An investigation of the noise from London Heliport and the Effect on the Local Residents

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Summary

London has only one commercial heliport, London Heliport, which is now surrounded by a high density of residential dwellings. Together with the collaboration of three adjacent London boroughs, a noise survey was developed for the first time to establish a baseline for the effect of operation of the heliport on local residents. Long term noise monitoring was undertaken in residences of each of the three boroughs to establish the internal and external noise levels both along the river Thames, the main heliport flight path, and away from the heliport. The key parameters measured were LAeq LA90 and $LA_{max,f}$ over a five month period during the spring and summer of 2017. The data collected was then compared to a large set of applicable or relevant policy and guidance. The paper will report on the results of the objective monitoring, draw conclusions on expected impact on health, wellbeing and annoyance. Another paper will report elsewhere on the community response to the heliport operation noise emissions.

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1. Introduction

This paper presents the work undertaken to establish a baseline on the noise emissions from the London Heliport operation in three London, UK local authorities: Wandsworth, Hammersmith & Fulham and Kensington & Chelsea
The complete study constituted of two parts: firstly, objective long term noise monitoring and secondly, an subjective study s on the impact and perceptions of the residents of the three boroughs reported in a separate paper. The measurements were taken over five months to represent multiple seasons using homes from the three boroughs to assess according to relevant policy and guidance the effect of the operation of the heliport on health, wellbeing and annoyance.

London Heliport was built in 1959 located by the river Thames in Battersea, London SW11 3BE. Operational restrictions were first imposed on the heliport by the former Greater London Council (GLC) during the 1970s when the area was a derelict dock. Helicopter fly by and landings were divided into complying with noise emission standards, 81 dBA_{Max} as measured 150 m from the flight path, and those which did not. Currently, those that do not comply, unrestricted helicopter category, are limited to 1500 movements per year. The maximum number of movements is set at 12,000 movements per year, with a daily limit of 80. Flight times are restricted to 07:00 to 23:00 except for emergency and military aircraft [1].

Research into helicopter noise in the urban environment has been scant in comparison to fixed wing aircraft. Recent studies include: improving the management of helicopter noise [2,3] and the application of Planning Policy Guidance 24 to a residential development adjacent to a helipad [4]. This demonstrates that rotary aircraft have been forgotten by the Civil Aviation Authority in their airspace change policy [5].

2. Current applicable and related Guidance, Standards and Regulations

Applicable guidance has recently been updated or newly published and includes the following:

1. ProPG: Guidance for Planning and Noise [6],
2. BS 8233:2014 - Guidance on sound insulation and noise reduction for buildings [7],
3. Aviation Framework Policy 2013 [8],
4. Planning condition set by Greater London Council [9]
5. British Standard BS4142:2014 –Method for assessing and rating industry and commercial sound [10]. Note: standard used tentatively.

The criteria used in these documents will be used in the assessment of the noise levels monitored inside and outside of the residential dwellings employed in this survey during the day time when the heliport operates (0700:23:00).

2.1 ProPG: Planning and Noise

In May 2017 a new planning guidance document was jointly produced by the Institute of Acoustics (IOA), Association of Noise consultants (ANC) and Chartered Institute of Environmental Health (CIEH) ProPG: Planning and Noise - Professional Practice Guidance for Planning and Noise [6]. The document provides guidance for sustainable development in regard to noise in the planning process through good acoustic design. It provides the latest information on criteria noise levels based on the principle of NOEL (No observable effect level), LOEL (Lowest observable effect level), and SOEL (Significant observable effect level) as introduced in Noise Policy Statement for England (NPSE) [11]
The primary method of assessing a site is by considering the health risks to the residents using negligible risk, low risk, medium risk and high risk noise levels, see Table I.

Table I: Health Risk based on External Noise Levels (free field)

	Negligible Risk	**Low Risk**	**Medium Risk**	**High Risk**
$L_{Aeq,\ 16\ h}$ (07:00h-23:00h)	<50 dBA	>60 dBA	>65 dBA	>70 dBA

2.2 British Standard 8233:2014. Guidance on Sound Insulation and Noise Reduction for Building

Based on the World Health Organisation recommendations [12], BS8233:2014 has been recently produced which recommends maximum internal noise levels in residential buildings.

Table II: Recommended internal and external noise levels (LAeq, 16hours) in residential spaces for different activities during daytime (0700:2300); extracted from BS 8233: 2014

Activity	**Location**	**$L_{Aeq,\ 16h}$ 07:00-23:00**
Resting	Living Room	35 dBA
Dining	Dining Area	40 dBA
Sleeping/ Day time rest	Bedroom	35 dBA
Amenity	External area	50- 55dBA

2.3 Aviation Policy Framework

In 2013 the UK Government's Aviation Policy Framework was published [8]. It confirmed the three noise level thresholds used to define expected low, moderate and high annoyance to residents from aviation noise in terms of outdoor (free field) L Aeq, 16 hours (0700:2300), and corresponding entitlement to remedial measures see table III.

Table III: Recommended external noise levels from the Aviation Policy Frame with entitlements

	Low Annoyance	Medium Annoyance	High Annoyance
Daytime $L_{Aeq,\ 16h}$ (dB)	57	63	69
Entitlement	None	Sound Insulation	Moving Costs

2.4 BS4142:2014 Method for rating and assessing industry and commercial sound

This standard is used as an environmental noise assessment and prediction tool. It considers relative levels rather than taking absolute noise criteria and make use of penalties for tonality, impulsivity and intermittency of the specific noise source being assessed. It is unclear from the standard if a commercial heliport can be considered an industrial or a commercial sound source. Hence, the assessment is only tentative but it can give an idea of the difference the operation of the heliport makes to the residential environment. The standard takes the long term average noise level, $LAeq,_{16h}$ and subtracts the long term background noise level $LAf90,_{16h}$. A modest +6 dB penalty was added to measured levels to account for impulsivity and intermittency of the sound.

3. Noise Monitoring

Long term noise monitoring was undertaken at four sites in the three boroughs between 11th April 2017 and the 1st September 2017, see Figure 1. Measurements were taken on balconies (external free field corrected noise levels) and in unused rooms (internal noise levels) of residential dwellings. The residents were selected from a list of 25 volunteers provided by the London Heliport

Consultative Committee which is partly formed by the representatives of the three boroughs. The Heliport has an allocated airspace called Air Traffic Zone (ATZ), see Figure 1 which covers an area centred on the Heliport of one nautical mile, 1852m. This is the area the noise monitoring took place.

3.1 Locations of the Noise Monitoring stations

Measurements were taken only during the opening times of the heliport (0700:2300) at the four locations giving a total of 120 days of valid data during April-September 2017, see Table 6. Each day of measurements were divided into 5 minute intervals as this is approximately the duration of a helicopter movement. This gave a total data set of 14,400 measurements, 9,600 measurements were analysed,

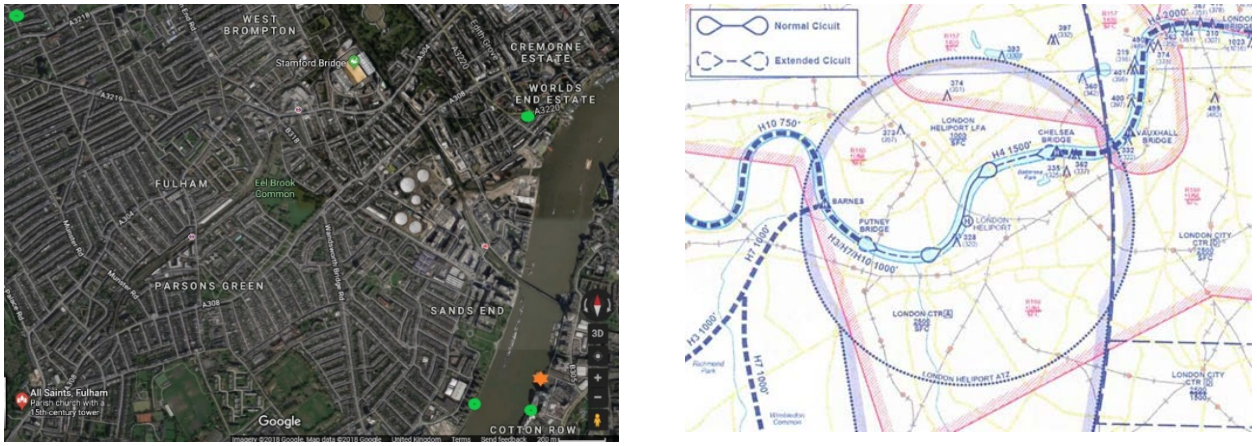

Figure 1. Left, aerial photo showing the heliport (*orange) and four monitoring locations (green dots), right, heliport ATZ Copyright Google.

3.2 Measurement Instrumentation

Measurements were taken with a Norsonic Nor140 Class 1 sound level meter (internal measurements) and NTi XL2 Class 1 sound level meter with outdoor environmental kit for external measurements. Both meters were within external laboratory calibration period. Both meters were calibrated onsite before and after each monitoring session.

3.3 Measurement Parameters

The instrumentation was set to measure on a long term basis, The acoustic parameters measured were LAeq, $_{5\ mins}$, $LAmax_f$, and $LAf90_{,5miss}$. During the post processing of the raw data, the LAeq, $_{5\ mins}$ measurements were combined to obtain the relevant average day time noise level, a LAeq, 16 hours (0700:2300). This value was further averaged over the duration of the measurements typically from 10-45 days. The highest average noise level is the nosiest of the days monitored.

Further data analysis was undertaken: firstly, by counting the number of times the maximum criterion was exceeded, called exceedances at each location each day. This was then averaged over the number of days the monitoring took place. In addition, the highest number of exceedances was also reported.
Secondly, to obtain the average external background noise level at each location when no helicopter movements are registered. This was recorded using the LAf90 parameter. This can be used to show the typical noise level at a location without helicopter noise

4. Monitoring Results

The results are presented by borough: Wandsworth, Hammersmith and Fulham, and Kensington and Chelsea.

4.1. Wandsworth Results

Only one monitoring location was in Wandsworth, Prices Court, 150m from the Heliport. Internal and external noise levels were measured.

Table IV. Prices Court Long Term Noise Monitoring Measurements

	Long Term Average Noise Level LAeq, 16h (dB)	Highest Daily Average Noise Level LAeq, 16h (dB)	Maximum number of Exceedances Per Day based on 81 dBA $_{Maxf}$	Average number of Exceedances Per Day based on 81 dBA $_{Maxf}$
Internal Level	56.9	63.1	45	11
External Level	64.2	66.0	55	36
Background External Level $L_{A90,\ 16\ h}$	47.4	NA	NA	NA

The unexpected small difference in internal and external day long term averaged noise level is due to the large balcony door being open for a large part of the day over the summer months of monitoring, see Table IV.

Table V: Percentage of days where there was a risk of adverse health effects due to noise according to ProPG guidance: Prices Court

	Percentage of Days where Risk of Adverse Health Effects Occurred
Negligible Risk	0%
Low Risk	67%
Medium Risk	33%
High Risk	0%

Health risks can now be assessed based on the measurements in accordance to ProPG : Planning and Noise guidance. Noise levels at this monitoring location have an attributed low risk of adverse health effects, see Table V. according to the BS4142:2014 method of assessment that the scenario is likely to have significant adverse impact.

The monitored long term noise levels when compared to the recommendations in BS8233:2014, both inside and outside, were well in excess of those criteria, see Table IV. Finally, when compared against to the Aviation Framework Policy, the long term noise levels show levels indicating medium levels of annoyance and that the dwelling would qualify for installation sound insulation.

It was found that on average 36 exceedances occurred per day, see Table IV. This is equal to 3276 exceedances in the quarter measured. In the same quarter, Quarter 2 of 2018, the Civil Aviation Authority recorded 3788 movements of which 228 could be excluded from the 81 dBA (Max) criteria level, as they were from the unrestricted helicopter category. This verifies the measurement methodology of 5-minute measurement periods, and also demonstrates a very high level of exceedances amongst the heliport flights. Moreover 85.6% of restricted helicopter flights produced noise levels in exceedance at this location.

4.2. Hammersmith and Fulham Results

Two sites were used in Hammersmith and Fulham for the study, Waterman Quay 200m from the Heliport and Queen's Club Gardens, approximately 1800m from the heliport. Internal and external noise levels were measured. The use of the two sites allowed noise levels to be assessed both near to and far from the heliport, although both are regularly affected by helicopters according to local residents.

Table VI. Queen's Club Gardens Long Term Noise Monitoring Measurements

	Long Term Average Noise Level LAeq, 16 h (dB)	Highest Daily Average Noise Level LAeq, 16h (dB)	Maximum number of Exceedances Per Day based on 81 dBA $_{Maxf}$	Average number of Exceedances Per Day based on 81 dBA $_{Maxf}$
Internal Level	40.9	44.8	0	0
External Level	52.1	53.3	2	0
Background External Level $L_{A90, 16\ h}$	40.8	NA	NA	NA

This monitoring location was situated far from the Heliport. As such, as expected the day time levels were in line with the criteria in BS 8233:2014 for an urban residence. The difference between in internal and external long term averaged noise level 11.2 dBA, was as expected for summer conditions, the windows being ajar. Only a minimal number of exceedances were measured.

Table VII: Percentage of Days where there was a risk of adverse health effects due to noise according to ProPG guidance in the Queen's Club Gardens

	Percentage of Days where Risk of Adverse Health Effects Occurred
Negligible Risk	100%
Low Risk	0%
Medium Risk	0%
High Risk	0%

From Table VII it can be clearly seen that the health risks from excessive noise at this location far from the heliport operation were negligible. Therefore, there is no significant risk of adverse impact. No significant Exceedances were recorded. According to ProPG guidance and the Aviation Framework Policy the external long term noise level of 52.1 dBA offer negligible risk effects to health or annoyance.

At Waterman's Quay only internal measurements were monitored due to technical difficulties

Table VIII: Waterman's Quay Long Term Noise Monitoring Measurements

	Long Term Average Noise Level LAeq, 16 h (dB)	Highest Daily Average Noise Level LAeq, 16 h (dB)	Maximum number of Exceedances Per Day based on 81 dBA $_{Maxf}$	Average number of Exceedances Per Day based on 81 dBA $_{Maxf}$
Internal Level	57.2	64.0	31	7

From Table VIII it can be seen that the internal noise levels measured are in line with those taken on the other side of the river at Prices Court, as were the number of Exceedances The levels measured when compared to BS 8233:2014 were well in excess of the 35 dBA levels for day time rest in bedrooms.

4.3. Kensington and Chelsea Results

Only one site in Kensington and Chelsea was used for the study, World's End, located 1200m from the Heliport adjacent to the river Thames and on the approach to the heliport. Internal and external noise levels were measured.

Table IX. World's End Long Term Noise Monitoring Measurements

	Long Term Average Noise Level LAeq, 16h (dB)	Highest Daily Average Noise Level LAeq, 16h (dB)	Maximum number of Exceedances Per Day based on 81 dBA $_{Maxf}$	Average number of Exceedances Per Day based on 81 dBA $_{Maxf}$
Internal Level	42.8	45.3	0	0
External Level	63.2	65.2	91	33
Background External Level $L_{A90, 16\ h}$	57.0	NA	NA	NA

There was a large difference in the long term average noise level internal and external due to the doors and windows being shut in April when the internal measurements were taken. The external long term averaged noise levels were taken in July and August and were found to be very similar to those at Prices Court, 64.2 dBA compared to 63.2 dBA, both higher than the annoyance criteria given in the Aviation Framework Policy where sound insulation should be offered to the residents. The average number of day time Exceedances were also similar for the two locations, 33 compared to 36, respectively, see Table IX. The maximum number of day time Exceedances was greater than the number of allowed heliport movements hence other primary noise sources have to be considered. From onsite observations it is highly likely that this is from road traffic noise along Chelsea Embankment. It was found that there was a significant risk of adverse impact according to BS4142:2014. Health risks can now be assessed, see Table X.

Table X: Percentage of days where there was a risk of adverse health effects according to ProPG guidance due to Noise at World's End

	Percentage of Days where Risk of Adverse Health Effects Occurred
Negligible Risk	0%
Low Risk	94%
Medium Risk	6%
High Risk	0%

As can be seen from Table X there was low risk of adverse health effects at World's End. When comparing the noise levels to the criteria in BS 8233:2014 the internal noise levels are above the criteria as were the external levels. When comparing against the Aviation Framework Policy the external noise level would cause medium annoyance and would require additional sound insulation to be installed.

5. Summary of Results

Table XI has been produced which shows the result for each location measured against the criteria in each of the five documents referenced.

Table XI. Summary of effect and compliance with relevant guidance and policy

	ProPG Health Risk	BS4142 Assessment (advisory only)	BS8233 Citeria (internal/ external)	Aviation Policy (Annoyance / Remedial Action)	Local Planning Condition
Prices Court	Low/Medium	Adverse Impact	Exceeded / Exceeded	Medium/ Eligible for Sound Insulation	Regularly Exceeded
World's End	Low	Adverse Impact	Exceeded / Exceeded	Medium Annoyance / Sound Insulation	Regularly Exceeded
Waterman's Quay	NA	NA	Exceeded NA	NA	Regularly Exceeded
Queen's Club Gardens	Negligible	Adverse Impact	Met Met	None / None	Not Exceeded

6. Conclusion and Recommendations

Long term measurements were undertaken over the months April to September 2017 around London Heliport, UK. For the first time the noise monitoring consisted of geographically spread locations, temporal detail and was measured inside and outside the monitored properties. Assessment based on current applicable or relevant criteria [6] demonstrated that the residents along the flight path were at risk of adverse health effects from environmental noise attributable to the operation of the heliport.

In addition, the noise level recorded outside attributable to heliport operations at residential dwellings along the river were assessed as able to cause medium levels of annoyance such that each home would be eligible for sound insulation according to the Aviation Framework Policy [8]. It was also found that the heliport operations would cause significant adverse impact on the residents of all properties monitored based on a BS4142 type assessment [10] and that the internal noise levels consistently exceed current design practice [7].

The local planning condition, GLC Heliport Planning Condition 81 dBA (Max), for the Heliport was found to be regularly exceeded at residences along the river [9].

When the original planning enforcement conditions were set the Heliport was located in an industry complex, where there were only a few noise sensitive locations. In addition, other commercial heliports were in operation in London. Now there are hundreds, if not thousands, of sensitive receptors (residents) living along the river in newly built residential properties. As such it is recommended that Local Planning services review the current operation of London Battersea Heliport "Vertical Gateway to London".

It is recommended that any new local planning applications consider the noise attributed to the Heliport operation reported in this paper. It is also recommended that the design of future dwellings in the affected area by the heliport operation take into consideration the relevant guidance and policy employed in this paper. Particular attention should be focused on the design of building facades and the inclusion of any form of balcony in any proposed developments along the river Thames.

Another paper will report elsewhere on the community response study

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