

# 2017 AERONAUTICAL NOISE MANAGEMENT REPORT

-VANCOUVER AIRPORT AUTHORITY-

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## INTRODUCTION

Vancouver Airport Authority (“Airport Authority”) is a not-for-profit organization, governed by a community-based Board of Directors, which oversees the daily operations of the Vancouver International Airport (“YVR”) to ensure the airport runs safely and efficiently. As a community based organization, the Airport Authority is committed to a positive long-term relationship with our surrounding communities and is dedicated to operating YVR in a manner that minimizes negative impacts on the environment, while providing 24-hour airport services.

The Airport Authority took over management of YVR from Transport Canada in 1992 under a long term lease agreement. Managing noise from aircraft operations has been a priority for us since assuming responsibility of YVR.

As with all work undertaken by the Airport Authority, we approach noise management using a sustainability framework, which integrates the economic, environmental, social and governance aspects of our business. This framework is essential to our success and provides a responsible approach for our business objectives and our commitment to the local community.

The objective of this report is to share information with the community about activities of the YVR Aeronautical Noise Management Program, and to facilitate informed dialogue between stakeholders involved in managing aircraft noise. Data and information compiled for this report also helps to support discussions with members of the YVR Aeronautical Noise Management Committee (“ANMC”), a consultative forum for independently appointed community and industry representatives to share information and provide advice and input on the development of initiatives to the Airport Authority through a collaborative process.

## 2017 HIGHLIGHTS

The Airport Authority has a comprehensive noise management program to manage noise from aircraft and airport operations while balancing the need of 24-hour airport access in the region. The 5-year Noise Management Plan is an integral part of advancing the goals of the program and is a requirement under the Airport Authority's ground lease with Transport Canada. The current Plan (2014-2018) can be found at [www.yvr.ca](http://www.yvr.ca).

The 2014-2018 YVR Noise Management Plan contains ten focus areas along with supporting initiatives. A summary of work undertaken in 2017 is provided below.

### YVR 2037 MASTER PLAN

In 2017, Phase 3 of the multi-phased consultation process to support the creation of the YVR 2037 Master Plan was completed, and the final Master Plan document was submitted to Transport Canada for approval.

During Phase 3 consultations, the YVR Master Plan team reported back to the community on six focus areas presented in Phase 2, which included: airport terminal; airside and airspace; ground access; community amenities; environment; and land use. Information was also provided on how earlier input was used to inform decisions for the Master Plan. Overall feedback received during Phase 3 was positive and supportive of the preferred options included in the Master Plan. Further information on the Master Plan process and consultation summary reports can be found on [www.yvr2037.ca](http://www.yvr2037.ca).

### *Review of Noise Exposure Forecast Contour*

In support of the Master Plan process, a review of long term Noise Exposure Forecast ("NEF") planning contour was completed in 2017.

The NEF is the official metric prescribed by Transport Canada for airport noise assessment and compatible land use planning in the vicinity of the airport. The sole purpose of the NEF is to help aviation and City planners implement compatible land use practices. The current long term NEF planning contour for YVR was created in 1994 using 20-year forecast period extending to 2015.

A review of the 2015 NEF planning contour was initiated to assess its continued use as the long-term planning tool and determine its ability to protect for the expected future growth in air traffic and the potential for future runway options.

The review concluded that the 2015 NEF planning contour would provide sufficient protection for potential future air traffic growth and airfield expansions. As a result, the 2015 NEF planning contour will be retained as the long-term planning contour and included in the Master Plan documents.

### NORTH AIRFIELD RUNWAY END SAFETY AREA (“RESA”) PROJECT

In 2017, consultations with the community on the north airfield RESA project took place.

RESAs are specialized areas at the end of a runway that protect aircraft, passengers, and crew in the unlikely event of an overrun or undershoot. The Airport Authority is proactively building RESAs in a multi-phased project to meet international recommendations and to exceed the anticipated Canadian standard.

The first phase of the RESA project included the design and construction of 300m RESAs on the south and crosswind runways. Construction work began in 2015 and concluded in 2017. The second phase includes the design and construction of 300m RESAs on the north runway.

The project team hosted two stakeholder meetings and a public open house to provide information on selected options for the north runway RESA and to gather feedback and comments. Each option provided different impacts on runway performance, such as the runway length available during take-off and landing.

Based on assessments and feedback received during consultations, the project team received management approval to move forward with the option which protects existing take-off runway length and performance for the north runway, while providing the required 300m RESA. Construction work is planned to commence in 2018 and will be carried out over a three-year period.

### SUMMER 2017 SOUTH RUNWAY CLOSURE

The summer months are typically the busiest season at YVR with the high volume of aircraft traffic and a number of airfield projects. Airfield maintenance and project work is essential to sustain safe operations and to maintain assets at the airport.

In 2017, the Airport Authority completed the final year of the three-year project to construct RESAs on the south and crosswind runways as well as various other projects on the south airfield. To accommodate all this work, the south runway was closed six nights a week (Sunday-Friday) between 10PM and 7AM, starting on May 29. During the periods of south runway closure, all departures and arrivals were accommodated on the north runway.

While work was scheduled to be completed on the morning of September 17, this had to be extended to the morning of September 23 due to project delays experienced throughout the summer.

### EARLY MORNING INSTRUMENT LANDING SYSTEM CHECKS

In 2017, the Airport Authority worked with NAV CANADA to accommodate earlier start times for select instrument landing system (“ILS”) checks to enhance the level of safety and to shorten the duration of flight checks.

Starting the flight checks earlier in the morning hours, when the traffic volume is low, helps avoid the periods of high traffic volume encountered during the day and provides increased opportunities to mitigate noise by shortening the flying time of the aircraft, using reduced engine power settings, and using modified flight circuit patterns to minimize overflights of populated areas whenever possible.

Future major flight checks will continue to be planned to start earlier in the morning at YVR as well as other major airports across Canada. NAV CANADA is also continuing their efforts to improve efficiency to further reduce flight duration associated with the checks.

As background, the ILS is a ground-based navigation system that provides vertical and lateral guidance to aircraft on approach to ensure for a safe landing. NAV CANADA maintains the ILS and performs regular maintenance and checks to ensure the system meets stringent certification standards prescribed by Transport Canada.

In general, each ILS requires two checks per year with a minor check during the winter and a major check in the summer. In the past, flight checks were performed during the daytime. However, performing the flight checks during the daytime has become very challenging due to increasing volume of air traffic in the Vancouver airspace. This often results in an extension of the flight duration as the flight inspection aircraft is asked to hold at low altitudes until the airspace is clear enough for the checks to continue.

## FLY QUIET AWARDS

The 2016 YVR Fly Quiet Awards were presented at the YVR Chief Pilots Meeting in May 2017. The goal of these awards is to raise awareness of noise issues within the aviation community. Eligibility criteria for the awards include:

1. The airline must not be in suspected violation of any of the published Noise Abatement Procedures.
2. The airline must have the lowest average annual noise level for their aircraft category as measured by the airport's Aircraft Noise & Operations Monitoring System.
3. The airline must fly regular services at YVR.

The winners included: Horizon Air (propeller category); Jazz (narrow-body jets); and Xiamen Airlines (wide-body jets). Award winners for the past three years are presented in Table 1.

TABLE 1: YVR Fly Quiet Award Winners, 2014-2016

YEAR	Propeller	Narrow Body Jets	Wide Body Jets
2016			
2015			
2014			



## YVR OPERATIONS IN REVIEW

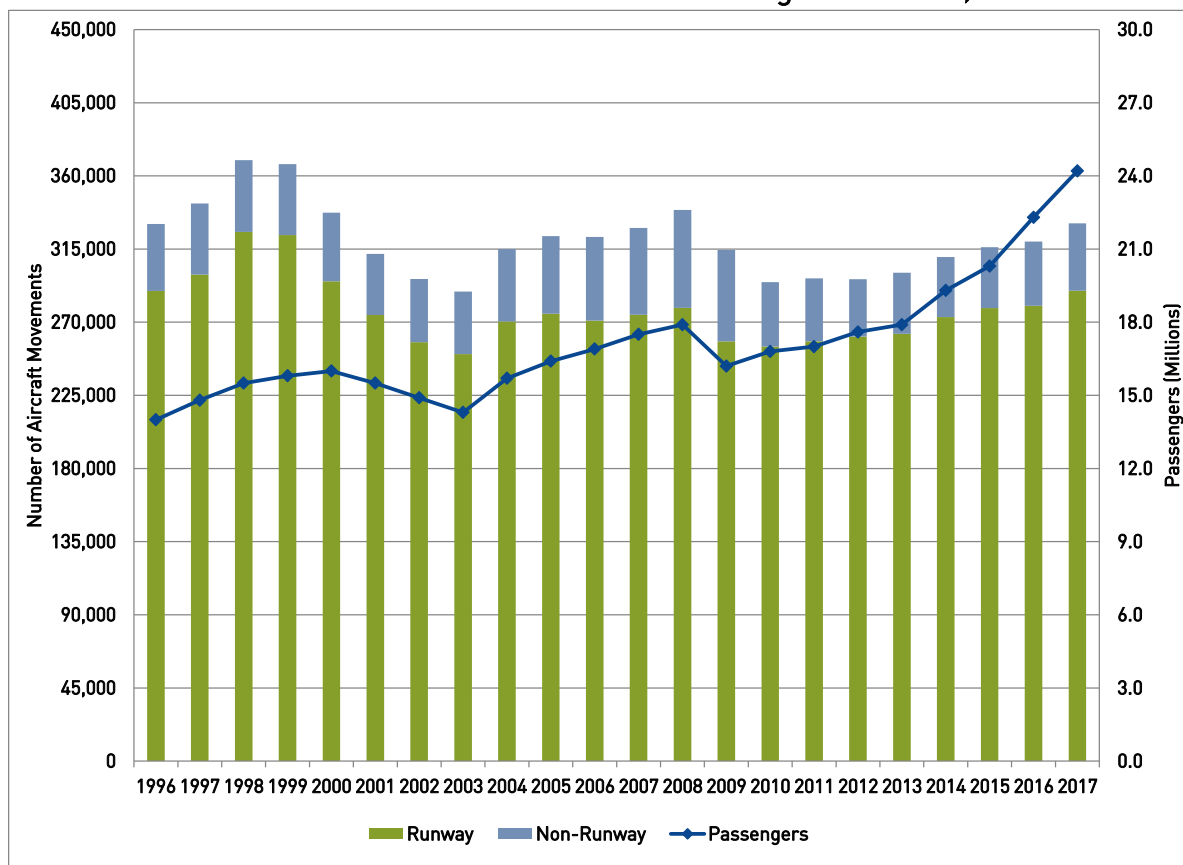
In 2017, aircraft movements, cargo tonnage, and total passengers all experienced growth at YVR. Table 2 presents the annual operational statistics in 2017.

**TABLE 2: Operational Statistics for YVR, 2017**

Total Movements	330,839	3.5% increase from 2016
Total Cargo (Tonnes)	313,437	11.5% increase from 2016
Total Passengers	24,166,122	8.4% increase from 2016

Figure 1 illustrates the historical trend of aircraft movements and passengers at YVR for the time period of 1996-2017. In 2017, the number of aircraft movements remains less than what occurred in the peak year (1998) while the number of passengers surpassed its record year in 2016 by 1.9 million. This trend indicates that aircraft are carrying more passengers per aircraft and cargo is also being moved more efficiently, which is a benefit with respect to noise and emissions.

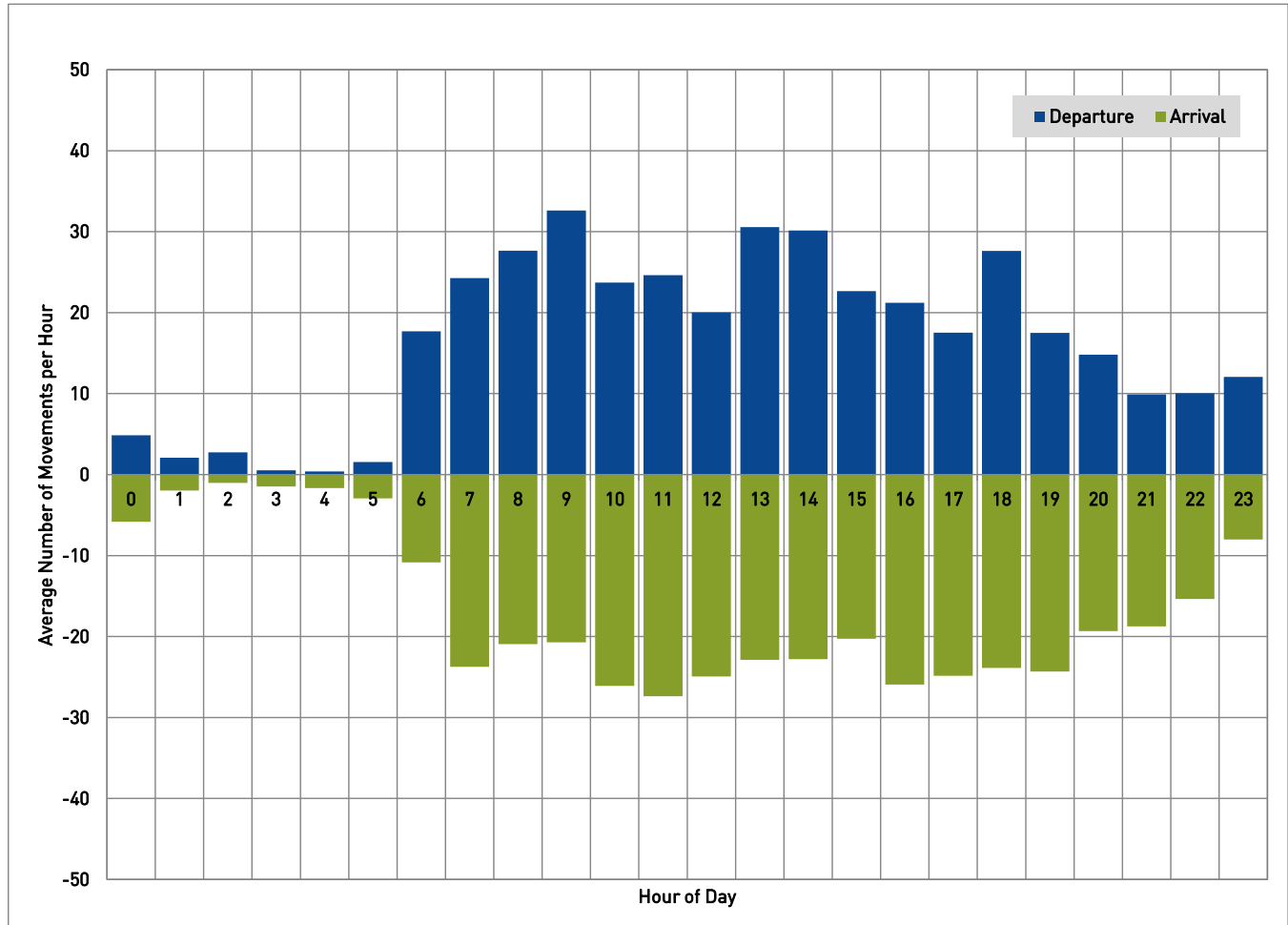
**FIGURE 1: Annual Aircraft Movements<sup>1</sup> & Passenger Statistics, 1996-2017**



<sup>1</sup> Aircraft movements in this chart include both runway and non-runway movements. Non-runway movements are associated with helicopter and float plane operations using helipads and waterdrome at YVR.

In 2017, approximately 97% of aircraft movements occurred during the day-time hours<sup>2</sup> and approximately 3% of aircraft movements during the night-time hours<sup>3</sup>. Figure 2 illustrates the average hourly runway movements by arrival and departure. As illustrated, the number of aircraft movements begins to increase at 6:00AM and continues with a number of peaks experienced throughout the day.

**FIGURE 2: Average Hourly Runway Movements, 2017**



<sup>2</sup> For this report, day-time is defined as the time period between 6:00AM and Midnight.

<sup>3</sup> For this report, night-time is defined as the time period between Midnight and 6:00AM.

## OPERATIONAL SNAPSHOT – NIGHT OPERATIONS

Like most international airports around the world and all international airports in Canada, YVR is open 24-hours a day. While the majority of aircraft activities occur during the day-time hours, some operations occur during the night-time hours. Night-time operations are typically associated with passenger, cargo, and courier services.

In 2017, there were approximately 9,890 runway movements during the night-time hours. This equates to an average of 27 movements between the hours of midnight and 6:00AM. Of these movements, approximately 55% were arrivals, which are generally quieter than departures. Table 3 summarizes the breakdown of the average night-time movements by aircraft type and operation.

**TABLE 3: Average Nightly Movements by Aircraft Type and Operation, 2017**

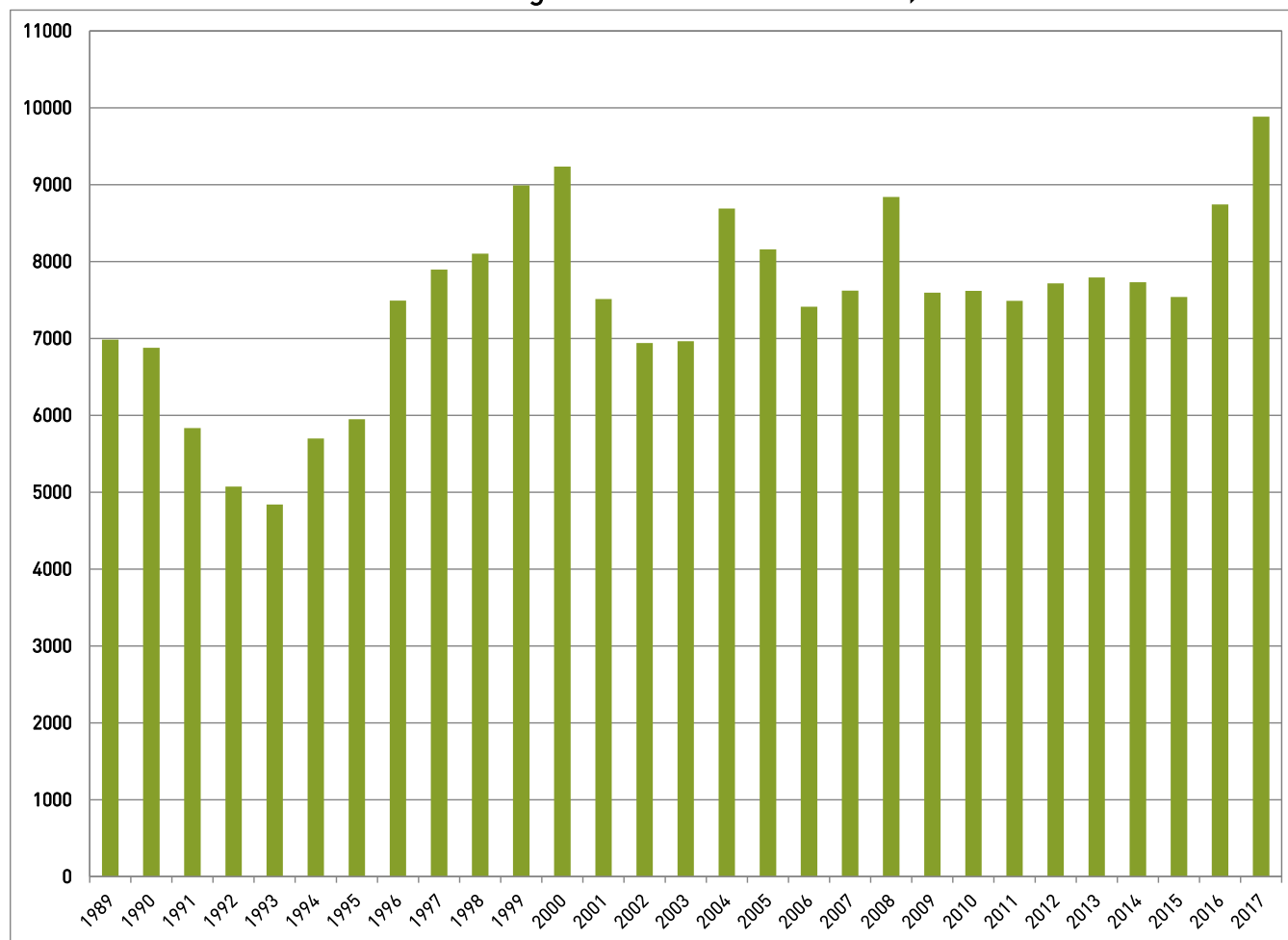
Aircraft Type	Operation	
	Arrival	Departure
Propeller	3	2
Business Jet	1	1
Narrow Body Jet	8	2
Wide Body Jet	4	7

- Propeller aircraft include types such as the Dash-8, Navajo, Beech 1900, Saab 340, etc.
- Business jets include types such as the Citation, Learjet, etc.
- Narrow-body jets include types such as the A320, B737, CRJ, E190, etc.
- Wide-body jets include types such as the B787, B777, A350, A330, etc.

YVR has always been open 24-hours a day, including when the airport was managed by Transport Canada prior to the transfer to the Airport Authority in 1992. Figure 3 illustrates the annual night-time runway movements at YVR for the years 1989 to 2017.

In 2017, the number of night-time movements increased by approximately 13% compared to the previous year. This equates to an average of 3 additional movements between the hours of midnight and 6:00AM.

FIGURE 3: Annual Night-time Movements at YVR, 1989-2017



## OPERATIONAL SNAPSHOT – JET FLEET MIX BY NOISE CERTIFICATION

The International Civil Aviation Organization (“ICAO”) is an agency of the United Nations and establishes principles and techniques for the planning and development of international air transportation to ensure safe and orderly growth. The ICAO Committee on Aviation Environmental Protection (“CAEP”) prescribes standards for noise with the goal of promoting reduction at the source. These standards are contained in *Annex 16: Volume I Environmental Protection - Aircraft Noise* and categorize jet aircraft as either Chapter 2, Chapter 3 or Chapter 4 depending on three measured noise levels (take-off, landing, and sideline) obtained during prototype development<sup>4</sup>.

<sup>4</sup> To reduce aircraft noise exposure on communities, the Government of Canada legislated the phase-out of Chapter 2 jet aircraft over 34,000kg from operation in Canada by the year 2002. These aircraft are no longer permitted to operate in Canada and were either retired from operation or modified to meet Chapter 3 standards. A few exemptions were granted to aircraft operating from airfields in northern Canada.

A new noise standard was confirmed at the 9th meeting of CAEP in February 2013. This new standard, Chapter 14, will apply to new large aircraft types certified after 2017 and to aircraft less than 55 tonnes after 2020. To meet the Chapter 14 standard, aircraft must be at least 7 EPNdB (Effective Perceived Noise in Decibels) quieter than the current Chapter 4 standard. This reduction is cumulative over three measurements points: take-off, landing and sideline.

An analysis was performed on jet operations occurring in 2017 to determine the percentage of Chapter 3 and Chapter 4 movements. Table 4 below presents the results of the analysis, and provides an additional breakdown by the Gross Take-off Weight ("GTOW") of the aircraft. In 2017, 93% of all jet aircraft operating at YVR met Chapter 4 noise standards.

**TABLE 4: ICAO Noise Certification of Jet Operations at YVR, 2017**

ICAO Noise Certification	All Jet Aircraft	GTOW less than 34,000kg (n~11,290)	GTOW greater than or equal to 34,000kg	
			Narrow Body (n~111,880)	Wide Body (n~37,659)
Chapter 3	7%	20%	6%	5%
Chapter 4	93%	80%	94%	95%

Approximately 89% of the jet aircraft operations occurring during night time hours between midnight and 6:00 AM met Chapter 4 noise certification standards.

The airline industry has invested billions to upgrade their fleet to reduce both noise and emissions. Aircraft operating today are approximately 30 dB quieter (or a 90% reduction in noise footprint area) as compared to original commercial jet aircraft. Airlines in Canada continue to invest and upgrade their fleet with new modern aircraft and are known to have one of the youngest fleets in the world.

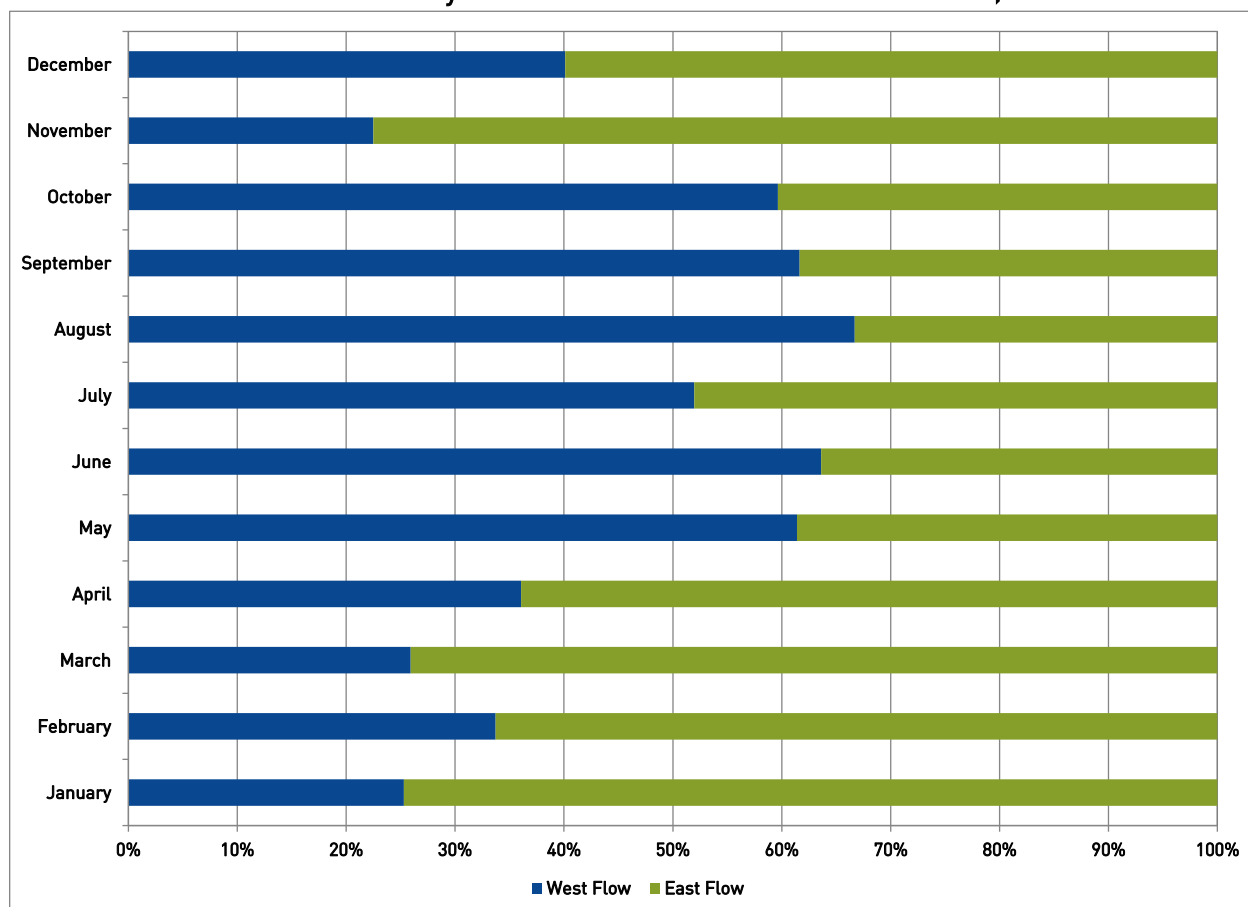
## AIR TRAFFIC FLOW

YVR has two parallel runways and a crosswind runway. The parallel runways, which include the south runway (08R/26L) and the north runway (08L/26R), are aligned in an east-west direction with magnetic headings of 083° and 263°. The crosswind runway (13/31) is oriented in a northwest and southeast direction with magnetic headings of 125° and 305°.

The active runways are determined by wind conditions at the airport as aircraft must take-off and land into the wind for safety reasons. The predominant winds at YVR are typically in an easterly or westerly direction; therefore, the parallel runways are the primary runways in use. Based on historical observations, traffic flow in an easterly direction (Runway 08L and 08R) are more common during the fall and winter months, and traffic flow in a westerly direction (Runway 26L and 26R) are more common during the spring and summer months.

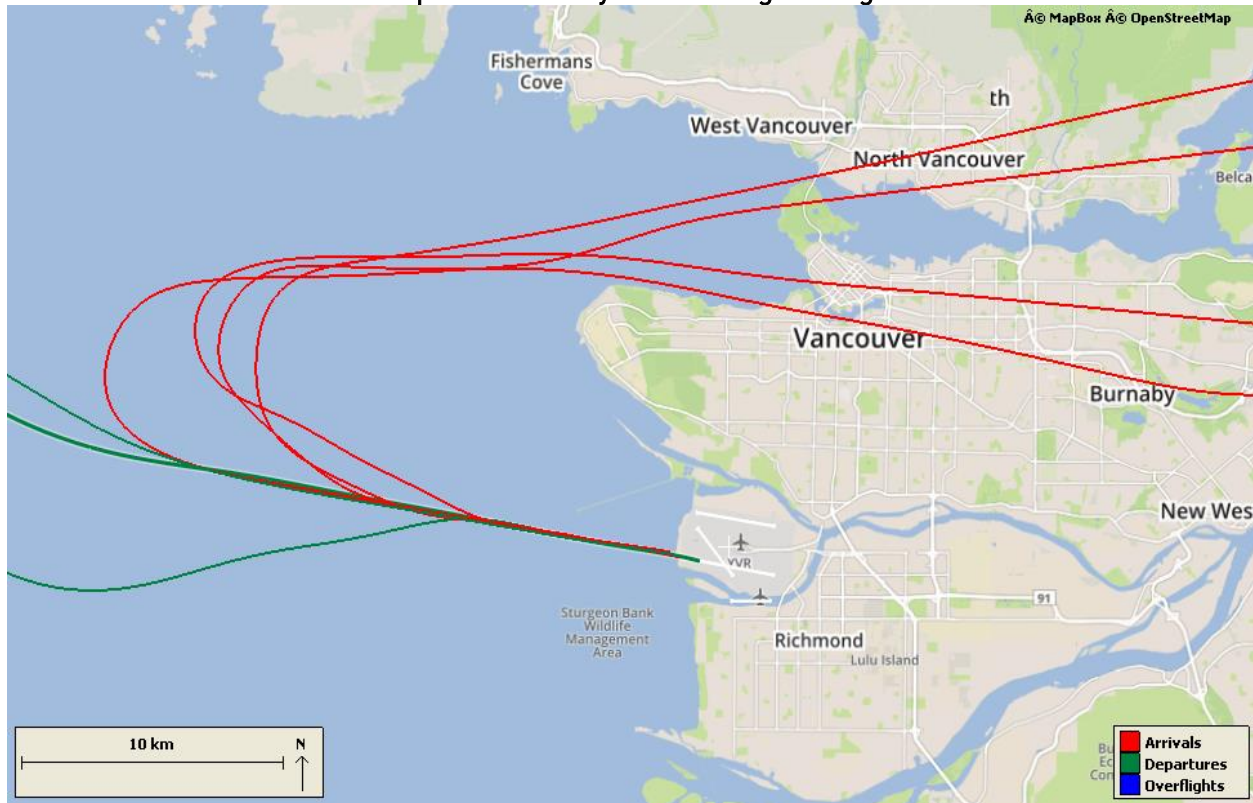
Figure 4 illustrates the monthly distribution between easterly and westerly flow on the parallel runways, and the seasonal trends can be observed with more dominant east flow during the fall and winter months and more dominant west flow during the spring and summer months. Overall, the wind conditions were balanced with 47% westerly flow and 53% easterly flow throughout 2017.

**FIGURE 4: Monthly Distribution of Air Traffic Flow at YVR, 2017**



The published Noise Abatement Procedures for YVR prescribes westerly flow of traffic as the preferred mode of operation whenever possible to reduce noise exposure on the community as this puts departures, the noisiest type of operation, over the Strait of Georgia. In addition, NAV CANADA will attempt to accommodate two-way flow between the hours of 11:00PM and 6:00AM by keeping both arriving and departing aircraft over the Strait of Georgia in an effort to minimize over-flights and noise on the community as illustrated in Figure 5. However, the use of two-way flow is dependent on traffic volume and weather conditions and cannot be used all the time.

FIGURE 5: Example of Two-way Flow during the Night-time Hours



## RUNWAY USE

As mentioned in the previous section, the parallel runways, the south (08R/26L) and the north (08L/26R), are the primary runways at YVR. The crosswind runway (13/31) is used infrequently during strong crosswind conditions. Figure 6 and 7 illustrate the distribution of arrivals and departures on all runways in 2017.

The south runway is the main 24-hour runway while the north runway is normally closed between the hours of 10:00PM and 7:00AM (except for emergencies and airfield maintenance activities). Between 7:00AM and 10:00PM, the north runway is used primarily for landings except during peak periods when departures may occur to reduce delays, or during emergencies, maintenance, and snow events.

Every year, YVR closes the south runway on selected nights for routine maintenance and project work, and aircraft are diverted to the north runway during these instances. In 2017, along with the annual routine maintenance, the Airport Authority completed the final year of a three-year project to construct Runway End Safety Areas (RESAs) on the south runway. To accommodate this work, the north runway was used during the night-time hours six nights a week for approximately 16 weeks.



FIGURE 6: Runway Arrival Distribution, 2017



FIGURE 7: Runway Departure Distribution, 2017





## RUN-UPS

Transport Canada standards require that aircraft undergo regular maintenance to ensure safe operations. Engine run-ups are a critical part of maintenance work and involve running the engines at various power settings for a period of time to stress components and to simulate flight conditions. This ensures work has been done properly and that the aircraft is safe to return to service.

### YVR RUN-UP DIRECTIVES AND PROCEDURES

In an effort to ensure a high level of safety on the airfield and to reduce community noise exposure from run-ups, the Airport Authority maintains directives and procedures that prescribe how, when, and where run-ups can be performed. Aircraft operators are required to request approval from the Airport Authority prior to performing a run-up, and approved run-ups are assigned a specific location and heading to ensure safety and to minimize noise impacts on surrounding communities. All maintenance run-ups are logged, and these records are routinely analyzed to track run-up activities and identify trends.

### YVR RUN-UP ACTIVITY

There were 4,939 run-ups performed at YVR in 2017. This is an 8% increase compared to the previous year, and equates to an average of one additional run-up per day. Table 5 provides the number of run-ups performed each year at YVR for the time period of 2013-2017.

**TABLE 5: Number of Run-ups Performed at YVR, 2013-2017**

Year	Number of Approved Run-ups
2013	5,157
2014	4,916
2015	4,653
2016	4,584
2017	4,939

Operators performing run-ups can be divided into two distinct areas of the airfield - those located on the north airfield, and those located on the south airfield, with the south runway acting as the dividing line. In 2017, north airfield operators accounted for approximately 39% of all run-up activities at YVR and south airfield operators accounted for the remaining 61%. The run-ups by south airfield operators are generally performed on propeller aircraft, as many operators of propeller aircraft have their maintenance facilities on the south airfield.

In general, there are three different power settings associated with run-ups: idle; above idle; and full power. Full power run-ups are considered the noisiest because the engine is operated at maximum power. Run-ups performed at full power are less frequent and are often shorter

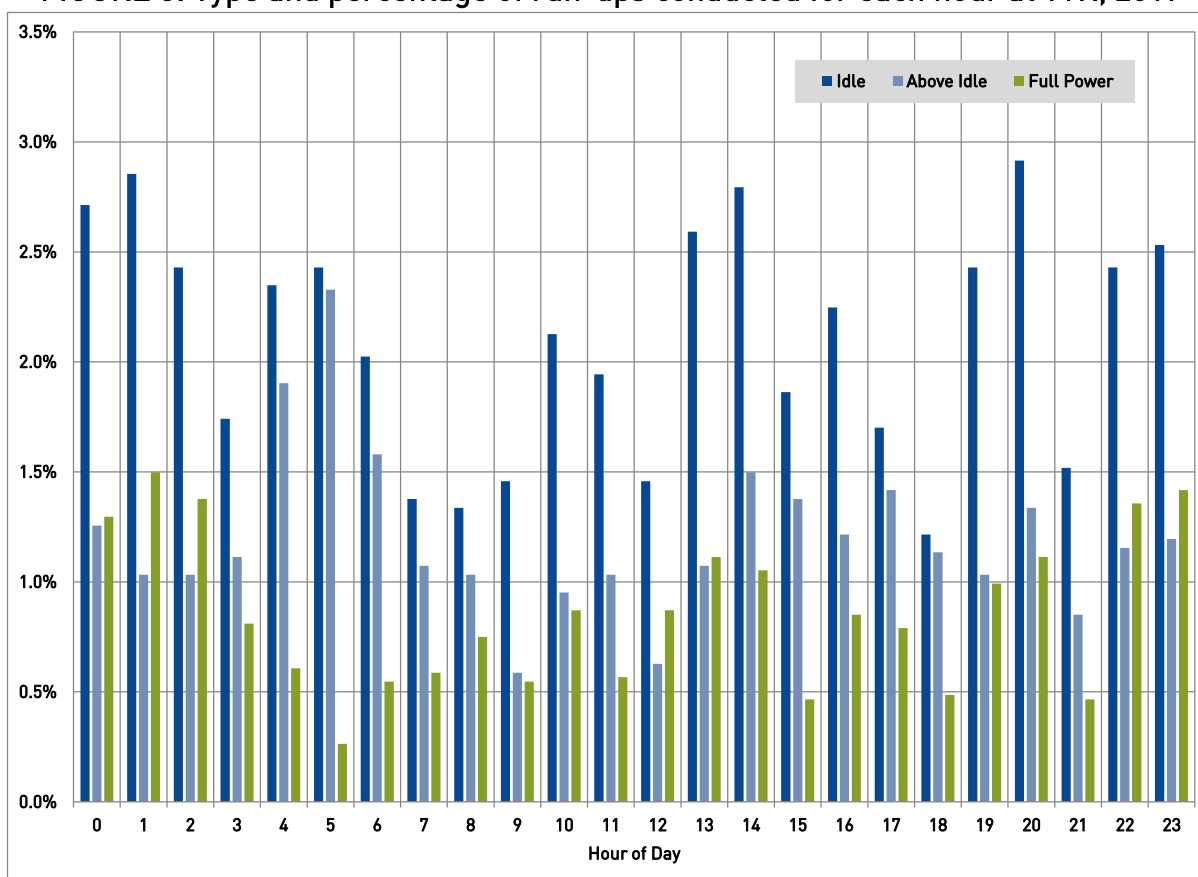
in duration when compared to idle and above idle run-ups. This is due to the increased wear on the engines and fuel consumption associated with running engines at full power for prolonged periods. Table 6 provides a breakdown of run-up types and per cent total at YVR for 2017.

**TABLE 6: Run-up Type (by power setting) Distribution, 2017**

Run-up Category	Percent Total of Runs
Idle	50%
Above Idle	29%
Full Power	21%

Run-ups are performed at all times of the day. Figure 8 provides a breakdown for all run-ups (n=100%) carried out at YVR in 2017 by power setting and hour of the day. Because most aircraft are flying during the day, maintenance work on aircraft is often performed at night when maintenance crews have access to the aircraft, and the associated run-up also occurs at night to ensure the aircraft is airworthy to return to service in the morning. However, as illustrated, operators are consistently busy throughout the day with run-ups being carried out at all hours of the day.

**FIGURE 8: Type and percentage of run-ups conducted for each hour at YVR, 2017**



## GROUND RUN-UP ENCLOSURE

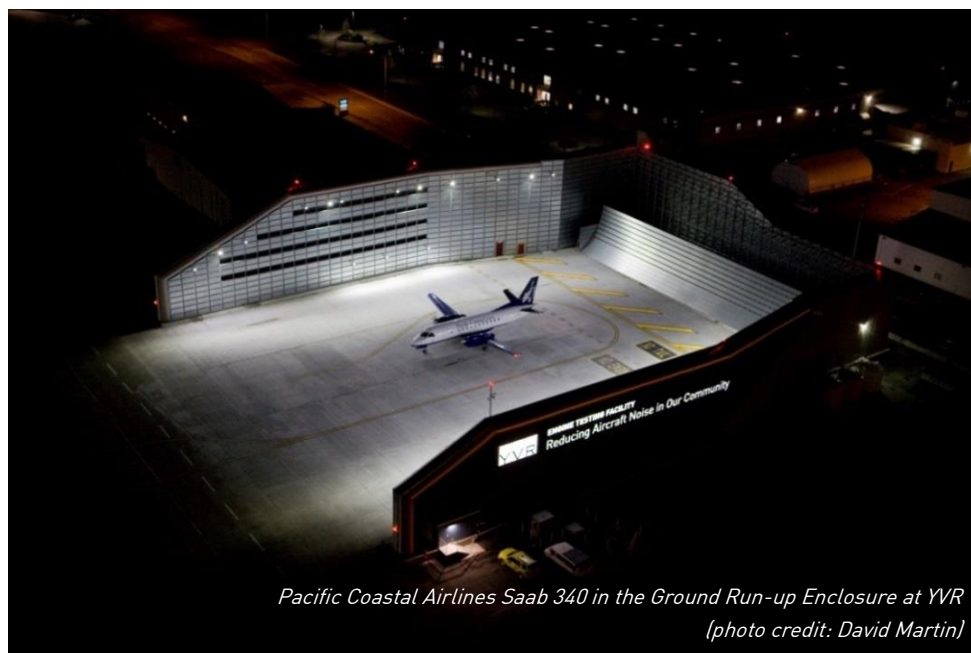
To reduce noise from the high number of propeller run-ups by operators located on the south airfield, the Airport Authority constructed Canada's first Ground Run-up Enclosure ("GRE") and the facility was opened in January 2012. While the GRE is designed to provide an average of 15 dBA noise reduction, the results will vary depending on the location of the receiver in relationship to the GRE.

The GRE facility is the preferred location for high power run-ups on the south airfield. In 2017, there were approximately 1,600 high power run-ups performed by south airfield operators, with 78% of these performed in the GRE. Table 7 provides a more detailed breakdown of high power run-ups on the south airfield and their location in comparison with the GRE.

**TABLE 7: South Airfield High Power Run-up Locations, 2017**

Power Setting	Location	Approx. % of South Airfield Run-ups
Above Idle	GRE	56%
	Apron III	40%
	Apron II	3%
	Apron I	<1%
Full Power	GRE	95%
	Apron III	5%
	Apron II	<1%

The GRE has reduced noise in the community and has been a great success with operators, who often request use of the facility for their run-ups due to its safe and controlled setting.



*Pacific Coastal Airlines Saab 340 in the Ground Run-up Enclosure at YVR  
(photo credit: David Martin)*

## NOISE CONCERNS

One of the goals of the YVR Aeronautical Noise Management Program is to provide the community with up-to-date information on airport operations and noise management efforts and initiatives. The community is able to contact the Airport Authority with their questions and concerns through a variety of means, including:

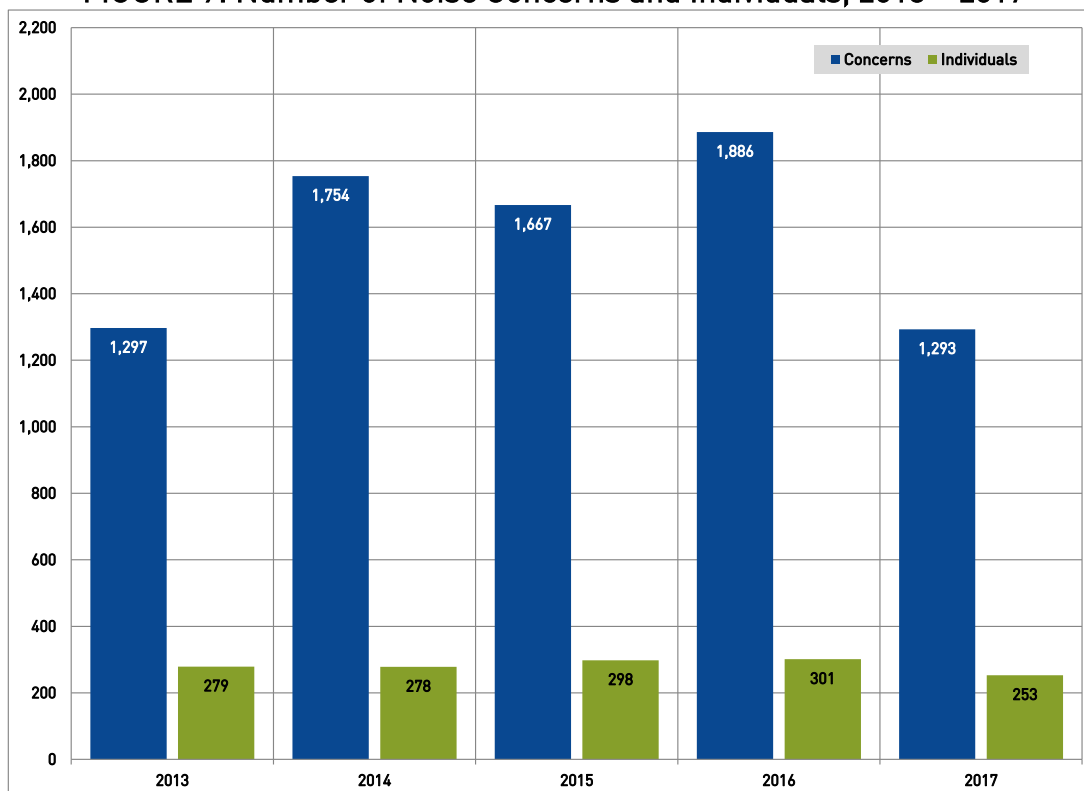
- Dedicated e-mail ([noise@yvr.ca](mailto:noise@yvr.ca))
- Real-time flight and noise tracking system ([WebTrak](#))
- YVR Noise Information Line (604-207-7097), 24-hours.

Information provided by residents and results of investigations are logged in a database, which is used to analyze and identify trends. The YVR Aeronautical Noise Management Committee is provided a summary of concerns at each meeting to review and discuss.

### NUMBER OF CONCERNS

In 2017, the Airport Authority received 1,293 noise concerns from 253 individuals. This represents a 31% decrease in concerns and a 16% decrease in the number of individuals compared to 2016. Figure 9 presents a breakdown on the number of concerns and individuals for the past five years (2013-2017).

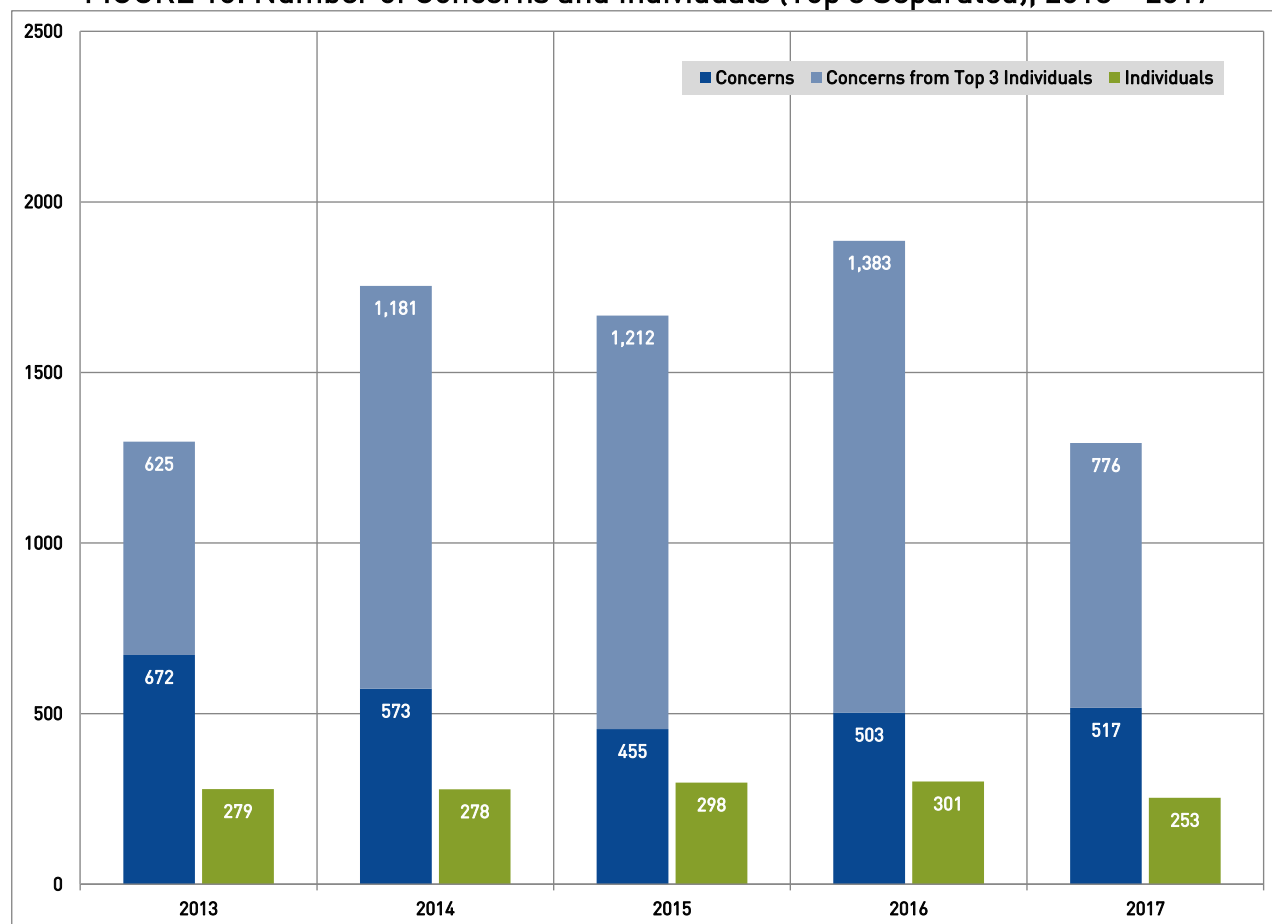
**FIGURE 9: Number of Noise Concerns and Individuals, 2013 – 2017**



There are a number of individuals who register multiple concerns throughout the year. In 2017, 60% (n=776) of all concerns were received from three individuals.

Figure 10 provides a further breakdown of the number of concerns and individuals between 2013 and 2017 by separating the number of concerns submitted by the top three individuals each year.

**FIGURE 10: Number of Concerns and Individuals (Top 3 Separated), 2013 – 2017**



Facts about top three individuals in 2017 include:

- These individuals registered 50 or more concerns each with the range of complaints being between 50-651;
- Two individuals are located further than 10 nautical miles from the airport and registered a combined 701 concerns regarding over-flights of their area;
- One individual resides within 10 nautical miles from the airport and registered 75 concerns mostly related to propeller aircraft departures over the City.

## NOISE CONCERNS BY LOCATION

Whenever possible, individuals are asked to provide information on which city they live in to help determine where in the Lower Mainland concerns are originating from. Figure 11 shows the number of concerns and individuals for the various cities in the Lower Mainland.

**FIGURE 11: Number of Concerns and Individuals by Location, 2017**

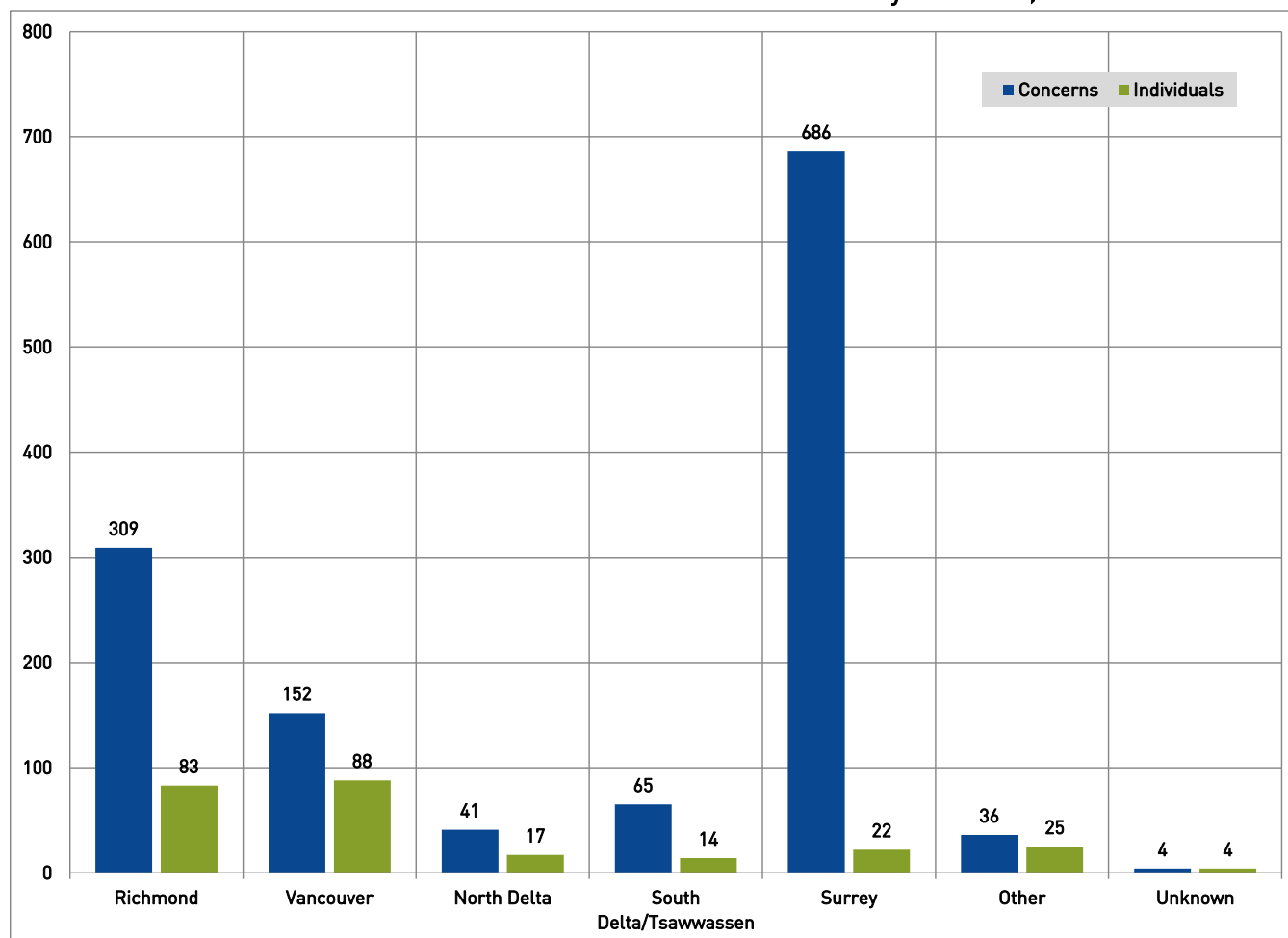
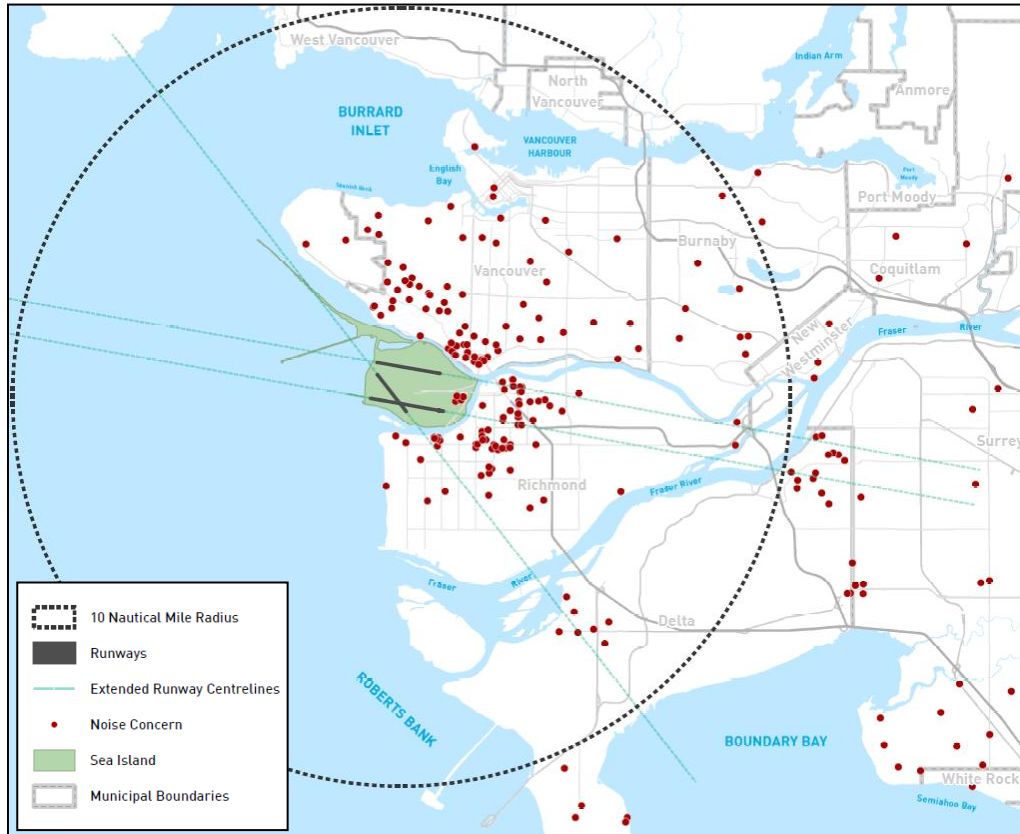
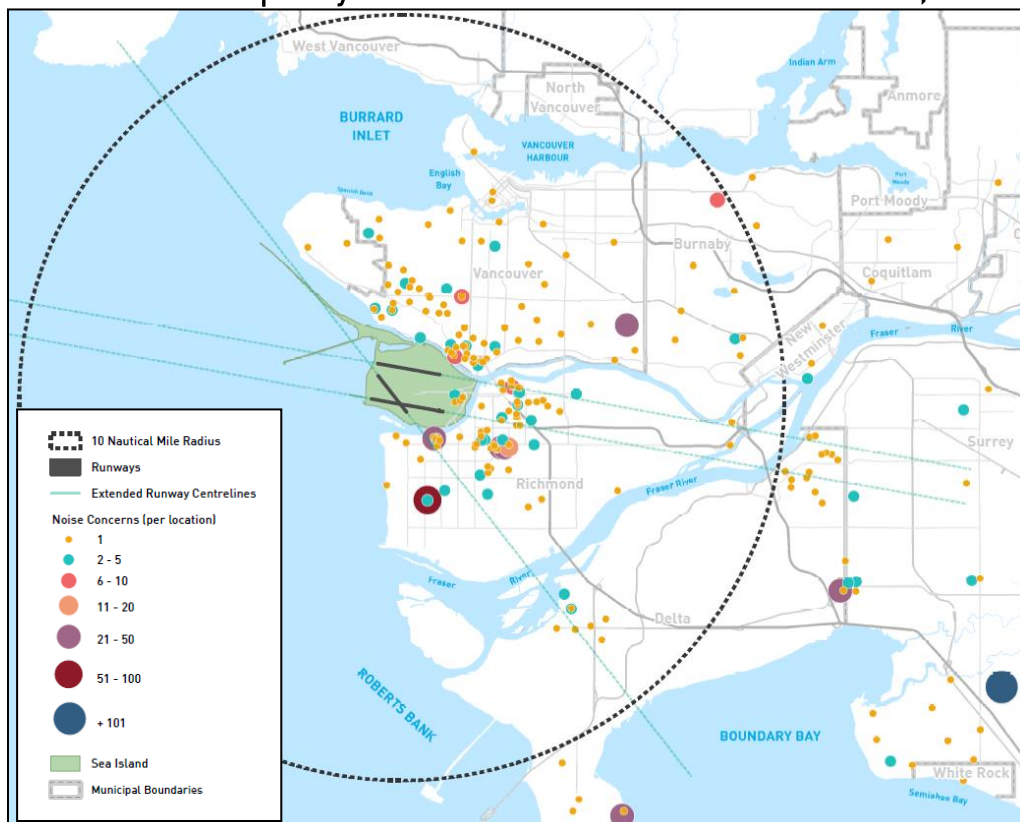


Figure 12 represents the geo-distribution of noise concerns in the Lower Mainland in 2017 based on postal code. Locations closer to the airport generally exhibit a greater density of noise concerns due to the lower altitude of aircraft and regularity of aircraft activity in these locations.

Figure 13 represents the geo-distribution and the frequency of concerns in the Lower Mainland from 2017. The size of each dot represents the volume of concerns originating from that postal code. As illustrated, some of the most individuals registering frequent concerns are located more than 10 nautical miles away from the airport. Aircraft noise concerns from these areas are generally related to the general routing and flight paths over populated areas.

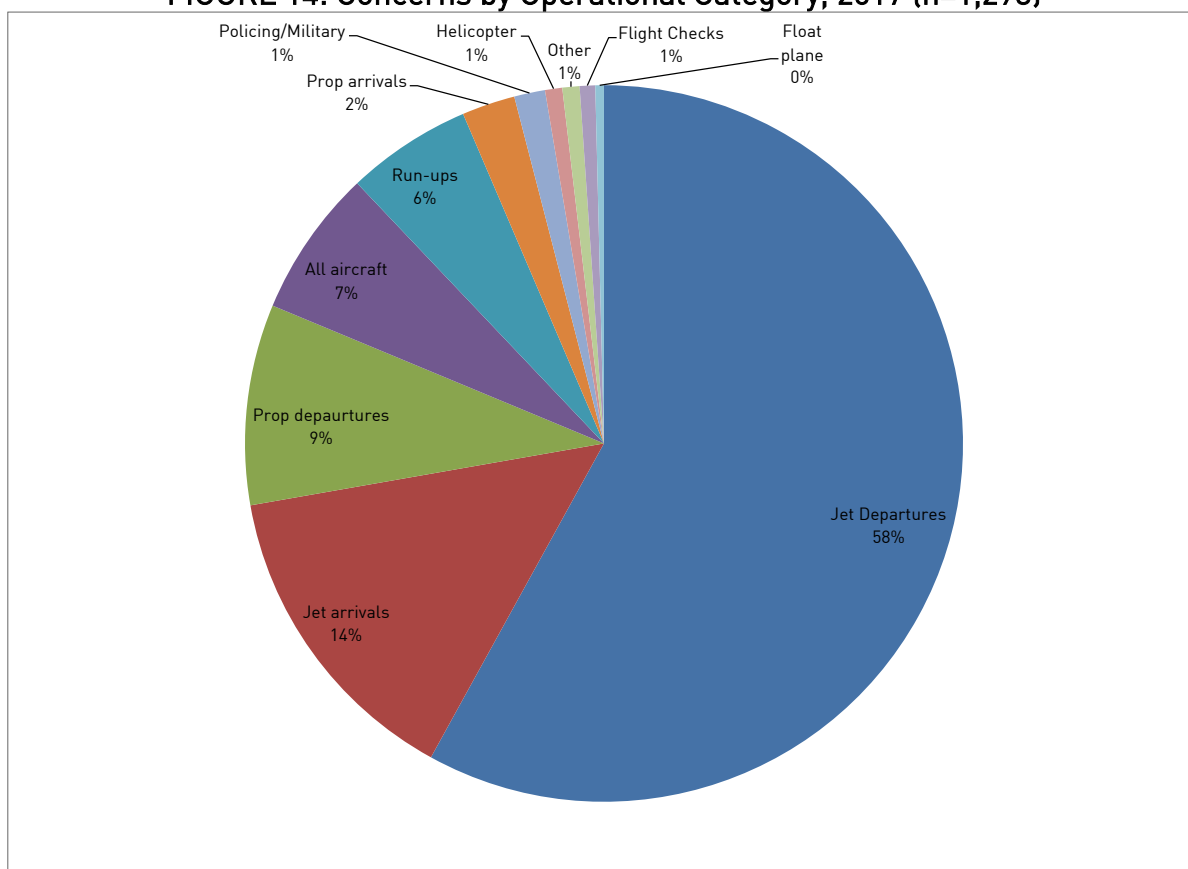
**FIGURE 12: Geo-distribution of Noise Concerns, 2017**

**FIGURE 13: Frequency and Geo-distribution of Noise Concerns, 2017**


## NOISE CONCERN BY OPERATION TYPE

When reporting noise concerns, individuals generally provide details of date, time, and location of the noise event. Based on the information provided, each concern is categorized into an operation type such as jet departure, jet arrival, helicopter and run-ups. In some cases, the information provided by the individual is not sufficient to categorize the concern to a specific operation. In these instances, Airport Authority staff will review flight tracks and procedures to best categorize the nature of the concern. General concerns that cannot be matched against a specific operation type are categorized as “All aircraft”.

The nature of concerns varies greatly and often depends on where the individual is located with respect to the airport and flight paths. Figure 14 shows a breakdown of all noise concerns received in 2017 by operation category.

**FIGURE 14: Concerns by Operational Category, 2017 (n=1,293)**

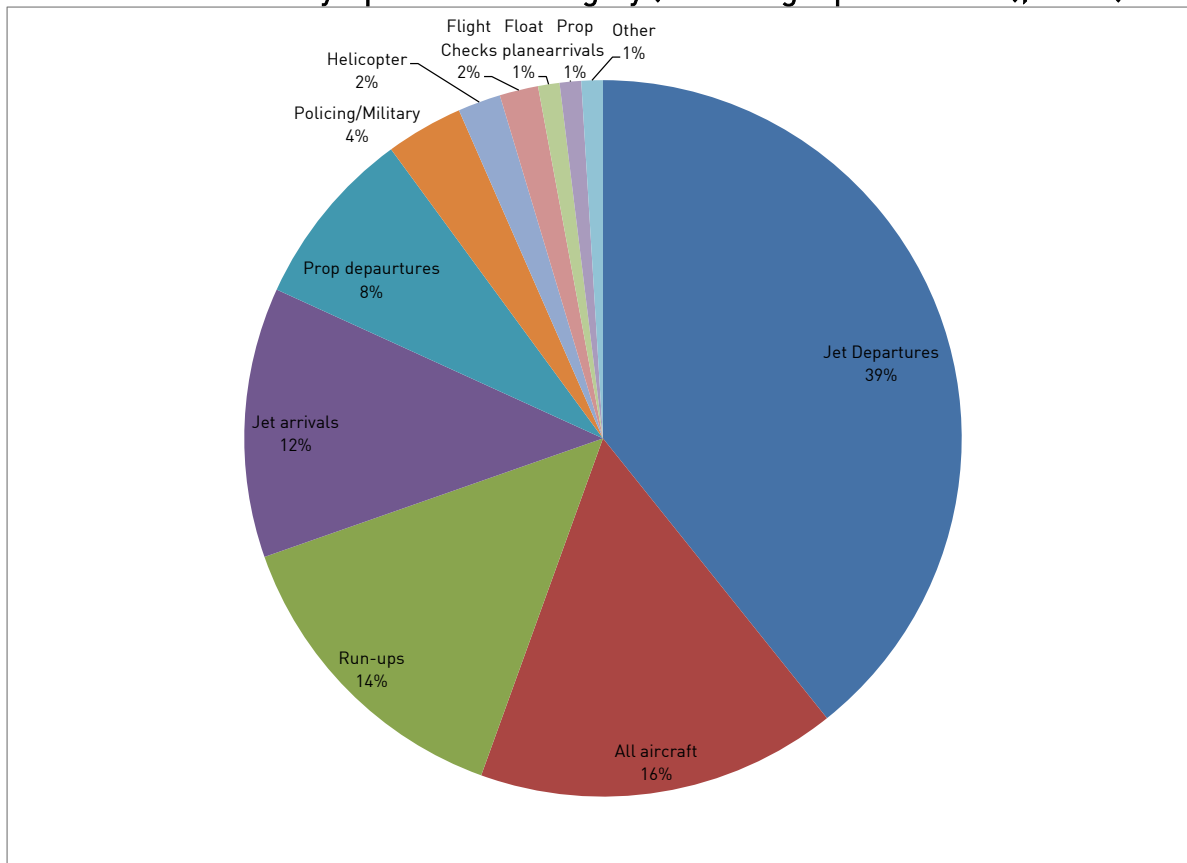


As illustrated, the top three operational categories associated with noise concerns were jet departures, jet arrivals, and prop departures. However, majority of concerns related to these operational categories were submitted by four individuals who registered the three highest numbers of concerns in 2017.



When a small number of individuals register multiple concerns, this can heavily influence the analysis. Therefore, to better understand the nature and trends of concerns from the other individuals, further analysis was done with the dataset that excluded the 776 concerns from top three individuals. Figure 15 illustrates a breakdown of remaining 517 concerns received from 250 individuals by operation type.

**FIGURE 15: Concerns by Operational Category (excluding top individuals), 2017 (n=517)**



As illustrated, jet departures remained the top operational category, accounting for approximately 39% of the concerns. Further analysis is provided below:

- Approximately 79% of concerns related to jet departures originated from residents in the City of Richmond and City of Vancouver, where areas are exposed to jet aircraft take-off activities at lower altitudes.
- Approximately 20% of concerns related to jet departures were received during the periods when the south runway was closed for regular and annual maintenance and project work.
- Approximately 16% of concerns were of a general nature with no specific operations referenced by the individuals, and these concerns were counted in the “All aircraft” category.

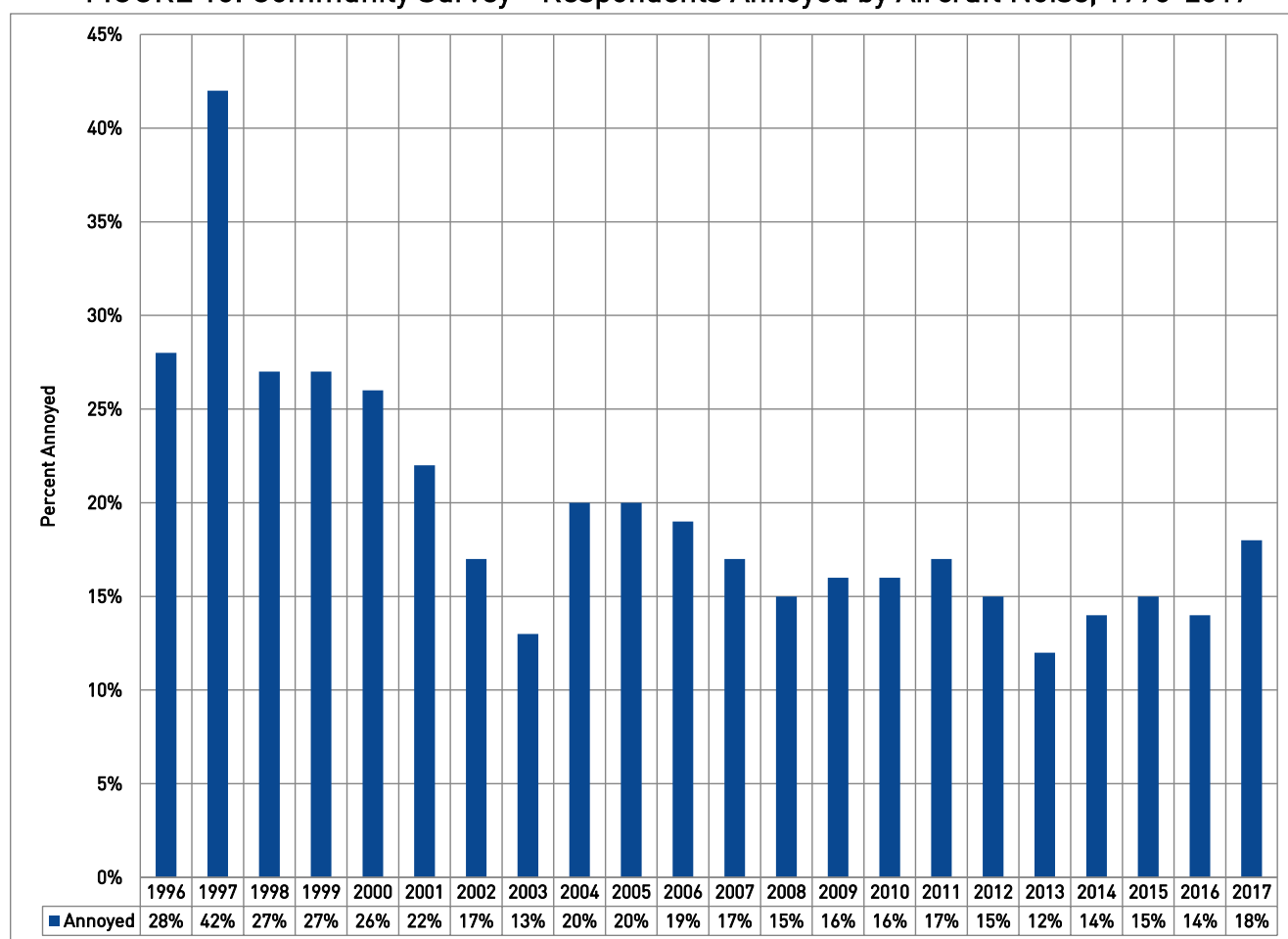
- Approximately 14% of these concerns were related to run-ups (75% of these concerns were submitted by a small number of individuals living in the close proximity to the south part of the airport where a number of operators maintain their aircraft).

## COMMUNITY SURVEY

Since the mid-1990s, the Airport Authority has commissioned a third party survey to track public attitudes and opinions about YVR on a number of topics including aircraft noise. This community survey represents the opinions of approximately 1,000 residents from across communities of the Lower Mainland and provides one means to gauge the level of community annoyance triggered by aircraft noise.

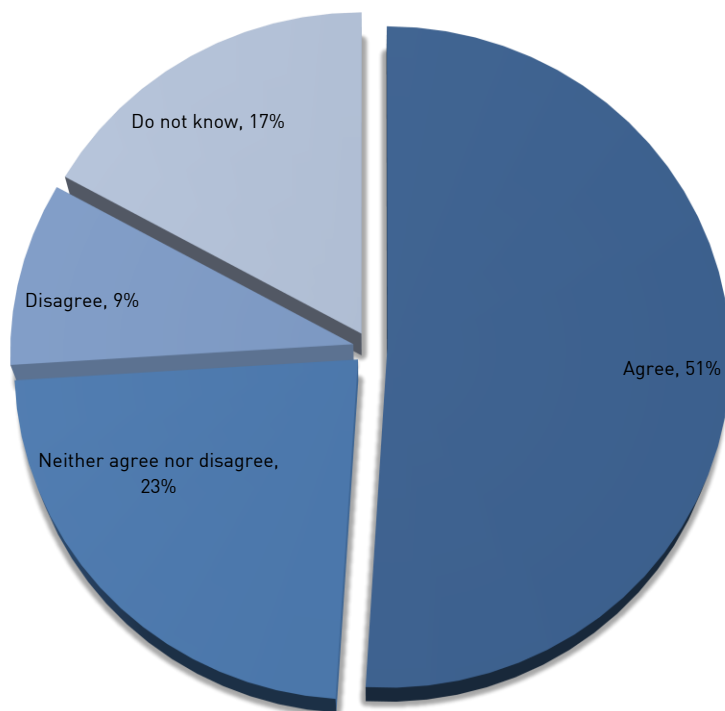
When asked, “*While you have been at home during the past year, have you been annoyed by aircraft noise in your neighbourhood?*” approximately 18% of the respondents in 2017 stated that they were annoyed by aircraft noise. Figure 16 illustrates the trend since 1996.

**FIGURE 16: Community Survey - Respondents Annoyed by Aircraft Noise, 1996-2017**



The community survey respondents are also asked to rate whether they agree or disagree with the statement “YVR keeps aircraft noise in my neighbourhood at an acceptable level”. In 2017, 51% of the respondents agreed with the statement while 9% of the respondents disagreed. Figure 17 provides the breakdown of responses.

**FIGURE 17: Community Survey - Response to the YVR Noise Management Effort, 2017**



## NOISE MONITORING DATA

The monitoring of noise levels and aircraft activity in the vicinity of the airport is a major component of the YVR Aeronautical Noise Management Program. To achieve this, the Airport Authority uses the Aircraft Noise & Operations Monitoring System (“ANOMS”) provided by Brüel & Kjær. This system allows for an objective assessment of aircraft noise levels in the surrounding communities, and allows for the identification of trends and checks for compliance with published procedures.

ANOMS combines noise data collected at Noise Monitoring Terminals (“NMT”), radar flight tracking data provided by NAV CANADA, and mapping data from a Geographic Information System. ANOMS correlates flight track data with noise monitoring data collected at each NMT, which then allows an understanding of the contribution of aircraft noise at each site. Figure 18 illustrates the NMT network and their relationship to runways at YVR. In 2009, the Airport Authority replaced and upgraded all hardware at the NMT sites and expanded the network from 16 to 20 NMTs.

**FIGURE 18: NMT Locations in the Lower Mainland**



## ANNUAL AVERAGE NOISE LEVELS (LEQ)

There are numerous metrics available to assess noise. One common metric for community noise assessment is the equivalent sound level, or average noise level (“Leq”) measured over a given period of time. Table 8 presents the annual average Leq, measured in units of A-weighted decibel or dBA, at each NMT location for the last five years. The average noise levels, presented below, include contributions from all sources in the community, including aircraft, motor vehicles, people, lawn mowers, barking dogs, etc.

**TABLE 8: Annual Average Noise Level (in dBA), 2013-2017**

YEAR	NMT# 1	NMT# 2	NMT# 3	NMT# 4	NMT# 5	NMT# 6	NMT# 7	NMT# 8	NMT# 9	NMT# 10
2013	-	65.8	53.4	60.1	58.6	60.1	-	53.0	51.0	55.3
2014	-	65.0	52.7	60.6	58.5	69.4	-	55.4	50.3	54.4
2015	61.4	65.1	52.7	60.3	58.4	61.7	58.4	52.0	50.1	54.3
2016	61.2	65.3	53.0	62.4	58.4	58.1	58.4	55.8	51.3	56.7
2017	61.0	64.9	54.1	59.9	58.5	57.1	57.5	51.4	50.1	55.1

YEAR	NMT# 11	NMT# 12	NMT# 13	NMT# 14	NMT# 15	NMT# 16	NMT# 17	NMT# 18	NMT# 19	NMT# 20
2013	61.2	67.4	60.6	55.3	52.9	55.3	53.7	57.8	53.3	54.4
2014	60.8	74.7	61.0	65.7	53.1	54.5	54.0	57.5	55.7	54.3
2015	61.4	65.1	61.5	64.1	53.5	56.3	56.2	54.7	55.9	53.0
2016	60.6	66.9	61.4	56.1	53.8	54.6	54.1	53.8	56.3	56.1
2017	61.1	73.3	61.8	58.9	53.3	54.3	54.2	53.7	55.3	60.0

## SINGLE EVENT NOISE LEVEL

Another metric used to assess noise is the single event noise level (“SEL”), measured in dBA. For an aircraft fly-over, either a landing or take-off, the SEL represents the total acoustic energy above a prescribed reference threshold. In general, the SEL is typically 10 dBA greater than the maximum noise level experienced during the aircraft fly-over. The primary use of the SEL is to provide a comparison of noise events with different noise levels and durations.

While reference thresholds are set individually at each NMT according to the ambient noise levels in the area, thresholds are typically set between 65 and 70 dBA during the day (7:00AM – 10:00PM) and between 55 and 60 dBA.

ANOMS categorizes noise events into types: correlated and uncorrelated. Correlated events are those associated with aircraft and uncorrelated events are those associated with other sound sources in the community. For NMTs located close to flight paths, noise events are

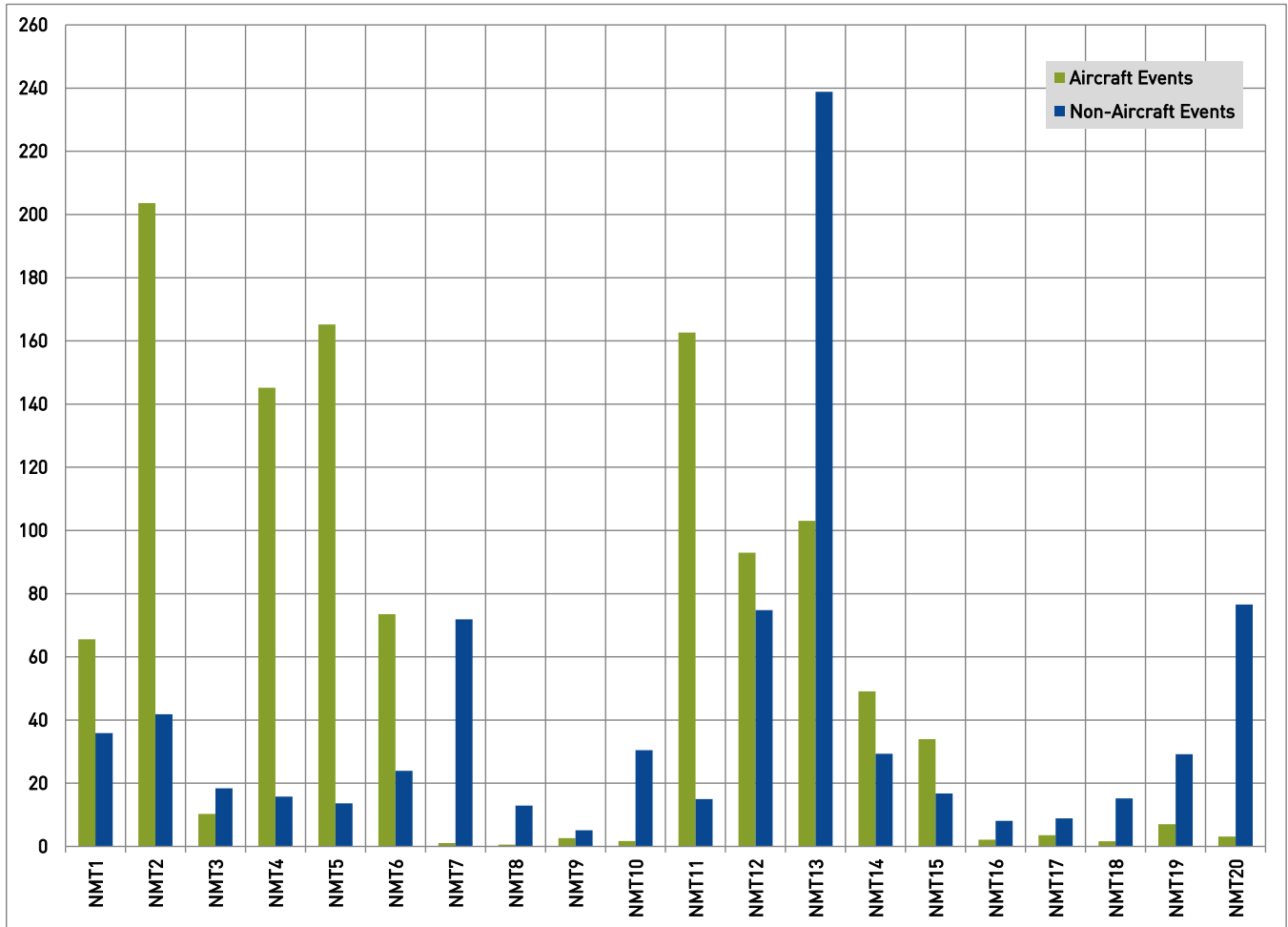
primarily associated with aircraft, whereas noise events at NMTs located farther away from the airport and flight path are primarily associated with non-aircraft sources.

Table 9 presents the 2017 daily average number of aircraft and non-aircraft noise events with a SEL above 70 dBA at each of the NMT locations. Figure 19 presents this same information graphically.

**TABLE 9: Average Daily Number of Noise Events at NMTs, 2017**

NMT #	Name	Location	Average number of DAILY noise events $\geq$ 70 dBA		
			Aircraft	Non-Aircraft	Total
1	Richmond Olympic Oval	6111 River Rd., Richmond	66	36	101
2	Airside Burkeville	Templeton St., Richmond	204	42	245
3	Lynas Lane Park	Lynas Lane & Walton Rd., Richmond	10	18	29
4	Tomsett Elementary	Odlin Rd. and No. 4 Rd., Richmond	145	16	161
5	Bath Slough	Bath Rd. & Bath Slough, Richmond	165	14	179
6	Outer Marker	Westminster Hwy & No. 7 Rd., Richmond	74	24	97
7	Crofton School	W41st & Blenheim St., Vancouver	1	72	73
8	McKechie School	W59th & Maple St., Vancouver	1	13	13
9	UBC	Northwest Marine Dr., Vancouver	3	5	8
10	Marpole	W67th & Cartier St., Vancouver	2	30	32
11	Bridgeport	No. 4 Rd. & Finlayson Dr., Richmond	163	15	178
12	West Sea Island	Airside YVR, Richmond	93	75	168
13	North Sea Island	Ferguson Rd., Richmond	103	239	342
14	Annieville-Delview Second	9111-116th St., Delta	49	29	78
15	Alex Fraser Bridge	North Delta Rec. Ctr. 11415-84th Ave., Delta	34	17	51
16	Burnaby - St. Francis	6610 Balmoral St., Burnaby	2	8	10
17	Maple Lane Elementary	Alouette Dr. & Tweedsmuir Ave., Richmond	4	9	12
18	South Delta - Tsawwassen	53rd Street & 8A Ave., Delta	2	15	17
19	North Surrey	82A Ave. & 146th St., Surrey	7	29	36
20	South Surrey	20th Ave. & Ocean Forest Dr., Surrey	3	77	80

**FIGURE 19: Average Daily Number of Noise Events at NMTs, 2017**





## ENVIRONMENT – YVR Noise Management

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E-mail: [noise@yvr.ca](mailto:noise@yvr.ca)

[WebTrak](#)

YVR Noise Information Line: 604- 207-7097

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## Note on Reported Figures and Data:

The Airport Authority receives aircraft operations data from NAV CANADA. This data includes daily aircraft arrivals and departures at YVR as well as aircraft transiting through the Vancouver Control Zone. Every effort is made to verify and correct anomalies in the dataset, and numbers stated in this report may vary slightly from those reported by others.

Version 1.00

- APR 26, 2018 -

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