Night Time Noise Impacts

Dave Gilbert HCNF 27th April 2022

HCNG – Heathrow Communities Noise Group

People are woken up by Noise Events at Night (11pm to 7am)

- 10 x 60dB L_{Amax} night events is a key threshold *
- Impact contours calculated through Modelling

- Concern 1 Annual night numbers shows significant increase in population impact from 2006 to today
- Concern 2 Very large amounts of people are impacted in London >1m
- Concern 3 CAA/ERCD ANCON model requires validation and averaging can miss opportunities
- Concern 4 Lack of understanding of annoyance and sleep disturbance caused by aircraft noise at night

* See WHO guidelines 1999

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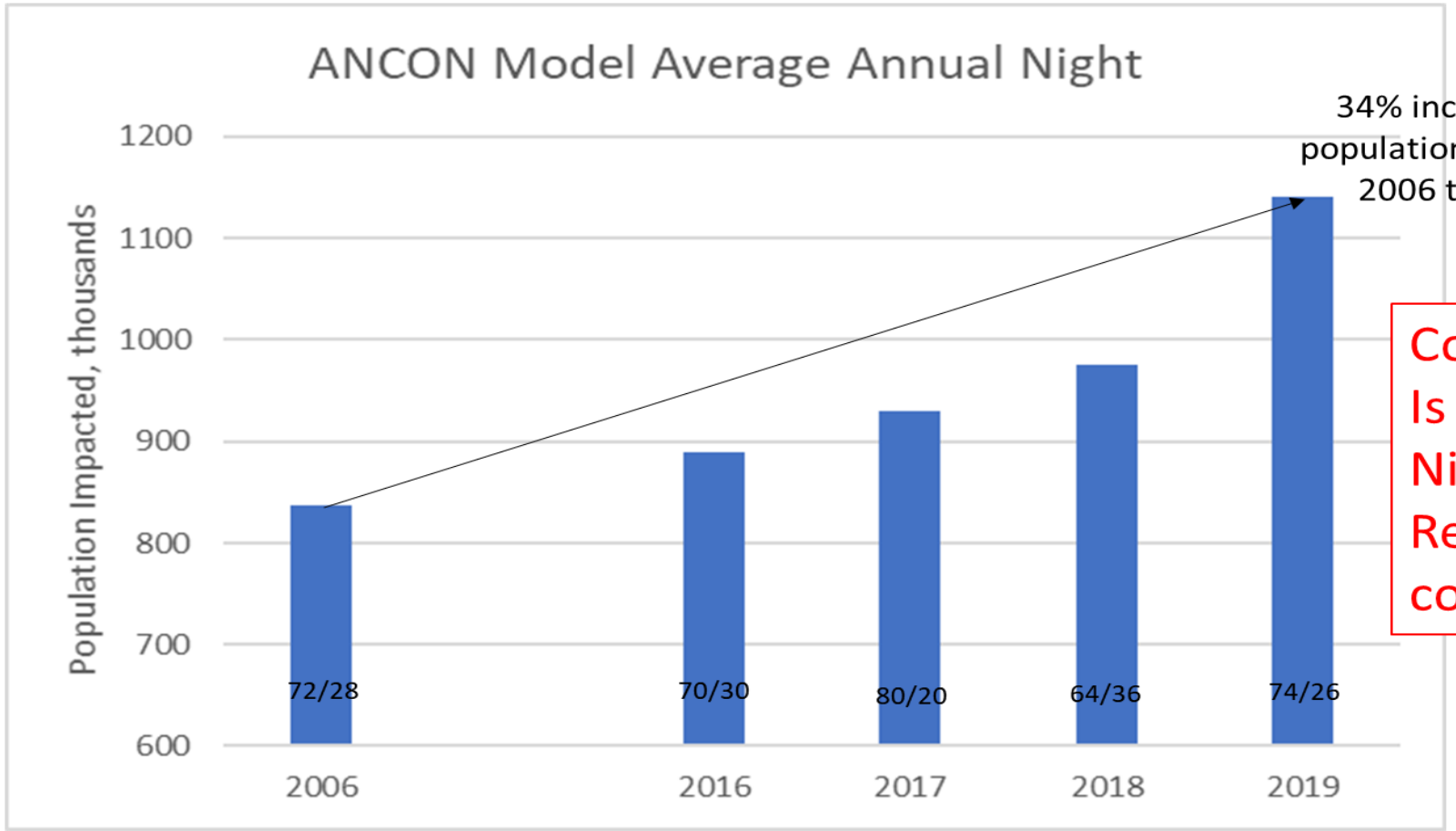
Acronyms; ERCD - Environmental Research and Consultancy Department. ANCON - Aircraft Noise Contour Model,

Population Impact from CAA/ERCD ANCON Modelling – for 10x Night Time N60 events

- Concern 1 Annual night numbers shows significant increase in population impact from 2006 to today

1 million



Concern 1 - Is the existing Night Time Regime protecting communities?

Average 2015/19 split - 72/28

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Sources – CAA reports CAP 1701, 1801, 1901, 2001

Acronyms; ERCD - Environmental Research and Consultancy Department. ANCON - Aircraft Noise Contour Model,

(for reference)

Table 25 Heathrow 2006 and 2019 annual average 8-hour night N60 contours - area, population and household estimates

N60	Area (km^2)			Population			Households		
	2006	**2019**	change	2006	**2019**	change	2006	**2019**	change
> 10	184.4	207.6	+13%	837.2	1119.7	+34%	387.6	466.3	+20%
> 20	89.9	118.1	+31%	389.9	700.7	+80%	175.7	286.9	+63%
> 50	0.5	1.0	+100%	< 0.1	0.0	(n/a)	< 0.1	0.0	(n/a)

Note: Populations and households are given in thousands. The 2006 population/household counts are based on a 2006 CACI update of the 2001 Census. The 2019 population/household counts are based on a 2019 CACI update of the 2011 Census.

Source – CAA LHR Annual Contour Report CAP 2001

People are woken up by Noise Events at Night (11pm to 7am)

- 10 x 60dB L_{Amax} night events is a key threshold *

- Concern 2 Large amounts of people are impacted in London

  - CAA/ERCD ANCON Modelling** says 0.97m (2018) and 1.1m (2019) people impacted (Annual Average Night Numbers) from Annual Contour Reports

  - Heathrow AEDT/INM Modelling*** says 1.6m (2019) people impacted (Summer Time Average Night Numbers)

- Night time impacts are most significant during the Summer period with higher traffic levels and when people want to sleep with windows open
- Government aviation policy is normally based on Summer Time Impacts (Heathrow/CAA Annual reports should therefore include summer night N60 data)

* See WHO guidelines 1999

** Data from CAP 1901 & CAP 2001

*** Data from Slightly Steeper Approaches Consultation

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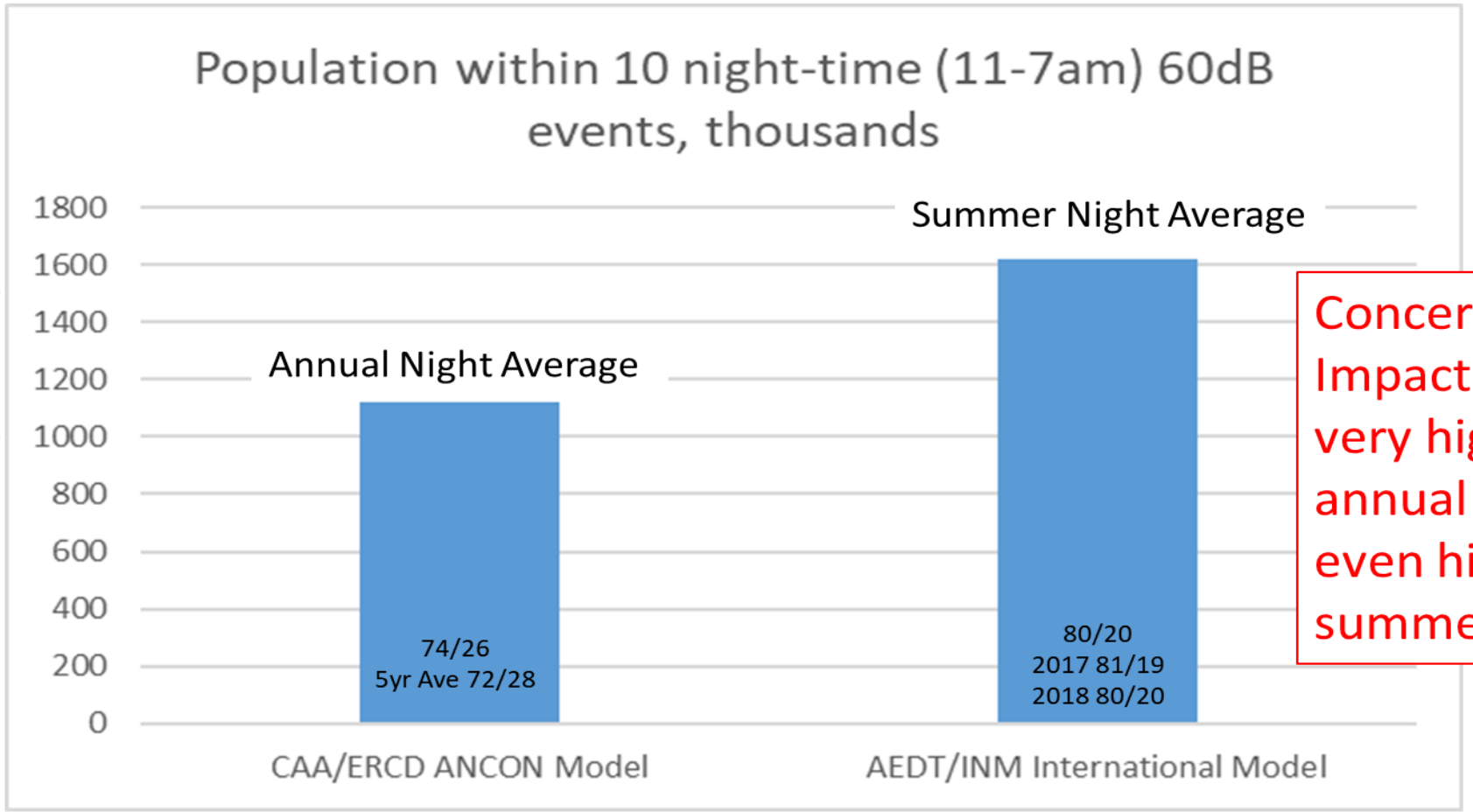
Acronyms; ERCD - Environmental Research and Consultancy Department. ANCON - Aircraft Noise Contour Model, AEDT - Aviation Environmental Design Tool, INM – Integrated Noise Model

Population Impact 2019
– for 10x Night Time N60 events

1.5 million

1 million



Concern 2 - Impact levels are very high on annual basis but even higher during summer

Source – CAP 2001

Source – Heathrow Analysis using AEDT/INM model from Slightly Steeper Approaches Consultation

Impacted Population Single Mode Summer is 1.9m

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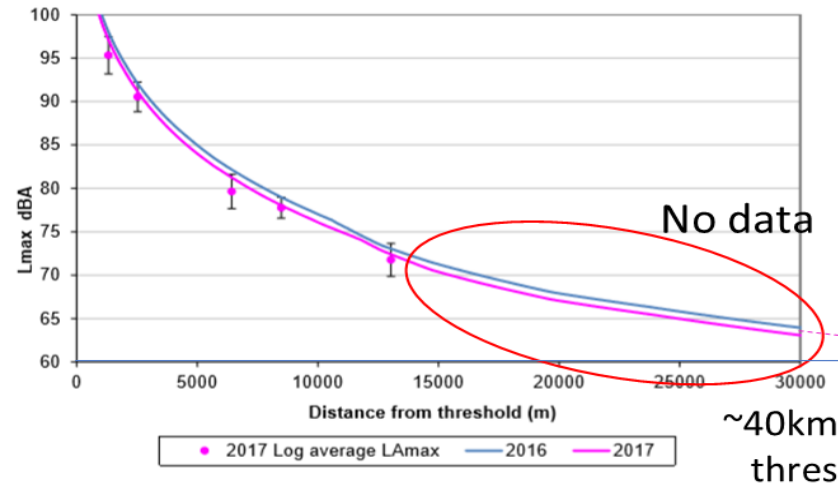
Acronyms; ERCD - Environmental Research and Consultancy Department. ANCON - Aircraft Noise Contour Model, AEDT - Aviation Environmental Design Tool, INM – Integrated Noise Model

Improved validation required for CAA/ERCD ANCON Model

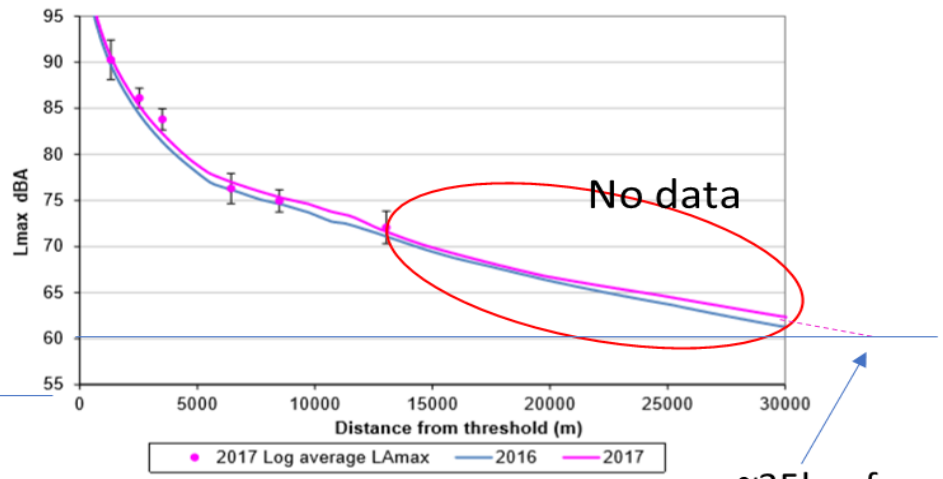
(Noise monitors need to be set to record <60dB events – should be possible in lower noise background locations)

Figure E8 Boeing 777-300ER/GE engines arrival L_{max}



~40km from threshold

Figure E24 Airbus A380/EA engines arrival L_{max}



~35km from threshold

Figure E16 Airbus A320/CFM engines arrival L_{max}

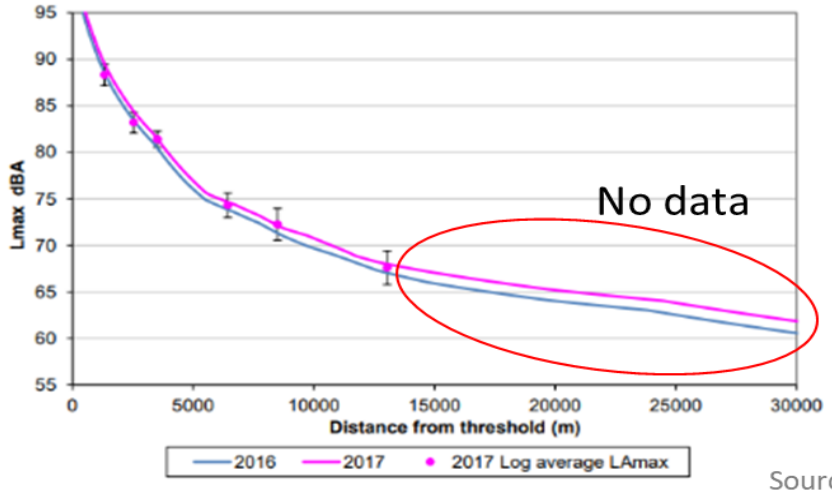
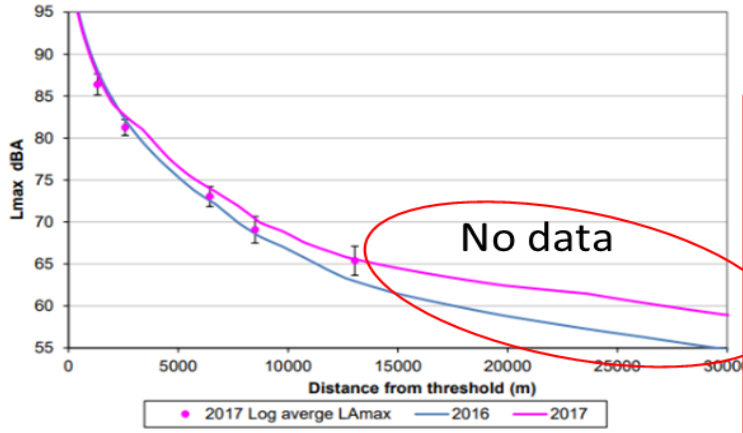


Figure E20 Airbus A320/IAE V2500 engines arrival L_{max}



Concern 3 - Validation is required. Also Averaging may miss opportunities for improvements

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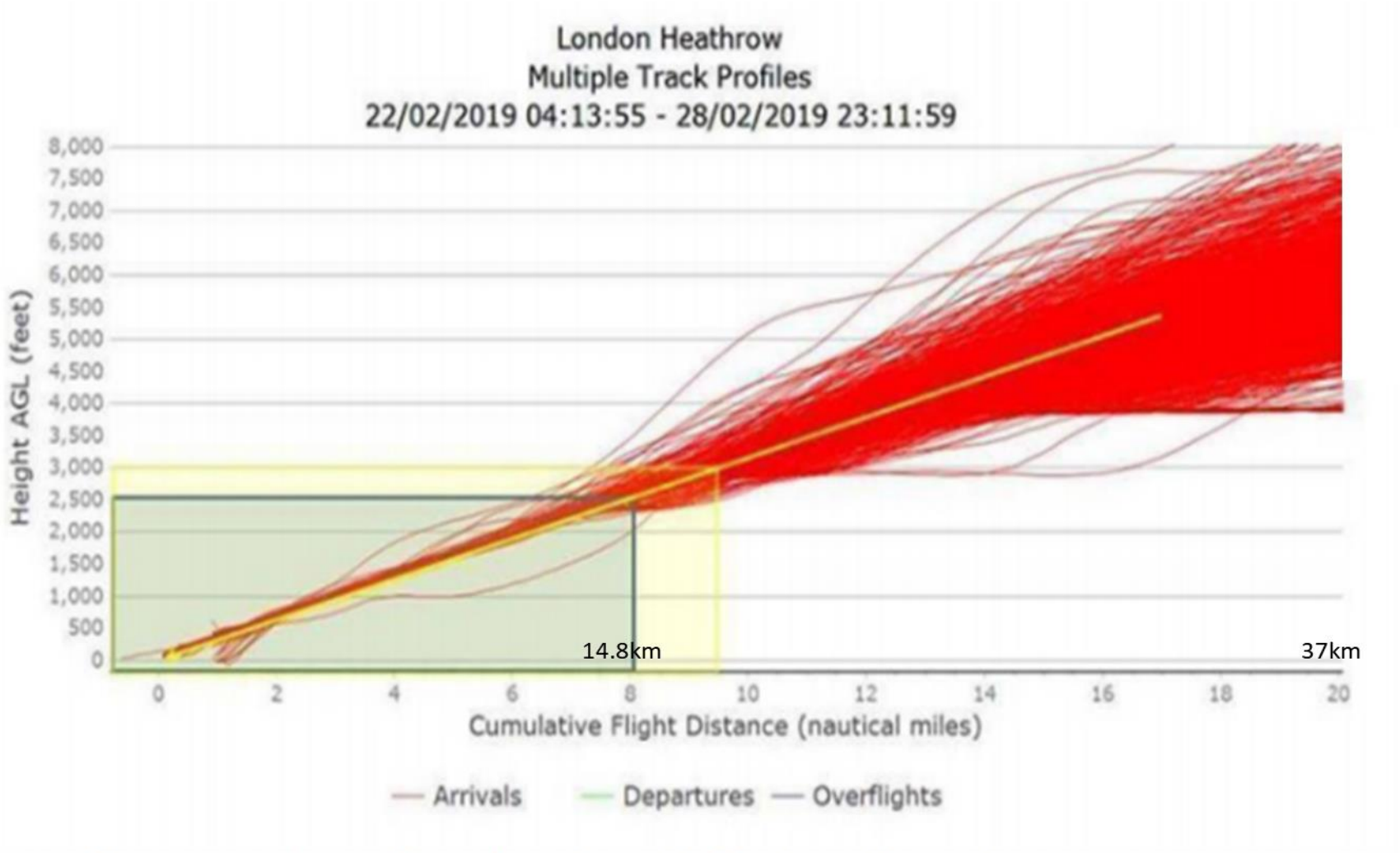
Source – CAA report CAP 1801 – Appendix E covering Model validation

Arrivals at Heathrow

- typical data supplied by Heathrow



Averaging may miss opportunities for improvements

Please note: This diagram is only to provide an understanding and should not be used for analysis.

Arrivals at Frankfurt – LNAS system – what it does

Red before – Blue with system

https://www.skylab.swiss/final-results-from-trilateral-skylab-dlr-empa-project-pilot-assistance-system-lnas-cda/

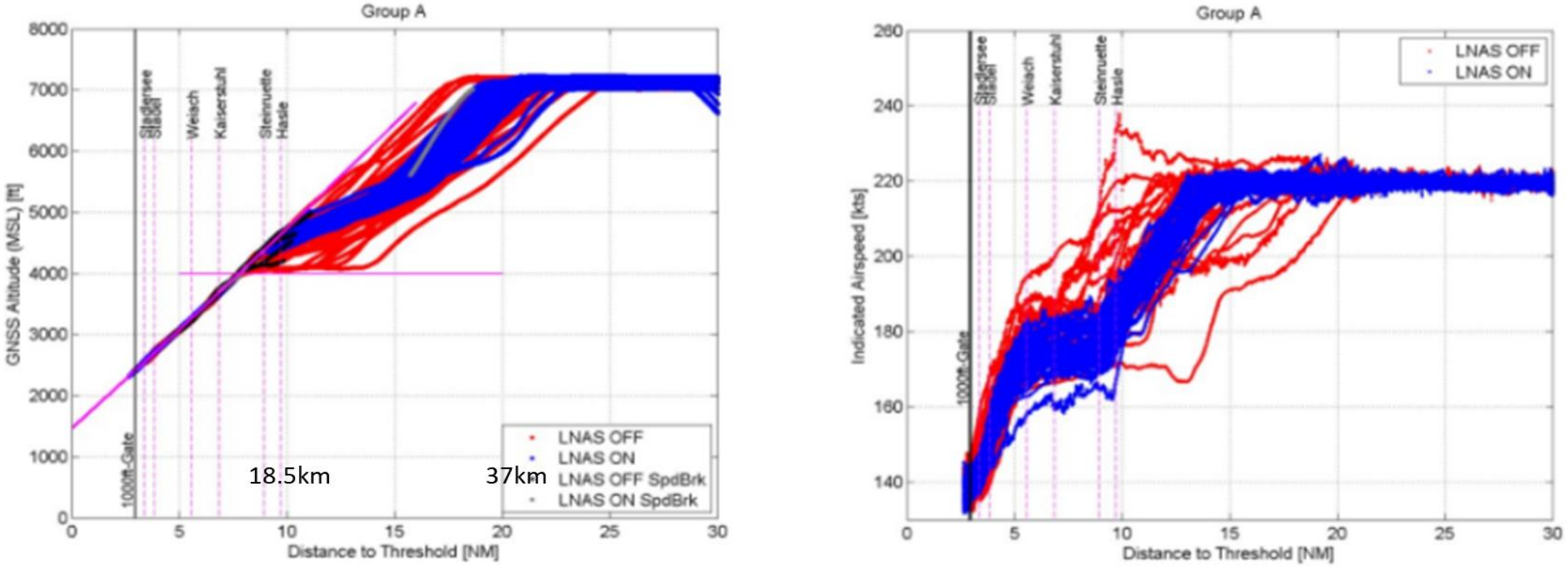


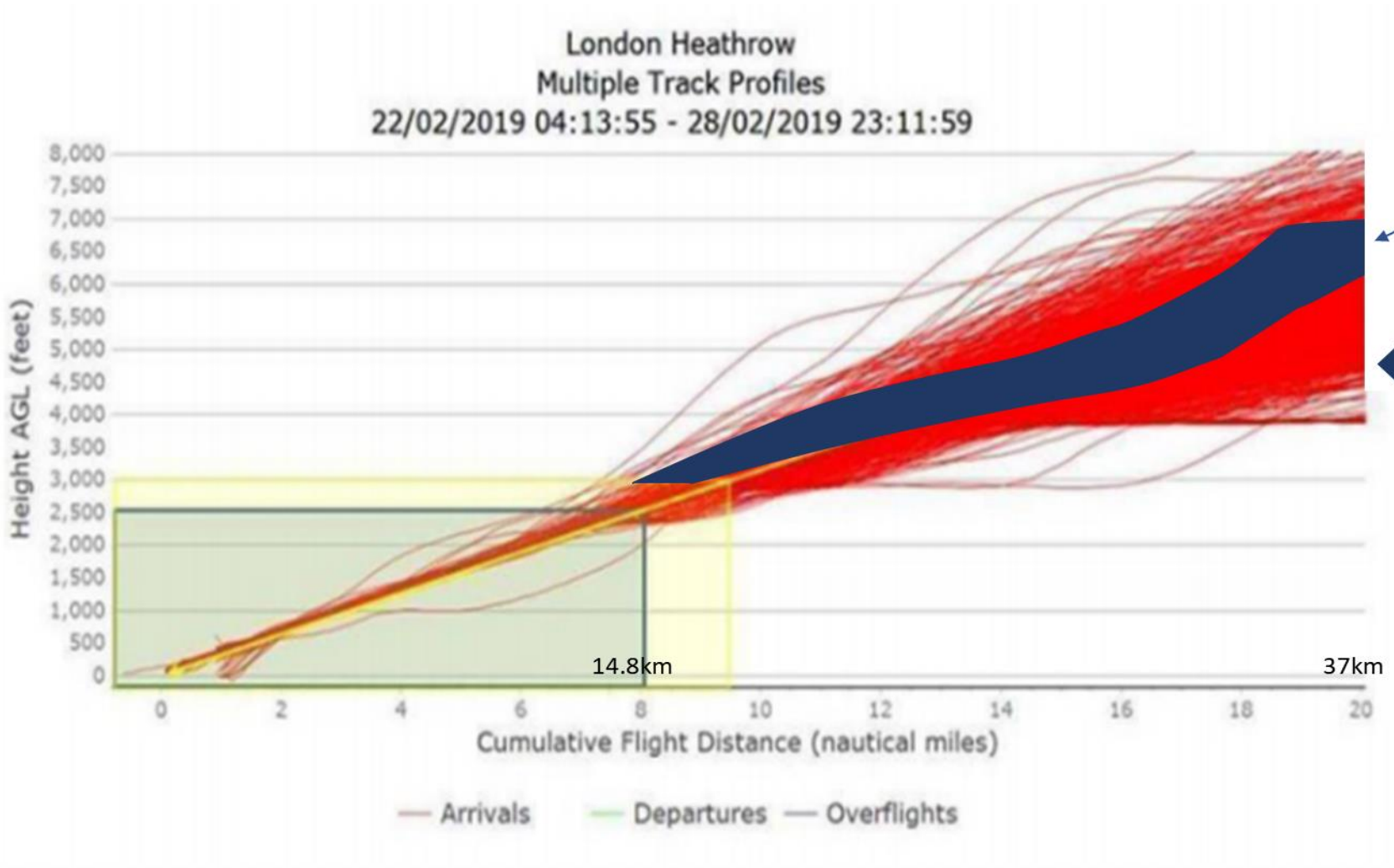
Figure 2 *The vertical profiles (left) and the airspeeds (right) were flown with LNAS (blue) much more evenly. Picture: DLR.*

Acronym - LNAS – Low Noise Arrivals System

LNAS at Heathrow

– possible impact using similar overlay / improvement potential as seen at Frankfurt shown in dark blue?

(note airports at different heights above sea level)



Please note: This diagram is only to provide an understanding and should not be used for analysis.

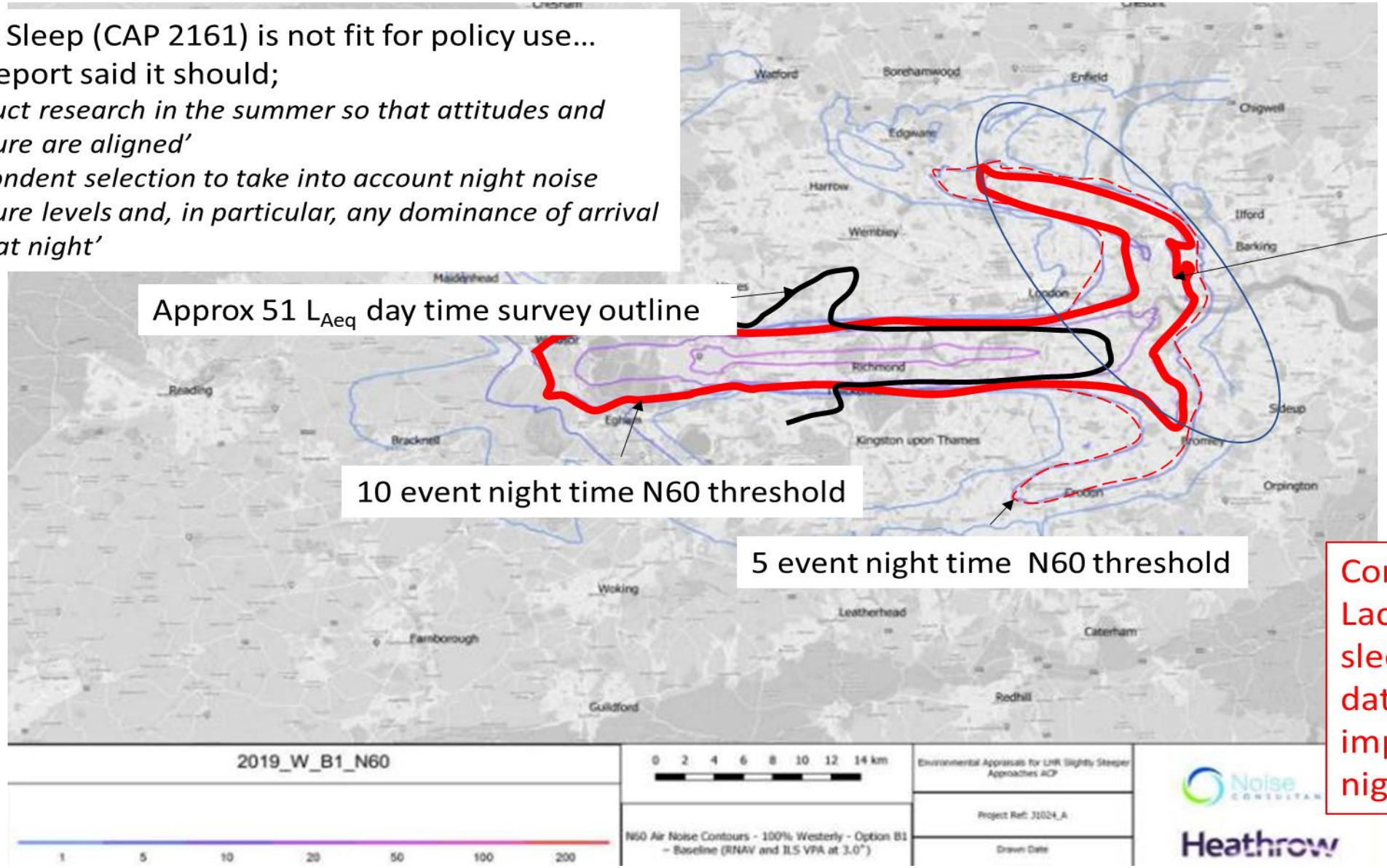
Potential to remove low flying noisier tracks?

Potential to save fuel & pollution on flatter sections?

Detailed understanding of individual flight paths can show opportunities for improvements

Are night time impacts in London truly understood?

SoNA Sleep (CAP 2161) is not fit for policy use…
The report said it should;
'Conduct research in the summer so that attitudes and exposure are aligned'
'Respondent selection to take into account night noise exposure levels and, in particular, any dominance of arrival noise at night'



1.6m People in this area experience 10x60dB a night on average but were never questioned about impacts on sleep disturbance or annoyance

Concern 4 -
Lack of annoyance / sleep disturbance data for people impacted by night noise

Conclusions

- Concern 1 Annual night numbers shows increasing population impact
- Concern 2 Very large numbers of people are impacted by night noise in London
- Concern 3 Validation of ANCON model is required
- Concern 4 Lack of UK annoyance/sleep disturbance understanding in establishing night flight policies

Proposed actions

- HCNG noise representatives meeting with DfT to discuss issues in depth and routes forward
- Available evidence indicates night noise regime should be tightened

Night Time Noise Impacts. Dave Gilbert (Teddington Action Group). Heathrow Community Noise Forum 27/04/2022.

Reference Slides

WHO 1999 Community Noise Guidelines

For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB LAmax* more than 10–15 times per night (Vallet & Vernet 1991), and most studies show an increase in the percentage of awakenings at SEL values of 55–60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995). For intermittent events that approximate aircraft noise, with an effective duration of 10–30 s, SEL values of 55–60 dBA correspond to a LAmax value of 45 dB. Ten to 15 of these events during an eight-hour night-time implies an LAeq,8h of 20–25 dB. This is 5–10 dB below the LAeq,8h of 30 dB for continuous night-time noise exposure, and shows that the intermittent character of noise has to be taken into account when setting night-time limits for noise exposure. For example, this can be achieved by considering the number of noise events and the difference between the maximum sound pressure level and the background level of these events.

* Note 60dB LAmax is an outside level, attenuation through an open window is assumed to result in a 45dB event

More recent studies have suggested a noise level of 42dB in the bedroom can disturb sleep (WHO 2009 Night Noise Guidelines for Europe)

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Acronyms; SEL – Sound Energy Level

Summer Night – 2019 baseline figures

Source – Heathrow Analysis using AEDT/INM model from Slightly Steeper Approaches Consultation

BACK TO OVERVIEW TABLE

N65 and N60 Data Tables - 80% West 20% East - 2019

N65	Number of Dwellings, 2019 N65		
	Option B1 – Baseline (RNAV and ILS VPA at 3.0˚)	Option B2 – SSA (3.2˚ RNAV and 3.0˚ ILS VPA)	All aircraft operating 3.2o RNAV SSA
1	2316171	2312978	2269715
5	1074091	1073819	1060303
10	713805	713621	700150
20	539873	539969	533513
50	241693	241534	246348
100	131446	131446	126307
200	68538	68538	68103

N60	Number of Dwellings, 2019 N60		
	Option B1 – Baseline (RNAV and ILS VPA at 3.0˚)	Option B2 – SSA (3.2˚ RNAV and 3.0˚ ILS VPA)	All aircraft operating 3.2o RNAV SSA
1	2185274	2181157	2154061
5	1093025	1093088	1077766
10	672990	672699	666983
20	338781	338819	335286
50	3768	3764	3798
100	0	0	0
200	0	0	0

N65	Population Count, N65		
	Option B1 – Baseline (RNAV and ILS VPA at 3.0˚)	Option B2 – SSA (3.2˚ RNAV and 3.0˚ ILS VPA)	All aircraft operating 3.2o RNAV SSA
1	5846352	5838538	5729548
5	2663371	2662681	2631067
10	1762363	1761913	1728952
20	1333103	1333324	1315768
50	614171	613823	625240
100	341603	341603	329682
200	185586	185586	184675

N60	Population Count, N60		
	Option B1 – Baseline (RNAV and ILS VPA at 3.0˚)	Option B2 – SSA (3.2˚ RNAV and 3.0˚ ILS VPA)	All aircraft operating 3.2o RNAV SSA
1	[illegible]	5460934	5390598
5	2685005	2685054	2644942
10	1619636	1618960	1602863
20	825243	825356	817090
50	[illegible]	11787	11909
100	0	0	0
200	0	0	0

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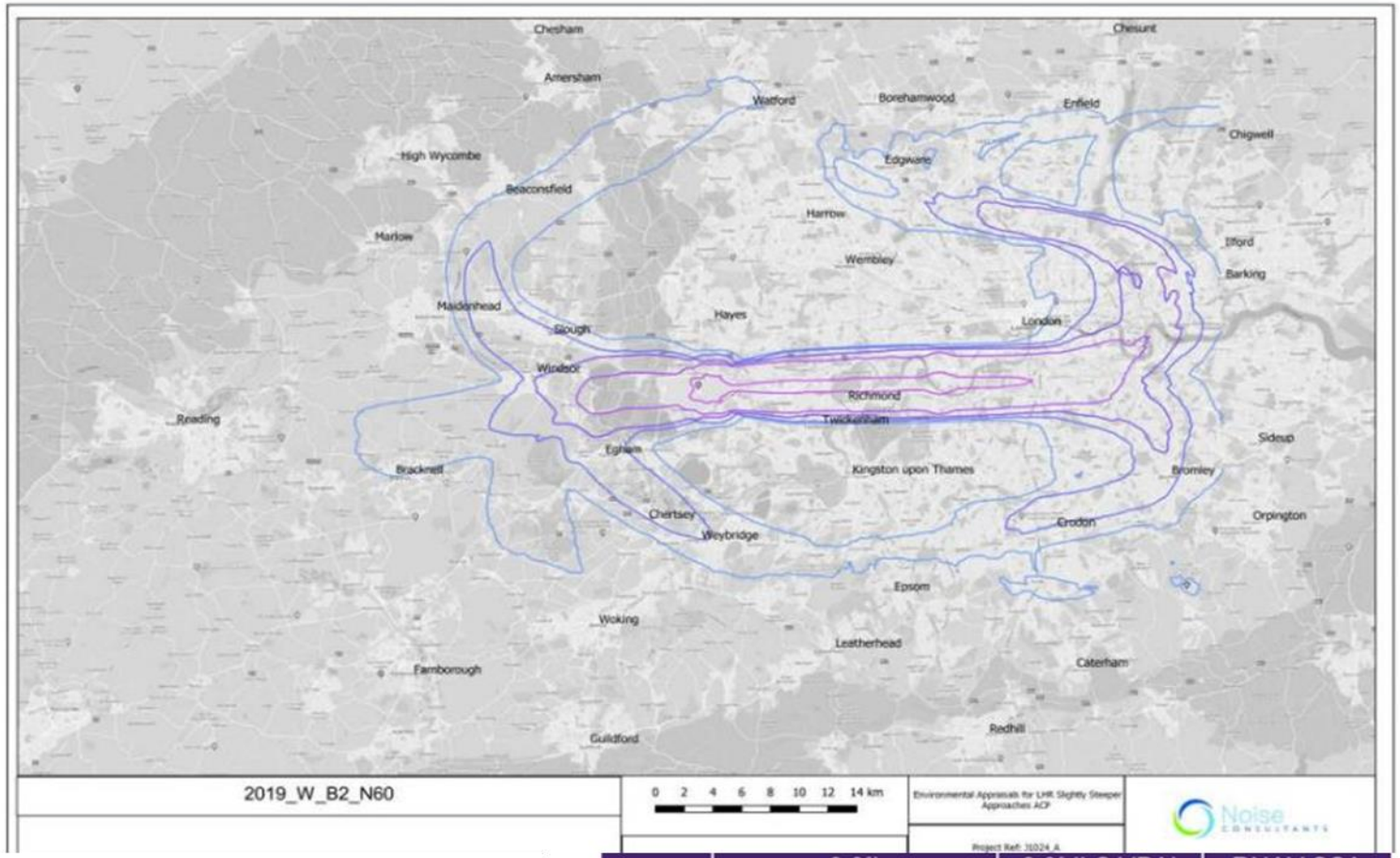
N60 (night) contours– Option B2 (SSA) – 2019 – Westerly



	3.0˚)	3.0˚ ILS VPA)	RNAV SSA
1	4703588	4703588	4604276
5	2284443	2284453	2271874
10	1440888	1441102	1401663
20	1150670	1150680	1121713
50	684032	684160	688443
100	353292	353210	341494
200	210832	210832	206555

Single Mode N60 Summer Night
– shows an even higher impacted population

N60	Number of Dwellings, 2019 N60		
	Option B1 – Baseline (RNAV and ILS VPA at 3.0˚)	Option B2 – SSA (3.2˚ RNAV and 3.0˚ ILS VPA)	All aircraft operating 3.2o RNAV SSA
1	1963294	1963294	1932403
5	1168466	1168466	1157185
10	792287	792287	779866
20	405918	405918	403582
50	56234	56234	53714
100	0	0	0
200	0	0	0

N60	Population Count, N60		
	Option B1 – Baseline (RNAV and ILS VPA at 3.0˚)	Option B2 – SSA (3.2˚ RNAV and 3.0˚ ILS VPA)	All aircraft operating 3.2o RNAV SSA
1	4890750	4890750	4810272
5	2879338	2879338	2850402
10	1924758	1924758	1894102
20	980280	980280	975121
50	138213	138213	132323
100	0	0	0
200	0	0	0

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2.31 The 2016 and 2017 runway modal splits for the day and night summer periods are summarised in **Table 3**.

Table 3 Heathrow 2016 and 2017 summer runway modal splits

Time period	2016 actual split (W/E percentage)	2017 actual split (W/E percentage)	2016 standard split (W/E percentage)	2017 standard split (W/E percentage)
16-hour day	86 / 14	84 / 16	79 / 21	79 / 21
8-hour night	85 / 15	81 / 19	Data not available	Data not available

2.32 The annual noise contours were modelled with the 2017 actual West/East (W/E) runway modal splits, which are summarised in **Table 4** along with the modal splits from the previous year, and also the 5-year rolling average.

Table 4 Heathrow annual runway modal splits

Time period	2016 actual split (W/E percentage)	2017 actual split (W/E percentage)	5-year average 2013-2017 (W/E percentage)
12-hour day	70 / 30	81 / 19	72 / 28
4-hour evening	72 / 28	81 / 19	72 / 28
8-hour night	70 / 30	80 / 20	72 / 28
24-hour day	70 / 30	81 / 19	72 / 28
6.5-hour night	71 / 29	75 / 25	72 / 28

Note: The 6.5-hour night covers the period from the end of March in one year to the end of March in the following year.

2.31 The 2017 and 2018 runway modal splits for the day and night summer periods are summarised in **Table 3**.

Table 3 Heathrow 2017 and 2018 summer runway modal splits

Time period	2017 actual split (W/E percentage)	2018 actual split (W/E percentage)	2017 standard split (W/E percentage)	2018 standard split (W/E percentage)
16-hour day	84 / 16	78 / 22	79 / 21	79 / 21
8-hour night	81 / 19	80 / 20	Data not available	Data not available

2.32 The annual noise contours were modelled with the 2018 actual West/East (W/E) runway modal splits, which are summarised in **Table 4** along with the modal splits from the previous year, and also the 5-year rolling average. In 2018 there was a 16% modal split shift towards easterly operations over the annual 24-hour period.

Table 4 Heathrow annual runway modal splits

Time period	2017 actual split (W/E percentage)	2018 actual split (W/E percentage)	5-year average 2014-2018 (W/E percentage)
12-hour day	81 / 19	65 / 35	71 / 29
4-hour evening	81 / 19	65 / 35	72 / 28
8-hour night	80 / 20	64 / 36	71 / 29
24-hour day	81 / 19	65 / 35	72 / 28
6.5-hour night	75 / 25	69 / 31	71 / 29

2.31 The 2018 and 2019 runway modal splits for the day and night summer periods are summarised in **Table 3**.

Table 3 Heathrow 2018 and 2019 summer runway modal splits

Time period	2018 actual split (W/E percentage)	2019 actual split (W/E percentage)	2018 standard split (W/E percentage)	2019 standard split (W/E percentage)
16-hour day	78 / 22	80 / 20	79 / 21	80 / 20
8-hour night	80 / 20	80 / 20	Data not available	Data not available

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Modal splits
from CAP reports