

Accessibility Measures in BC and the Complete Communities Program



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Data Exploration and Integration Lab, Centre for Special Business Projects, Statistics Canada



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User Information

The following standard symbols are used in Statistics Canada publications:

- . Not available for any reference period
- .. Not available for a specific reference period
- ... Not applicable
- 0 True zero

1 Executive Summary

This report provides some methodological details and results of the following measures of access to each amenity produced by the Data Exploration and Integration Lab, Centre for Special Business Projects:

- The ***measure of access to amenities by transit during peak hours*** represents the degree to which select amenities are accessible within a 90-minute trip on the transit network during peak hours of service (7:00 a.m.-9:00 a.m.).
- The ***measure of access to amenities by transit during off-peak hours*** represents the degree to which select amenities, are accessible within a 90-minute trip on the transit network during off-peak hours of service (2:00 p.m.-4:00 p.m.).
- The ***measure of access to amenities by cycling*** represents the degree to which select amenities, are accessible within a 30-minute bike ride.
- The ***measure of access to amenities by walking*** represents the degree to which select amenities, are accessible within a 30-minute walk.

The main aggregate results can be summarized as follows for Employment, Childcare Facilities, and Pharmacies accessibility measures. Educational Facilities, Health Care Facilities, and Retail accessibility measures were calculated but not discussed in this report for brevity.

- 90.1%, 85.6%, and 82% of British Columbians have access to places of employment, Childcare Facilities, and Pharmacies by transit during peak hours, respectively.
- 90%, 85.6%, and 81.9% of British Columbians have access to places of employment, Childcare Facilities, and Pharmacies during off-peak hours by transit, respectively.
- 98.3%, 94.7%, and 90.8% of British Columbians have access to places of employment, Childcare Facilities, and Pharmacies by cycling, respectively.
- 98.4%, 92.1%, and 79.6% of British Columbians have access to places of employment, Childcare Facilities, and Pharmacies by walking, respectively.

2 Introduction

This report provides a granular analysis of accessibility measures in the province of British Columbia for a variety of amenities. These measures can support the creation of more sustainable and resilient public transportation (PT) and active transportation (AT) infrastructure across British Columbia; for example, the proposed set of measures can enable policymakers to assess spatial patterns and socioeconomic disparities of potential access to increase and improve services for British Columbians. Moreover, these measures could be supplemented with periodic updates that would provide insights on whether access to a service or amenity has improved or worsened over a given timescale.

This work expands on previous forays and initiatives in this space by achieving a provincial analysis that is compatible with national standards of spatial accessibility measures by PT and AT. The measures analyzed in this report are an advancement of Statistics Canada's Proximity Measures Database (Alasia et al.) and follow a similar methodological approach to the Spatial Accessibility Measures (Forthcoming) completed with Infrastructure Canada (INFC). The remainder of this report briefly describes the data dependencies and methodology. Specifically, Section 3 explains the data dependencies required to produce the measures; Section 4 describes the methodology applied to acquire the appropriate data and calculate the four measures of access for Employment, Childcare Facilities, Pharmacies, Educational Facilities, Health Care Facilities, and Retail. Section 5 details the results and provides summary statistics of the measures, while Section 6 discusses assumptions applied for this study, notes on interpretation, and data limitations.

3 Data Dependencies

In summary, the following data are required to compute the measures of access to amenities in British Columbia: (1) public transit routes, schedules, and stops formatted using General Transit Feed Specification (GTFS)¹ and (2) road networks for calculating durations; (3) origin and destination point locations (i.e., latitude and longitude); (4) count of amenities linked to the destination locations; and (5) carsharing services locations. This section details the data leveraged or excluded to meet the project's scope. For an in-depth review of the data sources, routing, or building footprints, please read Section 4: Methodological Summary: Acquisition to Computation below.

3.1 Data Sources for Destination Masses

OpenStreetMap (OSM)² is a free and editable global geographic database. It hosts a wide variety of geographic data and is used by many major governments, corporations, and end users. OSM

¹ See: [GTFS Static Overview | Static Transit | Google Developers](#)

² See: [OpenStreetMap](#)

data uses a system of key-value pairs called 'tags' to describe physical or non-physical attributes of every feature, ultimately offering an open format of georeferenced road and AT (cycling and pedestrian) network data. General Transit Feed Specification (4.4GTFS) data, OSM road and AT network data, as well as Building Footprint data were used as inputs into the routing engines to determine travel time durations between dissemination blocks (DBs). Specifically, Building Footprint Data was used to determine the most representative potential origin and destination points of the dissemination blocks for routing. OSM road network data was used with GTFS data for routing of transit durations, while OSM road and AT network data, comprised of cycling and walking tags, were used to determine respective path durations in Valhalla. Static GTFS sources containing transit route, location, and stop information were leveraged to derive the transit access measures.

3.2 Data Source for Building Footprints

To create the most accurate building footprint database with the best possible coverage, a compilation of sources was required. Three existing databases were combined using the following hierarchy: Open Database of Buildings (ODB)³, a collection of authoritative open sources; Open Street Map Buildings (OSM), user generated open-source data hosted using OSM; and Microsoft Building Footprints (BING)⁴, automatically generated and cleaned data created from Microsoft's satellite imagery.

4 Methodological Summary: Acquisition to Computation

This section briefly details the steps for collecting and processing the GTFS sources, calculating the travel time matrices between DBs with the compiled GTFS sources, and computing the four measures of access to places of employment, childcare, pharmacies, education, healthcare, grocery stores, bank branches, hardware stores, post offices, places of worship, cafes/restaurants/pubs, libraries, sports and recreational facilities, and carshare services.

4.1 GTFS Data Collection and Transit Region Compilation

For this analysis, PT was defined as regularly scheduled, fixed route transportation systems available to the general public. As a result, on-demand services, typically for users with special accommodation requirements (e.g., para transportation, school buses) or in smaller communities, were excluded from the measurements. Moreover, larger inter-city services (such as Via Rail and BC Ferries) were excluded given their price and required advanced booking. Under these

³ See: [The Open Database of Buildings \(statcan.gc.ca\)](https://www.statcan.gc.ca/oddb/)

⁴ See: [microsoft/CanadianBuildingFootprints: Computer generated building footprints for Canada \(github.com\)](https://github.com/microsoft/CanadianBuildingFootprints)

conditions, the following modes of transportation were considered public transportation: bus, commuter train, subway⁵, sea buses, light-rail trains, and streetcars (trams) services.

A total of 28 GTFS sources were acquired via government data portals, non-government data portals, and outreach, providing coverage for around 88.91% of the population of British Columbia (Figure 1). After acquisition, data were processed into groupings of transit regions. More specifically, each transit region is a compilation of GTFS sources that are grouped together based on the assumption that intersecting bounding boxes of the sources' transit stop locations meant commuters could connect between different transit providers. With this, 14 transit regions were generated (Appendix Figure 1).

Figure 1. Percentage of BC population living in a dissemination block with at least one bus stop, by census division. Calculated using 2021 population data for the entire province; therefore, rural and urban percent coverages only reflect GTFS data collected, and their sum will be less than 100%.



Note: GTFS coverage percentages may be slightly less than those representing measures of access since walking to stops is permitted in the latter.

4.2 Origin and Destination Points

Regarding the creation of origin and destination points, the 2021 Census Dissemination Blocks (DB) were leveraged, using an approach based on building footprint distance matrices. A DB is defined as an area bounded on all sides by roads and/or boundaries of standard geographic areas. DBs cover all of Canada and are the smallest geographic area for which population and dwelling counts are disseminated (Statistics Canada 2017b).

⁵ This includes SkyTrain.

To use building footprints to create an origin or destination point, distance matrices were created for each DB. This process was done by first turning the building footprints into building centroids. Then, for each DB, the building centroids within it were selected. For each DB subset, a distance matrix was created comprised of calculated distances from each centroid to each other centroid within the subset. Finally, the centroid that had the lowest mean distance (i.e., located closest to all other buildings) was selected as the origin and destination point for that DB.

4.3 Calculating Travel Times

The travel times via public transportation were calculated using r5r⁶ (Pereira et al.), an R package which provides an interface to the open-source Java-based routing engine developed by Conveyal, R^{5,7}. Meanwhile, travel times via cycling and walking were calculated using Valhalla⁸, an open-source C++-based routing engine.

4.4 Healthcare Destinations

Healthcare destinations were comprised of facilities servicing under the following NAICS codes in the Business Register (BR): 6211 (Offices of physicians), 6212 (Offices of dentists), 6213 (Offices of other health practitioners), 621494 (Community health centres), and 622 (Hospitals). This extract was supplemented by ambulatory health care services, hospitals, and urgent care centres within the Open Database of Healthcare Facilities version 2 (ODHF).

The ODHF was linked to healthcare facilities within the 2021 BR extract using the python toolkit, recordlinkage⁹. Recordlinkage is comprised of tools to assist in data cleaning, indexing, comparing, and classifying matches. Distance scoring thresholds were used to assess validity of candidate pairing by recordlinkage both manually and using recordlinkage's naïve bayes classifier.

4.4.1 Healthcare Mass Imputation

After ODHF was linked to the BR extract, employment bins for ODHF facilities that did not have a match in the BR were predicted using a random forest classifier with bagging. The training set was comprised of two parameters: binned 2021 CSD populations, and facility type. With the highest cross-validated score among models tested, a random forest classifier¹⁰ from scikitlearn was

⁶ See: [Rapid Realistic Routing with R5 • r5r \(ipeagit.github.io\)](https://github.com/ipeagit/r5r)

⁷ See: [conveyal/r5: Developed to power Conveyal's web-based interface for scenario planning and land-use/transport accessibility analysis, R5 is our routing engine for multimodal \(transit/bike/walk/car\) networks with a particular focus on public transit \(github.com\)](https://github.com/conveyal/r5)

⁸ See: [valhalla/valhalla: Open Source Routing Engine for OpenStreetMap \(github.com\)](https://github.com/valhalla/valhalla)

⁹ See: <https://pypi.org/project/recordlinkage/>

¹⁰ See: <https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestClassifier.html?highlight=random%20fores#sklearn.ensemble.RandomForestClassifier>

employed with bagging¹¹ to predict employment bins, where missing. The classifier predicted employment intervals for 1.58% of the BR augmented with ODHF data.

4.5 Carshare Locations

Carshare location data was digitized into geospatial feature classes in polygons for point-to-point zones and points for fixed location parking hubs using three BC carshare operators. Digitization occurred either by manually digitizing the geometry indicated on operator websites, or by incorporating data that was provided directly from the operator. Only carshare operators that owned a fleet were included; peer-to-peer carshare was excluded. The geometry was buffered by 400 m to allow for varying sizes of hub locations, for example, large parking lots that can be accessed from multiple points, and to approximate a five-minute walk to any point location. The buffered geometry was then dissolved into a single multi-polygon layer.

4.6 Measuring Presence and Destination Masses

The masses of employment, childcare facilities, pharmacies, bank branches, hardware stores, post offices, cafes/restaurants/pubs, places of worship, and grocery stores were derived from the BR. OSM was leveraged for sports and recreational facilities and Government of BC open data was leveraged for libraries. K-12 educational facilities were selected from the Open Database of Educational Facilities¹². Amenities derived from open data that were utilized for this project were assumed to be uniform in size; that is, each amenity was given a value of 1. The total mass of a DB is the sum of the masses of the facilities within it (i.e., count of observations). For BR amenities, employment counts were partitioned into eight bins, for which the numeric categorical code, ranging from one to eight, was used as a mass. The total mass of a DB is the sum of the masses of the facilities within it.

4.7 Modelling

The gravity model adopted for this analysis is identical to the one specified in the Spatial Accessibility Measures (Forthcoming) completed with INFC. This model builds on the methods developed in Alasia et al (2021), who produced the first Proximity Measures Database for Canada (PMD). In its simplest form, the gravity model considers the attractiveness of a destination and the willingness to travel to said destination.

Mathematically, the attractiveness of a destination point j from an origin point i is proportional to the amenity mass (m) at j and proportional to the willingness to travel (f) the distance or duration (d) between i and j . The access level of origin point i is the summation of the destination attraction of all destinations J within a designated range of i .

¹¹ See: <https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.BaggingClassifier.html>

¹² See: <https://www.statcan.gc.ca/en/lode/databases/odef>

Equation (1) illustrates the formula and conditions that define the access level (AL) for a geographic unit i :

$$AL_i = \sum_{j \in J} f(d_{i,j}) * m_j \tag{1}$$

where

$$f(d_{(i,j)}) = 1 - \left(1 - e^{\left(-\frac{d_{(i,j)}}{\lambda}\right)}\right) \tag{2}$$

Here, λ , is chosen such that the median duration of travel – determined using GSS data (see Table 1) – to that amenity corresponds to the midpoint of the interval [0,1].

Table 1. Median trip durations by mode of transportation.

Destination Type	Median Duration Public Transportation	Median Duration Cycling	Median Duration Walking
Cultural and Arts Facilities	15 minutes	15 minutes	10 minutes
Educational Facilities	20 minutes	20 minutes	10 minutes
Recreational Facilities	15 minutes	15 minutes	10 minutes
Employment	20 minutes	20 minutes	15 minutes
Healthcare Facilities	15 minutes	15 minutes	10 minutes
Grocery Stores	15 minutes	15 minutes	10 minutes
Cafes, Restaurants and Bars	15 minutes	15 minutes	10 minutes
Banking Facilities	15 minutes	15 minutes	10 minutes
Postal Offices	15 minutes	15 minutes	10 minutes
Places of Worship	15 minutes	15 minutes	10 minutes
Childcare Facilities	15 minutes	15 minutes	10 minutes
Pharmacies	15 minutes	15 minutes	10 minutes
Car Share	10 minutes

Source: GSS and authors' computations.

Finally, the level values are rescaled into an index – where the minimum value for all of British Columbia is 0 and the maximum value for all of British Columbia is 1 – by min-max normalization.

4.8 Measures of Access

Following the methodology outlined above, four measures of access to each amenity were produced:

- The ***measure of access to amenities by transit during peak hours*** represents the degree to which select amenities are accessible within a 90-minute trip on the transit network during peak hours of service (7:00 a.m.-9:00 a.m.).
- The ***measure of access to amenities by transit during off-peak hours*** represents the degree to which select amenities, are accessible within a 90-minute trip on the transit network during off-peak hours of service (2:00 p.m.-4:00 p.m.).
- The ***measure of access to amenities by cycling*** represents the degree to which select amenities, are accessible within a 30-minute bike ride.
- The ***measure of access to amenities by walking*** represents the degree to which select amenities, are accessible within a 30-minute walk.

5 Access Measures

5.1 Access to Select Amenities in British Columbia by Public Transit

The following are summary statistics on the four measures of access to the select amenities derived. These results are limited to regions with public transit data available in GTFS format.

Tables 2 – 13 show the percentage of the population in the top, middle, and bottom thirds of the access index distribution with equal number of dissemination blocks in each group. “No access” is the percentage of the population in areas with an access index value of zero. Outside is the percentage of the population in areas that are out of scope for this study (i.e., communities where transit data in GTFS format is suspected to exist but was not available at the time this report was written).

5.1.1 Employment During Peak Hours

We estimated that 90.1% of British Columbia’s population lives within a CD that has some degree of access to places of employment by transit during peak hours (Table 2). Around 40% fell within the top tercile whereas the middle and bottom tercile had approximately 32% and 18.1%, respectively.

The census divisions that have the highest coverage are Greater Vancouver, Capital, and Central Okanagan. Each has between 97-99.9% of their population living within a DB that has at least some access via transit during peak hours. The two CDs that have the highest proportion of their population in the top tercile are Greater Vancouver and Capital. The proportion of the population that falls outside the transit area is between 0.1% and 56.7%. Central Coast, Mount Waddington, Northern Rockies, and Stikine have no access to places of employment via transit during peak hours.

Table 2. Terciles of population living in a CD with access to places of employment by transit during peak hours.

Census Division	Bottom	Middle	Top	No Access	Outside
Values are in percentages					
Alberni-Clayoquot	70.5	-	-	22	7.5
Bulkley-Nechako	-	-	-	43.3	56.7
Capital	13	78.7	5.4	2.9	0.1
Cariboo	-	-	-	66.9	33.1
Central Coast	-	-	-	100	-
Central Kootenay	64.5	5.2	-	21.4	8.9
Central Okanagan	26	71.1	-	2.9	-
Columbia-Shuswap	1.6	-	-	83.9	14.5
Comox Valley	62.5	31.6	-	5.9	-
Cowichan Valley	87.5	6.2	-	6.3	-
East Kootenay	23	12.2	-	45.6	19.1
Fraser-Fort George	20.5	56.1	-	23.3	-
Fraser Valley	32	64.3	-	3.7	-
Greater Vancouver	4.2	20.8	74.9	0.1	-
Kitimat-Stikine	72.1	0.5	-	26.8	0.7
Kootenay Boundary	56.8	-	-	43.2	-
Mount Waddington	-	-	-	100	-
Nanaimo	44.2	50.6	-	5.2	-
North Okanagan	59.1	30.9	-	10	-
Northern Rockies	-	-	-	100	-
Okanagan-Similkameen	23.6	35.7	-	40.7	-
Peace River	43	13.3	-	43.7	-
Powell River	90.9	-	-	9.1	-
Skeena-Queen Charlotte	70.2	-	-	29.8	-
Squamish-Lillooet	69.1	5.9	-	18.2	6.7
Stikine	-	-	-	100	-
Strathcona	39.9	46	-	14.1	-
Sunshine Coast	86.9	-	-	13.1	-
Thompson-Nicola	14	56.8	-	29.2	-
British Columbia	18.1	32	40	8.3	1.5

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero. Outside is the percentage of the population in areas that are out of scope for this study (i.e., communities where transit data in GTFS format is suspected to exist but was not available at the time this report was written).

Greater Vancouver, Strathcona, Squamish-Lillooet, and Capital were the top four CDs with a high percentage of their urban population with access to places of employment via transit at 98.5% to 99.9% of their urban population with coverage. Fraser Valley, Nanaimo, and Kootenay Boundary

closely followed with 97.5% to 98% of their urban population with access to places of employment during peak transit. Peace River had the lowest percentage, at 74.3%, of their urban population with access to places of employment during peak transit of the CDs reporting access levels. Cowichan Valley and Sunshine Coast had the highest percentage of their non-urban population with access to places of employment during peak transit at 92.6% and 86.9% coverage respectively. Of the CDs reporting, Thompson-Nicola had the lowest percentage of their non-urban population with access to places of employment during peak transit at 1.2%.

5.1.2 Employment During Off-Peak Hours

Off-peak hours showed comparable results to peak hours, with an estimated 90% of British Columbia's population living within a CD that has some degree of access to places of employment by transit (Table 3). Around 39.9% fell within the top tercile whereas the middle and bottom tercile had approximately 31.8% and 18.4%, respectively.

As also represented during on-peak hours, the census divisions that have the highest coverage are Greater Vancouver, Capital, and Central Okanagan. Each has between 97-99.9% of their population falling in a CD that has at least some access via transit during off-peak hours. The two CDs that have the highest proportion of their population in the top tercile are Greater Vancouver and Capital. The percentage of the population that fell outside of the coverage areas in CDs was between 0.1% and 56.7%. Central Coast, Mount Waddington, Northern Rockies, and Stikine continue to have no access to places of employment via transit during off-peak hours.

Table 3. Terciles of population living in a CD with access to places of employment by transit during off-peak hours.

Census Division	Bottom	Middle	Top	No Access	Outside
Values are in percentages					
Alberni-Clayoquot	70.5	-	-	22	7.5
Bulkley-Nechako	-	-	-	43.3	56.7
Capital	14.6	71.1	11.4	2.9	0.1
Cariboo	-	-	-	66.9	33.1
Central Coast	-	-	-	100	-
Central Kootenay	63.2	5.6	-	22.2	8.9
Central Okanagan	31.3	65.8	-	2.9	-
Columbia-Shuswap	1.6	-	-	83.9	14.5
Comox Valley	61	32.5	-	6.5	-
Cowichan Valley	87.3	6.9	-	5.9	-
East Kootenay	19.2	16.1	-	45.6	19.1
Fraser-Fort George	17	59.6	-	23.3	-
Fraser Valley	32.6	63.8	-	3.6	-
Greater Vancouver	4.4	21.7	73.8	0.1	-
Kitimat-Stikine	72.1	0.5	-	26.8	0.7
Kootenay Boundary	57	-	-	43	-
Mount Waddington	-	-	-	100	-
Nanaimo	43.1	51.7	-	5.3	-
North Okanagan	58.7	31.3	-	10	-
Northern Rockies	-	-	-	100	-
Okanagan-Similkameen	23.8	35.5	-	40.7	-
Peace River	40.6	15.6	-	43.7	-
Powell River	90.9	-	-	9.1	-
Skeena-Queen Charlotte	70.2	-	-	29.8	-
Squamish-Lillooet	63.1	12	-	18.2	6.7
Stikine	-	-	-	100	-
Strathcona	37.9	48	-	14.1	-
Sunshine Coast	86.9	-	-	13.1	-
Thompson-Nicola	17.5	53.4	-	29.2	-
British Columbia	18.4	31.8	39.9	8.4	1.5

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero. Outside is the percentage of the population in areas that are out of scope for this study (i.e., communities where transit data in GTFS format is suspected to exist but was not available at the time this report was written).

Like peak transit, Greater Vancouver, Strathcona, Squamish-Lillooet, and Capital were the top four CDs with a high percentage of their urban population with access to places of employment via off-peak transit at 98.5% to 99.9% of their urban population with coverage. Fraser Valley,

Nanaimo, and Kootenay Boundary closely follow at 97.5% to 98%. Peace River had the lowest percentage, at 74.3%, of their urban population with access to places of employment during off-peak transit of the CDs reporting access levels. Cowichan Valley and Sunshine Coast had the highest percentage of their non-urban population with access to places of employment during off-peak transit at 92% and 86.9% coverage respectively. Of the CDs reporting access levels, Thompson-Nicola had the lowest percentage of their non-urban population with access to places of employment during off-peak transit at 1.2%.

5.1.3 Childcare Facilities During Peak Hours

An estimated 85.6% of British Columbia's population lives within a CD that has some degree of access to childcare facilities by transit (Table 4). Around 36.8% fell within the top tercile whereas the middle and bottom tercile had approximately 29.4% and 19.4%, respectively.

Census divisions that have the highest coverage are Greater Vancouver and Capital with 98.6% and 93.9% of their population falling in a CD that has at least some access via transit during peak hours. Greater Vancouver is the only CD with a proportion of their population in the top tercile. The percentage of population that fell outside of the coverage areas in CDs was between 1.4% and 56.7%. Central Coast, Mount Waddington, Northern Rockies, and Stikine have no access to childcare facilities during peak hours.

Table 4. Terciles of population living in a CD with access to childcare facilities by transit during peak hours.

Census Division	Bottom	Middle	Top	No Access	Outside
Values are in percentages					
Alberni-Clayoquot	51.9	-	-	40.6	7.5
Bulkley-Nechako	-	-	-	43.3	56.7
Capital	14	79.9	-	4.7	1.4
Cariboo	-	-	-	66.9	33.1
Central Coast	-	-	-	100	-
Central Kootenay	48.1	-	-	43	8.9
Central Okanagan	44.4	43.5	-	12	-
Columbia-Shuswap	-	-	-	85.5	14.5
Comox Valley	75.6	0.1	-	24.3	-
Cowichan Valley	74.3	0.1	-	25.6	-
East Kootenay	23	8.1	-	49.8	19.1
Fraser-Fort George	22.3	51.6	-	26.1	-
Fraser Valley	29.2	58.4	-	12.5	-
Greater Vancouver	3.6	25.3	69.7	1.4	-
Kitimat-Stikine	62.9	-	-	35.7	1.4
Kootenay Boundary	51.6	-	-	48.4	-
Mount Waddington	-	-	-	100	-
Nanaimo	40.1	42.7	-	17.2	-
North Okanagan	55.7	12	-	32.3	-
Northern Rockies	-	-	-	100	-
Okanagan-	48.1	2.2	-	49.7	-
Peace River	54.9	-	-	45.1	-
Powell River	68.3	-	-	31.7	-
Skeena-Queen	61.3	-	-	38.7	-
Squamish-Lillooet	73.3	-	-	20	6.7
Stikine	-	-	-	100	-
Strathcona	81.2	0.3	-	18.6	-
Sunshine Coast	71.1	-	-	28.9	-
Thompson-Nicola	40.4	28.3	-	31.3	-
British Columbia	19.4	29.4	36.8	12.7	1.6

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero. Outside is the percentage of the population in areas that are out of scope for this study (i.e., communities where transit data in GTFS format is suspected to exist but was not available at the time this report was written).

Greater Vancouver, Squamish-Lillooet, Capital, and Strathcona and Capital were the top four CDs with a high percentage of their urban population with access to daycare via transit at 96.37% to

98.6% of their urban population with coverage. Nanaimo and Kootenay Boundary closely followed with 92.5% and 91.6% of their urban populations with access to daycare during peak transit. Alberni-Clayoquot had the lowest percentage, at 66.8%, of their urban population with access to daycare during peak transit of the CDs reporting access levels. Sunshine Coast and Cowichan Valley had the highest percentage of their non-urban population with access to daycare during peak transit at 71.1% and 63.7% coverage. Alberni-Clayoquot had the lowest percentage of their non-urban population with access to employment during peak transit at 2.49%.

5.1.4 Childcare Facilities During Off-Peak Hours

Consistent with peak hours, an estimated 85.6% of British Columbia's population lives within a CD that has some degree of access to childcare facilities by transit during off-peak hours (Table 5Table 3). Around 36.9% fell within the top tercile whereas the middle and bottom tercile had approximately 29.2% and 19.5%, respectively.

In agreement with on-peak hours, the CDs that have the highest coverage are Greater Vancouver and Capital and the only CDs that have a proportion of their population in the top tercile. The percentage of population that fell outside of coverage areas in CDs was between 1.4% and 56.7%. Central Coast, Mount Waddington, Northern Rockies, and Stikine have no access to childcare facilities during off-peak hours.

Table 5. Terciles of population living in a CD with access to childcare facilities by transit during off-peak hours.

Census Division	Bottom	Middle	Top	No Access	Outside
Values are in percentages					
Alberni-Clayoquot	51.9	-	-	40.6	7.5
Bulkley-Nechako	-	-	-	43.3	56.7
Capital	15.4	77.8	0.8	4.7	1.4
Cariboo	-	-	-	66.9	33.1
Central Coast	-	-	-	100	-
Central Kootenay	46	-	-	45	8.9
Central Okanagan	46	42	-	12	-
Columbia-Shuswap	-	-	-	85.5	14.5
Comox Valley	74.9	-	-	25.1	-
Cowichan Valley	71.7	0.6	-	27.6	-
East Kootenay	20.2	10.9	-	49.8	19.1
Fraser-Fort George	16.5	57.5	-	26	-
Fraser Valley	28.4	59.4	-	12.2	-
Greater Vancouver	4.1	24.8	69.7	1.4	-
Kitimat-Stikine	62.4	-	-	36.2	1.4
Kootenay Boundary	53.5	-	-	46.5	-
Mount Waddington	-	-	-	100	-
Nanaimo	42.3	40.9	-	16.8	-
North Okanagan	54.8	12.6	-	32.7	-
Northern Rockies	-	-	-	100	-
Okanagan-	46.3	3.6	-	50.1	-
Peace River	54.9	-	-	45.1	-
Powell River	68.3	-	-	31.7	-
Skeena-Queen	61.3	-	-	38.7	-
Squamish-Lillooet	73.7	-	-	19.6	6.7
Stikine	-	-	-	100	-
Strathcona	76.9	3.5	-	19.6	-
Sunshine Coast	72	-	-	28	-
Thompson-Nicola	37.8	31	-	31.2	-
British Columbia	19.5	29.2	36.9	12.8	1.6

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero. Outside is the percentage of the population in areas that are out of scope for this study (i.e., communities where transit data in GTFS format is suspected to exist but was not available at the time this report was written).

Like peak transit, Greater Vancouver, Squamish-Lillooet, Capital, and Strathcona were the top four CDs with a high percentage of their urban population with access to daycare via off-peak transit at 95.1% to 98.6% of their urban population with coverage. Alberni-Clayoquot had the lowest

percentage, at 66.8%, of their urban population with access to daycare during off-peak transit of the CDs reporting access levels. Sunshine Coast and Cowichan Valley had the highest percentage of their non-urban population with access to daycare during off-peak transit at 72% and 53.7% coverage. Of the CDs reporting access levels, Alberni-Clayoquot had the lowest percentage of their non-urban population with access to daycare during off-peak transit at 2.4%.

5.1.5 Pharmacies During Peak Hours

We estimated that 82% of British Columbia's population lives within a CD that has some degree of access to pharmacies by transit during peak hours (Table 6). Around 34% fell within the top tercile whereas the middle and bottom tercile had approximately 28.8% and 19.2%, respectively.

The census divisions that have the highest coverage are Greater Vancouver and Capital. Each has between 91-96.8% of their population living within a DB that has at least some access via transit during peak hours. CDs that have proportions of their population in the top tercile are also Greater Vancouver and Capital. The proportion of the population that falls outside the transit area, and pharmacy locations, is between 1.6% and 56.7%. Central Coast, Mount Waddington, Northern Rockies, and Stikine have no access to pharmacies via transit during peak hours.

Table 6. Terciles of population living in a CD with access to pharmacies by transit during peak hours.

Census Division	Bottom	Middle	Top	No Access	Outside
Values are in percentages					
Alberni-Clayoquot	33.3	-	-	59.1	7.5
Bulkley-Nechako	-	-	-	43.3	56.7
Capital	20.1	70.8	0.1	6.2	2.8
Cariboo	-	-	-	66.9	33.1
Central Coast	-	-	-	100	-
Central Kootenay	40.2	0.9	-	49.9	8.9
Central Okanagan	36.4	45	-	18.6	-
Columbia-Shuswap	-	-	-	85.5	14.5
Comox Valley	63.5	3.7	-	32.9	-
Cowichan Valley	57.7	0.6	-	41.7	-
East Kootenay	30.1	0.2	-	50.6	19.1
Fraser-Fort George	67	3.9	-	29.2	-
Fraser Valley	42.6	36.3	-	21	-
Greater Vancouver	2.9	29.7	64.3	3.2	-
Kitimat-Stikine	61.2	0	-	37.1	1.6
Kootenay Boundary	51.6	0.1	-	48.3	-
Mount Waddington	-	-	-	100	-
Nanaimo	43.5	33.1	-	23.4	-
North Okanagan	32.2	16.6	-	51.2	-
Northern Rockies	-	-	-	100	-
Okanagan-Similkameen	22.9	22.9	-	54.1	-
Peace River	54.9	-	-	45.1	-
Powell River	64.9	0.7	-	34.4	-
Skeena-Queen Charlotte	15.7	-	-	84.3	-
Squamish-Lillooet	71.4	-	-	21.9	6.7
Stikine	-	-	-	100	-
Strathcona	67.8	12.8	-	19.4	-
Sunshine Coast	66.5	0.3	-	33.2	-
Thompson-Nicola	40.4	27	-	32.6	-
British Columbia	19.2	28.8	34	16.3	1.7

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero. Outside is the percentage of the population in areas that are out of scope for this study (i.e., communities where transit data in GTFS format is suspected to exist but was not available at the time this report was written).

Greater Vancouver, Capital, Strathcona, and Squamish-Lillooet were the top four CDs with a high percentage of their urban population with access to pharmacies via transit at 93.5% to 96.8% of their urban population with coverage. Kootenay Boundary, Nanaimo, and Thompson-Nicola

closely followed with 84.4% to 91.8% of their urban population with access to pharmacies during peak transit. Of the CDs reporting, Skeena-Queen Charlotte had the lowest percentage, at 21.3%, of their urban population with access to pharmacies during peak transit. Sunshine Coast and Squamish-Lillooet had the highest percentage of their non-urban population with access to pharmacies during peak transit at about 66.8% and 51% coverage. Capital had the lowest percentage of their non-urban population with access to pharmacies during peak transit at 1%.

5.1.6 Pharmacies During Off-Peak Hours

We estimated that 81.9% of British Columbia's population lives within a CD that has some degree of access to pharmacies by transit during off-peak hours (Table 7). Around 33.8% fell within the top tercile whereas the middle and bottom tercile had approximately 28.6% and 19.5%, respectively.

The census divisions that have the highest coverage are Greater Vancouver and Capital. Each has between 90.5-96.9% of their population living within a DB that has at least some access via transit during off-peak hours. CDs with proportions of their population in the top tercile are Greater Vancouver and Capital. The proportion of the population that falls outside the transit area, and pharmacy locations, remains between 1.6% and 56.7%. Central Coast, Mount Waddington, Northern Rockies, and Stikine continue to have no access to pharmacies via transit during off-peak hours.

Table 7. Terciles of population living in a CD with access to pharmacies by transit during off-peak hours.

Census Division	Bottom	Middle	Top	No Access	Outside
Values are in percentages					
Alberni-Clayoquot	33.3	-	-	59.1	7.5
Bulkley-Nechako	-	-	-	43.3	56.7
Capital	21.3	67.6	1.6	6.7	2.8
Cariboo	-	-	-	66.9	33.1
Central Coast	-	-	-	100	-
Central Kootenay	38.1	1.2	-	51.7	8.9
Central Okanagan	38.3	43.2	-	18.6	-
Columbia-Shuswap	-	-	-	85.5	14.5
Comox Valley	62.2	4	-	33.8	-
Cowichan Valley	57.2	0.3	-	42.5	-
East Kootenay	29.3	0.6	-	51	19.1
Fraser-Fort George	65.9	5.2	-	28.9	-
Fraser Valley	41.3	38.3	-	20.4	-
Greater Vancouver	3.8	29.5	63.6	3.1	-
Kitimat-Stikine	57.1	0.1	-	41.2	1.6
Kootenay Boundary	53.5	0.1	-	46.4	-
Mount Waddington	-	-	-	100	-
Nanaimo	46.4	30.1	-	23.5	-
North Okanagan	31.2	16.7	-	52.1	-
Northern Rockies	-	-	-	100	-
Okanagan-Similkameen	19.4	26.6	-	54.1	-
Peace River	54.7	0.2	-	45.1	-
Powell River	65.4	0.7	-	33.9	-
Skeena-Queen Charlotte	15.7	-	-	84.3	-
Squamish-Lillooet	71.8	-	-	21.5	6.7
Stikine	-	-	-	100	-
Strathcona	54.9	18.9	-	26.2	-
Sunshine Coast	61.7	1.4	-	36.9	-
Thompson-Nicola	38.9	28.6	-	32.5	-
British Columbia	19.5	28.6	33.8	16.4	1.7

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero. Outside is the percentage of the population in areas that are out of scope for this study (i.e., communities where transit data in GTFS format is suspected to exist but was not available at the time this report was written).

Greater Vancouver, Capital, Squamish-Lillooet, and Kootenay Boundary were the top four CDs with a high percentage of their urban population with access to pharmacies via off-peak transit at 92.7% to 96.9% of their urban population with coverage. Nanaimo, Strathcona, Thompson-Nicola,

and Fraser Valley closely followed with 82% to 87.5% of their urban population with access to pharmacies during off-peak transit. Of the CDs reporting, Skeena-Queen Charlotte had the lowest percentage, at 21.3%, of their urban population with access to pharmacies during off-peak transit. Sunshine Coast and Squamish-Lillooet had the highest percentage of their non-urban population with access to pharmacies during off-peak transit at about 63.1% and 51.7% coverage. Capital had the lowest percentage of their non-urban population with access to pharmacies during off-peak transit at 1%.

5.2 Access to Select Amenities in British Columbia by Cycling

5.2.1 Employment

It's estimated that 98.3% of British Columbia's population lives within a DB that has some degree of access to places of employment by cycling (Table 8). Around 52.9% fell within the top tercile whereas the middle and bottom tercile had approximately 31.4% and 14.0%, respectively.

The census divisions that have the highest coverage are Greater Vancouver, Capital, and Central Okanagan. Each has between 99.5% and 100% of their population falling in a DB that has at least some access to employment via cycling. The two CDs that have the highest proportion of their population in the top tercile are Greater Vancouver and Capital. Central Coast and Stikine have the lowest percentage of their population falling within a DB with access to places of employment via cycling. The percentage of the population in each CD that do not have access to places of employment varies between 0% and 54.5%.

Table 8. Terciles of population living in a CD with access to employment by cycling.

Census Division	Bottom	Middle	Top	No Access
Values are in percentages				
Alberni-Clayoquot	25.1	68.8	-	6.1
Bulkley-Nechako	66.3	11.9	-	21.8
Capital	7.6	38.8	53.3	0.3
Cariboo	45.7	40.3	-	14
Central Coast	76.2	-	-	23.8
Central Kootenay	72.1	20.7	-	7.2
Central Okanagan	13.5	63.9	22.1	0.5
Columbia-Shuswap	54.5	41.1	-	4.4
Comox Valley	22.9	75.9	-	1.1
Cowichan Valley	60.3	38.3	-	1.4
East Kootenay	57.3	39.7	-	3
Fraser-Fort George	26.8	66.7	3	3.4
Fraser Valley	13.2	64.5	21.4	0.9
Greater Vancouver	0.6	12.3	87.1	0
Kitimat-Stikine	47.7	42.1	-	10.2
Kootenay Boundary	93.6	-	-	6.4
Mount Waddington	95	-	-	5
Nanaimo	23.5	75.7	-	0.8
North Okanagan	36.2	63.1	-	0.7
Northern Rockies	77.1	-	-	22.9
Okanagan-	44.5	53.6	-	2
Peace River	26.2	57.9	-	15.9
Powell River	41.7	49.9	-	8.4
Skeena-Queen	23.8	62.6	-	13.7
Squamish-Lillooet	22.3	69.3	-	8.4
Stikine	45.5	-	-	54.5
Strathcona	26.8	70.9	-	2.3
Sunshine Coast	87.3	6.8	-	5.8
Thompson-Nicola	33.8	58.8	-	7.5
British Columbia	14	31.4	52.9	1.7

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero.

Columbia-Shuswap, Greater Vancouver, North Okanagan, and Capital are the top four CDs with a high percentage of their urban population with access to places of employment via cycling at 99.8% to 100% coverage. Cariboo had the lowest percentage of their urban population with access to employment via cycling at 91.1% coverage. Cowichan Valley, East Kootenay, and North Okanagan had the highest percentage of their non-urban population with access to employment via cycling at 97.4% to 99.6%. Stikine had the lowest percentage of their non-urban population with access to employment via cycling at 45.5% coverage.

5.2.2 Childcare Facilities

It's estimated that 94.7% of British Columbia's population lives within a DB that has some degree of access to daycare by cycling (Table 9). Around 47% fell within the top tercile whereas the middle and bottom tercile had approximately 31.4% and 16.3%, respectively. The census divisions that have the highest coverage are Greater Vancouver, Capital, and Central Okanagan. Each has between 97.5-99.9% of their population falling in a DB that has at least some access to daycare via cycling. The two CDs that have the highest proportion of their population in the top tercile are Greater Vancouver and Capital. Out of the CDs reporting access levels, Buckley-Nechako and Mount Waddington have the lowest percentage of their population falling within a DB with access to daycare via cycling. The percentage of the population in each CD that do not have access to daycare varies between 0.1% and 100%.

Table 9. Terciles of population living in a CD with access to daycare by cycling.

Census Division	Bottom	Middle	Top	No Access
Values are in percentages				
Alberni-Clayoquot	88.5	-	-	11.5
Bulkley-Nechako	49.3	-	-	50.7
Capital	8.3	60.9	29	1.8
Cariboo	55.7	12.3	-	32.1
Central Coast	-	-	-	100
Central Kootenay	69.2	-	-	30.8
Central Okanagan	26.1	71.4	-	2.5
Columbia-Shuswap	68.2	7.3	-	24.4
Comox Valley	27.2	64.8	-	8
Cowichan Valley	65	29.6	-	5.5
East Kootenay	54	33.5	-	12.4
Fraser-Fort George	12.8	75.4	-	11.8
Fraser Valley	12.6	65.5	19.3	2.6
Greater Vancouver	1.3	16.5	82.1	0.1
Kitimat-Stikine	66.9	-	-	33.1
Kootenay Boundary	79.2	-	-	20.8
Mount Waddington	54.6	-	-	45.4
Nanaimo	34.9	59.1	-	5.9
North Okanagan	31.6	60.9	-	7.6
Northern Rockies	76	-	-	24
Okanagan-	41.9	43.8	-	14.3
Peace River	27	43.1	-	30
Powell River	68.4	-	-	31.6
Skeena-Queen	67.5	0.4	-	32.1
Squamish-Lillooet	75.7	11.7	-	12.6
Stikine	-	-	-	100
Strathcona	29.5	57.1	-	13.4
Sunshine Coast	81.2	-	-	18.8
Thompson-Nicola	32.8	51.6	-	15.6
British Columbia	16.3	31.4	47	5.2

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero.

Greater Vancouver, Squamish-Lillooet, Capital, and Nanaimo had a high percentage of their urban population with access to daycare via cycling at 99.5% to 99.9% coverage. Cariboo had the lowest percentage of their urban population with access to daycare via cycling at 76.9% coverage. Cowichan Valley, North Okanagan, and East Kootenay had the highest percentage of their non-urban population with access to daycare via cycling at 83.3% to 90.1%. Of the reporting CDs,

Strathcona had the lowest percentage of their non-urban population with access to childcare facilities via cycling at 18.1% coverage. Central Coast, Powell River, Skeena-Queen Charlotte, and Stikine reported no daycare facilities in non-urban areas.

5.2.3 Pharmacies

Around 90.8% of residents in British Columbia have access to pharmacies by cycling (Table 10). Terciles of population living in a CD with access to pharmacies by cycling.. Greater Vancouver has the highest percentage of residents living in the top tercile of access to pharmacies by cycling at 75.8%, followed by Capital with 33.6%. While residents of Sunshine Coast and Bulkley-Nechako have poor cycling access to pharmacies (61.6% and 56.9% of the respective populations have no access), no residents within Central Coast and Stikine have access by cycling to pharmacies.

Table 10. Terciles of population living in a CD with access to pharmacies by cycling.

Census Division	Bottom	Middle	Top	No Access
Values are in percentages				
Alberni-Clayoquot	75.6	3.8	-	20.7
Bulkley-Nechako	43.1	-	-	56.9
Capital	19.2	43	33.6	4.2
Cariboo	45	9.6	-	45.4
Central Coast	-	-	-	100
Central Kootenay	50.1	9.3	-	40.6
Central Okanagan	31	64.9	-	4.1
Columbia-Shuswap	66.1	-	-	33.9
Comox Valley	22.5	58.5	-	19.0
Cowichan Valley	60.1	7.4	-	32.5
East Kootenay	57	19.9	-	23
Fraser-Fort George	31.7	50.8	-	17.5
Fraser Valley	12.9	78	0.7	8.3
Greater Vancouver	2.8	21	75.8	0.4
Kitimat-Stikine	65	-	-	35
Kootenay Boundary	77.5	0.1	-	22.5
Mount Waddington	52.3	-	-	47.7
Nanaimo	20.9	63.5	-	15.6
North Okanagan	16.3	60.4	-	23.3
Northern Rockies	73.2	-	-	26.8
Okanagan-Similkameen	38.8	44.1	-	17.1
Peace River	63.5	-	-	36.5
Powell River	60	0.7	-	39.3
Skeena-Queen Charlotte	67	-	-	33
Squamish-Lillooet	77.1	-	-	22.9
Stikine	-	-	-	100
Strathcona	31.9	49.7	-	18.4
Sunshine Coast	38.4	-	-	61.6
Thompson-Nicola	16.5	52.8	-	30.7
British Columbia	16.8	31.1	42.9	9.1

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero.

Greater Vancouver, Squamish-Lillooet, Kootenay Boundary, and Capital had a high percentage of their urban population with access to daycare via cycling at 97.8% to 99.6% coverage. Cariboo had the lowest percentage of their urban population with access to daycare via cycling at 67.2% coverage. Northern Rockies, Okanagan-Similkameen, and Fraser-Fort George had the highest percentage of their non-urban population with access to daycare via cycling at 68.2% to 73.2%. Of the reporting CDs, Peace River had the lowest percentage of their non-urban population with access to childcare facilities via cycling at 16.1% coverage. Central Coast, Powell River, Skeena-Queen Charlotte, and Stikine reported no daycare facilities in non-urban areas.

5.3 Access to Select Amenities in British Columbia by Walking

5.3.1 Employment

It's estimated that 98.4% of British Columbia's population lives within a DB that has some degree of access to places of employment by walking (Table 11). Around 48.1% fell within the top tercile whereas the middle and bottom tercile both had approximately 34.5% and 15.8%, respectively.

The CDs that have the highest coverage are Greater Vancouver, Capital and Fraser Valley with 100%, 99.7% and 99.6% of their population with at least some access to places of employment via walking. The two CDs that have the highest proportion of their population in the top tercile are Greater Vancouver (73%) and Capital (37.9%) while Squamish-Lillooet has the lowest (0%). Proportions of CD populations with no access to places of employment is between 0% and 55.6%.

Table 11. Terciles of population living in a CD with access to places of employment by walking.

Census Division	Bottom	Middle	Top	No Access
Values are in percentages				
Alberni-Clayoquot	37.1	55.7	-	7.2
Bulkley-Nechako	52.4	24.9	-	22.7
Capital	13.3	48.5	37.9	0.3
Cariboo	48.8	34.5	-	16.7
Central Coast	78.7	-	-	21.3
Central Kootenay	53	33	8.6	5.5
Central Okanagan	21.8	50.7	26.7	0.8
Columbia-Shuswap	53.9	40.5	-	5.6
Comox Valley	33.9	54.4	10.5	1.2
Cowichan Valley	64.8	26	8.2	1.1
East Kootenay	43.2	43.7	8.8	4.4
Fraser-Fort George	28.6	49.4	17.8	4.2
Fraser Valley	19.9	48.3	31.4	0.4
Greater Vancouver	1.9	25.1	73	0
Kitimat-Stikine	46.2	46.2	-	7.7
Kootenay Boundary	53.8	40.1	-	6
Mount Waddington	70.5	26	-	3.6
Nanaimo	31.2	48	20.4	0.4
North Okanagan	45.4	26.3	26.2	2
Northern Rockies	16.4	63.5	-	20.1
Okanagan-Similkameen	34.1	36.4	25.9	3.5
Peace River	27.6	41.9	14.5	15.9
Powell River	56.6	37.9	-	5.5
Skeena-Queen Charlotte	23.6	65.9	-	10.5
Squamish-Lillooet	32.4	60.1	0	7.5
Stikine	44.4	-	-	55.6
Strathcona	29.2	56.3	11.1	3.5
Sunshine Coast	64	33.2	-	2.8
Thompson-Nicola	33.8	48.2	10.6	7.4
British Columbia	15.8	34.5	48.1	1.7

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero.

Columbia-Shuswap, Squamish-Lillooet, Nanaimo, Strathcona, Greater Vancouver, and Fraser Valley had a high percentage of their urban population with access to places of employment via walking at 99.9% to 100% coverage. Cariboo had the lowest percentage of their urban population with access to employment via walking at 87.1%. Capital had the highest percentage of their non-

urban population with access to employment via walking at 97.5%. Stikine had the lowest percentage of their non-urban population with access to employment via walking at 44.4%.

5.3.2 Childcare Facilities

It's estimated that 92.1% of British Columbia's population lives within a DB that has some degree of access to daycare by walking (Table 12). Around 45% fell within the top tercile whereas the middle and bottom tercile both had approximately 29.2% and 17.9%, respectively. The CDs that have the highest coverage are Greater Vancouver and Capital. They respectively have 99.3% and 95.2% of their population with at least some access to daycare via walking. The two CDs that have the highest proportion of their population in the top tercile are Greater Vancouver (73.3%) and Fraser Valley (39.5%) while Thompson-Nicola has the lowest (0.4%). Proportions of CD populations with no access to daycare is between 0.7% and 100%.

Table 12. Terciles of population living in a CD with access to childcare facilities by walking.

Census Division	Bottom	Middle	Top	No Access
Values are in percentages				
Alberni-Clayoquot	68.1	11.8	-	20.1
Bulkley-Nechako	49.2	-	-	50.8
Capital	16.4	45.3	33.5	4.8
Cariboo	31.7	27.4	-	40.9
Central Coast	-	-	-	100
Central Kootenay	47.8	20.8	-	31.5
Central Okanagan	36.6	55.5	3.3	4.6
Columbia-Shuswap	48.7	19.1	-	32.2
Comox Valley	32.9	51.7	-	15.3
Cowichan Valley	59.7	24.3	-	16
East Kootenay	50.4	28.9	1	19.8
Fraser-Fort George	18.7	53.8	11.5	15.9
Fraser Valley	18.1	35.7	39.5	6.7
Greater Vancouver	4.1	22	73.3	0.7
Kitimat-Stikine	43.7	17.5	-	38.7
Kootenay Boundary	68.8	-	-	31.2
Mount Waddington	47.7	-	-	52.3
Nanaimo	34.2	44.1	11.6	10.2
North Okanagan	42.9	28.1	11.3	17.7
Northern Rockies	68.6	-	-	31.4
Okanagan-Similkameen	45.3	34.6	-	20.1
Peace River	17.9	47.6	-	34.5
Powell River	51.1	15.1	-	33.8
Skeena-Queen Charlotte	19.8	47.9	-	32.3
Squamish-Lillooet	57.2	24.2	-	18.7
Stikine	-	-	-	100
Strathcona	30.3	52.3	-	17.4
Sunshine Coast	63.6	14.4	-	22
Thompson-Nicola	40.2	40	0.4	19.4
British Columbia	17.9	29.2	45	7.8

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero.

Greater Vancouver, Squamish-Lillooet, Capital and Strathcona were the top four CDs that had a high percentage of their urban population with access to daycare via walking at 97% to 99.3% coverage. Cariboo had the lowest percentage of their urban population with access to employment via walking at 68.5%. Cowichan Valley, Sunshine Coast and East Kootenay had the highest percentage of their non-urban population with access to daycare via walking at 77% to

78.9% coverage. Of the CDs reporting, Strathcona had the lowest percentage of their non-urban population with access to childcare facilities via walking at 3.8%. Central Coast, Powell River, Skeena-Queen Charlotte, and Stikine reported no daycare facilities in non-urban areas.

5.3.3 Pharmacies

It's estimated that 79.6% of British Columbia residents live within a CD that has access to pharmacies by walking (Table 13. Terciles of population living in a CD with access to pharmacies by walking.). The CDs with the greatest percentage of their populations living in the top tercile of access to pharmacies by walking are: Greater Vancouver (55%), North Okanagan (20.7%), and Fraser Valley (19.6%). Those without any residents living within walking access to pharmacies include Stikine and Central Coast. Percentages of CD populations with access to pharmacies in the bottom tercile are between 6.9% and 63.5%.

Table 13. Terciles of population living in a CD with access to pharmacies by walking.

Census Division	Bottom	Middle	Top	No Access
Values are in percentages				
Alberni-Clayoquot	36.2	27.2	-	36.5
Bulkley-Nechako	14.4	21.9	-	63.7
Capital	30.1	32.9	18.6	18.4
Cariboo	20.1	12	1.5	66.3
Central Coast	-	-	-	100
Central Kootenay	25.8	22.6	-	51.7
Central Okanagan	32.9	27.2	12.4	27.5
Columbia-Shuswap	41.7	0.1	-	58.2
Comox Valley	30.5	21.5	1.4	46.5
Cowichan Valley	22.2	18.8	0.7	58.3
East Kootenay	32.2	28.8	-	39
Fraser-Fort George	42.5	23.7	1	32.8
Fraser Valley	27	29.8	19.6	23.6
Greater Vancouver	13.5	25.7	55	5.8
Kitimat-Stikine	22.5	22.6	-	54.9
Kootenay Boundary	38.2	12.7	-	49.1
Mount Waddington	53.6	-	-	46.4
Nanaimo	19.6	28.4	15	36.9
North Okanagan	20.3	6.3	20.7	52.8
Northern Rockies	63.5	-	-	36.5
Okanagan-Similkameen	23.7	31.8	17.6	26.9
Peace River	20.2	27.7	-	52.1
Powell River	6.9	21.7	-	71.4
Skeena-Queen Charlotte	51.2	-	-	48.8
Squamish-Lillooet	44.5	4.7	-	50.8
Stikine	-	-	-	100
Strathcona	33.6	26.4	2.3	37.7
Sunshine Coast	37.8	9.6	-	52.5
Thompson-Nicola	28.2	15.6	7.8	48.4
British Columbia	20.7	24.9	34	20.5

Source: authors' computations.

"No access" is the percentage of the population in areas with an access index value of zero.

Greater Vancouver, Okanagan-Similkameen, Capital and Fraser Valley were the top four CDs that had a high percentage of their urban population with access to daycare via walking at 78.8% to 94.2% coverage. Powell River had the lowest percentage of their urban population with access to employment via walking at 34.4%. Fraser-Fort George and Northern Rockies had the highest percentage of their non-urban population with access to daycare via walking at 64.4% and 64.5%

coverage. Of the CDs reporting, Nanaimo had the lowest percentage of their non-urban population with access to childcare facilities via walking at 5.6%. Central Coast, Powell River, Skeena-Queen Charlotte, and Stikine reported no daycare facilities in non-urban areas.

6 Discussion and Limitations

6.1 Interpreting Results

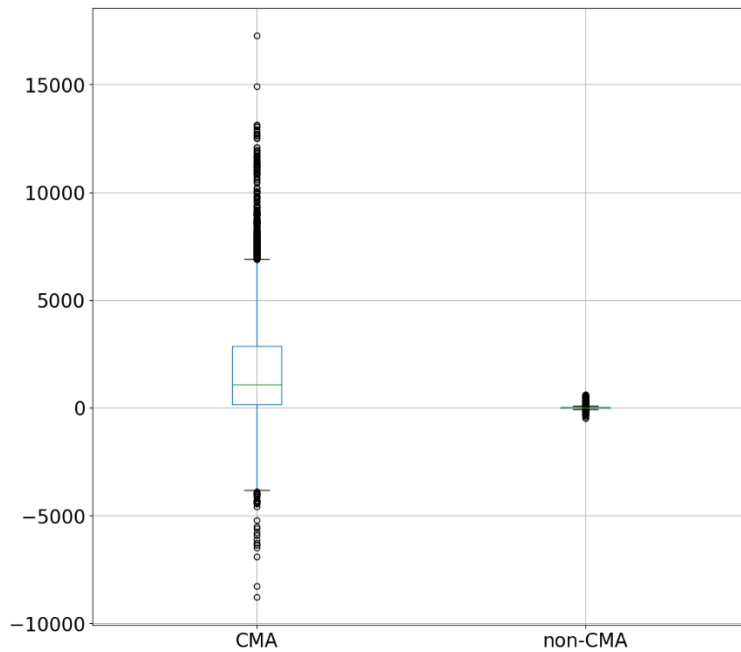
It is important to note that access to amenities may reflect both availability of transit routes and GTFS data. With that in mind, although the richness in transit access for British Columbia could be linked to the large subset of the GTFS sources leveraged for this study, the results are also an indication of standardization by the transit authorities that operate across larger regions. For example, BC Transit operates across the entire province in 5 distinct regions. This wide-scale standardization of both formatting in GTFS and making data centrally and publicly enables greater population coverage within regions where BC Transit operates.

6.1.1 Peak vs. Off-Peak Transit

For this report, PT was analyzed at peak and off-peak hours to better understand disparities in certain service regions. Peak hours were defined as travelling during the hours of 7:00 a.m. to 9:00 a.m. while off-peak hours were defined as travelling during the hours of 2:00 p.m. – 4:00 p.m. By subtracting the overall amenity access during off-peak hours from the access during peak hours, the differences between the two became clearer.

Figure 2 shows a large variation between on- and off-peak access levels, possibly implying scheduling adjustments in populous regions to accommodate rush-hour travel. It is also apparent that CMA CDs demonstrate greater variation in differences between on and off-peak levels of access to employment than non-CMA regions, indirectly highlighting the complexity in transit operations of these areas.

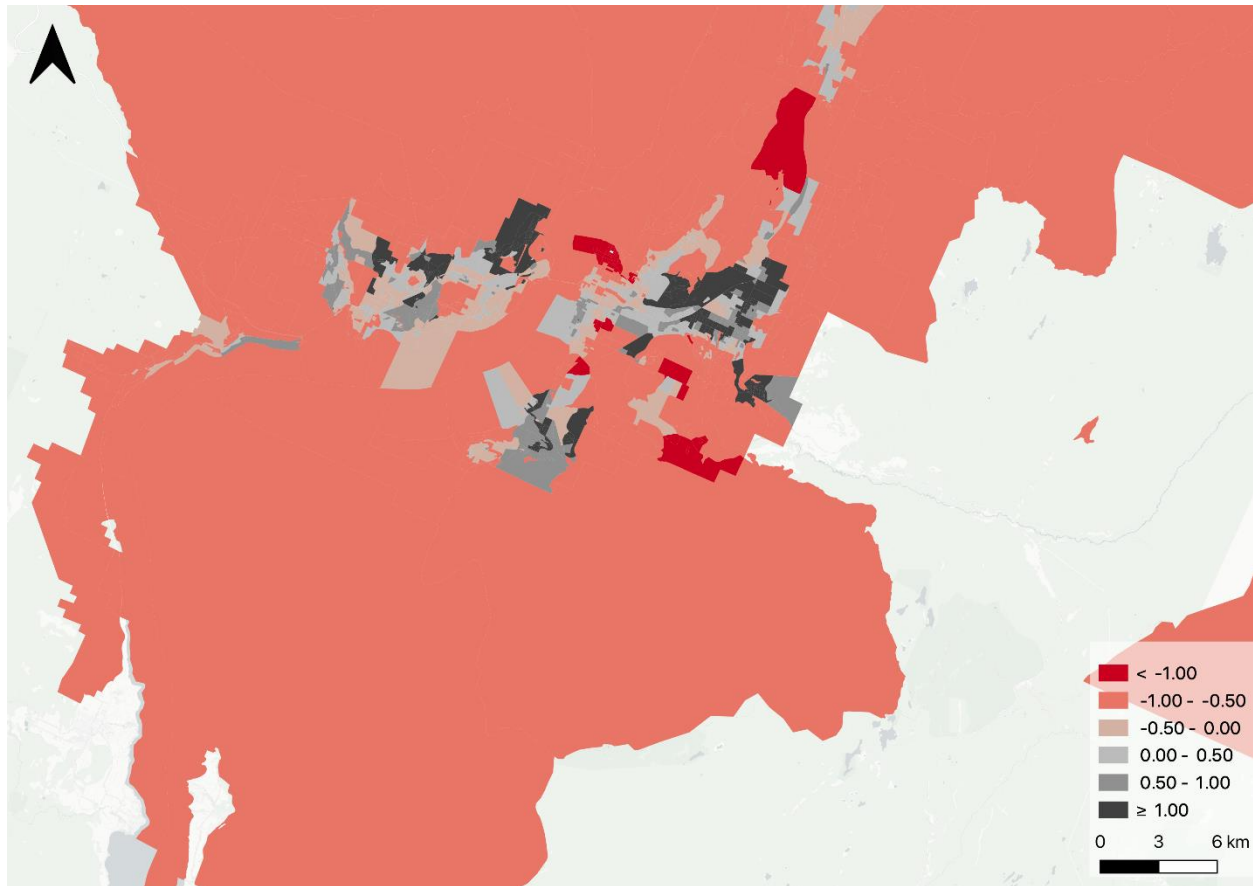
Figure 2. Boxplot of differences in peak and off-peak levels of access to employment for CMA and non-CMA CDs.



Source: authors' computations.

When comparing DBs that show a decline or increase in access to employment between peak and off-peak hours, certain patterns are revealed; for example, in Central Okanagan, areas within East and West Kelowna increase in access during peak hours (Figure 3). This may be a result of a greater availability of bus routes during peak hours for commuters. Conversely, several DBs on the North end of East Kelowna and towards Lake Country show a decrease in access during off-peak hours by up to one standard deviation. This observation is possibly indicative of dedicated school bus routes that inflate the number of trips available outside 7:00-9:00 AM peak-hours. Further investigation into specialized routes or departure times may be insightful.

Figure 3. Comparison of peak and off-peak transit to employment in Central Okanagan.



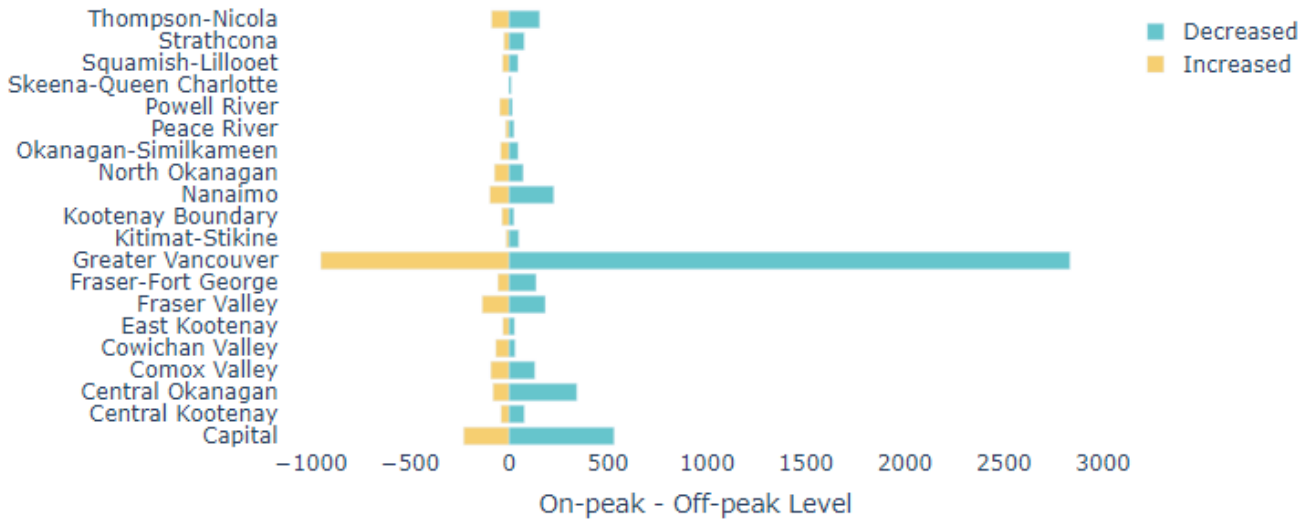
Source: Statistics Canada, Centre for Special Business Projects & © [OpenStreetMap](#) contributors, © [CARTO](#)

Note: Symbology is based on standard deviation of the difference in peak and off-peak access levels for the CD of Central Okanagan. Positive values correspond to a higher access level for that DB during peak hours compared to during off-peak hours while negative values correspond to a lower access level for that DB during peak hours compared to during off-peak hours.

Of CDs that showed change in level of access to employment during off-peak hours relative to peak hours, Greater Vancouver demonstrated the largest mean change (Figure 4). Outside of rush-hour, all CDs show a larger mean decrease in access levels to employment than increase.

Skeena-Queen Charlotte, Peace River and East Kootenay had the smallest degree of overall change, suggesting consistent transit routes or trip frequency throughout the day.

Figure 4. Mean change in access levels to employment during on and off-peak hours for CD.



Note: Only CDs demonstrating a change in access level in off-peak relative to peak hours are shown.

Source: authors' computations.

Altogether, around 74.8% of non-CMA DBs changed in access level during off-peak hours with 45.5% worsening and 29.2% improving (Table 14). One third of non-CMA DBs showed no difference between on and off-peak hours (25.2%) compared to the small proportion of CMA DBs that remained unchanged (8.6%). Conversely, majority of CMA DBs decreased in access during off-peak hours (83.3%). This might be explained by a supplement of transit departure times or alternative routes during peak hours to accommodate rider demand. Further investigations into scheduling, traffic volumes, and real-time stop frequencies may offer more detailed insight into the temporal variation in access.

Table 14. Percentage of DBs with decreased, increased, and no difference between access levels to employment during peak and off-peak hours.

Area Classification	Decreased	Increased	No Change
Values are in percentages			
CMA	83.3	8.1	8.6
Non-CMA	45.5	29.3	25.2

Source: authors' computations.

6.2 Data Limitations

6.2.1 GTFS Data

For this analysis, public transportation was defined as a regularly scheduled, fixed-route transportation systems available to the general public. This meant that on-demand services, typically for users with special accommodation requirements or in smaller communities, were excluded from measurements. Additionally, inter-city transportation services that require pre-booking were not included, resulting in the exclusion of BC Ferries and VIA Rail from analysis.

Second, the static nature of GTFS data used in the model meant that only a snapshot of the transit system at a given date was represented. With this, these indicators do not reflect the exact reality of a given date, but rather a conceivable trip using the data available. Though variance in schedules within a day were accounted for with r5r's time window parameter (i.e., computing route every minute between 7:00-9:00 AM), seasonal variances in schedules as well as circumstances such as COVID-19 impacting schedules were not considered for simplicity.

While GTFS has become an increasingly popular data format for transit operators and municipalities, several regions have yet to adopt this specification; moreover, rural communities are more likely to offer informal transportation options such as on-demand or carsharing¹³ services. Since the GTFS format is designed primarily for regularly scheduled services, these informal types of transportation are rarely included in GTFS feeds. As a result, densely populated regions typically have more up-to-date and comprehensive coverage relative to rural areas.

Finally, it should also be noted that an additional data file providing coverage for all of Cranbrook, Elk Valley, Sparwood, Fernie, and Kimberly was later identified during production and can be used for future iterations.

¹³ E.g. <https://www.carsharecoop.ca/car-locations/kaslo/>

6.2.2 Carshare Data

Similar to the static property of GTFS data, collected carshare locations represent a “point-in-time” picture of carshare access as of February-March 2023. In recognizing that carshare operators may reconfigure their services at any time, it is understood that the access measures propose a plausible trip using the data available.

6.3 Model Limitations

There are inevitable limitations with measuring access to amenities and services through a model-based approach given the underlying assumptions applied. Broadly, these assumptions include: (1) how the origins are defined; (2) how the destinations and their presence and size of service are represented; (3) the routing algorithm selected and associated required parameters (e.g., time window, walking speed and max distance) are applied to compute the durations; and (4), the distance decay function leveraged to account for the willingness to travel. In turn, techniques such as applying standards outlined in existing literature and leveraging survey data (namely the General Social Survey) to determine appropriate parameters (e.g., max walking speed) was implemented to ensure data-driven and fact-based assumptions. That said, further sensitivity testing could be explored to better evaluate and fine-tune the techniques applied to produce custom measures per each type of amenity or service.

One of the major challenges in any modelling scenario is the decision that must be made about how to approach weighting. Assuming a uniform mass for the access to select amenities in British Columbia might be misleading due to the varied nature of the types of activities and services at various facilities. Further exploration on weighting by different facility categories could be carried out for future iterations.

7 References

Alasia, Alessandro, Nick Newstead, Joseph Kuchar, and Marian Radulescu. 2021. "Measuring proximity to services and amenities: An experimental set of indicators for neighbourhoods and localities." Reports on Special Business Projects, Statistics Canada.

Data Exploration and Integration Lab. (Forthcoming). Active and Public Transportation Spatial Accessibility Measures: Methodology.

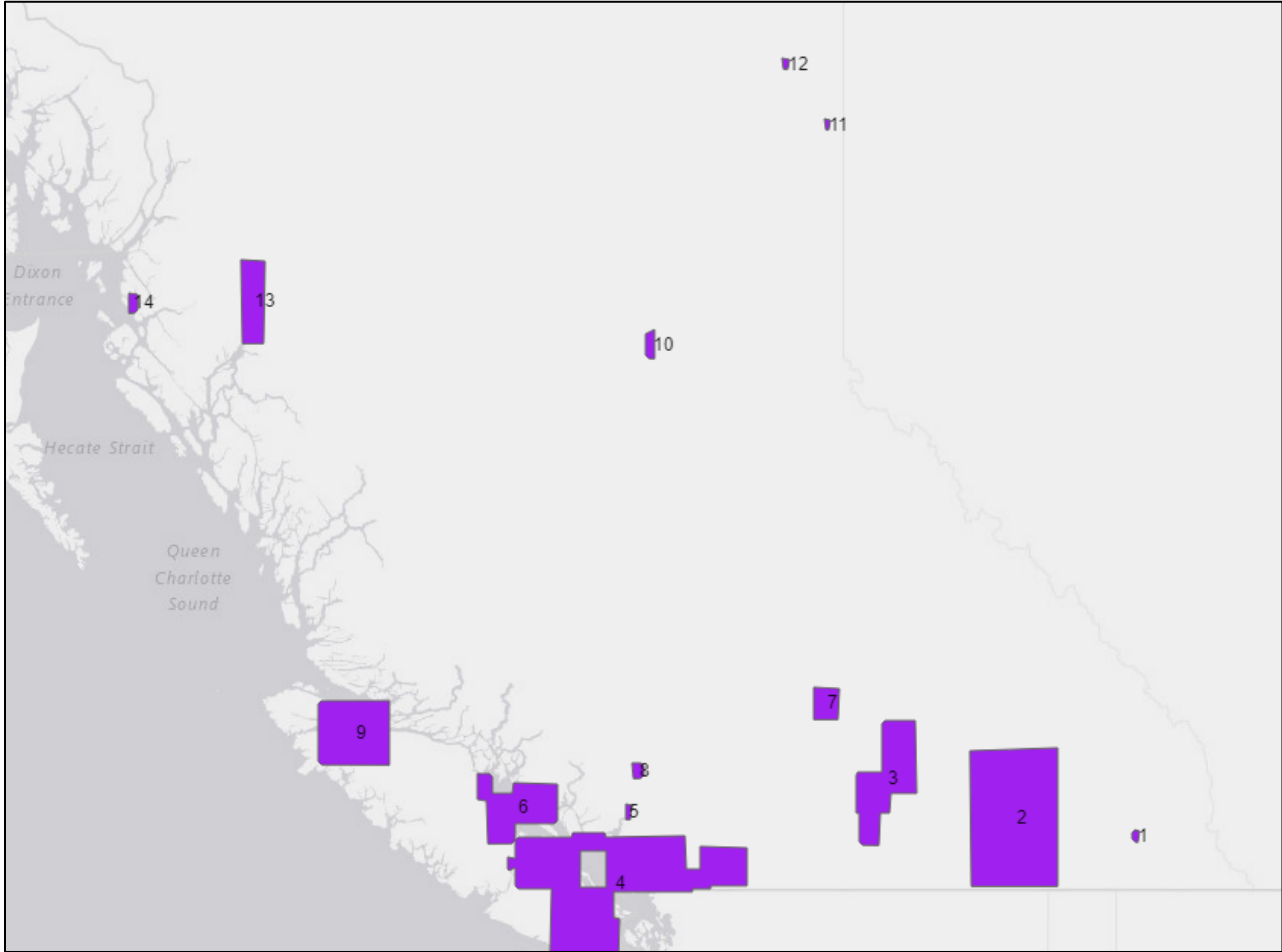
Pereira, Rafael H. M., Saraiva, Marcus, Herszenhut, Daniel and Braga, Carlos Kaue. 2021. "r5r: Rapid Realistic Routing on Multimodal Transport Networks with R5 in R." Findings, March. <https://doi.org/10.32866/001c.21262>.

8 Notes

1. See: [GTFS Static Overview | Static Transit | Google Developers](#)
2. See: [OpenStreetMap](#)
3. See: [The Open Database of Buildings \(statcan.gc.ca\)](#)
4. See: [microsoft/CanadianBuildingFootprints: Computer generated building footprints for Canada \(github.com\)](#)
5. This includes SkyTrain.
6. See: [Rapid Realistic Routing with R5 • r5r \(ipeagit.github.io\)](#)
7. See: [conveyal/r5: Developed to power Conveyal's web-based interface for scenario planning and land-use/transport accessibility analysis, R5 is our routing engine for multimodal \(transit/bike/walk/car\) networks with a particular focus on public transit \(github.com\)](#)
8. See: [valhalla/valhalla: Open Source Routing Engine for OpenStreetMap \(github.com\)](#)
9. See: <https://pypi.org/project/recordlinkage/>
10. See: [https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestClassifier.html?highlight=ra
ndom%20fores#sklearn.ensemble.RandomForestClassifier](https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestClassifier.html?highlight=random%20fores#sklearn.ensemble.RandomForestClassifier)
11. See: <https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.BaggingClassifier.html>
12. See: <https://www.statcan.gc.ca/en/lode/databases/odef>
13. E.g. <https://www.carsharecoop.ca/car-locations/kaslo/>

9 Appendix

Appendix Figure 1. **Map of the transit region (i.e., intersecting bounding boxes of GTFS stops) across Canada. Table A1 specifies the place names included within each numbered region.**



Appendix Table 1. **Designated regional coverage and place names within the identified transit regions.**

Transit Region Id	Designated Regional Coverage & Place Names
1	Cranbrook
2	West Kootenay
3	South Okanagan-Similkameen, Vernon, Kelowna
4	Chilliwack, Nanaimo, Port Alberni, Cowichan Valley, Vancouver TransLink, Sunshine Coast, Fraser Valley Express, New Westminster, Central Fraser Valley, Surrey, Victoria
5	Squamish
6	Comox Valley, Campbell River, Powell River
7	Kamloops
8	Whistler
9	Mt. Waddington
10	Prince George
11	Dawson Creek
12	Fort St. John
13	Kitimat
14	Prince Rupert