

2013 AERONAUTICAL NOISE MANAGEMENT REPORT

-VANCOUVER AIRPORT AUTHORITY-

TABLE OF CONTENTS

Page No.

INTRODUCTION.....	1
THE HIGHLIGHTS.....	2
YVR OPERATIONS IN REVIEW.....	4
OPERATIONAL SNAPSHOT – FLEET MIX.....	6
JET AIRCRAFT FLEET MIX BY NOISE CERTIFICATION.....	7
AIR TRAFFIC FLOW.....	9
RUNWAY USE.....	10
RUN-UPS.....	13
COMMUNITY ENGAGEMENT.....	16
NOISE CONCERNS.....	19
NOISE MONITORING DATA.....	25

LIST OF TABLES

Table 1: Aircraft Operations at YVR, 2013.....	4
Table 2: ICAO Noise Certification of Jet Operations at YVR, 2013.....	7
Table 3: ACI Noise Rating Index of Jet Operations at YVR, 2013.....	8
Table 4: YVR Runway Utilization, 2013.....	10
Table 5: Number of Run-ups Performed at YVR, 2009-2013.....	13
Table 6: Run-up Types and Per cent total , 2013.....	14
Table 7: South Airfield Run-ups, Power Setting and Location, 2013.....	15
Table 8: Fly Quiet Award Winners, 2010-2012.....	17
Table 9: Annual Average Noise Level (in dBA), 2009-2013.....	26
Table 10: Average Daily Noise Events at NMTs, 2013.....	27

LIST OF FIGURES

Figure 1: YVR Annual Aircraft Movements & Passenger Statistics, 1996-2013.....	4
Figure 2: Percent Number of Runway Movements per Hour, 2013.....	5
Figure 3: Breakdown of Aircraft Types Operating at YVR, 2013.....	6
Figure 4: Monthly Distribution of Air Traffic Flow at YVR, 2013.....	9
Figure 5: YVR Runway Utilization – ARRIVALS, 2013.....	11
Figure 6: YVR Runway Utilization – DEPARTURES, 2013.....	12
Figure 7: Type and percentage of run-ups conducted for each hour at YVR, 2013.....	14
Figure 8: Number of Noise Concerns and Individuals, 2009-2013.....	19
Figure 9: Concerns by Operational Category, 2013.....	20
Figure 10: Concerns and Associated Aircraft, 2013.....	21
Figure 11: Number of Concerns & Individuals by Location, 2013.....	22
Figure 12: Geo-distribution of Noise Concerns (with 10 nm radius identified), 2013.....	23
Figure 13: Frequency and Geo-distribution of YVR Noise Concerns (with 10nm radius identified), 2013.....	23
Figure 14: Community Survey - Respondents <i>Not</i> Annoyed by Aircraft Noise, 1996-2013.....	24
Figure 15: NMT Locations in the Lower Mainland.....	25

LIST OF APPENDICES

Appendix A – YVR Aeronautical Noise Management Committee Membership	24
Appendix B – NMT Sound Level Data 1995-2012	27
Appendix C – Glossary and Definitions of Acoustical Terms.....	29

INTRODUCTION

As a community based organization, the Airport Authority is committed to the long-term health and vitality of our surrounding communities, and is dedicated to operating Vancouver International Airport (YVR) in a manner that minimizes negative impacts on the environment, while supporting the community demands for safe and efficient 24-hour airport services.

In 2013, YVR served over 17.9 million passengers and accommodated approximately 300,454 movements, making YVR the second busiest airport in Canada. With this level of aircraft activity, comes associated noise. To manage noise impacts on the surrounding community, the Airport Authority has a comprehensive aeronautical noise management program. This report provides a summary of efforts that were undertaken by the program for calendar year 2013, as well as information and statistics on aircraft operations, aircraft fleet mix, noise concerns, runway usage, and results of noise monitoring in the community.

The primary goal of this report is to share information with the community about noise management activities and to facilitate informed dialogue between stakeholders involved in managing aircraft noise. Data and information compiled for this report helps in discussions with members of the YVR Aeronautical Noise Management Committee (ANMC), a consultative group that provides advice and input on the development of initiatives through a collaborative process. The Airport Authority wishes to thank all ANMC members for their contributions in 2013.

THE HIGHLIGHTS

2013 saw the completion of a number of major initiatives contained in the [2009-2013 YVR Noise Management Plan](#). Below is a description of these initiatives.

NOISE MANAGEMENT PLAN 2014-2018

The year 2013 saw a close to the 2009-2013 YVR Noise Management Plan. As a requirement of the ground lease with Transport Canada, the Airport Authority is required to have a Noise Management Plan that addresses the airport's noise exposure on the surrounding communities.

Much of the work in 2013 focused on the development of the 2014-2018 YVR Noise Management Plan. Some of the major tasks completed during the development of the Plan included a comprehensive review of practices used at other airports as well as a collaborative and consultative process to determine stakeholder sentiment on noise issues. The process included:

- Administering an online survey developed and hosted by Vision Critical;
- Completing a review of noise management best practices (see below);
- Reviewing noise concerns received over the past five-year period;
- Consulting with each City staff and citizen representatives on the ANMC; and,
- Consulting with airlines, NAV CANADA, Transport Canada and other Airport Authority staff.

The Plan identifies ten areas of focus with supporting initiatives. The areas of focus include land-use planning, community awareness, industry awareness, run-up activities and performance-based navigation.

The final draft of the 2014-2018 YVR Noise Management Plan was submitted to Transport Canada for review and approval. Once approval is received, a copy of the Plan will be made available at www.yvr.ca/noise

NOISE MANAGEMENT: BEST PRACTICES REPORT

The Airport Authority commissioned AirBiz to carry-out a review of best practices report on aircraft noise management. As part of their work, AirBIZ reviewed technological advancements, noise management programs and public outreach initiatives at other international airports. The objective of the study was to provide information to ANMC members on the unique practices at other airports, and to help identify potential initiatives for consideration in the 2014-2018 YVR Noise Management Plan. A number of initiatives were assessed including airport policy, community outreach, technological advancements and aircraft phase-outs.

A copy of the AirBiz report may be found at www.yvr.ca/noise

PORTABLE NOISE MONITORING – Initiative #12

The Airport Authority set up the portable noise monitor in North Surrey from August 15 through to October 11, 2013. The monitoring site, located at Woodland Park Elementary (specifically 9025-158 Street, Surrey, BC) was set up in response to concerns related to aircraft noise.

During the 58-day monitoring period, a total of 1,357 noise events were measured at the site. Of these events, 51% (n=688) were related to YVR aircraft, 5% (n=70) were related to non-YVR aircraft, and the remaining 44% (n=599) were associated with other community sources. The full report can be accessed at www.yvr.ca/noise

AMENDMENT OF NOISE ABATEMENT PROCEDURES - NIGHT OPERATIONS - Initiative #1

Initiative #1 in the 2009-2013 YVR Noise Management Plan outlines efforts to manage noise during the night-time hours. In 2012, a study of night-time operations at YVR was completed to assist with reviewing the Airport Authority's guidelines for granting approval for jet operations between the hours of mid-night and 0700 local.

In 2013, the Airport Authority completed this review and submitted proposed amendments to the Noise Abatement Procedures (NAP) to Transport Canada for review and approval. The objective of the amendments are to ensure wording in the NAP were clear and concise, and to ensure consistency with the guidelines and procedures used by the Airport Authority for granting request to operate at night.

YVR OPERATIONS IN REVIEW

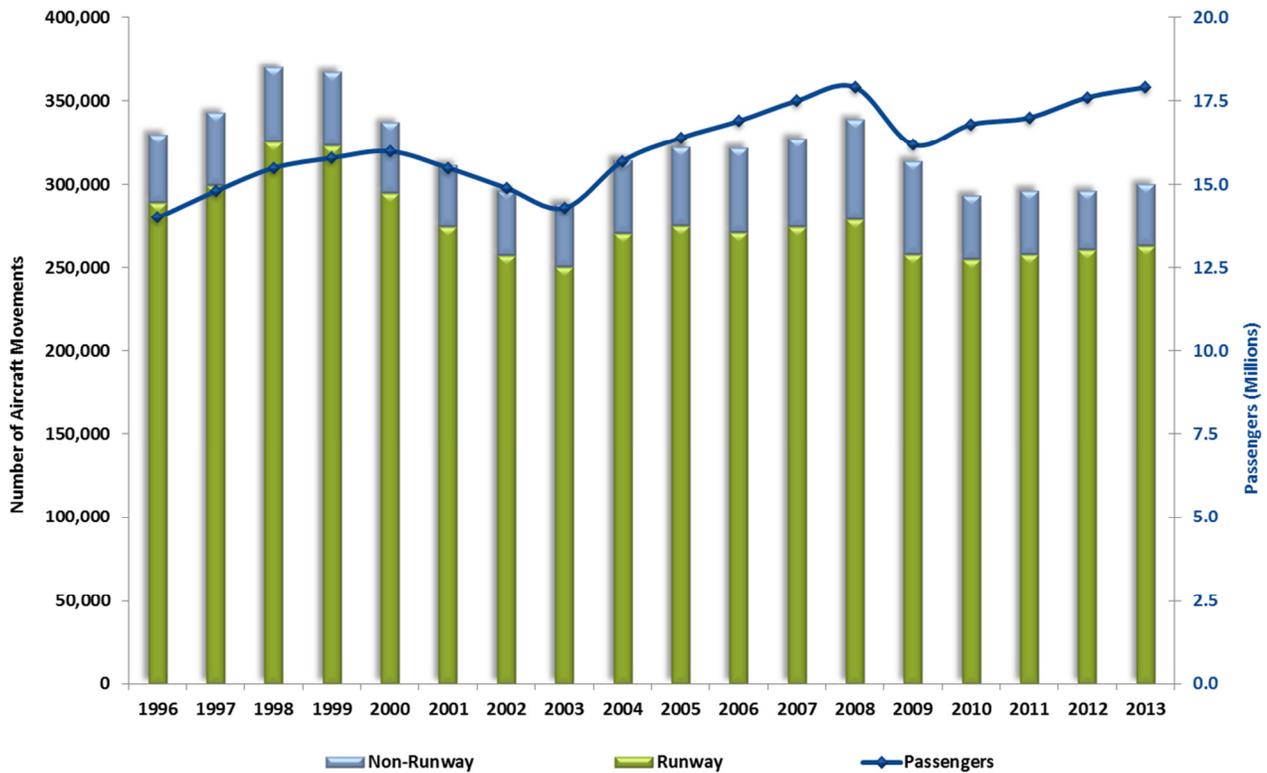
In 2013, there were positive indications of growth at YVR since the decline in aircraft movements and passengers that began in 2008 - due to the slowing global economy. Aircraft movements, cargo tonnage and total passengers all experienced modest growth from 2012.

Table 1 and Figure 1 present the operational statistics for 2013. As illustrated in Figure 1, the annual number of aircraft movements peaked in 1998. Since then, the number of movements has decreased, but the number of passengers served has continued to slowly increase. This means that aircraft are now carrying more passengers per aircraft movement, which is a benefit with respect to noise and air emissions.

Table 1: Aircraft Movements at YVR, 2013

Total Movements	300,454	1.3% increase from 2012
Total Cargo (Tonnes)	228,263	0.1% increase from 2012
Total Passengers	17,971,883	2.1% increase from 2012

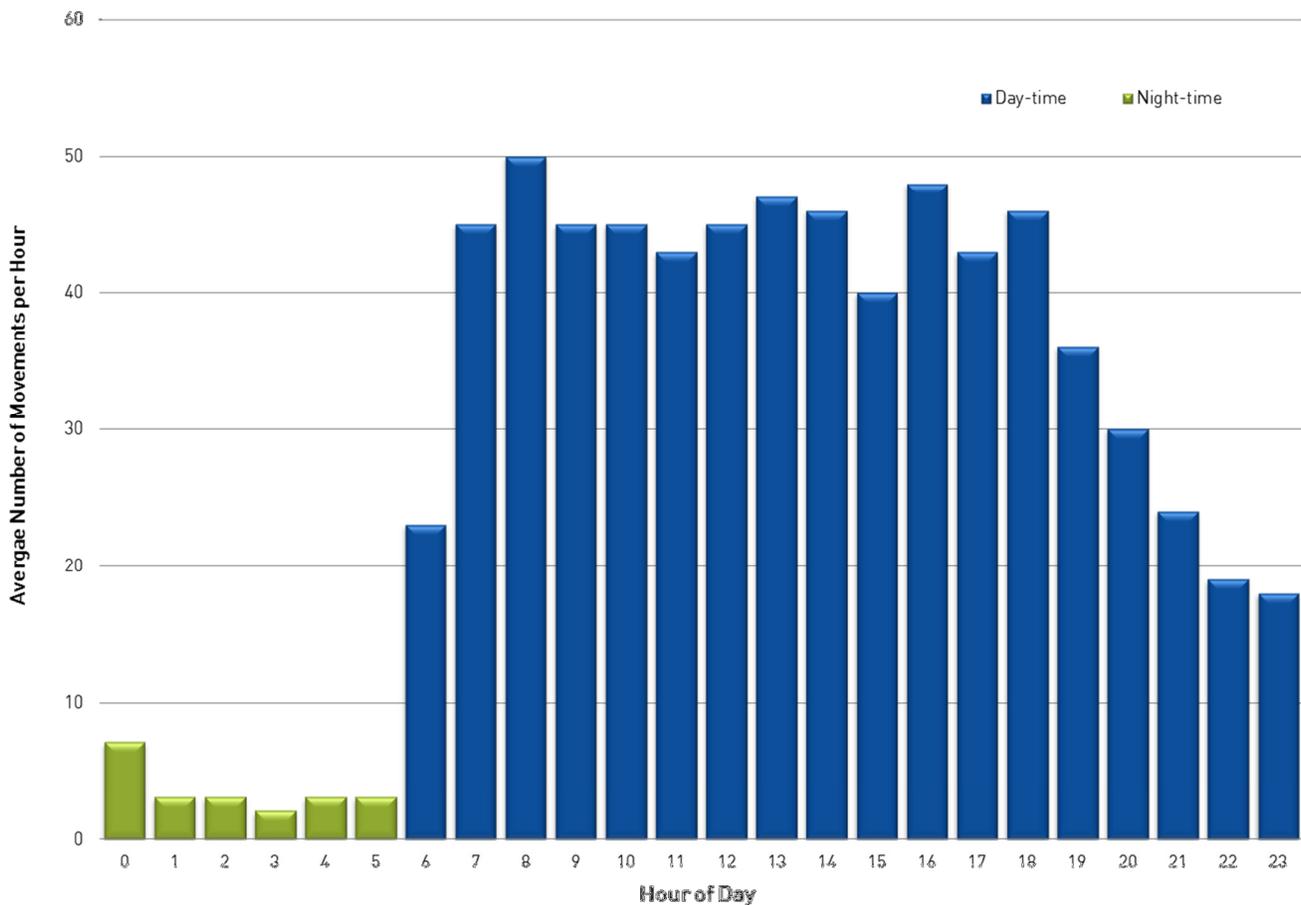
Figure 1: YVR Annual Aircraft Movements & Passenger Statistics, 1996-2013



Like most international airports around the world and all international airports in Canada, YVR operates 24-hours a day. While the majority of aircraft movements occur during the day-time hours¹, there are some operations during the night-time hours². These operations are primarily associated with the cargo/courier industry with some scheduled passenger flights to Asia-Pacific.

Approximately 97% of all aircraft activity at YVR occurs during the day-time hours. As illustrated in Figure 2, the peak times for aircraft movements during a typical day commences at 0700 and remains constant until 1800 hours where then activity drops of precipitously. Movements during the night-time hours account for approximately 3% of total aircraft activity at YVR.

Figure 2: Percent Number of Runway Movements per Hour, 2013



¹ Day-time is defined as the hours between 0600 - midnight.

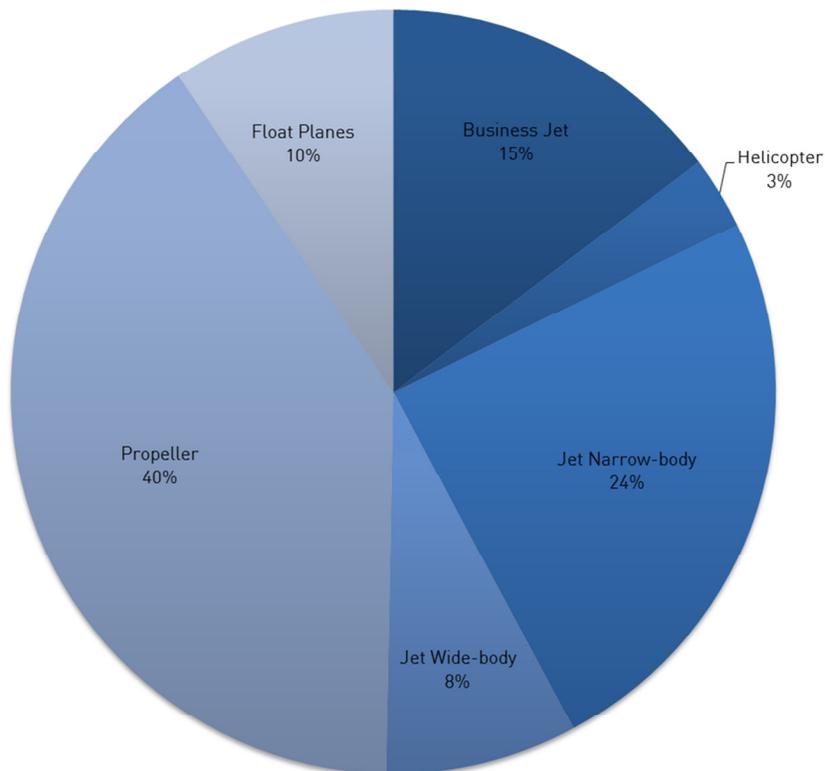
² Night-time is defined as the hours between midnight - 0600.

OPERATIONAL SNAPSHOT – FLEET MIX

YVR accommodates a diverse and unique mix of aircraft. There are a number of large commercial airlines, which use large wide-bodied jet aircraft, and a number of regional airlines that serve the province and western Canada with smaller propeller aircraft. This diversity in the fleet mix presents a tremendous challenge for air traffic control to integrate the wide range of aircraft sizes and differing performance characteristics in a safe and efficient manner. Figure 3 provides a breakdown of 2013 total movements by the following aircraft categories.

- Wide-body jets (e.g., B747; B777)
- Narrow-body jets (e.g., B737, CRJ),
- Business jets (e.g., Citation, Learjet),
- Propeller (e.g., Dash-8, Navajo, Beech)
- Float planes
- Helicopter (e.g., S76, B412)

Figure 3: Breakdown of Aircraft Types Operating at YVR, 2013



As illustrated, half of all movements at YVR are with propeller aircraft – this includes float plane activities. Jazz Aviation, Pacific Coastal, Harbour Air, and Central Mountain Air are the top four operators of propeller aircraft – accounting for approximately 70% of all propeller operations. The Bombardier Dash-8, Beech 1900, de Havilland Beaver, and the Piper Navajo are the most common propeller aircraft operating at YVR.

The most common jet aircraft types at YVR are the Embraer 190, Boeing 737-700/800, and the Airbus 320. These aircraft types account for approximately 47% of all jet operations. Air Canada, WestJet, Jazz Aviation, and United Airlines are the top four operators of jet aircraft – accounting for approximately 75% of all jet operations.

JET AIRCRAFT FLEET MIX BY NOISE CERTIFICATION

International Civil Aviation Organization – Annex 16

The 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 categorizes 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 development³.

A new noise standard for newly certified aircraft types was agreed at the 9th meeting of CAEP in February 2013. The new aircraft noise standard, which will be Chapter 14 of *Annex 16*, will apply to new large aircraft types certified after 2017 and to aircraft less than 55 tonnes after 2020. To meet this 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 to determine the noise certification of jet aircraft movements at YVR in 2013. Table 2 below presents the results of the analysis according to the Gross Take-off Weight (GTOW) of the aircraft. As illustrated, 95% of all jet aircraft operating at YVR meet Chapter 4 noise standards.

Table 2: ICAO Noise Certification of Jet Operations at YVR, 2013

ICAO Noise Certification	GTOW ≤ 34,000kg (n=18,600)	GTOW less than 34,000kg	
		Narrow Body (n=99,670)	Wide Body (n=25,710)
Chapter 3	8%	4%	3%
Chapter 4	92%	96%	97%

Airports Council International - Noise Rating Index

Airports Council International (ACI) is a non-profit global trade organization that represents the world's airports. When the Chapter 4 standard was adopted by ICAO, ACI concluded that the standard was insufficient to manage noise impacts and created the ACI Aircraft Noise Rating Index ("Index") as a tool to better define the wide ranging noise performance of aircraft within the Chapter 3 and Chapter 4 categories.

Based on measured noise levels in comparison to Chapter 3 noise certification limits, the aircraft are placed into one of six categories of noise performance. These range from "A" (quietest) to "F" (noisiest). Table 3 breaks down the percentage of aircraft operating at YVR based on this Index.

³ 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.

Table 3: ACI Noise Rating Index of Jet Operations at YVR, 2012

ACI Noise Rating Index	GTOW < 34,000kg (n=18,600)	GTOW greater or equal to 34,000kg	
		Narrow Body (n=99,670)	Wide Body (n=25,710)
A	91%	3%	6%
B	1%	18%	57%
C	0%	72%	21%
D	0%	3%	12%
E	0%	2%	3%
F	1%	2%	2%
UNKNOWN	7%	-	-

Gross Take-off Weight less than 34,000kg Category

This category contains business jets and smaller regional jets. The majority of aircraft in this category have an ACI Noise Rating Index of 'A'. The main aircraft in this 'A' category include the:

- CRJ-100/200 series (with CF34-3A1/3B1 engines)
- Learjet 31
- Learjet 45
- Cessna Citation V (model 560)

Gross Take-off Weight greater or equal to 34,000kg Narrow Body Category

This category has a high percentage of aircraft with an ACI Noise Rating Index of 'C'. The main aircraft in this 'C' category include the:

- E190 (with CF34-10E5A1G05 engines)
- B737-700 (with CFM56-7B-22 engines)
- A320 (with CFM56-5A1 engines)

Gross Take-off Weight greater than or equal to 34,000kg Wide Body Category

This category has a high percentage of aircraft with an ACI Noise Rating Index of 'B'. The main aircraft in this 'B' category include the:

- A330-200 (with Trent 772B-60 engines)
- B77W (with GE90-115BL/2 engines)
- B767-300 (with PW4060 engines)
- B77L (with GE90-110B1L engines)

Summary

With approximately 95% of the landings and take-offs by jet aircraft that meet the *quietest* ICAO Chapter 4 noise standards and ACI's Noise Rating Index of 'C' or better, it can be concluded that aircraft operating at YVR are some of the quietest aircraft in the industry.

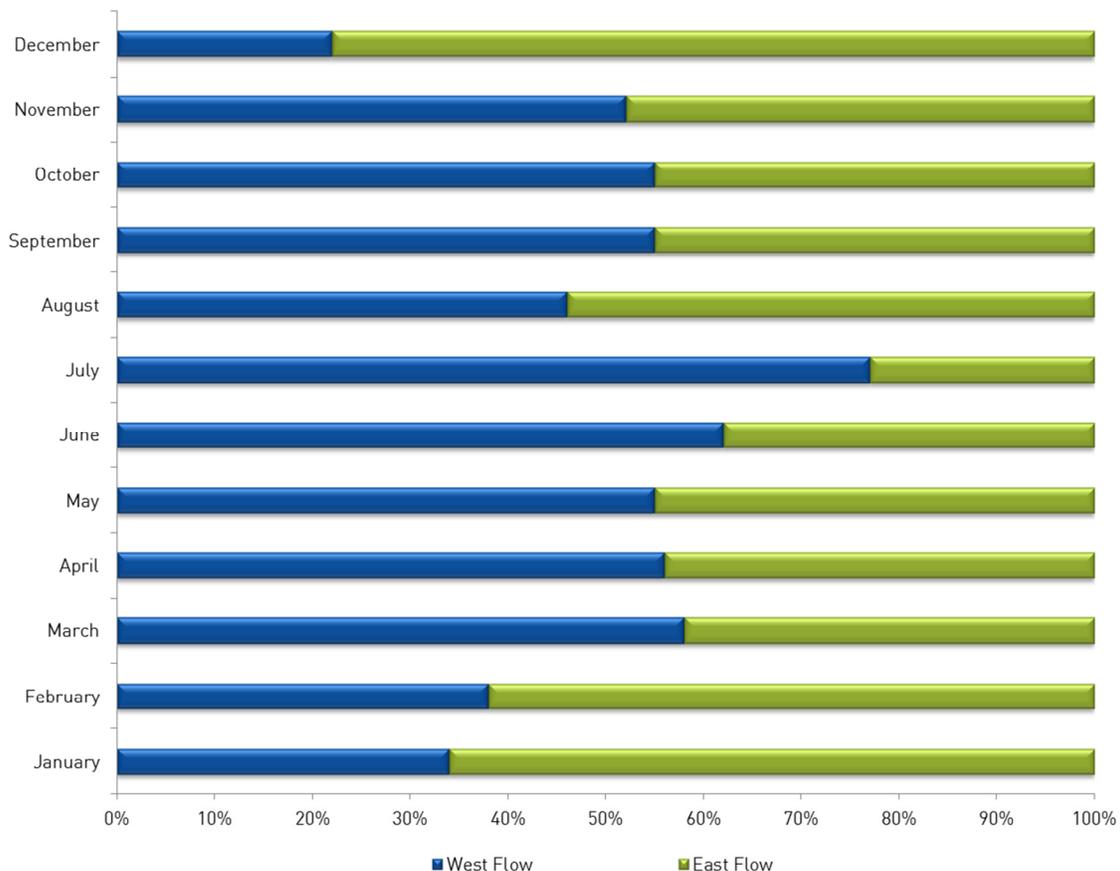
AIR TRAFFIC FLOW

YVR has two parallel runways and a crosswind runway. The parallel runways – 08R/26L and 08L/26R - are aligned in an east-west direction (aligned with magnetic headings of 083° and 263°) and the crosswind runway - 12/30 - is oriented in a northwest and southeast direction (aligned with magnetic headings of 125° and 305°).

Aircraft flight routes and patterns over the Lower Mainland are highly dependent on the active runway, which is determined by the wind conditions on the airfield. For safety reasons aircraft must land and take-off into the wind. Based on historical observations, departures and arrivals in an easterly direction (runway 08L and 08R active) are more common during the fall and winter months, and departures and arrivals in a westerly direction (runway 26L and 26R active) are more common during the spring and summer months. However, wind conditions are dynamic and may change throughout the course of a day, resulting in a change to the active runway.

A westerly flow of traffic is the preferred mode of operation to reduce noise exposure on the community as this places the noisiest operations (departures) over the Strait of Georgia. During the night-time hours, when the winds are calm, air traffic control will attempt to keep both arriving and departing aircraft over the Strait of Georgia in an effort to minimize noise on the community. However, this procedure of two-way flow is dependent on traffic volume and weather and cannot always be used. Figure 4 illustrates the monthly relationship between the easterly and westerly flow of traffic throughout 2013. Overall, the wind conditions were well balanced in 2013 with a 51% (westerly flow) and 49% (easterly flow) split. However, the month of July was predominantly a westerly flow and in December the traffic flow was predominantly easterly.

Figure 4: Monthly Distribution of Air Traffic Flow at YVR, 2013



RUNWAY USE

At YVR, there were no significant changes in how the runways were utilized in 2013 from 2012. Consistent with previous years, the south runway (08R/26L) was closed at night for an 8-week period over the summer to accommodate airfield lighting and maintenance work. During this period, aircraft were diverted to the north runway (08L/26R) which is normally closed to all operations between the hours of 2200-0700 (except for emergencies, weather, and airfield maintenance activities).

Table 4 provides information on the runway utilization for 2013. As demonstrated, departures usage favor 08R/26L and arrival usage favors 08L/26R. Figures 5 and 6 illustrate graphically the runway utilization information provided in Table 4.

Table 4: YVR Runway Utilization, 2013

ARRIVALS				Runway	DEPARTURES			
Days in 2013 with NO Activity	Range Of Activity	% Of Total	Average Daily ^A		Average Daily ^A	% Of Total	Range of Activity	Days in 2013 with NO Activity
23	0-162	15.3%	58	08R	193	47.3%	0-438	45
74	0-141	14.9%	66	26L	199	50.3%	0-437	35
60	0-341	33.2%	141	08L	19	1.4%	0-67	269
92	0-273	36.5%	173	26R	16	0.8%	0-59	303
352	0-68	0.1%	14	12	24	0.2%	0-63	357
361	0	0	0	30	0	0	0	365

^AThis number represents the average number of movements for the days when the runway was operational.

Figure 5: YVR Runway Utilization – ARRIVALS, 2013

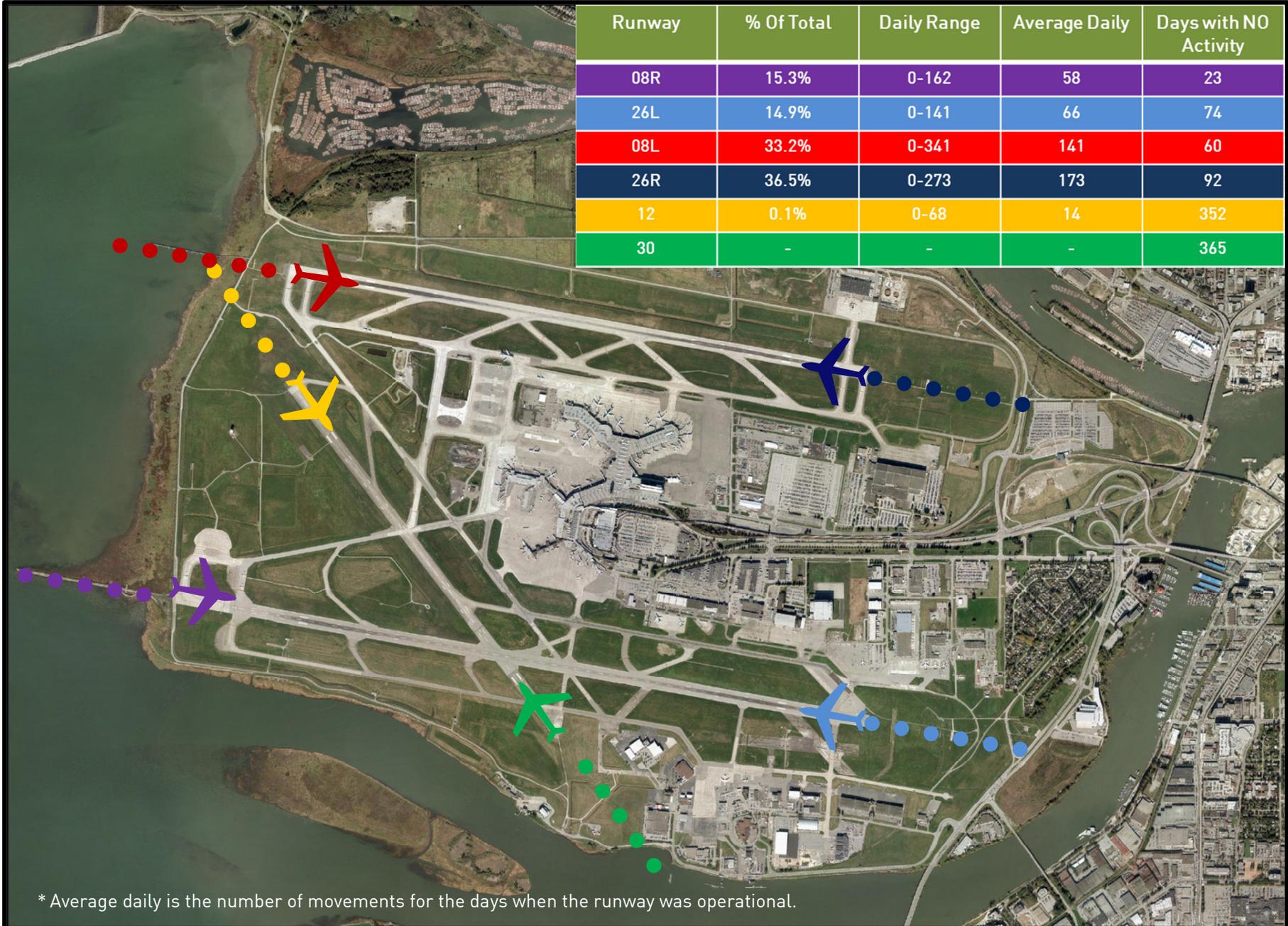
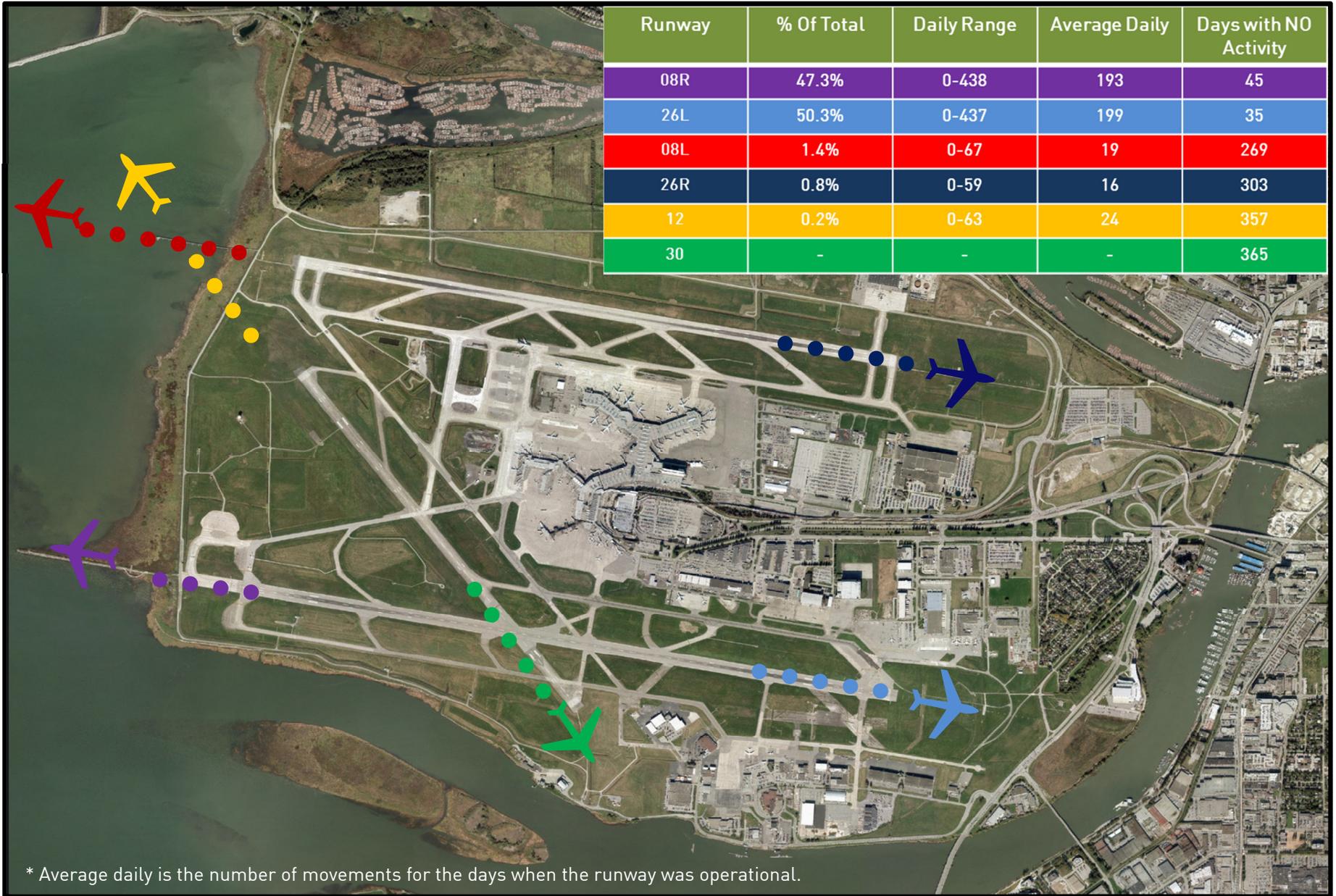


Figure 6: YVR Runway Utilization – DEPARTURES, 2013



RUN-UPS

Regular maintenance is a regulatory requirement by Transport Canada and manufacturers to ensure aircraft are safe to operate. Engine run-ups are performed as a part of maintenance work and involve running the engines at high power for a period of time to stress components and to simulate flight conditions. This ensures maintenance 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 reduce noise impacts from run-ups, the Airport Authority maintains directives and procedures which prescribe how and when run-ups can be performed. Maintenance operators must request permission of YVR Operations to perform a run-up, and approved run-ups will be assigned a location and heading to ensure safety and to minimize noise impacts on surrounding communities. Information on all maintenance run-ups are logged by the Airport Authority, and these records are routinely analyzed to track run-up activity and identify trends.

YVR Run-up Activity

Over the last five years, there has been an increase in the number of run-ups performed at YVR. This could be attributed not only to increased maintenance activity, but also because of continued engagement with the operators and diligent work to ensure understanding of the run-up directive and procedures. In 2013, there was a ten percent decrease in the number of run-ups carried out at YVR. Table 5 provides a breakdown of run-up activity at YVR over the last five years.

Table 5: Number of Run-ups Performed at YVR, 2009-2013

Year	Number of Approved Run-ups
2009	3,715
2010	4,114
2011	5,701
2012	5,706
2013	5,157

For the purpose of analysis, operators conducting run-ups are divided into two distinct areas of the airfield, those that are located on the north airfield and those that are located on the south airfield, with the south runway acting as the dividing line. In 2013, north airfield operators accounted for approximately 47% of all run-up activities at YVR. Run-ups by south airfield operators account for the remaining 53% of all run-ups at YVR. The run-ups by south-airfield operators are generally done on propeller aircraft, as many of the smaller operators that have their maintenance facilities on the south airfield.

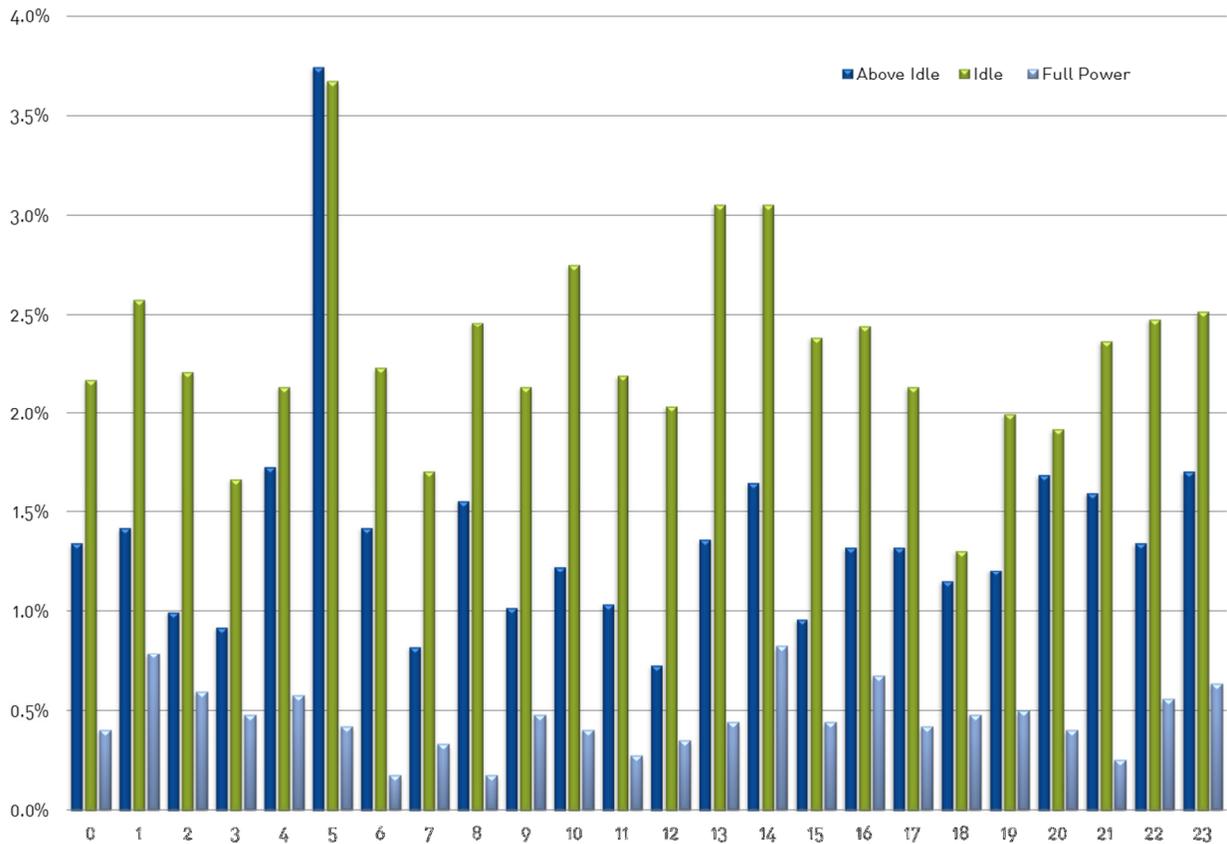
There are three distinct types of run-ups carried out by operators – Idle, Above Idle and Full Power. Full power run-ups are considered the noisiest because the engine is run at maximum power. Full power run-ups are very infrequent when compared to idle and above idle. This is due to the increased engine wear 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 2013.

Table 6: Run-up Types and Per cent total , 2013

Run-up Category	Percent Total of Runs
Idle	53%
Above Idle	36%
Full Power	11%

Run-ups occur at all times of the day, but those that occur at night may result in disturbance to residents located close to airport. Below Figure 7 provides a percentage breakdown for all run-ups (n=100%) carried out at YVR through-out YVR and the hour the runs occurred at. As Figure 7 illustrates, 'Idle' runs are by far the most common, followed by 'Above Idle' which are followed with very few 'Full Power' runs. The busiest hours for 'Above Idle' and 'Idle' run-ups are at 0500 and 1400 hours. The busiest hour for 'Full Power' run-ups is at 0100 and 1400 hours. However, as Figure 7 illustrates, operators are consistently busy throughout the day with run-ups being carried out at all times of the day. Aviation is a 24-hour industry and aircraft are required to be maintained when they are available, which is often at all hours of the day.

Figure 7: Type and percentage of run-ups conducted for each hour at YVR, 2013



Ground Run-up Enclosure (GRE)

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 GRE and the facility was opened on 25 January 2012. The GRE is designed to accommodate high power run-ups by propeller and business jet aircraft maintained on the south airfield. The facility is designed to provide an average of 15 dBA noise reduction, and residents to the south of YVR experience a 50% reduction in run-up noise.

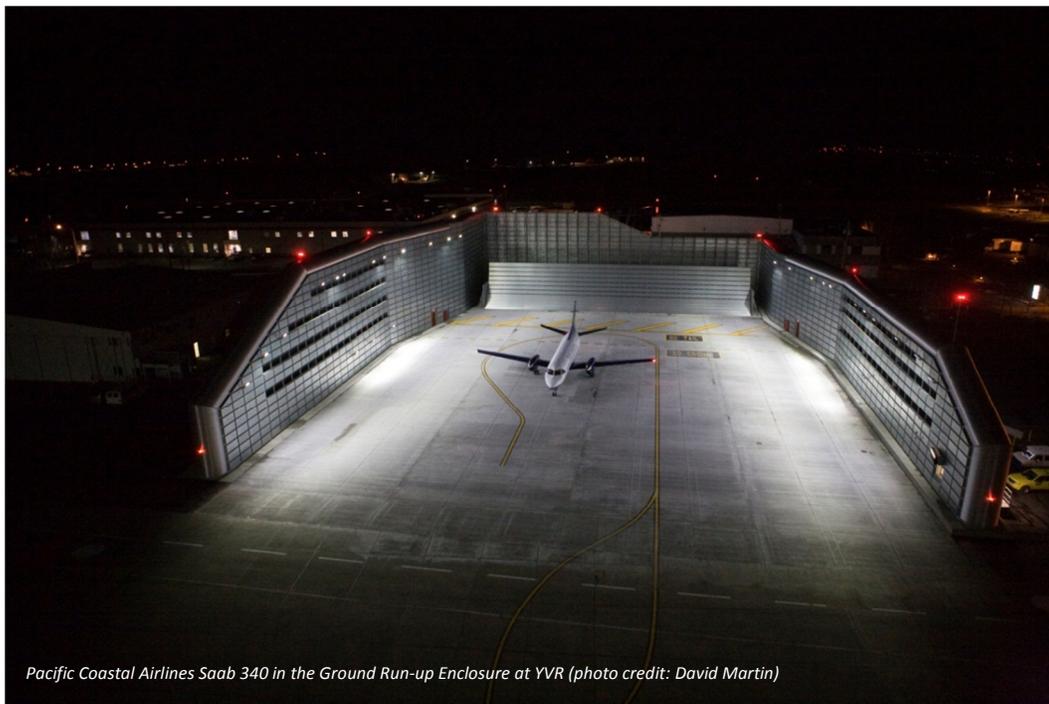
In 2013, 20% of all run-ups at YVR were conducted in the GRE. Table 6 provides a more detailed breakdown of south airfield run-ups and their location in comparison with the GRE.

Table 7: South Airfield Run-ups, Power Setting and Location, 2013

Power Setting	Location	Approx. % of South Airfield Run-ups
Above Idle	GRE	68%
	Apron III	30%
	Apron II	3%
Full Power	GRE	87%
	Apron I, II, III	13%

As illustrated in Table 7, the majority of south airfield high powered run-ups (i.e. 'Above Idle' and 'Full Power') were performed in the GRE. In 2013, there was a period of night-time construction on Taxiway 'F', which presented problems for some maintenance crews trying to access the GRE. As a result, some of the run-ups that would normally have used the GRE had to be accommodated at other locations on the airfield.

The GRE has been a great success from reducing noise in the community and operator usability. Operators often request use of the facility for their run-ups due to its safe and controlled setting.



COMMUNITY ENGAGEMENT

Education & Awareness

A key component of the YVR Aeronautical Noise Management Program is to educate and provide the community with information on airport operations and aircraft noise management activities. The following are some examples of education and awareness initiatives undertaken in 2012.

- Hosting quarterly meetings of the ANMC and posting meeting minutes on the airport's website.
- Discussing noise issue at the annual YVR Chief Pilot's meeting and presenting the YVR Fly Quiet Awards.
- Offering community noise information seminars.
- Providing access to the WebTrak community flight tracking system.

Aeronautical Noise Management Committee

Stakeholder involvement and consultation is an integral component to managing aircraft noise. The forum for this at YVR is the ANMC, whose membership includes a wide variety of stakeholders, including: cities, government, air traffic control, first nations, airlines, industry associations, and various departments within the Airport Authority (full membership list is provided in Appendix A). The objective of the ANMC is to discuss and address noise issues in a consultative and collaborative process. The ANMC also provides a forum for dialogue, exchange of ideas, and improved understanding between all stakeholders.

The ANMC meets quarterly and members are appointed independently by their respective organizations. In 2013, the major topics discussed at each of the quarterly meetings are presented below. Full minutes for each meeting are posted on the web and are available at www.yvr.ca

Quarter I Meeting – Discussion Highlights

- Discussed the data analysis and results of the 2012 Annual Noise Report.
- Discussed the development of the 2014-2018 YVR Noise Management Plan
- Discussed the development of best management practices and pilot brochure for YVR float plane operations
- Presentation by National Airport Council of Canada on aircraft noise and emissions.
- Noise abatement procedures – discussion of proposed amendments.

Quarter II Meeting - Highlights

- ANMC members were provided a tour of the YVR Wildlife Management Program.

Quarter III Meeting - Highlights

- NAV CANADA provided a review and summary of 2013 summer runway operations.
- Portable noise monitoring activities in North Surrey were discussed.
- Discussed the development of the 2014-2018 YVR Noise Management Plan
- Information on the new proposed ICAO Chapter 14 noise standard was provided.

Quarter IV Meeting - Highlights

- Draft layout of the YVR Float Plane Pilot Brochure was discussed.
- Information on the proposed amendments to the YVR Noise Abatement Procedures was provided.

- The results of temporary noise monitoring in North Surrey were presented and discussed. The full study can be found at www.yvr.ca
- Status update provided on the 2014-2018 YVR Noise Management Plan.
- Presentation provided on the development of Performance Based Navigation procedures and the role of Transport Canada, airlines, air traffic control, and airport authorities.
- Discussion on implementing Runway End Safety Areas (RESA) at YVR to meet Transport Canada requirements.

YVR Fly Quiet Awards

The 2012 YVR Fly Quiet Awards were presented at the annual YVR Chief Pilot’s Meeting. This is the sixth year for these awards and the goal is to raise the awareness of community noise issues within the aviation community. Eligibility criteria to win includes:

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 Aircraft Noise & Operations Monitoring System).
3. The airline must fly regular services at YVR.

The winners of the 2012 awards included: Jazz Aviation (propeller category); WestJet (narrow-body jets); and Japan Airlines (wide-body jets). Award winners for past years are presented in Table 8.

Table 8: Fly Quiet Award Winners, 2010-2012

YEAR	Propeller Wing	Narrow Body Jets	Wide Body Jets
2012			
2011			
2010			

Noise Information Seminars

The Airport Authority continued with its program of offering noise information seminars to members of the community. The objective of the seminars are to provide interested residents with information on the complex issue of noise management and provide an opportunity to ask questions about the YVR Aeronautical Noise Management Program. In 2013, two sessions were offered for the months of June and September.

WebTrak

Aviation is a very complex subject. To assist residents to better understand flight operations and noise levels in their community, the Airport Authority provides YVR WebTrak, a web-based tool that allows residents to view ‘real-time’ and historical flight and noise data collected by the Aircraft Noise & Operations Monitoring System⁴.

⁴ For aviation security reasons, ‘real-time’ flight tracks are delayed by 10 minutes and other sensitive information is not shown. In addition, sensitive operations, such as law enforcement and military flights, are not displayed. Historical data (up to 30 days in the past) is available for replay. The intended use of WebTrak is to display the general location and flow of air traffic in the vicinity of YVR. Information is not intended for navigational or regulatory enforcement purposes.

WebTrak is an extremely informative tool and allows residents to see the air routes and how aircraft navigate over the Lower Mainland. This can provide useful information to address concerns. WebTrak also allows residents to register complaints about specific aircraft or general concerns about aviation.

WebTrak can be accessed at the following link - [WebTrak](#).

NOISE CONCERNS

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

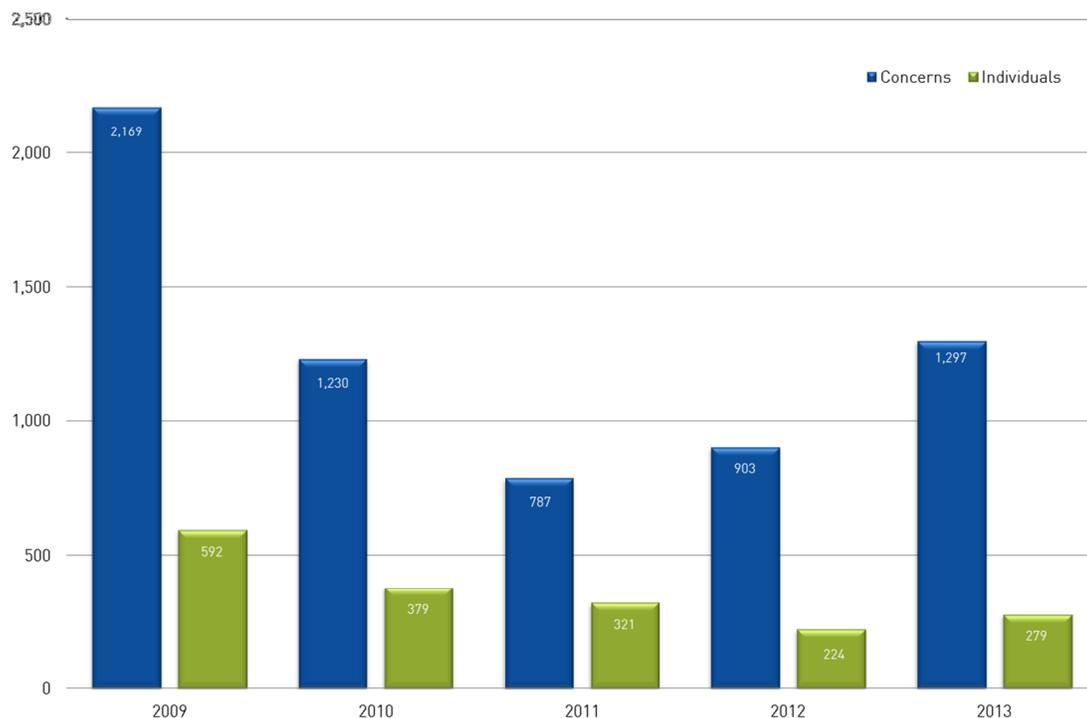
- Dedicated e-mail (noise@yvr.ca)
- [WebTrak](#)
- YVR Noise Information Line (604-207-7097), 24-hours.

Information provided by the complainant and investigation results are logged in a database, which is used to identify trends. The ANMC is provided a summary of complaints at each quarterly meeting and will review and discuss issues.

Number of Concerns

In 2013, the Airport Authority received 1,297 noise concerns from 279 individuals; this represents a 44% increase in concerns and a 25% increase in the number of complainants over 2012. The increase in concerns is attributed primarily to two individuals who submitted 39% (n=502) of all noise concerns in 2013. The top ten complainants in 2013 registered 69% (n=889) of all concerns, resulting in the remaining 269 complainants submitting 408 concerns. Figure 8 presents a breakdown on the number of concerns and individuals for the past five years, 2009-2013.

Figure 8: Number of Noise Concerns and Individuals, 2009-2013

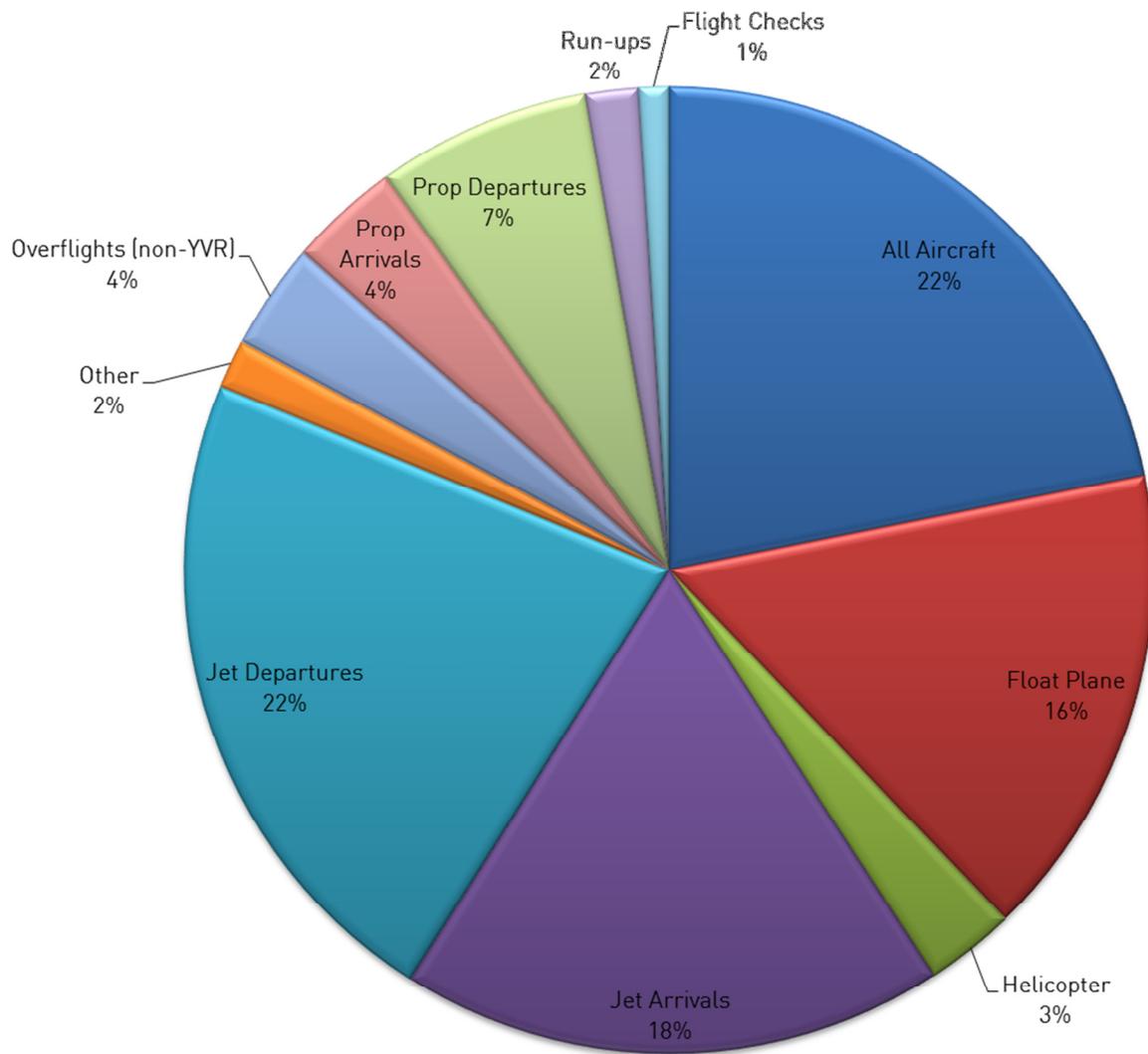


Noise Concern by Operation Type

Each noise concern that is registered is categorized into one of the following main operational categories: departure, arrival, over-flight, run-up, or circling. In some cases, Airport Authority staff will categorize the concern due to lack of information provided by the complainant. The nature of concerns varies greatly and often depends on where the individual lives with respect to the airport.

Figure 9 shows a breakdown of all noise concerns by operational categories. As a general observation, take-off activities generate the most concern. However, in 2013, float plane activities made up 16% of all concerns. This was not due to any changes to float plane operations, but rather to one individual submitting numerous concerns related to their activities in the Richmond area. 'All aircraft' activity concerns are related to complaints related to general concerns with no specificity of operation.

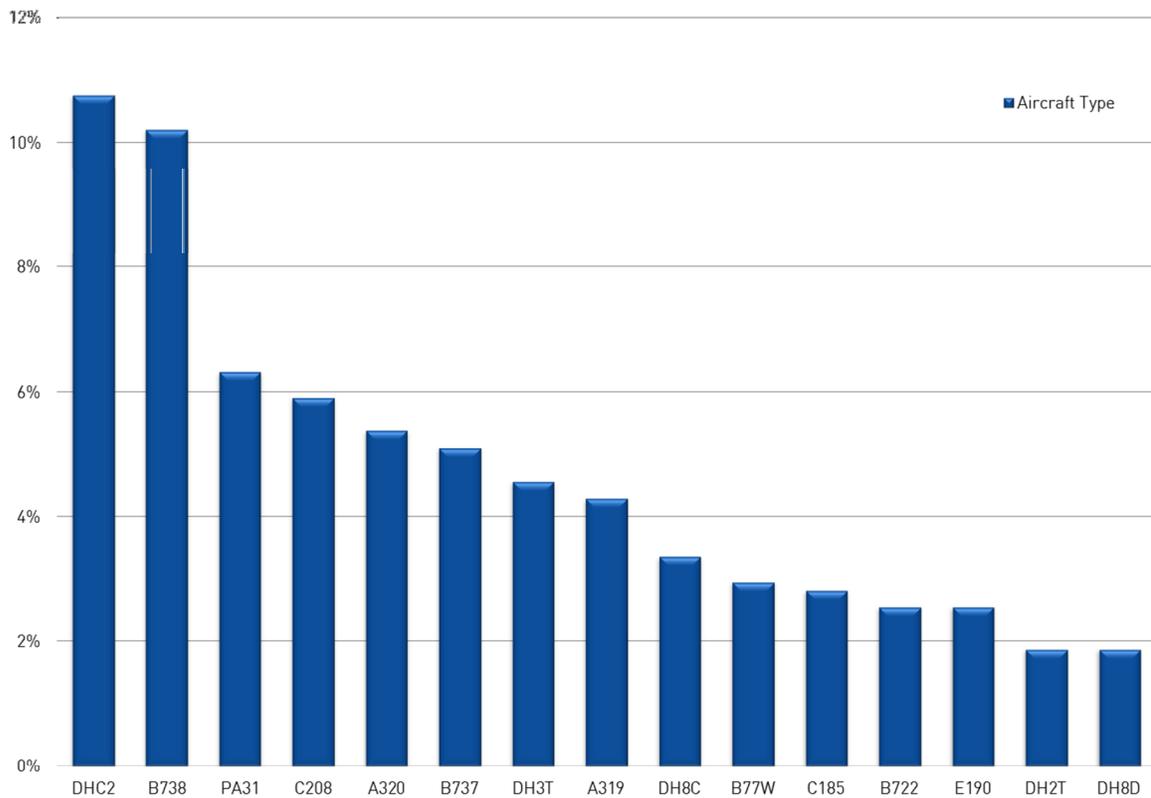
Figure 9: Concerns by Operational Category, 2013



Concerns by Aircraft Type

Certain aircraft can cause concern due to its technology or size. Not all concerns can be tagged to one aircraft operations. Figure 10 illustrates the top aircraft that invoke the most responses from the community.

Figure 10: Concerns and associated aircraft, 2013



In 2013, the aircraft type associated with the most community concerns was the DHC2 float plane. This fact is attributed to one individual in Richmond that submitted over two hundred concerns related to float plane operations. The remaining aircraft cited in concerns (Figure 10) are a mix of propeller and jet aircraft. Looking at the data, there is not a strong relationship between concerns and aircraft type / noise produced; however, there is a relationship between the individual complainant and aircraft type.

Noise Concerns by Location

Whenever possible, individuals are asked to provide information on which city they live in, which allows us to determine where concerns are originating from. Figure 10 illustrates the number of concerns and individuals for the various Cities in the Lower Mainland.

Figure 11: Number of Concerns & Individuals by Location, 2013

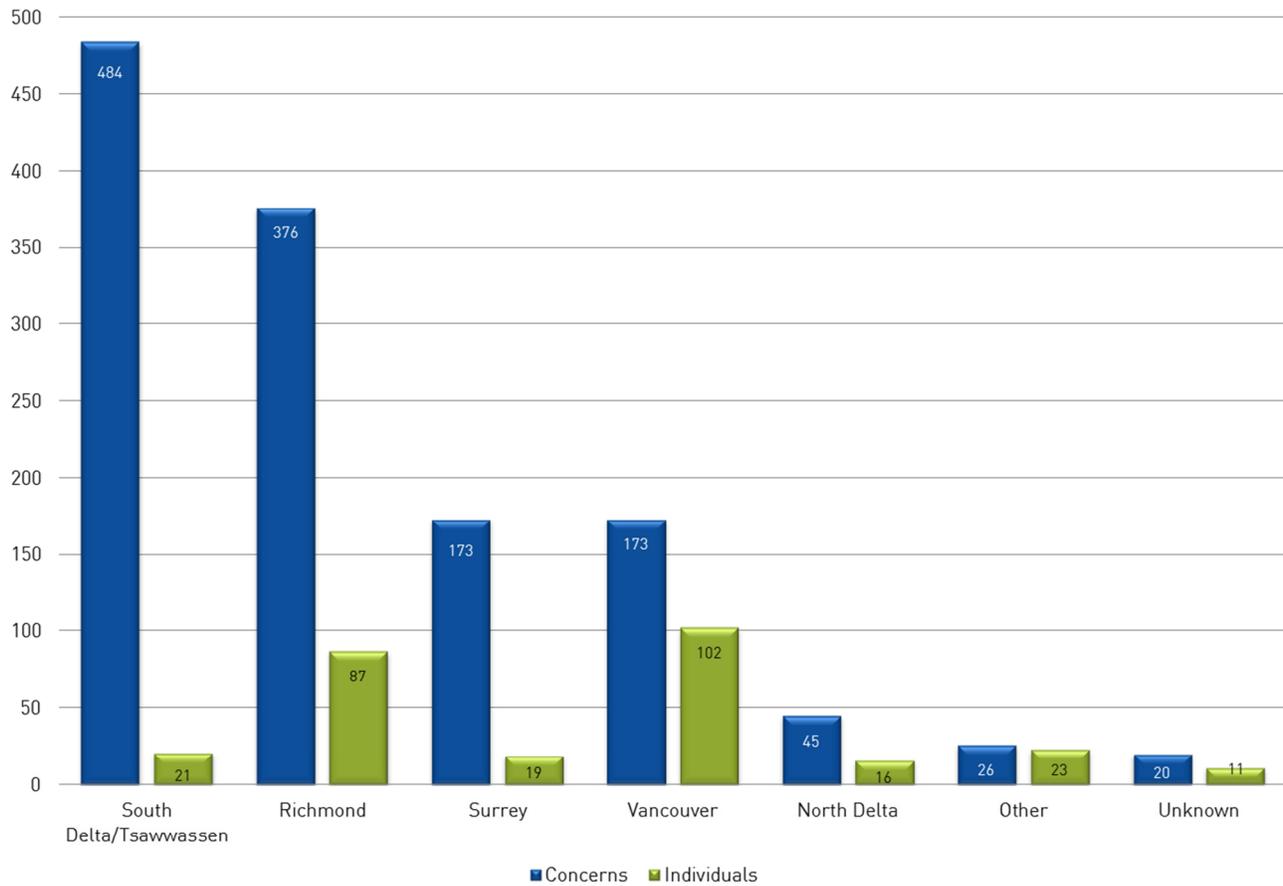


Figure 11 illustrates that there are a number of individuals that registered multiple concerns throughout the year. Some facts about the top ten complainants in 2013 include:

- Registering a combined total of 889 concerns, constituting 69% of all concerns;
- Registering 17 or more concerns each with the range being between 17-277;
- One individual, located more than 10 nautical miles (or 18.5 km) from the airport, registered 277 concerns (21% of all concerns in 2013)⁵;
- One individual, located within Richmond and near the arrival and departure route for float planes registered 225 concerns (17% of all concerns for 2013); and
- Seven out of the 10 individuals are located further than 10 nm from the airport.

Figure 12 represents the geodistribution of concerns in the Lower Mainland. Locations closer to the airport 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.

⁵ Under its Ground Lease with the Federal Government of Canada, the Airport Authority is responsible for managing noise concerns within 10 nautical mile (nm) of the airport. Concerns related to noise outside this area can be directed to Transport Canada.

Figure 12: Geo-distribution of Noise Concerns (with 10 nm radius identified), 2013

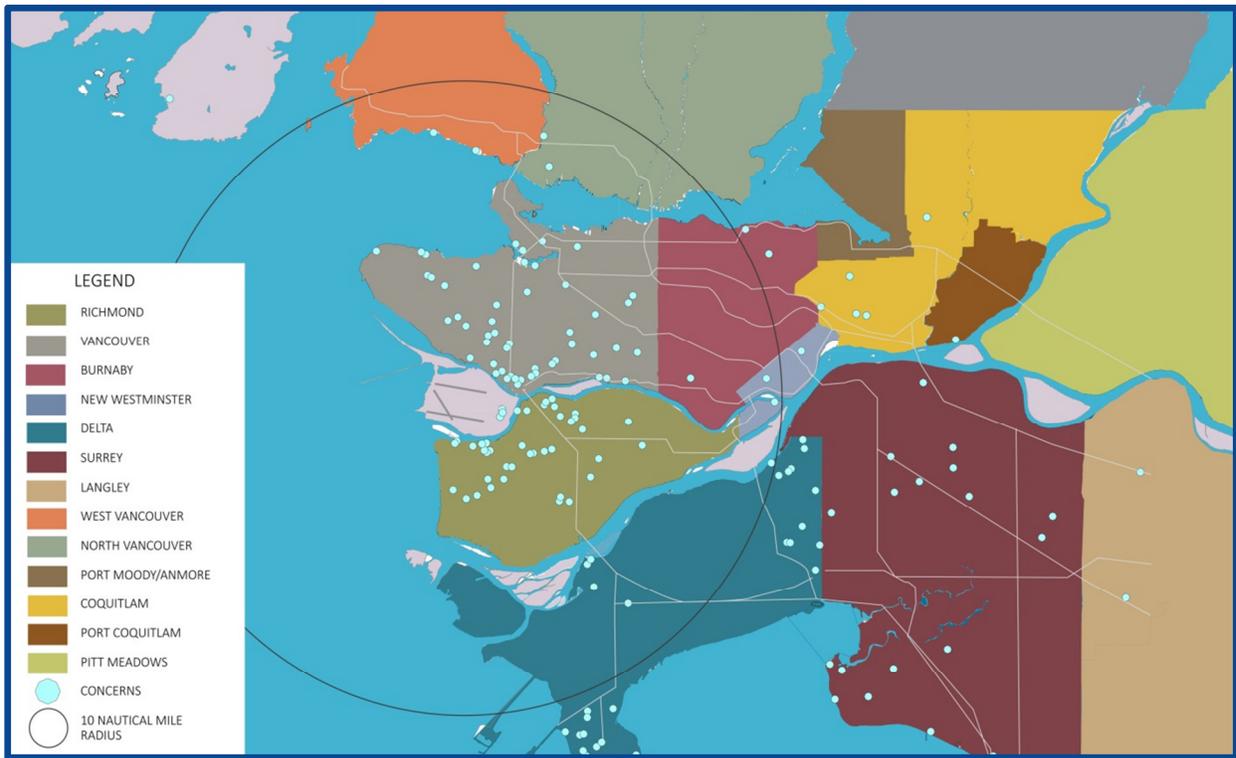
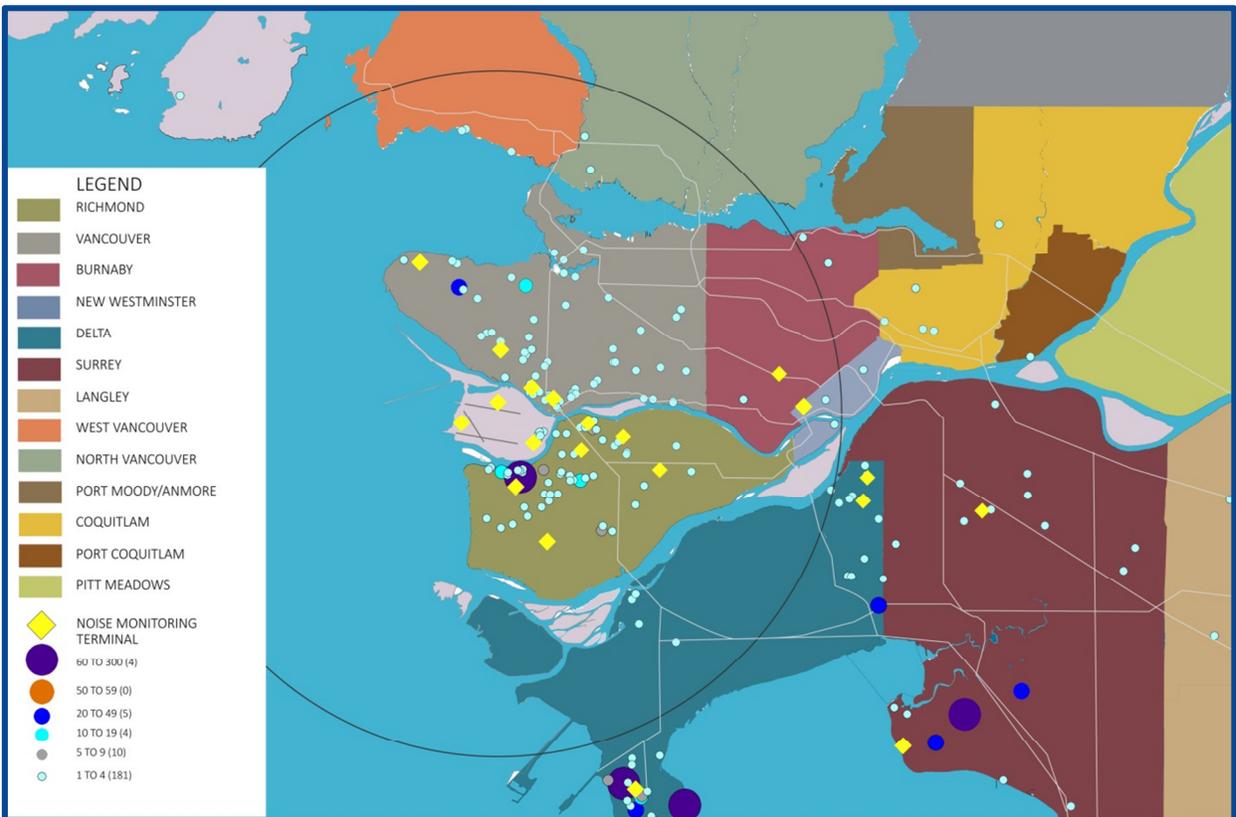


Figure 13: Frequency and Geo-distribution of YVR Noise Concerns (with 10nm radius identified), 2013



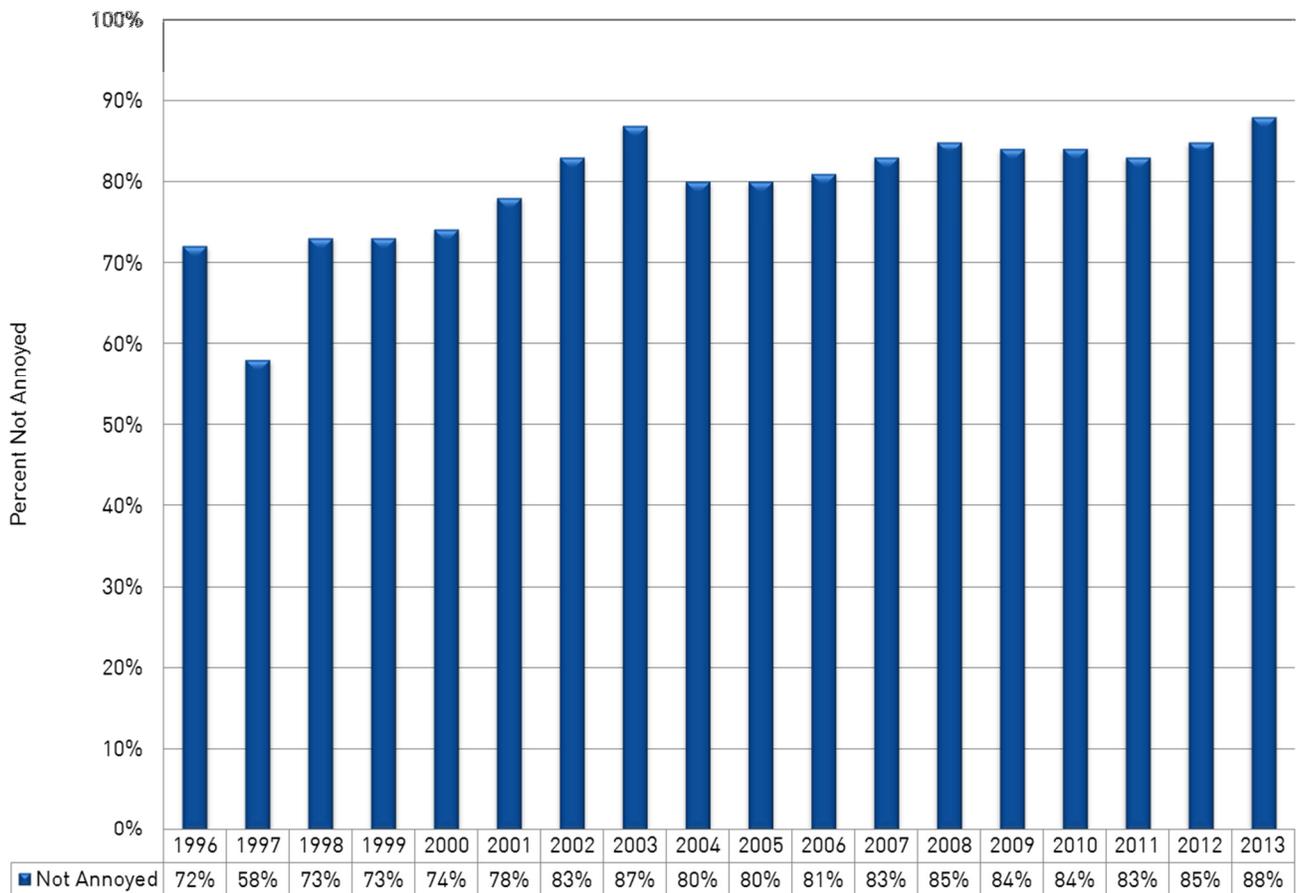
In Figure 13, each dot and its size represents a range of concerns originating from that area. As illustrated, seven individuals logged over 20 concerns with five out of the seven individuals living in areas well outside the 10 nm radius. Concerns outside the 10nm radius are generally related to over-flight activities where aircraft altitudes range from 6,000 feet Above Sea Level (ASL) to upwards of 15,000 feet ASL depending on location.

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 impact of 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 88% of the respondents in 2013 stated that they were not annoyed by aircraft noise. Figure 14 illustrates the trend since 1996.

Figure 14: Community Survey - Respondents Not Annoyed by Aircraft Noise, 1996-2013



NOISE MONITORING DATA

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

ANOMS combines noise data collected at Noise Monitoring Terminals (NMT) with radar flight tracking data from NAV CANADA⁶ and mapping data from a Geographic Information System (GIS). ANOMS correlates flight track data with noise monitoring data collected at each NMT sites around YVR. Figure 15 illustrates the NMT network and their relationship to runways at YVR. In 2009, the Airport Authority replaced and upgraded all hardware at the NMTs sites and expanded the network from 16 to 20 NMTs.

Figure 15: NMT Locations in the Lower Mainland



⁶ NAV CANADA is the not-for-profit company with provides civil air navigation services in Canada. NAV CANADA provides air traffic control, flight information, weather briefings, aeronautical information services, airport advisory services, and maintains the electronic aids to navigation.

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 9 presents the annual average Leq, measured in units of A-weighted decibel (or dBA), at each NMT for the last five years. Appendix B provides more annual Leq data for each NMT. The average noise levels, presented below, include contributions from all sources, including aircraft, motor vehicles, people, lawn mower, barking dogs, etc. A brief explanation on noise concepts and terminology is provided in Appendix C.

Table 9: Annual Average Noise Level (in dBA), 2009-2013

YEAR	NMT#1	NMT#2*	NMT#3	NMT#4	NMT#5	NMT#6	NMT#7	NMT#8	NMT#9	NMT#10
2009	62.6	65.9	56.4	61.3	58.5	58.5	53.3	52.3	50.4	54.6
2010	-	66.2	53.4	61.6	59.2	58.6	51.3	52.0	50.4	54.5
2011	-	65.3	53.2	61.6	60.8	58.2	51.6	51.8	50.4	54.2
2012	-	65.5	53.5	60.9	58.8	58.2	-	52.2	50.7	54.0
2013	-	65.8	53.4	60.1	58.6	60.1	-	53.0	51.0	55.3

YEAR	NMT#11	NMT#12*	NMT#13*	NMT#14	NMT#15	NMT#16	NMT#17	NMT#18	NMT#19	NMT#20
2009	61.0	76.2	61.9	55.0	52.2	64.2	56.6	53.6	55.7	54.4
2010	61.0	62.8	61.4	55.2	53.6	55.2	56.5	53.5	53.8	54.2
2011	60.9	68.3	60.8	56.4	52.4	54.9	56.5	53.4	55.9	54.4
2012	60.1	63.9	59.5	55.1	52.9	54.9	53.5	53.9	53.9	53.4
2013	61.2	67.4	60.6	55.3	52.9	55.3	53.7	57.8	53.3	54.4

*These NMTs are located on Sea Island and will have higher readings than other NMTs at other locations in the Lower Mainland.

The majority of monitoring locations experienced a similar or lower level of noise than in previous years. NMT#18 experienced the largest increase in noise levels (3.9 dBA) from 2012 to 2013. NMT #18 is located in South Delta/Tsawwassen on an elementary school. The reason for the increase in noise at this location is unknown; however, the noise measured at this location not only measures aircraft noise, but all ambient noise. An increase in noise could be attributed to local noise including construction activities in the area.

For a number of NMTs, the data shows a trend of decreasing noise levels within community (see Appendix B for the 1995-2013 data). This is particularly noticeable at the NMTs that have data dating back to 1995. In 1995, aircraft were significantly louder and there were more aircraft operations than in 2013.

Single Event Noise Level

Another metric used to assess noise is the single event noise level (SEL), also measured in dBA. The primary use of an SEL is to provide a comparison of noise events with different noise levels and durations. A brief explanation on noise concepts and terminology used in this report is provided in Appendix B.

Noise events at the NMT sites can be categorized as either *aircraft* or *non-aircraft*.

- Aircraft-related noise events are those associated with an aircraft operation based on radar flight track information. In most cases, the SEL for an aircraft related noise event is typically 10 dBA greater than the maximum noise level experienced during the event.
- Non-aircraft related noise events are associated with other sources in the community.

Table 10 presents the 2013 daily average number of aircraft and non-aircraft daily noise events above 70 dBA at each of the NMT locations. For those locations close to the airport or near major flight paths, the noise events tend to be primarily aircraft-related, whereas noise events at NMTs located farther from the airport are primarily non-aircraft related.

Table 10: Average Daily Noise Events at NMTs, 2013

NMT Site	Name	Location	Average number of DAILY noise events ≥ 70 dBA		
			Aircraft	Non-Aircraft	Total
1	Richmond General Hospital ^A	n/a			
2	Airside Burkeville	Templeton St., Richmond	122	135	257
3	Lynas Lane Park	Lynas Lane & Walton Rd., Richmond	11	25	36
4	Tomsett Elementary	Odlin Rd. and No. 4 Rd., Richmond	121	20	141
5	Bath Slough	Bath Rd. & Bath Slough, Richmond	152	16	168
6	Outer Marker	Westminster Hwy & No. 7 Rd., Richmond	84	37	121
7	Crofton School ^B	W41st & Blenheim St., Vancouver	-	-	-
8	McKechnie School	W59th & Maple St., Vancouver	2	12	14
9	UBC	Northwest Marine Dr., Vancouver	3	10	13
10	Marpole	W67th & Cartier St., Vancouver	9	22	31
11	Bridgeport	No. 4 Rd. & Finlayson Dr., Richmond	160	14	174
12	West Sea Island	Airside YVR, Richmond	100	189	289
13	North Sea Island	Ferguson Rd., Richmond	71	200	271
14	Annieville-Delview Second	9111-116th St., Delta	42	25	67
15	Alex Fraser Bridge	North Delta Rec. Ctr. 11415-84th Ave., Delta	37	51	88
16	Burnaby - St. Francis	6610 Balmoral St., Burnaby	4	6	10
17	Maple Lane Elementary	Alouette Dr. & Tweedsmuir Ave., Richmond	4	9	13
18	South Delta - Tsawwassen	53rd Street & 8A Ave., Delta	4	41	45
19	North Surrey	82A Ave. & 146th St., Surrey	9	31	40
20	South Surrey	20th Ave. & Ocean Forest Dr., Surrey	4	31	35

^A The NMT was permanently removed from this location at the request of the property owner. The Airport Authority is continuing to look for a new location for this NMT in 2014.

^B The NMT has been temporarily removed due to construction at the school. The NMT will be reinstated once construction is complete.

Appendix A

YVR AERONAUTICAL NOISE MANAGEMENT COMMITTEE MEMBERSHIP

As of December 2013

MEMBERS:

Rick Hedley

Citizen Representative, Corporation of Delta

Margot Spronk

Citizen Representative, Richmond

Don Flintoff

Citizen Representative, Richmond

Jonathan Parker

Citizen Representative, Vancouver

Meg Brown

Citizen Representative, Vancouver

Ron Sorenson

Citizen Representative, Surrey

Victor Wei

City of Richmond, staff representative

Jim Bailey

City of Vancouver, staff representative

Michael Gomm

Corporation of Delta, staff representative

Craig MacFarlane

City of Surrey, staff representative

Doug Martin

Airline Operators Committee (Air Canada)

Ahmad Zakaria

Airline Operators Committee (Lufthansa)

Don McLeay

National Airlines Council of Canada

Terry Hiebert

Floatplane Operators Association

Scott MacPherson

Canadian Business Aviation Association

Marlene Keefe

Air Canada Pilots Association

John Nehera

Transport Canada

Brent Bell

NAV CANADA

Willard Sparrow

Musqueam Indian Band

Brett Patterson

Director Airside Operations, Airport Authority

Shaye Folk-Blagbrough

Environmental Analyst, Airport Authority

Mark Cheng

Supervisor Noise & Air Quality, Airport Authority

CHAIR PERSON:

Anne Murray

Vice-President Community & Environmental Affairs, Airport Authority

SECRETARIAT:

Jody Armstrong

Administrative Assistant, Airport Authority

Appendix B

NMT Sound Level Data 1995-2012

Data below represents the annual average Leq, measured in units of A-weighted decibel (or dBA), at each NMT from 1995- 2012.

YEAR	NMT#1	NMT#2	NMT#3	NMT#4	NMT#5	NMT#6	NMT#7	NMT#8	NMT#9	NMT#10
1995	69.9	71.2	58.0	69.7	59.0	59.3	52.4	53.1	-	-
1996	68.7	71.4	57.8	69.7	59.0	61.1	52.7	55.6	57.9	53.3
1997	64.8	71.8	57.0	69.1	60.5	59.3	52.8	54.0	57.9	53.7
1998	67.1	70.8	56.9	68.3	59.8	62.1	52.7	57.3	57.4	53.6
1999	64.4	71.0	58.5	68.3	60.2	62.0	52.9	54.4	58.1	65.6
2000	62.3	69.5	56.3	67.7	59.9	60.3	53.1	53.0	69.1	64.0
2001	62.1	67.9	55.4	66.6	59.3	60.1	51.9	55.1	59.9	55.6
2002	61.7	66.8	55.1	65.1	59.2	59.6	51.3	53.5	59.7	53.5
2003	66.4	67.7	54.0	66.2	58.2	65.3	51.1	56.9	57.5	54.5
2004	62.9	67.8	61.8	63.8	59.5	59.9	51.3	56.2	62.2	55.4
2005	63.1	67.3	54.1	63.0	59.3	60.0	51.9	54.0	60.9	55.5
2006	63.3	66.2	54.4	62.5	59.3	62.0	56.2	52.4	58.4	56.2
2007	63.9	66.1	59.6	62.7	58.5	59.2	56.3	59.0	63.6	56.1
2008	63.6	66.2	62.6	62.6	58.5	58.9	55.5	54.9	66.0	55.6
2009	62.6	65.9	56.4	61.3	58.5	58.5	53.3	52.3	50.4	54.6
2010	-	66.2	53.4	61.6	59.2	58.6	51.3	52.0	50.4	54.5
2011	-	65.3	53.2	61.6	60.8	58.2	51.6	51.8	50.4	54.2
2012	-	65.5	53.5	60.9	58.8	58.2	-	52.2	50.7	54.0
2013	-	65.8	53.4	60.1	58.6	60.1	-	53.0	51.0	55.3

YEAR	NMT#11	NMT#12	NMT#13	NMT#14	NMT#15	NMT#16	NMT#17	NMT#18	NMT#19	NMT#20
1995	-	-	-	-	-	-	-	-	-	-
1996	58.1	69.4	-	-	-	-	-	-	-	-
1997	62.8	68.7	-	-	-	-	-	-	-	-
1998	62.0	68.4	-	-	-	-	-	-	-	-
1999	64.7	69.1	66.2	54.8	54.2	-	-	-	-	-
2000	62.0	66.9	62.0	54.7	53.2	-	-	-	-	-
2001	62.4	71.4	62.1	56.0	53.4	55.5	-	-	-	-
2002	61.3	68.9	60.0	57.2	54.4	55.2	-	-	-	-
2003	60.0	74.8	60.1	56.7	53.0	54.4	-	-	-	-
2004	62.4	63.9	63.9	55.8	53.6	55.1	-	-	-	-
2005	61.7	N/A	61.5	56.3	53.3	55.2	-	-	-	-
2006	61.3	65.0	62.7	59.8	53.6	55.0	-	-	-	-
2007	60.9	63.5	64.4	57.6	52.9	55.5	-	-	-	-
2008	61.2	75.1	64.9	55.6	52.9	68.3	-	-	-	-
2009	61.0	76.2	61.9	55.0	52.2	64.2	56.6	53.6	55.7	54.4
2010	61.0	62.8	61.4	55.2	53.6	55.2	56.5	53.5	53.8	54.2
2011	60.9	68.3	60.8	56.4	52.4	54.9	56.5	53.4	55.9	54.4
2012	60.1	63.9	59.5	55.1	52.9	54.9	53.5	53.9	53.9	53.4
2013	61.2	67.4	60.6	55.3	52.9	55.3	53.7	57.8	53.3	54.4

Appendix C

NOISE METRICS, CONCEPTS & TERMINOLOGY

Below is a brief description of basic acoustical terms and metrics used in the assessment of aircraft noise.

A-Weighted Decibels (dBA)

Sound levels are measured in decibels with the A-weighting filter applied (dBA). The A-weighting filter closely resembles how the human ear responds to sound at different frequencies - the decibel values of sounds at low frequencies are reduced, as the human ear is less sensitive at low audio frequencies, especially below 1,000 Hz.

Equivalent Sound Level (LEQ)

Community noise from road, rail, aircraft and other local sources are rarely steady but will vary in intensity from second to second, minute to minute or hour to hour. When attempting to describe the overall noise exposure of a community over a period of time, it is necessary to average the noise level in some way. An average noise-level descriptor, such as the Equivalent Sound Level (Leq) is often used. The Leq, is a measure of the exposure resulting from the accumulation of A-weighted decibel sound levels over a particular time period (e.g., 1 hour, 8 hour, 24-hour). Conceptually, Leq may be thought of as a constant sound level over the period of interest that contains as much sound energy as the actual time-varying sound level with its normal peaks and valleys. It is important to realize, however, that the two signals (the constant one and the time-varying one) would sound very different from each other if compared in real life. Variations in the “average” sound level suggested by Leq are not an arithmetic value, but a logarithmic (“energy-averaged”) sound level. Thus, loud events clearly dominate any noise environment described by the metric.

Sound Exposure Level (SEL)

The SEL is a function of both intensity and duration. SEL is a noise metric derived from the noise energy dose of a single sound event such as a single vehicle or train compressed to a single second of exposure. As such, the SEL reflects both the maximum sound level and the duration, or length of time, of the event. The SEL measures the subjective loudness, expressed as the energy of the event, as it would be experienced in a one second interval. As a result, the SEL of a given noise event is always greater than its maximum noise level. For an aircraft over-flight, the SEL is generally 10dBA higher than the maximum noise level experienced during the event. The normalization, to the duration of one second, enables the comparison of noise events with differing durations or maximum level. Additionally, since it is a cumulative measure, a higher SEL can result from either a louder or longer event, or some combination.

ENVIRONMENT – YVR Noise Management

Vancouver Airport Authority
PO Box 23750 Airport Postal Outlet
Richmond, BC V7B 1Y7 Canada
www.yvr.ca

For questions regarding this report or aircraft noise, please contact us at the following:

E-mail: noise@yvr.ca

[WebTrak](#)

Fax: 604-276-6699

YVR Noise Information Line: 604- 207-7097

REPORTING:

Shaye Folk-Blagbrough, M. E. Des. – Environmental Analyst

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 report this may vary slightly from those reported by others.

Version 2.00
- April 30, 2014 -

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