Appendix A
Meeting Agenda
Billy Bishop Toronto City Airport
Noise Sub Committee Meeting 15

Wednesday January 26, 2022
7:00 PM to 8:30 PM
Zoom Virtual Meeting

AGENDA

7:00 Welcome

7:05 Agenda Review

7:10 Ground Noise Study 101 (Harvey Watson, R.J. Burnside)

7:55 Commercial Service Update (Michael MacWilliam)

8:05 Permanent Noise Management Terminal Update (Michael MacWilliam)

8:15 Business Arising

- 2021 Year-In-Review
- Request by Max for ICAO's involvement
- Meeting planning for 2022

8:30 Adjourn

Appendix B
Ground Noise Study Presentation

Ground Noise Assessment

Billy Bishop Toronto City Airport

Prepared by: Harvey Watson, R.J. Burnside & Associates Limited

Presented to: Noise Management Sub-Committee

Delivered on: Wednesday January 26, 2022

Agenda

- Team Background
- Ground Noise
  - What is it?
  - Who Regulates it?
  - How are ground noise studies conducted?
  - Source Characterization
  - Background Noise
  - What are dB and why use dBA?

Agenda - continued

- BBTCA Ground Noise Study
  - Recap Scope
  - Background at Billy Bishop Airport
  - What have we measured so far?
  - What is outstanding?
  - Model of site
    - What is included
    - Why we use it
  - How do we prioritize mitigation investigation?

Team Background – Dr. Novak

- Ph.D. from University of Windsor, 2005
- Extensive Airport Noise Experience at Toronto Pearson International Airport, Winnipeg International Airport, Billy Bishop Airport, Montreal-Trudeau Airport and NAV Canada.
- Development of metrics for community noise expectations for control of airport & aircraft noise emissions
- Professor at University of Windsor
- Consulting Engineer in Acoustics

Team Background – Mr. Watson

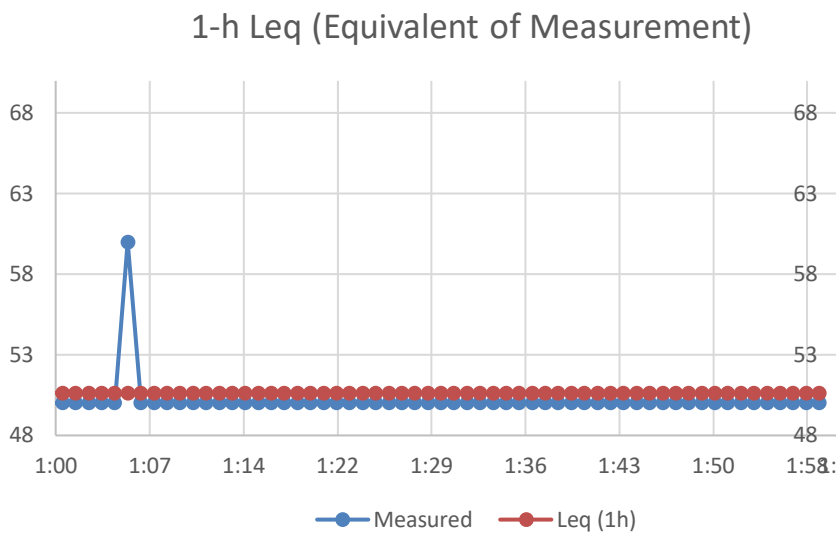
- B.A.Sc. from University of Waterloo, 1991
- Consulting in ground-based acoustics since 2008
- Completed over 100 Acoustic Assessments for companies submitting to the Ministry of the Environment, Conservation and Parks (MECP), all of which were accepted in support of Environmental Compliance Approvals (ECAs).

Ground Noise

- What is noise?
  - Sound is a pressure wave transmitted through the air.
  - Noise is unwanted sound.
  - If a tree falls in a forest but no one is there to hear it, does it make any noise? (Sound – yes, noise - no)
- What is Ground Noise?
  - Ground noise is the noise emitted by something that sits on the ground at the facility. Sources can include:
    - HVAC equipment, Trucks, Bird deterrent noise makers, Taxiing planes
  - For our purposes, it is all the noise made by anything at the airport while it is touching the ground. Once it leaves the ground, it is no longer considered in this study.

Ground Noise - Continued

- Who Regulates Ground Noise?
  - In Ontario, ground noise is regulated by the MECP using NPC-300 for provincially regulated facilities (not Billy Bishop Airport which is federally regulated).
  - Header Merza from the MECP presented to this committee on NPC-300 in 2019.
  - The MECP calls this noise “Stationary Noise”.
  - Stationary Noise includes vehicles while they are on Site.
  - Stationary Noise does not include construction noise or emergency/safety signals.
  - Stationary noise is assessed on a 1-hour equivalent noise level basis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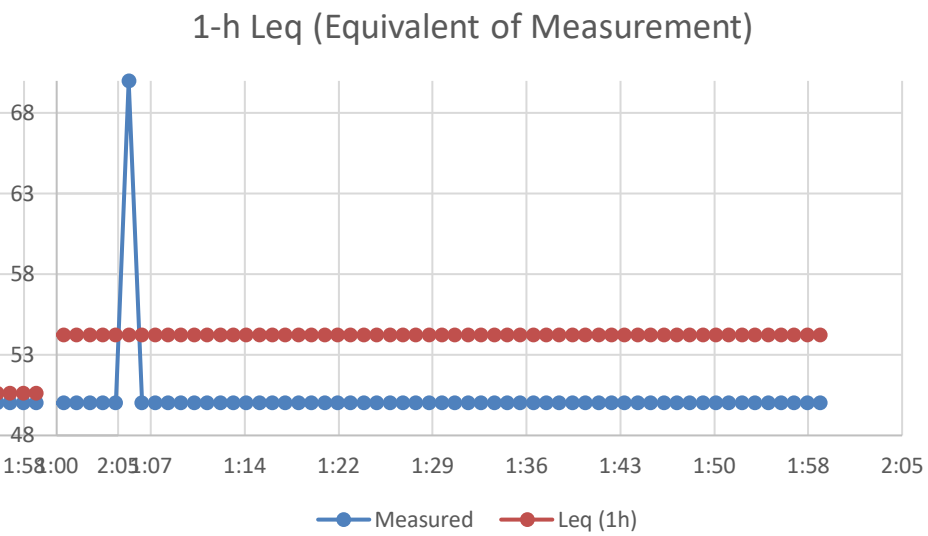
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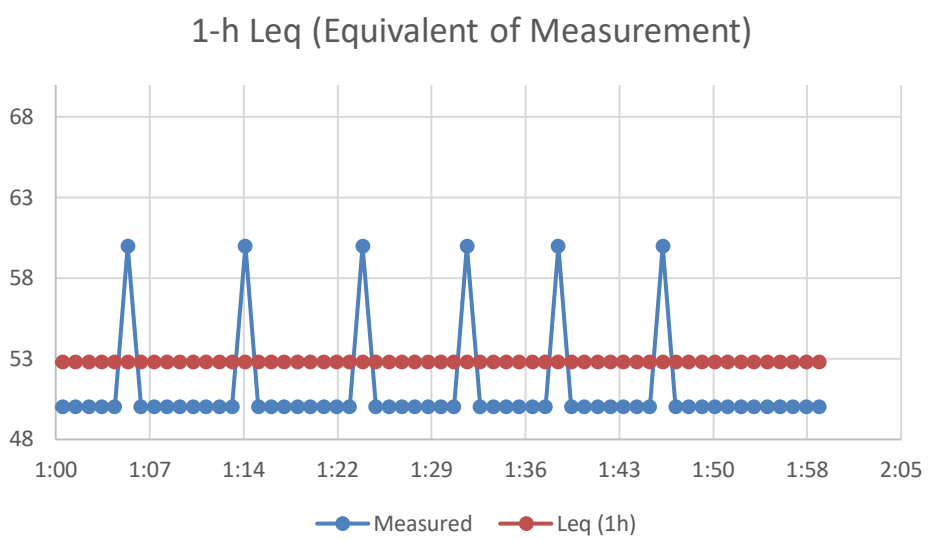
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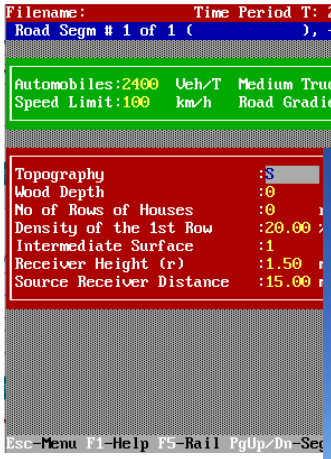
Ground Noise Studies

- How are ground noise studies usually done?
  1. Determine background noise (noise already there if site was not there)
     - Road Model estimate
     - Measure

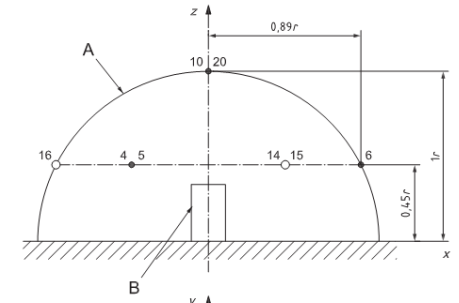


Background noise at the two locations below will be very different because of the traffic and industry already there.

Ground Noise Studies - Continued

- Identify all noise sources at the site
- Screen noise sources for relative noise emission
- Measure noise from sources with significant noise

ISO 3746:2010(E)

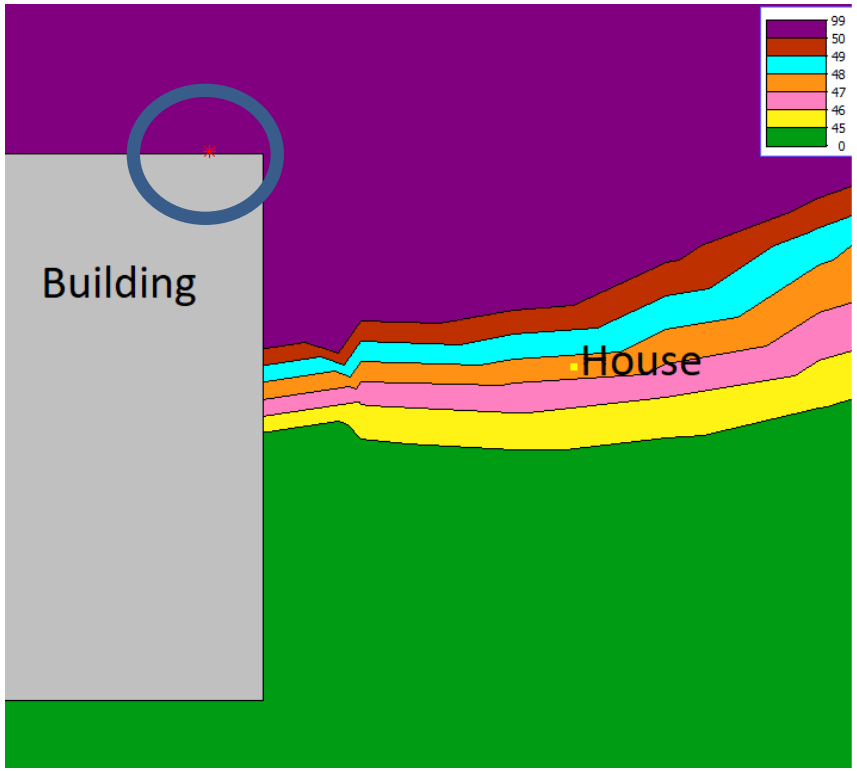


Key
- ● key microphone positions (4, 5, 6, 10)
- O additional microphone positions (14, 15, 16, 20)
- A measurement surface
- B reference box
- r radius of measurement surface

Figure B.2 — Microphone positions on the hemispherical measurement surface

Ground Noise Studies - Continued

- Input Sound Power of sources into a noise model
- Predict the impact at noise sensitive receptors called Points of Reception (PORs)

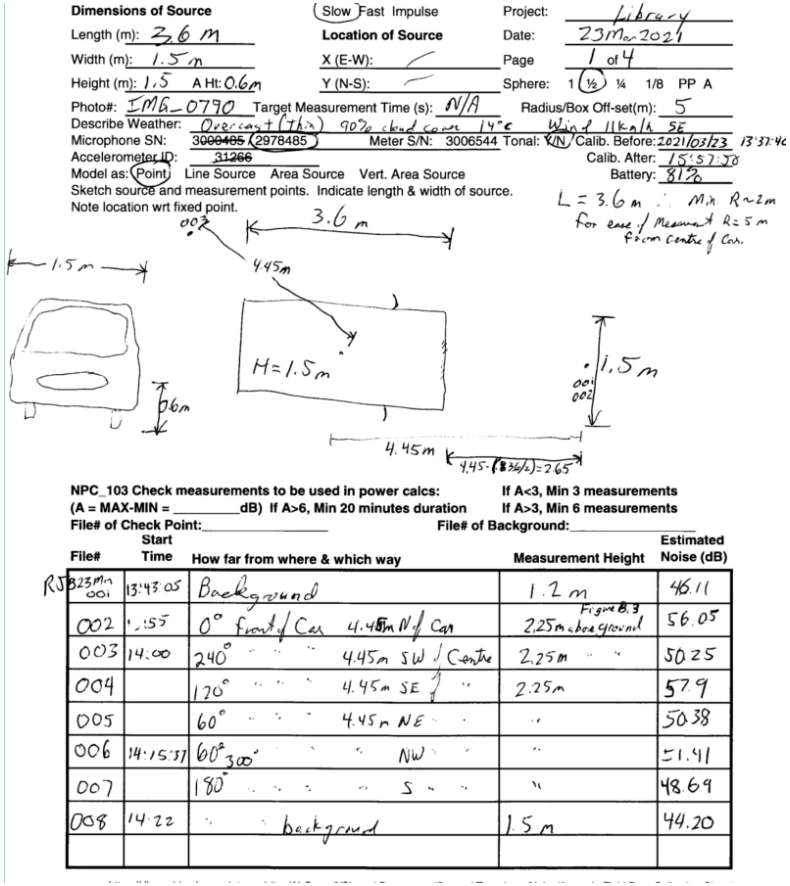


Ground Noise Studies - Continued

- Compare the impact at PORs to criteria (background)
- If there are exceedances, figure out which sources are the major contributors
- Figure out what can be done to reduce the impact
  - Adjust how the source is used
  - Move source to a better place
  - Change source to different equipment
  - Silencer
  - Barrier

Ground Noise - Continued

- Source Characterization
  - Determine Free Field
  - Decide optimal measurement distance to minimize influence from other sources but maximize distance.
  - Measure at several locations to get representative average
  - Measure Background during measurement



Dimensions of Source — Slow / Fast / Impulse — Project: Library
Length (m): 3.6 m — Location of Source — Date: 23 Mar 2021
Width (m): 1.5 m — X (E-W): — Page: 1 of 4
Height (m): 1.5 — A Ht: 0.6m — Y (N-S): — Sphere: 1 (½) ¼ 1/8 PP A
Photo#: IMG_0790 — Target Measurement Time (s): N/A — Radius/Box Off-set(m): 5
Describe Weather: Overcast (Thin) 90% cloud cover 14°C — Wind 11 km/h SE
Microphone SN: ~~3006485~~ (2978485) — Meter S/N: 3006544 — Tonal: Y/N — Calib. Before: 2021/03/23 13:32:46
Accelerometer ID: ~~31266~~ — Calib. After: 15:57:30
Model as: (Point) Line Source Area Source Vert. Area Source — Battery: 81%
Sketch source and measurement points. Indicate length & width of source.
Note location wrt fixed point.

L = 3.6 m ∴ Min R = 2m
for ease of Measurement R = 5 m from centre of Car.

NPC_103 Check measurements to be used in power calcs: — If A<3, Min 3 measurements
(A = MAX-MIN = _____dB) If A>6, Min 20 minutes duration — If A>3, Min 6 measurements
File# of Check Point:_____ — File# of Background:_____

File#	Start Time	How far from where & which way	Measurement Height	Estimated Noise (dB)
RJB 23Mar 001	13:43:05	Background	1.2 m	46.11
002	13:55	0° Front of Car 4.45m N of Car	2.25m above ground (Figure B.3)	56.05
003	14:00	240° 4.45m SW of Centre	2.25m	50.25
004		120° 4.45m SE of	2.25m	57.9
005		60° 4.45m NE		50.38
006	14:15:37	60° 300° NW		51.41
007		180° S		48.69
008	14:22	background	1.5m	44.20

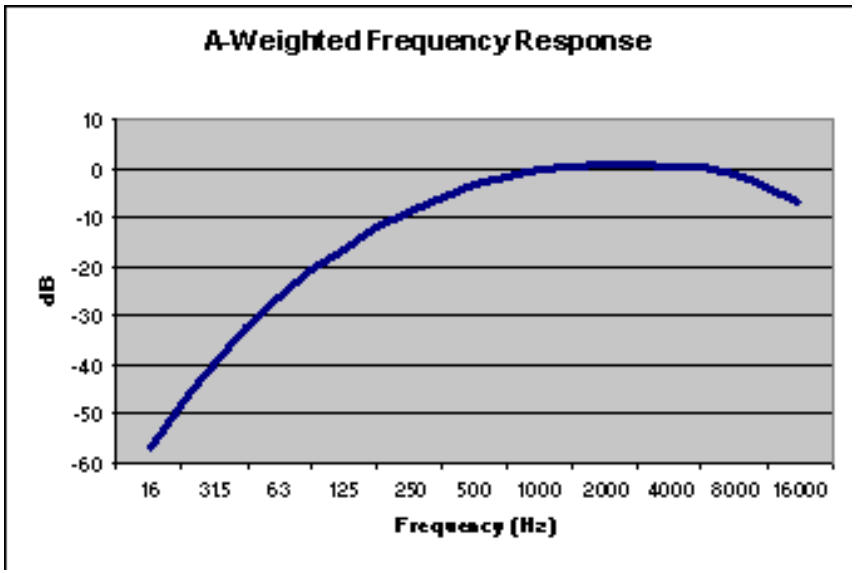
Ground Noise - Continued

- Background Noise
  - Background for study – what level of noise already exists at a location or would exist if the site were not there.
  - In this location, measuring background noise is hard because the airport is already here and running
  - We need to record sound for a period of time and then remove the parts of the measurement that occurred that include noises that we know are part of the airport. For instance, if we record for 10 minutes but a plane takes off during that time, while the plane is audible in the measurement, that time has to be removed.

Ground Noise - Continued

What are dB and why use dBA?

- dB (A, C, or Z) is the logarithm of the energy in W/m2.
- We use dB because the range of values would otherwise be between 0.000 000 000 001 W/m2 and 1000 W/m2. With dB, the range is 1 to 130 dB.
- The human ear responds more to frequencies between 500 Hz and 8 kHz and is less sensitive to very low-pitch or high-pitch noises. The frequency weightings used in sound level meters are often related to the response of the human ear, to ensure that the meter is measuring pretty much what you actually hear.
- It is extremely important that sound level measurements are made using the correct frequency weighting - usually A-weighting. For example, measuring a tonal noise of around 31 Hz could result in a 40 dB error if using C-weighting instead of A-weighting.
- https://www.noisemeters.ca/help/faq/frequency-weighting/



Relative Response (dB)	Frequency f in Hz									
	31.5	63	125	250	500	1000	2000	4000	8000	16000
dBA	−39.4	−26.2	−16.1	−8.6	−3.2	0	+1.2	+1.0	−1.1	−6.6
dBC	−3.0	−0.8	−0.2	0	0	0	−0.2	−0.8	−3.0	−8.5
dBZ	0	0	0	0	0	0	0	0	0	0

NMSC Comments already provided

What We've Heard

- Members of the committee are interested in both the dBA and dBZ values.
- Bass frequencies should be acknowledged by the study for the disruption they cause as noise that is felt more than heard by residents.
- Model must account for environmental factors and surfaces noise interacts with.

How it is being Addressed

- Data will be reported in both dbA and dbZ.
- Low frequency spectrum is accounted for in the noise propagation model. Study also accounts for an annoyance factor.
- The model accounts for these factors including wind direction, surfaces sound is absorbed or reflected by, and the size and orientation of buildings.

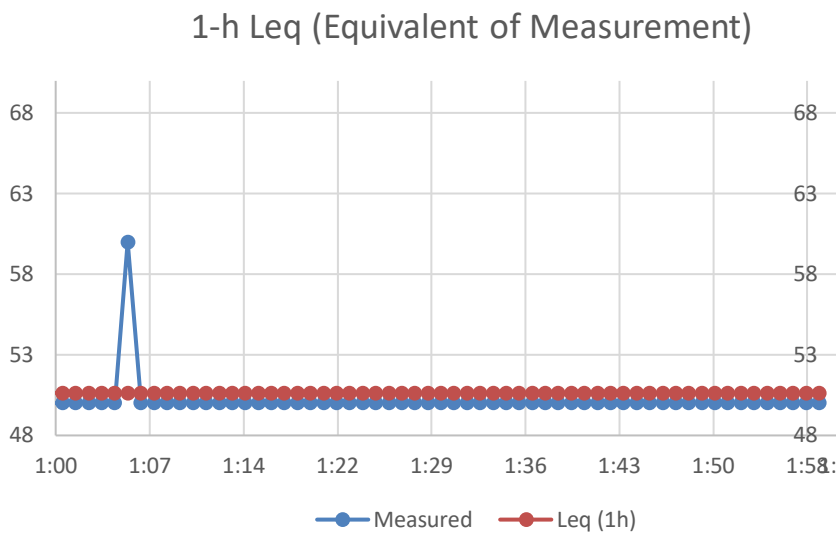
NMSC Comments already provided

What We've Heard

- Concerns were identified that 1-minute peaks do not accurately translate and are obscured in the Average Hour 1-h LEQ.
- Location of the temporary noise monitors is important to the study's findings

How it is being Addressed

- Assessment methods beyond 1-h Leq are being implemented and will be presented in the report.
- The team has been working closely to align the location of these monitors with the best practise locations discussed with the subcommittee.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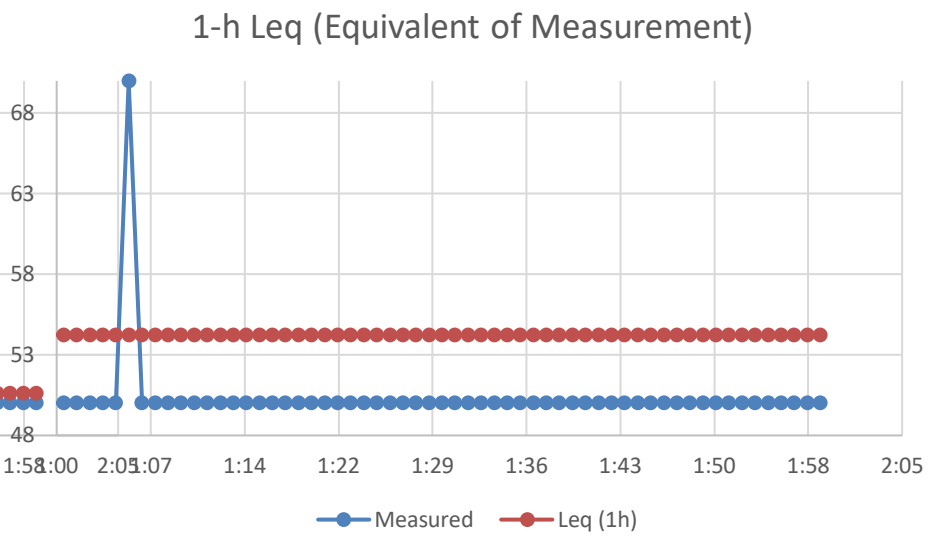
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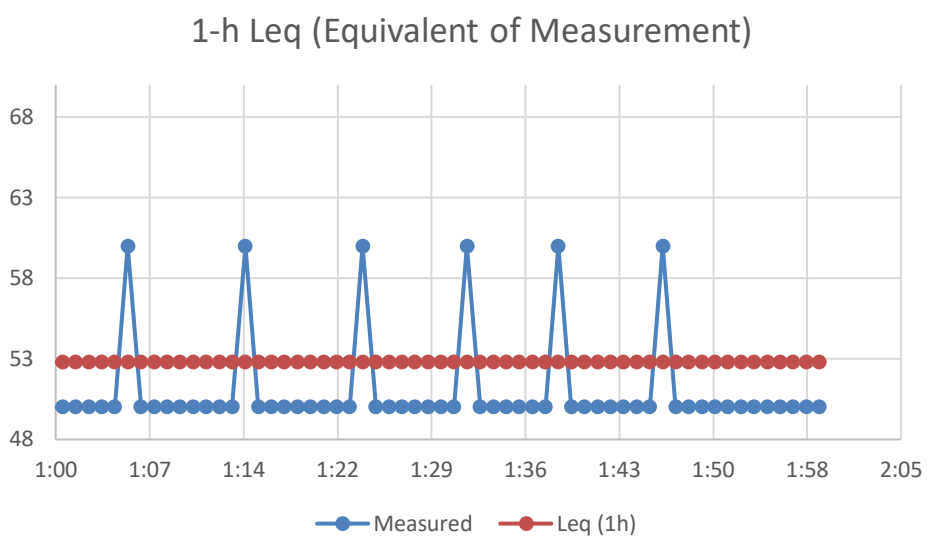
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NMSC Comments already provided

What We've Heard	How it is being Addressed
• Concerns that airborne aircraft noise would raise the ambient noise data.	• Airborne aircraft noise will be scrubbed from the ambient noise monitoring portion of the study.
• It would be valuable to capture fly-by noise.	• This is not within the scope of the Ground Noise Study. PortsToronto is aware of this request and can consider it in future studies.
• Consider a series of evocative, digestible, and representative vignettes for the public-facing reporting.	• This advice is taken. PortsToronto will report back to the subcommittee to discuss presentation of the findings to a public-facing audience.

BBTCA Ground Noise Study

- Recap Scope
  - Measure Background
  - Measure Sources
  - Build Model
  - Assess Impact
  - Propose Mitigation
  - Prioritize Mitigation
- Continued engagement though NMSC

BBTCA Ground Noise Study

- Background at Billy Bishop Airport
  - Put on hold during pandemic
    - Noise from cars dramatically reduced since many people working from home
    - Will be proceeding in the spring
    - Hopefully, noise levels will have returned to close to historical levels, but we expect that they will still be lower than they would have been in 2019.

BBTCA Ground Noise Study

- What have we measured so far?
  - Q400 Taxiing & throttling
  - Diesel Ferry movement and related operations like docking, loading
  - HeliTour Helicopter
  - Anti Bird Pyrotechnics & Horn
  - Runway snowblower and sweeper
  - Single Engine airplane
  - Fire Pump

BBTCA Ground Noise Study

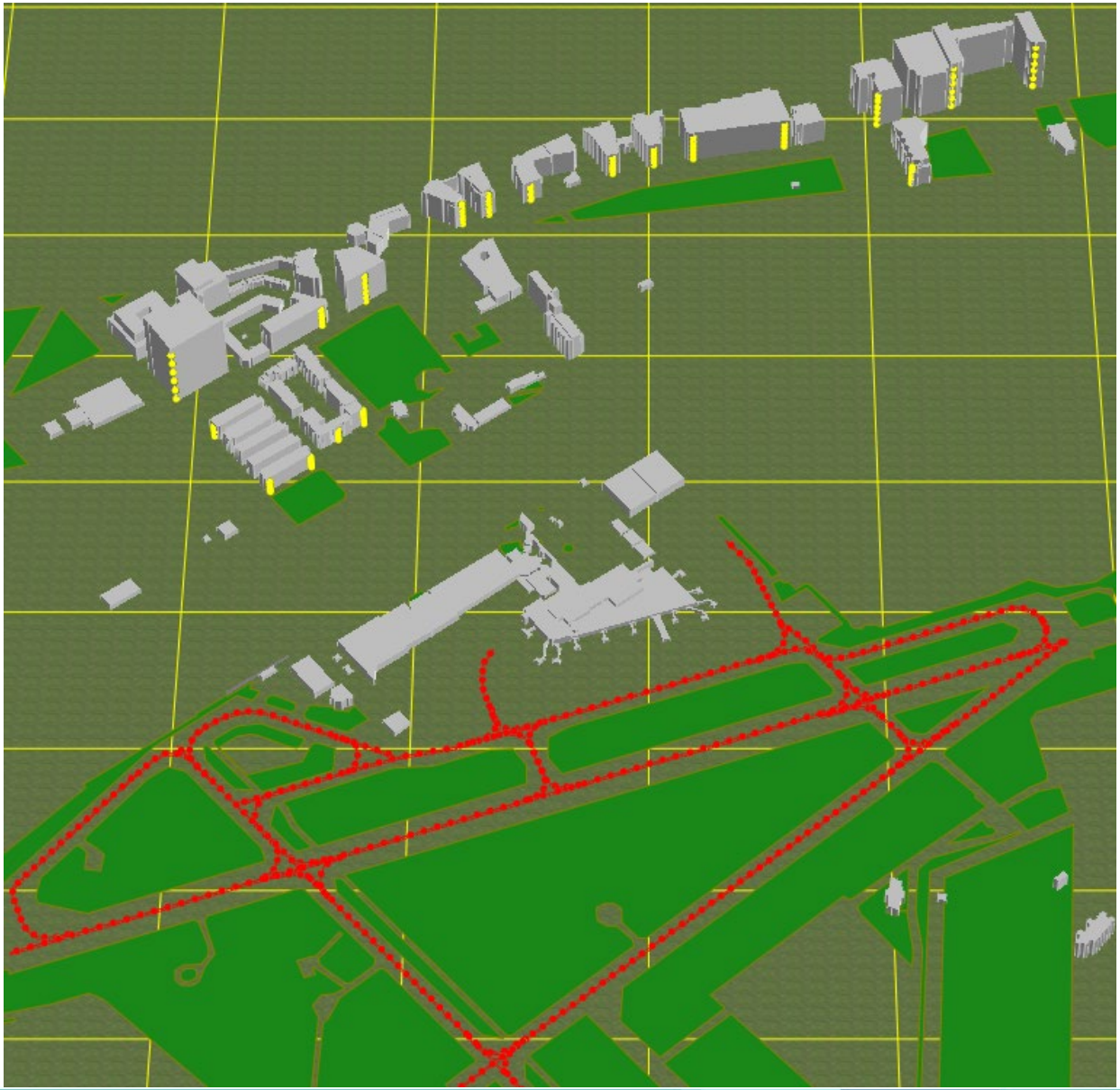
- What is outstanding?
  - ORNGE Helicopter
  - Twin engine plane (Piper)
  - Lawn mowers
  - Backup generators
  - HVAC equipment
  - Deicer truck
  - Tractors & Tugs
  - Ground Power Units and Air Carts

BBTCA Ground Noise Study

- Model of site
  - What is included
    - Noise sources (sound power, duration of operation, paths, equipment speed)
    - Buildings and barriers (City download plus all on-site)
    - Surface for land/water
    - Location of receptors (x, y, and height)

Model Example for Q400

3-D Model Example for Q400



BBTCA Ground Noise Study

- Model of site - Why we use it
  - Much easier to get worst case – put everything in and then add it all up. Alternative would be to get everything at the site running at the same time.
  - Isn't affected by wind conditions or interference from other sources.
  - Easier to identify which sources are the bigger problem.

BBTCA Ground Noise Study

- How do we prioritize mitigation investigation?
  - Balance of factors:
    - Magnitude of the impact
    - Number PORs affected
    - Ease of mitigation
    - Cost of mitigation
    - Magnitude of improvement

Questions

Appendix C
Letter to ICAO re: Airport Ground Noise Measurement Standards

Prepared by Community Subcommittee Member Max Moore, January 8, 2022

Harbourfront
Community Association
Station A, Box 144,
Toronto, M5W 1A2
Jan. 8, 2022, Draft

For: ICAO President Salvatore Sciacchitano
cc. ICAO Air Navigation Commission (ANC)
Re: Airport Ground Noise Measurement Standards

We are writing to request that ICAO initiate the development and adoption of **Ground Noise Measurement Standards for Airports**.

As members of the Noise Management Committee for Billy Bishop Island Airport in Toronto, we have learned that the current ICAO Noise Standards do not include noise standards for ground noise created by an airport, located near a community.

ICAO Noise Standards currently only measure the noise made by airplanes in flight. These ICAO standards for flight noise do not accurately measure airport ground noise, because flight noise standards are based on statistically adjusted noise measures, but We have learned that *Ground noise measurements should not be statistically adjusted*.

In airplane certification exercises, noise measures are averaged, and statistically adjusted as DBA Decibels, with EQ and LEQ adjustments, etc. Noise measures for airplane certification are statistically adjusted to provide standard comparisons, which are useful for certifying planes, but they are not measures of noise as people hear noise.

Standardized certification noise measures also serve a second purpose, as the basis for NEF Contours, which regulate flight noise around airports, but they, also, do not provide measures of ground noise at an airport.. Billy Bishop Island Airport is an example.

As a city center airport on Toronto Island, Billy Bishop Airport is unique, because there is No Land Buffer between the airport runways and neighboring homes. Runways are a mere 100-200 meters from nearby housing. When airport neighbors complained of excessive noise, Airport Management worked hard to make improvements, with a $10 million GRE, and single engine taxiing policy, for example. The relationship between the airport and the community is a good one, and a Noise Management Committee was organized to discuss airport noise management issues.

Despite good relations between the airport and the community, one issue remains unresolved - How To Measure and Report Airport Ground Noise. As ICAO's plane certification noise measures are not accurate measures of ground noise, we are requesting that ICAO work with this community to develop accurate ground noise measurements, for reporting ground noise at airports located close to communities.

Background Information is included, with proposals for developing Community Airport Ground Noise. Standards. Thank you for your interest in this matter.

Max Moore, Harbourfront Community Association
Lesley Monette, Bathurst Quay Neighborhood Association
Hal Beck, York Quay Neighborhood Association
Bryan Bowen, Toronto Waterfront Planning

ICAO Noise Standards - Background Information

The International Civil Aviation Organization (ICAO) is an agency of the United Nations, based in Montreal, which sets standards of operation for the airline industry around the world. This includes standards for design of airport facilities, runway lengths, flight paths, navigation and communications protocols, reporting requirements, safety standards, and Standards for Certification of Airplanes for commercial operation.

Air Industry Technical Standards

In addition to its role as an airline industry council for nearly 200 nations, ICAO is a standards setting agency. It determines whether airline industry measurements will be made in meters or feet, liters or gallons, for example. ICAO specifies measurements for altitude, temperature, air pressure, flight paths, communications standards etc.

The Air Navigation Commission (ANC) is the technical body within ICAO, which studies, negotiates and recommends different standards for adoption. Standards are developed under the direction of the ANC through a formal process of ICAO Panels. When they receive ANC approval, proposed standards are sent to the ICAO Council, for consultation and coordination with member states before final ICAO adoption.

Adopted standards are communicated to member states in an Aeronautical Information Publication (AIP), which contains all ICAO information essential to air navigation. Countries are required to update their AIP manuals every 28 days.

ICAO Noise Standards thus far apply only to noise made by planes in the air. There are no noise standards for measuring airport ground noise. If a *Community Noise Standard* is proposed for measuring airport ground noise, the approval process must go through all the steps outlined above, in order to become an ICAO standard.

Airplane Flight Certification Procedures & NEF Contours

The airplane certification procedure is designed as a certificate of airworthiness. It is not designed as a system of noise measurement, but it does have a noise rating component.

Certification of planes for commercial operation involves a series of standardized noise measurements which rank newly manufactured planes in a noise category, compared to other planes **Stage 1** older and more noisy planes (Boeing 707, DC-8). **Stage 2** includes B727 and DC-9. **Stage 3** is 737 Classic. **Stage 4** is A320, B737NG, B747-400. **Stage 5** includes newer, less noisy planes (A320, A350, B737 MAX, B777).

ICAO Airplane Certification Noise Ratings for commercial planes are also used by the aviation industry for NEF Modelling. NEF (Noise Exposure Forecasts) set limits on how many planes can be in the air, near an airport, at any point in time, by calculating the total amount of flight noise made. (# of Planes Times Noise Ratings for each plane)

Airplane Flight Certification & Airport Ground Noise Measurement

The procedure for certifying airplanes requies three noise monitors to measure the noise of a plane flying overhead. These three noise meters are placed at different distances from the source of the noise, ie. 1/2 mile, 2 miles and 5 miles from the airport.

Noise measurements from these three microphones, 1/2, 2 and 5 miles away, are statistically averaged to get an average noise reading for the aircraft takeoff, flyover and landing. The averaged noise measure is called an PNL (Perceived Noise Level).

Airplane certification noise measurements are then statistically adjusted to produce EPNL - Effective Perceived Noise Level Reports. EPNL statistics make it possible to compare noise from different planes, by removing specific components of the noise - bass rumble, occasional noise peaks, intermittent noise (ie. on-again, off-again noise).

By averaging and adjusting airplane noise measurements for the purpose of certification the resulting DBA Decibel measurement is 15-20 Decibels lower than full DBZ Decibel noise readings. This reduced DBA decibel number is not an accurate noise reading, but only a standardized index number, which can be compared to similar statistically adjusted noise ratings for different planes.

Because the ICAO noise measurement procedure for airplane certification has only a limited purpose, (to rank new planes in existing noise categories), the procedure for measuring flight noise is done in a particular way, not as an objective noise measure, but as a standard procedure which allows comparisons of noise for different planes.

This is why the airplane certification noise procedure is only a partial measure of noise, which is limited to a specific purpose. It is not valid as a full measure of noise as people experience it. The purpose of this ICAO procedure is for airplane noise certification, and not for measuring the effect of airport noise on surrounding homes.

Airport Ground Noise cannot be measured with the ICAO's Airplane Flight Certification method because ICAO's EPNL-DNA noise measures report noise as much as 15-20 decibels lower than full DBZ noise reports, as the noise is heard by airport neighbours. EPNL reports using discounted DBA Decibels, are only partial noise measures.

Ground Noise Reports need to measure noise as it is experienced by airport neighbours. Ground noise requires noise measurement, with DBZ Decibels instead of DBA Decibels, with No Statistical Adjustments, and Peak Noise Measurements, near noise sources.

Background Discussion Paper Compiled by Max Moore, May 10, 2021
info@harbourfrontcommunity.com *www.harbourfrontcommunity.com*