2011 AERONAUTICAL NOISE MANAGEMENT REPORT

-VANCOUVER AIRPORT AUTHORITY-

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INTRODUCTION

WELCOME to Vancouver Airport Authority's 2011 Aeronautical Noise Management Report.

This report summarizes annual trends on issues regarding aircraft noise from Vancouver International Airport (YVR) operations for calendar year 2011. This report includes information on aircraft operations, aircraft fleet mix, community-based noise concerns, runway usage, noise monitoring and community outreach activities. One of the primary goals of this report and the Vancouver Airport Authority's (Airport Authority) outreach efforts is to share information with the public and to encourage further communication between all parties involved in the issue of aeronautical noise. This report is an essential part of noise management at YVR because it is prepared for the community and for members of the YVR Aeronautical Noise Management Committee (ANMC). The community and ANMC provide the Airport Authority with important insight as to what issues are happening in the communities we serve. The ANMC is a critical element of the YVR Aeronautical Noise Management Program as Committee members assist in the ongoing review and development of noise management initiatives through a consultative and collaborative process.

In 2011, YVR served over 17 million passengers and 296,000 runway movements, making YVR the second busiest airport in Canada. With this level of operational activity, there will inevitably be associated noise issues and concerns raised by the community. This report aims to summarize the issues and concerns raised throughout 2011. The Airport Authority works in partnership with government, regulatory agencies, industry, and community stakeholders in an effort to minimize impacts from aircraft noise on communities in the Lower Mainland. This is achieved by working with stakeholders while, at the same time, supporting the role of YVR in providing first-rate passenger and cargo services regionally, nationally and internationally.

The Airport Authority considers YVR a proud member of the community, and makes every effort to minimize noise from airport operations. The YVR Aeronautical Noise Management Program has been created to balance the demands for safe and efficient 24-hour airport services and enjoyable community living.

2011: HIGHLIGHTS

2011 saw the completion of many initiatives identified in the 2009-2013 YVR Noise Management Plan. Below is a description of some of the major highlights.

GROUND RUN-UP ENCLOSURE (GRE) PROJECT

Construction of Canada's first Ground Run-up Enclosure (GRE) began in early 2011. The GRE facility is designed to accommodate high power run-ups conducted on propeller aircraft maintained on the south side of the airport. These run-ups account for approximately 60% of the run-ups performed at YVR each year. The facility also includes an in ground glycol collection system so that the facility can be used for aircraft deicing operations if needed.

In addition to the construction of the facility, other work to support the project included the construction of a public viewing platform near the South Terminal Building, drafting of operational procedures for run-up and deicing operations, completion of community noise measurements from activities at current run-up locations, training sessions for the operators, and project information displays at local community centres.

Acoustical and aerodynamic verification testing were completed in January 2012, and the facility was opened for operation on January 25, 2012.

YVR FLOAT PLANE OPERATIONS

The Airport Authority hosted a meeting in February 2011 with the YVR float plane operators, Transport Canada and City of Richmond representatives (both staff and citizens) on the YVR Aeronautical Noise Management Committee to discuss community noise issues. Following this meeting, the Airport Authority invited and the Floatplane Operators Association appointed a member to the YVR Aeronautical Noise Management Committee.

Throughout 2011, the Airport Authority continued to meet extensively with the operators to identify ways to further reduce noise from YVR float plane operations. Some of the measures included the following.

- Formalizing the operational area on the River
- Using preferential runways (westbound take-off and eastbound landing) when possible
- Using reduced noise take-off procedures when able
- Limiting the use of 2-bladded propeller aircraft
- Avoiding arrival and departure routes that fly over Richmond when possible
- Planning approaches to use minimal reverse when possible
- Reinforcing Westminster downwind at 500 feet

Many of the measures identified are already in use by the major float plane operators. The Airport Authority is currently in the process of seeking publication of these procedures and an educational program will be created to promote these practices more broadly to the float plane community.

CONTROL ZONE PROCEDURES REVIEW WORKING GROUP UPDATE

In 2010, a Control Zone Procedures Working was formed with members from the Airport Authority, Transport Canada, and NAV CANADA. The objectives were to: ensure aviation risks are appropriately managed to the lowest levels that are reasonably practicable; maintain or improve upon airport and aircraft operational efficiency; minimize aircraft emissions; and, minimize noise on affected communities. The scope for the Working Group was to review published procedures for arrival and departure routes to the airport's runways, helipads and waterway.

In 2011, the Working Group worked on several initiatives. Those that had a noise management component were:

- Missed Approach Procedures & Float Plane Over-Head Harbour Transit Routes
  To eliminate conflicts with the required Missed Approach Procedure altitude for the airport's runways, a review of the over-head Harbour Transit Routes – used by float planes traveling between Vancouver and Victoria Harbour – currently set at 2,500 feet was completed to assess options of moving this route to a higher altitude (3,500 feet or 4,000 feet). While this transiting traffic is not associated with YVR, this move would have the added benefit of reducing noise as aircraft would be flying at a higher altitude while over flying Vancouver and Richmond. This change will be made effective in Spring 2012.

- Departure Procedures
  The STANLEY ONE DEP standard instrument departure (SID) procedure was published in May 2011. This SID is for propeller aircraft departing runway 08L/R turning south and requires the aircraft to climb to 1,000 feet before initiating a turn. While this procedure has the primary benefit of providing increased vertical separation between aircraft using the runway and float planes operating off the Middle Arm of the Fraser River, it also has a noise benefit to the community in that the aircraft are at a higher altitude before turning on course. The former procedure had the turn initiated at 500 feet.

2011: YVR IN REVIEW

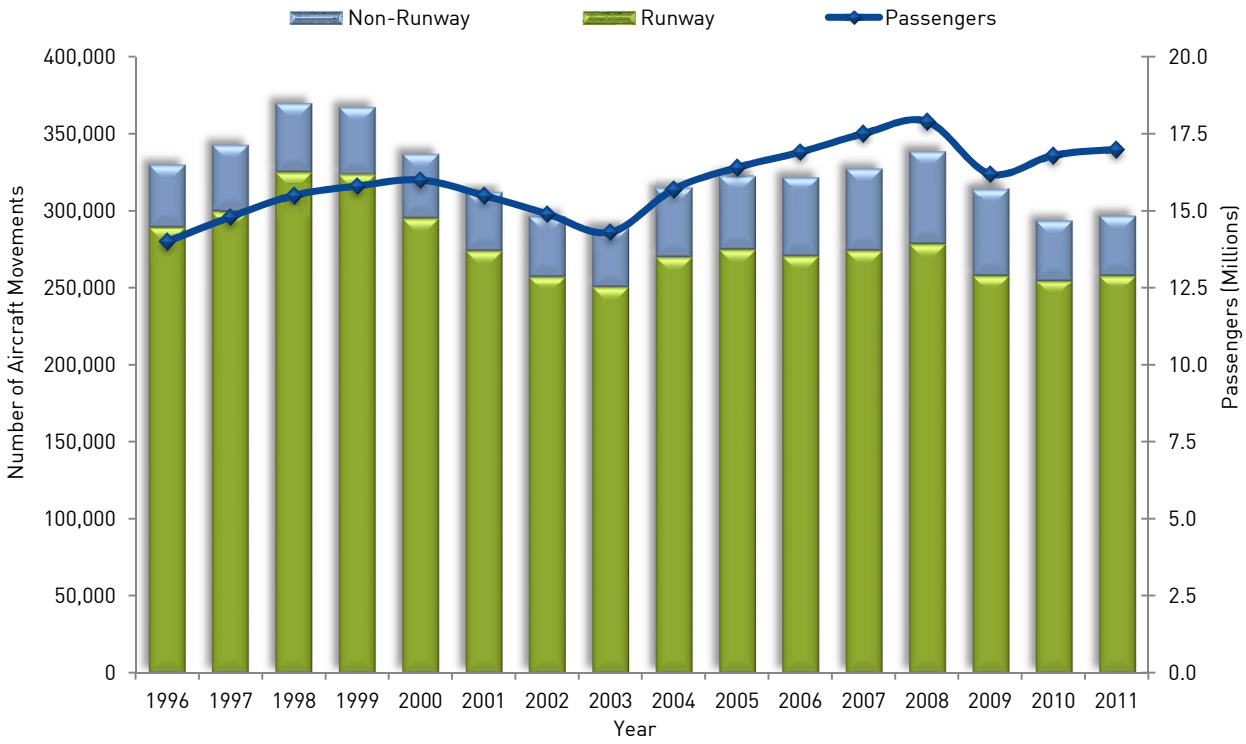
In 2011, there were indications of regaining growth at YVR, since the decline experienced in 2008 due to the slowing global economy, with observed modest rises in aircraft movements[1] and passengers enplaned and deplaned. Cargo experienced a nominal decrease in tonnage from 2010.

The following table and graph present the results of 2011 and how it compares to the previous years (see Table 1 & Figure 1). As illustrated in Figure 1, the number of aircraft operations at YVR peaked in 1998-1999. Since then, landings and take-offs has decreased and the number of passengers served has increased. This means that each aircraft are carrying more passengers and are operating more efficiently with respect to noise and emissions.

Table 1: Activity at YVR in 2011.

Total Movements	296,942	1% increase from 2010
Total Cargo (Tonnes)	223,878	2% decrease from 2010
Total Passengers	17,302,742	1.5% increase from 2010

Figure 1: YVR Annual aircraft movements and passenger statistics 1996-2011.



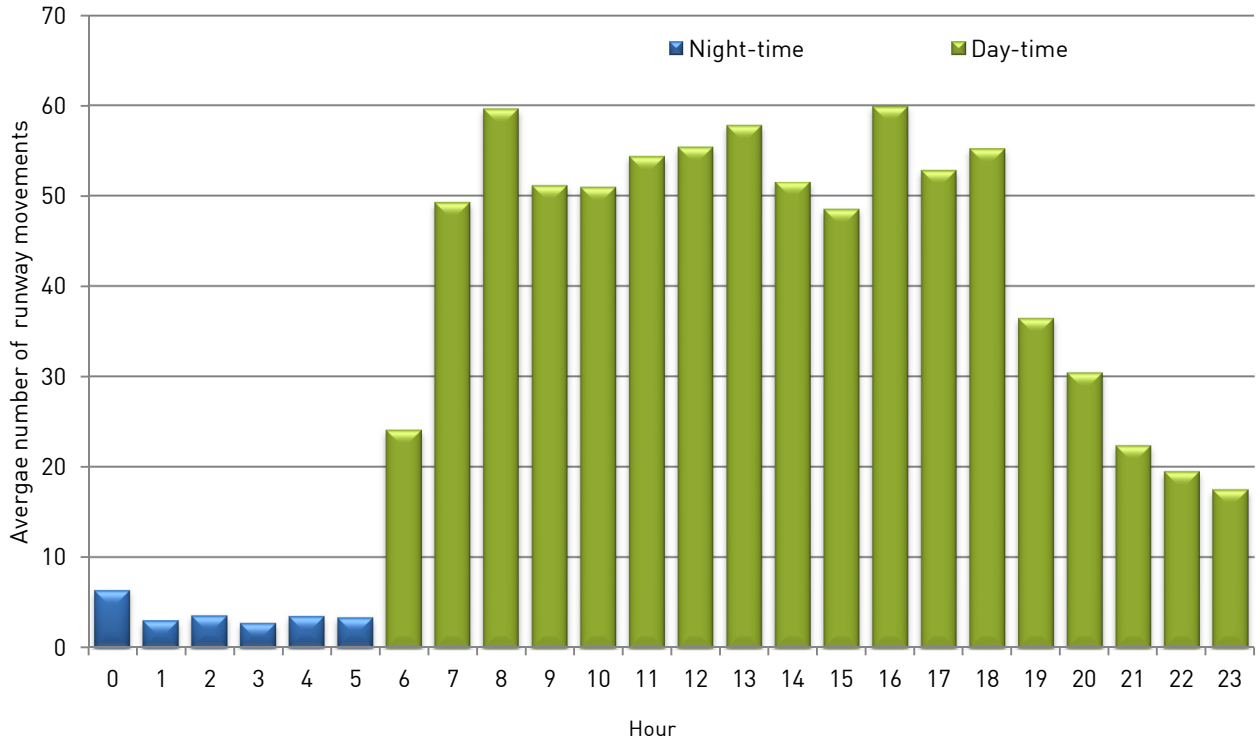
[1]Total movements at YVR include all aircraft movements- arrivals and departures.

Like all other international airports around the world, YVR operates 24-hours a day. The majority of aviation traffic occurs during the daytime hours[2]; however, some operations do occur during the night-time hours[3]. The cargo industry makes up the bulk of night-time operations with some scheduled passenger traffic operating to Asia and the South Pacific.

At YVR, the bulk of aviation activity occurs between 0700 and 1800 hours and day-time aircraft operations comprise of 97% of all activity. YVR's 'rush hour' commences at 0700 hours, with aircraft activity doubling during this hour and aircraft operations holding this level of activity until1900 hours. Busiest hours are 0800 and 1600 hours.

Night-time movements account for less than 3% of aviation activity at YVR. There is minimal activity between 0000 and 0600 hours with less than five aircraft operations per hour on average during this time frame (see Figure 2).

Figure 2: Average number of runway movements per hour in 2011



[2] Day-time hours is designated between 0600 - midnight.

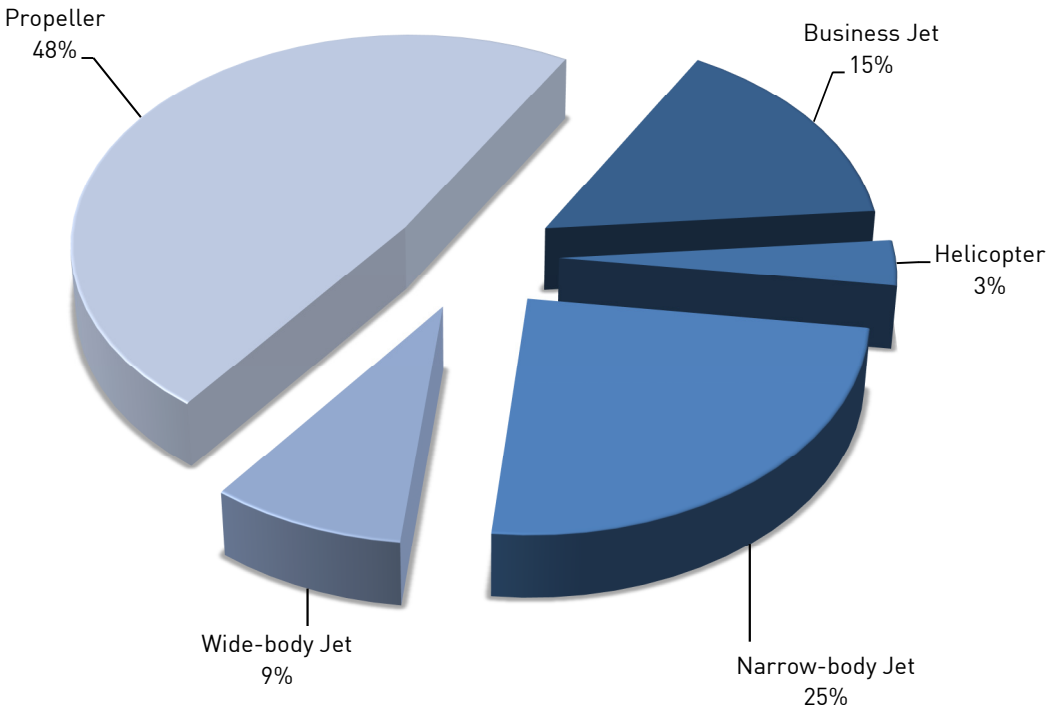
[3] Night-time hours is designated between midnight - 0600.

2011: OPERATIONAL SNAPSHOT

Aircraft activity at YVR is diverse. YVR sees numerous international carriers, with large jet aircraft, but also sees a number of regional airlines that service the province and western Canada through propeller aircraft. Figure 3 provides an analysis of YVR's 2011 aircraft categories. Aircraft categories can be broken down into:

- wide-body jets (e.g., B747; B777),
- narrow-body jets (e.g., B737, E120; CRJ),
- business jets (e.g., Citation),
- propeller (e.g., Dash-8, Navajo, Beech), and
- helicopter (e.g., S76, B412) aircraft.

Figure 3: Aircraft types at YVR in 2011.

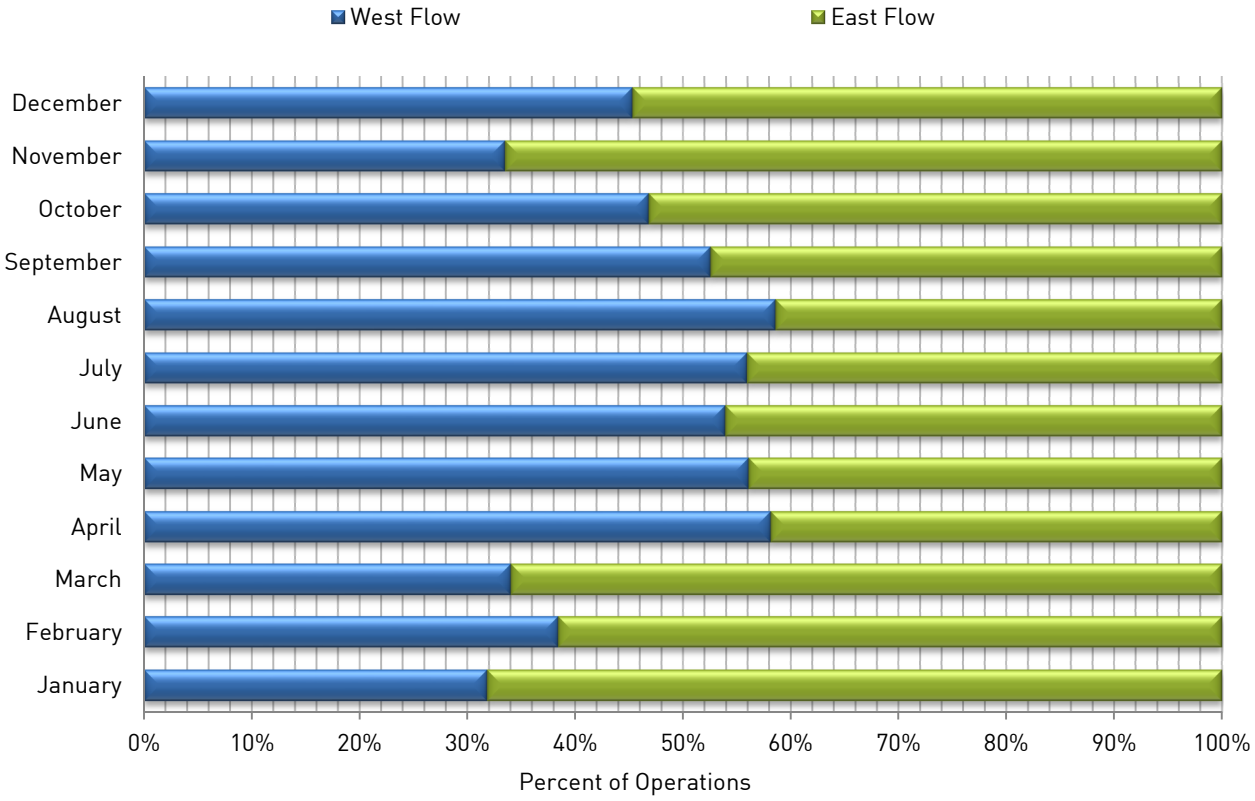


2011: TRAFFIC FLOW

YVR has two parallel runways and a crosswind runway. The parallel runways are aligned in an east-west direction, whereas the crosswind runway is oriented in a northwest and southeast direction. The flight patterns and the distribution of aircraft over the Lower Mainland is dependent on which runway is active, and which runway is active is dependent on the wind conditions on the airfield – for safety reasons aircraft must land and take-off into the wind.

Based on historical observations, we typically see more departures and arrivals in an easterly direction (Runway 08L and 08R active) during the fall and winter, and aircraft departures and arrivals in a westerly direction (Runway 26L and 26R active) during the spring and summer. Over the course of a day, there is not a single area in the Lower Mainland that is not exposed to some level of aircraft over-flights. Figure 4 illustrates the seasonal relationship between the easterly and westerly flow of traffic throughout 2011.

Figure 4: 2011Monthly traffic flows at YVR.



2011: RUNWAY USE

At YVR, there were no significant changes in how the runways were utilized in 2011 from 2010. The summer of 2011 did see the night-time closure of Runway 08R/26L (south runway) for nine weeks to accommodate work to upgrade the south airfield lighting system. During this project, air traffic was diverted to the north runway which is normally closed at night. Runway 08R/26L is the primary runway at YVR and is used for both arrival and departure activities. Runway 08L/26R (north runway) is limited in its use and the Airport Authority is required to operate it in compliance with the 1992 Minister of Transport's conditions, including the main operating restrictions below.

- The north runway is closed between 10:00 PM and 7:00 AM, with exemptions for emergencies, weather, and airfield maintenance activities.
- Use is primarily for arrivals, however when demand traffic approaches capacity limits, such as during peak times, departures are permitted.
- Minimal use of reverse thrust on landing consistent with safe operating procedures.

Table 2 provides the analysis of runway utilization at YVR for 2011. As illustrated, runway departure usage favours the south runway and arrival usage favours the north runway consistent with the Minister of Transport's operating commitments. Figures 5 and 6 provide further information on runway utilization at YVR for 2011.

Table 2: Runway utilization in 2011.

Arrivals					Departures			
Days in 2011 with NO Activity	Daily Range	% Of Total	Average Daily[4]	Runway	Average Daily[5]	% Of Total	Daily Range	Days in 2011 with NO Activity
19	0-153	16.6%	62	08R	201	50.5%	0-409	38
72	0-250	13.3%	59	26L	190	47.5%	0-409	40
19	0-333	34.8%	142	08L	19	1.0%	0-101	294
95	0-320	31.9%	153	26R	18	0.7%	0-72	312
211	0-90	3.5%	28	12	23	0.3%	0-73	355
365	-	-	-	30	-	-	-	365

[4] Average daily is the number of movements for the days when the runway was operational.

[5] Average daily is the number of movements for the days when the runway was operational.

Figure 5: Arriving aircraft traffic flow at YVR.

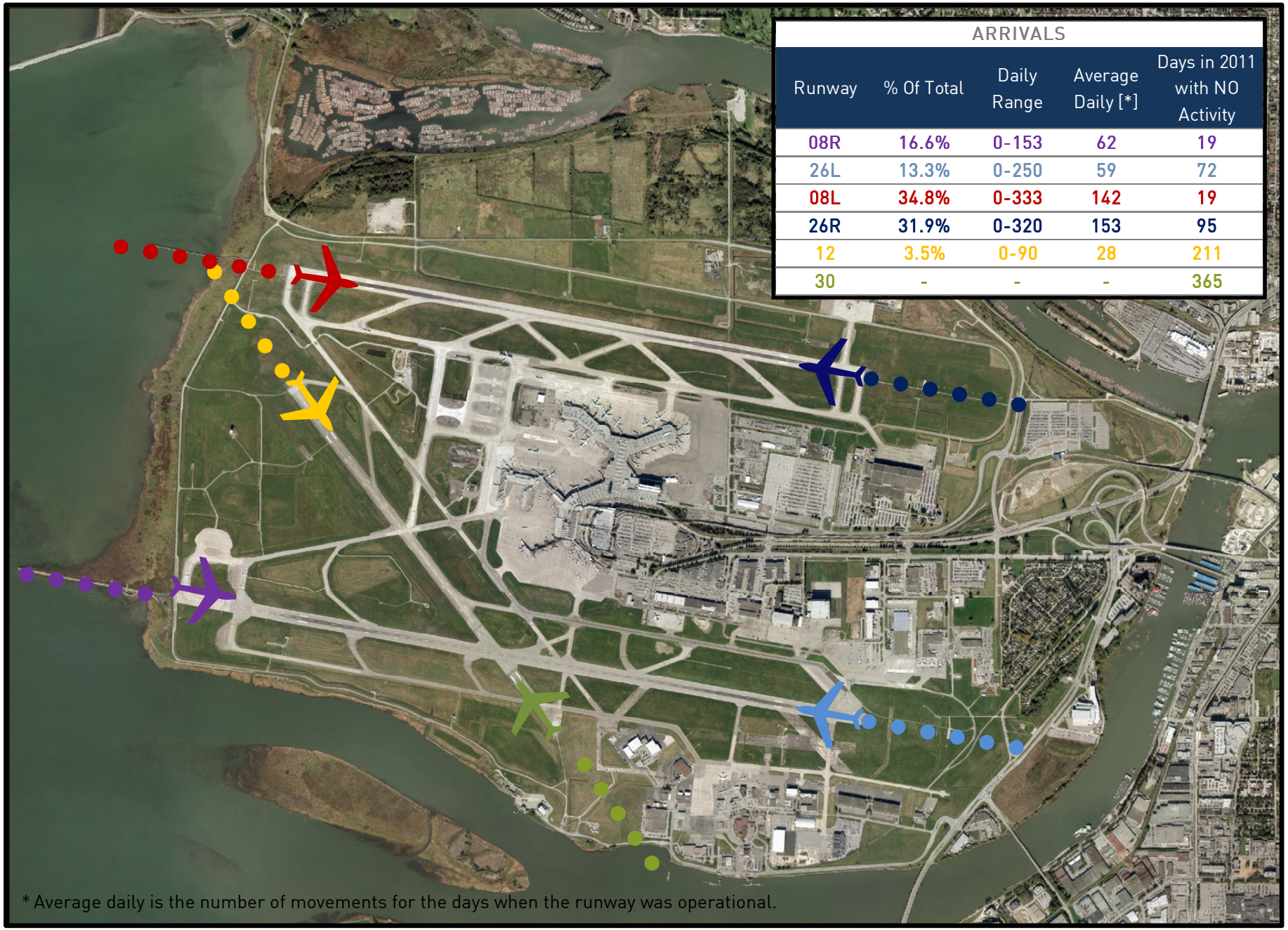
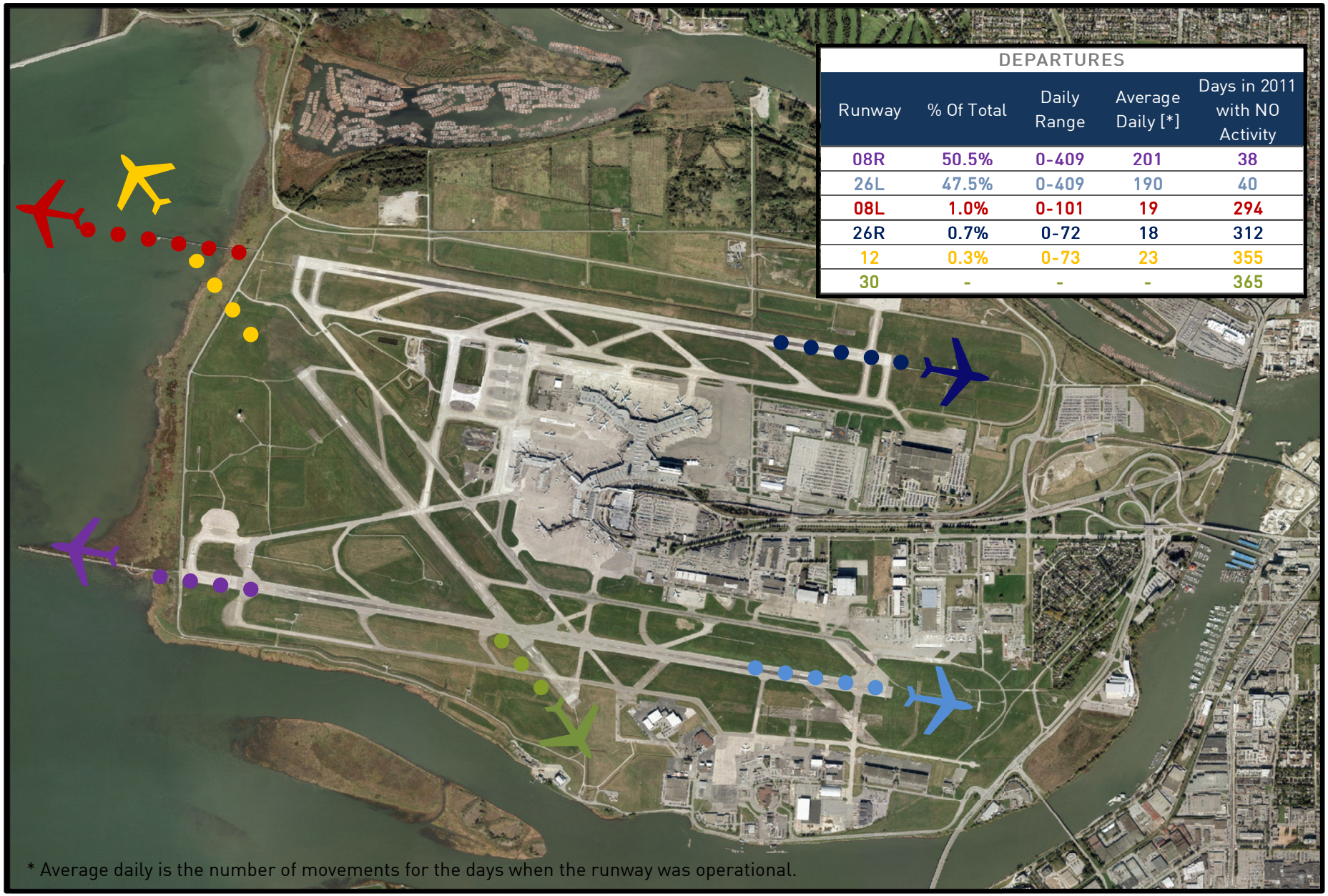


Figure 6: Departing aircraft traffic flow at YVR.



DEPARTURES				
Runway	% Of Total	Daily Range	Average Daily [*]	Days in 2011 with NO Activity
08R	50.5%	0-409	201	38
26L	47.5%	0-409	190	40
08L	1.0%	0-101	19	294
26R	0.7%	0-72	18	312
12	0.3%	0-73	23	355
30	-	-	-	365

* Average daily is the number of movements for the days when the runway was operational.

2011: RUN-UPS

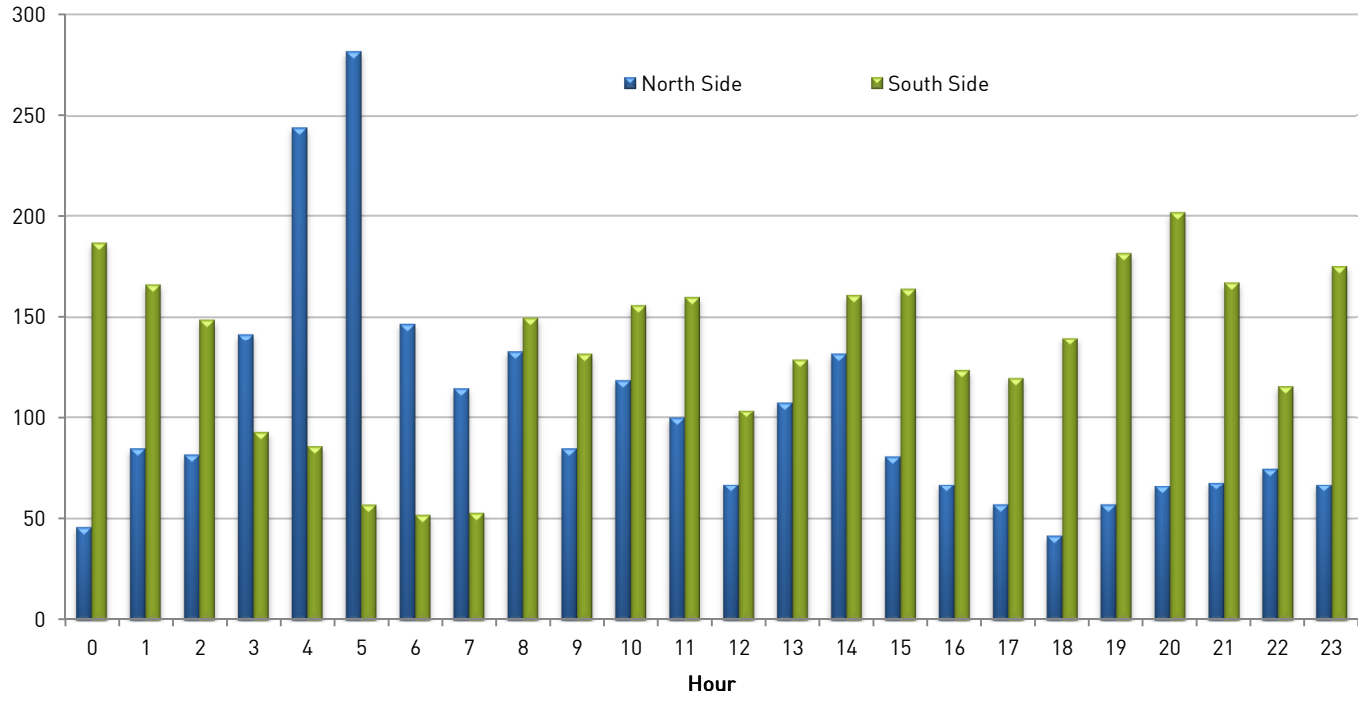
Aircraft engine run-ups are performed as a part of a standard maintenance schedule and often involve the running of aircraft engines at high power for a period of time to simulate flight operations. Engine run-ups are a regulatory requirement by Transport Canada and aircraft engine manufacturers to ensure aircraft are safe to fly. Run-ups occur at all times of the day, but those that occur at night can sometimes result in disturbance to those area residents trying to sleep. In general, run-ups are categorized as either compass swings; idle runs; above idle runs; and full power runs. Table 3 provides a breakdown of run-up activity at YVR over the last five years. In 2011, four suspected unapproved run-ups were identified and reported to Transport Canada.

Table 3: Number of run-ups at YVR in 2011.

Year	Number of Approved Run-ups
2007	3,317
2008	3,889
2009	3,715
2010	4,114
2011	5,701

For analysis purposes, run-up locations are divided in to two distinct areas: those conducted on the north side of the airfield and those that are conducted on the south side of the airfield. Run-up locations are given to operators based on location of the aircraft at the time of the requested run-up, aircraft size, type of aircraft and time of day. Run-up activities occurring on the north side are comprised of both jet and some propeller aircraft. South side run-up activities are primarily propeller aircraft and account for approximately 60% of all run-ups at YVR. Run-up activity is conducted all times of the day (see Figure 7); however a large number occur in the early morning hours, primarily on the north side of the airfield.

Figure 7: Number of run-ups conducted for each hour in 2011 at YVR.



GROUND RUN-UP ENCLOSURE (GRE)

To further manage noise from run-ups operations, the construction of Canada's first Ground Run-up Enclosure (GRE) began in early 2011 and was completed in January, 2012. The GRE facility is designed to accommodate high power run-ups conducted on propeller aircraft maintained on the south side of the airport. Run-ups located on the south side account for approximately 60% of all run-ups performed at YVR each year. Residents south of YVR will experience a 50% reduction in engine run-up noise, as the facility is expected to reduce noise by approximately 15 decibels. The Airport Authority is very pleased to have this facility in operation and a detailed analysis of the facility will occur in the 2012 Aeronautical Noise Management Report.

2011: COMMUNITY ENGAGEMENT

EDUCATION & AWARENESS

The Airport Authority places high importance on educating the community on airport operations and aircraft noise management activities. It is also essential that the Airport Authority has a firm understanding on community issues. In addition to recording and responding to noise concerns on a daily basis, the Airport Authority undertakes a number of initiatives to educate the aviation and local communities. The following are some examples of education and awareness initiatives undertaken in 2011.

- Meetings of the Aeronautical Noise Management Committee
- Presenting the YVR Fly Quiet Awards
- Hosting Noise Information Seminars
- WebTrak Flight Tracking System

AERONAUTICAL NOISE MANAGEMENT COMMITTEE (ANMC)

Community involvement is an integral and necessary component to noise management at YVR. The most important and effective part of our noise management program is the ANMC, which includes a variety of stakeholders, including neighbouring cities (membership list is provided in Appendix A). The goal of the ANMC is to address noise issues through a consultative and collaborative process. The ANMC objectives are to provide a forum for dialogue and improved understanding between stakeholders and parties affected by noise related to YVR operations.

Working with stakeholders is a role that the Airport Authority takes very seriously. The ANMC meets quarterly and members are independently appointed by their respective stakeholder groups that include citizen representatives, municipal governments, the Musqueam Indian Band, airlines, NAV CANADA and Transport Canada. In 2011, 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

Highlights Quarter I

-Ground Run-up Enclosure: discussed project timeline.
-Control Zone Working Group: provided update on work and reviewed issues and potential options.
-Night-time Standard Instrument Departure (SID): discussed possible creation of night-time departure routes.
-YVR Float Plane Operators: provided update on discussions with operators
- Noise Abatement Departure Procedures changes: Transport Canada and provided information on.

Highlights Quarter II

-Ground Run-up Enclosure: provided update on construction status.
-Control Zone Working Group: provided update on potential options and issues.
-2010 Annual Noise Report Summary.
-Summer 2011 Runway Operations.

Highlights for Quarter III

-2010 YVR Economic Impact Assessment: results presented on recent economic impact study for Sea Island.
-GRE Update: project update provided.
-Control Zone Working Group: provided update on potential options and issues.
-YVR Float Plane: presentation on YVR float plane project provided.
-City of Richmond: City staff provided a brief update on Council meeting and update on City's Noise Task Force.

Highlights Quarter IV

-Ground Run-up Enclosure: provided project update.
-Runway End Safety Area (RESA): discussed upcoming regulatory requirements for RESA.
-YVR Capacity Study: discussed work plan to update the 2000 Airside Capacity Study.
-Annual Reporting: requested input from ANMC members on the 2012 annual report content and format.
-Surrey citizen representative presentation: presentation provided by Surrey citizen representative community noise issues in South Surrey.

FLY QUIET AWARDS

The 2010 YVR Fly Quiet Awards were presented at the annual 2011 YVR Chief Pilot's Meeting. These are the sixth year for these awards and the goal is to raise the awareness of noise issues within the aviation community in a friendly manner. To win an award an airline must:

1. Not be in violation of any of the Noise Abatement Procedures at YVR.
2. Have the lowest average annual noise level during the previous year for their aircraft category (as measured by the Aircraft Noise & Operations Monitoring System).
3. Fly fairly regularly in and out of YVR.

The winners of the 2010 awards included: Pacific Coastal Airlines (propeller and rotary wing category); United Airways (narrow-body jets); and Japan Airlines (wide-body jets). Award winners for the past five years are presented in Table 4 below.

Table 4: Fly Quiet Award Winners.

YEAR	Propeller Wing	Narrow Body Jets	Wide Body Jets
2010	Pacific Coastal Airlines	U·S Airways	JAL Japan Airlines
2009	Horizon Air	UPS	air transat
2008	Pacific Coastal Airlines	Mexicana	Air New Zealand
2007	Horizon Air	WestJet	JAL Japan Airlines
2006	Horizon Air	nwa	Air Canada

NOISE INFORMATION SEMINARS

In 2011, the Airport Authority continued with its program of offering Noise Information Seminars to members of the community for the second year. The purpose of the seminars are to provide interested residents with information on the complex issue of noise management and to provide them an opportunity to meet Airport Authority staff and ask questions about the YVR Aeronautical Noise Management Program. In 2011, sessions were offered for the months of March, July, October, and November; however, only one seminar was held in March due to low registration.

The seminars include a short presentation by Airport Authority staff on noise management activities at YVR, followed by a demonstration of the Aircraft Noise & Operations Monitoring System. This powerful and sophisticated system receives noise monitoring data from 20 fixed NMTs located throughout the community as well as radar flight track information from NAV CANADA. To conclude the seminar, attendees are provided a tour of the airfield aircraft gates, taxiways, runways, de-icing pads, and run-up locations. Dates for seminars in 2012 can be found at www.yvr.ca

WEBTRAK

Aviation is complex. To aid the community to furthering their understanding of flight operations and noise levels in their area, the Airport Authority provides YVR Webtrak, a web-based tool that allows residents to view 'real-time[6]' and historical flight and noise data collected by YVR's Aircraft Noise Monitoring & Flight Tracking System.

[6] 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 first-hand how aircraft are navigating over the Lower Mainland and allows users to see what aircraft over their area are doing - arriving, departing, or over-flying. This can be useful information when there are concerns about a particular activity or aircraft. WebTrak also allows concerned citizens to register complaints about particular aircraft or general concerns about aviation in their community.

To access WebTrak, please use the following link:

- WebTrak; or,
- www.yvr.ca

2011: NOISE CONCERNS

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

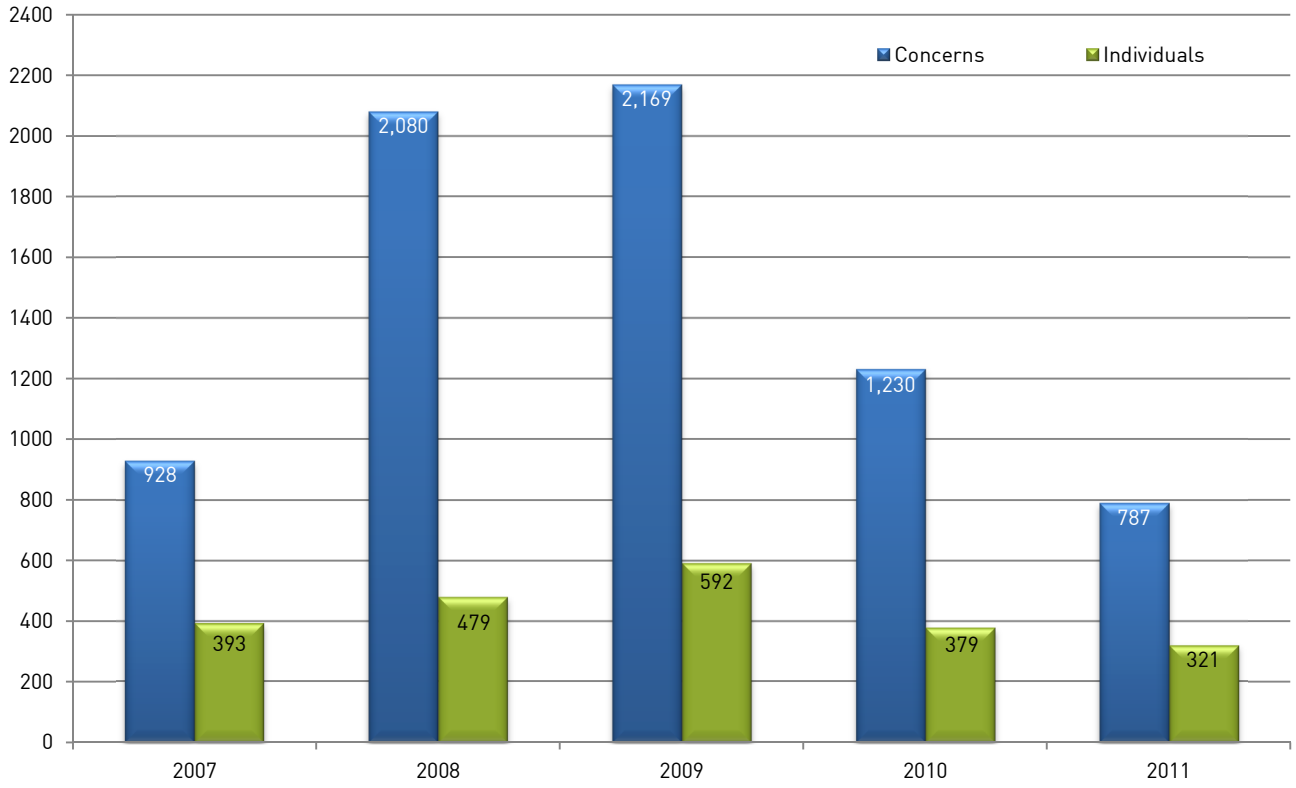
- E-mail (noise@yvr.ca)
- WebTrak
- 24-hour YVR Noise Information Line (604-207-7097)

Complaint information and investigation results are logged in a database, which is used to identify trends. The YVR ANMC reviews and discusses complaint summaries at every quarterly meeting. The concerns submitted through these methods provide the basis of the following analysis of noise concerns for the Lower Mainland and the cities that comprise the region.

LOWER MAINLAND

In 2011, the Airport Authority received 787 noise concerns from a total of 321 individuals. Noise concerns and individuals continued their downward trend since the recent peak year of 2009. In 2011, there was a 36% decrease in concerns from 2010 and a 63% decrease from 2009. Figure 8 provides the breakdown on the number of concerns and individuals logging concerns for the past five years (2007-2011).

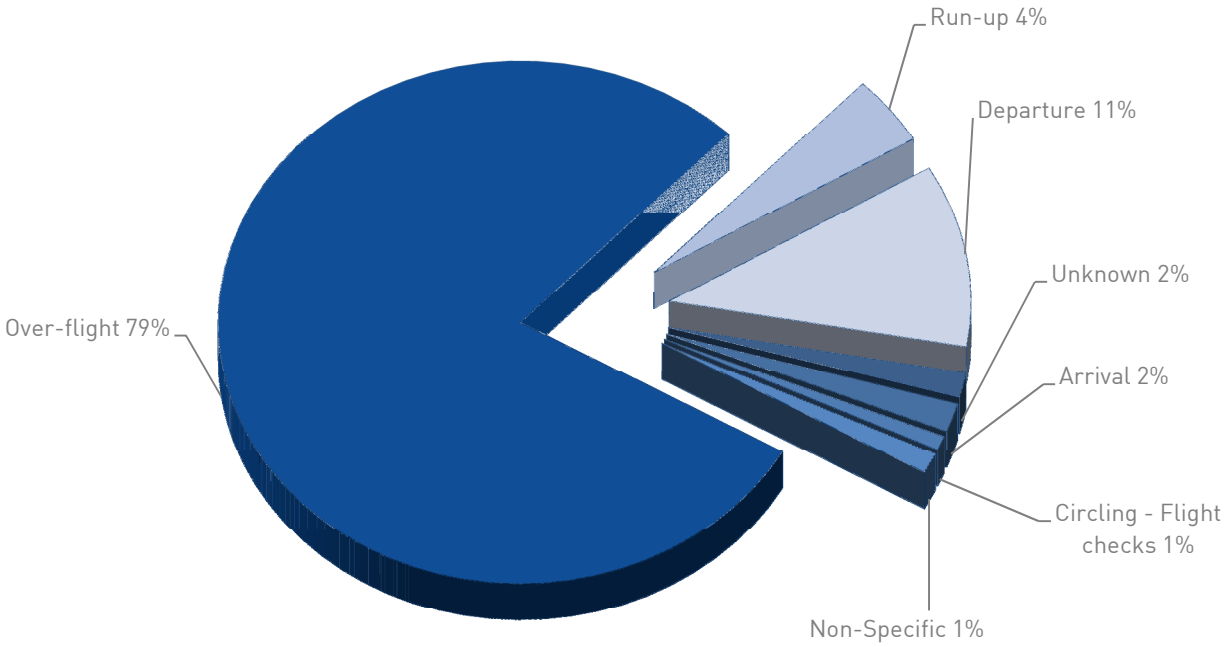
Figure 8: Number of noise concerns and individuals from the Lower Mainland.



Aircraft using YVR have different operational phases and all have the ability to create noise. These operational phases include departure, arrival, over-flight, run-up and circling. Each noise concern that is registered is categorized into one of these operational phases. In some cases, an attempt must be made to categorize the concern due to lack of information provided by the complainant. The categories of concerns vary and often depend on where the individual is living in proximity to YVR.

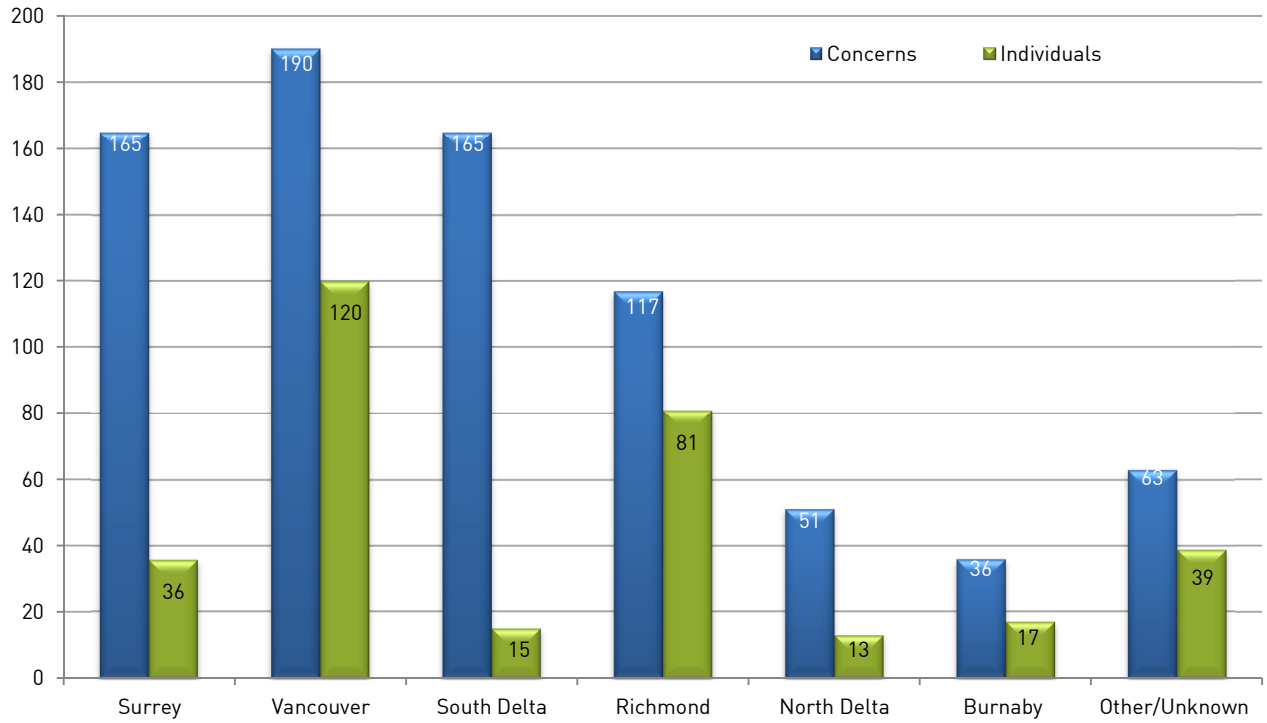
Figure 9 provides an operational analysis of all noise concerns. As a general rule, departure and over-flights activity generate the most concern.

Figure 9: Concerns by operation type in 2011.



Further analysis allows us to determine where noise concerns are emanating from. Figure 10 provides the number of concerns and individuals from each location in the Lower Mainland.

Figure 10: Number of concerns and individuals from all locations in the Lower Mainland.



By looking at the number of concerns versus the number of individuals (Figure 10), it is apparent that there are a number of individuals that file multiple concerns. In 2011, the top ten individuals filed:

- 297 concerns constituting 38% of total concerns;
- filed 10 or more concerns each with the range being between 10-80;
- 8 out of the 10 individuals are located further than 10 nautical miles (nm), or 18.5 km, from the airport; and
- one individual filed 80 concerns out of the 787 (10%). This individual was located further than 10 nm away from the airport.

Figure 11 represents the geodistribution of concerns registered in the Lower Mainland. All areas of the Lower Mainland are represented since all areas experience some level of aircraft activity. Locations closer to the airport exhibit a greater density of noise concerns due to the altitude and regularity of aircraft activity in these locations.

Figure 11: 2011 YVR Noise Complaints by location within the Lower Mainland (with 10nm radius[7]).

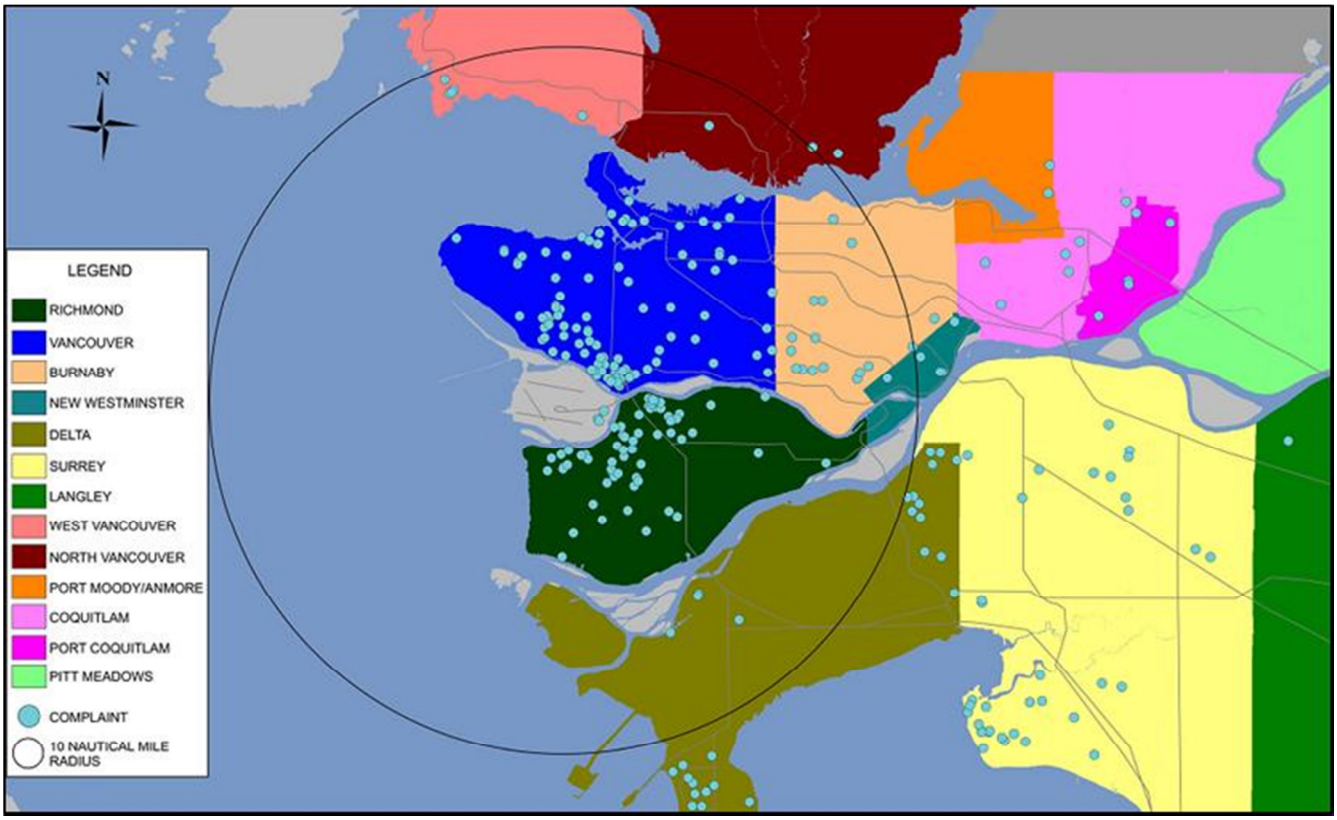
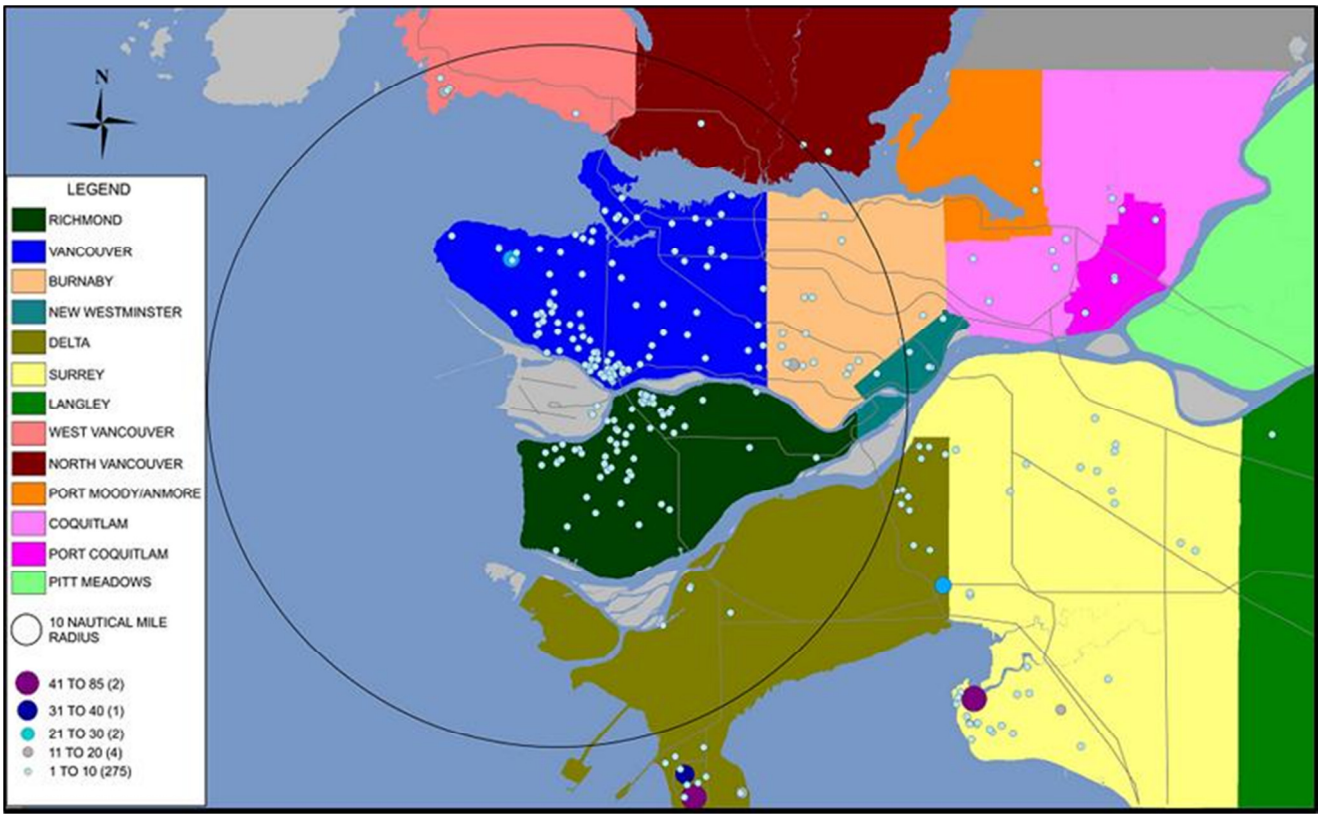


Figure 12 provides a detailed map of individuals' locations and the number of noise concerns communicated. Each point on the map represents a range of concerns originating from each location. As illustrated in Figure 12, two individuals logged over 41 concerns. Individuals that logged the largest number of concerns, experience over-flight activity over their area and are outside the 10nm radius. However, the over-flight activity ranges in altitude from 6,000 feet Above Sea Level to upwards of 15,000 feet Above Sea Level.

[7]Under the Grounds Lease with the Federal Government of Canada, the Airport Authority is only responsible for managing noise concerns within a 10 nautical mile (NM) radius from the airport. Concerns related to noise outside this radius can be directed to Transport Canada.

Figure 12: 2011 YVR Noise Complaints by location within the Lower Mainland (frequency).

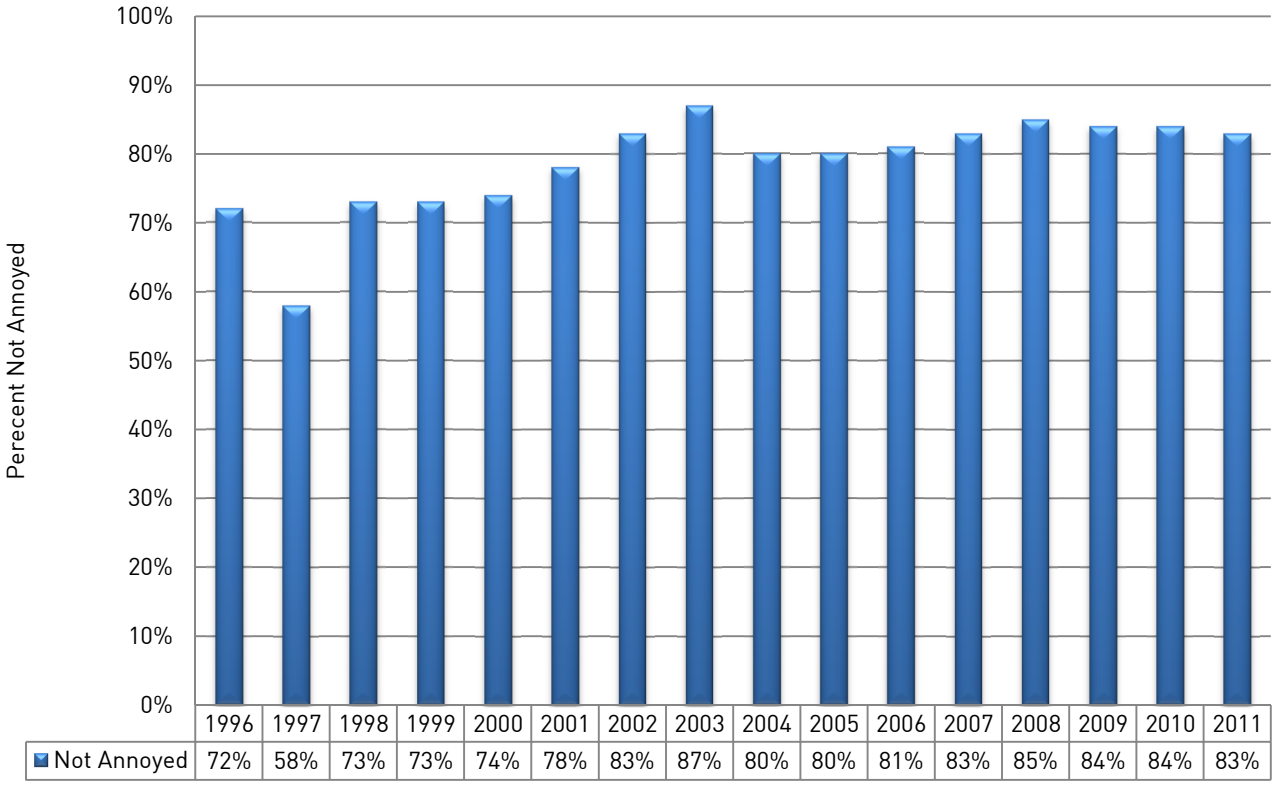


COMMUNITY SURVEY

Since 1996, 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 randomly selected 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 83% of the respondents stated that they were *not* annoyed by aircraft noise. Figure 13 illustrates the trend since 1996.

Figure 13: Lower Mainland survey respondents 'not annoyed by aircraft noise' (1996-2011).



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Not Annoyed	72%	58%	73%	73%	74%	78%	83%	87%	80%	80%	81%	83%	85%	84%	84%	83%

2011: 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 20 Noise Monitoring Terminals (NMT), with radar flight tracking data from NAV CANADA[8] 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 14 provided displays the present 20 NMT locations in relationship to YVR's runways[9]. In 2009, the Airport Authority installed new NMTs to replace the aging hardware in the field and expanded the network from 16 to 20 NMTs. The 16 original NMTs maintained their original location.

[8] NAV CANADA is the civil air navigation services provider in Canada. NAV CANADA provides air traffic control, flight information, weather briefings, aeronautical information services, airport advisory services and electronic aids to navigation.

[9] YVR has two parallels: Runways 08R-26L and 08L-26R; a crosswind runway 12-30, a floatplane runway 07-25 and three helipads.

Figure 14: NMT Locations throughout the Lower Mainland.

ANNUAL AVERAGE NOISE LEVELS (Leq)

There are a variety of metrics available to assess noise. One commonly used metric is the average noise level (Leq) measured over a given period of time. Table 5 provides the annual Leq, measured in units of A-weighted decibel (or dBA), at each NMT since 1995. A brief explanation on noise concepts and terminology is provided in Appendix B. These average noise levels include aircraft and community noise sources, such as motor vehicles, people, lawn mower, barking dogs, etc.

The majority of monitoring locations in the community experienced the same or lower levels of noise than in previous years. NMT#12, experienced the largest increase in noise levels (5.5 dBA). This NMT is located on the airfield and is positioned adjacent to a run-up location and the threshold of Runway 08R. Noise monitored from this location will experience variation due to run-up and runway activities. All other locations noise level remained consistent with other years. Any decreases or increases in sound would be imperceptible.

Table 5: Annual average noise levels (dBA).

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	0.0	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
YEAR	NMT#11	NMT#12	NMT#13	NMT#14	NMT#15	NMT#16	NMT#17	NMT#18	NMT#19	NMT#20
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

SINGLE EVENT NOISE LEVELS (SEL)

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: *aircraft* or *non-aircraft*.

- Aircraft-related noise events are those tagged to an aircraft fly-over based on radar flight track information; the SEL is typically 10 dBA greater than the maximum noise level experienced during the fly-over event.
- Non-aircraft-related noise events are associated with other sources in the community.

Table 6 below presents the 2011 daily average number of aircraft and non-aircraft daily noise events above 70 dBA at each of the NMT locations. For those NMTs located 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 6: Average Daily Noise Events at NMTs.

NMT Site	Name	Location	Average number of daily noise events › 70 dBA		
			Aircraft	Non-Aircraft	Total
1	See notes below[10]	n/a			
2	Airside Burkeville	Templeton St., Richmond	193	60	253
3	Lynas Lane Park	Lynas Lane & Walton Rd., Richmond	13	21	34
4	Tomsett Elementary	Odlin Rd. and No. 4 Rd., Richmond	143	32	176
5	Bath Slough	Bath Rd. & Bath Slough, Richmond	172	67	240
6	Outer Marker	Westminster Hwy & No. 7 Rd., Richmond	95	27	122
7	Crofton School	W41st & Blenheim St., Vancouver	5	12	16
8	McKechnie School	W59th & Maple St., Vancouver	2	10	12
9	UBC	Northwest Marine Dr., Vancouver	3	11	14
10	Marpole	W67th & Cartier St., Vancouver	7	27	34
11	Bridgeport	No. 4 Rd. & Finlayson Dr., Richmond	153	26	180
12	West Sea Island	Airside YVR, Richmond	97	214	311
13	North Sea Island	Ferguson Rd., Richmond	73	175	248
14	Annieville - Delview Secondary	9111-116th St., Delta	41	18	59
15	Alex Fraser Bridge	N.Delta Rec. Ctr. 11415-84th Ave., Delta	39	23	62
16	Burnaby - St. Francis	6610 Balmoral St., Burnaby	4	6	9
17	Maple Lane Elementary	Alouette Dr. & Tweedsmuir Ave., Richmond	6	11	17
18	South Delta - Tsawwassen	53rd Street & 8A Ave., Delta	3	15	17
19	North Surrey	82A Ave. & 146th St., Surrey	10	28	38
20	South Surrey	20th Ave. & Ocean Forest Dr., Surrey	3	25	28

[10] NMT #1 was removed from the location at the request of the property owner. The Airport Authority is continuing to look for a new location for this NMT.

Appendix A

YVR AERONAUTICAL NOISE MANAGEMENT COMMITTEE MEMBERSHIP AS OF DECEMBER 2011

CHAIR PERSON:

Anne Murray
Vice-President Community & Environmental Affairs, Airport Authority

SECRETARIAT:

Becky Henwood
Administrative Assistant, Airport Authority

MEMBERS:

Rick Hedley
Citizen Representative, Corporation of Delta

Margot Spronk
Citizen Representative, Richmond

Haydn Acheson
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

Paula Kolisnek
Corporation of Delta, staff representative

Craig MacFarlane
City of Surrey, staff representative

Doug Martin
Airline Operators Committee (Air Canada)

Warren Lampitt
Air Canada

Terry Hiebert
Floatplane Operators Association

Scott MacPherson
Canadian Business Aviation Association

Marlene Keefe
Air Canada Pilots Association

Claudio Bulfone
Transport Canada

Brent Bell
NAV CANADA

Leona Sparrow
Musqueam Indian Band

Brett Patterson
Director Airside Operations, Airport Authority

Toni Frisby
Manager Environment, Airport Authority

Shaye Folk-Blagbrough
Environmental Analyst, Airport Authority

Mark Cheng
Supervisor Noise & Air Quality, Airport Authority

Appendix B

NOISE METRICS, CONCEPTS & TERMINOLOGY

Below is a 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. It varies 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. 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 fictional duration of one second, enables the comparison of noise events with differing true duration and/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.

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.

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