

Multi-Family Residential Development

Winnipeg, MB

Acoustic Zoning Review

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1. Measuring Noise at Canadian Airports - Noise Exposure Forecast

Canada's major airports use the Noise Exposure Forecast (NEF) tool for measuring and predicting noise near major airports. The NEF system calculates a specific area's expected noise exposure, which is represented as an "NEF level, by measuring the average number of flights travelling over a given area along with loudness, frequency, duration, time of occurrence, and tone.[1] The NEF was primarily designed as a land-use planning tool as it allows planners to predict a community's response to aircraft noise.

Generally, three contours are generated to delineate areas of individual noise ranges (greater than NEF 40, NEF 35-40, and NEF 30-35). At extended distances from aircraft flight paths, ambient noise levels typically dominate.

Transport Canada recommends that the construction of new residential developments not proceed in areas where sound levels exceed 30 NEF. If developments are constructed in these noise sensitive areas it is recommended that detailed noise analysis should be conducted and noise reduction practices should be implemented.[2]

2. Winnipeg Airport's Relation to the Proposed Development Site

The Winnipeg James Armstrong Richardson International Airport is the 7th busiest airport in Canada measured by passenger traffic. There are four runways extending in different directions and the use of each is determined by wind directions as well as time of day.

Noise pollution generated at airports across Canada is currently being reduced as planes become more efficient and routes become more direct. Airlines now use continuous descent approaches as much as possible in order to reduce aircraft noise. While the number of air passengers has increased significantly over the last decade, improvements in the size of aircraft have allowed this to happen without an accompanying increase in overall aircraft movements.[3]

Living under a flight path may have long-term health effects due to noise- related stress and interrupted sleep. Night time noise generated by airport operation is more problematic for health, so the Winnipeg Airport has put the following measure into place to mediate night time noise.

- Preferential runways;
- Minimum Noise Routes; and

[1] "Noise Exposure Forecast and Related Programs From Transport Canada". *Government of Canada*, 19 July 2018, https://www.tc.gc.ca/en/services/aviation/operating-airports-aerodromes/managing-noise/exposure-forecast.html. 20 September 2019,
[2] "Noise Exposure Forecast and Related Programs From Transport Canada". *Government of Canada*, 19 July 2018, https://www.tc.gc.ca/en/services/aviation/operating-airports-aerodromes/managing-noise/exposure-forecast.html. 20 September 2019,
[3] "Assessing The Impact Of Aircraft Noise In The Vicinity Of Major Canadian Airports". *Government of Canada*, 19 March 2019., http://publications.gc.ca/collections/collection_2019/parl/xc27-1/XC27-1-1-421-28-eng.pdf. 20 September 2019,

- Hours when aircraft operations are prohibited or restricted. Between 11PM and 7AM most arrivals and departures will occur on the North runways so the flight path is primarily over farmland and industrial parks. [4].

The proposed multi-family residential development site, located on the corner of St. James Street and Maroons Road, immediately north of the Polo Park Shopping Centre, is surrounded by existing residential and commercial development. It is also quite near the Assiniboine river and several small public parks. According to the most recent published map, the Noise Exposure Factor at the proposed site is between 25 and 30 NEF[5]. According to NAV Canada the decibels at the site of the new development when a jet flies over head will be 65 to 70 decibels. [6]

The proposed site for the multi-family residential development is located within Area 1 on the Winnipeg Airport Vicinity Development Plan. Within Area 1 existing multiple-family dwelling units may be replaced if the new development does not exceed the original number of dwelling units. Minor residential infill may also be approved in areas of established residential development. [7]

3. Noise Mitigation Requirements in other Canadian Jurisdictions

Noise mitigation requirements across Canada share many similarities to the Winnipeg Acoustic Insulation By-law. The top 8 busiest Canadian Airports operate 24/7 and intend on maintaining those operating hours while also minimizing aircraft noise related complaints from occupants in dwelling units nearby. Residential development is allowed in the 25 - 30 NEF zone surrounding the Toronto Pearson International Airport and the Vancouver International Airport, if additional acoustic requirements are met. The additional acoustic requirements for each jurisdiction are listed below. For an outline of the allowed development surrounding the 13 busiest airports, refer to Appendix 1 of this report.

3.a Ontario

According to the Ontario Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning (NPC-300), the following is required when constructing a new residential development within the NEF 25- 30 contours.

- *C7.4 Aircraft Noise Control Measures- "If a new residential unit is within the NEF/NEP contours of 25 and 30, the dwelling should be designed with central air conditioning. In addition, building components including windows, doors, walls and ceiling/roof should be designed so living and dining rooms do not exceed 5 NEF and sleeping areas do not exceed 0 NEF. Warning clause Type C is also recommended."*

[4] "Airport Development Plan Summary". WAA.ca, December 2000, https://www.waa.ca/uploads/ck/files/Reports/AirportDevelopmentPlan_Summary.pdf. 20 September 2019,
[5] "Airport Development Plan Summary". WAA.ca, December 2000, https://www.waa.ca/uploads/ck/files/Reports/AirportDevelopmentPlan_Summary.pdf. 20 September 2019,
[6] "Improving routes for Winnipeg James Armstrong Richardson International Airport". *NAV Canada*, 15 February 2017, http://www.navcanada.ca/EN/about-us/Documents/YWG%20Airspace%20Proposal%20Package.pdf . 20 September 2019,
[7] "Airport Vicinity Protection Area Secondary Plan By-Law No. 6378/94". *The City of Winnipeg*, 27 April 2011, http://clkapps.winnipeg.ca/DMIS/Documents/DocExt/BL/1994/1994.6378.cons.pdf. 20 September 2019,

- *Warning clause Type C - "This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."*
- *Air conditioning in itself is not a noise control measure. The use of air conditioning allows windows and doors to remain closed, and therefore reduce the indoor sound levels.*
- *C7.9 Verification of Noise Control Measures- "It is recommended that the implementation of noise control measures be verified by qualified individuals with experience in environmental acoustics."*[8]

3.b Vancouver B.C.

In Richmond, B.C., the Aircraft Noise Sensitive Development Management in the City of Richmond Community Plan- Bylaw 900 outlines the development requirements for new residential development adjacent to the Vancouver International Airport. The following criteria are listed:

Where aircraft noise sensitive land uses are permitted in an area or on a site, they are to achieve a high level of livability and maximize aircraft noise mitigation requirements; the livability and aircraft noise mitigation considerations include:

- *varying the development mix:*
- *mixing aircraft noise sensitive development such as residential with other non-aircraft noise sensitive land uses like parks, commercial, and office spaces;*
- *mixing various aircraft noise sensitive developments residential land uses (e.g., single family, mid-rise, high-rise, live/work, work/live);*
- *varying the density of aircraft noise sensitive land uses;*
- *varying the degree of aircraft noise sensitive land use site coverage;*
- *orienting and facing land uses and buildings to minimize aircraft noise;*
- *ensuring land use compatibility;*
- *encouraging high quality, innovative urban design and landscaping.*

In a high aircraft noise area, the following requirements must be met:

- *Provide an Acoustic Report*
- *Noise mitigation incorporated in construction.*
- *Mechanical ventilation incorporated in construction.*
- *Central air conditioning system incorporated in construction.*

[8] "Ontario Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning (NPC-300)". *Ontario.ca*, August 2013 https://www.ontario.ca/page/environmental-noise-guideline-stationary-and-transportation-sources-approval-and-planning. 20 September 2019.

- *Required Design Guidelines for siting and/or replacement of outdoor amenity areas with indoor amenity areas; such as enclosed balconies and increased size and type of indoor amenity areas.* [9]

4. Review requirements of the National Building Code (with Manitoba Amendments)

The current 2010 National Building Code of Canada and Manitoba Amendments does not set out requirements for mitigating noise though exterior walls, roof, or exterior windows and doors.

The only acoustic requirements set out in the National Building Code of Canada relate to interior partitions. According to Section 5.8.1.1 Protection from Airborne Noise, construction separating a dwelling units from an elevator shafts or refuse chutes must have a sound transmission class (STC) not less than 55. Dwelling units must also be separated from all other noise generating spaces with assemblies that provide an STC of 50. This would apply to corridor walls, interior partitions separating units etc.

5. Designing for Noise Control Mitigation

Transportation noise from jet aircrafts has substantial low- frequency content, so noise is transmitted though vibration that move though the exterior walls, roof, windows and doors. When mitigating low- frequency noise from aircrafts, the design of the walls and roofs contribute significantly to the overall noise reduction. Therefore, the wall and roof composition as well as material selection becomes particularly important

Walls:

The mass of a wall/ roof is a key factor in its ability to block sounds. Heavier, stiffer materials vibrate less when exposed to sound and therefore tend to make better noise barriers when dealing with low frequency sounds. Concrete block walls will contribute more significantly to sound mitigation than lightweight steel stud walls with gypsum board. Structural separation (disconnection) between the outer and inner surfaces of building facades may also help control the transmission of sound. [10]

- Increase mass of lightweight constructions with additional interior layers of gypsum board, or use heavy external materials such as cement block walls, insulated concrete panels, or brick to improve sound transmission further;
- Fully insulate cavities (with glass, mineral or cellulose fibre batts or loose-fill, blow- in insulation) and seal around any penetrations though the exterior walls;
- If constructing stud walls, attach interior gypsum board (one or two layers) to the framing using resilient channels which will separate the interior finishes from the building structure and outer skin. This will reduce the amount of sound transfer.

[9] "3.0 Connected Neighbourhoods With Special Places". *City of Richmond Community Plan- Bylaw 900*, 19 November 2012, https://www.richmond.ca/__shared/assets/OCP_9000_neighbourhoods34167.pdf. 20 September 2019.

[10] "City of Vancouver Noise Control Manual*", City of Vancouver,* https://vancouver.ca/files/cov/noise-control-manual.pdf. 20 September 2019.

- Consider using staggered-stud or double-stud exterior walls which like resilient channels separate the interior finishes from the building structure.

Roofs

Roofs are particularly important when dealing with aircraft noise. The strategies for dealing with roofs is similar to the strategies for walls;

- Increase mass of construction by using hollow core slabs or cast in place concrete slabs;
- Install 200 to 300 mm (8" to 12") thermal/acoustical insulation above roof deck;
- Acoustically line any ventilation openings, cover with hood and caulk or otherwise seal all holes and cracks;
- Construct suspended ceiling using one or two layers of gypsum board mounted on resilient channels.

Windows:

There are several strategies to increase the acoustic performance of windows. The best option is to add an additional layer of glass, separated by an air gap of 1⁄2" or more. Air gaps less than 1⁄2" add relatively little sound attenuation. The acoustic rating of a triple glazed window with two 1⁄4" air gaps is rarely higher than the STC rating of double-glazed window with a 1⁄2" air gap. Triple- glazed windows with two 1⁄2" air gaps will have decent thermal and acoustic performance. Strategies for improving the acoustic ratings of windows include:

- Provide airtight perimeter seals;
- Reduce window size;
- Locate larger windows on quiet side of building;
- Using laminated glass;
- Using panes of glass with differing thicknesses;
- Use heavier/ thicker panes of glass and larger airspace between sheets of glass.

Doors:

For both sound and thermal insulation reasons, all exterior doors should be of either solid wood (typically 45 to 50 mm thick) or insulated steel construction along with the other sound mitigation strategies listed below:

- Use solid wood, solid core or insulated steel doors;
- Perimeter of the frame should be fitted with airtight seals along top, bottom and sides;
- Create an entrance vestibule.

6. Recommendations for Walls and Roof Types

The recommendations for walls and roof types listed below are the best performing acoustic barriers listed in the Airport Vicinity Acoustic Insulation By-law. Once a floor plan is established calculations may be performed to ensure the designed partitions and building components (walls, roof, windows and doors) meet the requirements in the Airport Vicinity By-law.

Recommended wall types as per the best performing walls listed in the Airport Vicinity Acoustic Insulation By-law 6419/94 and CMHC, listed in increasing order of acoustic performance:

EW5 -Exterior Wall 5

- 12.7mm gypsum board, vapor barrier, 38mm x 89mm studs with 50mm mineral wool or glass fibre batts in the stud cavity*, sheathing, 25 mm airspace, 100 mm brick veneer.

EW7 -Exterior Wall 7

- 12.7mm gypsum board, 25-50mm rigid insulation*, 140 mm concrete block (or other back up block), 100 mm face brick.

EW8 -Exterior Wall 8

- 12.7mm gypsum board, 25-50mm rigid insulation*, 200 mm concrete.

Recommended roof types as per the best performing walls listed in the Airport Vicinity Acoustic Insulation By-law 6419/94 and CMHC, listed in increasing order of acoustic performance:

C3 -Roof Ceiling Assembly 3

- Paint finish, 150 mm concrete slab, 50 mm rigid insulation, built-up roofing

C2D -Roof Ceiling Assembly 2D

- 12.7 mm gypsum board mounted on resilient clips, 75mm batt insulation*, wood roof truss with vented attic space, sheathing and asphalt roofing.

C2DR -Roof Ceiling Assembly 2DR

- 2 layers 12.7 mm gypsum board mounted on resilient clips, 75mm batt insulation*, wood roof truss with vented attic space, sheathing and asphalt roofing.

* note, this insulation amount meets the acoustic barrier requirements but may not meet the Energy Code.

Appendix A:

Canadian Airport Zoning Comparison

Ranking	Canada's Busiest Airports Ranked by Passenger Traffic in 2018	Residential Development Permitted in 30-35 Noise Exposure Forecast (NEF) Zone	Residential Development Permitted in 25-30 Noise Exposure Forecast (NEF) Zone	Acoustic Requirements for New Residential Developments or when Replacing Existing	Exist. Buildings within Noise Sensitive/ Regulated Areas	Airport Open 24 Hours?	Reference Documents
1	Toronto Pearson International Airport	Yes if additional requirements are met, including: Providing a detailed feasibility noise impact study; a detailed noise impact study by a professional engineer; and a Aircraft Noise Warning Agreement. Exceptions have been made for some new developments.	New or Existing Allowed	Provide a feasibility noise impact study and detailed noise impact study - to assess the impact of all transportation and stationary noise sources on the indoor and outdoor environment. Post a aircraft noise warning notice advising of noise in a development	Residential and Commercial	Yes	Mississauga Official Plan - By-law 0133-2017
2	Vancouver International Airport	Yes- All Aircraft Noise Sensitive Land Uses may be considered. (page 3-78)	New or Existing Allowed	Achieve CMHC interior noise standards An Acoustic Report. Noise mitigation incorporated in construction.	Residential and Commercial	Yes	Main 2041 Official Community Plan - Bylaw 9000- 3.6.3 Noise Management & Richmond Aircraft Noise Development Requirements
3	Montréal–Pierre Elliott Trudeau International Airport	Yes if additional soundproofing requirements are met.	New or Existing Allowed	Prohibit residential and institutional land use in areas where the NEF is greater than 35; require soundproofing for residential and institutional construction in areas where the NEF is greater than 30.	Residential and Commercial	Yes	Montreal Master Plan, part 1, Chapter 2, 2.7, Object 19
4	Calgary International Airport	No New Development (Exception; if approved before current regulations came into force)	New or Existing Allowed	Yes- comply with acoustical requirements set out in the Alberta Building Code for Residential Development with a NEF of over 25	Residential and Commercial	Yes	Calgary Airport- Vicinity Protection Area Regulation
5	Edmonton International Airport	No New Development (Exception; if approved before current regulations came into force)	New or Existing Allowed	Yes- comply with acoustical requirements set out in the Alberta Building Code for Residential Development with a NEF of over 25	Commercial	Yes	Vicinity Protection Area Regulation - Alberta Regulation 55/2006
6	Ottawa International Airport	No new residential development and other noise sensitiveoccupancies above the 30 Noise Exposure Forecast	New or Existing Allowed	Comply with City's Environmental Noise Control Guidelines which are based on the applicable Provincial noise guidelines [currently NPC – 300, MOECC 2013] or Provide a Noise Control Study	Residential and Commercial	Yes	Official Plan Amendment No 76 – Airport and Employment Hearing 2011 (page 9) & Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning (NPC-300)
7	Winnipeg International Airport	Replace Existing only	Replace Existing only	Comply with the Airport Vicinity Acoustic Insulation By-Law 6419/94 (Equivalent to **Achieving CMHC interior noise standards**) for all residential developments in the Winnipeg Airport Vicinity Protection Area	Residential and Commercial	Yes	Airport Vicinity Protection Area Zoning By-Law No. 6418/94 & Winnipeg Airport Development Plan 2020
8	Halifax Stanfield International Airport	Large-scale residential subdivisions prohibited	New or Existing Allowed	No existing requirements. Open proposal to design to CMHC interior noise standards and disclosure on the land title indicating that the subject property could potentially be impacted by noise. Currently no requirements	Residential and Commercial	Yes	Halifax Stanfield International Airport: Regulation of Adjacent Development
9	Billy Bishop Toronto City Airport	N/A	Information not Available	N/A The orientation of the runways allows the flight path to be over Lake Ontario therefore, very little developed land is affected.	Commercial	No	Noise Exposure Contours Billy Bishop Toronto City Airport
10	Kelowna International Airport	Suggests no new residential development and other noise sensitive uses above the 30 Noise Exposure Forecast	Information not Available	No existing requirements available	None	Yes	City of Kelowna Zoning Bylaws & Kelowna Airport Master Plan

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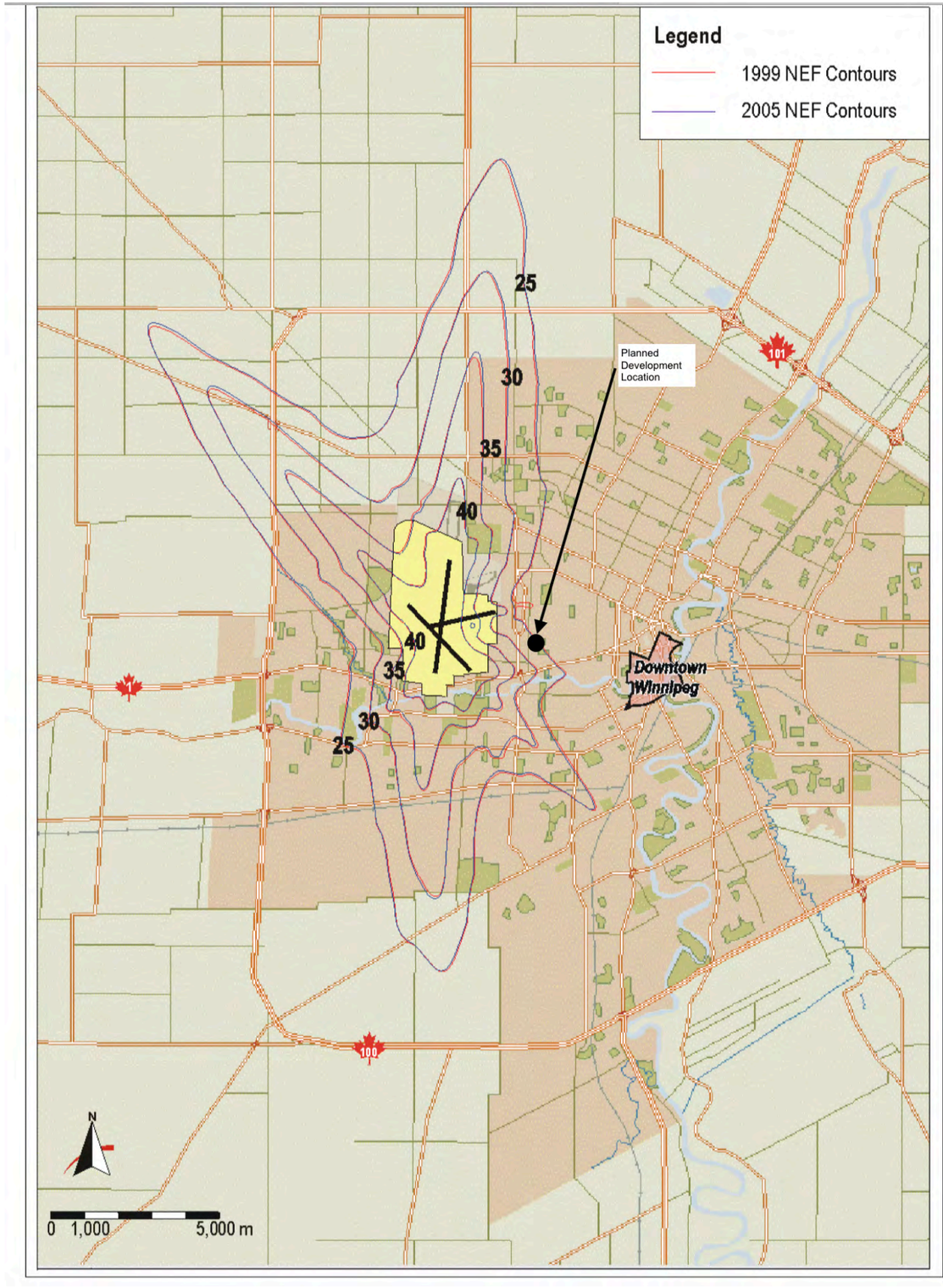
11	Victoria International Airport	Information not Available	Information not Available	Noise contours, in conjunction with a set of guidelines, are to be used to encourage compatible land use in the vicinity of the airport site	Residential and Commercial	No	Victoria International Airport: Master Plan 2012
12	Québec City Jean Lesage International Airport	Information not Available	Information not Available	Aeroporto de Quebec Master Plan (2010) indicates that a NEF study has not been completed for this airport.	Residential and Commercial	Yes	Aeroporto de Quebec Master Plan (2010)
13	St. John's International Airport	Residential land uses restricted within the NEF 30 Contour.	New or Existing Allowed	Policies in the Municipal Plan regulate establishment of noise sensitive Land Uses in NEF	Residential and Commercial	Yes	Airport Master Plan Update 2015-2035 St. John's International Airport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