Environmental Research and Consultancy Department

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 Attitudes[1] (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 Defra[3] 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 N70 or N65 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.

Figure 1 Road noise exposure L_{Aeq16h} annual average 2016 at Heathrow Airport

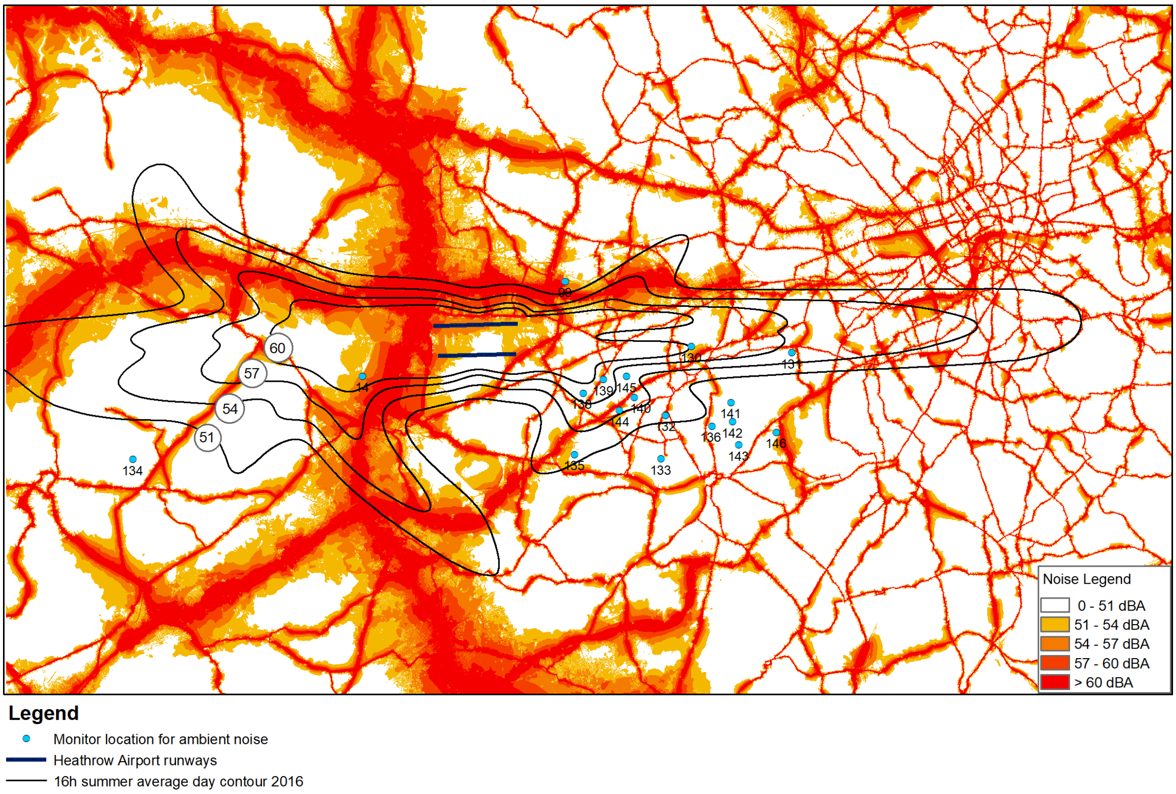


Figure 2 Road noise exposure L_{Aeq16h} annual averages 2016 at Gatwick Airport

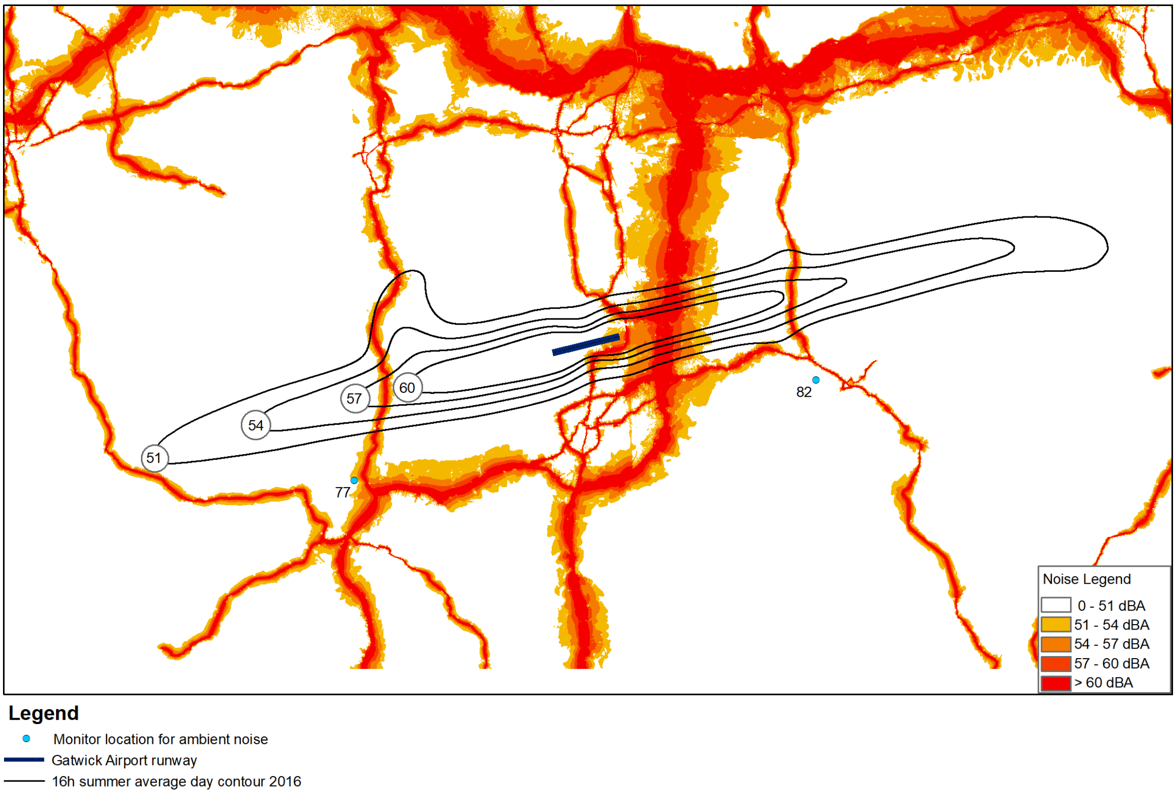
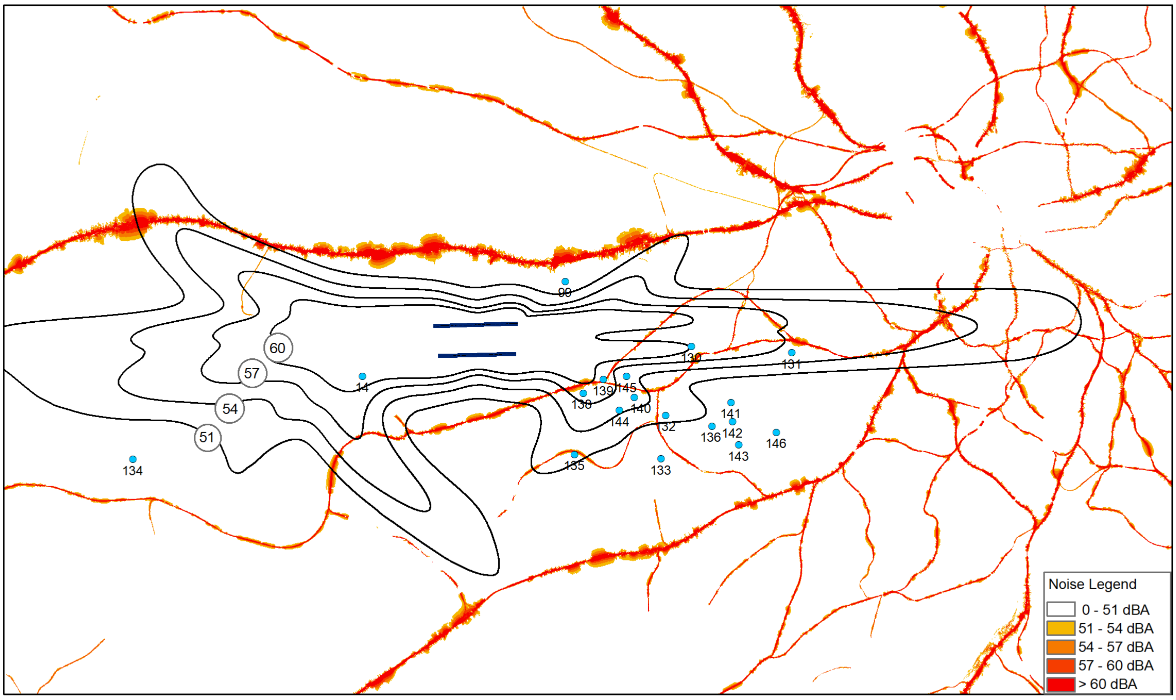


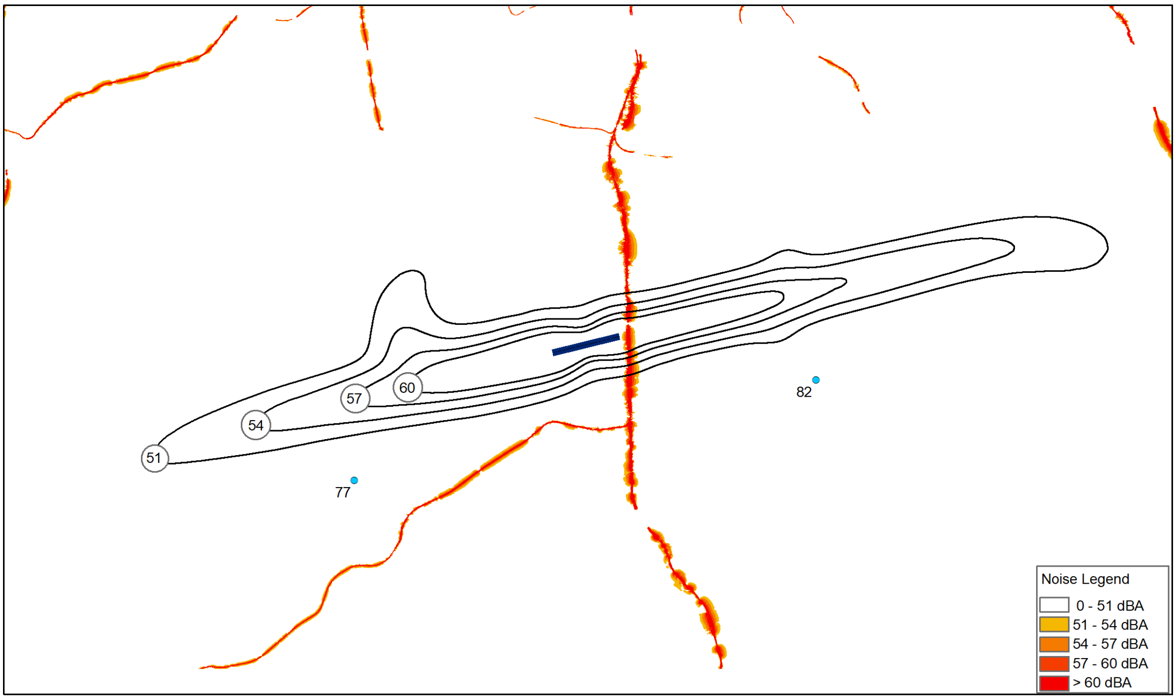
Figure 3 Rail noise exposure Laeq16h annual averages 2016 at Heathrow Airport



Legend

- Monitor location for ambient noise
- Heathrow Airport runways
- 16h summer average day contour 2016

Figure 4 Road noise exposure Laeq16h annual averages 2016 at Gatwick Airport



Legend

- Monitor location for ambient noise
- Gatwick Airport runway
- 16h summer average day contour 2016

Ambient noise levels from measurements at Heathrow and Gatwick Airports

Aircraft noise is continuously monitored at Heathrow and Gatwick airports via noise monitors connected to each airport's NTK system. Some of these airport noise monitors were utilised to measure ambient noise when not being overflown by aircraft.

The noise monitoring sites at Heathrow and Gatwick airports were selected on the basis of the following criteria:

1) The noise monitor site was <u>not</u> overflown by aircraft during a particular runway operating mode (i.e. easterly or westerly). For example, an airport monitor positioned to capture aircraft noise under a departure route for a particular runway direction may not necessarily be overflown when the airport is operating in the opposite runway direction.
2) Each monitor should have been deployed for at least six months during 2016, or alternatively for at least six months during other recent years[4].

Comparison between Defra rail and road modelled noise and airport noise measurements

To investigate the extent of any underestimation from 'minor' roads and railways that are not modelled under the END, the combined Defra road and rail noise calculations ($L_{Aeq16hr}$) have been compared to ambient noise levels recorded at existing airport NTK monitoring sites located around Heathrow and Gatwick airports.

The average noise exposure levels of each of these monitors was then compared to readings of rail and road noise levels, and a difference calculated, as presented in Table 1.

[4] Analysis of ambient noise measurements recorded at airport monitors deployed over several consecutive years have indicated that ambient levels generally do not vary significantly from year to year. The use of ambient noise monitor data for other years, is therefore considered appropriate for this study.

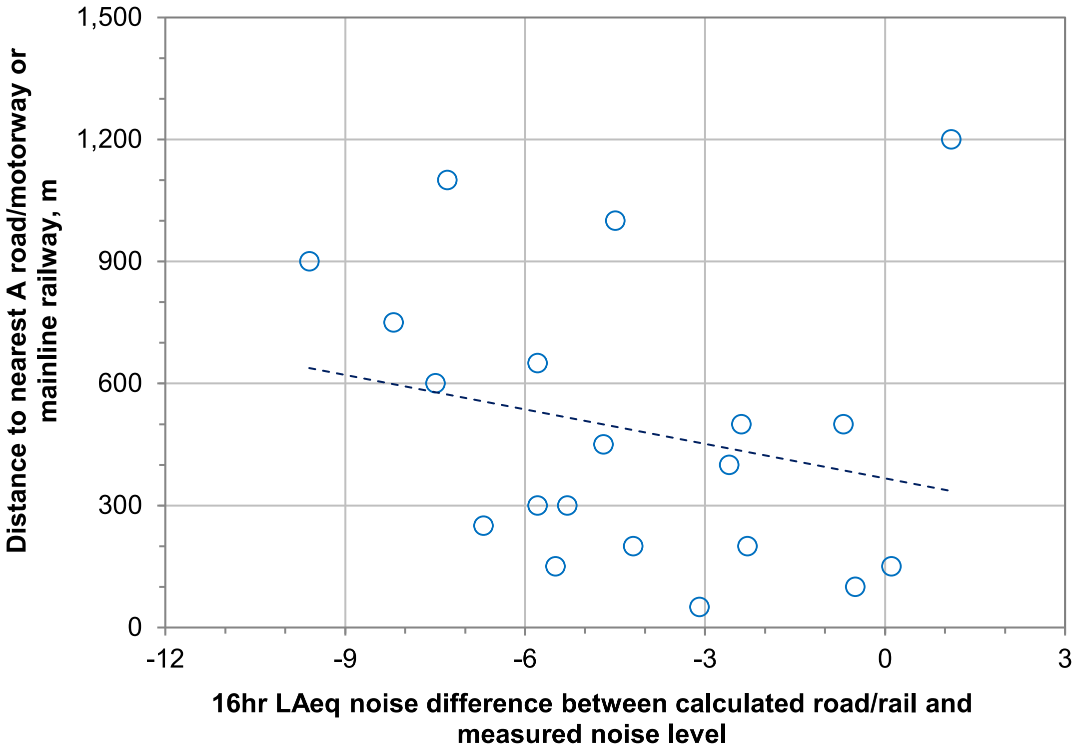
Table 1: Noise exposure levels from Defra rail and road noise modelling and from ambient noise measurements at Heathrow and Gatwick airports (rows highlighted where estimated background ambient noise exposure was below 50 dB L_{Aeq16h})

	Monitor ID for ambient noise	Ambient Noise Measurement	Defra Rail Noise Modelling	Defra Road Noise Modelling	Defra Road & Rail Modelling	Road & Rail Modelling minus Measurement
Airport	**(-)**	**L_{Aeq16h} (dB)**	**L_{Aeq16h} (dB)**	**L_{Aeq16h} (dB)**	**L_{Aeq16h} (dB)**	**L_{Aeq16h} (dB)**
LGW	77	51.9	-	51.2	51.2	-0.7
LGW	82	47.2	-	41.4	41.4	-5.8
LHR	14	52.9	-	54.0	54.0	1.1
LHR	99	62.7	39.3	58.0	58.0	-4.7
LHR	130	53.0	40.7	50.2	50.6	-2.4
LHR	131	53.2	34.7	47.7	47.9	-5.3
LHR	132	51.6	28.5	51.1	51.1	-0.5
LHR	133	51.0	25.1	45.2	45.2	-5.8
LHR	134	48.2	-	43.7	43.7	-4.5
LHR	135	51.8	47.2	50.1	51.9	0.1
LHR	136	50.6	-	43.9	43.9	-6.7
LHR	138	51.9	45.3	47.1	49.3	-2.6
LHR	139	52.7	39.4	49.2	49.6	-3.1
LHR	140	52.2	29.8	49.9	49.9	-2.3
LHR	141	51.5	-	41.9	41.9	-9.6
LHR	142	49.4	-	42.1	42.1	-7.3
LHR	143	49.5	17.6	42.0	42.0	-7.5
LHR	144	53.1	18.2	47.6	47.6	-5.5
LHR	145	51.8	29.2	43.4	43.6	-8.2
LHR	146	52.0	-	47.8	47.8	-4.2

The results show that where noise exposure levels are greater than 50 dB L_{Aeq16h} there is reasonable agreement between calculated road/rail noise exposure and monitored ambient noise exposure. However, when calculated road/rail noise exposure reduces below 50 dB, the difference between calculated road/rail noise and monitored background ambient noise exposure increases, with monitored ambient noise exposure tending to be higher.

Figure 5 presents the difference in calculated road/rail noise and monitored ambient noise levels against the distance from the nearest road or railway line for a selection of locations where the distance to the nearest road or rail line was calculated from GIS mapping data/ This shows that the further away from a road or railway line, the higher the difference.

Figure 5: Noise differences between calculated road/rail and monitored ambient noise levels

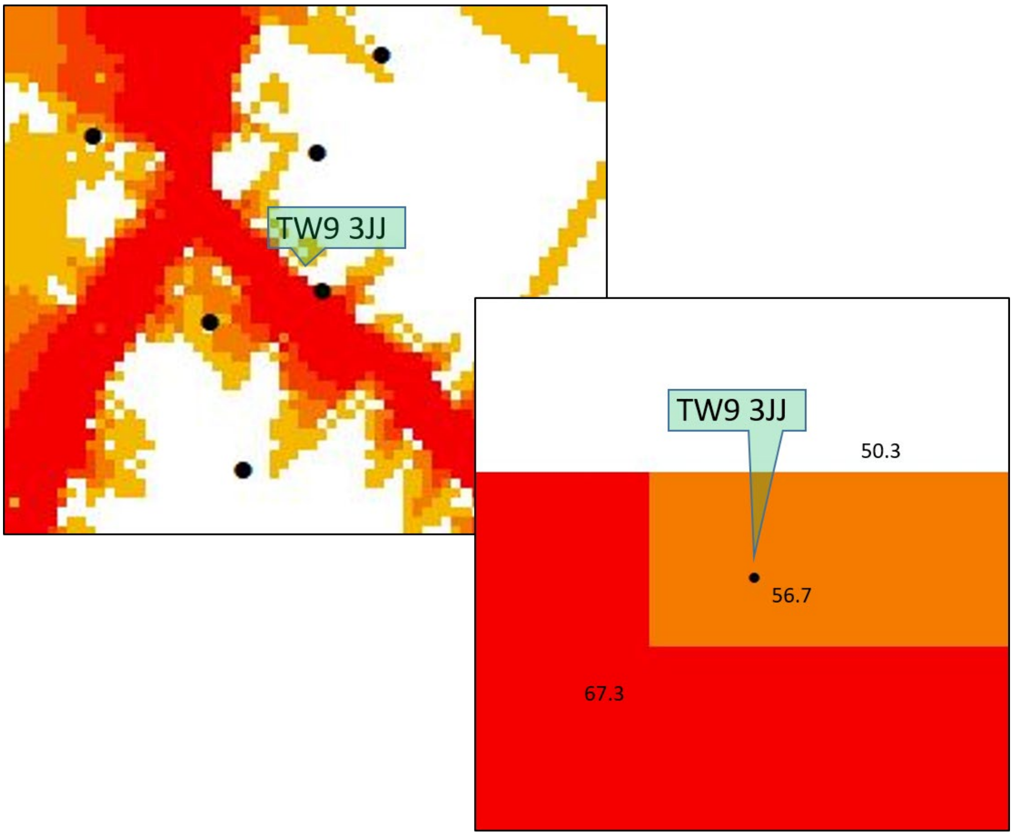


The results show that in areas in proximity to railway lines/main roads, whereby those were the main source of noise, the data shows alignment between calculated road/rail noise levels and monitored ambient noise levels, with differences of 0-2.5 dB. For residential/neighbourhood areas with minor or unclassified roads at mid distance from main roads, the results indicate an underestimate of the order of 2.5-5 dB. Areas with no main roads or railway lines and served by unclassified roads show most divergence (5-7.5 dB). For each noise monitor location, a list of noise sources and their distance to the monitor was produced and presented in Appendix B, including minor roads not included in the strategic noise mapping.

An attempt was made to correlate quantitatively the difference observed and the absence of minor roads contributing significantly to the noise load, however the task has proven complex due to the presence of multiple noise sources at different distances (which may or may not have shielding due to buildings or landscape features). However, qualitatively, the correlation exists as listed above.

A sensitivity test was undertaken at a specific postcode to highlight the differences in noise exposure level at adjacent locations (due to shielding effects). Figure 6 shows a variation in noise level of 17 dB for road traffic noise over a short distance, in this case approximately 20 m.

Figure 6: Road noise variation at TW9 3JJ postcode (17 dB change going from -10m to +10m)



Development of a background ambient noise to aircraft noise exposure difference metric

In some countries the concept of an audibility noise metric has already been defined[5]. In the example cited, it uses the concept of the time audible, i.e. where the time-varying aircraft noise exposure of individual noise events exceeds the background ambient noise level, which is assumed not to vary over time.

For this analysis, a more simplified approach has been taken to calculate the difference in average L_{Aeq16h} noise exposure between aircraft noise and background ambient noise.

Given that the calculated ambient noise levels do not include the effect of minor roads, which has been found to reduce levels by up to 7.5 dB, the development of a difference metric must be taken with caution, and awareness of the potential effect of the underestimation taken into account. Further work would be required to come up with a correction for the under estimation of background ambient noise due to smaller roads, by undertaking the preceding analysis over a wider range of locations and taking into account the impact of multiple roads in order to estimate a different correction for a range of locations and scenarios.

5 Aviation Environmental Design Tool (AEDT) Technical Manual Version 2d, US FAA, September 2017.

Chapter 3

Effect of ambient noise on attitudes to aviation noise

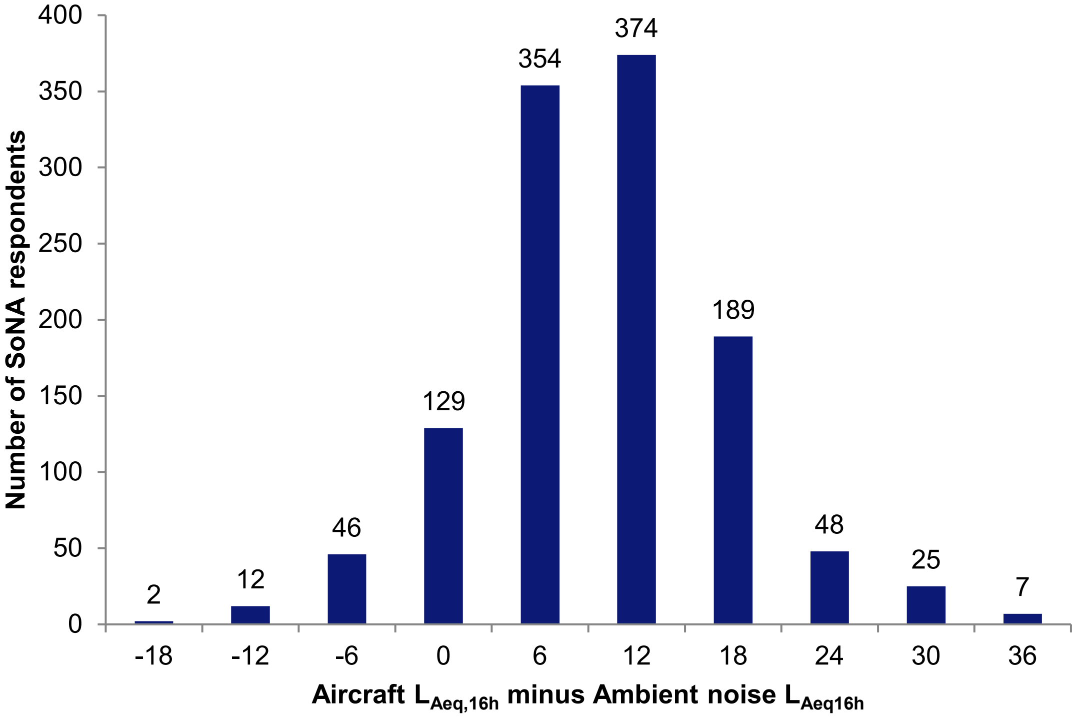
Analysis

The Survey of Noise Attitudes 2014 (SoNA 2014)[1] provided updated evidence on attitudes to aviation noise around airports in England. Mean annoyance scores from approximately 2,000 respondents were correlated with aircraft noise exposure estimates for a 2014 average summer day. The SoNA 2014 survey was designed to obtain attitudes from residents in the vicinity of airports exposed to at least 51 dB L_{Aeq16h}. 43% of those sampled were exposed to aircraft noise levels between 51-54 dB L_{Aeq16h}. 4% of the respondents were exposed to levels between 48-51 dB and 4% percent to levels greater than 63 dB L_{Aeq16h}, with the remaining 50% exposed to levels between 54 and 63 dB. As well as investigating the effect of a number of non-acoustic factors, the SoNA 2014 study investigated the potential effect of the urban/rural classification of each residential dwelling, but found no association, one possible reason being that urban/rural classification gives no indication of background ambient noise levels.

In order to determine if there is any influence between the ambient noise level and aircraft noise annoyance, estimates of the ambient noise level at each SoNA respondent's postcode in the Greater London and Gatwick area have been calculated from the Strategic noise mapping data generated for Defra for road and rail noise in 2016. For this initial, exploratory analysis, no adjustments were made to background ambient noise level estimates to account for minor roads not reflected in the strategic noise maps.

For each respondent the difference between the background ambient noise level and aircraft noise level was calculated. Figure 7 shows the number of respondents in each average noise level difference band and shows that the majority of respondents experience aircraft noise exposure 6-12 dB higher than the background ambient noise level. A small number of respondents' experience aircraft noise levels less than the background ambient noise levels.

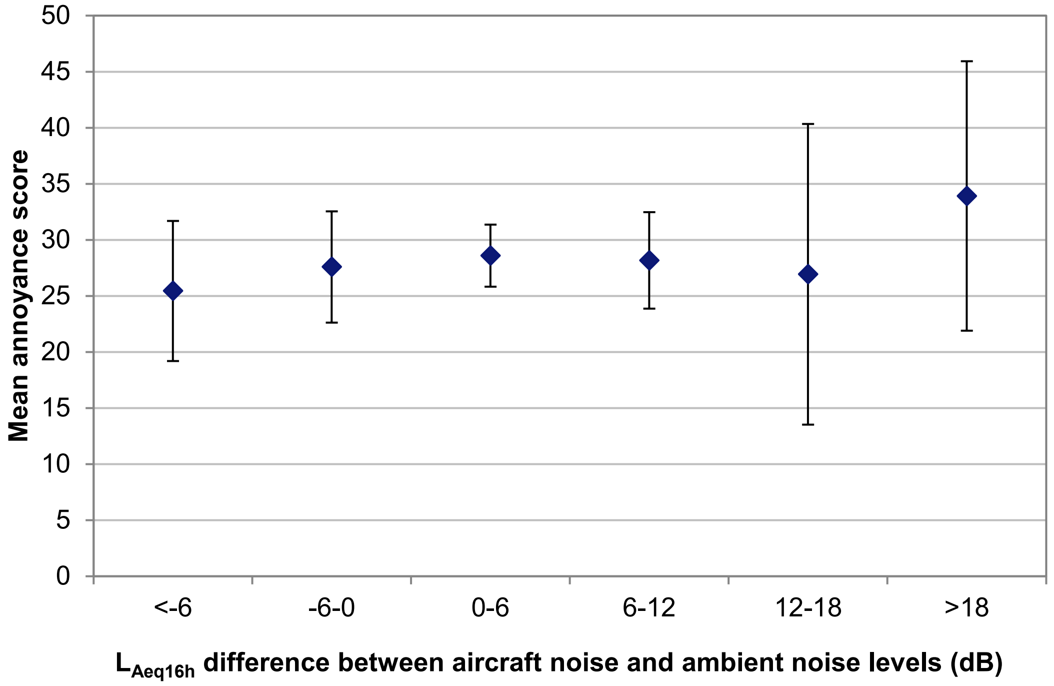
Figure 7 Distribution of SoNA respondents by difference between average background ambient noise level and average aircraft noise level (N=1,186)



It is important to highlight that there is additional uncertainty when associating a SoNA resident to a background ambient noise level. As highlighted earlier, in one example background ambient noise levels were found to vary by up 17 dB over a distance of 20m. Since the exact address and thus location of each SoNA respondent is not available, the estimates of background ambient noise levels derived from the Defra datasets were based on postcode locations. Because a single postcode location often covers a large number of households, it should be noted that the ambient noise level for each SoNA respondent is subject to uncertainty.

For the first analysis, the effect of background ambient noise was investigated by keeping aircraft noise exposure level constant. For this, a subset of data for residents exposed to aircraft noise levels between 51-54 dB L_{Aeq16h} was used, since this band contained the largest sample in any 3 dB band and residents exposed to lower aircraft noise exposure might be more susceptible to influence from background noise exposure. Residents exposed within the 51-54 dB L_{Aeq16h} aircraft noise exposure band were grouped into 6 dB-wide intervals based on their average aircraft noise to background ambient noise level difference and mean annoyance scores calculated. The results (Figure 8) show that for all aircraft to background ambient noise level differences, the level of annoyance reported due to aircraft noise remains very similar. There appears to be some effect when the difference in level is greater than 18 dB, however, the sample size is small (N=11) and the variation in mean annoyance score is much greater (illustrated by the vertical uncertainty bars), therefore the difference is not statistically significant.

Figure 8 Summary of association between SoNA respondent Mean Annoyance Score exposed to aircraft noise between 51-54 dB L_{Aeq16h} and the difference between background ambient noise and aircraft noise exposure level (N=494)



Because of the lack of variation in mean aircraft noise annoyance score over such a wide range of background ambient to aircraft noise level differences, even if further significant effort were put into refining the estimated background ambient noise levels, the analysis is unlikely to find that background ambient noise levels influenced attitudes to aircraft noise as surveyed in the SoNA 2014 dataset; or if there is an influence, its effect is small compared with the variation in attitudes from person to person. Therefore it would require a much larger survey in order to quantify the magnitude of the influence of background ambient noise levels on attitudes to aircraft noise.

Confounding factors

The preceding analysis investigated the influence of background ambient noise on noise attitudes whilst holding aircraft noise exposure constant between 51-54 dB L_{Aeq16h}. This reduced the analysis sample from 1,186 to 494 residents, increasing uncertainty. It is also possible that other factors may be changing as background ambient noise level changes, such as self-declared sensitivity to noise and socio-economic status.

In order to address these points, a more complex statistical approach was applied that used odd-ratios to estimate the likelihood of an outcome occurring based on a range of input factors chosen. Such an approach is common in the field of noise effects research and was used to investigate the influence of non-acoustic factors on the full SoNA 2014 data set as reported in CAP 1506[1]. Odds-ratios are estimated using multivariate logistic regression analysis, and indicate the likelihood of an outcome occurring or not-occurring. The outcome used is whether a respondent's annoyance rating was categorised as being highly annoyed or not as set out in para 5.33 of CAP 1506. The method is much more complex, but enables the full range of aircraft noise exposure levels between 48-69 dB $L_{Aeq,16h}$ to be assessed, along with their estimated background ambient noise exposure, whilst controlling for other factors, including noise sensitivity and socio-economic status. For this analysis, background ambient noise level was incorporated into the prediction model as a continuous independent variable, rather than relative to the aircraft noise exposure level.

With both average summer day L_{Aeq16h} and background ambient L_{Aeq16h} variables included, the influence of background ambient L_{Aeq16h} was found to be statistically significant (p=0.017), contrary to the earlier finding when looking only at residents exposed to aircraft noise between 51-54dB $L_{Aeq16h.}$ The estimated odds ratio of 0.967, indicates that the probability of being highly annoyed decreased with increasing background ambient noise level. At 54dB L_{Aeq16h} an odds ratio of 0.967 indicates the likelihood of being highly annoyed increases by 1 percentage point for each 5dB decrease in background ambient noise level. Since, the majority of background ambient noise levels vary over a ±6dB range, this equates to a shift of the dose response curve by ±1.5dB for a given likelihood of being highly annoyed. Thus, where SoNA 2014 found that approximately 10% of respondents were highly annoyed at 54dB L_{Aeq16h}, the inclusion of background ambient noise would find 10% highly annoyed at 52.5dB or 55.5dB, where background ambient noise levels were 6dB quieter or 6dB higher than average respectively.

With noise sensitivity added to the prediction model, the influence of background ambient noise level was largely unchanged, though the significance of the association reduced (p=0.025). However, with noise sensitivity and socio-economic status added to the prediction model, the influence of background ambient noise level no longer remained significant (p=0.058, p>0.05). This implies some confounding association between background ambient noise level and socio-economic status, which is not unexpected. Therefore, it is not possible to recommend an aircraft noise-annoyance dose response relationship that is related to background ambient noise from the SoNA 2014 data set.

Chapter 4
Conclusions

It is widely accepted that attitudes to aircraft noise are affected by non-acoustic factors as well as the level of aircraft noise exposure. 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.

This report investigates possible data sources and methods for the estimate of background ambient noise over wide areas. Potential data sources include strategic road traffic and railway noise maps commissioned by Defra and airport noise monitor systems that can capture non-aircraft noise data. Initial findings are that strategic road noise maps may under predict road traffic noise below 50 dB L_{Aeq16h} because they do not include smaller roads (below A-roads) within agglomerations. This has the potential for increasing the perceived difference between background ambient noise levels and aircraft noise levels.

When assigning background ambient noise levels to 2014 SoNA respondents, it was found that the precise residential location could heavily influence the estimated road traffic noise levels and thus background ambient noise levels; in one example road traffic noise levels were found to vary by 17dB over 20m (across three grid points). For the 2014 SoNA survey, respondent's locations are defined only by postcode, the location of which may be tens of metres away from the dwelling itself.

Having estimated background ambient noise levels to each 2014 SoNA survey respondent in the London and Gatwick area agglomerations, the study found that the background ambient to aircraft noise level difference varied from -18dB to +36dB, with over half residing in the range +6 to +18dB. Since over 40% of SoNA 2014 respondents were exposed to aircraft noise levels between 51-54dB L_{Aeq16h}, the study examined how attitudes to aircraft noise varied within this band (i.e. whilst aircraft noise exposure remained constant) and background ambient noise levels varied. The study found little variation in reported attitudes to aircraft noise across the range of background ambient to aircraft noise level difference between -6dB to +18dB,. Although some effect was observed when the difference in level was greater than +18 dB, the sample size was small (N=11) and the variation in mean annoyance score is much greater, therefore the difference in noise attitudes identified was not statistically significant.

Because of a lack of variation in the mean aircraft noise annoyance score over such a wide range of background ambient to aircraft noise level differences (for aircraft noise levels of 51-54dB L_{Aeq16}), even if further significant effort were put into refining the estimated background ambient noise levels, it is likely that any analysis is unlikely to find that background ambient noise levels influenced attitudes to aircraft noise as surveyed in the SoNA 2014 dataset; or if there is an influence its effect is small compared with the variation in attitudes from person to person. Therefore, it would require a much larger survey in order to quantify the magnitude of the influence of background ambient noise levels on attitudes to aircraft noise.

Having not found any association between background ambient noise for those exposed to aircraft noise levels between 51-54 dB $L_{Aeq,16h}$, a more complex statistical analysis was performed over a full range of aircraft noise exposure (48-69 dB L_{Aeq16h}). This analysis found a statistically significant influence from ambient background noise levels. However, the effect was much weaker than the effect of aircraft noise exposure level. The effect remained significant, but the strength of association weakened with the inclusion of noise sensitivity. With the inclusion of both noise sensitivity and socio-economic status, background ambient noise was no longer statistically significant in predicting the likelihood of being highly annoyed. This implies some confounding association between background ambient noise level and socio-economic status, which is not unexpected. Therefore, it is not possible to recommend an aircraft noise-annoyance dose response relationship that is related to background ambient noise from the SoNA 2014 data set.

APPENDIX A

Glossary

Background ambient to aircraft noise difference metric

The difference between the average background ambient noise level and the aircraft noise level at the same location

END Environmental Noise Directive

LGW London Gatwick Airport

LHR London Heathrow Airport

L_{Aeq16h} Equivalent continuous sound level of aircraft noise in dBA for average day (summer or annual) 16 hour day, between 0700 and 2300.

NTK Noise and Track Keeping (NTK) system

SoNA Survey of Noise Attitudes 2014

APPENDIX B

Summary of noise sources in the vicinity of each noise monitor

Airport	NMT	Deployment Period	Background when	NTK Ambient 16hr Leq (dBA)	Defra Rail 16hr Leq (dBA)	Defra Road 16hr Leq (dBA)	Defra Road & Rail 16hr Leq (dBA)	Defra minus NTK 16hr Leq (dBA)	Approx distance to nearest A road/motorway or railway (metres)	*Comment*
LGW	77	Apr-Oct 2014	Easterly	51.9	-	51.2	51.2	-0.7	500	*100m to minor road*
LGW	82	Jul-Dec 2016	Westerly	47.2	-	41.4	41.4	-5.8	650	*110m to minor road*
LHR	14	Jan-Dec 2016	Easterly	52.9	-	54.0	54.0	1.1	1,200	*M25 is nearest main road. 270m to minor road*
LHR	99	Jan-Dec 2016	Westerly	62.7	39.3	58.0	58.0	-4.7	450	*M4 480m away. 130m to minor road, and 250m from another minor road with a crossing*
LHR	130	Jan-Dec 2016	Easterly	53.0	40.7	50.2	50.6	-2.4	500	*Mid-Surrey Golf Course. Twickenham rod at 500m and Isleworth on the other side of river 400m*
LHR	131	Jan-Dec 2016	Easterly	53.2	34.7	47.7	47.9	-5.3	300	*equidistant from two main roads(100m), another at 300m*
LHR	132	Jan-Dec 2016	Westerly	51.6	28.5	51.1	51.1	-0.5	100	*100m for a main road and an unclassified road*
LHR	133	Jan-Dec 2016	Westerly	51.0	25.1	45.2	45.2	-5.8	300	*Main road transitions into minor road. 300m away conurbation of roads. Around 200m away road in the park. Minor roads around it*
LHR	134	Mar-Dec 2016	Westerly	48.2	-	43.7	43.7	-4.5	1,000	*280m to minor road*
LHR	135	Apr-Dec 2016	Westerly	51.8	47.2	50.1	51.9	0.1	150	*Kempton Park Racecourse. Also 800m to main road, 150m rail line*
LHR	136	Apr-Dec 2017	Westerly	50.6	-	43.9	43.9	-6.7	250	*2 minor roads at less than 50m. Between these and the main road many other neighbourhood roads*
LHR	138	Apr-Dec 2017	Westerly	51.9	45.3	47.1	49.3	-2.6	400	*Equidistant from road and railway, close to a crematorium*
LHR	139	May-Dec 2017	Westerly	52.7	39.4	49.2	49.6	-3.1	50	*Also 80m from railway (in neighbourhood)*
LHR	140	May-Dec 2017	Westerly	52.2	29.8	49.9	49.9	-2.3	200	*Also 400m from railway*
LHR	141	May-Dec 2017	Westerly	51.5	-	41.9	41.9	-9.6	900	*Richmond Park, next to possible construction site*
LHR	142	May-Dec 2017	Westerly	49.4	-	42.1	42.1	-7.3	1,100	*Richmond Park, around 60m from minor road*
LHR	143	May-Dec 2017	Westerly	49.5	17.6	42.0	42.0	-7.5	600	*Richmond Park, around 60m from minor road*
LHR	144	Jun-Dec 2017	Westerly	53.1	18.2	47.6	47.6	-5.5	150	*80m from minor road, surrounded by roads*
LHR	145	Jun-Dec 2017	Westerly	51.8	29.2	43.4	43.6	-8.2	750	*90m from minor road, with many amenities, 45m to another minor road*