Open Building Population Layer for Canada (v3)

Technical Document (2026-04-17)

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Note

The Open Building Population Layer (Canada) is a personal project by Maxim Fortin. It is not an official Government of Canada data source for building footprints or population distribution. No warranty is given as to the accuracy or completeness of the information provided.

Introduction

How many people live in each building across Canada? This dataset answers that question with population estimates for every building in all provinces and territories, calculated from publicly available census data. Population density products have long been used to quantify demographic information and to assess relationships with hazards, ecosystems, human health and infrastructure — but proprietary datasets can be expensive and public datasets lack the resolution required for most analyses. This open layer fills that gap, and both the data and code can be downloaded and used freely under open-source licenses.

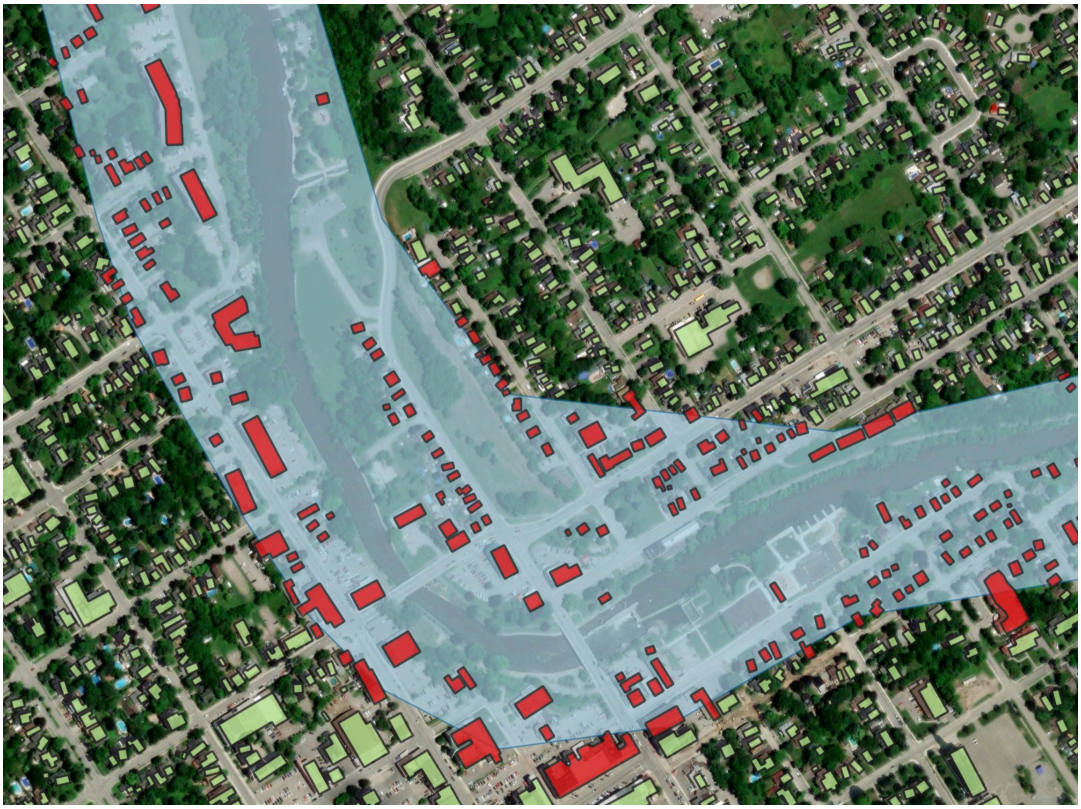
The Open Building Population Layer for Canada was first released in 2022 (v1), then updated in 2024 (v2). Version 3 (2026) brings three major upgrades: approximately 13.7 million building footprints from Public Safety Canada's Canada Structures dataset, population allocation at the Dissemination Block level (498,547 units) using 2021 Census data, and an orphan rescue mechanism that recovers population from Dissemination Blocks with no buildings. Both Points and Footprints layers are provided in the EPSG:3978 coordinate reference system.

Open Building Population Layer (Canada) in Victoria, BC

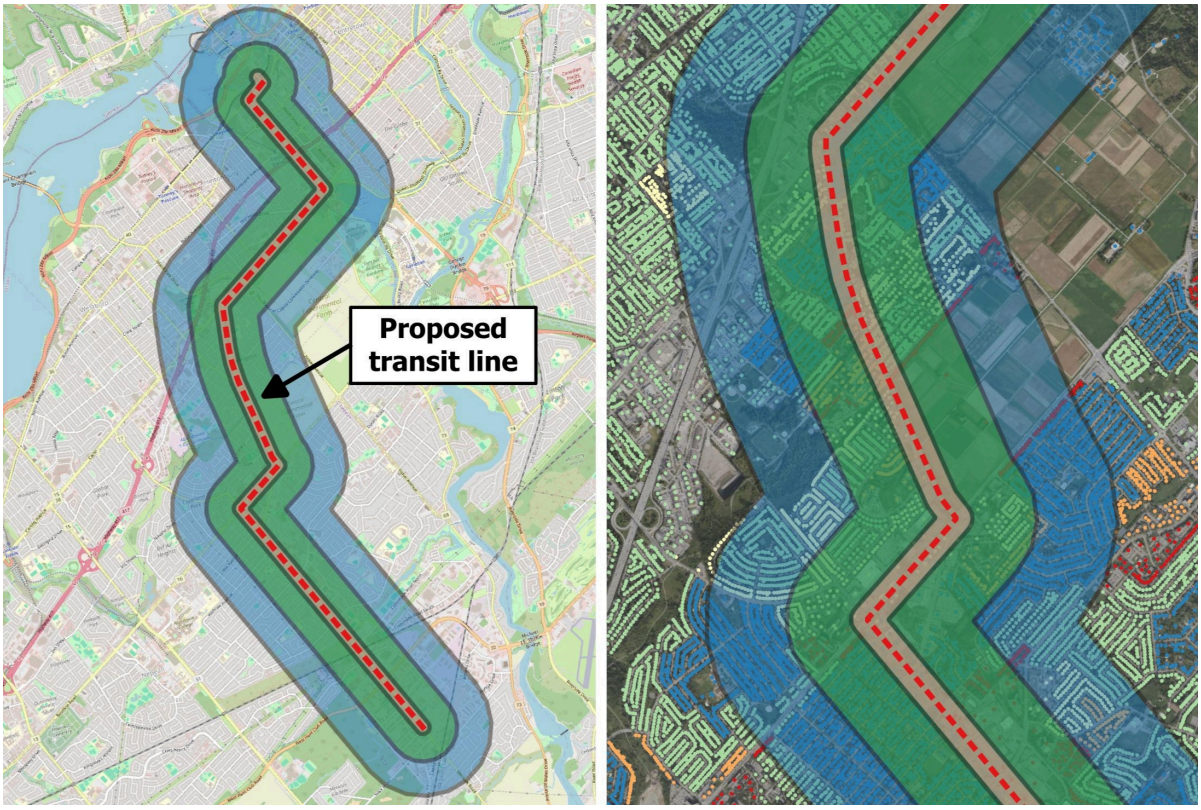
Explore the data live: this interactive map shows a sample area in Ottawa, Canada. Toggle between building points and footprints, or switch the basemap, using the layer control in the top-right corner.

Interactive map sample: Sample area in Ottawa, ON

In practice, the layer can help answer questions like: how many people live in a floodplain? How many residents would a new transit line serve?



A fictional floodplain overlaid with the building population data layer provides a direct estimate of directly exposed population



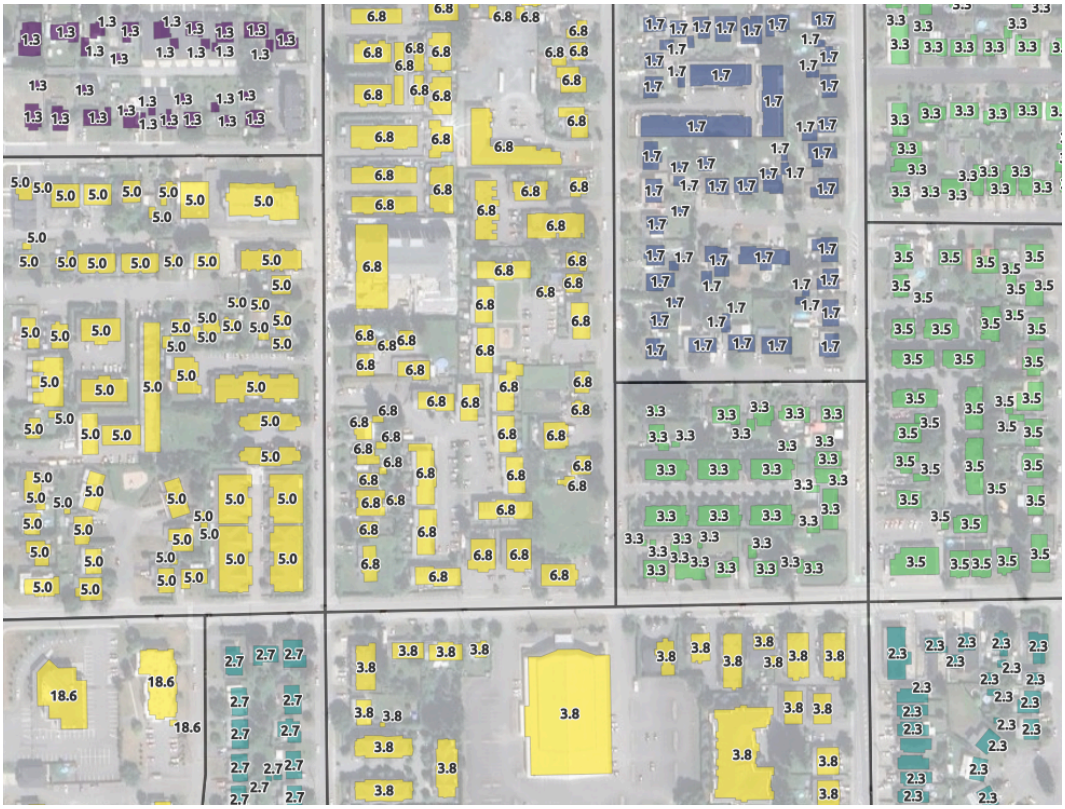
Buffers of 100 m, 500 m, and 1 km around a fictional transit line intersected with the building population layer

What's new in v3

Version 3 moves to Dissemination Blocks for a tenfold increase in resolution over v2's Dissemination Areas, introduces an orphan rescue mechanism to redistribute population from Dissemination Blocks with census population but zero buildings, and closes the conservation gap from -1.626% to +0.069%.

Aspect	**v2 (2024)**	**v3 (2026)**
Primary census unit	Dissemination Area (57,932)	Dissemination Block (498,547)
Fallback chain	DA → CSD → CD → PT	DB → DA → CSD → CD
Building footprints	Microsoft Bing (12.3M)	Public Safety Canada Structures (13.7M)
Orphan rescue	None	Population from 0-building DBs redistributed
Quality flags	None	QF_O (orphan pop exceeds DB pop for that building), QF_V (implausible pop/height)
Population conservation gap	-1.626%	-0.015%
Output precision	Full float	3 decimal places
File format	GeoPackage	GeoPackage & GeoParquet

The image below shows an example of the v3 process in action at the Dissemination Block level.



Close-up view with population labels in Chilliwack, BC

Methodology

The layer combines two open data sources:

1. **Public Safety Canada — Canada Structures building footprints**: Approximately 13.7 million building footprints from the Canada Structures dataset, freely available under the Open Government License (OGL). Each footprint includes a building height estimate where available. The product is provided in vector format created by Public Safety Canada (PS). This dataset combines and harmonizes different building footprint sources into one (Canada Open Database of Buildings, OpenStreetMap and Microsoft Bing Canada Building Footprints), with a notable increase in coverage compared to the Microsoft Bing Canada dataset previously used in v1 and v2 (+1.4 million buildings).

2. **2021 Canada Census**: Population distribution at the smallest available census geographical units, in a hierarchical fallback chain:

3. Dissemination Blocks - DB (498,547 units)
4. Dissemination Areas - DA (57,932 units)
5. Census Subdivisions - CSD (5,161 units)
6. Census Divisions - CD (293 units)

The building population is estimated through the following pipeline:

1. Load census geospatial data at the DB/DA/CSD/CD hierarchy and reproject to EPSG:3978
2. Validate and repair census geometries
3. Load Canada Structures building footprints and reproject to EPSG:3978
4. Perform spatial joins of building representative points to each census level
5. Calculate population-per-building ratios, with fallbacks when no results are available at the detailed level:
6. DB_RATIO = DB_POP / COUNT_DB
7. DA_RATIO = DA_POP / COUNT_DA (fallback)
8. CSD_RATIO = CSD_POP / COUNT_CSD (fallback)
9. CD_RATIO = CD_POP / COUNT_CD (fallback)
10. Orphan population rescue: redistribute population from DBs with census population > 0 but zero buildings to buildings in the same DA
11. Assign: BLDG_POP = best_available_ratio + ORPHAN_RATIO, rounded to 3 decimal places
12. Assign flags documenting potential data quality concerns
13. Output: Points and Footprints layers per province and nationally

> **Note**
>
> The orphan population rescue mechanism introduced in v3 is important. Without it, census population in Dissemination Blocks with zero building footprints would be entirely excluded from the dataset (approx. 290,000 people nationally). Moving to finer census granularity (DBs) would actually result in *more* missed population compared to the coarser DA approach if this complementary process was not introduced (since it's more much likely to find 0 buildings in a smaller DB, than it is in the larger DA). The orphan rescue enables more detailed census data while accepting that some population estimates become partially dependent on redistribution from neighboring areas.

The entire pipeline is automated in Python using GeoPandas and Pyogrio. The code is available here in a Codeberg Git repository.

Data dictionary

Data fields provided with this data layer are described below. The main data field is "BLDG_POP" which provides the best available population estimate for each building.

View data dictionary (17 fields)

Field	Type	Description
BLDG_ID	int	Building index unique identifier, consistent with Canada Structures input dataset
HEIGHT	float	Building height in metres (3 decimal places)
DBUID	str	Dissemination Block unique identifier
DB_RATIO	float	Population per building at DB level (3 decimal places)
DAUID	str	Dissemination Area unique identifier
DA_RATIO	float	Population per building at DA level (3 decimal places)
CSDUID	str	Census Subdivision unique identifier
CSD_RATIO	float	Population per building at CSD level (3 decimal places)
CDUID	str	Census Division unique identifier
CD_RATIO	float	Population per building at CD level (3 decimal places)
ORPHAN_RATIO	float	Bonus population from orphaned DBs (3 decimal places)
HAS_ORPHAN_BONUS	int	1 if building receives orphan bonus, 0 otherwise
BLDG_POP	**float**	**Estimated building population (3 decimal places). Sourced from DB_RATIO, DA_RATIO, CSD_RATIO, CD_RATIO, or NONE.**
POP_SOURCE	str	Ratio used: DB_RATIO, DA_RATIO, CSD_RATIO, CD_RATIO, or NONE
QF_O	int	1 if (ORPHAN_RATIO > DB_RATIO) AND (DB_RATIO > 0), 0 otherwise. Flags buildings where the orphan bonus exceeds the DB allocation.
QF_V	int	1 if BLDG_POP > 100 AND 0 < HEIGHT < 5m, 0 otherwise. Flags physically implausible combinations of high population and low building height.

Quality Flags

Two boolean columns identify buildings with potential data quality concerns.

QF_O — Orphan Bonus Exceeds DB Allocation

`QF_O = 1` when `ORPHAN_RATIO > DB_RATIO` AND `DB_RATIO > 0`.

The orphan rescue mechanism redistributes population from Dissemination Blocks with census population but zero building footprints. This flag identifies buildings where the orphan bonus exceeds the building's own DB allocation — meaning most of the population estimate comes from redistribution rather than the building's local DB. **24,139 buildings** (0.18%) are flagged with QF_O.

Why does this happen? The mismatch between census population and available building footprints has several causes: - **Incomplete footprint coverage** — the most common cause. Some areas have census population but missing building footprints. - **Temporal misalignment** — census data is from 2021, while footprint data was compiled from multiple sources collected at different times. Areas with very recent land and housing developments tend to have more flags, as census population exists for these areas but buildings may not yet be captured in the footprint data. - **Source compilation gaps** — Canada Structures combines footprints from multiple datasets with varying completeness.

QF_V — Implausible Population for Building Height

`QF_V = 1` when `BLDG_POP > 100` AND `0 < HEIGHT < 5`.

This flag identifies buildings with physically implausible combinations: over 100 residents but confirmed heights under 5 metres. **830 buildings** (0.006%) are flagged with QF_V.

Why does this happen? - Height data errors — some buildings have incorrect height values, visible when compared against satellite imagery. - **Small dissemination blocks with high population density** — a DB with only 4-5 high-rise buildings may distribute high population to small auxiliary structures (garages, sheds) nearby.

Only buildings with confirmed heights are flagged (HEIGHT = 0 or NaN excluded). Note: 66.5% of buildings in the footprint dataset have height data, and there is high data coverage for urban areas since height was originally estimated in Canada Structures from national lidar data holdings.

Flag	Buildings	% of Dataset
QF_O only	24,032	0.175%
QF_V only	723	0.005%
Both QF_O and QF_V	107	0.001%
Neither	13,735,892	99.819%

Flags per jurisdictions

Province/Territory	QF_O	QF_V	% Flag Instances
AB	3,701	35	0.196%

Province/Territory	QF_O	QF_V	% Flag Instances
BC	1,105	97	0.078%
MB	863	15	0.122%
NB	10	3	0.003%
NL	668	0	0.233%
NS	29	2	0.006%
NT	0	0	0.000%
NU	0	0	0.000%
ON	13,833	585	0.305%
PE	0	0	0.000%
QC	3,332	91	0.123%
SK	448	2	0.061%
YT	150	0	0.936%

Download

The following files are available for download in zipped GeoPackage format and GeoParquet format (EPSG:3978 coordinate reference system).

File packages are provided for each province and territory (GeoPackage), along with a complete country-wide package (GeoPackage and GeoParquet).

Building footprints

Province/Territory	Size
Alberta	245 MB
British Columbia	206 MB
Manitoba	89 MB
New Brunswick	50 MB

Province/Territory	Size
Newfoundland and Labrador	33 MB
Northwest Territories	3.4 MB
Nova Scotia	60 MB
Nunavut	1.2 MB
Ontario	641 MB
Prince Edward Island	9.5 MB
Quebec	354 MB
Saskatchewan	93 MB
Yukon	1.8 MB
Canada (all) - Zipped GeoPackage	**1.8 GB**
Canada (all) - GeoParquet	**1.5 GB**

Building points

Province/Territory	Size
Alberta	102 MB
British Columbia	79 MB
Manitoba	40 MB
New Brunswick	23 MB
Newfoundland and Labrador	16 MB
Northwest Territories	892 KB
Nova Scotia	26 MB
Nunavut	476 KB
Ontario	238 MB
Prince Edward Island	4.5 MB

Province/Territory	Size
Quebec	160 MB
Saskatchewan	42 MB
Yukon	740 KB
Canada (all) - Zipped GeoPackage	**723 MB**
Canada (all) - GeoParquet	**405 MB**

QA/QC

The building population layer was validated by comparing the sum of BLDG_POP for each province and territory against the official 2021 Census Dissemination Block population totals. Additional QA/QC was also done to validate features, geometries and results by comparison between v2 and v3 layers, as well as deep-dives on the behaviour of the orphan rescue implementation.

The overall population conservation gap is -0.015% at the national level (computed as the sum of all provincial differences divided by the total census population). Some provinces show slight over-allocation, others under-allocation. This is primarily due to privacy suppressed DBs (843 nationally) receiving population via fallback ratios rather than DB_RATIO, plus minor rounding effects. The orphan population redistribution itself conserves population exactly and is not the source of these variations.

Key metrics: - Approximately 99.6% of buildings receive population via DB_RATIO (Dissemination Block level) - 1,808,449 buildings receive an orphan bonus (13.1%) - 843 Dissemination Blocks have suppressed (null) population data due to privacy reasons - these receive population estimates from fallback ratios - 24,139 buildings (0.18%) flagged with QF_O — orphan bonus exceeds DB allocation - 830 buildings (0.006%) flagged with QF_V — implausible population/height combination - Combined: 24,862 buildings (0.18%) have at least one quality flag

View per-province comparison table

Province & territory	Census DB population 2021	Sum of BLDG_POP	Difference	Difference (%)
AB	4,262,635	4,269,294.6	+6,659.6	+0.156
BC	5,000,874	5,002,649.5	+1,775.5	+0.036
MB	1,342,153	1,346,313.6	+4,160.6	+0.310
NB	775,610	776,061.0	+451.0	+0.058

Province & territory	Census DB population 2021	Sum of BLDG_POP	Difference	Difference (%)
NL	510,545	511,272.7	+727.7	+0.143
NS	969,383	970,161.1	+778.1	+0.080
NT	41,070	41,075.9	+5.9	+0.014
NU	36,858	36,876.4	+18.4	+0.050
ON	14,223,942	14,222,563.0	-1,379.0	-0.010
PE	154,331	154,466.2	+135.2	+0.088
QC	8,501,833	8,514,167.0	+12,334.0	+0.145
SK	1,132,505	1,132,249.1	-255.9	-0.023
YT	40,232	40,191.0	-41.0	-0.102
Total	**36,991,971**	**37,017,341.1**	**+25,370.1**	**+0.069**

Limitations and potential improvements

Found an error, or have an idea for improvement? Please send me a message on LinkedIn or using the contact form in the site menu.

Population is averaged per building. No differentiation is made between residential, commercial, industrial, or institutional buildings — population is distributed evenly across all buildings within each Dissemination Block. **This layer is suitable for high-level assessments and approximations, but not for determining the population of a specific building or address.**

Northern and remote areas may have limited footprint coverage. The Canada Structures dataset has gaps in Yukon, the Northwest Territories, and particularly Nunavut — use with caution in these regions. Building footprint age varies across sources, and height data quality varies by source; neither should be relied upon for site-specific analysis. Additionally, recent constructions or changes in land use may affect building footprint gaps.

Census data is from 2021. A new census should be conducted in 2026 by Statistics Canada, and detailed census data profiles will likely be available around 2028. There are 843 Dissemination Blocks with privacy-suppressed population that receive values through fallback ratios at the DA, CSD, or CD level.

License and attribution

The Open Building Population Layer (Canada) v3 has been produced by Maxim Fortin as open and free data.

Dataset license

The dataset is released under the Open Database License (ODbL) v1.0. This license allows you to freely use, distribute, and modify the database, and produce works from it, as long as you attribute the source and share any adapted database under the same license.

When using the dataset, please attribute as follows: *Fortin, Maxim (2026). Open Building Population Layer — Canada v3. https://maximfortin.com/project/obpl-ca-v3/*

This database incorporates data from the Open Database of Buildings (ODB), OpenStreetMap (OSM) buildings, and Microsoft Building Footprints (MSB) via Canada Structures (Public Safety Canada), all released under their respective open licenses. Census data is from Statistics Canada under the Open Government License – Canada. All upstream attributions must be preserved. A comprehensive list of all data providers and their attributions for the Open Database of Buildings (ODB) is available in the attribution table (CSV).

No warranty is given as to the accuracy or completeness of the information provided. While the dataset provides estimates of population for each building in Canada, please note that these are derived approximations and do not represent exact population counts. Use caution when interpreting and utilizing the data for decision-making purposes.

Code license

The code is released under the Apache 2.0 License. This license allows you to freely use, distribute, and modify the code for both commercial and non-commercial purposes, with limited liability and warranty.

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