



Portable Noise Monitor Report:

Balsall Common Noise and Overflights Study 2019

4th – 29th April 2019

12th September – 7th October 2019



Report Title: Balsall Common Noise and Overflights Study 2019

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Date: 08/02/2022

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1. Background

In May 2014, as part of the Airspace Change Process following the extension to the runway, changes were made to flightpaths for aircraft departing from Runway 15. These included a revision to the Standard Instrument Departure (SID) procedure commonly referred to as the 'Northbound Turn', whereby aircraft departing from Runway 15, but whose destinations required a northerly heading, made a left-hand turn, taking them over the north of the village of Balsall Common.

Following implementation, pro-active monitoring of compliance on the revised SID by Birmingham Airport Ltd (BAL) identified that while jet aircraft were flying close to the centreline of the revised Northbound Turn as intended, turbo-prop aircraft, tended to follow either a track that took them further north of the Noise Preferential Route (NPR) or a track that took them further south of the NPR and consequently closer to the northern part of Balsall Common.

Recognising that this situation was not satisfactory, in June 2016 BAL appointed procedure designers to redesign the SID with the aim of bringing turbo-prop aircraft performance on the Northbound Turn in line with that of jet aircraft. The resulting re-designed Northbound Turn became operational on 23rd May 2019.

In response to requests from members of the Airport Consultative Committee (ACC), BAL committed to undertake a study to investigate aircraft operations before and after the implementation of the re-designed Northbound Turn with a view to comparing noise levels and traffic patterns, the results of which are presented in this report.

2. Methodology

The Balsall Common Noise and Overflights Study was conducted over two 26-day periods - 4th to 29th April 2019 inclusive - i.e. before the implementation of the revised SID - and 12th September to 7th October 2019 inclusive, or after the revised SID was brought into use. For ease of understanding, these study periods will be referred to hereafter as 'before' and 'after'.

For both periods, the study involved the use of the airport's Portable Noise Monitor (PNM) to measure aircraft noise levels in the northern part of Balsall Common. The PNM was deployed at a resident's garden in Wootton Green Lane, Balsall Common. This location is approximately 3.9 miles from the end of the runway and is located close to the northern extremity of the main part of the village. BAL confirmed the suitability of the location, both in terms of its proximity to aircraft tracks over the ground and in practical terms - that there was clear access to power and there were no barriers which might reflect or absorb noise.

In order to mitigate against the possibility of community noise events unrelated to aircraft activities triggering a noise reading (for example, passing motorcycles or nearby lawnmowers), the noise threshold for the PNM was set at 65 dB(A).

The study also collected data via the Airport Noise and Operations Monitoring System (ANOMS), to monitor flight tracks and assess the number of aircraft operating in the vicinity. The ANOMS system integrates secondary radar data with the noise data captured by the PNM, which can be correlated to specific aircraft operations. In order to determine the number of overflights, a 'gate' was set up in ANOMS, stretching from the point at which the A452 crosses the railway in the north, to the junction of the A452 and the B4101 to the south. Any aircraft passing 'through' this gate was determined to be an overflight. A map showing the location of both the gate and the PNM can be found in Appendix A.

Analysis of the data focuses primarily on the tracks and noise generated by aircraft departing from Runway 15 Northbound.

The majority of aircraft departing from Runway 15 use RNAV (Area Navigation) Standard Instrument Departure (SID) procedures. RNAV procedures use satellite technology to

navigate aircraft through a series of waypoints, enabling them to operate with increased accuracy when compared to those using conventional procedures, using ground-based radio beacons. The SID is a set of published instructions and is designed to provide aircraft with safe entry into the UK airways system.

Constructed around the SID are Noise Preferential Routes (NPRs) which for aircraft departing from Runway 15 are represented by a swathe 2km in width. Aircraft must remain within the NPR until an altitude of 3000ft has been achieved when departing on route P6 (referred to as the northbound turn) and 4000ft for those departing using route P1 (and heading south). The NPRs for aircraft departing from Runway 15 can be found in Appendix B.

There are also a small number of aircraft that depart on a southerly heading using a non-standard departure procedure P21 commonly referred to as MOSUN. MOSUN is typically used by aircraft heading to destinations such as Portugal and the Canary Islands as it avoids the congested London Airspace and provides a shorter routing. Its availability is, however, restricted due to a section of airspace to the west of the Airport with which MOSUN interacts not always being available for commercial operations.

3. Results

3.1 Results of the 'before' study (4th April – 29th April)

3.1.1 Noise study

The results of the 'before' noise study identified a total of 2,946 aircraft departing from Runway 15 during the study period. Of these, 286 (9.71%) registered noise levels above the 65dB(A) threshold set for the PNM.

The most common aircraft type to register noise events on the PNM was the Boeing 737-800 (B738), which accounted for 114 (39.86%) of the 286 registered noise events.

The 286 movements which registered a noise event were analysed by route – either Northbound (P6) or Southbound (P1).

Departures from Runway 15 Northbound (P6)

819 aircraft were identified as departing Runway 15 Northbound during the study period. Of these, 283 (34.55%) registered noise levels above the 65dB(A) threshold. The most common aircraft type to register noise events was the Boeing 737-800 (B738) which accounted for 113 (39.92%) of the 283 aircraft registering a noise event.

The noisiest single event registered at 75dB(A). This was generated by an Airbus A320 aircraft which remained within the NPR until its requisite altitude had been achieved and operated according to standard recommended procedure.

Departures from Runway 15 Southbound (P1)

2,024 aircraft were identified as departing from Runway 15 Southbound during the study period. Of these, 3 (0.15%) registered noise levels above the 65dB(A) threshold set up for the PNM, a Boeing 737-800 (B738), an Airbus A321-200 (A321) and an Embraer 190 (E190). The noisiest were the B738 and the A321, both of which registered at 72.1dB(A). Both aircraft flew off-track; they did not fly the SID and instead took a straight-ahead route which saw them overfly the vicinity of the PNM at heights of 3,883 and 4,372 feet respectively. The analysis of all noise data can be found in Appendix D.

3.1.2 Overflights study

Data was gathered for all aircraft operations departing from Runway 15 during the study period, but this analysis focuses on those aircraft flying through the gate referred to in the methodology section of this report. A total of 430 aircraft flew through the gate during this study period.

Departures from Runway 15 Southbound (P1)

Six of these aircraft were on southerly headings, making up 0.30% of the total number of operations which departing Runway 15 on a southerly heading. The average altitude of these aircraft through the gate was 4,683ft.

Departures from Runway 15 Northbound (P6)

424 of the 430 aircraft which flew through the gate were on northerly headings, making up 51.77% of the total number of operations departing Runway 15 on a northerly heading. The average altitude of these aircraft through the gate was 4,264ft.

The analysis of all overflight data can be found in Appendix E.

3.2 Results of the 'after' study (12th September – 7th October)

3.2.1 Noise study

The results of the 'after' noise study identified a total of 2,111 aircraft departing from Runway 15 during the study period. Of these, 163 (7.72%) registered noise levels above the 65dB(A) threshold set for the PNM. The most common aircraft type to register noise events on the PNM was the Boeing 737-800 (B738), which accounted for 70 (42.94%) of the 163 registered noise events.

The 163 movements which registered a noise event were analysed by route – either Northbound (P6) or Southbound (P1).

Departures from Runway 15 Northbound (P6)

478 aircraft were identified as departing Runway 15 Northbound during the study period. Of these, 155 (32.43%) registered noise levels above the 65dB(A) threshold. The most common aircraft type to register noise events was the Boeing 737-800 (B738) which accounted for 66 (42.58%) of the 155 aircraft registering a noise event.

The noisiest single event registered at 78.3dB(A). This aircraft was an Antonov AN12 aircraft which flew off-track, being wide on the northbound turn and exiting the NPR close to the PNM at a height of approximately 2,465 feet.

A map showing this track can be found at Appendix C.

Departures from Runway 15 Southbound (P1)

1,568 aircraft were identified as departing from Runway 15 Southbound during the study period. Of these, only 8 (0.51%) registered noise levels above the 65dB(A) threshold set up for the PNM. The most common aircraft type to register noise events was the Boeing 737-800 (B738) which accounted for 4 (50%) of the 8 aircraft registering a noise event on the PNM.

The noisiest operation registered at the PNM at 76.6dB(A). This aircraft was an Airbus A321-200 (A321) which flew off-track, not flying the SID and overflying the PNM at a height of approximately 3,726 feet.

The analysis of all noise data can be found in Appendix D.

3.2.2 Overflights study

Data was gathered for all aircraft operations departing from Runway 15 during the study period, but this analysis focuses on those aircraft flying through the gate referred to in the methodology section of this report. A total of 144 aircraft flew through the gate during this study period.

Departures from Runway 15 Southbound (P1)

Four of these aircraft were on southerly headings, making up just 0.26% of the total number of operations which departing Runway 15 on a southerly heading. The average altitude of these aircraft through the gate was 4,440ft.

Departures from Runway 15 Northbound (P6)

140 of the 144 aircraft which flew through the gate were on northerly headings, making up 29.29% of the total number of operations departing Runway 15 on a northerly heading. The average altitude of these aircraft through the gate was 3,632ft.

The analysis of all overflight data can be found in Appendix E.

3.3 Discussion of results

3.3.1 Overflights Study Discussion

The total number of departures from Runway 15, regardless of whether or not they flew through the gate, fell from 2,946 during the 'before' study period to 2,111 'after'. This may be explained by natural fluctuations in traffic patterns and in runway usage. Runway usage is determined by meteorological conditions, primarily wind direction. Runway 15 was in operation less frequently during the 'after' period, this is largely a function of natural variations in wind direction and weather patterns between the two study periods.

We can make an accurate comparison between the two study periods by examining the respective number of Runway 15 Northbound operations which passed through the gate, as a percentage of overall Runway 15 Northbound operations. The analysis of all overflight data can be found at Appendix E.

The study shows that 51.77% of all Runway 15 Northbound operations flew through the gate during the 'before' study period, with 29.29% doing the same 'after'. This represents a 22.48% reduction in the number of operations overflying Balsall Common.

Analysis by aircraft type shows that 75.42% of all R15 Northbound Jet aircraft operations flew through the gate 'before', this decreased to 7.69% of jet aircraft flying through the gate 'after'.

Whilst this is a significant decrease (67.73%), the tracks of these aircraft show that the majority of jets flew within the NPR both 'before' and 'after' with the difference being that the jets were further concentrated at the centreline of the SID 'after', with this centreline lying just above the gate location.

38.31% of all R15 Northbound turbo-prop aircraft operations flew through the gate 'before', this increased to 42.57% of turbo-prop aircraft flying through the gate 'after'. Whilst this is a minor increase (4.26%), the tracks of these aircraft 'before' show the two swathes of turbo-props either flying too far north of the SID, or too far south of the SID and overflying Balsall Common. The 'after' tracks show that the turbo-props are now flying close to the centreline of the SID, within the NPR, as intended by the re-design of the Northbound turn.

Maps showing aircraft tracks can be found at Appendix E.

A comparison of average altitudes was undertaken for Runway 15 departures Northbound. This comparison showed that the average altitude of jet aircraft remained largely unchanged between the two study periods with an average of 4,203ft 'before' and 4,003ft 'after' (a 4.87% decrease). The average altitude of turbo-prop aircraft decreased by 18.68% from 4,331ft 'before' to 3,591ft 'after', with the majority of turbo-prop's being Dash 8 aircraft (DH8D). In 2019 this aircraft type was predominantly flown by Flybe. It should be noted that this aircraft type has not operated frequently since March 2020 and retrospectively it is not possible to determine the reasoning for this change in altitude observed in 2019.

3.3.2 Noise Study Discussion

Comparison between the two study periods has been made by means of calculating the number of Runway 15 operations which registered a noise event (i.e. were recorded at greater than 65dB(A) at the PNM), as a percentage of overall Runway 15 operations.

For all departures from Runway 15, regardless of route, we see that this was at 9.71% during the 'before' study period, with this decreasing to 7.72% for the 'after' study period. For Runway 15 departures Northbound, this decreased from 34.55% 'before' to 32.43% 'after'.

Whilst these figures show that noise events have decreased, they have not decreased significantly. Having seen a 22.48% reduction in overflights, it might be considered surprising that a larger reduction in noise events was not observed. There are two factors which can help explain this.

Analysis by aircraft type shows that 79.15% of aircraft registering noise events 'before' were jets, with 89.03% after. It can be observed that the jet aircraft were flying the revised SID accurately 'before', and flew closer to the centreline of the SID 'after' with no significant proportion overflying south Balsall Common either 'before' or 'after' (as was the case with the turbo-prop aircraft 'before'). This is reflected in the similar percentages of R15 Northbound operations registering a noise event when comparing the two study periods, with 75.42% of jets registering a noise event 'before' and 75.82% of jets registering a noise event 'after'. This means that if we were to observe any significant reduction in the number of noise events, this would arise from turbo-prop operations. This is indeed the case; the percentage of turbo-prop aircraft registering noise events decreased from 11.3% 'before' to 5.74% 'after'. However, given that 20.85% of aircraft registering noise events were turbo-props 'before' with 10.97% 'after', any reduction in noise events has a proportionately smaller impact on the overall figures.

Maps showing aircraft tracks can be found at Appendix E.

In addition, the data reveal a 16% reduction in the average altitude of aircraft departing Runway 15 northbound, as detailed in the overflights study discussion above. Aircraft flying at a lower altitude over the PNM are more likely to register a noise event and this is therefore a factor for consideration when analysing the results.

Taken together, these factors explain why the reduction in noise events was not more strongly correlated with the observed fall in the percentage of aircraft flying through the gate.

4. Conclusion

The study shows that the revision to the P6 SID (known as the Northbound turn), commissioned by the Airport Company, did result in the expected improvement in track keeping, significantly reducing the number of overflights over Balsall Common.



The noise climate at the location of the PNM (located to the north of Balsall Common) also showed an improvement.

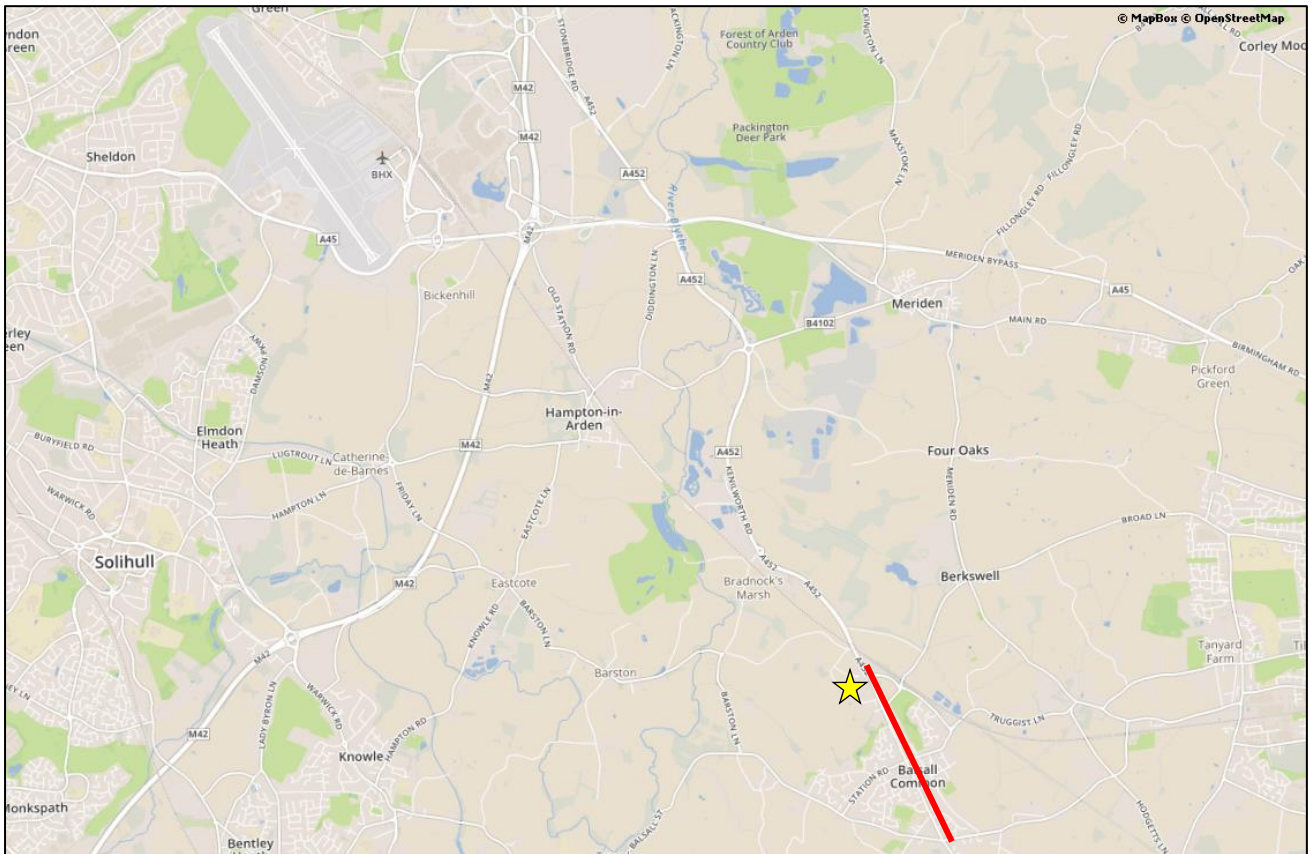
Birmingham Airport has recognised for many years that aircraft noise is a sensitive issue for local communities and has operated a comprehensive noise management programme for many years.

While minimising and mitigating noise in Balsall Common is undoubtedly challenging due to its close proximity to the SID routes, Birmingham Airport is committed to investigating all practicable means to do so and the results of this study have illustrated some of the practical benefits that can be achieved when the Airport and its neighbours work together. Birmingham Airport is grateful to the Airport Consultative Committee for its involvement in the study and to those residents who have waited patiently for the results throughout the long delay caused by the impact of the COVID-19 pandemic.

5. Appendices




Appendix A – Map showing the location of the Portable Noise Monitor and the gate

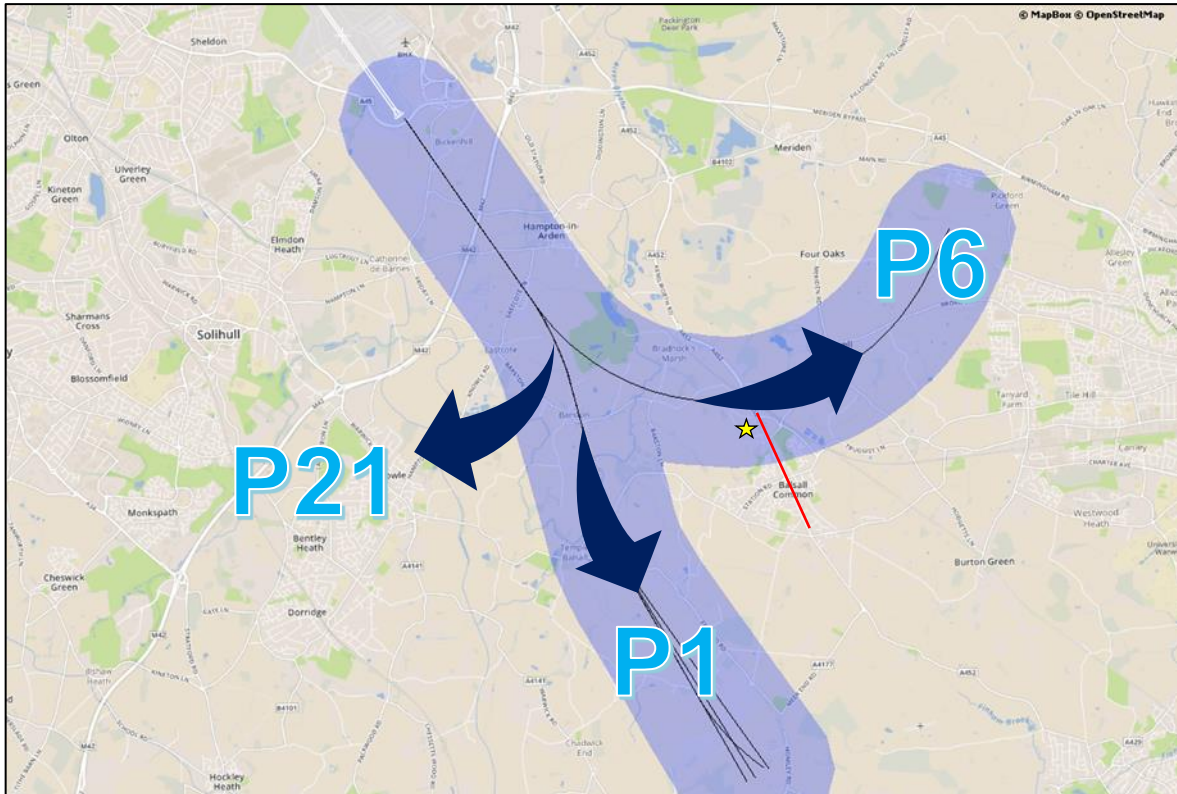
Key
Gate = 
Location of the PNM = 







Appendix B – Map showing Runway 15 Standard Instrument Departure Routes (SID's) and MOSUN routing in relation to Balsall Common

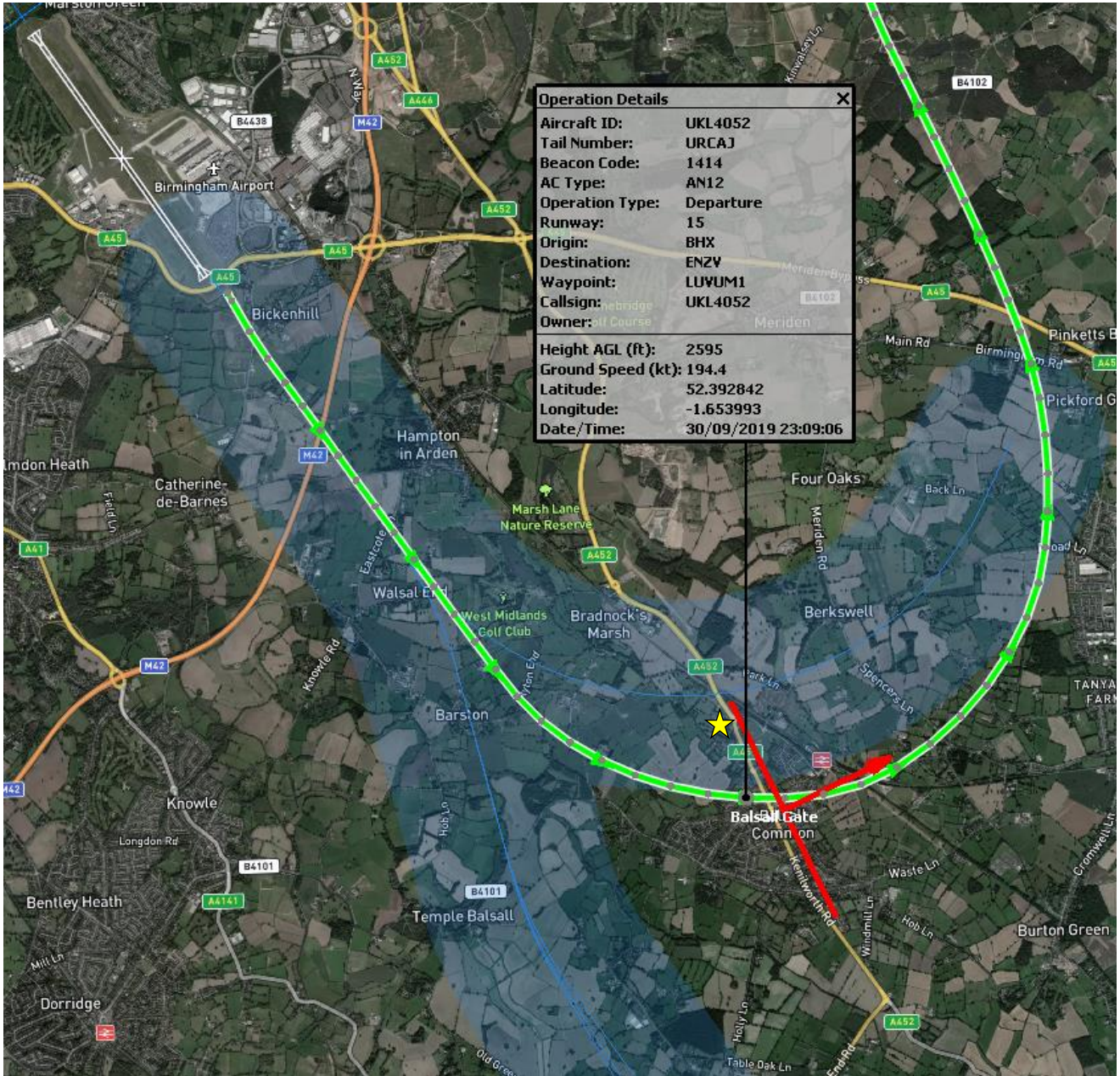
Key

- Gate = 
- Location of the PNM = 
- Noise Preferential Route = 



Appendix C – Antonov-12 (AN12) Noise Preferential Route (NPR) Deviation

Key		
Gate =		Noise Preferential Route = 
Location of the PNM =		AN12 track = 



Appendix D – Analysis of Noise Data

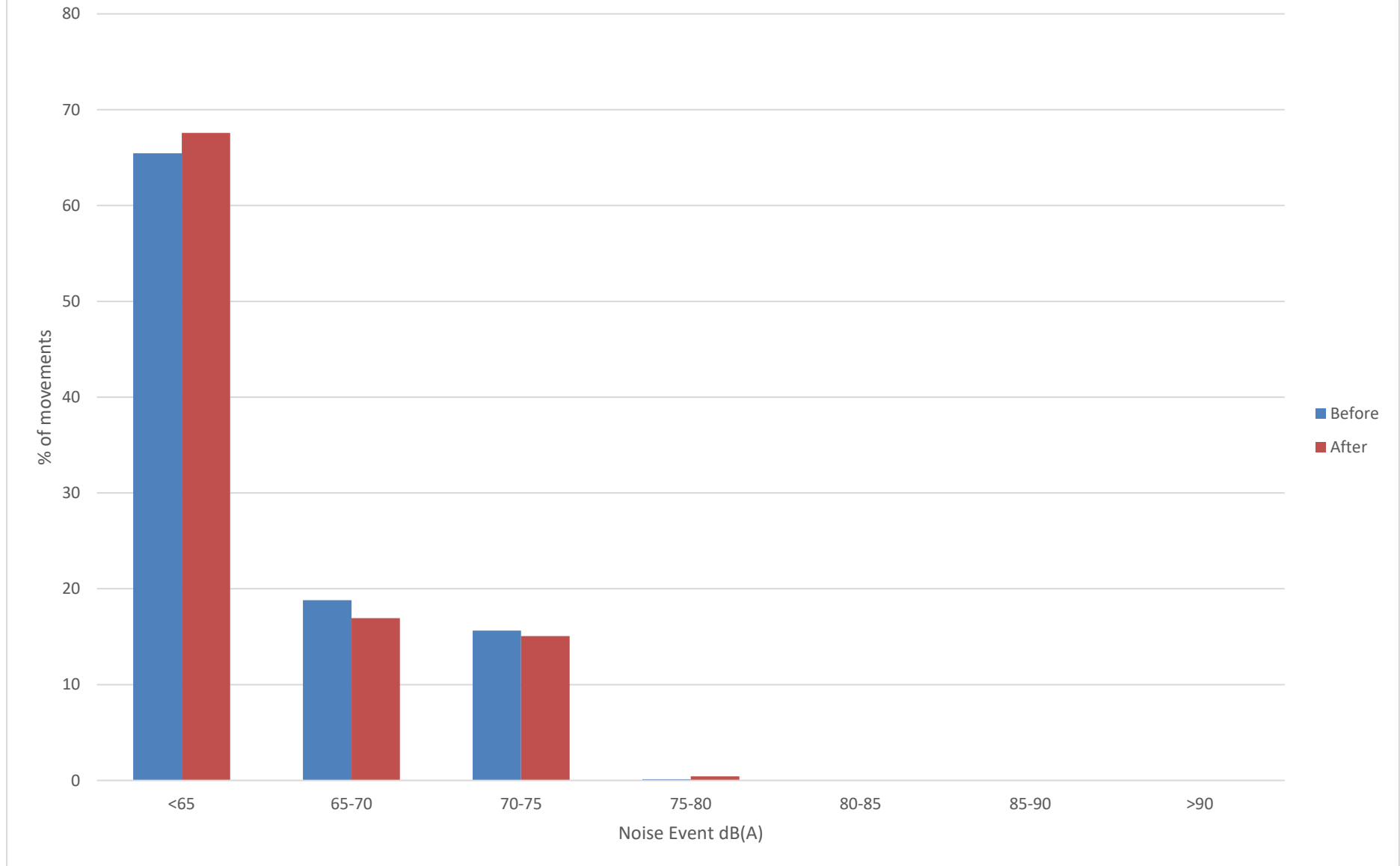
	Total operations	Total operations registering noise events (greater than 65dB(A))		Noise Events dB(A)													
				<65		65-70		70-75		75-80		80-85		85-90		>90	
				Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%
Departures Runway 15	2946	286	9.71%	2660	90.29%	155	5.26%	130	4.41%	1	0.03%	0	0%	0	0%	0	0%
Departures Runway 15 - Northbound	819	283	34.55%	536	65.45%	154	18.80%	128	15.63%	1	0.12%	0	0%	0	0%	0	0%
Departures Runway 15 - Southbound	2024	3	0.15%	2021	99.85%	1	0.05%	2	0.10%	0	0.00%	0	0%	0	0%	0	0%
Departures Runway 15 - MOSUN	103	0	0.00%	103	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0%	0	0%	0	0%

Table showing noise events at Balsall Common PNM between 4th April – 29th April

	Total operations	Total operations registering noise events (greater than 65dB(A))		Noise Events dB(A)													
				<65		65-70		70-75		75-80		80-85		85-90		>90	
				Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%
Departures Runway 15	2111	163	7.72%	1948	92.28%	84	3.98%	75	3.55%	4	0.19%	0	0%	0	0%	0	0%
Departures Runway 15 - Northbound	478	155	32.43%	323	67.57%	81	16.95%	72	15.06%	2	0.42%	0	0%	0	0%	0	0%
Departures Runway 15 - Southbound	1568	8	0.51%	1560	99.49%	3	0.19%	3	0.19%	2	0.13%	0	0%	0	0%	0	0%
Departures Runway 15 - MOSUN	65	0	0.00%	65	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0%	0	0%	0	0%

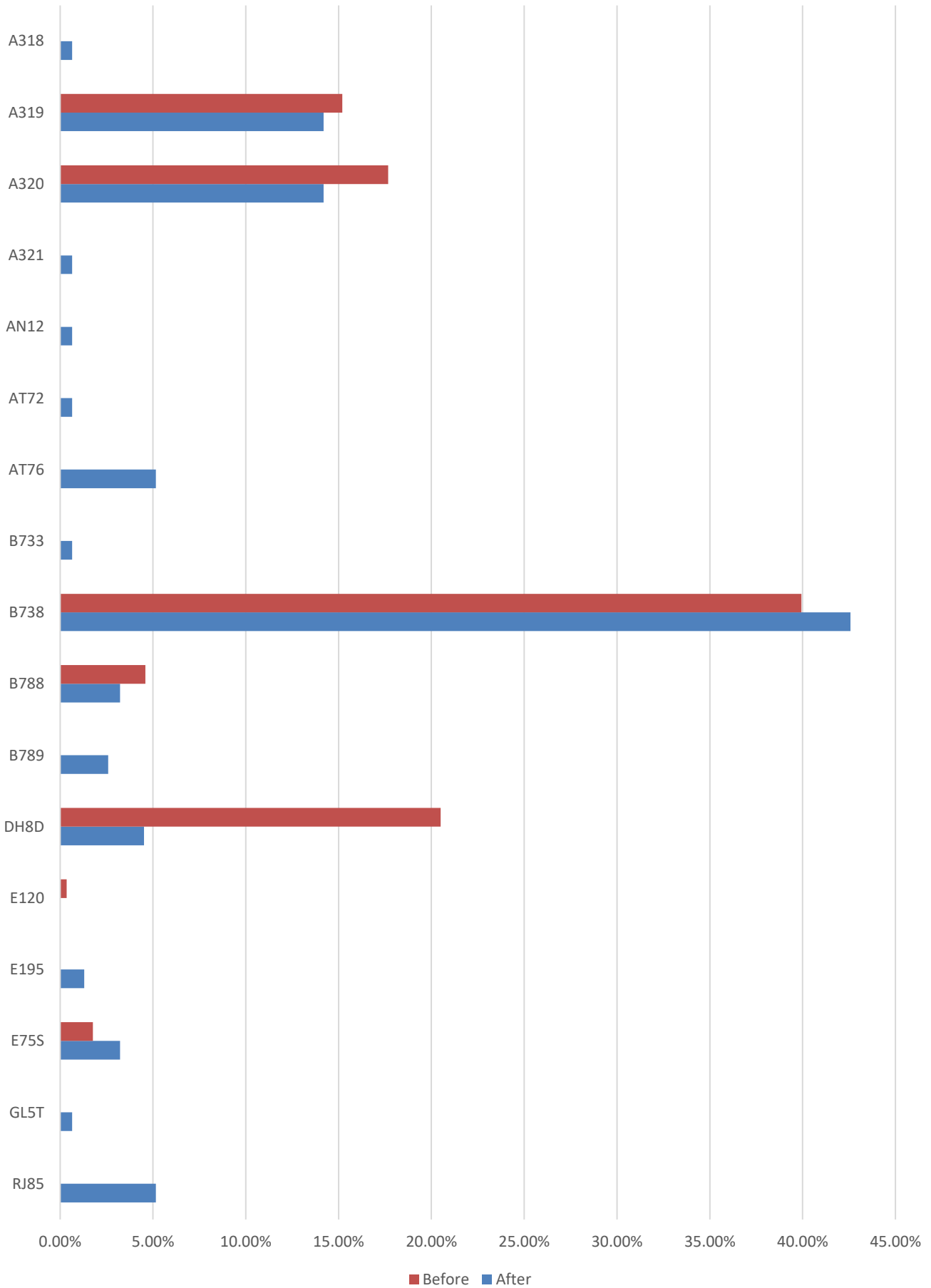
Table showing noise events at Balsall Common PNM between 12th September – 7th October

Noise Band Reading's % of Runway 15 Northbound ATM's



Jet/ Turbo-prop	Aircraft Type	Number of Runway 15 Northbound operations registering a noise event		Total number of Runway 15 Northbound operations		Percentage of Runway 15 Northbound operations registering a noise event	
		Before	After	Before	After	Before	After
Jet	A20N	0	0	4	0	0.00%	N/A
Jet	A318	0	1	0	1	N/A	100.00%
Jet	A319	43	22	48	28	89.58%	78.57%
Jet	A320	50	22	67	28	74.63%	78.57%
Jet	A321	0	1	0	1	N/A	100.00%
Turbo-prop	AN12	0	1	0	1	N/A	100.00%
Turbo-prop	AT72	0	1	2	7	0.00%	14.29%
Turbo-prop	AT76	0	8	43	24	0.00%	33.33%
Turbo-prop	ATP	0	0	1	2	0.00%	0.00%
Jet	B733	0	1	0	1	N/A	100.00%
Jet	B738	113	66	130	73	86.92%	90.41%
Jet	B752	0	0	3	7	0.00%	0.00%
Jet	B788	13	5	23	6	56.52%	83.33%
Jet	B789	0	4	1	4	0.00%	100.00%
Turbo-prop	BE20	0	0	2	5	0.00%	0.00%
Turbo-prop	BE40	0	0	2	0	0.00%	N/A
Turbo-prop	C56X	0	0	2	1	0.00%	0.00%
Jet	C68A	0	0	1	0	0.00%	N/A
Jet	CRJ9	0	0	8	0	0.00%	N/A
Turbo-prop	DH8D	58	7	463	253	12.53%	2.77%
Turbo-prop	E120	1	0	6	0	16.67%	N/A
Jet	E145	0	0	0	8	N/A	0.00%
Jet	E195	0	2	1	3	0.00%	66.67%
Jet	E55P	0	0	1	1	0.00%	0.00%
Jet	E35L	0	0	0	1	N/A	0.00%
Jet	E75S	5	5	7	9	71.43%	55.56%
Jet	FA7X	0	0	1	0	0.00%	N/A
Jet	GL5T	0	1	0	1	N/A	100.00%
Jet	GLF4	0	0	1	1	0.00%	0.00%
Jet	GLF6	0	0	0	1	N/A	0.00%
Turbo-prop	LJ35	0	0	1	1	0.00%	0.00%
Jet	LJ45	0	0	1	0	0.00%	N/A
Turbo-prop	P180	0	0	0	1	N/A	0.00%
Turbo-prop	PA31	0	0	0	1	N/A	0.00%
Jet	RJ85	0	8	0	8	N/A	100.00%
Total – Turbo-props		59	17	522	296	11.30%	5.74%
Total - Jets		224	138	297	182	75.42%	75.82%
Total		283	155	819	478	34.55%	32.43%

% of Runway 15 Departures Northbound Registering Noise Events



Appendix E – Analysis of Overflights Data

	Total operations	Total Balsall Common overflights		Average altitude of overflight when adjacent to Balsall Common
Departures Runway 15	2946	430	14.60%	4,269ft
Departures Runway 15 - Northbound	819	424	51.77%	4,264ft
Departures Runway 15 - Southbound	2024	6	0.30%	4,683ft
Departures Runway 15 - MOSUN	103	0	0.00%	N/A





Table showing Balsall Common overflights between 4th April – 29th April

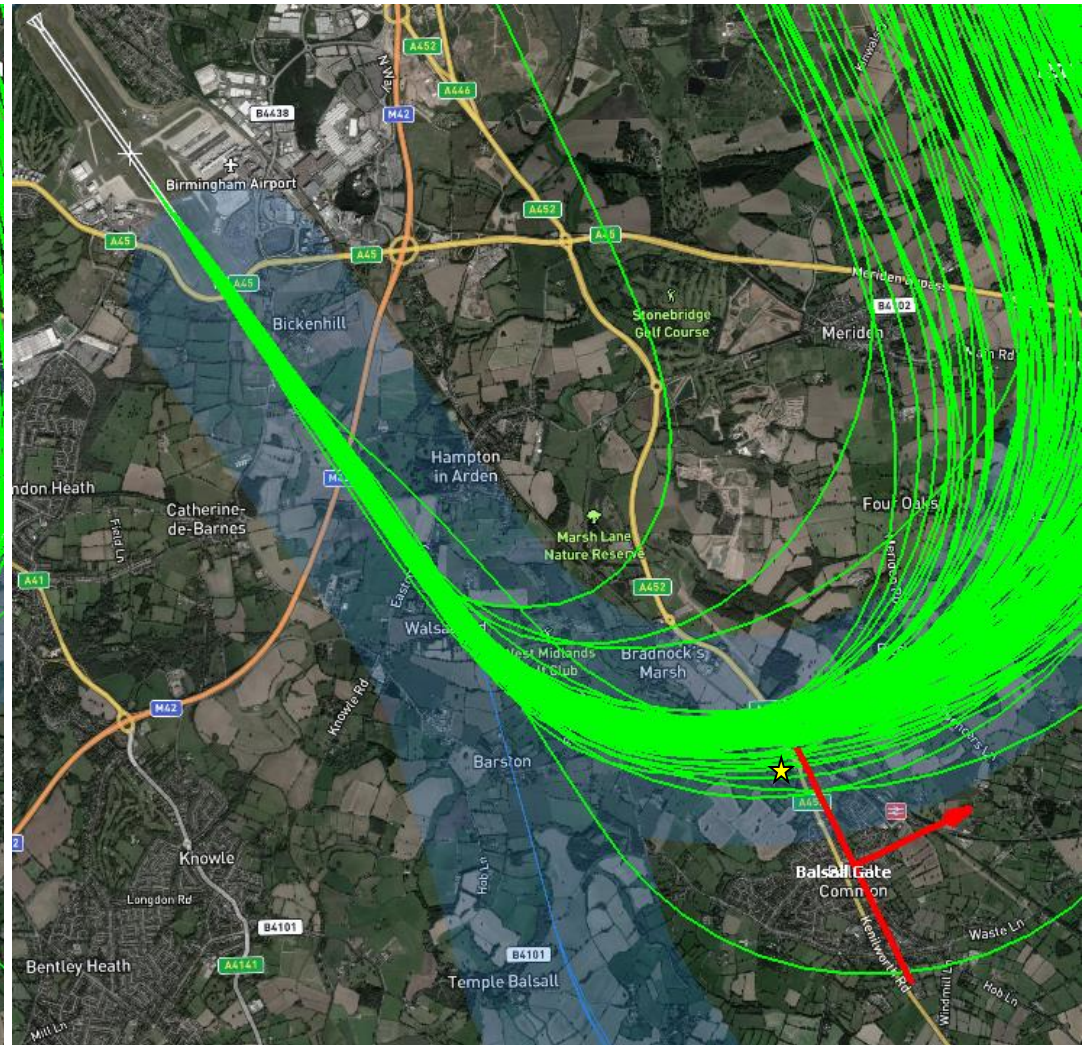
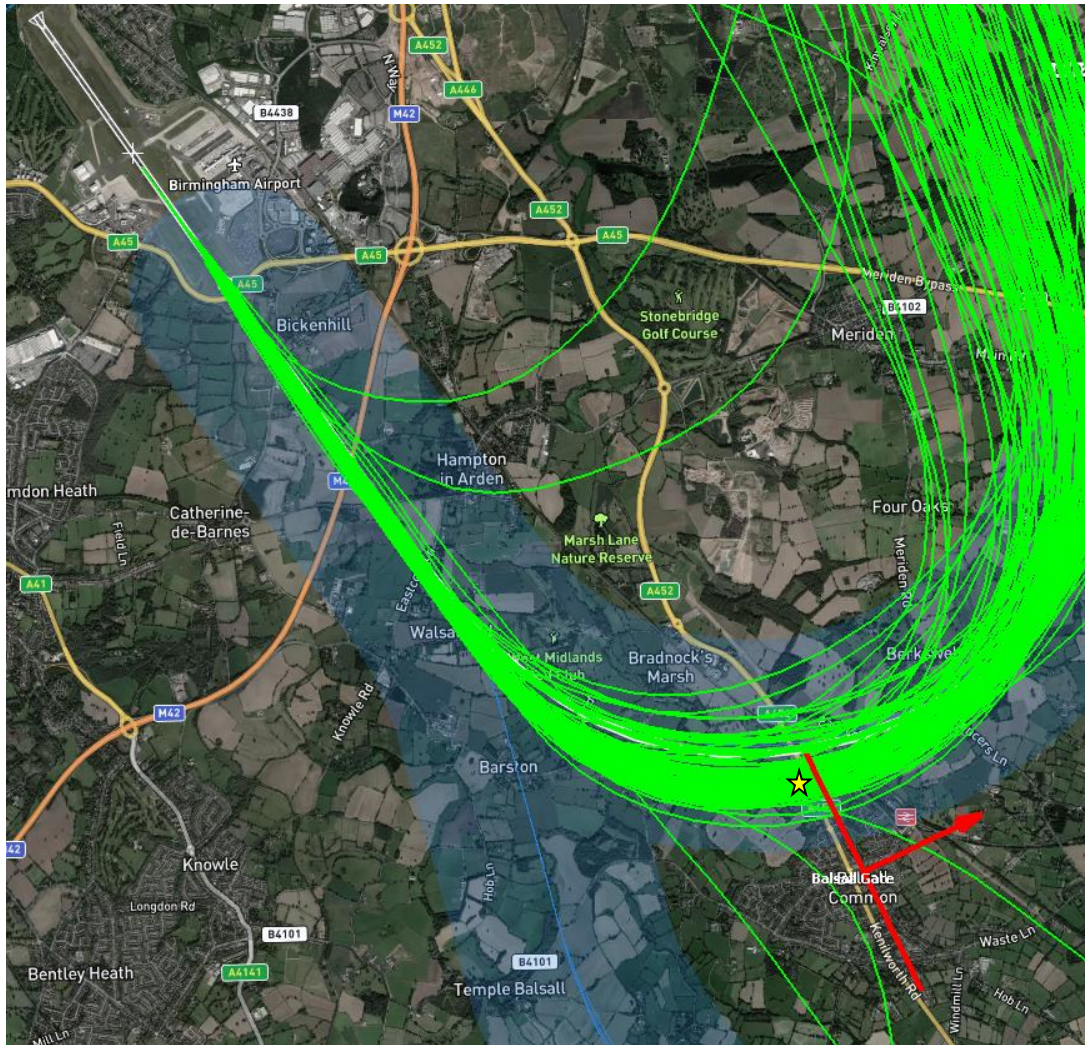
	Total operations	Total Balsall Common overflights		Average altitude of overflight when adjacent to Balsall Common
Departures Runway 15	2111	144	6.82%	3,656ft
Departures Runway 15 - Northbound	478	140	29.29%	3,632ft
Departures Runway 15 - Southbound	1568	4	0.26%	4,440ft
Departures Runway 15 - MOSUN	65	0	0.00%	N/A

Table showing Balsall Common overflights between 12th September – 7th October




Jet/ Turbo-prop	Aircraft Type	Number of Runway 15 Northbound overflight operations		Total number of Runway 15 Northbound operations		Percentage of Runway 15 Northbound overflight operations		Average Altitude of overflights when adjacent to Balsall Common (ft)	
		Before	After	Before	After	Before	After	Before	After
Jet	A20N	4	0	4	0	100.00%	N/A	5258	N/A
Jet	A318	0	0	0	1	N/A	0.00%	N/A	N/A
Jet	A319	42	0	48	28	87.50%	0.00%	4412	N/A
Jet	A320	57	4	67	28	85.07%	14.29%	4429	4121
Jet	A321	0	0	0	1	N/A	0.00%	N/A	N/A
Turbo-prop	AN12	0	1	0	1	N/A	100.00%	N/A	2670
Turbo-prop	AT72	1	1	2	7	50.00%	14.29%	3950	2857
Turbo-prop	AT76	34	2	43	24	79.07%	8.33%	3639	2972
Turbo-prop	ATP	1	0	1	2	100.00%	0.00%	3969	N/A
Jet	B733	0	0	0	1	N/A	0.00%	N/A	N/A
Jet	B738	104	2	130	73	80.00%	2.74%	3928	4338
Jet	B752	2	2	3	7	66.67%	28.57%	5566	6135
Jet	B788	4	0	23	6	17.39%	0.00%	3499	N/A
Jet	B789	0	0	1	4	0.00%	0.00%	N/A	N/A
Turbo-prop	BE20	1	1	2	5	50.00%	20.00%	4753	4671
Turbo-prop	BE40	1	0	2	0	50.00%	N/A	6263	N/A
Turbo-prop	C56X	2	0	2	1	100.00%	0.00%	5723	N/A
Jet	C68A	0	0	1	0	0.00%	N/A	N/A	N/A
Jet	CRJ9	6	0	8	0	75.00%	N/A	4751	N/A
Turbo-prop	DH8D	155	120	463	253	33.48%	47.43%	4404	3589
Turbo-prop	E120	4	0	6	0	66.67%	N/A	6399	N/A
Jet	E145	0	0	0	8	N/A	0.00%	N/A	N/A
Jet	E195	0	0	1	3	0.00%	0.00%	N/A	N/A
Jet	E55P	0	0	1	1	0.00%	0.00%	N/A	N/A
Jet	E35L	0	0	0	1	N/A	0.00%	N/A	N/A
Jet	E75S	4	0	7	9	57.14%	0.00%	3938	N/A
Jet	FA7X	0	0	1	0	0.00%	N/A	N/A	N/A
Jet	GL5T	0	0	0	1	N/A	0.00%	N/A	N/A
Jet	GLF4	1	0	1	1	100.00%	0.00%	4760	N/A
Jet	GLF6	0	0	0	1	N/A	0.00%	N/A	N/A
Turbo-prop	LJ35	1	1	1	1	100.00%	100.00%	3959	5593
Jet	LJ45	0	0	1	0	0.00%	N/A	N/A	N/A
Turbo-prop	P180	0	0	0	1	N/A	0.00%	N/A	N/A
Turbo-prop	PA31	0	0	0	1	N/A	0.00%	N/A	N/A
Jet	RJ85	0	6	0	8	N/A	75.00%	N/A	3102
Total – Turbo-props		200	126	522	296	38.31%	42.57%	4331	3591
Total - Jets		224	14	297	182	75.42%	7.69%	4203	4003
Total		424	140	819	478	51.77%	29.29%	4264	3632

Maps showing Runway 15 Departures Northbound Jet Aircraft tracks 'before' (left) and 'after' (right)

Key		
Gate =		Noise Preferential Route = 
Location of the PNM =		Departing aircraft tracks = 



Maps showing Runway 15 Departures Northbound Turbo-prop Aircraft tracks 'before' (left) and 'after' (right)

Key		
Gate =		Noise Preferential Route = 
Location of the PNM =		Departing aircraft tracks = 