



BWI-Thurgood Marshall Airport Aircraft Operations and Noise Exposure

Presented by DC Metroplex BWI Community Roundtable in cooperation with Vianair, Inc.


Monthly Report for December 2022

DC Metroplex BWI Community Roundtable link to Noise Exposure Monthly Reports below
<https://marylandaviation.com/environmental/environmental-compliance-sustainability/dc-metroplex-bwi-community-roundtable/>



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Introduction



This is a summary of a larger report (the “Monthly Report”) prepared by Vianair, Inc. (“Vianair”) for the benefit of the DC Metroplex BWI Community Roundtable (the “BWI Roundtable”).

The Monthly Reports are the first comprehensive data detailing the noise pollution generated by daily commercial jet plane operations across the entire geography of significantly overflowed communities in our region. The BWI Roundtable believes that the analysis of the full environmental impact of airport operations on overflowed communities has been understudied, but it is essential information in order to improve the likelihood of success in achieving balanced solutions for the complex set of stakeholders involved in airport operations.

Howard and Anne Arundel Counties hired Vianair to help analyze flight activity in and out of BWI Thurgood Marshall Airport (“BWI-Marshall”). In coordination with representatives from the two counties and support from the BWI Roundtable, Vianair developed the Monthly Report which includes the analysis of key elements (operational and acoustic) to help the wide array of stakeholders understand the existing noise exposure and to provide the ability to track changes over time.

While comprehensive, the elements in the report were selected by those who contributed to the report development (representatives from the two counties and the BWI Roundtable). This report will be published monthly, beginning with March 2022. Report content may change based on input from the contributors and/or the community. This report uses A-weighted decibels or dBA and DNL, described later within this summary report.



Definitions

Decibel (dB(A)): A unit of measurement of sound pressure adjusted for the human ear's response to particular frequencies

Day-Night Average Sound Level (DNL): A descriptor of 24-hour noise (midnight to midnight) that adds a ten-decibel (dB) nighttime penalty to noise events which occur between the hours of 10 p.m. and 7 a.m to account for the intrusive nature of noise at night. DNL is the standard metric used by the Federal Aviation Administration ("FAA") as required by federal regulation. Federal guidelines require **DNL 65** as the level of aircraft noise exposure that is incompatible with noise-sensitive applications including residential development. This metric is required by FAA and COMAR

The Noise-above (NA): A noise metric counts the number of times the noise level exceeds a specific threshold. In this report, the Number-of-Events-Above 55 metric (NA55) is calculated. NA55 quantifies the number of aircraft events resulting in noise exposure of 55 decibels or higher at each location depicted.

Day-evening-night level (Lden): It is a descriptor of noise level defined by the European Environment Agency ("EEA") and based on energy equivalent noise level (Leq) over a whole day with a penalty of 10 dB(A) for night-time noise (11.00 pm -7.00 am) and an additional penalty of 5 dB(A) for evening noise (7.00 pm -11.00 pm).

Airport Noise Zone (ANZ): An area of land surrounding the airport within which noise levels are equal to or greater than DNL 65 dBA.

Maryland Department of Transportation Maryland Aviation Administration (MDOT MAA): Operator of Baltimore/Washington International Thurgood Marshall Airport (BWI Marshall Airport).

Code of Maryland Regulations (COMAR): Requires MDOT MAA to control development in areas where noise levels are DNL 65 dBA or more..

Disclaimer and Information Sources and Disclosures

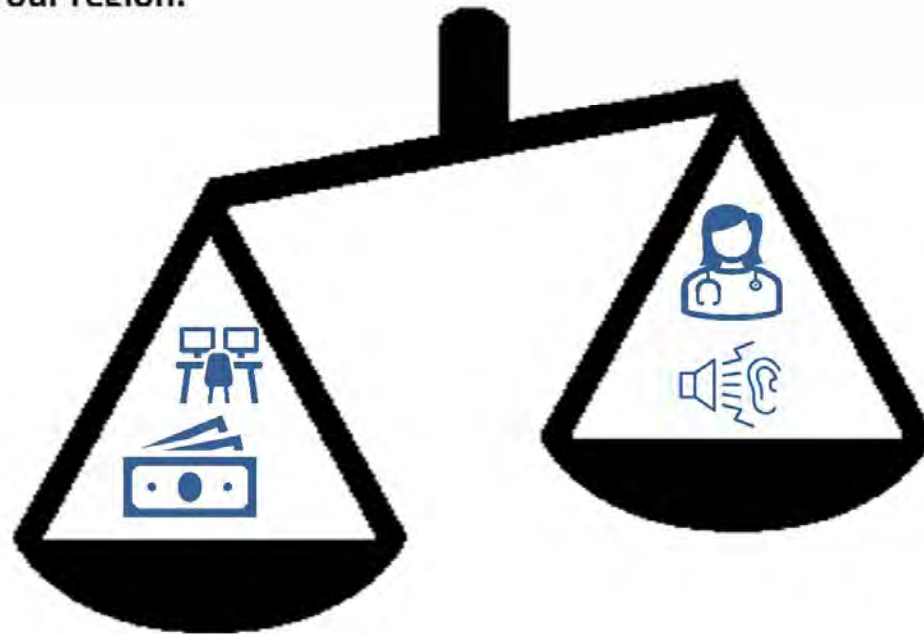
Disclaimer: The views and opinions expressed in this document are those of the BWI Roundtable and do not necessarily reflect the views or positions of the state senators who appoint voting members to the BWI Roundtable, the MDOT/MAA, the FAA, Howard or Anne Arundel County elected or appointed officials, commercial carriers or Vianair, Inc. Technical presentations prepared by Vianair Inc. are labeled with the Vianair logo.

Information Sources and Disclosures:

1. Page 7 - Economic Impact of BWI-Marshall. **Regional Economic Impact of BWI Marshal Airport, December 2017, a brochure of the Maryland Aviation Administration**. In response to a Public Information Act (PIA) request made on November 1, 2022, MDOT/MAA provided “The Economic Impact of Public Use Airports in Maryland”, July 2015. The study was prepared by Martin Associates and Landrum and Brown, consultants. MDOT/MAA states that “The 2017 Economic Impact Brochure [...] is an update to the 2015 Economic Impact Report. The 2015 Economic Impact Report and Monthly BWI Statistical Report Summaries serve as the source for the 2017 Economic Impact Brochure.” Once the BWI Roundtable verifies the underlying sources of the brochure’s statements, we will update this section.
2. Page 7 – Commercial Aviation and Health.
 - Zafari Z and Park, J. “Projecting the health and economic burden of aircraft noise”. University of Maryland School of Pharmacy, 2022
<https://www.pharmacy.umaryland.edu/media/SOP/wwwpharmacyumarylandedu/about/depts/p-shor/pdf/projecting-the-health-and-economic-burden-of-aircraft-noise-final-report.pdf>
 - Quarterly Noise Reports, Maryland Aviation Administration
<https://marylandaviation.com/environmental/environmental-compliance-sustainability/quarterly-noise-reports/>
 - World Health Organization: Environmental Noise Guidelines for the European Union. 2018
https://www.euro.who.int/_data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf
 - European Environment Agency: European Noise Directive. 2018
<https://www.eea.europa.eu/airs/2018/environment-and-health/environmental-noise>

Seeking Balance at BWI-Marshall Airport

The growth in operations at BWI-Marshall brings a number critically important social and economic impacts to communities surrounding the airport and to the State of Maryland, including economic development, jobs, and taxes collected. However, this also results in significant negative impacts, especially for residents of Anne Arundel and Howard counties, including stress, likely adverse health outcomes and a diminished quality of life. **Over the course of our almost six (6) years of existence, the BWI Roundtable has come to believe those impacts are unsustainably unbalanced in favor of economic impacts in our region.**



Economic Impact of BWI-Marshall

Airport-Generated	Visitor-Generated
\$4.4 B Total Impact	\$4.9 B Total Economic Impact
<u>Total Jobs 24,211</u> Direct 12,753 Indirect 11,458	<u>Total Jobs 82,277</u> Direct 46,857 Indirect 35,420
\$1.6 B Total Earnings	\$2.5 B Total Earnings
\$175.4 M Total State/Local Taxes	\$416.5 M Total State/Local Taxes

State taxes are estimated to be \$336.3 million and Local taxes are estimated to be \$255.7 million

Commercial Aviation and Health

University of Maryland- Baltimore study shows over \$800 million (2022 dollars) in health costs over 30-years from current BWI-Marshall operations

123,133 BWI-Marshall noise complaints (230 individuals) during 2nd Quarter of 2022. The airport received a total of 620,276 noise complaints in 2021.

The World Health Organization recommends aircraft noise levels in Europe to below 45 dB during the day (40 dB at night). Higher levels of noise is associated with adverse health effects.

55 dB Lden is the EU threshold for excess exposure defined in the Environmental Noise Directive

FAA has adopted 65 dBA DNL as the threshold of significant noise exposure, below which residential land uses are compatible

BWI Airport Noise Zone is noise above 65 dBA DNL

Runway Use

BWI has six runways: 10, 15R, 15L, 28, 33R, and 33L. Runway selection is based primarily on wind direction. BWI operates in two flows. When winds are out of the east or south, aircraft will arrive and depart in an **EAST FLOW** and when winds are out of the west or north, aircraft will arrive and depart in a **WEST FLOW**. Aircraft noise levels vary when below an aircraft landing or taking-off. Runway use also influences routes to and from the airport, which also affects aircraft noise for communities below.



EAST FLOW



WEST FLOW



East and West Flow

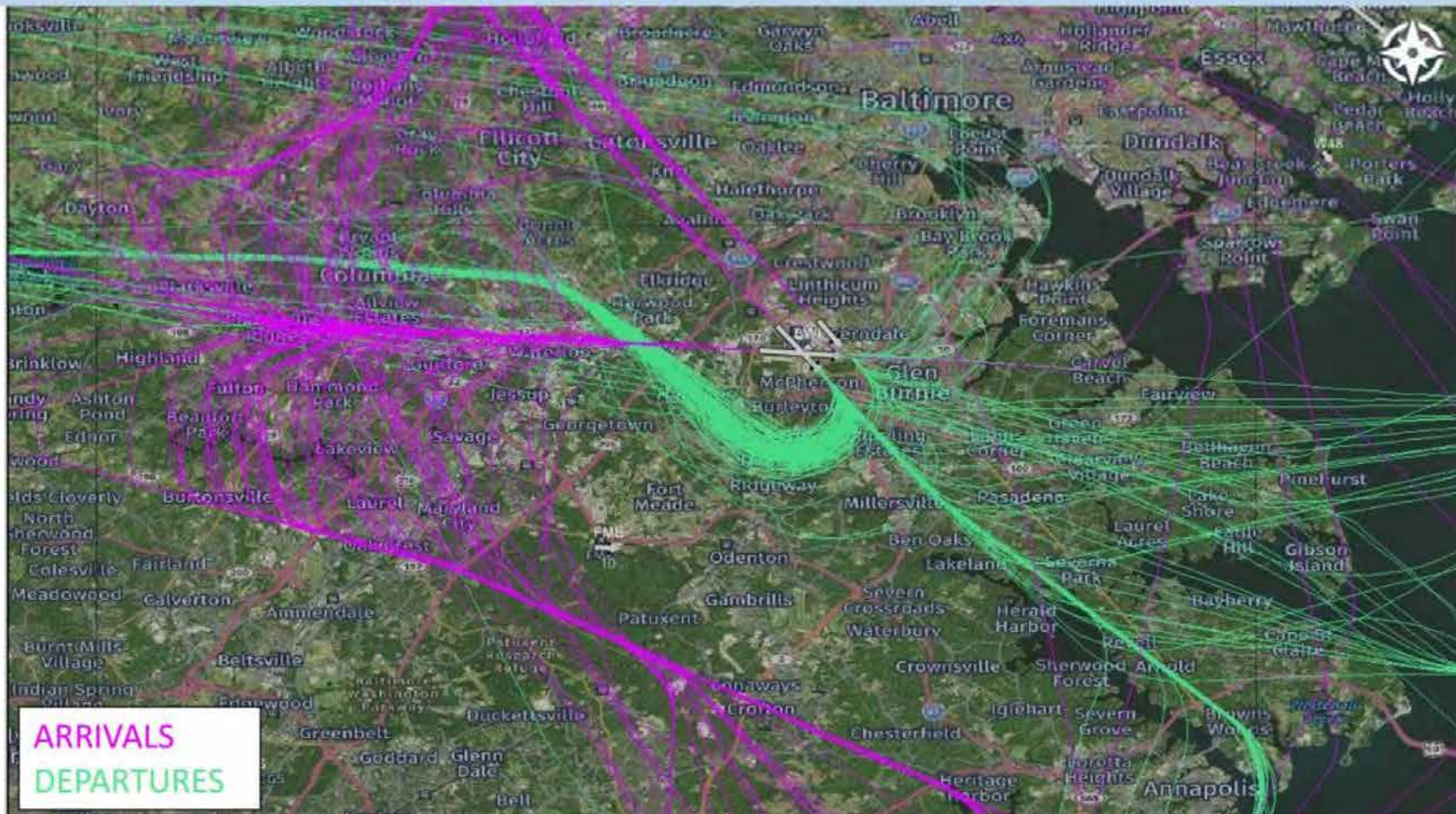
Prevailing wind speed, direction and weather factors determine the direction of air traffic flow from BWI-Marshall airport. Aircraft usually take off and land into the wind to meet safety and operational requirements.

During **EAST FLOW** conditions (winds from the south or east), aircraft arrive and depart toward the east. This includes runways 15L, 15R, and 10.

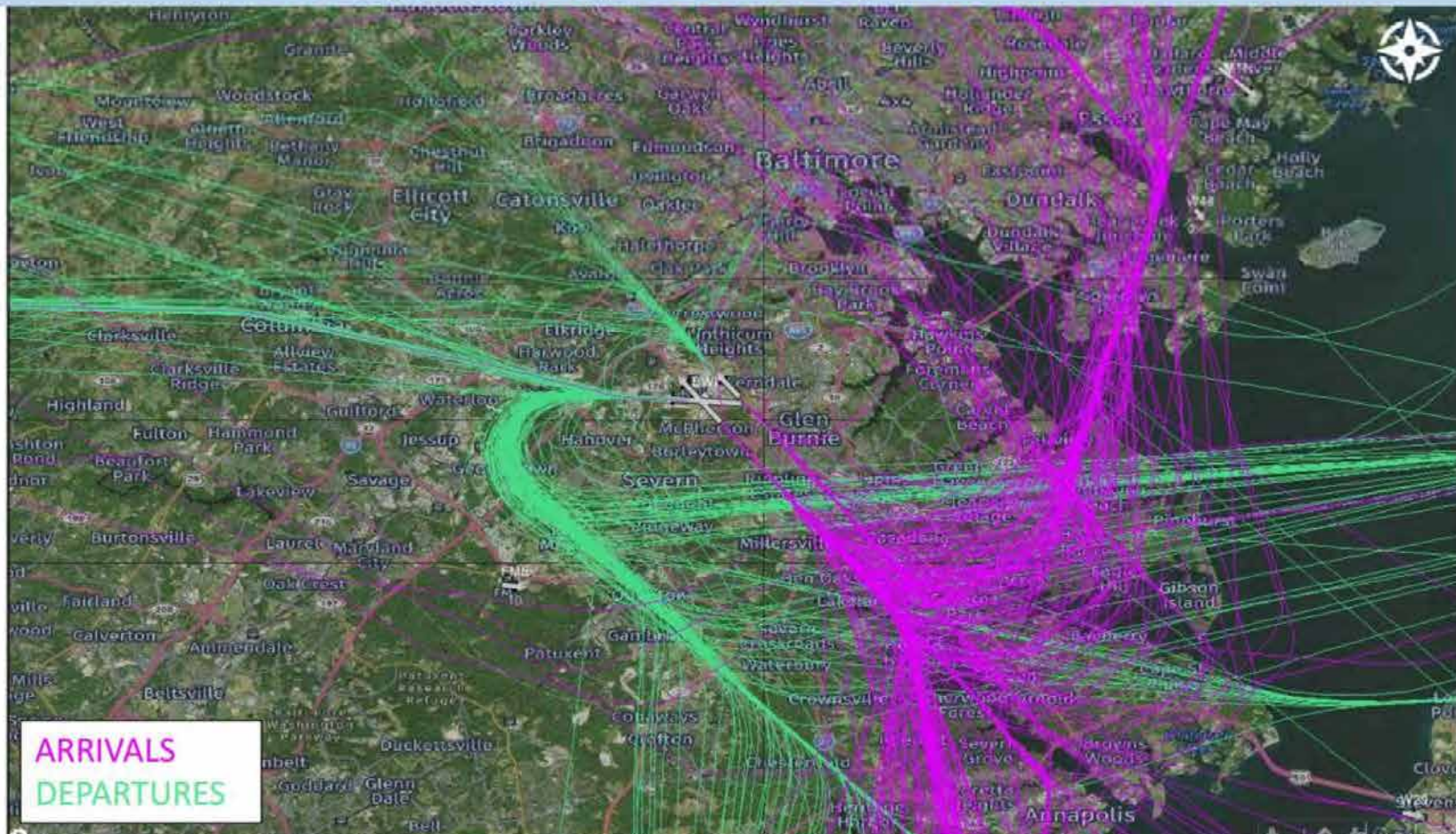
During **WEST FLOW** conditions (winds from the north or west), aircraft arrive and depart toward the west. This includes runways 33L, 33R, and 28. The following slides are intended to illustrate arrival and departure flight paths across the region during sample EAST and WEST flows days.

The next two pages illustrate a typical East Flow day and a typical West Flow day at the airport. Sample days were analyzed by Vianair and then depicted as all arrivals and departures consistent with a specific flow on a given day. While these flight patterns are typical, they may vary on other days based on operational conditions.

Visual representation of daily traffic patterns over the Baltimore region during East Flow operations at BWI-Marshall

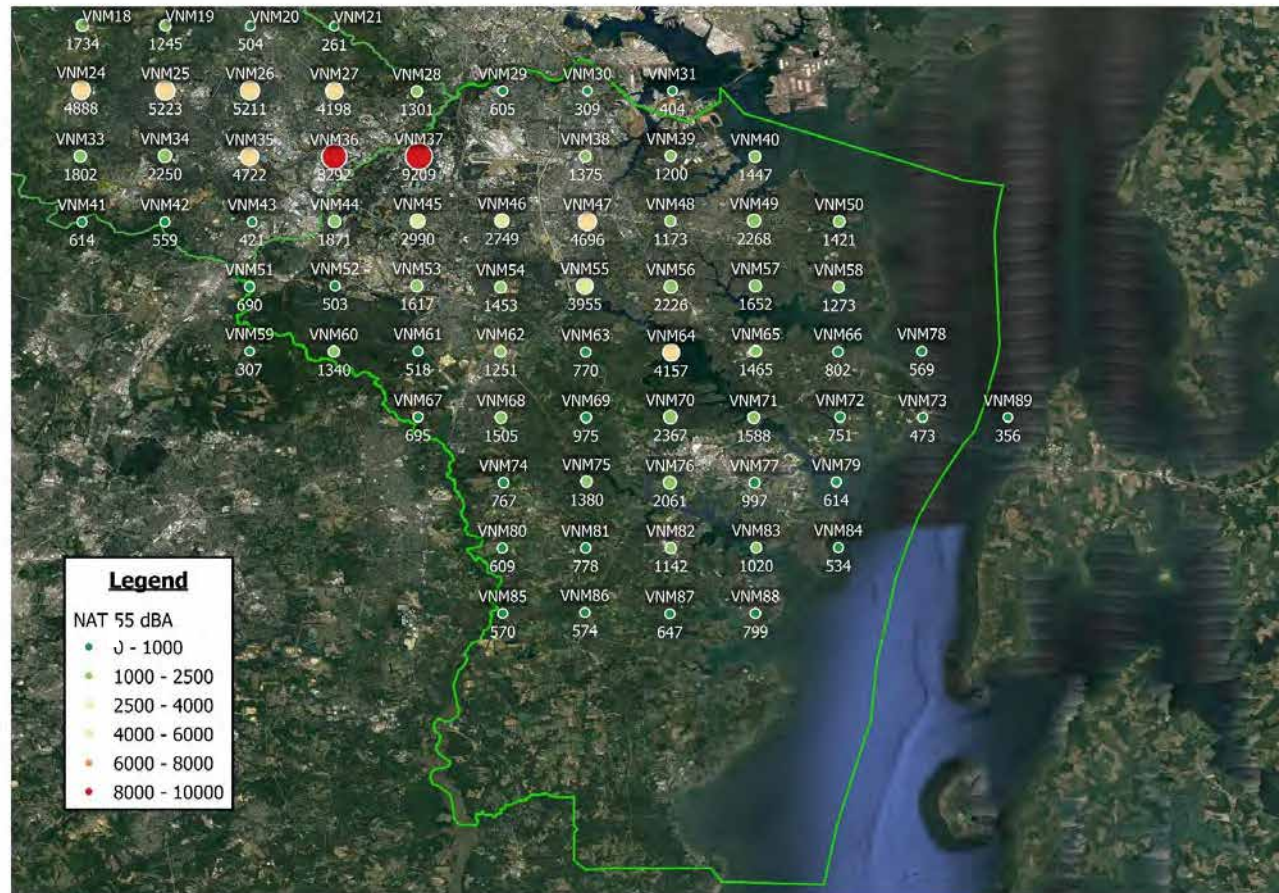


Visual representation of daily traffic patterns over the Baltimore region during West Flow operations at BWI-Marshall



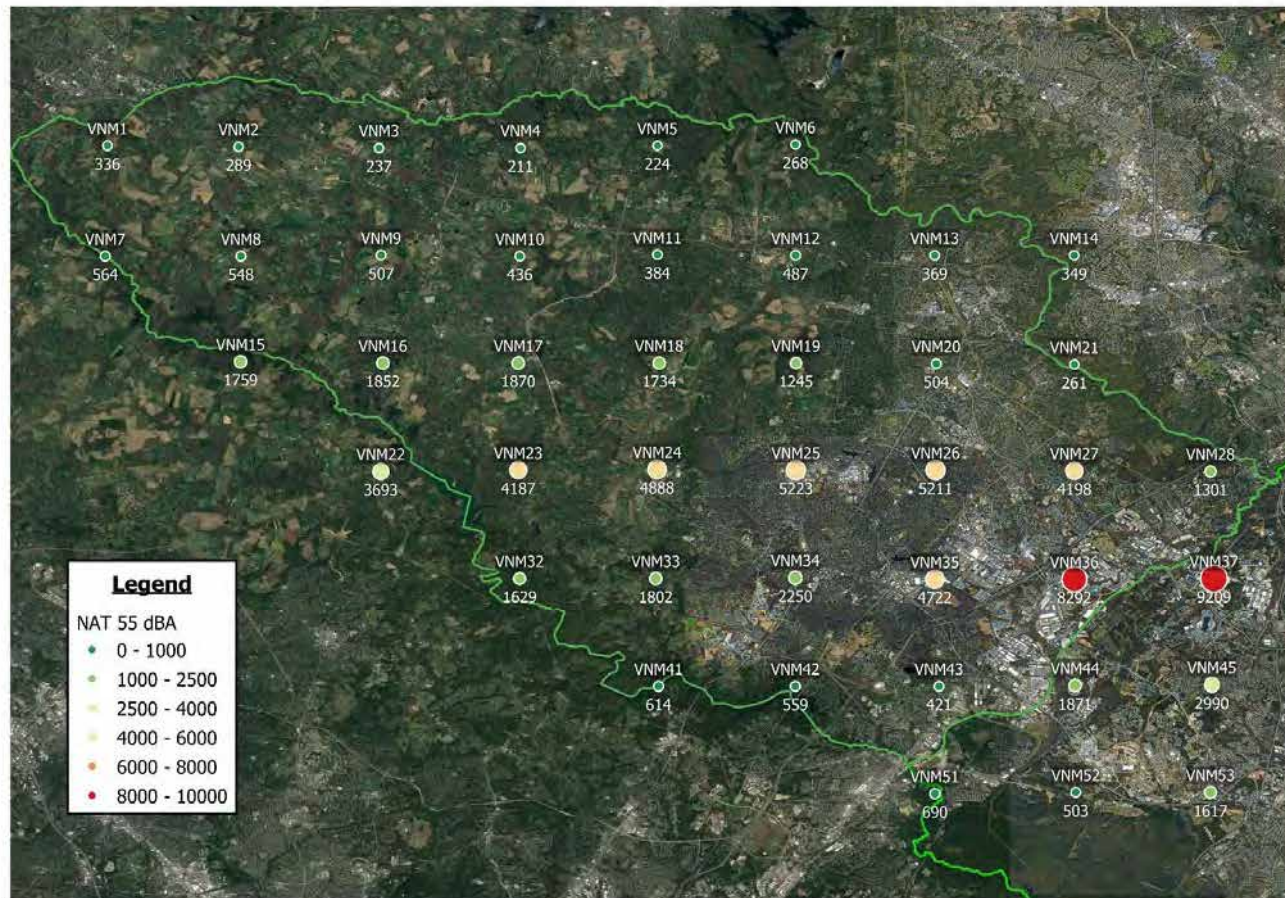
Noise Exposure – Number of Events Above 55 dBA

Anne Arundel County - VNM Grid



Noise Exposure – Number of Events Above 55 dBA

Howard County - VNM Grid



Noise Exposure – Full Grid, All Flows

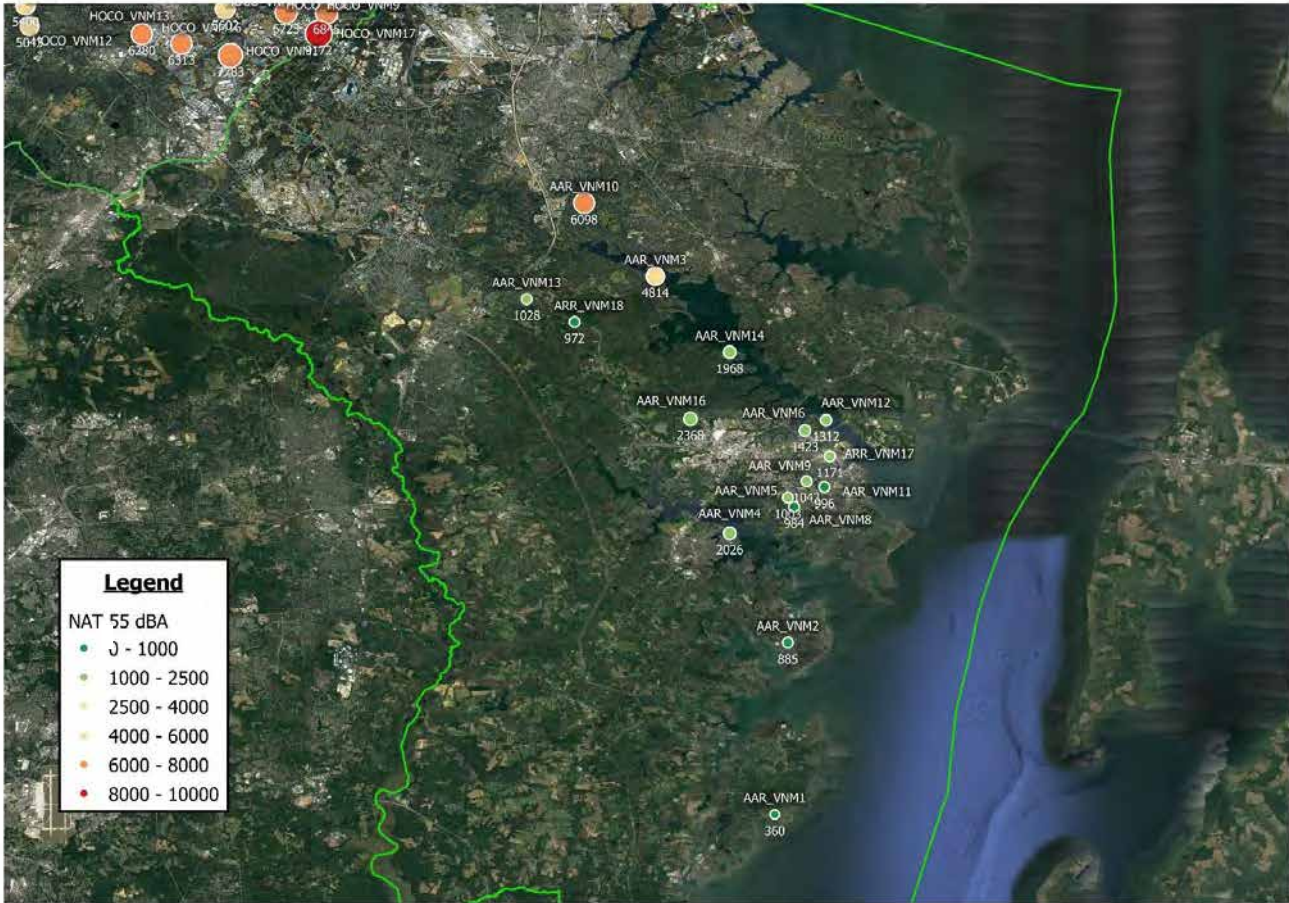
Name	Number-of-Events-Above 55dBA (Total)	Daily Average	DNL
VNM1	336	11	21.09
VNM2	289	9	24.96
VNM3	237	8	28.5
VNM4	211	7	35.54
VNM5	224	7	38.97
VNM6	268	9	46.82
VNM7	564	18	22.19
VNM8	548	18	25.75
VNM9	507	16	31.39
VNM10	436	14	34.6
VNM11	384	12	38.74
VNM12	487	16	43.28
VNM13	369	12	41.96
VNM14	349	11	44.89
VNM15	1759	57	28.31
VNM16	1852	60	38.54
VNM17	1870	60	43.63
VNM18	1734	56	47.46
VNM19	1245	40	46.85
VNM20	504	16	44.06
VNM21	261	8	42.49
VNM22	3693	119	39.72
VNM23	4187	135	44.82
VNM24	4888	158	52.44
VNM25	5223	168	55.61
VNM26	5211	168	56.07
VNM27	4198	135	53.43
VNM28	1301	42	52.04
VNM29	605	20	58.71
VNM30	309	10	46.09

Name	Number-of-Events-Above 55dBA (Total)	Daily Average	DNL
VNM31	404	13	41.1
VNM22	1629	53	43.88
VNM33	1802	58	49.81
VNM34	2250	73	54.13
VNM35	4722	152	55.52
VNM36	8292	267	59.85
VNM37	9209	297	72.63
VNM38	1375	44	56.93
VNM39	1200	39	51.69
VNM40	1447	47	48.27
VNM41	614	20	46.08
VNM42	559	18	45.16
VNM43	421	14	46.31
VNM44	1871	60	53.63
VNM45	2990	96	55.45
VNM46	2749	89	64.41
VNM47	4696	151	67.67
VNM48	1173	38	56.73
VNM49	2268	73	53.27
VNM50	1421	46	50.58
VNM51	690	22	45.5
VNM52	503	16	48.02
VNM53	1617	52	50.65
VNM54	1453	47	54.28
VNM55	3955	128	54.06
VNM56	2226	72	54.84
VNM57	1652	53	54.83
VNM58	1273	41	48.91
VNM59	307	10	40.54
VNM60	1340	43	47.84

Name	Number-of-Events-Above 55dBA (Total)	Daily Average	DNL
VNM61	518	17	44.77
VNM62	1251	40	49.47
VNM63	770	25	48.99
VNM64	4157	134	56.29
VNM65	1465	47	51.22
VNM66	802	26	47.23
VNM67	695	22	43.58
VNM68	1505	49	47.22
VNM69	975	31	45.57
VNM70	2367	76	57.15
VNM71	1588	51	51.34
VNM72	751	24	44.99
VNM73	473	15	37.85
VNM74	767	25	40.98
VNM75	1380	45	44.33
VNM76	2061	66	47.42
VNM77	997	32	44.82
VNM78	569	18	41.46
VNM79	614	20	37.98
VNM80	609	20	33.73
VNM81	778	25	34.97
VNM82	1142	37	34.99
VNM83	1020	33	32.13
VNM84	534	17	30.56
VNM85	570	18	27.5
VNM86	574	19	26.09
VNM87	647	21	26.59
VNM88	799	26	25.58
VNM89	356	11	30.18

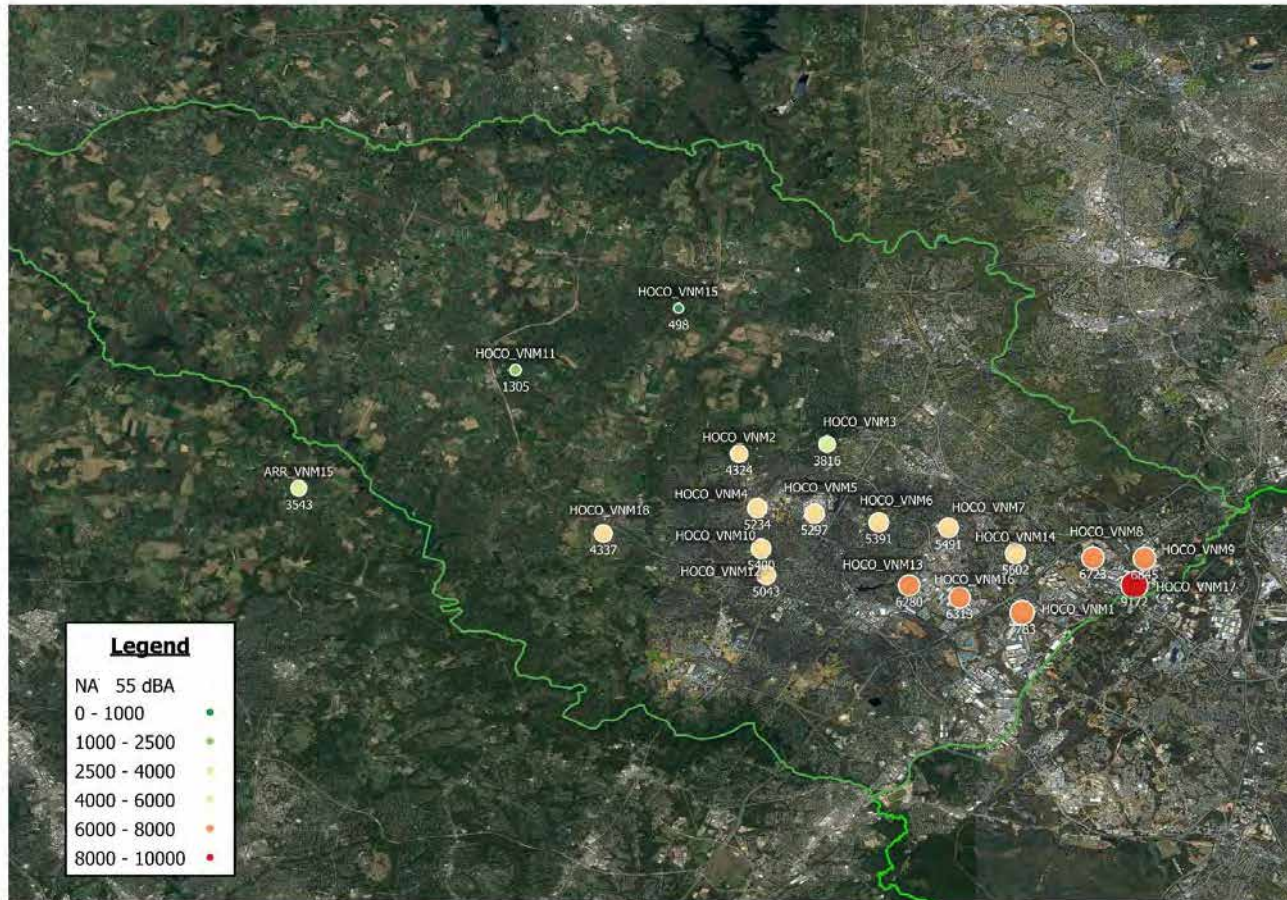
Noise Exposure – Number of Events Above 55 dBA

Anne Arundel County - Landmark Locations



Noise Exposure – Number of Events Above 55 dBA

Howard County - Landmark Locations



Monthly Noise Exposure – Landmark Locations

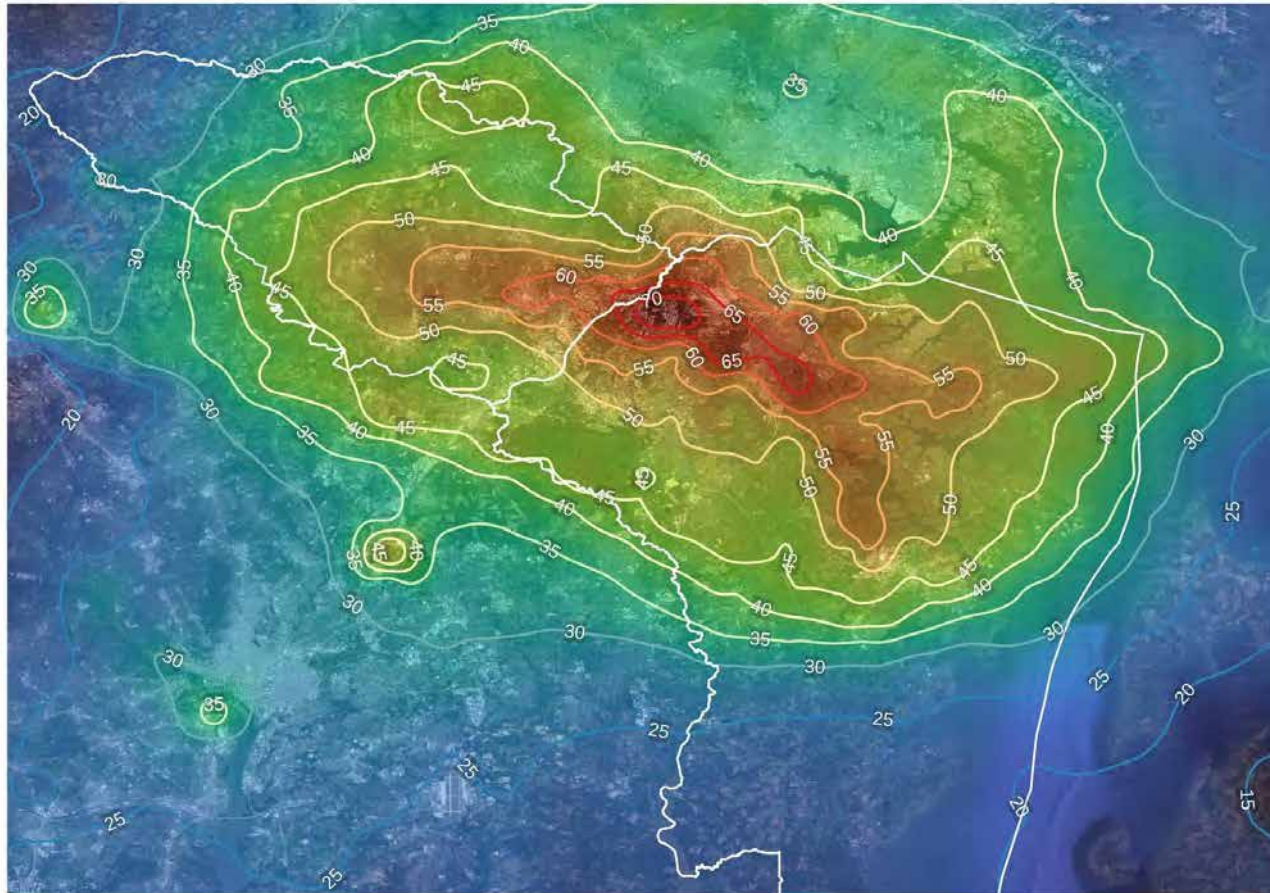
All Flows

<u>Name</u>	<u>Description</u>	<u>Number-of-Events-Above 55dBA (Total)</u>	<u>Daily Average</u>	<u>DNL</u>
AAR_VNM1	RAVNN	360	12	22.32
AAR_VNM2	JETNA	885	29	25.87
AAR_VNM3	Arden on the Severn	4814	155	59.88
AAR_VNM4	London Public House	2026	65	41.21
AAR_VNM5	Annapolis Middle School	1003	32	41.68
AAR_VNM6	West Annapolis Elementary	1423	46	49.43
AAR_VNM7	Herald Harbor	206	7	16.53
AAR_VNM8	Eastport Terrace	996	32	42.51
AAR_VNM9	Truxton Park	1043	34	44.59
AAR_VNM10	Shipley's Choice Elementary	6098	197	62.18
AAR_VNM11	Robinwood	984	32	39.74
AAR_VNM12	Wordour Bluffs	1312	42	47.63
AAR_VNM13	Millersville Elementary School	1028	33	49.68
AAR_VNM14	Sherwood Forest	1968	63	53.59
ARR_VNM15	Brookeville, Montgomery county	3543	114	36.22
AAR_VNM16	Rolling Knolls	2368	76	55.39
ARR_VNM17	Maryland State House	1171	38	46.64
ARR_VNM18	I-97 and MD 178 Crownsville	972	31	49.23

<u>Name</u>	<u>Description</u>	<u>Number-of-Events-Above 55dBA (Total)</u>	<u>Daily Average</u>	<u>DNL</u>
HOCO_VNM1	Howard Square Apartments	7783	251	57.81
HOCO_VNM2	HCPSS Administration Campus	4324	139	52.23
HOCO_VNM3	Centennial Park	3816	123	50.67
HOCO_VNM4	HoCo General Hospital	5234	169	55.59
HOCO_VNM5	Merriweather Post Pavillion	5297	171	56.88
HOCO_VNM6	Oakland Mills HS	5391	174	57.97
HOCO_VNM7	Long Reach HS	5491	177	58.73
HOCO_VNM8	Troy Park	6723	217	61.66
HOCO_VNM9	Harwood Park N'hood	6845	221	60.75
HOCO_VNM10	Abiding Savior Lutheran	5400	174	55.15
HOCO_VNM11	Tridelphia Ridge ES	1305	42	42.2
HOCO_VNM12	Atholton HS	5043	163	59.3
HOCO_VNM13	Christ Church Episcopal	6280	203	60.98
HOCO_VNM14	Mayfield Woods MS	5602	181	61.59
HOCO_VNM15	Manor Woods ES	498	16	42.09
HOCO_VNM16	Gateway Site	6313	204	60.72
HOCO_VNM17	Oxford Square Neighborhood	9172	296	67.97
HOCO_VNM18	St. Louis Catholic	4337	140	51.15

Noise Exposure – DNL Contours

Howard and Anne Arundel Counties



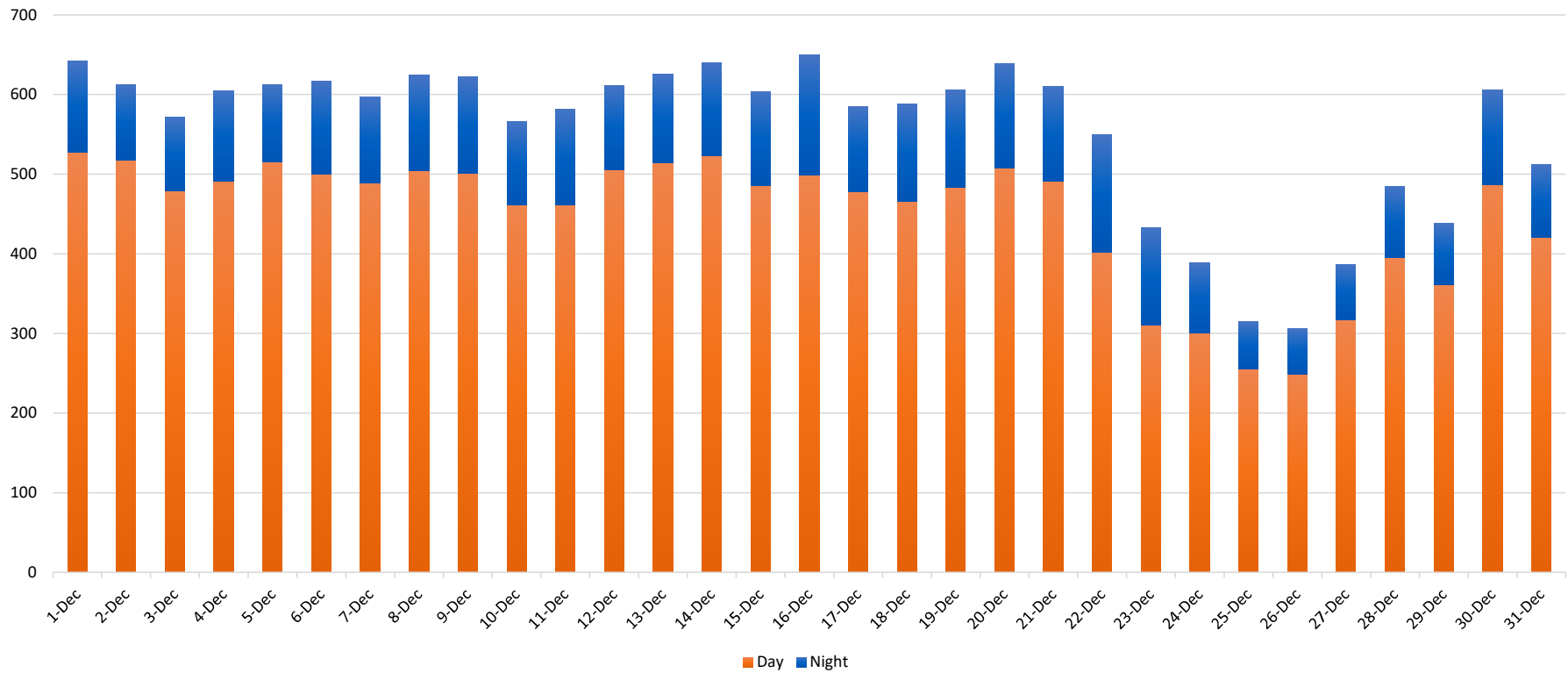
Flight Track Density – Heat Map



Monthly Operations

December 2022

Daily Operations (Day vs. Night)

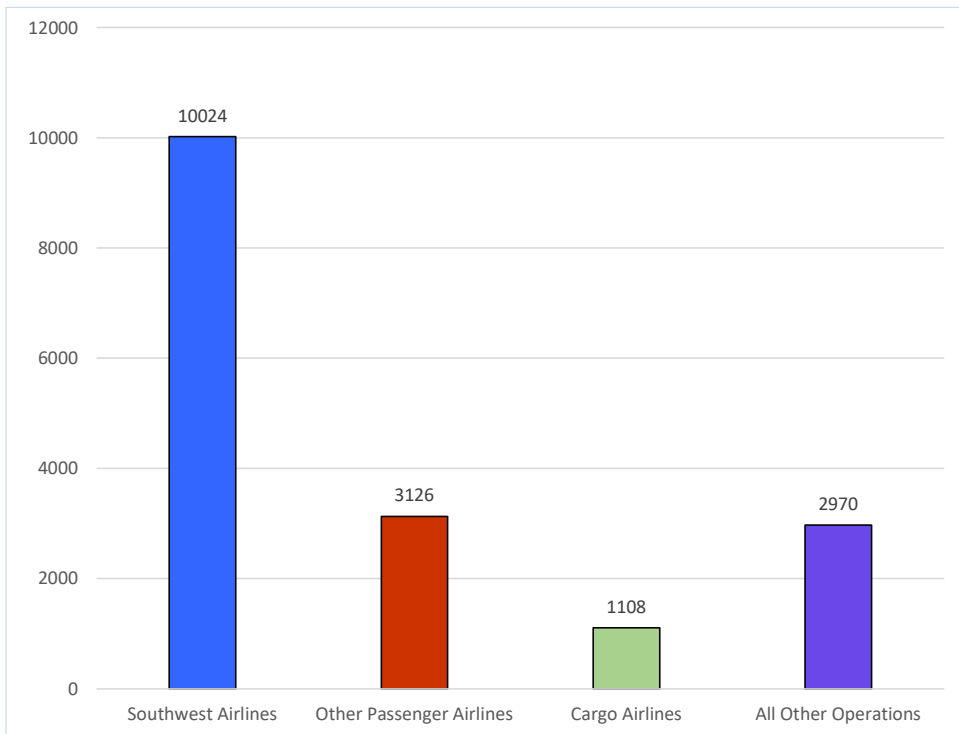


"Nighttime Hours" are from 10PM - 7AM

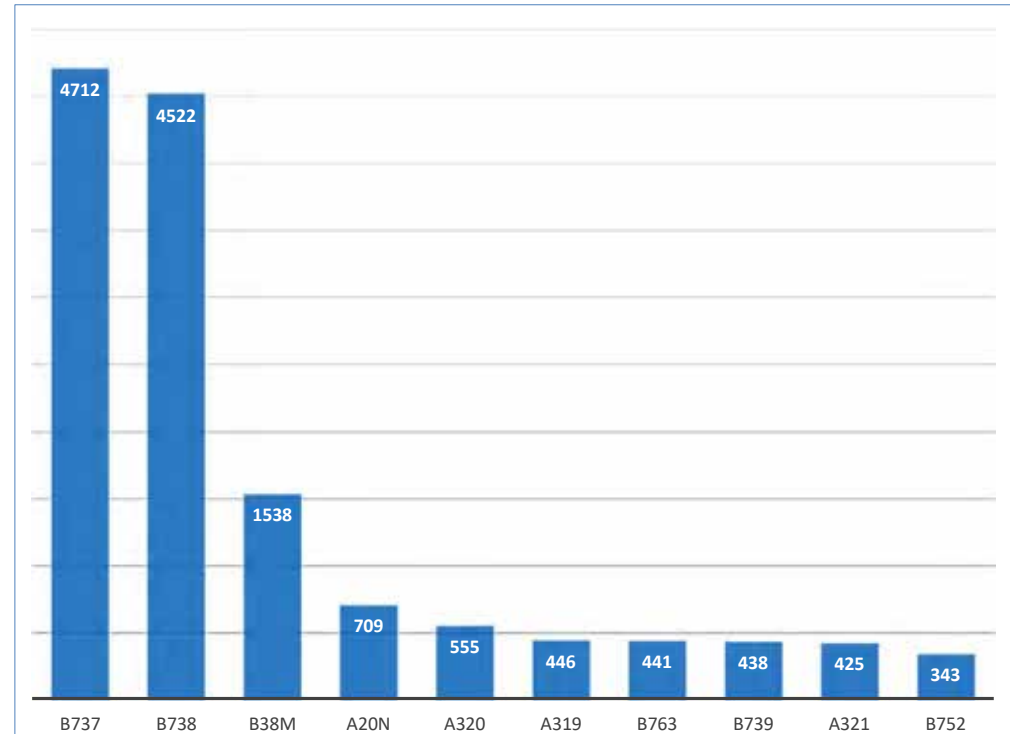
Aircraft Operations

December 2022

Southwest vs. All Other Operations



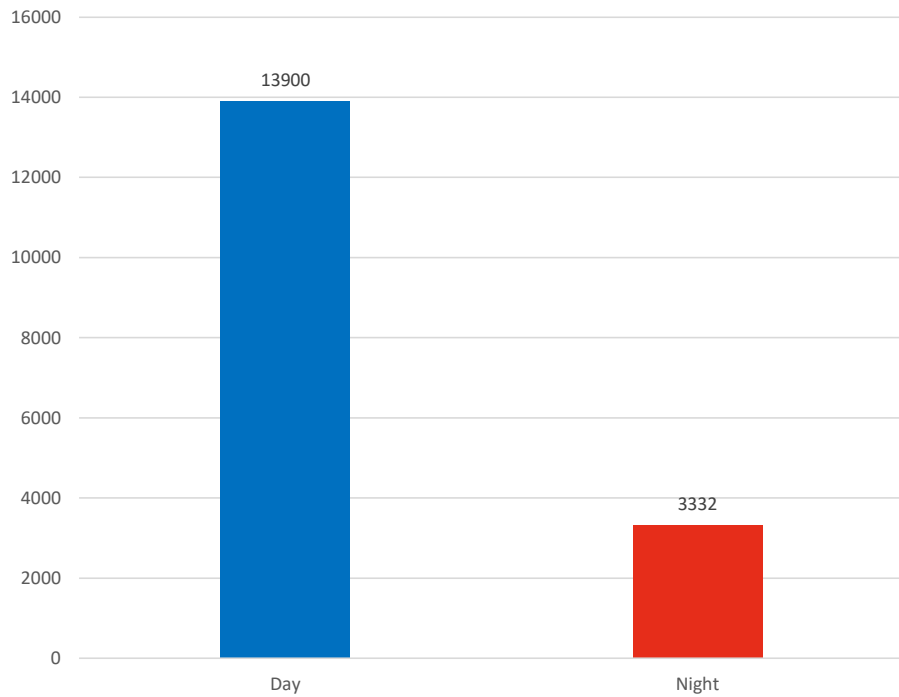
Total Operations by Aircraft Type (Top 10 Aircraft)



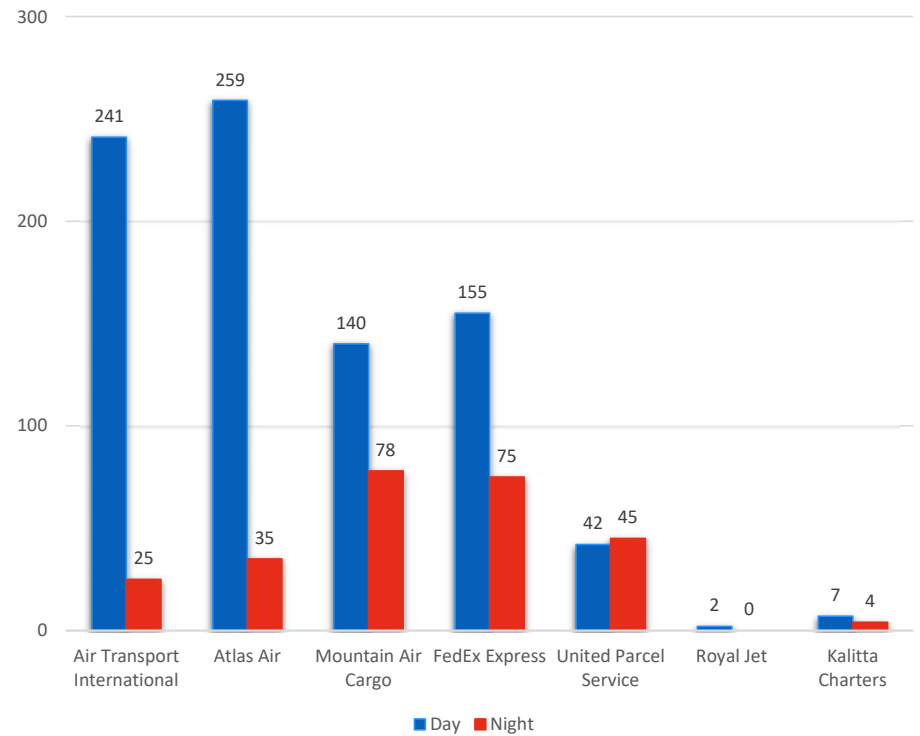
Monthly Operations – Daytime versus Nighttime

December 2022

Monthly Operations - Day vs. Night



Top Cargo Operations – Daytime vs. Nighttime





Aircraft Noise Basics

Noise is defined as “unwanted sound.” There are many ways to measure noise. Two common metrics will be used in these reports: Day-Night Level (DNL) and Number-of-Events-Above (NA).

DNL is the standard metric used by the Federal Aviation Administration as required by federal regulation. Federal guidelines recommend **DNL 65** as the level of aircraft noise exposure that is incompatible with noise-sensitive applications including residential development. A problem with DNL is it is difficult for the public to understand and doesn't seem to reflect what residents experience on a daily basis.

The NA noise metric counts the number of times the noise level exceeds a specific threshold. In this report, the Number-of-Events-Above 55 metric (NA55) is calculated. NA55 quantifies the number of aircraft events resulting in noise exposure of 55 decibels or higher at each location depicted.

Noise Basics

The scale below is intended to provide a basic understand of noise levels which are expressed in decibels (dB or dBA). The purpose of the chart is to provide examples of noise/sound level associated with common events. This is intended to provide the reader with a basic understanding or context of “how loud” 55, 65, 75, etc., decibels is.

It is worth noting, noise (sound) exposure and noise annoyance are different. Noise exposure is based on acoustics and represents a measure of sound energy a person is exposed to. Annoyance is based on an individual’s response to the noise exposure.



An Individual’s response (annoyed, highly annoyed, not annoyed, etc.), vary based many factors. Furthermore, sound exposure at a specific level (i.e. 65 db) may be perceived differently based on the source of the noise (i.e. music at 65 decibels vs. aircraft noise at 65 decibels. The source of the sound and the individual’s perception of the source is one of the many factors that contribute to our reaction.



Source: Hearing Health Foundation, <http://hearinghealthfoundation.org/>

Why the DNL metric is controversial

In September 2021, the General Accounting Office of the United States Government (GAO) published a review of the FAA’s implementation of the precision flight path component of NextGen, which is call Performance Based Navigation (PBN). That analysis showed that because DNL combines the effects of several components of noise into a single metric, it does not provide a clear picture of the flight activity or associated noise levels at a given location. For example, 100 flights per day can yield the same DNL as one flight per day at a higher decibel level, due to the averaging effect of FAA's metric.

Flights per day, by decibel (dB) level	Day-Night Average Sound Level
1 flight per day at 114.4 dB 	65 dB
100 flights per day at 94.4 dB 	65 dB

Note: For more details, see fig. 1 in GAO-22-105844.

Source: GAO analysis of Federal Aviation Administration information. | GAO-22-105844

The GAO's analysis and other research demonstrate the limitations of FAA relying solely on DNL to identify potential noise problems. This illustrates why communities often view DNL as a “permissive” measure, designed to allow increased airplane operations.



For More Information ...

For more information about the contents of this report or
for questions about the DC Metroplex BWI Community Roundtable

Please visit:

<https://marylandaviation.com/environmental/environmental-compliance-sustainability/dc-metroplex-bwi-community-roundtable/>