the UK, the Department for Transport commissioned the CAA to undertake an assessment of the influence of background ambient noise exposure within the 2014 SoNA dataset.

This report examines potential data sources for the estimation of background ambient noise levels at the locations of residents interviewed for the SoNA 2014 survey. The report then examines to what extent those ambient noise exposure levels play a role in addition to that of aircraft noise exposure in determining attitudes to aircraft noise. A glossary of terms can be found at Appendix A.

¹ [“Survey of noise attitudes 2014: Aircraft”, CAP 1506, UK Civil Aviation Authority, February 2017.](#)

Chapter 2

Calculation of Background Ambient Noise

Ambient noise from rail and road transport near two major UK airports

The 2014 SoNA survey interviewed 1,999 people around eight UK airports. The majority of those surveyed lived in the vicinity of Heathrow and Gatwick airports. As well as aircraft noise exposure, the predominant sources of noise exposure for these residents are noise from nearby roads and railway lines. Strategic noise maps of road and railway noise (as well as aircraft noise) are required to be produced every five years under the Environmental Noise Directive (END)². The END specifies that Major Roads and Major Railways should be considered. Additionally, all A-roads and mainline railways were included within agglomerations. Major Railways are defined as those sections of rail route above a flow threshold of 30,000 train passages per year. Major Roads are defined as regional or national sections of road which have a bi-directional flow of 3 million vehicle passages or more per year. Agglomerations are defined as those areas of urban settlement whose aggregated population is greater than 100,000^{Error! Bookmark not defined.}. Noise from other 'minor' roads and railways is not modelled. In order to make this initial assessment manageable, the scope was limited to the agglomerations associated with the Heathrow and Gatwick area, which coincide with the majority of the 2014 SoNA survey respondents.

The modelled road and railway noise exposure data generated for END and commissioned by Defra³ are calculated as annual average values for the 2016 noise mapping exercise of L_{day} , $L_{evening}$, L_{night} and L_{Aeq16h} noise exposure. Since SoNA 2014 concluded that average summer day L_{Aeq16h} was the most appropriate indicator of aircraft noise, annual L_{Aeq16h} road and rail noise was considered the most appropriate corresponding indicator of those available to compare with the SoNA 2014 L_{Aeq16h} aircraft noise exposure levels, since it covers the same 7am to 11pm daytime time period. In the absence of data to the contrary, potential differences between summer and annual road/rail noise exposure were ignored. Although SoNA 2014 found that alternative indicators such as N_{70} or N_{65} did not correlate as well as L_{Aeq16h} , they could not be considered in this study, since road traffic and rail noise data for such indicators are not generated for the END strategic noise mapping assessment.

It should also be noted that the END noise exposure assessment positions for road and rail noise relate to the façade of a dwelling. The requirements set in the END require that

² Directive 2002/49/EC, which is transposed into English law by the Environmental Noise (England) Regulations 2006 (as amended).

³ [Department for Environment, Food and Rural Affairs](#)

road and railway noise exposure is mapped at the most exposed façade of the dwelling, which may be considerably higher than for the least exposed façade, a factor that is much less significant for aircraft noise, because it propagates to residential dwellings primarily from above and is much less affected by ground absorption and shielding (especially from one building to another).

Figures 1 and 2 present the road noise exposure maps for Heathrow Airport (LHR) and Gatwick Airport (LGW) respectively. The figures show the extent of noise exposure of the roads in comparison with aviation noise exposure contours. As the noise from other 'minor' roads and railways are not modelled under the END, this means that ambient (non-aircraft) noise levels in some regions are likely to be underestimated.

Figures 3 and 4 present the rail noise exposure maps for the areas around Heathrow and Gatwick Airports respectively. These highlight that the noise exposure from rail is much more localised than the noise exposure from roads.

Figures 1 to 4 also show noise monitoring sites selected at each airport for which CAA hold noise measurement information supplied by each airport's respective Noise and Track Keeping (NTK) system. The NTK system noise monitors are configured to record non-aircraft noise, i.e. ambient noise levels as well as aircraft noise. The figures highlight that the sites selected experience a range of noise exposure level in terms of road and rail noise.