Welcome

Toronto Pearson Residents' Reference Panel on Noise Fairness and Airport Growth

Please sit where you like
We will get started at 9am

Toronto Pearson

Peter MacLeod

Chair of the Toronto Pearson Residents' Reference Panel

Toronto Pearson

Provide clarity

Create momentum

Ensure everyone feels heard

Make this a productive conversation

Toronto Pearson

Members' Profile


WELCOME
Toronto Pearson Residents' Reference Panel
Toronto Pearson

Why now?

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Pearson is planning a major expansion
Two major noise studies are underway

Pearson wants guidance on its next phase of growth to ensure that it manages the impact of its operations responsibly.

We are looking to you to suggest better ways to:

- provide new transit options for the airport and region
- manage and mitigate noise from aircraft
- engage and inform residents about our operations
- strengthen our commitment to the environment

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The Reference Panel is one of six initiatives underway to gather the insights and concerns of residents

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Your mandate

The Reference Panel is tasked with advising the GTAA on the measures, standards and commitments it should adopt to meet the needs of area residents and support regional growth.

Specifically, the Reference Panel will develop:

- A set of values which describe its vision of responsible growth;
- A list of issues which the GTAA should attempt to address within its growth plan
- Criteria for evaluating options to mitigate and manage aircraft noise
- Additional recommendations concerning transit options, noise management, environmental stewardship and public communications and engagement

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Your task

Learn about aviation trends, airport operations and their impacts, international best practices

Consider contrasting perspectives and the wider regulatory environment in which the airport operates

Address the concerns those most impacted by aircraft operations

Recommend actions that can support responsible growth of the airport and the region

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Members are asked to…

- Attend all sessions of the Reference Panel as well as at least one of the Public Workshops;
- Work to understand and represent the varied perspectives of all residents;
- Treat each other with respect and take an active role in the work of the Reference Panel; and
- Work collaboratively to achieve a strong consensus concerning the Panel's recommendations.

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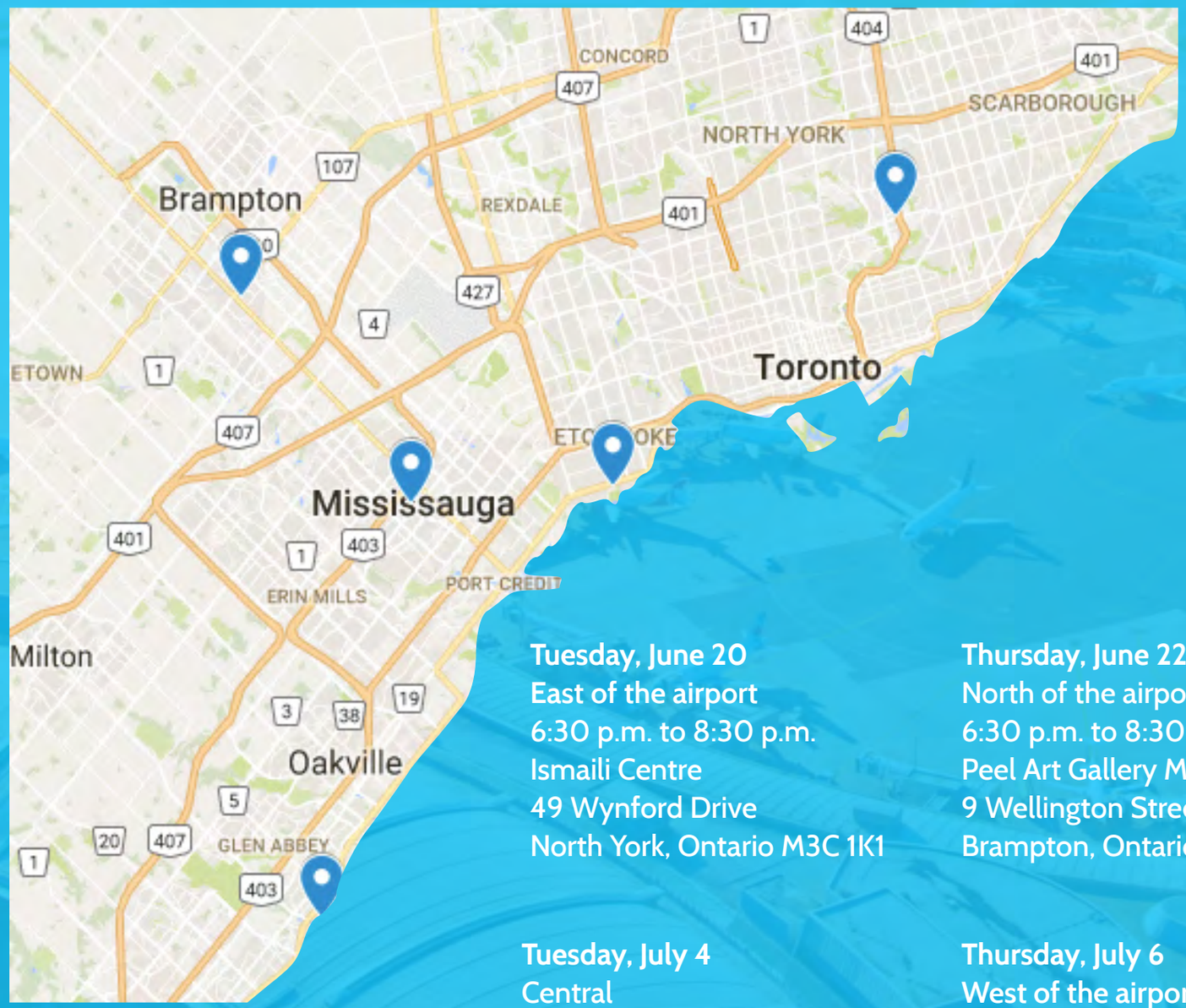
Program

	May 27	June 3	Summer Public Workshops	Sept 9	Sept 16
9	**Welcome & Orientation**			**Transit Perspectives**	Drafting recommendations
10	Break	**Mega-hubs: The Frankfurt Experience** Max Philipp Conrady		Break	
	Understanding the GTAA: History, structure, responsibilities, service volumes	**Toronto Pearson Operations 101** Cynthia Wood		**Environment Perspectives**	
11		Break		**Communications & Engagement**	
	What is the mega-hub vision: Demand-led growth, implications, opportunities	**Fundamentals of Acoustics and Aircraft Noise** Colin Novak, Ph.D., P.Eng.		Lunch	
12	Lunch	Lunch		Issues	Lunch
1	**Airport Tour:** Introduction to Pearson, and understanding the passenger pathway	**Managing the Toronto Pearson Airspace** Nick Boud, HELIOS			
2	Identifying issues and questions	**Community Perspectives** Better Flights Paths Markland Wood Rockwood Alderwood			Break
	Break	Break		Break	Report
3		Noise fairness discussion		Priorities	
4	Adjourn	Roundtable Prep and Adjourn		Adjourn	Adjourn

Help us host the public workshops



Each two-hour workshop will include a 30-minute presentation about the history of Toronto Pearson, the growth of the Greater Toronto and Hamilton area, and our vision for the future. You will then be invited to join a series of facilitated small group discussions with other local residents and members of the new Residents' Reference Panel, and suggest ways to:

- provide new transit options for the airport and region
- manage and mitigate noise from aircraft
- engage and inform residents about our operations
- strengthen our commitment to the environment

Tuesday, June 20
East of the airport
6:30 p.m. to 8:30 p.m.
Ismaili Centre
49 Wynford Drive
North York, Ontario M3C 1K1

Thursday, June 22
North of the airport
6:30 p.m. to 8:30 p.m.
Peel Art Gallery Museum & Archives
9 Wellington Street East
Brampton, Ontario L6W 1Y1

South of the airport
Wednesday, June 28
6:30 p.m. to 8:30 p.m.
Assembly Hall
1 Colonel Samuel Smith Park Drive
Etobicoke, Ontario M8V 4B6

Tuesday, July 4
Central
6:30 p.m. to 8:30 p.m.
Mississauga Living Art Centre
4141 Living Arts Drive
Mississauga, ON L5B 4B8

Thursday, July 6
West of the airport
6:30 p.m. to 8:30 p.m.
Harbour Banquet & Conference Centre
Bronte Room
2340 Ontario Street
Oakville, Ontario L6L 6P7

Toronto Pearson

Last week

Toronto Pearson

SIMCOE
BARRIE
YORK
KAWARTHA LAKES
PETERBOROUGH
PETERBOROUGH
DUFFERIN
WELLINGTON
Georgina
Brock
East Gwillimbury
Newmarket
King
Aurora
Whitchurch-Stouffville
Uxbridge
Scugog
Caledon
Richmond Hill
Vaughan
Markham
Pickering
Ajax
Whitby
Oshawa
Clarington
NORTHUMBERLAND
Brampton
Halton Hills
GUELPH
WATERLOO
TORONTO
DURHAM
Mississauga
Milton
PEEL
Oakville
Burlington
HALTON
HAMILTON
BRANTFORD
BRANT
HALDIMAND
NIAGARA

The Greater Golden Horseshoe

- 9.25 million people (26% of all Canadians)
- 4.5 million jobs (26% of all jobs in Canada)

The Greater Toronto Hamilton Area

- 7 million people (19% of all Canadians)
- 3.7 million jobs (21% of all jobs in Canada)

Greater Toronto and Hamilton Area
Rest of GO Service Area
Rest of Greater Golden Horseshoe

Our Region: By 2041...

The Greater Golden Horseshoe

- 9.25 million people (26% of all Canadians)
- 4.5 million jobs (26% of all jobs in Canada)

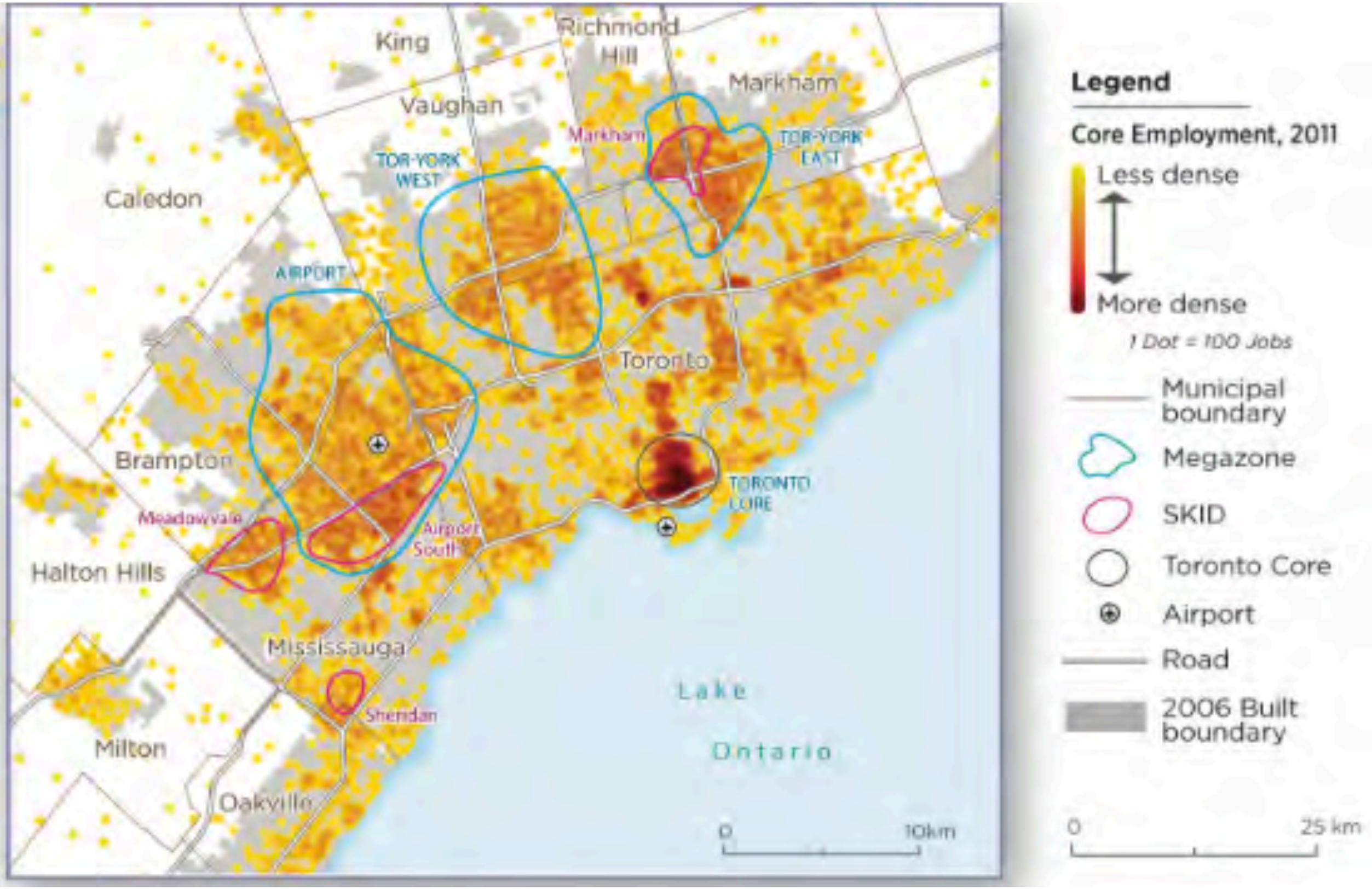
- 4.25 million more people
- 1.8 million more jobs

The Greater Toronto Hamilton Area

- 7 million people (19% of all Canadians)
- 3.7 million jobs (21% of all jobs in Canada)

- 2.7 million more people
- 1.1 million more jobs

Toronto Pearson


King
Richmond Hill
Markham
Vaughan
Markham
TOR-YORK WEST
TOR-YORK EAST
Caledon
AIRPORT
Toronto
Brampton
TORONTO CORE
Meadowvale
Airport South
Halton Hills
Mississauga
Sheridan
Milton
Oakville
Lake Ontario
0
10km
Legend
Core Employment, 2011
Less dense
More dense
1 Dot = 100 Jobs
Municipal boundary
Megazone
SKID
Toronto Core
Airport
Road
2006 Built boundary
0
25 km

The Emerging Megaregions

Cascadia

Northern California

Front Range

Southern California

Arizona Sun Corridor

Texas Triangle

Great Lakes

Northeast

Piedmont Atlantic

Gulf Coast

Florida

Metro Area Population

150,000 to 1 million

1 to 3 million

3 to 6 million

6 million +

Understanding the GTAA

Scott Armstrong, Director,
External Communications, GTAA

Toronto Pearson

Malton Airport 1937

Looking north on Sixth Line (Airport Road).
National Steel Car and Village of Malton
Four Corners can be seen in the top right.

Terminal 1:
1964 - 2004

Terminal 3 - 1991

Toronto Pearson at Transfer to GTAA – 1996

Managed and operated by the GTAA, a not-for-profit corporation, since 1996

Operated on a commercial basis

No taxpayer subsidy to fund operations or airport development

New Terminal 1
Opened 2004

T2 Parking

T2

Original T1

2nd stage of T1 Opened 2005

July 24, 2006

Growth Story

1970s
10.5 Million

1990s
21 Million

2016
44 Million

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Passenger growth & aircraft movements

	2015	2016	
Passengers	*41 Million*	*44 Million*	8%
Movements	*444,000*	*457,000*	2.8%

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1,500 GTAA employees

49,000 Toronto Pearson employees

300,000 jobs within the economic zone

Pearson Connects: Growing Canada with a mega hub airport

Eileen Waechter, Director, Planning, GTAA

Toronto Pearson

Toronto Pearson is one of Canada's most important economic assets

67% of world's economies by daily, nonstop flights

2nd in North America for international passengers

50% of Canada's air cargo

Toronto Pearson

Toronto Pearson's significance on the world stage is increasing

Airport	Passenger traffic, 2016, Millions	Change in passenger traffic between 2015 & 2016, %
Dubai	 83.7	+7.2%
London/ Heathrow	 75.7	+1.0%
Paris	 65.9	+0.3%
New York JFK	 60.6	+3.8%
Singapore	 58.7	+5.9%
Pearson	 **44.3**	+8.0%

SOURCE: Airport traffic statistics, GTAA Passenger Traffic statistics, Airport Council International, press search

Mega hubs of the world

Poised to be North America's next mega hub.

Toronto Pearson

Reaching the economic potential of Toronto Pearson

Toronto Pearson

Aviation demand challenge

110 million
over the next 25 years

49 million passengers
is the present regional demand

Southern Ontario Airport Network

- Airports play important local roles and can support more passenger service, general aviation, cargo flights, etc.
- Better using capacity allows for the “highest and best use” of airport infrastructure to the region’s benefit
- High order transit connecting the region to its passenger airports reduces road congestion and keeps goods and people moving

Transit mode share

Less than **10%** of passengers at YYZ take public transit

36% London Heathrow	**40%** Amsterdam Schiphol	**50%** Hong Kong Kai Tek	**60%** Shanghai Pudong

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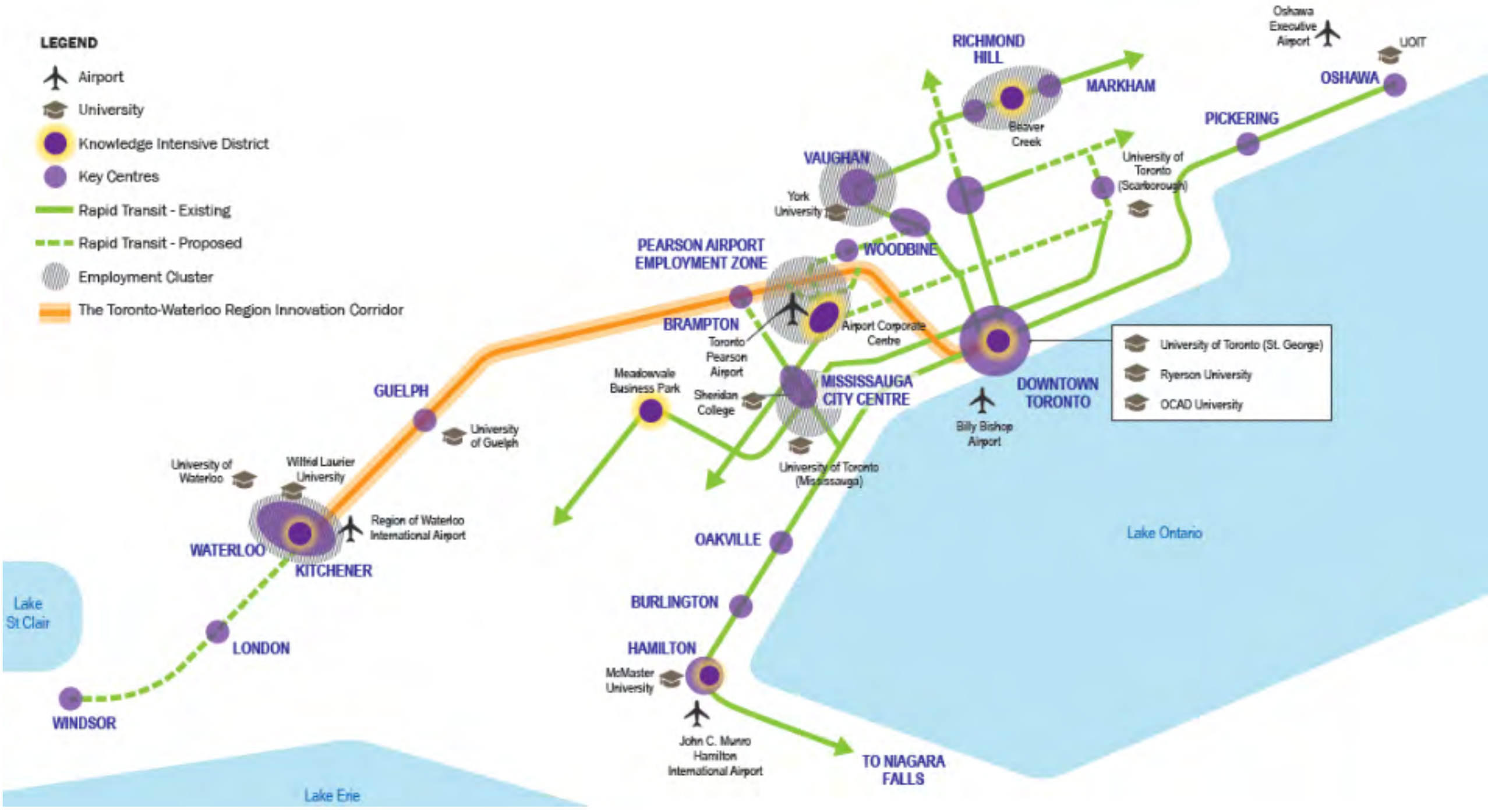
Toronto Pearson is well situated to connect jobs and innovation centres across the Greater Golden Horseshoe



Today

- The Frankfurt Experience
- Toronto Pearson Operations 101
- Fundamentals of Acoustics
- Revising our values
- *Lunch*
- Managing Pearson's Airspace
- Community Perspectives
- Noise issues
- Public workshops

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Mega-hubs:
The Frankfurt Experience

Max Philipp Conrady

Vice-president, Airside and Terminal Management, Corporate Safety and Security, Environmental Impact Noise and Air Quality, Frankfurt Airport

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Toronto Pearson Operations 101

Cynthia Woods

Manager, Noise Management Office, Stakeholder Relations and Communications

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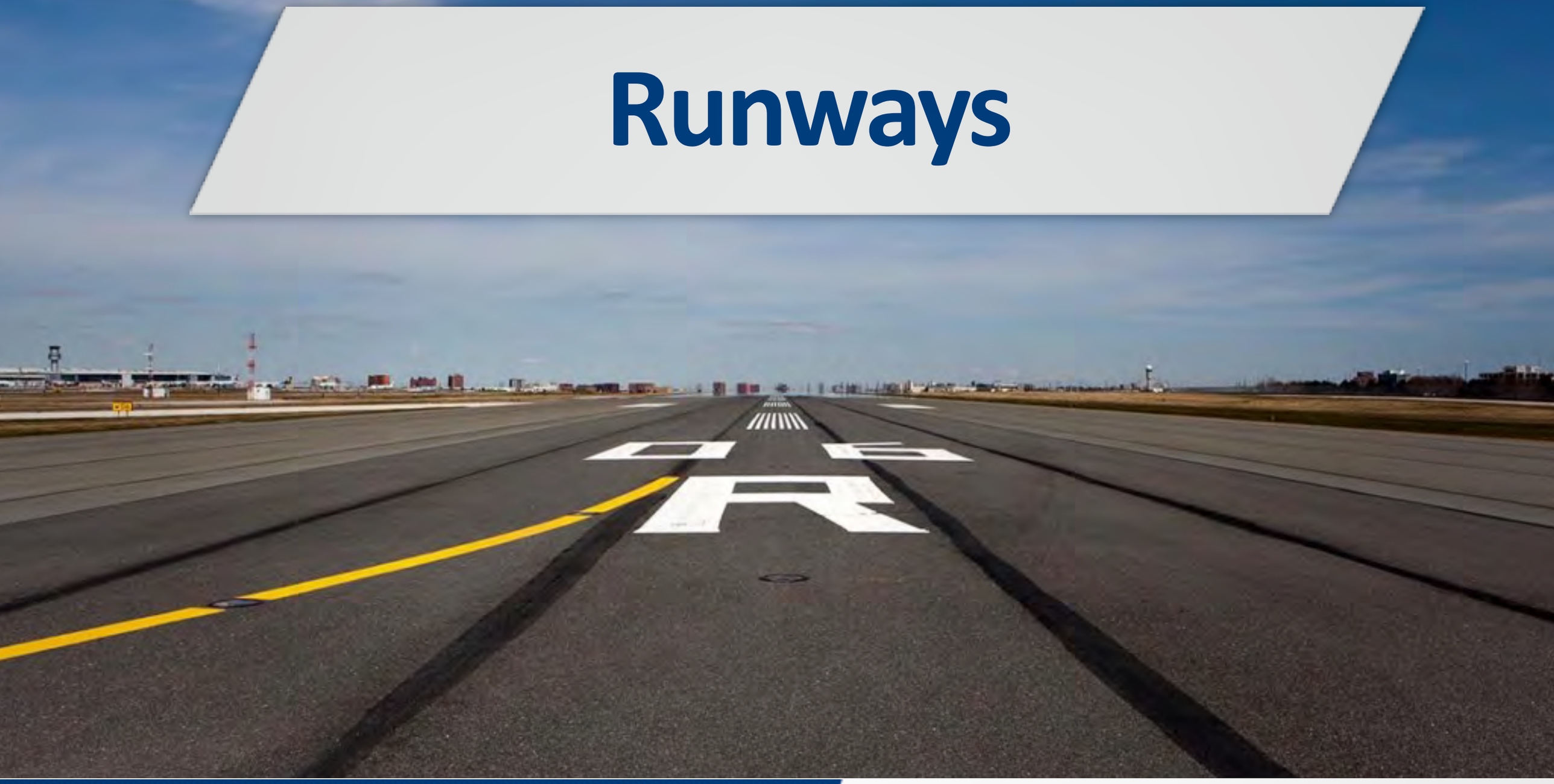
Toronto Pearson
Operations & Noise Management

Resident Reference Panel
June 3, 2017

Toronto Pearson

Runways



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Toronto Pearson Runways

Pearson

How Runways are Selected

NAV CANADA assigns runways based on the following considerations:

Wind, Weather, Surface Conditions: In calm wind Air Traffic Control can assign any operationally suitable runway regardless of wind direction; “Into the wind” runway configurations are required in windier conditions When runways are wet, covered in snow/ice, the crosswind threshold is reduced.

Runways may be selected to avoid aircraft flying toward a storm

Preferential runway system: Between 12:00am and 6:30am as set out in the Canada Air Pilot (CAP)

Arrivals: 05, 15L, 06L**; Departures**: 23, 33R, 24R

Under review as part of Toronto Noise Mitigation Initiatives – Idea #6

Demand/Capacity: Traffic levels vary throughout the day. Weekends and overnight= lower traffic so more configuration options. Weekend Runway Alternation under consideration – Idea #5

Runway Length: Pilots can request a specific runway based on operational requirements; Runway 15L/33R (a North/South Runway) is the longest runway, and is requested at times by long haul (heavy) aircraft

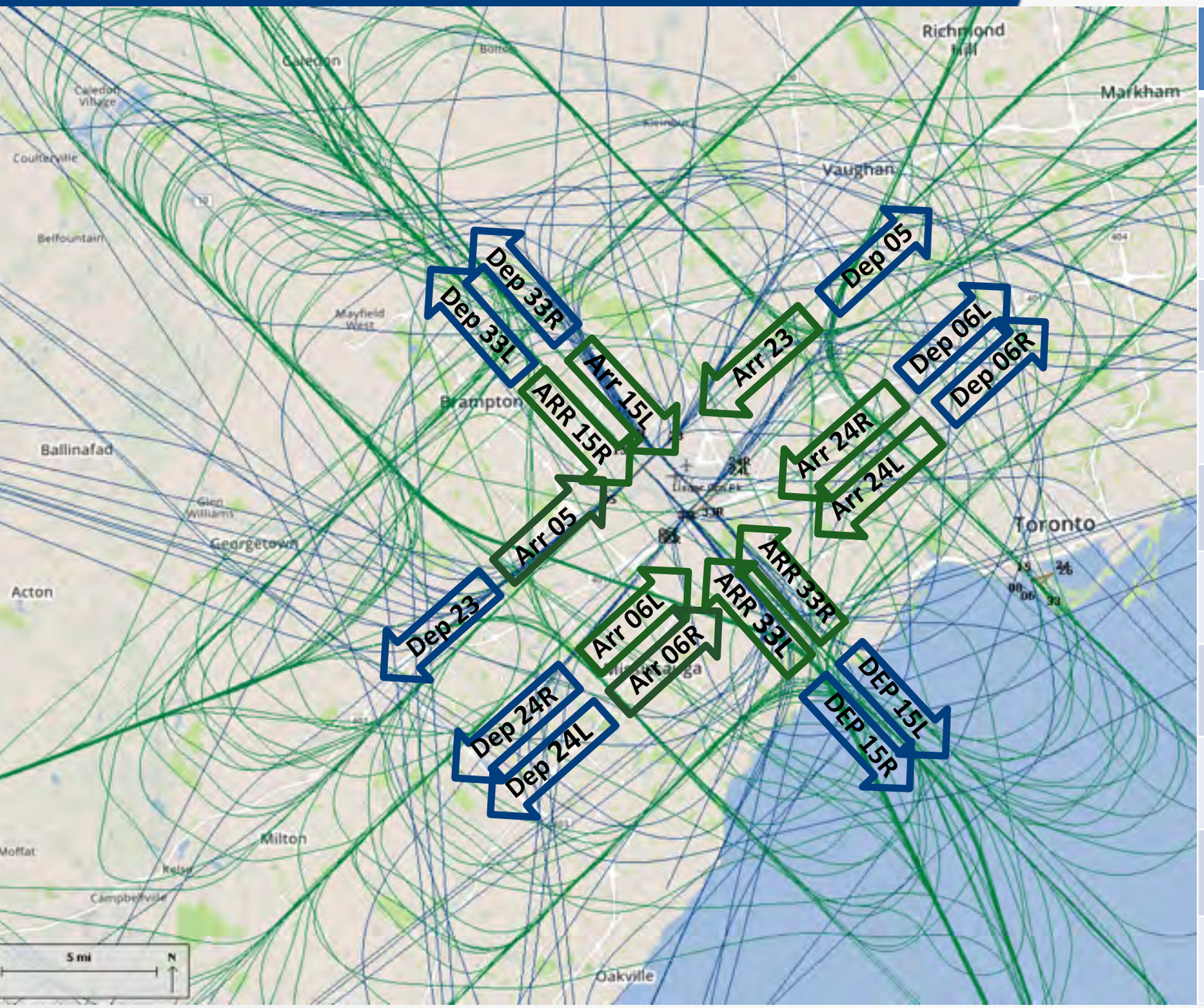
Runway Availability: Short term and longer term maintenance can affect runway configuration. Examples: airport surface closures (maintenance, snow clearing) or equipment outages (navigation aides, lighting)

East/West configurations are the most common:

1) Can use up to 3 runways at once
2) Aligned with prevailing wind direction (westerly)

Safety is #1 Priority when assigning runways!

2016 Runway Usage



Rwy	Arrivals		Departures	
05	52,906	23.1%	18,613	8.3%
06L	16,653	7.3%	56,764	25.3%
06R	10,160	4.4%	1,235	0.6%
15L	2,520	1.1%	1,660	0.7%
15R	1,572	0.7%	486	0.2%
23	49,091	21.5%	81,413	36.2%
24L	21,257	9.3%	801	0.4%
24R	64,446	28.2%	49,164	21.9%
33L	9,170	4.0%	762	0.3%
33R	959	0.4%	13,812	6.2%

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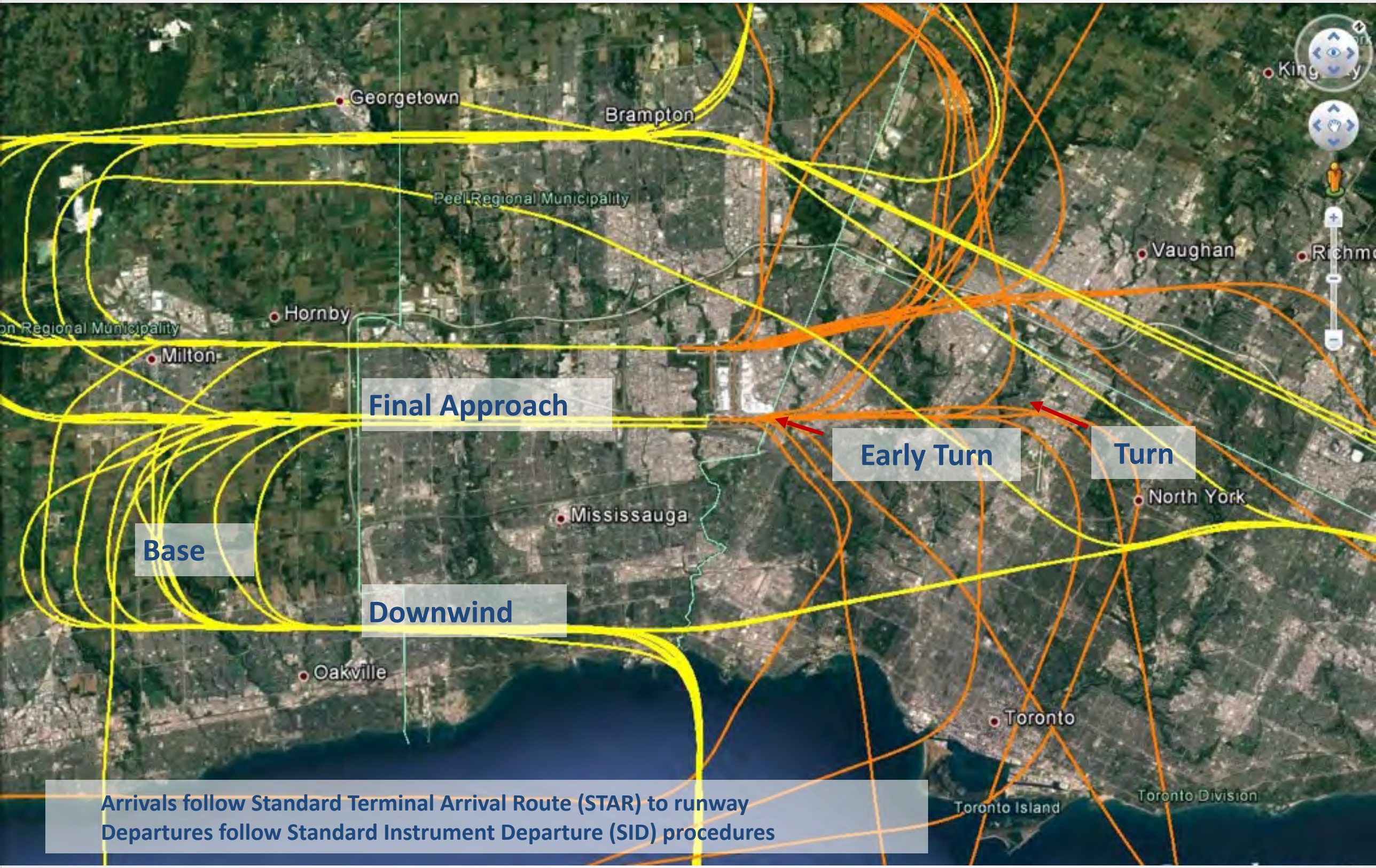
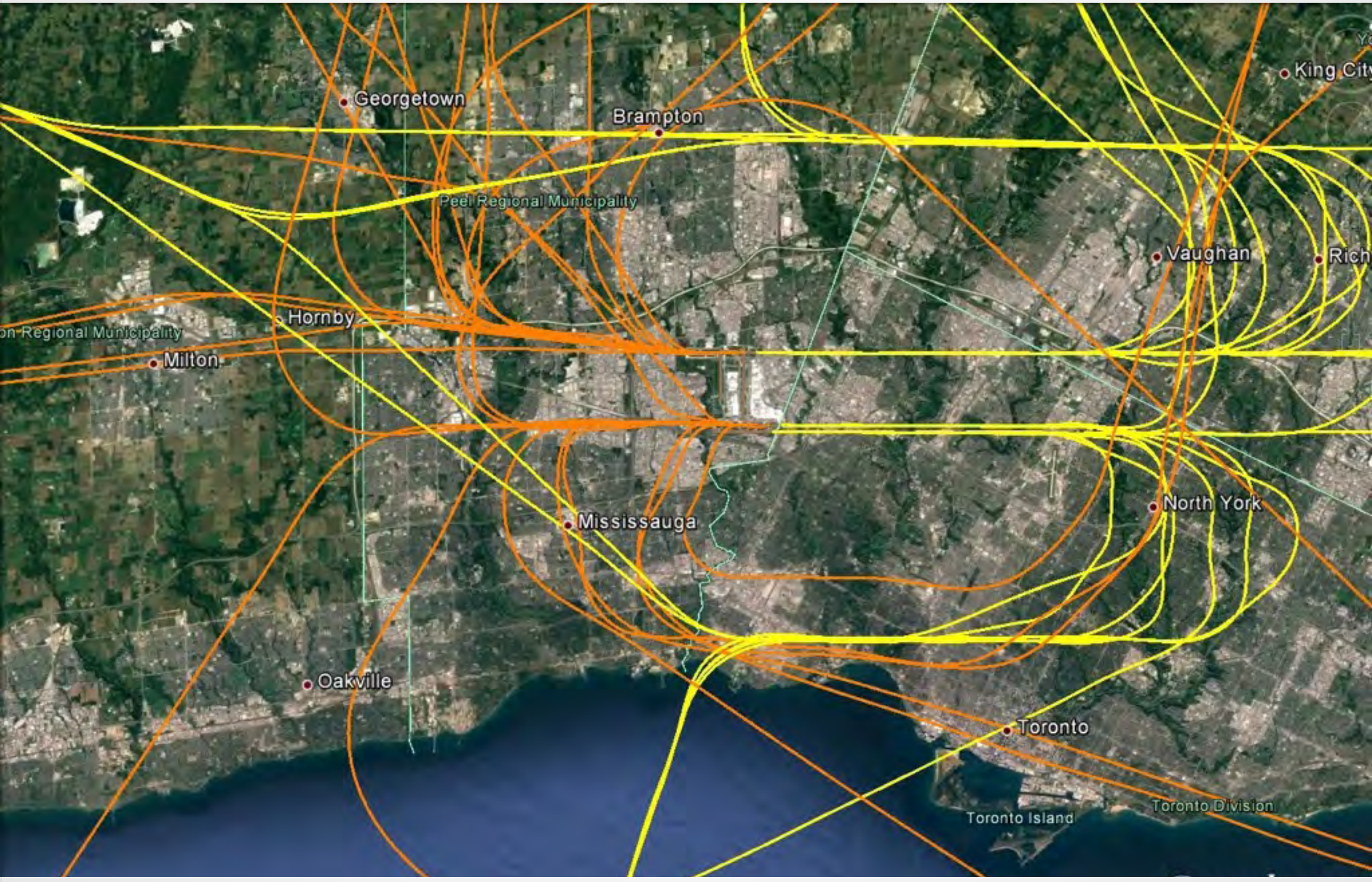
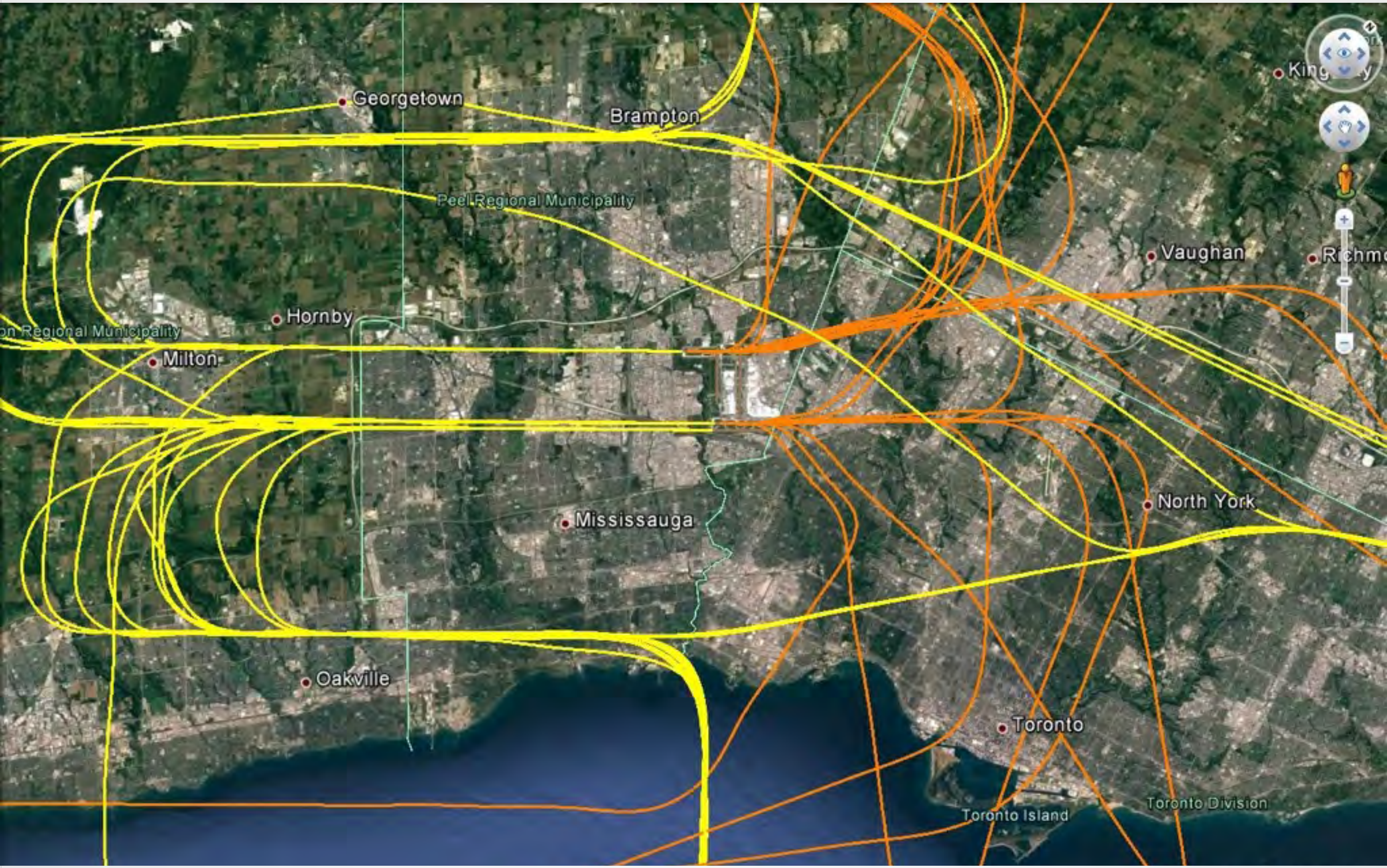
Phases of Flight



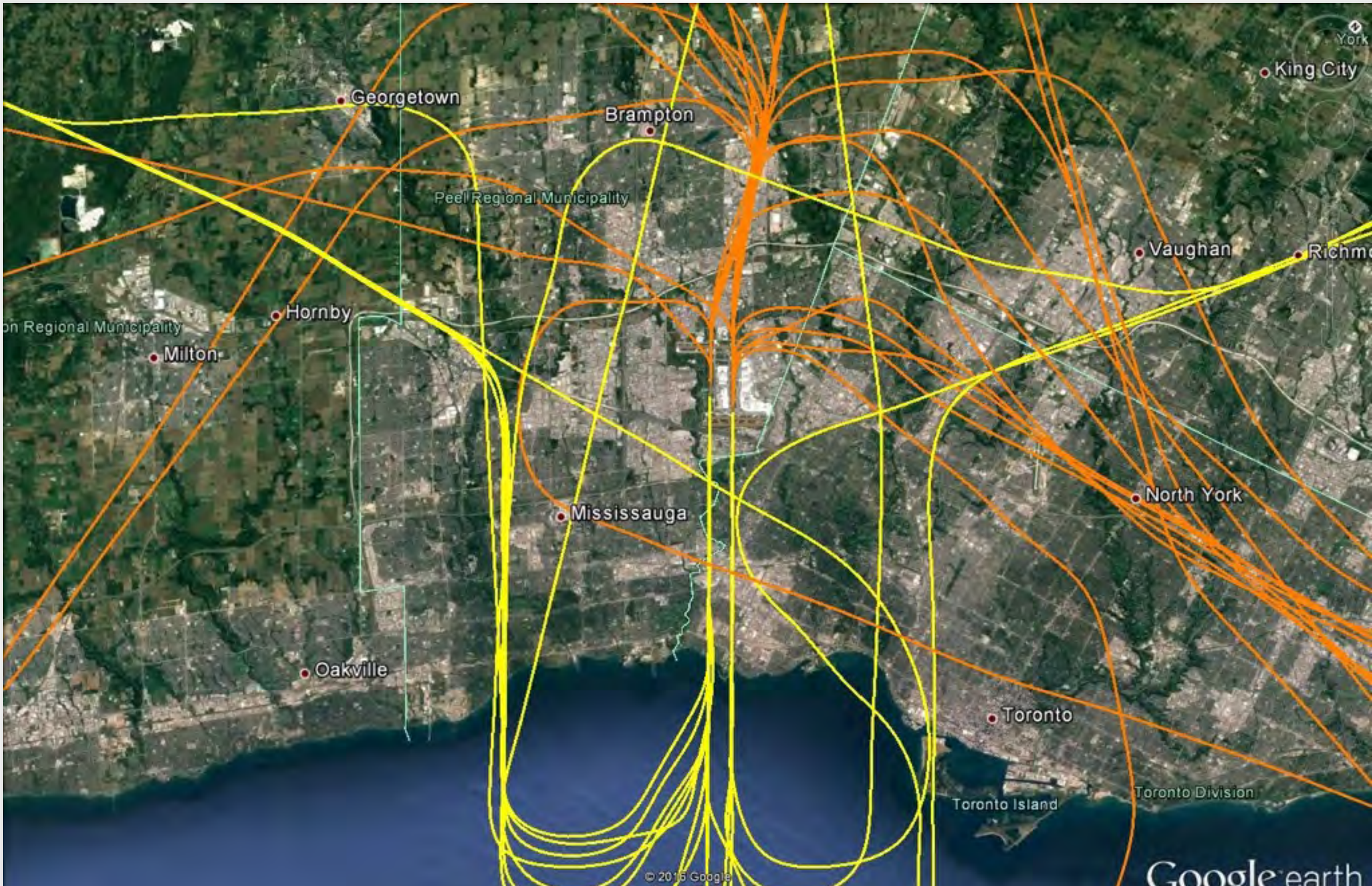
Flight Paths
Westerly Configuration



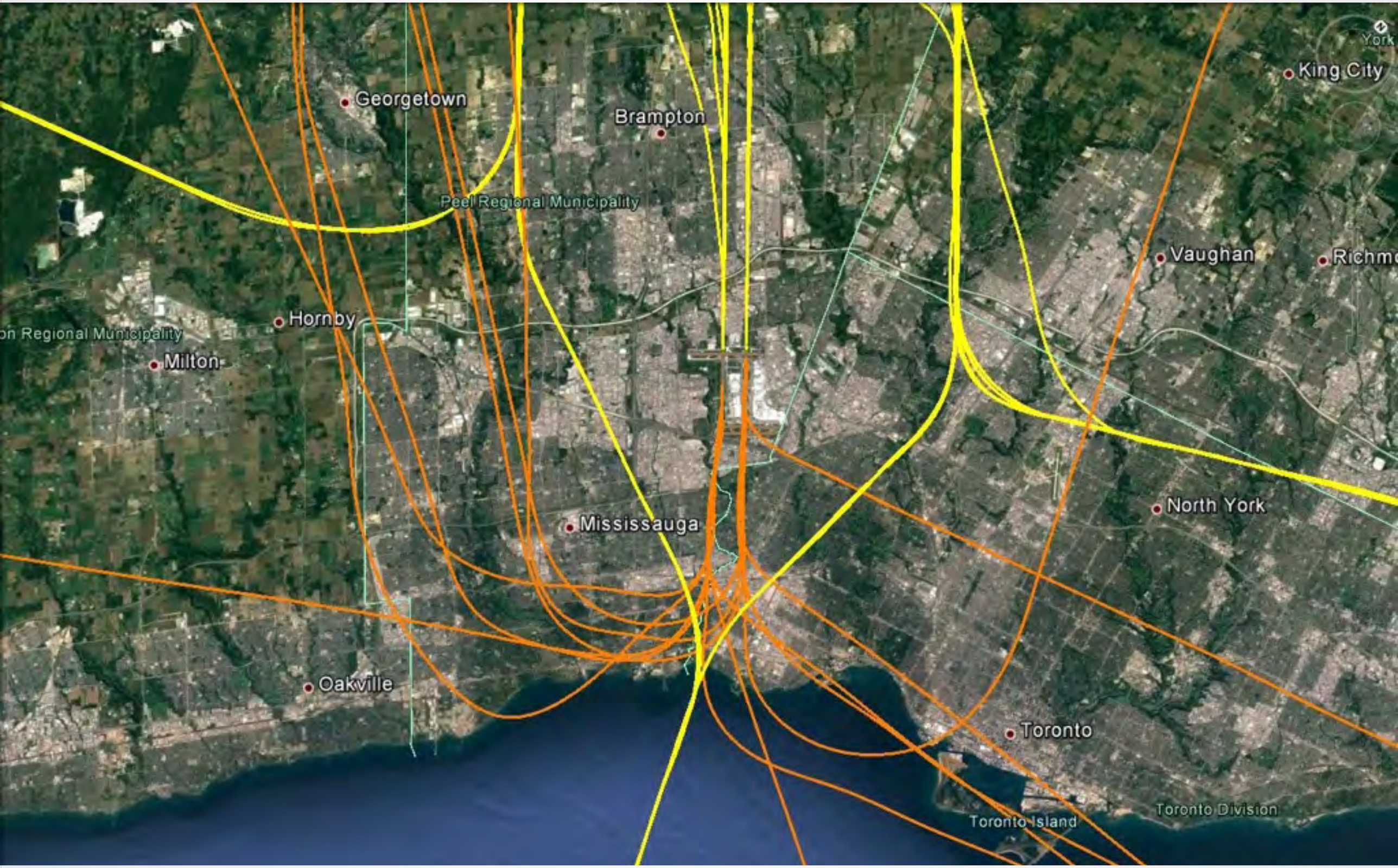
Flight Paths
Easterly Configuration



Flight Paths
Northerly Configuration



Flight Paths
Southerly Configuration



Noise Management Program

Toronto Pearson

Noise Management Program

Elements of our Noise Management Program

Noise Operating Restrictions

- Night Flight Restriction Program
- Engine Run-Up Restrictions
- Preferential Runway Assignment (midnight-6:30 a.m.)

Noise Abatement Procedures – Pilots are required to comply with these procedures designed to minimize noise impacts

Land Use Planning – We work with municipalities to restrict residential development in the highest noise impacted areas (the Airport Operating Area)

Enforcement Office – All flights operating to/from Toronto Pearson are monitored for compliance to Noise Abatement and Noise Operating Restrictions

Noise Management Office – Staff respond to questions and concerns about aircraft noise, register and report on noise complaints

Consultation and Outreach – program to meet with residents in various ways – CENAC meetings, community open houses, publication of monthly community e-newsletter, airport events such as Street Festival/Runway Run

Noise Management Action Plan – the purpose of the initiatives of the Noise Management Action Plan is to ensure continuous improvement of the Noise Management Program.
Recent/current initiatives include NMT Review and the Noise Management Benchmarking Study

Toronto Pearson

How we Communicate

Noise Complaints

Residents can register noise complaints using any of the following means:

- **Online:** Using WebTrak to investigate aircraft operations and register complaints, or our online Complaint Form
- **Phone:** (416) 247-7682

CENAC Meetings

- Held four to five times per year.
- CENAC committee is comprised of community and Elected official representatives
- Technical advisors (NAV CANADA, Transport Canada, acoustician, airline)

Community Open Houses/Events

- Meet community members at community open houses and community events

Monthly E-Newsletter

- **Checking In** includes relevant information about Toronto Pearson including airport events, activities, noise mitigation initiatives and public consultations.

Noise Complaints - 2016

Federal Riding	Complaints	Callers
Beaches-East York	119	2
Bramalea - Gore - Malton	1	1
Brampton Centre	437	38
Brampton East	30	10
Brampton North	12	7
Brampton South	58	23
Brampton West	2	2
Burlington	1	1
Davenport	39	4
Don Valley East	5086	17
Don Valley North	6	3
Don Valley West	2276	47
Dufferin-Caledon	41	3
Eglinton-Lawrence	260	19
Etobicoke - Lakeshore	266	48
Etobicoke Centre	2918	109
Etobicoke North	2643	32
Humber River-Black Creek	89	48
King-Vaughan	92	18
Markham-Stouffville	858	2
Markham-Thornhill	8	4
Markham-Unionville	9	4

Federal Riding	Complaints	Callers
Mississauga Centre	5	4
Mississauga East-Cooksville	198	37
Mississauga-Bram. South	1	1
Mississauga-Erin Mills	40	13
Mississauga-Lakeshore	69	13
Mississauga-Malton	270	33
Mississauga-Streetsville	891	44
Oakville	2610	67
Oakville North-Burlington	11606	88
Parkdale-High park	14756	35
Richmond Hill	2	2
Scarborough Centre	6	2
Scarborough-Agincourt	1	1
Scarborough-Guildwood	2	2
Scarborough-Rouge Park	639	1
Spadina-Fort York	1	1
Thornhill	12	10
Toronto-Danforth	3	3
Toronto-St.Paul's	991	19
University-Rosedale	6	4
Vaughan-Woodbridge	207	9
Wellington-Halton Hills	5431	23
Willowdale	73	10
York Centre	16	6
York South-Weston	3	3
Grand Total	**53135**	**880**

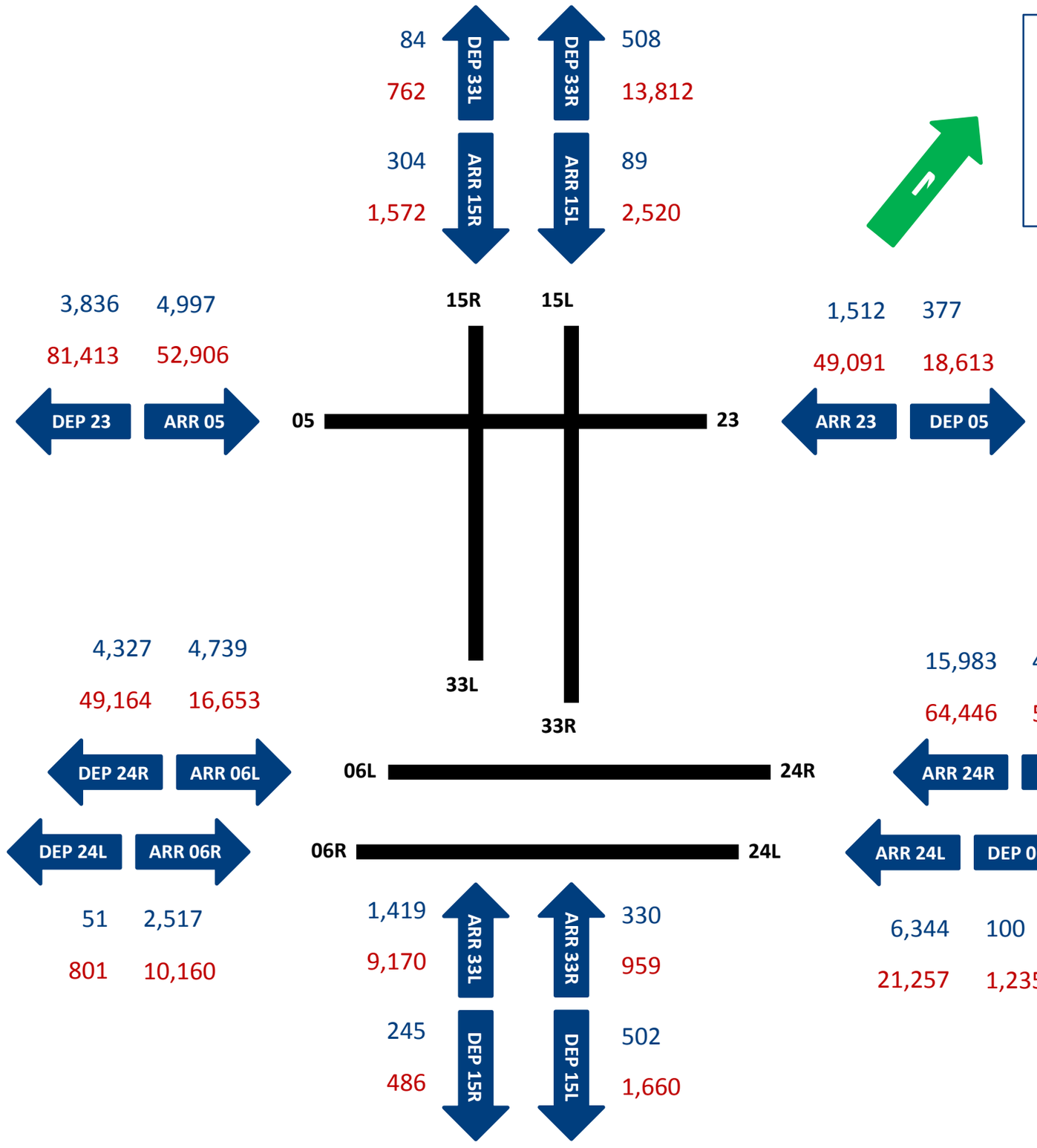
Complaints & Runway Movements
All Hours

Complaints by Runway Movements
Total = 53,001

Runway Movements
Total = 453,444

72% of the complaints were for Arrivals

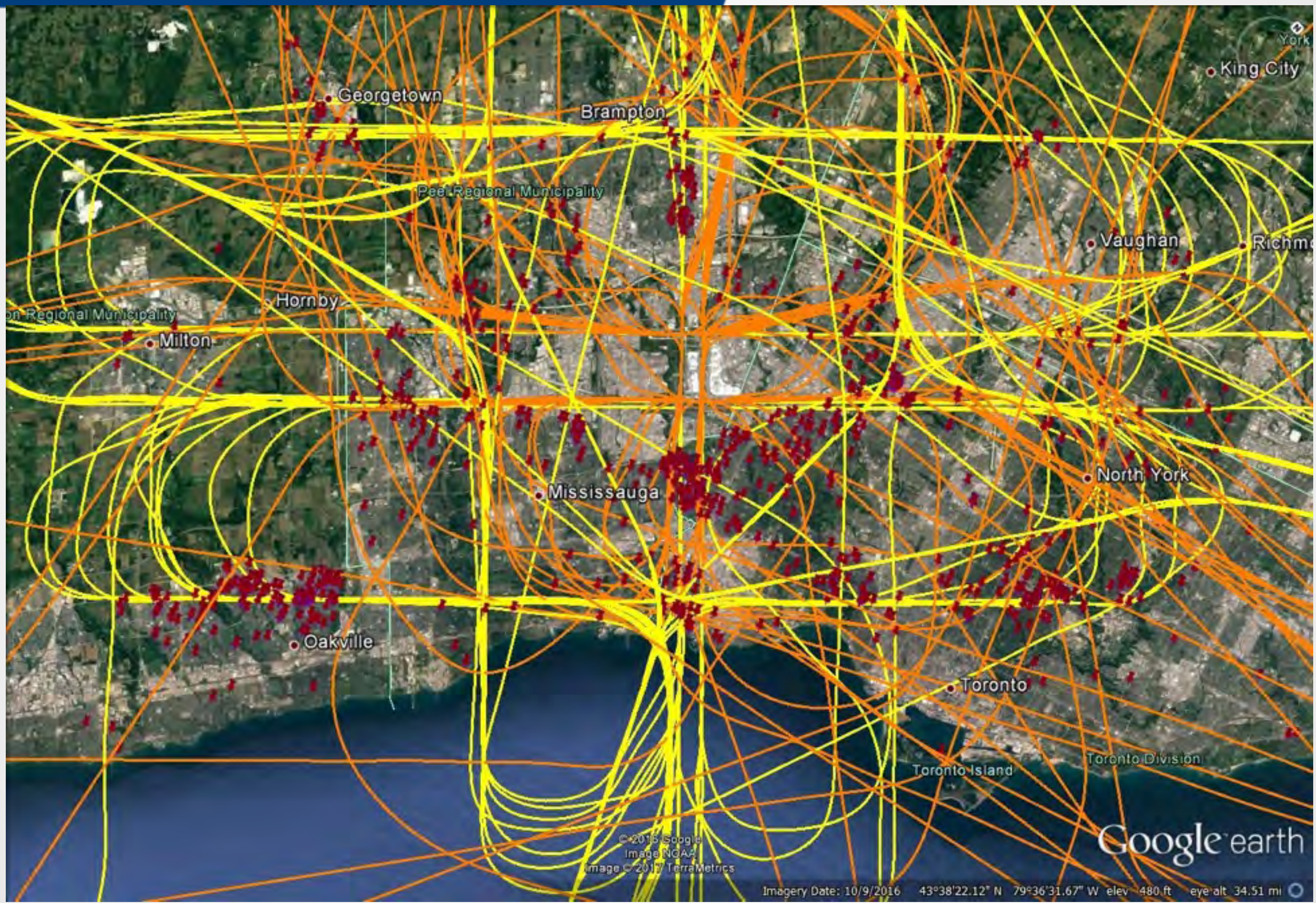
28% of the complaints were for Departures



Throughout the year, we also receive complaints against non-runway operations, including Helicopter, Instrument Landing Checks Overshoots, and Run Ups

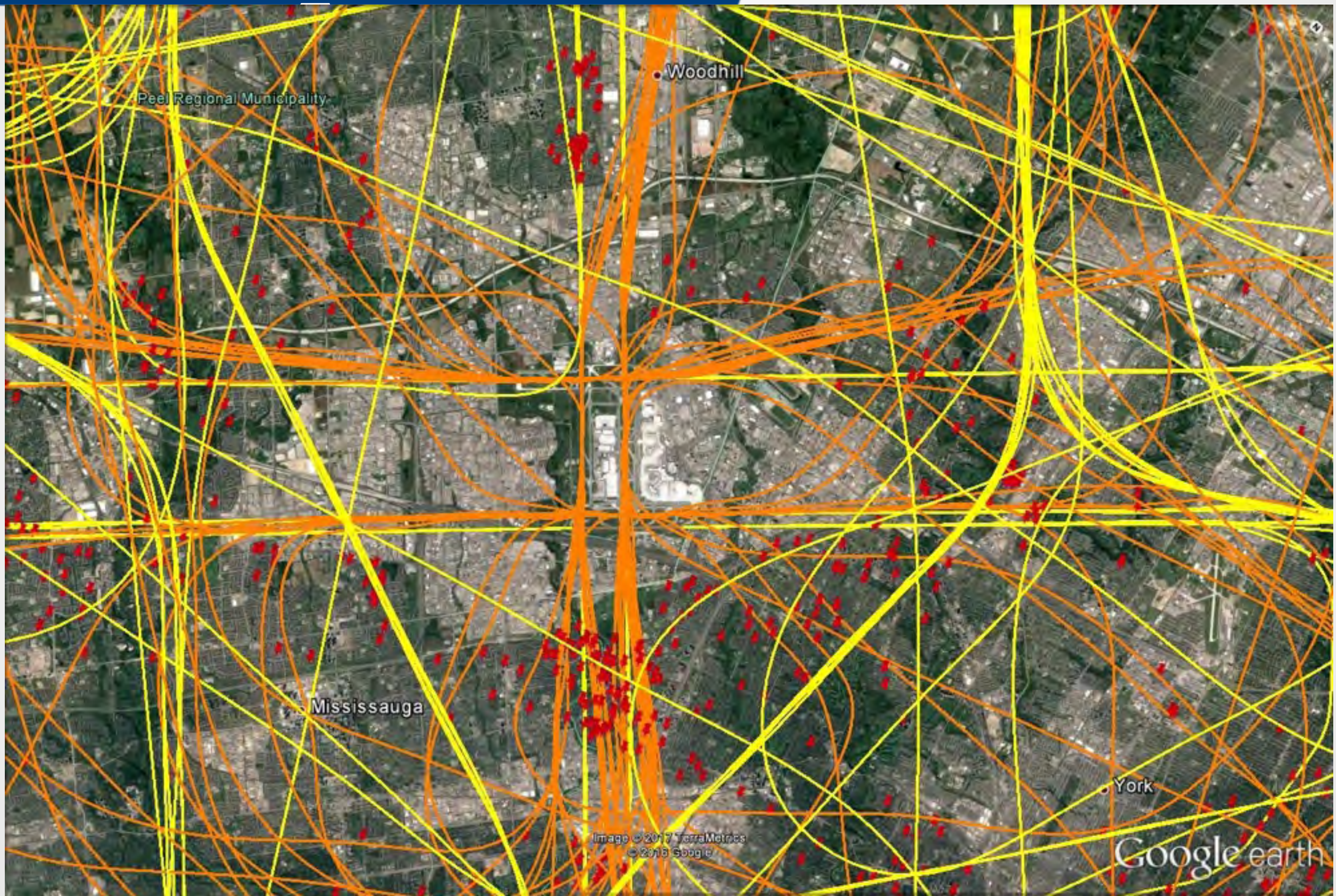
Non-Runway Complaints Total = 134

Complaint Distribution



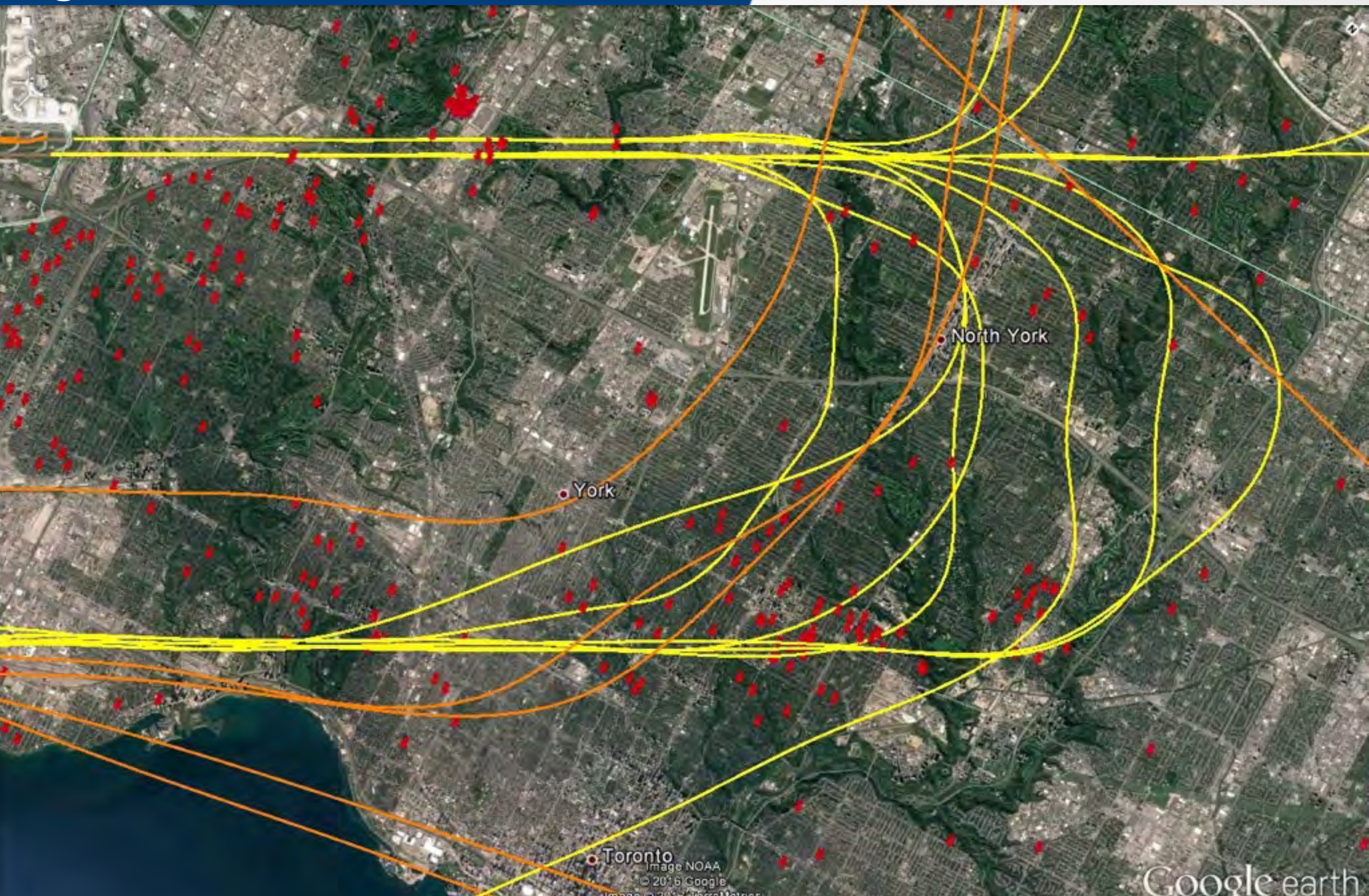
Noise Experiences

Low and Loud_



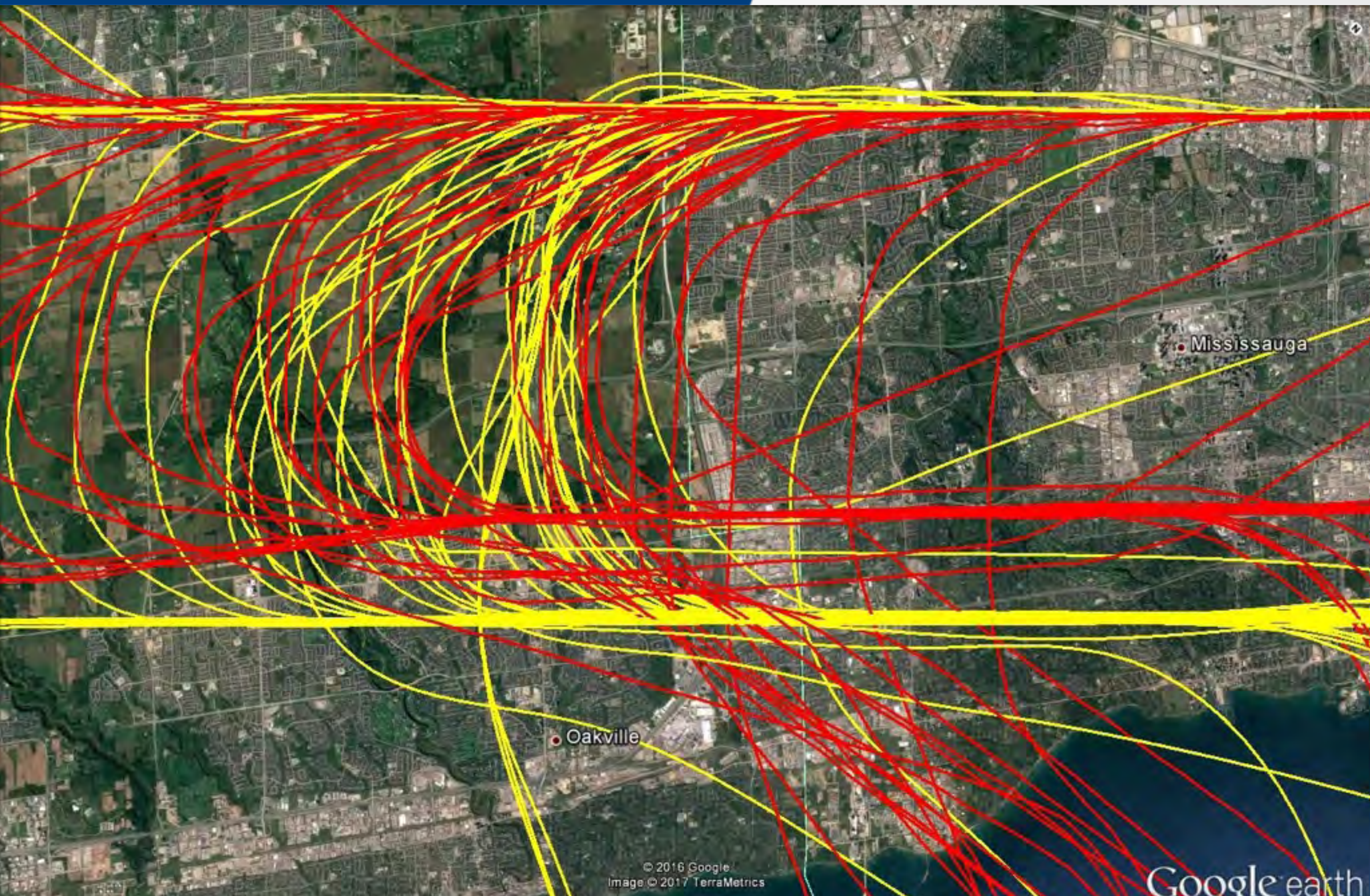
Noise Experiences

High Traffic Levels

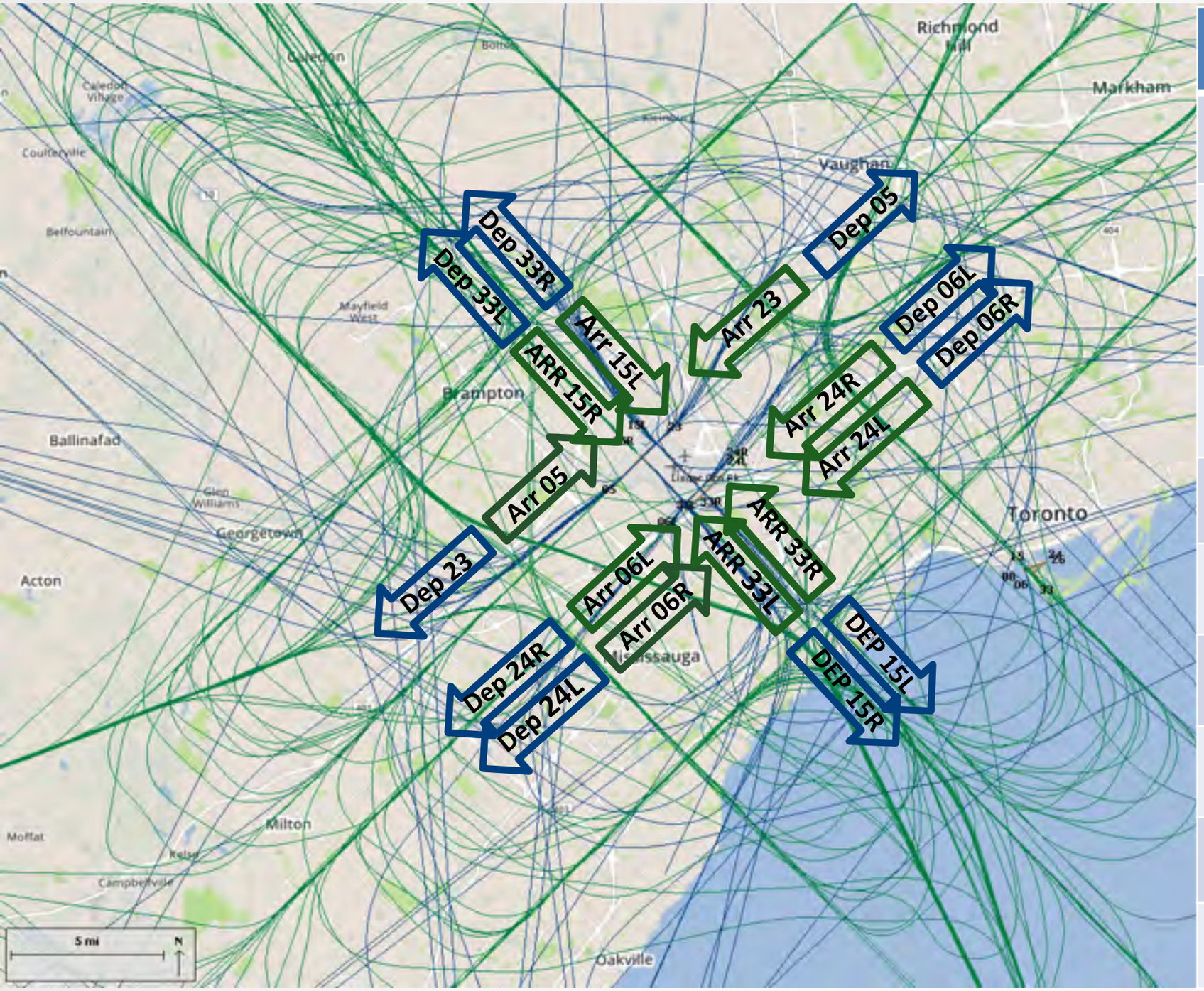


Noise Experiences

New Noise



Noise Experience
Nighttime Noise



Rwy	Arrivals		Departures	
05	5,759	40.2%	361	6.5%
06L	559	3.9%	302	5.4%
06R	73	0.5%	7	0.1%
15L	1,696	11.8%	100	1.8%
15R	114	0.8%	126	2.3%
23	4,631	32.3%	2,541	45.8%
24L	91	0.6%	0	0.0%
24R	1,103	7.7%	116	2.1%
33L	89	0.6%	28	0.5%
33R	216	1.5%	1,962	35.4%

Preferential Runways in order of priority:
Arrivals – 1) 05 2) 15L 3) 06L; Departures – 1) 23, 2) 33R, 3) 24R
Note high usage of non-preferential runways due to prevailing westerly wind

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Noise Experiences

Nighttime Noise (downwind)

Issues/Trends

Toronto Pearson

Night Flights

Night Flight Budget

- Night Flight = A flight that operates between 12:30 and 6:30 am
- In 1997, Transport Canada established a budget for the annual increase of night flights
- Formula - night flight movements can increase at the same rate as passenger growth.
- Only airport in Canada with a budget

2013 Night Flight Budget Amendment

- In 2011 following public consultation, the GTAA submitted a request to Transport Canada for an amendment to the Night Flight budget to accommodate growing demand. Transport Canada approved amendment in June 2013
- Amendment includes a “trigger” for three 10% bump-ups IF the annual actual night flight movements reaches 95% of the budget
- Bump up has not been required

Community Concern

- General concerns about night flights
- Formula based on passenger growth, not movements (passenger growth is higher)
- Concern about pending bump-up

Type of Flight	2017 Budget
Pre-Scheduled “Exemptions”	14,200
Unscheduled Day of “Extensions”	4,004
TOTAL	18,204 (7.57% increase)

2012 Airspace Changes

On February 9, 2012, NAV CANADA implemented a change to routings for the **Toronto-Ottawa-Montreal Corridor**

Purpose:

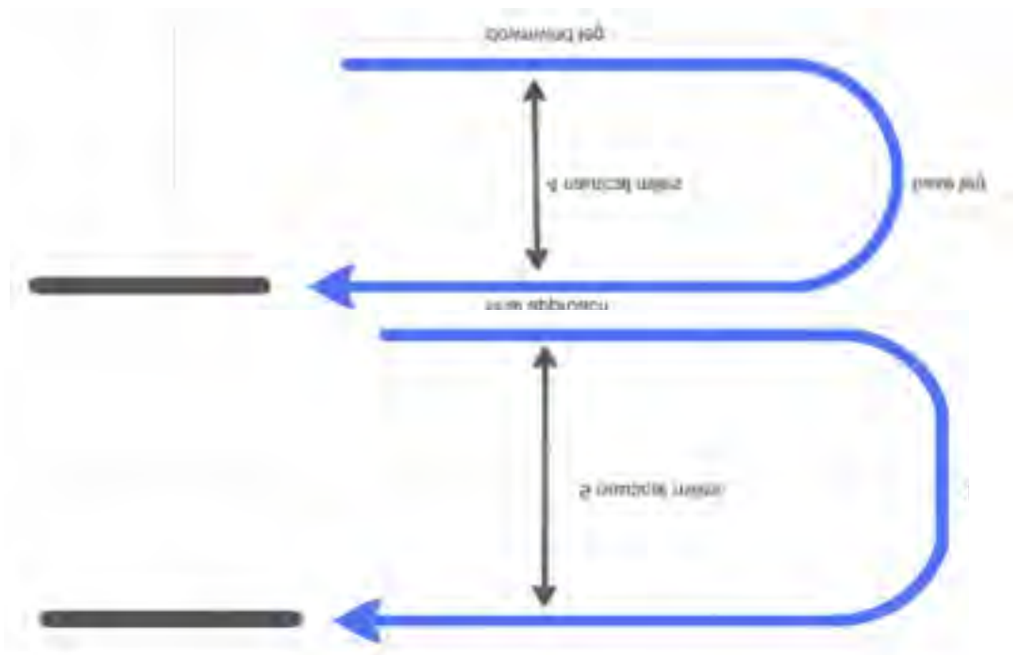
- To increase efficiency and consistency of the airspace while reducing controller/pilot complexity, track miles, fuel burn & GHG emissions

Local Impacts:

- When redesigning the airspace, NAV CANADA had to comply with Transport Canada's latest design criteria which required a wider turn radius on the base turn
- This meant the downwind for 06L/R and 24L/R moved 1 NM south (the downwind for other runways already met the criteria)

Before

After



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Airspace Change Protocol

Airspace Change Protocol

In June 2015, NAV CANADA and the Canadian Airports Council published the Airspace Change Communications & Consultation Protocol to ensure residents:

1. Have the opportunity to know that a change may be taking place and why the change is necessary
2. Have the ability to learn and understand how the change may affect them, and
3. Are able to provide input that will be taken into consideration as part of the design process

Toronto Pearson

Questions?

Noise Mitigation Initiatives

Study	Description	Status
Toronto Airspace Noise Review	Commissioned by NAV CANADA • Led by Helios • Review of Toronto airspace, to determine whether all reasonable actions to reduce aircraft noise are being considered with respect to design and operation of the Toronto area airspace.	• Helios undertook a consultation and public engagement process to gather public input. • Deadline for input was March 30th, however, due to increased interest in the study the public comment period has been extended to May 31, 2017.
Toronto Noise Mitigation Initiatives	NAV CANADA and the GTAA are studying six noise mitigation ideas: 1. New Approaches for night-time operations 2. New Nighttime departure procedures 3. Increase downwind arrival speeds 4. Use new technology to reduce need for low altitude leveling of arriving aircraft 5. Weekend Runway Alternation 6. Review of Preferential Runway System	• The GTAA expects to begin consultation on Ideas 5 & 6 later this fall.
Noise Management Benchmarking Study	Commissioned by GTAA • Initiative of the Noise Management Action Plan, • Working with Helios to benchmark Toronto Pearson Noise Management Program and identify potential new programs or initiatives to pursue.	• This study is expected to be completed by Summer 2017.

Toronto Pearson

Toronto Noise Mitigation Initiatives
The Six Ideas

The Six Ideas

In June 2015, the GTAA announced a three-phase Noise Mitigation Initiatives Engagement Plan with NAV CANADA to study six ideas that have the potential to reduce the noise impact of Toronto Pearson's operations on surrounding neighbourhoods.

- These ideas are in response to feedback that has been provided by the community.

1. New Approaches for night-time operations – improved descent profiles
2. New Departure Procedures for night-time operations – higher altitude requirements for turns
3. Increase downwind arrival speeds to reduce flap use
4. Use of RNP to allow for constant descent in parallel operations
5. Weekend Runway alternation
6. Preferential Runway Review

- Stakeholder roundtable sessions held in summer 2015
- Technical Briefing May 2016

Transport Canada / Transports Canada

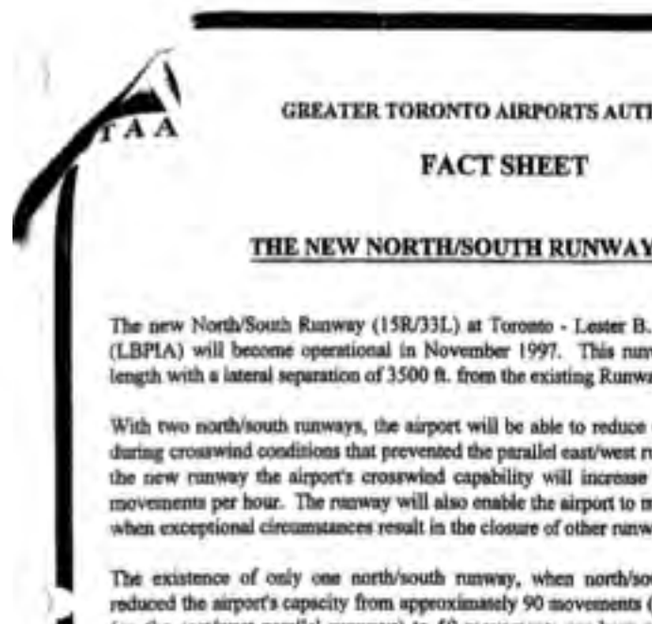
Information

THE NEW NORTH/SOUTH RUNWAY - 15R/33L

The final phase of construction for the second North/South Runway at Toronto - Lester B. Pearson International Airport is underway. On completion, this runway will be 8500 ft in operational length with a lateral separation of 3500 ft from the existing Runway 15L/33R. Approximately 6200' of the runway's total length is expected to be completed by late 1996, and construction of the balance of the runway will resume in the spring of 1997. It is anticipated that the runway will be operational by fall 1997.

Airport management is proposing to use the new runway (15R/33L) primarily for landings to minimize noise impacts and has furthermore committed that operations on the new runway will be limited to those periods when weather mandated (strong crosswinds incapacitating use of the parallel east/west runways) or required due to other exceptional circumstances (existing north/south runway out of service, disabled aircraft, or other safety concerns). With the new runway the airport's crosswind capability will increase from approximately 50 to 70 movements per hour.

Historical wind data indicate that mandatory usage of north/south runways will be for approximately 5% of the time for arrivals from the south and 1% of the time for arrivals from the north. When north/south operations are required, the airport's capacity drops from approximately 90 (arrival and departure) movements per hour (during east/west parallel runway operations) to 50 movements per hour. These numbers are determined by including attendant delays and congestion on the runways and within the terminals at LBPIA as well as other airports in the national system. With the addition of a second north/south runway, crosswind capability will increase to allow approximately 30 landings per hour on the new runway and 40 departures on the existing runway for a



GREATER TORONTO AIRPORTS AUT

FACT SHEET

THE NEW NORTH/SOUTH RUNWAY

The new North/South Runway (15R/33L) at Toronto - Lester B.
(LBPIA) will become operational in November 1997. This run
length with a lateral separation of 3500 ft. from the existing Runwa

With two north/south runways, the airport will be able to reduce
during crosswind conditions that prevented the parallel east/west r
the new runway the airport's crosswind capability will increase
movements per hour. The runway will also enable the airport to m
when exceptional circumstances result in the closure of other runw

The existence of only one north/south runway, when north/so
reduced the airport's capacity from approximately 90 movements

Fundamentals of Acoustics and Aircraft Noise

Colin Novak, Ph.D., P.Eng.

Akoustik Engineering Limited

Toronto Pearson

Fundamentals of Acoustics and Aircraft Noise

Residents' Reference Panel

Colin Novak Ph.D., P.Eng.

Akoustik Engineering Limited

June 03, 20157

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engineering limited

Why is it important to consider environmental noise?

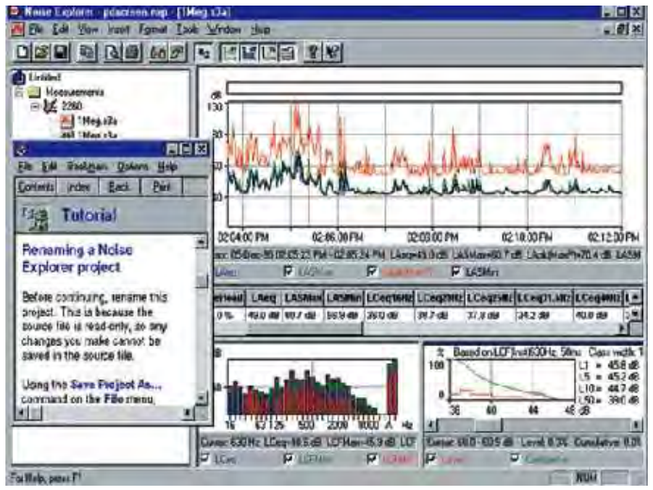
- Studies have shown that approximately 20% of the world population is exposed to unacceptable environmental noise.

- As cities grow, residential areas are encroaching on transportation routes and industrial sources.

- While regulatory requirements are becoming more prominent, many inconsistencies and lack of understanding still exist.

Terminology of Sound

- There are many ways to describe and quantify sound, it is important to understand the applicability of each, including:
  - Sound Pressure level (dB or dBA)
  - Sound Power level (dB)
  - Sound Intensity level (dB)
  - Loudness (Phons or Sones)
  - Effective Perceived Noise Level - EPNL (dB)
  - Statistical Parameters - Ln (dB)



- It is important to also refer to the physical quantities of sound when describing levels and the impact of changing levels

What is sound?

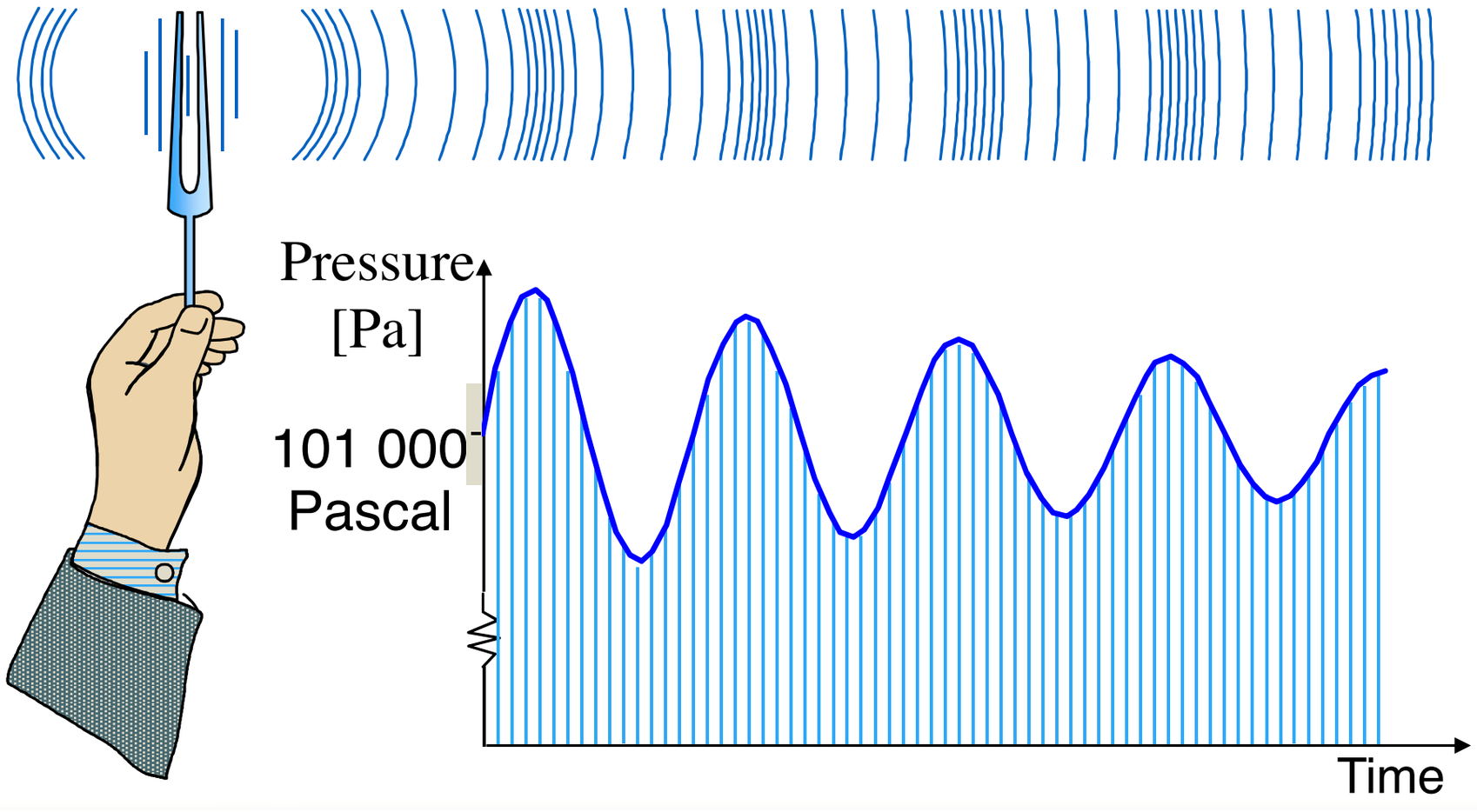
What is the definition of sound?

- Sound is the propagation of a disturbance through a medium. For air, sound propagates at the speed of sound or approximately 340 m/s at STP.

How would you define noise?

- Noise is generally considered to be any unwanted sound.
- Environmental Noise is generally referred to as unwanted sound produced by human activities which interfere with communication, work, rest, recreation and sleep.

What is sound?



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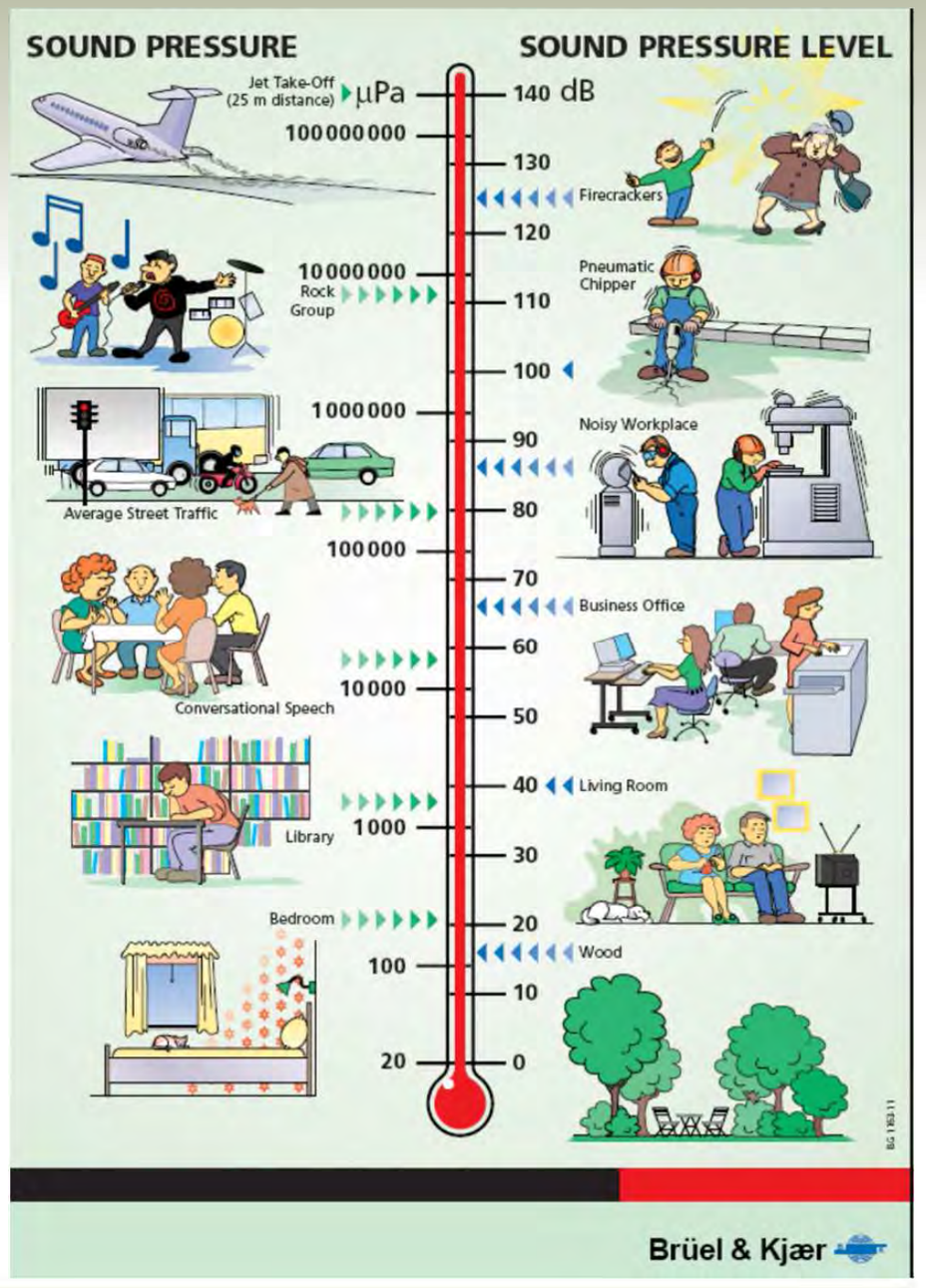
engineering limited

Pressure vs. Pressure Level

- Magnitude of sound pressure affecting the ear varies from $2x10^{-5}$ Pa at the threshold of perception to 200 Pa at instantaneous damage.

- To account for this, a log scale is used to describe sound pressure level which gives the units of dB.



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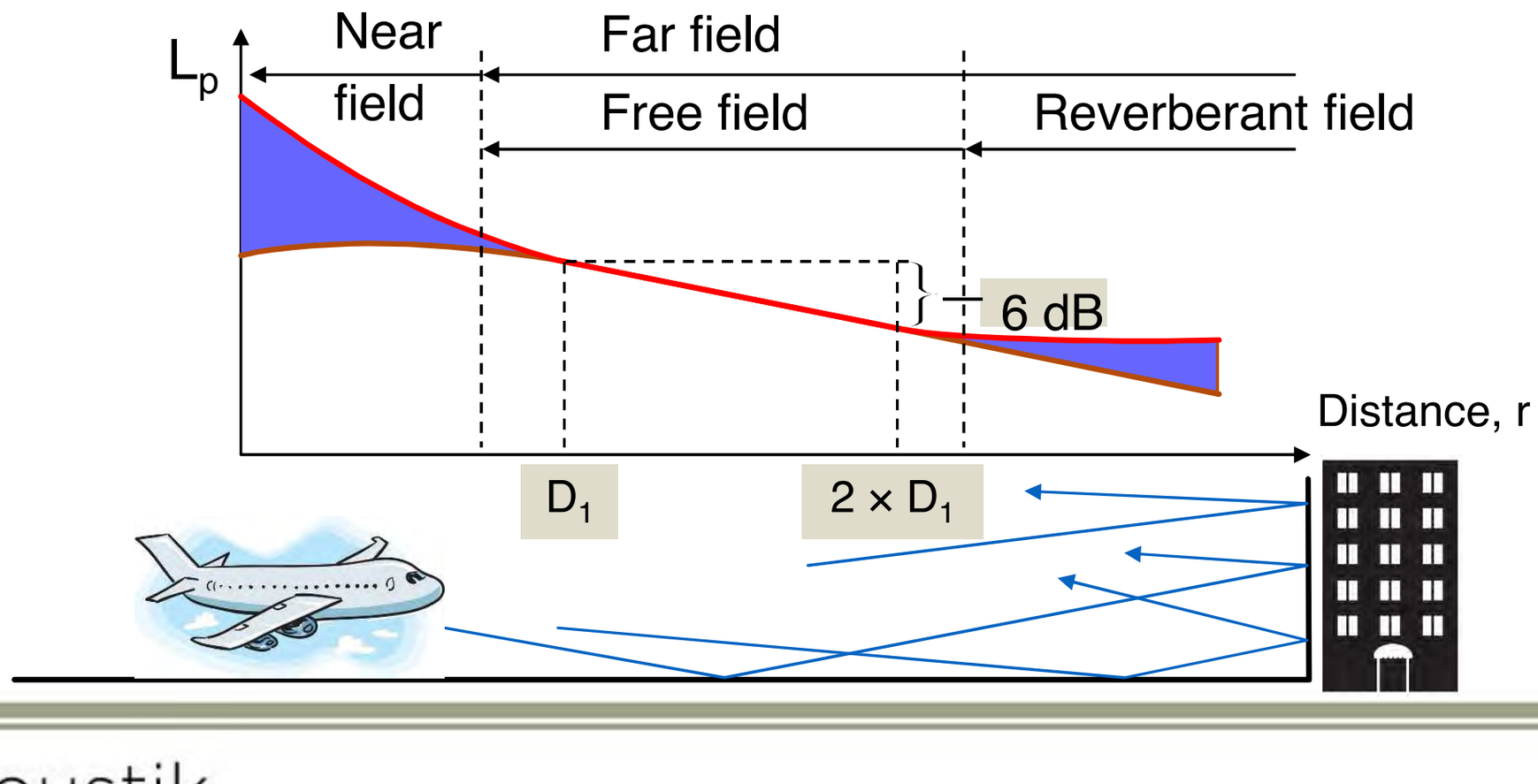
Propagation of Sound over Distance

- It is important to understand how the propagation of noise varies with distance.
- Ideally, we should experience a 6 dB reduction per doubling of distance. Most *real* sources DO NOT behave this way.



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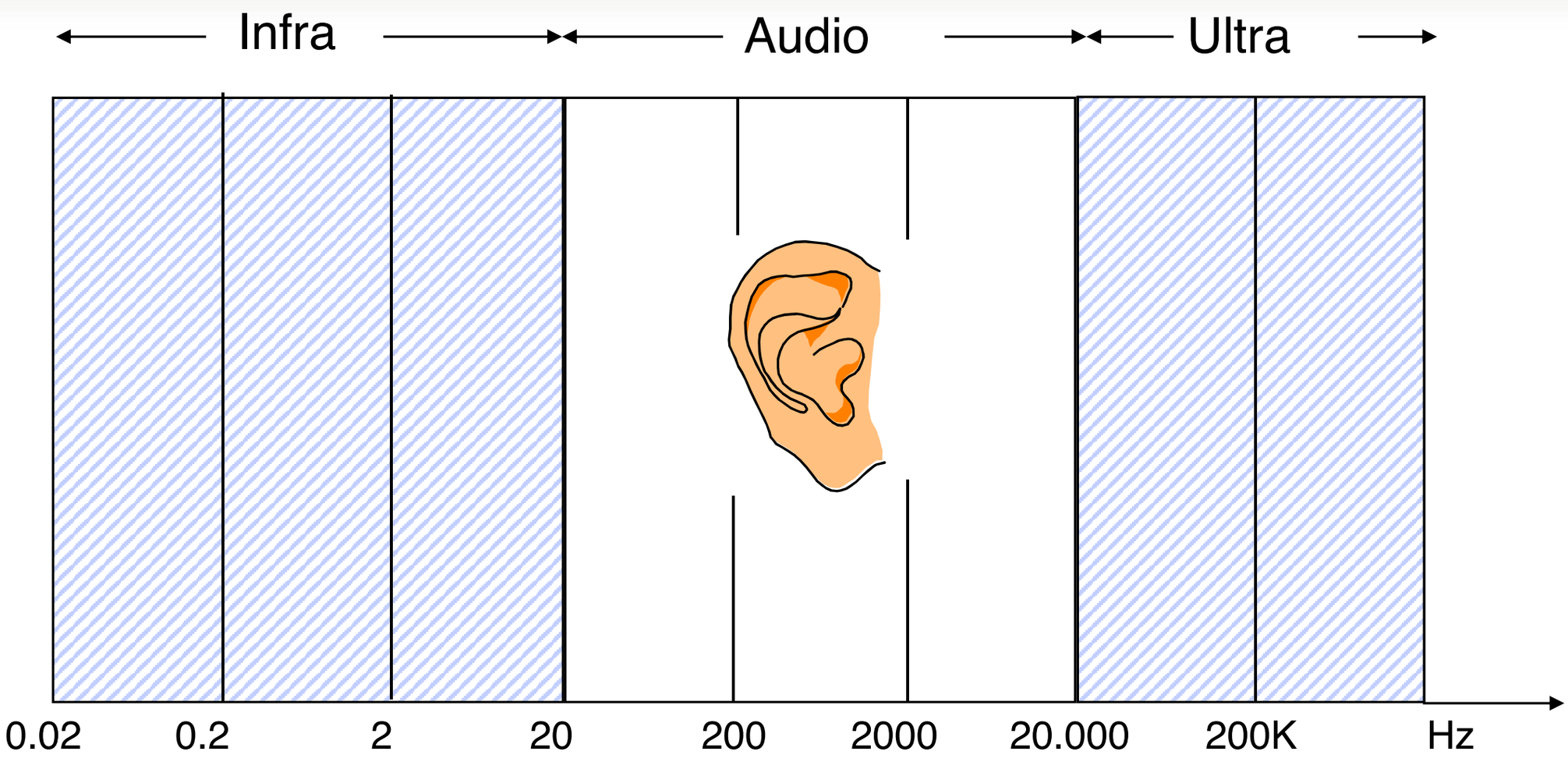
Frequency



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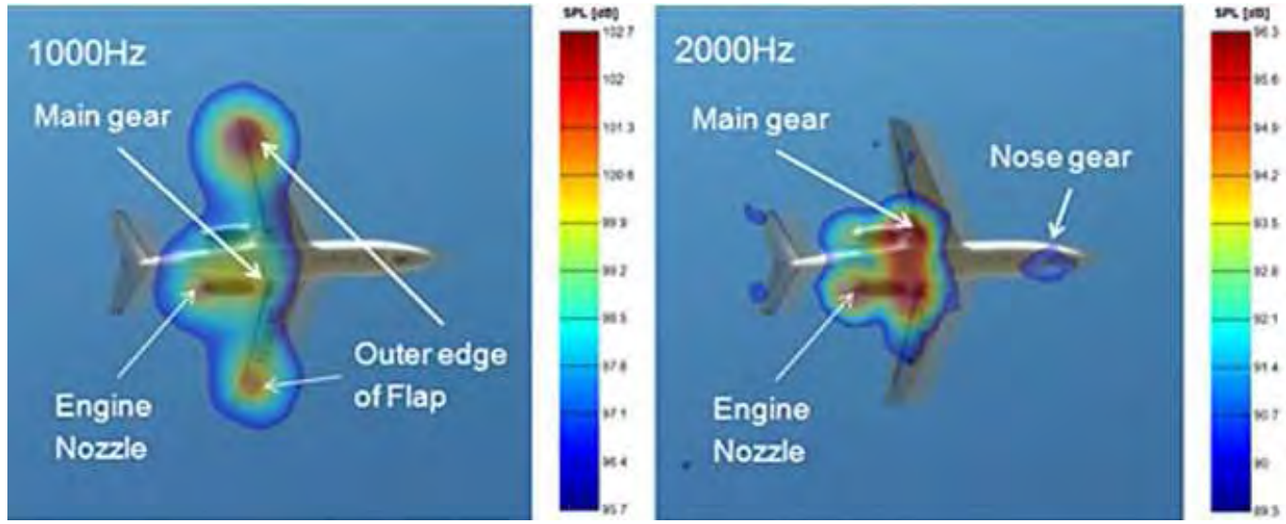
Perception of Sound

Change in Sound Level (dB)	Change in Perceived Loudness
1-3	Just perceptible
5	Noticeable difference
10	Twice (or 1/2) as loud
15	Large change
20	Four times (or 1/4) as loud

Sources of Aircraft Noise

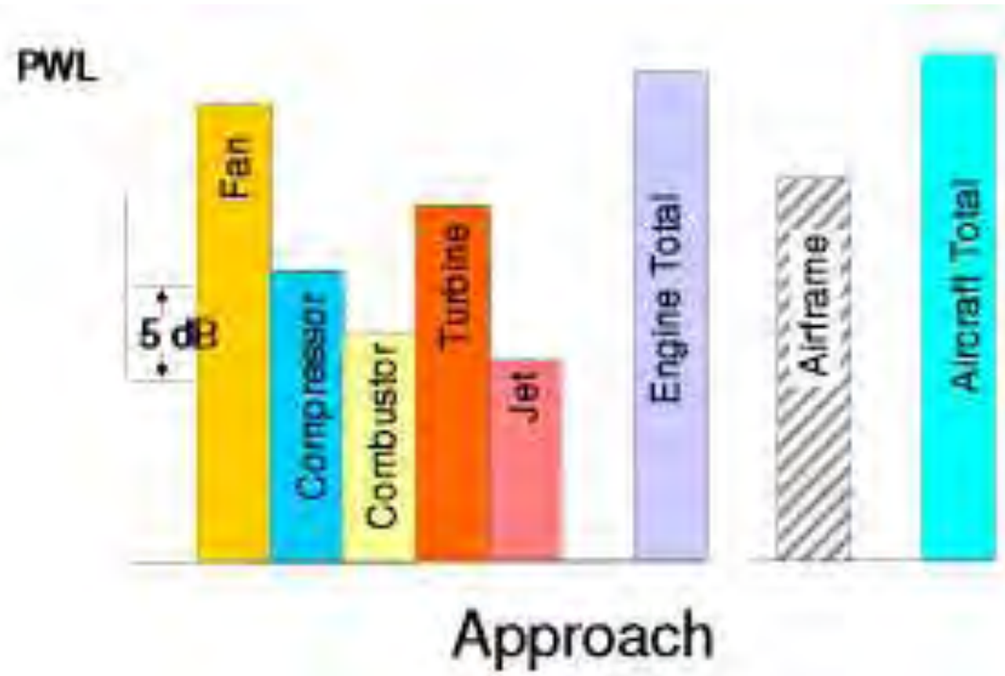
- Mechanical and Fluid Dynamic Noise
  - Fan and Compressor
  - Turbine and Combustion
  - Jet
- Aerodynamic Noise
  - Landing gear
  - Flaps
  - Air brakes



- Each source has its own characteristic amplitude, frequency and directivity that contributes to the aircrafts overall noise

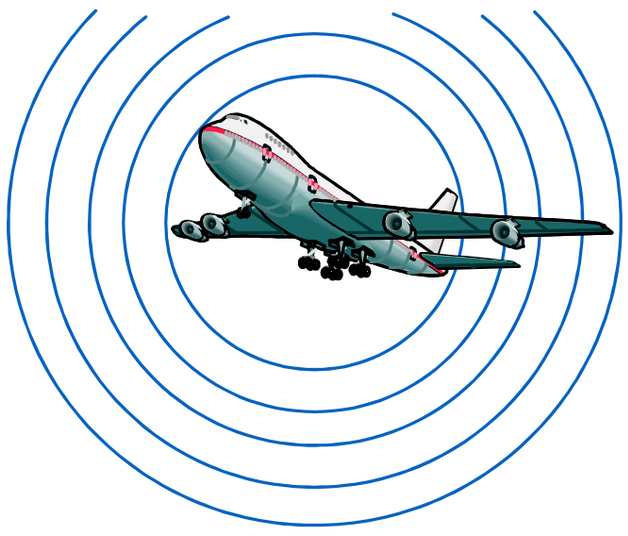
Sources of Aircraft Noise on Approach

- On approach, engine noise is generally the largest contributor to noise
- Most significant engine noise is from the fan and turbine
- Aerodynamic noise from landing gear and flaps can also be significant
- To reduce EPNL at approach, fan noise and airframe noise must be reduced



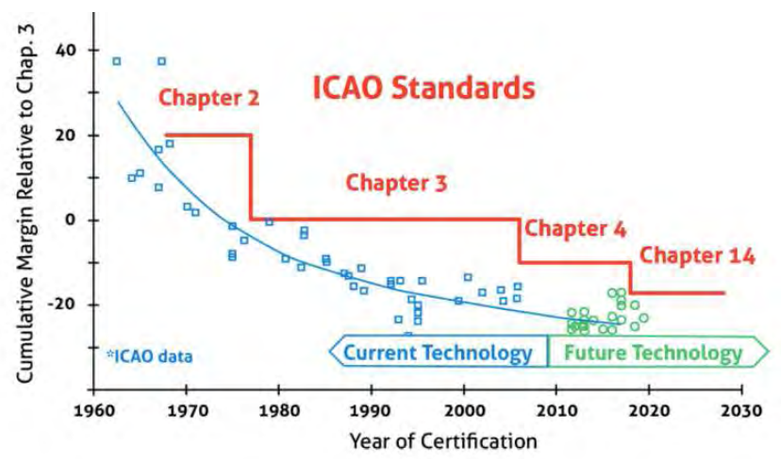
Propagation of Aircraft Noise

- The simplified statement of 6 dB attenuation of sound for each doubling of distance that the sound travels is an unrealistic over estimation
- The attenuation from propagation is the result of many variables (many of which are non linear) and is also frequency dependent, these include:
  - Degree of the uniformity of spherical spreading of the noise source
  - Atmospheric absorption and reflection,
  - Ground absorption and reflection
  - Atmospheric turbulence
  - Refraction due to wind
  - Temperature inversion



Managing Aircraft Noise

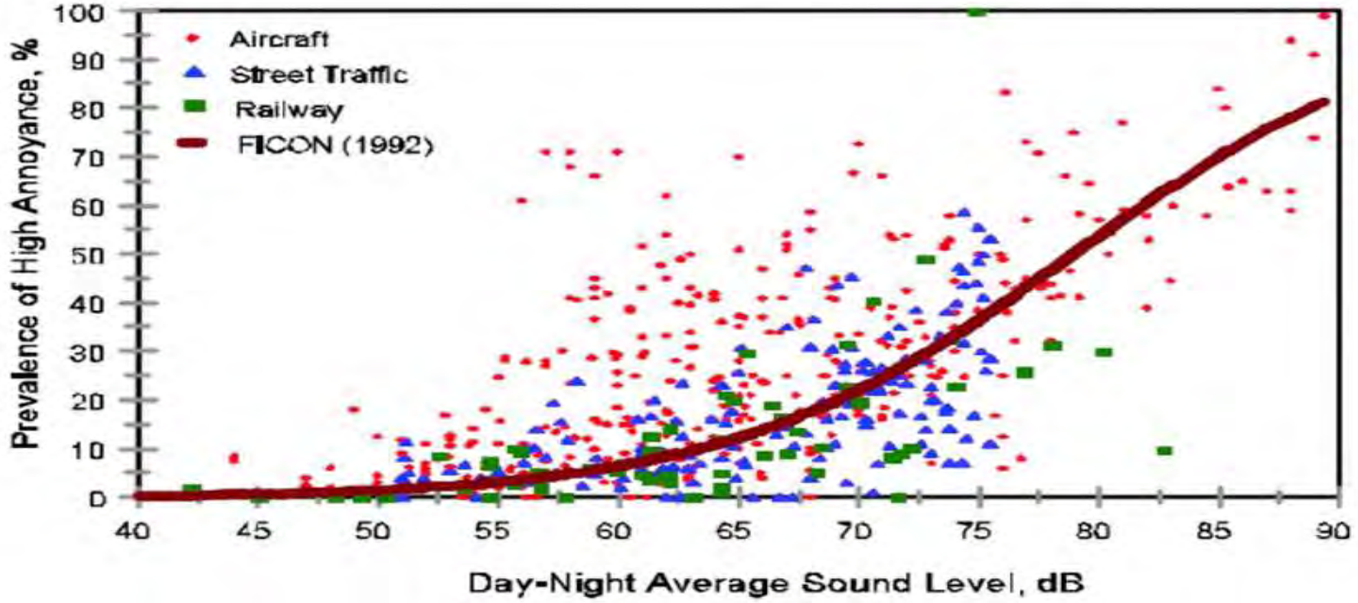
- Aircraft noise abatement has traditionally focused on:
  - Replacement of older aircraft and engine retrofit
  - Implementation of flight operations including:
    - Minimize overflying in high population areas
    - Minimize flying at sensitive times
    - Quieter procedures
    - Discourage new development



- These efforts have lessened or controlled the growth of ground level noise level contours
- However, present noise contour sizes will likely increase due to forecasted capacity demands

Quantifying Aircraft Noise

- Community noise exposure is presently measured using engineering noise metrics eg., L_{DN}, CNEL, Leq, SEL, TA, NA etc.
- These metrics are only some of the factors to quantify community annoyance
  - There is question to their true correlation to annoyance



Other Factors Driving Annoyance

- Noise level is not the only factor to drive annoyance of aircraft noise
  - Relative difference between aircraft noise level to ambient noise level
  - Frequency of aircraft flyover events
  - Higher concentration of aircraft flying a narrower slot due to improved navigation
  - Higher frequency component to aircraft noise is psychoacoustically less desirable
  - Time of day/week - night time and weekend operations
  - Demographics and geographic location

Thank you for listening!

Reviewing our values

Toronto Pearson

Lunch

Toronto Pearson

Managing the Toronto Pearson Airspace

Nick Boud

Principal Consultant, HELIOS

Toronto Pearson

HELIOS
The aviation consultancy of Egis

GTAA Resident Reference Panel

Saturday 3rd June

an egis company

Agenda

1. Who are Helios and who am I
2. Comparison of airport throughput and geographic footprints
3. Role of NAV CANADA
4. Toronto Airspace
5. Independent Toronto Airspace Review
6. Noise modelling for Initiatives 5 & 6

Who are Helios and who am I

- UK aviation consultancy, owned by Egis
- Approx. 65 employees
- Airports, Air navigation services, Institutions
- World wide experience
- Reputation for excellence and quality

- Nick Boud
- Aviation consultant
- 25 years aviation experience
- Airport planning
- Aviation noise
- Air space change
- Consultation
- Policy

Atlanta	
Site Area	23.8 km²
Pax	92.4mppa
Area/Pax	0.26
ATM	923 900

Beijing	
Site Area	39.8 km²
Pax	77.4mppa
Area/Pax	0.51
ATM	533 300

Heathrow	
Site Area	13.5 km²
Pax	69.4mppa
Area/Pax	0.19
ATM	480 900

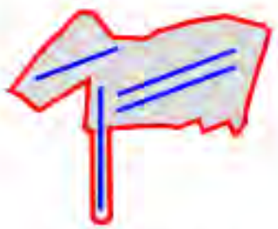
Chicago	
Site Area	29.1 km²
Pax	66.6mppa
Area/Pax	0.44
ATM	875 800

Tokyo-Haneda	
Site Area	14.6 km²
Pax	62.3mppa
Area/Pax	0.23
ATM	378 900

Los Angeles	
Site Area	11.6 km²
Pax	61.8mppa
Area/Pax	0.19
ATM	603 900

Paris-CDG	
Site Area	30.7 km²
Pax	60.9mppa
Area/Pax	0.5
ATM	506 900

Dallas	
Site Area	79.4 km²
Pax	57.8mppa
Area/Pax	1.37
ATM	646 800



Frankfurt	
Site Area	23.7 km²
Pax	56.4mppa
Area/Pax	0.42
ATM	487 200

Hong Kong	
Site Area	13.7km²
Pax	53.3mppa
Area/Pax	0.26
ATM	334 000

Denver	
Site Area	133 km²
Pax	52.7mppa
Area/Pax	2.52
ATM	634 700

Dubai	
Site Area	20.4 km²
Pax	50.9mppa
Area/Pax	0.40
ATM	326 300

Jakarta	
Site Area	16.3 km²
Pax	50.4mppa
Area/Pax	0.32
ATM	

Schiphol	
Site Area	54.5 km²
Pax	49.8mppa
Area/Pax	1.09
ATM	420 000

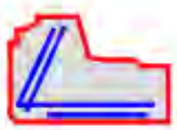
Madrid	
Site Area	53.5 km²
Pax	49.6mppa
Area/Pax	1.08
ATM	429 000

Bangkok	
Site Area	31.5 km²
Pax	47.9mppa
Area/Pax	0.66
ATM	289 100

New York-JFK	
Site Area	18.4 km²
Pax	47.6mppa
Area/Pax	0.38
ATM	409 400

Singapore	
Site Area	40.7 km²
Pax	46.5mppa
Area/Pax	0.88
ATM	301 700

Guangzhou	
Site Area	23 km²
Pax	45.4mppa
Area/Pax	0.51
ATM	351 000



Las Vegas	
Site Area	13
Pax	41.5mppa
Area/Pax	0.31
ATM	531 500

Role of NAV CANADA

- Provides air navigation services across Canada
- Accountable for the safe & efficient management of aircraft within controlled airspace
- Design the airspace structure and flight paths
- Publish information to support the safe & efficient use and operation of Canadian airspace

Airspace

- Airspace is a 3D jigsaw with many pieces
- Toronto's is no more or less complex
- Airspace is different at every airport as every airport is different
- The safest airspace is the most predictable airspace
- Airspace and air traffic control is very "systemised"
- NAV CANADA's operation is heavily manual / eye balling
- One unusual element is a 3000ft hard anchor on the south downwinds

Arrival flight paths

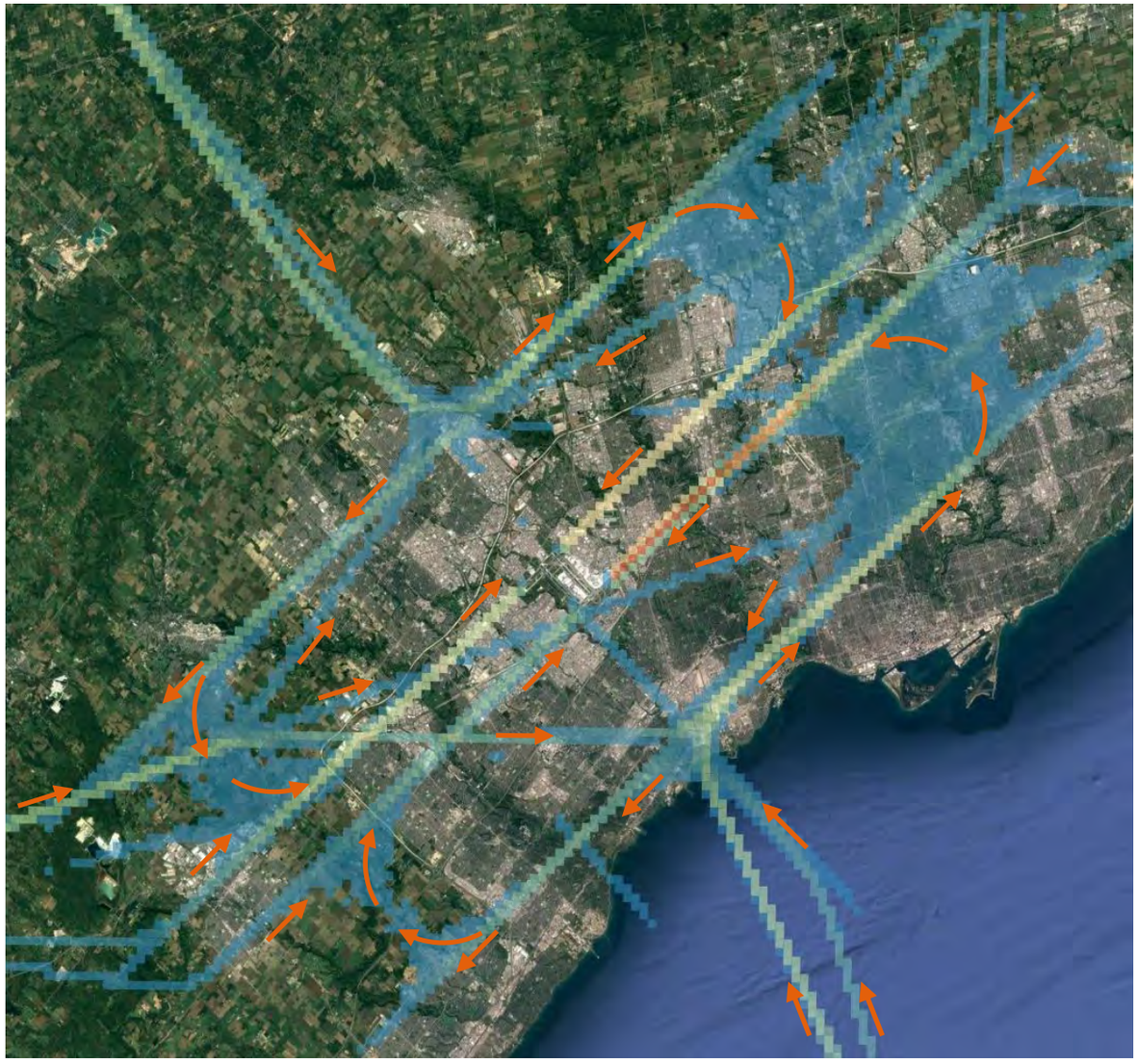
2010

2016

Arrivals

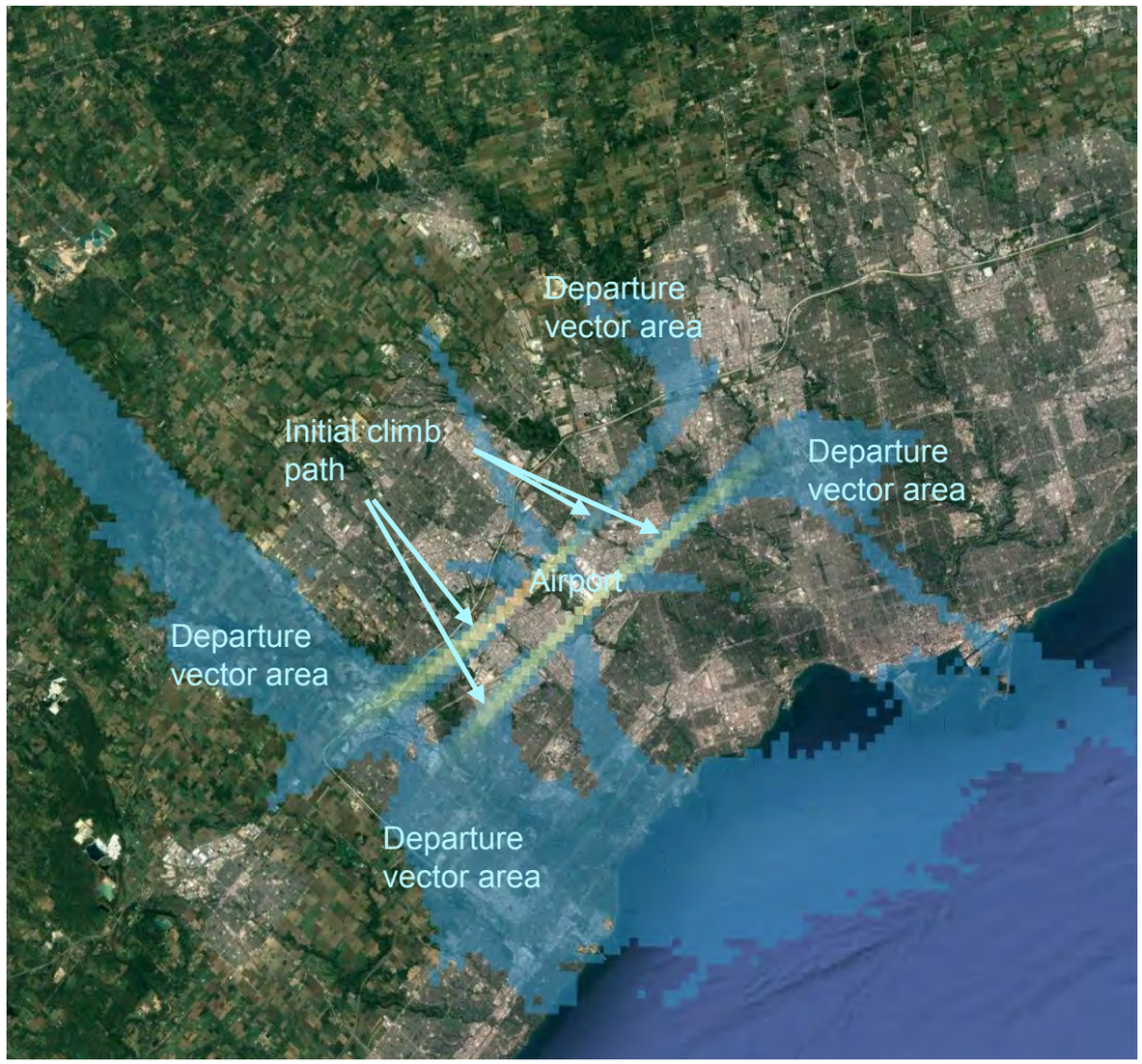
2010

2016

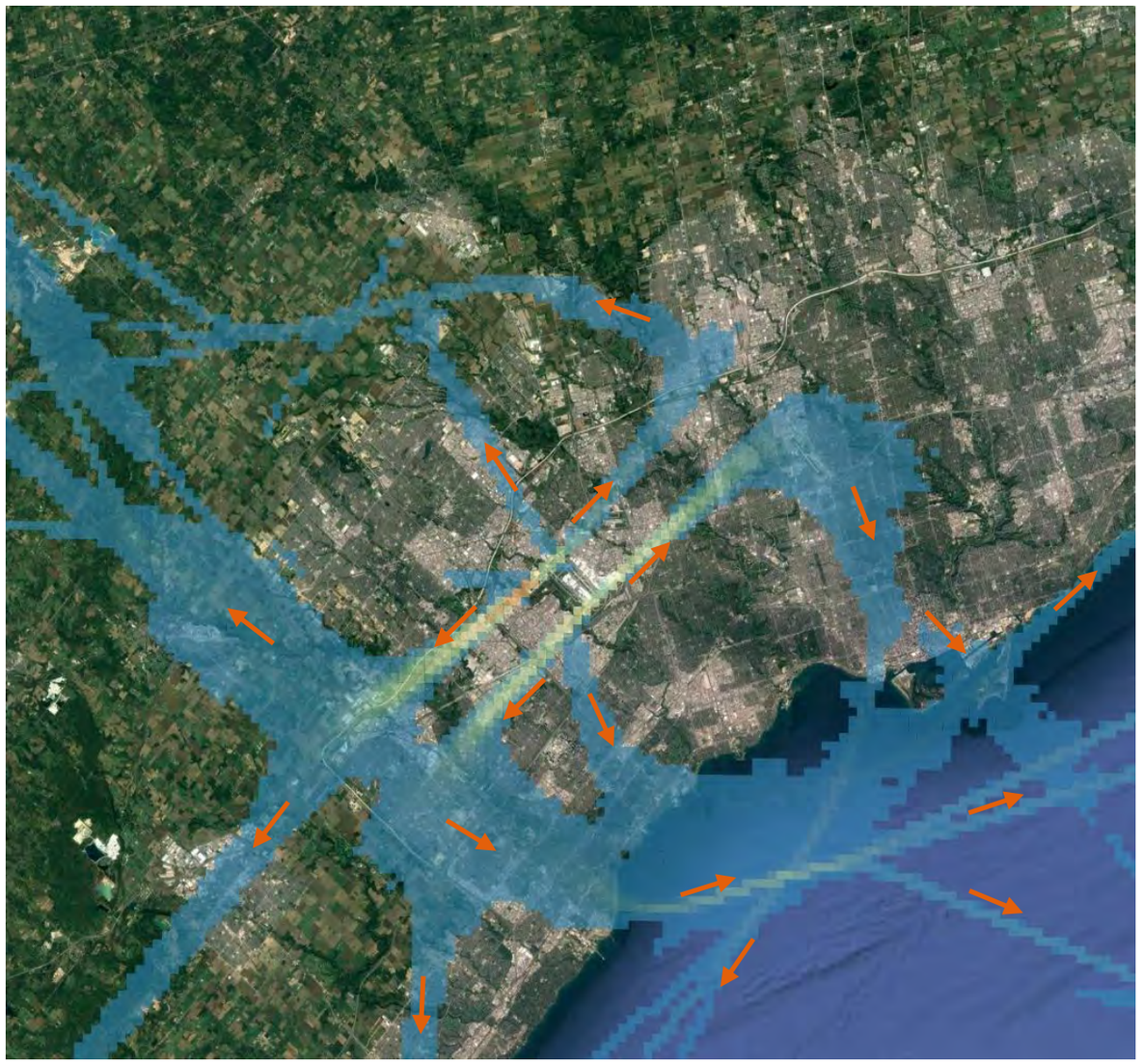


Departures

2010



2016



Change in arrival flight path density
Average July day 2016 vs 2010

Change in departure flight path density
Average July day 2016 vs 2010

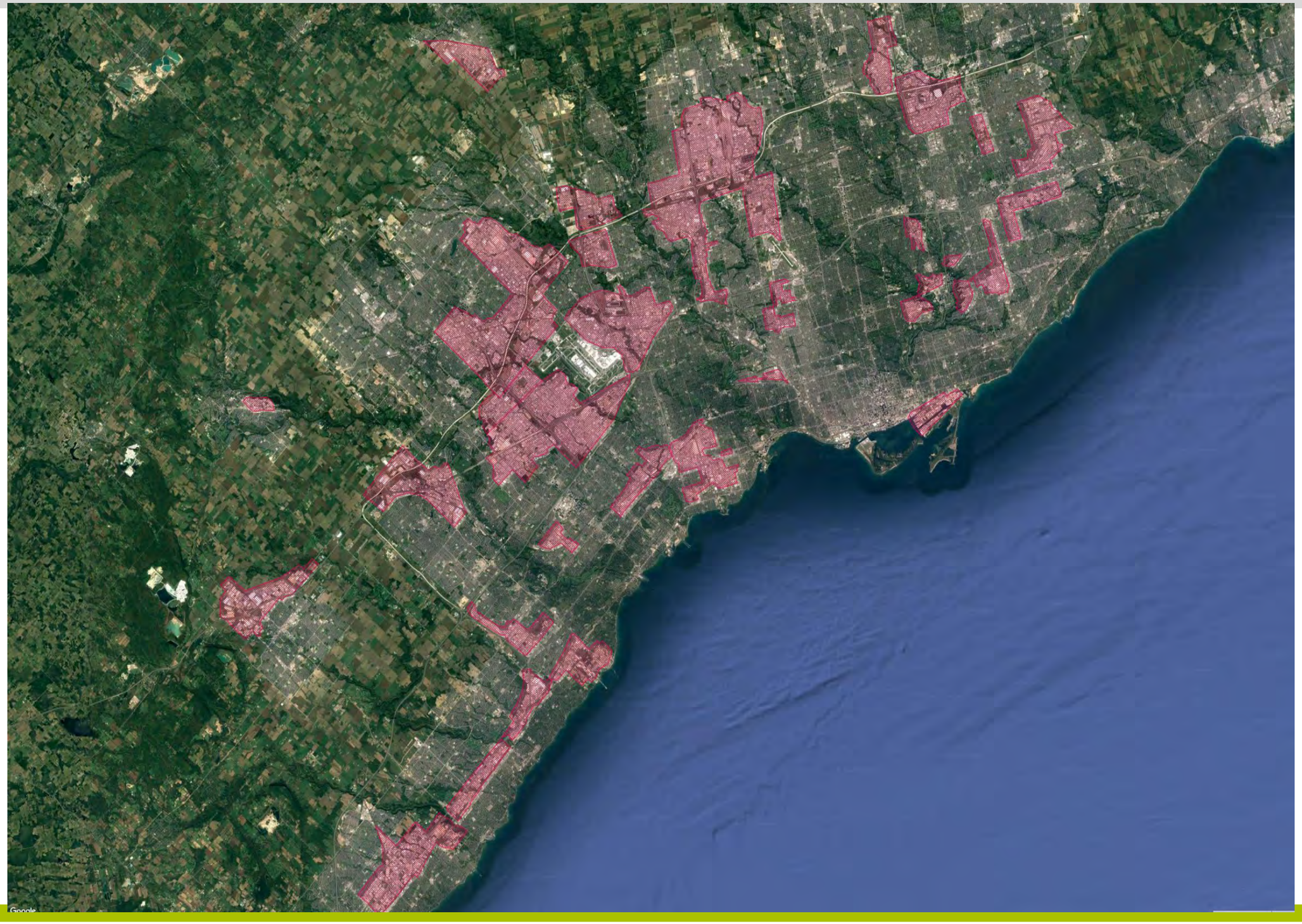
Independent Toronto Airspace Review

- Purpose to identify additional mitigations to reduce the impact of aviation noise.
- Will recommend mitigations where they will reduce noise e.g. keeping aircraft higher for longer.
- Options for noise sharing will be identified but require further consultation.
- Only able to make recommendations against NAV CANADA
- Further information: www.TorontoAirspaceReview.ca

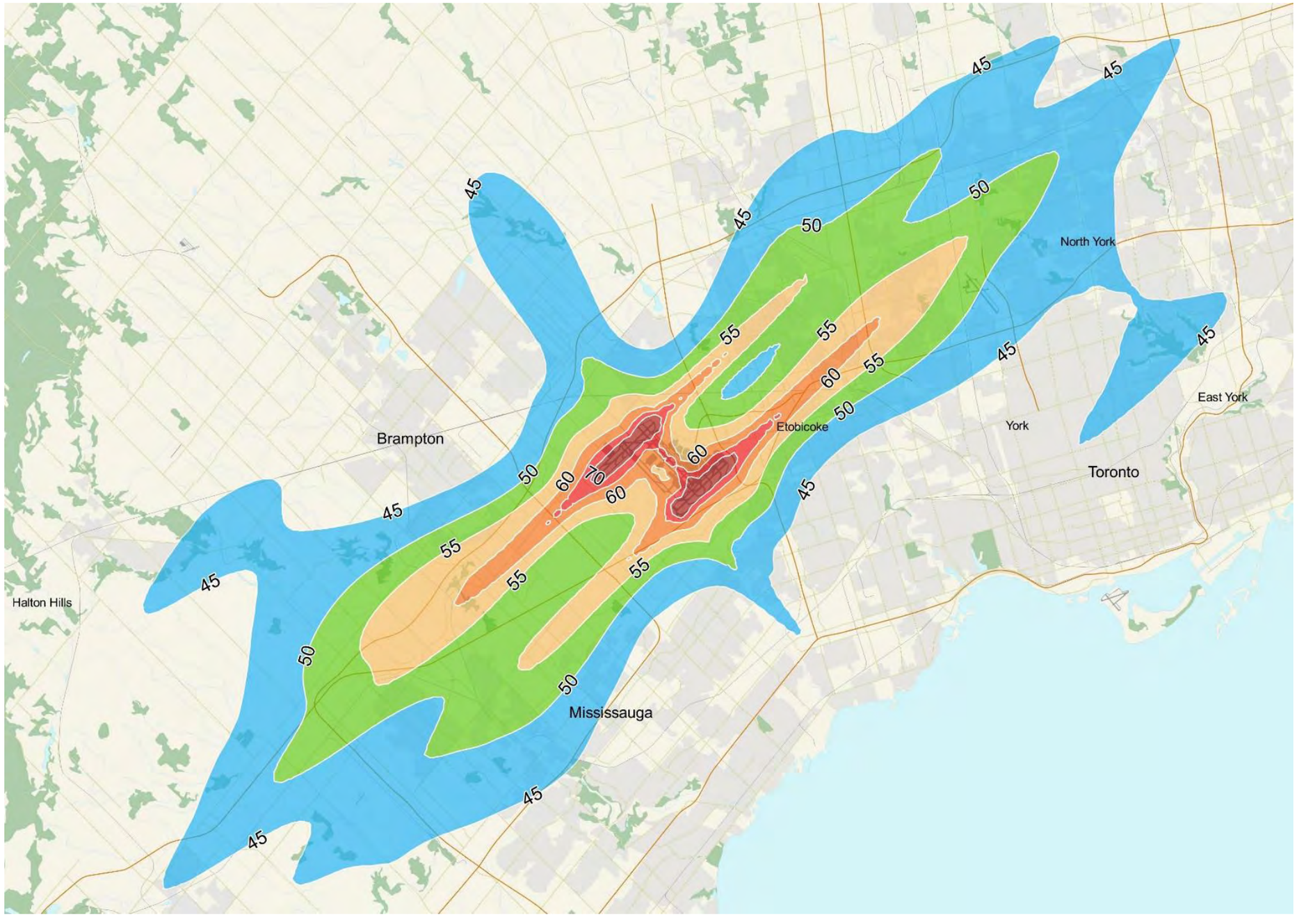
Noise mitigation initiatives 5 & 6

- 5 = Weekend runway alternation
  - Investigation of different scenarios that may allow aviation noise at weekends to be shared, on a pre-determined basis, across different communities.
  - Number of options being investigated and noise modelling undertaken.
  - GTAA would have to undertake community consultation before implementing
    - Noise sharing means some communities get less noise than they currently do but other communities get more.
    - Noise sharing can be a very emotive topic amongst communities.
- 6 = Review of night preference runways
  - The current night preference runways have not changed or been reviewed in many years.
  - Demographics have change substantially, what are the least impacting night runways now?
  - No preference runway for flights landing or taking off from the east to the west, although significant night operations in this direction due to winds

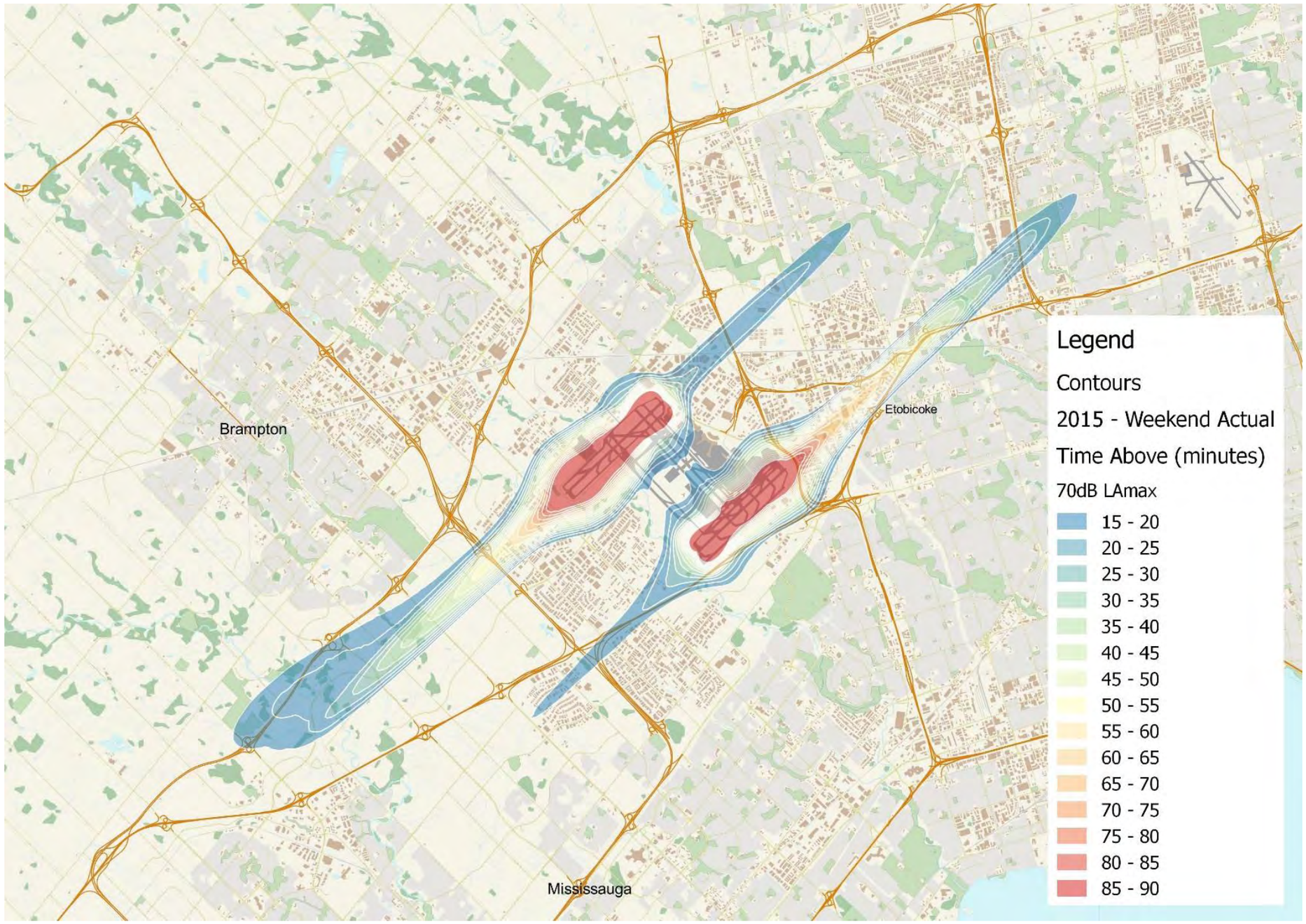
Large industrial areas around Pearson



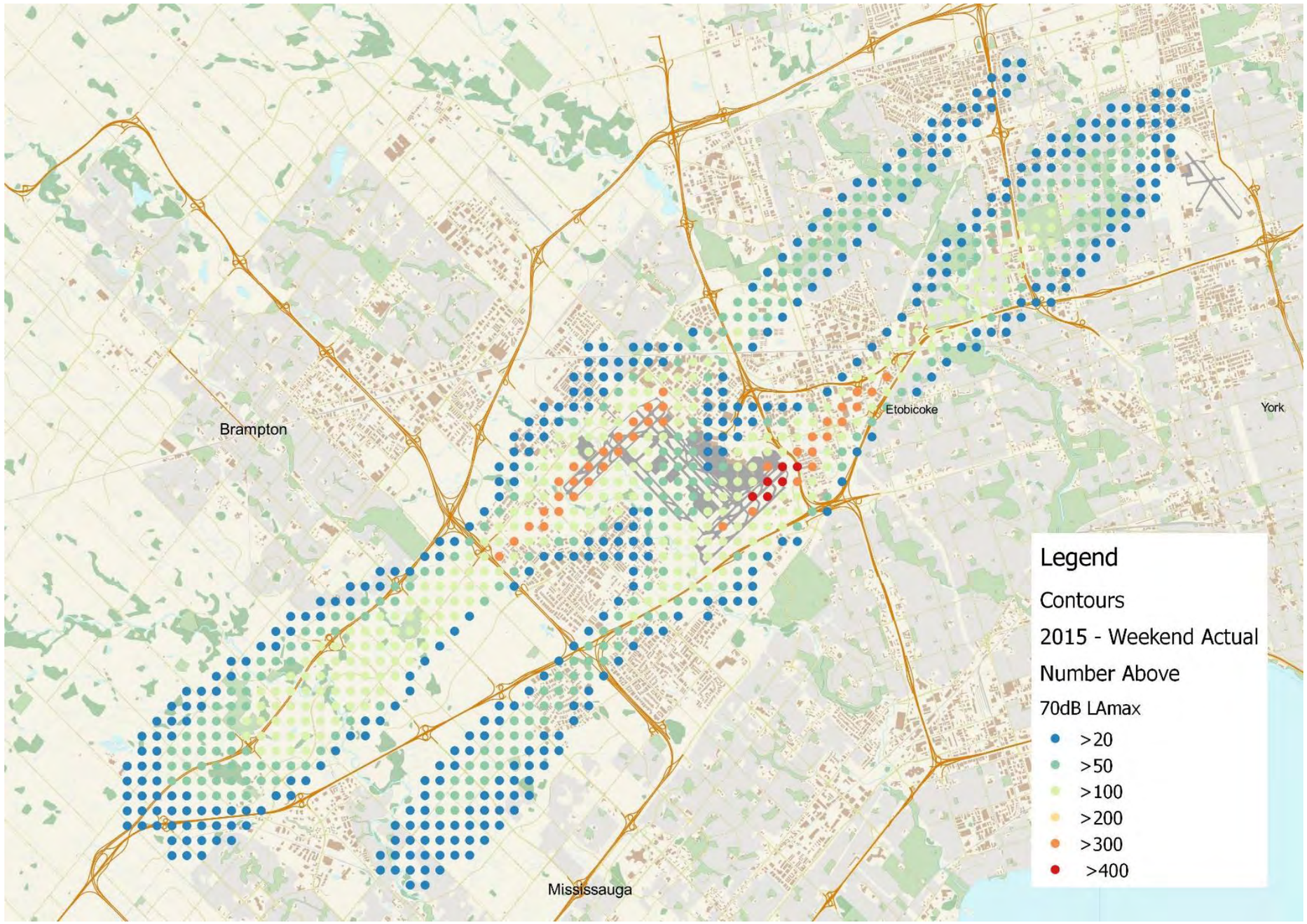
Average noise contour
2015 Actual Weekend 17.5LAeq



Time Above contours
2015 Actual weekend TA 70dB LAmax



Number Above contours
2015 Actual weekend NA 70dB LAmax



HELIOS

The aviation consultancy of Egis

Tel. 44 1252 451650

Nick.Boud@askhelios.com

www.askhelios.com

an egis company

Community Perspectives

Joe Silva, Rockwood Homeowners Association

Jane Stygall, Alderwood Airplane Noise

Richard Macklin, Better Flight Paths

Richard Boehnke and Donald Beggs,
Markland Wood Homeowners Association

Toronto Pearson

The Panel's mandate

The Reference Panel is tasked with advising the GTAA on the measures, standards and commitments it should adopt to meet the needs of area residents and support regional growth.

Specifically, the Reference Panel will develop:

- A set of values which describe its vision of responsible growth;
- A list of issues which the GTAA should attempt to address within its growth plan
- Criteria for evaluating options to mitigate and manage aircraft noise
- Additional recommendations concerning transit options, noise management, environmental stewardship and public communications and engagement

Toronto Pearson


Nobleton
BOLTON
Markland Wood
Richmond Hill
Markham
Vaughan
Rockwood
Whitby
Oshawa
Ajax
Pickering
CONCORD
NORTH YORK
SCARBOROUGH
REXDALE
Brampton
Toronto
ETOBICOKE
Mississauga
ERIN MILLS
PORT CREDIT
Oakville
GLEN ABBEY
Better Flight Paths
(Casa Loma)
Toronto Air Noise Group
(TANG) (Bloor)
Alderwood
Residents' Air Noise Group
of Oakville (RANGO)

TORONTO PEARSON
GTAA

Greater Toronto Airports Authority
Engineering Data
P.O. Box 6031, Toronto AMF, Ontario, Canada L5P 1B2
Tel (416) 776-7747 Fax (416) 776-4640

GENERAL AVIATION- NORTH:

1 Landmark Aviation
2,3 Landmark Aviation
4 Air Transat
6 Skyservice Investments
6A Skyservice Investments
7 I.M.P. Group International Inc.
8A Skycharter LTD.
8B Skycharter LTD.
9 Landmark Aviation
10 GTA Aviation Ground Equipment Specialties LTD.
11 Landmark Aviation - North Lounge

AVIATION FEATURES
- Apron
- Deicing Facility
- Runway
- Taxiway
- High Speed Exit
- CAT HOLDLINE

OTHER
- Airport Property Boundary
- Area under Construction
- ATC Authorization Required
- Building of Significance
- Emergency Stand-by Area
- LOC 05 Feature Area
- Field Electrical Centre
- Service Roads/Outer Perimeter Corridor
- Tunnel
- V302 Staffed Vehicle Access Gate
- NPS-V Checkpoint
- Critical Area

At no time shall a vehicle cross
an illuminated red stopbar.
Be alert to runway crossing instructions.
Readback of all hold short instructions is required!

RADIO FREQUENCIES

Unless otherwise authorized by the controlling unit
(eg: Ground Control & Apron Advisory)
North Ground - 121.650 - (North of AK)
South Ground - 121.900 (South of AK)
Centre Ground - 119.100/Tower Back-up - 118.000
North Apron, All T3 Gates, T3 Satellite, T1 Gates 101 to 128, 131, 133, 135, 137, 139, 140 to 142 and IFT, Fedex and Cargo 1, 2, 3 - 122.275
South Apron & Avitat/Skyservice/3 Bay Hangar, T1 Gates 132, 134, 136, 138, 143 to 145, gates 160 to 193, gates 244 to 272 and all H gates - 122.075
Apron Coordinator - 122.875
T1 and T3 Apron Back-up - 122.825
Pad Control (CDF) - 131.175
Iceman South - 131.375 (Pads 1,2,3) and Iceman North - 129.625 (Pads 4,5,6)
Back-up (CDF) - 131.950
Hangar Deicing Facility (HDF) - 130.875

MAY 2016
AVOP MAP

TORONTO PEARSON INTERNATIONAL AIRPORT


Nobleton
BOLTON
Markland Wood
Richmond Hill
Markham
Vaughan
Rockwood
Whitby
Oshawa
Ajax
Pickering
CONCORD
NORTH YORK
SCARBOROUGH
REXDALE
Brampton
Toronto
ETOBICOKE
Mississauga
ERIN MILLS
PORT CREDIT
Oakville
GLEN ABBEY
Better Flight Paths
(Casa Loma)
Toronto Air Noise Group
(TANG) (Bloor)
Alderwood
Residents' Air Noise Group
of Oakville (RANGO)

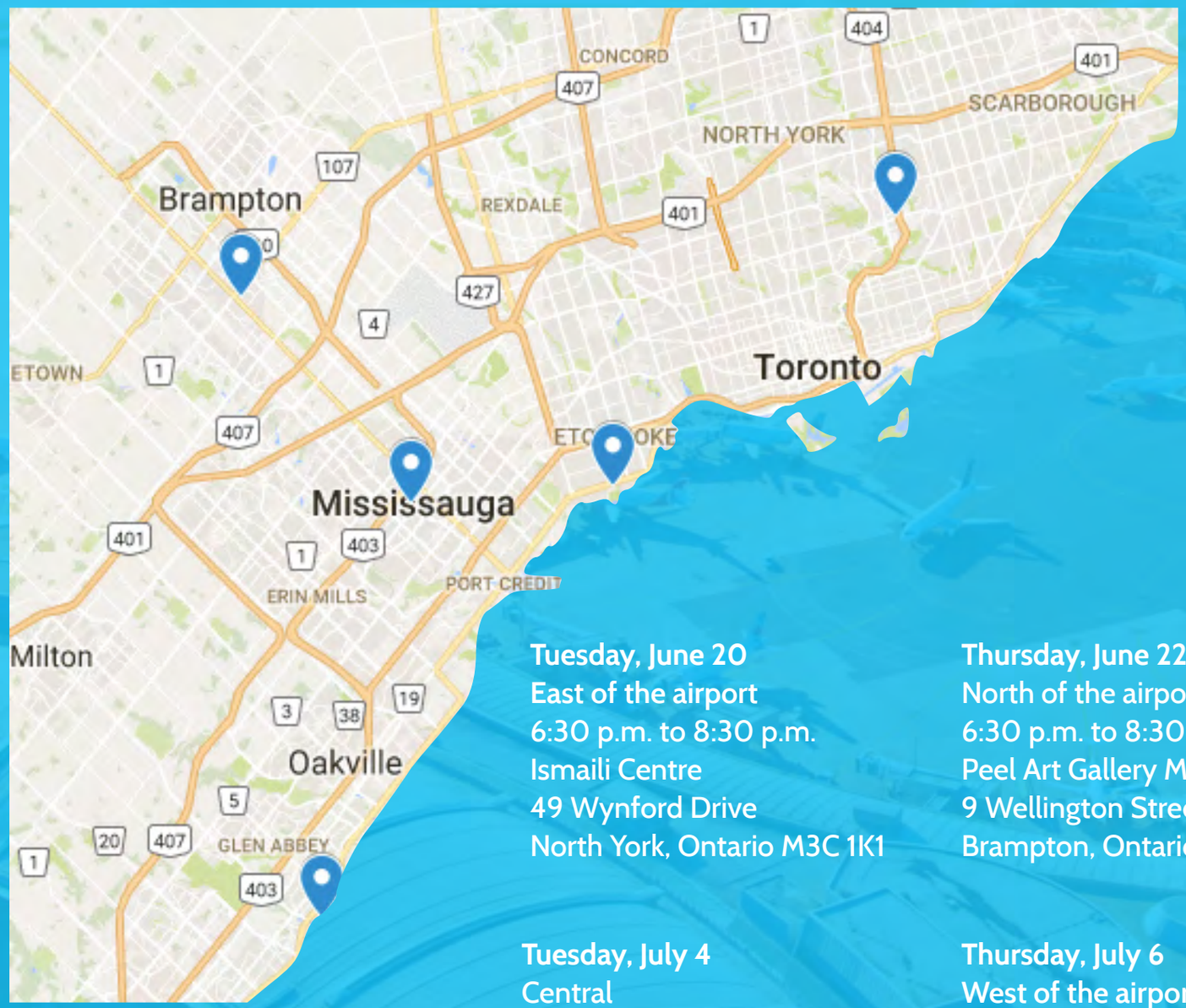
Two tasks...

What are the top six issues concerning noise as you understand them?

Propose three principles that should guide the GTAA's approach to managing and mitigating noise...

Toronto Pearson

Help us host the public workshops



Each two-hour workshop will include a 30-minute presentation about the history of Toronto Pearson, the growth of the Greater Toronto and Hamilton area, and our vision for the future. You will then be invited to join a series of facilitated small group discussions with other local residents and members of the new Residents' Reference Panel, and suggest ways to:

- provide new transit options for the airport and region
- manage and mitigate noise from aircraft
- engage and inform residents about our operations
- strengthen our commitment to the environment

Tuesday, June 20
East of the airport
6:30 p.m. to 8:30 p.m.
Ismaili Centre
49 Wynford Drive
North York, Ontario M3C 1K1

Thursday, June 22
North of the airport
6:30 p.m. to 8:30 p.m.
Peel Art Gallery Museum & Archives
9 Wellington Street East
Brampton, Ontario L6W 1Y1

South of the airport
Wednesday, June 28
6:30 p.m. to 8:30 p.m.
Assembly Hall
1 Colonel Samuel Smith Park Drive
Etobicoke, Ontario M8V 4B6

Tuesday, July 4
Central
6:30 p.m. to 8:30 p.m.
Mississauga Living Art Centre
4141 Living Arts Drive
Mississauga, ON L5B 4B8

Thursday, July 6
West of the airport
6:30 p.m. to 8:30 p.m.
Harbour Banquet & Conference Centre
Bronte Room
2340 Ontario Street
Oakville, Ontario L6L 6P7

Toronto Pearson

Thank you

Don’t worry. Don’t fester.

Call us: 1-844-788-5803

torontopearson.com/rrp

We’ll see you next week!

Toronto Pearson