



COUNCIL REPORT

Report Date: November 7, 2023
Contact: Lon LaClaire
Contact No.: 604.873.7336
RTS No.: 15914
VanRIMS No.: 08-2000-20
Meeting Date: November 15, 2023
[Submit comments to Council](#)

TO: Standing Committee on City Finance and Services

FROM: General Manager of Engineering Services and
General Manager of Planning, Urban Design, and Sustainability

SUBJECT: Elimination of Minimum Parking Requirements – Phase 2

Recommendations

- A. THAT Council approve, in principle, the second phase of the elimination of minimum vehicle parking requirements by expanding the Downtown parking standards to the West End, Robson North, and Broadway Plan Area, to be effective January 1, 2024.
- FURTHER THAT the Director of Legal Services be instructed to bring forward for enactment the necessary amending By-law generally in accordance with Appendix A.
- B. THAT Council approve, in principle, amendments to the loading rates and design standards and bicycle facility requirements, to be effective January 1, 2024.
- FURTHER THAT the Director of Legal Services be instructed to bring forward for enactment the necessary amending By-law generally in accordance with Appendix B.
- C. THAT Council direct staff to report back with a phasing plan and the next phase of eliminating minimum parking requirements across the city, consideration of parking maximums, and a complementary framework for improving regulation of on-street parking by the end of 2024.

Purpose and Executive Summary

This report recommends amendments to the Parking By-law 6059 to eliminate minimum vehicle parking requirements for new developments in the West End, Robson North Permit Area and Broadway Plan Area. This expands the off-street parking regulations that currently exist in the Downtown Area, as shown in Figure 1.



Figure 1 Proposed areas for no minimum parking requirements.

This report also includes minor updates to loading rates and design standards, changes to bicycle room design features, and coordinates with updates to the Transportation Demand Management (TDM) process.

The elimination of minimum parking requirements recommended in this report is limited to general purpose vehicle parking only. This report does not recommend any changes to the number of required accessible parking, visitor parking, or bicycle parking spaces.

Based on an evaluation of potential market impacts and data collected in the Downtown since parking minimums were eliminated in 2019, there are likely to be positive impacts of the regulation change, including:

- increasing the number of projects that are financially attractive, especially smaller and more challenging sites, and helping increase housing and job space supply;
- improving certainty of requirements for developers;
- eliminating the need for parking variances and likely accelerating the City's development review timelines;
- supporting reductions in construction costs, potentially enabling increased affordability at non-market rental projects; and
- reducing the amount of embodied carbon emissions in new construction (by reducing the amount of excavation and concrete).

Council Authority/Previous Decisions

The Vancouver Charter provides authority for Council to regulate parking and loading spaces for vehicles and bicycles in buildings through the Parking By-law.

Recent Council decisions that support or complement the recommended amendments provided herein include:

- In July 2018, [amendments to the Parking By-law](#) were approved by Council that eliminated minimum vehicle parking requirements in the Downtown (except West End Residential) and introduced the TDM program.

- In September 2020 City Council approved a [motion](#) directing staff to explore eliminating minimum parking requirements and adopting an Open Option Parking approach.
- The [Climate Emergency Action Plan \(CEAP\)](#) was approved by City Council in November 2020 which included directing staff to bring forward recommendations to eliminate vehicle parking minimums and implement parking maximums.
- The [Broadway Plan](#) was approved by City Council in June 2022 and included direction to pursue eliminating minimum parking requirements, requiring TDM, and introducing parking maximums for new developments within the Broadway Plan Area (Section 14.7.7).
- On September 14, 2023 Council approved multiple bylaw amendments to support adding [missing middle housing](#), which includes not requiring minimum parking requirements for multiplexes in the new R1-1 zone.

City Manager’s Comments

The City Manager concurs with the foregoing recommendations.

Context and Background

Minimum off-street parking requirements in the Parking By-law have historically been in place to ensure that all the vehicles associated with each building can park on that property and do not rely on street parking. While they were removed for the Downtown area in January 2019 and for the R1-1 Residential Inclusive (Multiplex) zone in September 2023, there are 28 residential and 35 non-residential minimum parking rates remaining in the by-law. While the most commonly-used rates reflect vehicle ownership levels fairly well, others have not been reviewed in decades.

Comparison to other jurisdictions across North America

Several cities in North America have removed minimum parking requirements in recent years. In Canada, the City of Edmonton eliminated city-wide parking minimums in 2020 and the City of Toronto followed in 2021. In the United States, dozens of cities have eliminated minimum parking requirements in part or all of their jurisdictions, including: New York City, Portland, Buffalo, Anchorage, Austin, and Minneapolis-St. Paul. The Technical Rationale in Appendix D provides examples of cities that have removed minimum off-street parking requirements, and some early observations from those jurisdictions.

Discussion

The West End, Robson North and Broadway Plan Area are well-positioned to have minimum parking requirements eliminated as:

- on-street parking is well-regulated and ready to react to changing demands;
- there is an existing oversupply of off-street parking that is able to absorb any imbalance in parking supply and demand; and
- they are dense walkable communities, which reduces vehicle dependence and is conducive to shorter, more active trips.

Neighbourhoods where these conditions are met are good candidates for eliminating minimum parking requirements. Staff recommend reporting back to Council with a phasing plan that lays out the expansion of eliminating minimum parking requirements to other areas of the city, coupled with setting parking maximums, introducing TDM and updating the City's on-street parking regulations.

Benefits of Eliminating Minimum Off-Street Parking Requirements

Where minimum off-street parking requirements are removed, expected positive outcomes include:

- Prioritizing investment in walking, cycling, transit, and car share rather than private vehicle parking.
 - Supports the CEAP goal for two-thirds of all trips to be by active transportation or transit by 2030.
- Enabling a reduction in embodied carbon.
 - The additional excavation, concrete, and rebar associated with underground parking infrastructure can account for 12-20% of a building's embodied emissions. More information is available in Appendix F.
 - Supports the CEAP goal to reduce carbon pollution associated with new building construction.
- Increasing the number of projects that are financially attractive, especially for smaller and more challenging sites, which could help increase housing and job space supply.
 - Building underground parking is more expensive on sites that are small, unusually shaped, or have more challenging soil conditions. By enabling lower parking provision, those sites can become more financially attractive.
- Improving clarity around requirements for developers, including the elimination of parking variances, which will likely accelerate the City's development review processes.
 - This is complimentary to the ongoing Permitting Improvement Program.
- Helping to increase viability or affordability of non-market rental projects.
 - Construction costs can impact the price of rent for non-market units.
- Lowering of unit prices at particular strata projects.
 - Some strata projects may elect to build less parking: in order to take advantage of smaller, more challenging sites; at projects near transit; or, if over time, market acceptability for strata units without parking becomes more commonplace.
 - Strata units without parking will likely sell for a discount (estimated at around \$50,000) in comparison to a similar unit with a parking space.

Coriolis Consulting Corp. was retained to evaluate the economic implications of removing minimum parking requirements for residential projects as they relate to housing costs, land values, project viability, and other market factors. This section summarizes some key findings on parking supply, construction costs, and observations made in the Downtown since 2019 (the full study is provided in Appendix E).

Parking Supply

Some of the key findings when analyzing data from newer multifamily residential projects outside of Downtown were as follows:

- Parking supply is most dependent on tenure.
 - On average, strata projects provide 1.21 spaces per dwelling unit, about 22% more than the current by-law minimum requirement.
 - On average, market and non-market rental projects provide an amount of parking about equal to the by-law requirement (0.71 and 0.38 spaces per dwelling unit, respectively).
- Market and non-market rental housing projects are more likely to provide less than the minimum by-law requirement (17% and 22% of them, respectively), compared to strata housing (10%). As a result of balancing this variance and the associated TDM in the review process, it is possible that market and non-market rental housing projects could have experienced longer review times during the application process.
- Besides tenure, the provision of parking is most related to proximity to transit than any other factor.
- Particularly for market rental projects, the availability and price of on-street parking may impact how much off-street parking is constructed. Where there is a large amount of on-street parking available at low (or no) cost, rental developers may explore larger parking reductions.

Construction Costs

Construction of parking can add significant costs to a development project. At the current minimum by-law requirements, the cost of constructing the underground parking levels for apartment projects (including service areas such as mechanical rooms, loading areas, or storage units) can exceed 20% of the total project construction costs. Detailed analysis of parking construction costs is available in Appendix E.

Excluding any necessary underground areas not used for parking (e.g. pedestrian circulation, service areas, mechanical rooms), the cost to construct an underground parking space is about \$60,000 to \$80,000, but can increase to over \$120,000 per stall depending on site size, layout efficiency, or soil conditions.

Observed Impacts of Removing Minimum Parking Requirements Downtown

Data is limited since only ten residential projects have been approved under the post-2019 Parking By-law. However, early conclusions indicate:

- Strata projects continue to supply parking at a similar rate to before the 2019 by-law change, providing 1.15 spaces per dwelling unit, which is above the pre-2019 by-law minimum requirement. This is consistent with GIS analysis suggesting that strata parking is less sensitive to a site's location characteristics.
- Parking provided for rental projects decreased substantially from pre-2019 requirements, providing close to zero parking for a total of 717 new dwelling units.

Considerations for Eliminating Off-Street Parking Minimum Requirements

The elimination of minimum parking requirements may result in an increase in on-street parking pressures if buildings undersupply on-site parking.

Where on-street parking is highly regulated, such as in the Metro Core, the City has tools such as residential permits, time limits or parking meters to manage the demand for curb space. The Metro Core is also well-served by many existing off-street parking facilities to help absorb surplus demand. Currently, where on-street parking is not regulated in residential areas, permit parking is typically only introduced at the request of residents on the block. In commercial areas, time limits or parking meters can be implemented to better manage on-street parking.

Having highly regulated on-street parking helps to ensure that the right amount of parking is provided in each development. Particularly for rental residential buildings, where there is ample, low-cost (or free) on-street parking in the neighbourhood, demand for off-street parking decreases. In anticipation of low demand, developers may choose to supply fewer spaces as those spaces are likely to be unoccupied.

Staff recommend reporting back to Council by the end of 2024 with the next area(s) to be considered for elimination of minimum parking requirements and a framework for regulating on-street parking to complement the phased elimination of minimum parking requirements.

Maximum Parking Allowances

There is an existing maximum parking allowance for non-residential uses in the Downtown. The recommendation includes expanding the existing Downtown non-residential maximum allowance to apply to the West End and the Broadway Plan Area, for the purpose of regulatory simplicity. Staff also recommend reporting back to Council with a refreshed and comprehensive approach to maximum parking allowances, including maximums for residential uses. This approach would include stakeholder engagement; an analysis of market expectations and outcomes; research on potential impacts to vehicle ownership and transportation behaviour; and measures to incentivize sustainable development.

Transportation Demand Management

The TDM program was introduced in 2019 as a way for development to encourage reduced driving in a comprehensive manner. The Parking By-law already includes many TDM measures such as secure bicycle parking and end of trip facilities that can reduce parking demand and encourage more trips by walking, biking, transit, and car share.

Staff plan to simplify the TDM program for new developments, as described in Appendix D, which is enabled by the draft by-law changes in Appendix A. The simplifications to the TDM program will take effect concurrent with the elimination of parking minimums, if approved.

Bicycle Facility Updates

One of the TDM measures to be re-allocated in the simplification is the bicycle maintenance facility (i.e. a stand with basic tools and a pump). Since the program was introduced, this measure has consistently been the most commonly-selected measure, provided on two-thirds of all TDM plans. Staff recommend including the provision of a bicycle maintenance facility into the Parking By-law to simplify the process, as described in Appendices B and D.

Loading Updates

Staff retained a third party engineering firm to evaluate the loading rates and design standards in the Parking By-law. As a result of that study, staff recommend decreasing the loading rates for some land uses, introducing Class A loading requirements for residential uses, and increasing the size of Class B and Class C loading spaces. Overall, this is expected to have approximately a neutral impact or minor decrease in loading requirements. Details of the study and the recommended amendments can be found in Appendices B, D, and G.

Financial Implications

The elimination of minimum vehicle parking requirements can lower the cost of construction and enhance development viability, particularly for rental projects and projects on smaller or more challenging sites. With the improved development economics, there may be opportunities to secure additional development contributions to deliver the necessary infrastructure and amenities to support growth.

Legal Implications

The recommendations direct Legal Services to prepare amendments to the Parking By-law.

* * * * *

**DRAFT By-law to amend Parking By-law No. 6059
regarding minimum requirements in the West End, Robson North
and in the Broadway Plan Area**

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts as follows:

1. This by-law amends the indicated provisions of the Parking By-law.
2. In section 2, Council:
 - (a) strikes out the definition of Central Broadway in its entirety;
 - (b) in the definition of Downtown, strikes out “**Downtown** means that area” and substitutes “**Downtown and Broadway Plan Area** means those areas”;
 - (c) strikes out the definition of West End and Robson North Permit Area in its entirety;
 - (d) strikes out Map 2A in its entirety; and
 - (e) strikes out Map 2B in its entirety and substitutes the following:

“Downtown and Broadway Plan Area



”

3. In section 4.1.1, Council:
 - (a) strikes out the title and substitutes “R, C, M, I, and First Shaughnessy District Requirements, except for the Downtown and Broadway Plan Area”; and
 - (b) strikes out “R, C except for Downtown and Central Broadway, M, I except for Mount Pleasant industrial area, and First Shaughnessy Districts shall be calculated according to section 4.2 and section 4.1.16” and substitutes “R, C, M, I, and First Shaughnessy Districts, except for the Downtown and Broadway Plan Area, shall be calculated according to section 4.2 and section 4.1.15”.
4. In section 4.1.2, Council:
 - (a) in the title, adds “and Broadway Plan Area” after “Downtown”; and
 - (b) strikes out “Downtown shall be calculated according to section 4.3” and substitutes “in the Downtown and Broadway Plan Area shall be calculated according to section 4.3”.
5. In section 4.1.3, Council:
 - (a) in the title, strikes out “Outside Downtown” and substitutes “Outside the Downtown and Broadway Plan Area”; and
 - (b) in subsections (a) and (b), strikes out “outside Downtown” and substitutes “outside Downtown and the Broadway Plan Area”.
6. In section 4.1.4, Council strikes out “section 4.1.16” wherever it appears and substitutes “section 4.1.15”.
7. In section 4.1.6, Council strikes out “section 4.1.16” and substitutes “section 4.1.15”
8. Council strikes out section 4.1.7 and renumbers sections 4.1.8 through 4.1.16 as sections 4.1.7 through 4.1.15, respectively.
9. In section 4.1.12, Council:
 - (a) strikes out “section 4.1.13(b)(i)” wherever it appears and substitutes “section 4.1.12(b)(i)”; and
 - (b) strikes out “section 4.1.13(d)” wherever it appears and substitutes “section 4.1.12(d)”.
10. In section 4.1.15, Council strikes out “except Downtown” wherever it appears and substitutes “except in the Downtown and Broadway Plan Area”.
11. In section 4.2, Council:
 - (a) strikes out the title and substitutes “**Table of Number of Required and Permitted Accessory Parking Spaces in R, C, M, I, DEOD, and First Shaughnessy Districts, and Broadway Station Precinct shown outlined in heavy black on Map 4.5, but not the Downtown and Broadway Plan Area**”;

- (b) strikes out “In R except for Downtown, C except for Downtown and Central Broadway, M, I except for Mount Pleasant industrial area, DEOD, and First Shaughnessy Districts and in Broadway Station Precinct,” and substitutes “In the R, C, M, I, DEOD, and First Shaughnessy District and the Broadway Station Precinct, but not the Downtown and Broadway Plan Area,”;
 - (c) in section 4.2.1.3, strikes out “except Mount Pleasant industrial area”; and
 - (d) in section 4.2.5.10, strikes out “except for Central Broadway and”.
12. In section 4.3, Council:
- (a) strikes out the title and substitutes “**Required and Permitted Accessory Parking Spaces in the Downtown and Broadway Plan Area**”;
 - (b) in section 4.3.1:
 - (i) strikes out the title and substitutes “Non-residential Uses – Downtown and Broadway Plan Area”, and
 - (ii) strikes out “uses Downtown” and substitutes “uses in the Downtown and Broadway Plan Area”;
 - (c) in section 4.3.2:
 - (i) strikes out the title and substitutes “Residential Uses including Live-Work – Downtown and Broadway Plan Area”,
 - (ii) strikes out and residential parking in the West End and Robson North Permit Area which is to be provided in accordance with sections 4.3.3 and 4.3.5,”
 - (iii) strikes out “uses Downtown” and substitutes “uses in the Downtown and Broadway Plan Area”;
 - (d) strikes out sections 4.3.3 and 4.3.5, and renumbers section 4.3.4 and 4.3.6 as sections 4.3.3 and 4.3.4, respectively;
 - (e) in section 4.3.3:
 - (i) strikes out the title and substitutes “Residential Visitor Parking – Downtown and Broadway Plan Area”, and
 - (ii) strikes out “uses Downtown” and substitutes “uses in the Downtown and Broadway Plan Area”; and
 - (f) in section 4.3.4:
 - (i) strikes out the title and substitutes “Transportation Demand Management – Downtown and Broadway Plan Area”, and
 - (ii) strikes out “Except for sites required to provide parking under section 4.3.3, the owners of all developments Downtown” and substitutes “The owners of all developments in the Downtown and Broadway Plan Area”.
13. In section 4.4, Council:
- (a) strikes out the title and substitutes “**Number of Required and Permitted Accessory Parking Spaces for Heritage Sites Outside the Downtown and Broadway Plan Area**”;
 - (b) strikes out “outside Downtown” wherever it appears and substitutes “outside the Downtown and Broadway Plan Area”; and
 - (c) strikes out “located Downtown” wherever it appears and substitutes “located in the Downtown and Broadway Plan Area”.
14. In section 4.5B1, Council strikes out “except Downtown” and substitutes “except in the Downtown and Broadway Plan Area”.

**DRAFT By-law to amend Parking By-law No. 6059
regarding loading and bicycle parking spaces**

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts as follows:

1. This by-law amends the indicated provisions of the Parking By-law.
2. In Column 2 of section 5.2.1, Council:
 - (a) under Class A, strikes out “No Requirement.” and substitutes the following:

“No requirement for less than 50 dwelling units.

At least one space for 50 to 299 dwelling units, and at least one additional space for any portion of each additional 200 dwelling units.”; and
 - (b) under Class B, strikes out “, except that where one or more parcels of land include multiple buildings that share a parking area or parking garage, the Director of Planning, in consultation with the City Engineer, may allow the loading requirement to be based on the total number of dwelling units in all the buildings”.
3. In Column 1 of section 5.2.5, Council:
 - (a) strikes out “Retail Uses, except for Neighbourhood Grocery Store;”; and
 - (b) strikes out “Manufacturing Uses;”.
4. In section 5.2, Council:
 - (a) renumbers sections 5.2.6, 5.2.7, 5.2.8, and 5.2.9 as sections 5.2.8, 5.2.9, 5.2.10 and 5.2.11, respectively; and
 - (b) adds the following new sections in the correct numerical order:

“

5.2.6	Retail Uses	No requirement.	No requirement for less than 100 square metres of gross floor area. A minimum of one space for the first 2 325 square metres of gross floor area plus one space for any portion of the next 2 325 square metres.	No requirement for less than 1 900 square metres of gross floor area. At least one space for 1 900 square metres to 5 000 square metres of gross floor area and at least two spaces for more than 5 000 square metres.
5.2.7	Manufacturing Uses	No requirement.	No requirement for less than 100 square metres of gross floor area.	No requirement for less than 2 000 square metres of gross floor area.

City Clerk

Section 4

This document is being provided for information only as a reference tool to highlight the proposed amendments. The draft amending by-laws attached to the Council report RTS No. 015914 entitled Elimination of Minimum Parking Requirements – Phase 2 as Appendix C represent the amendments being proposed to Council for approval. Should there be any discrepancy between this redline version and the draft amending by-laws, the draft amending by-laws prevail.

Section 4

Off street Parking Space Regulations

4.1 Number of Parking Spaces

[Parking regulations for developments located in parts of FCCDD, CWD, and BCPED are contained in the applicable Official and Area Development Plan By-laws, except as this By-law otherwise requires.]

- 4.1.1 R, C ~~except for Downtown and Central Broadway~~, M, I ~~except for Mount Pleasant industrial area~~, and First Shaughnessy District Requirements, except for the Downtown and Broadway Plan Area

Except as provided in section 4.1.3, the number of spaces required and permitted for the off-street parking of motor vehicles accessory to any development in the R, C ~~except for Downtown and Central Broadway~~, M, I ~~except for Mount Pleasant industrial area~~, and First Shaughnessy Districts, except for the Downtown and Broadway Plan Area, shall be calculated according to section 4.2 and section 4.1.1~~56~~.

- 4.1.2 Downtown and Broadway Plan Area Requirements

Except as provided in section 4.1.3, the number of spaces required and permitted for the off-street parking of motor vehicles accessory to any development in the Downtown and Broadway Plan Area shall be calculated according to section 4.3.

- 4.1.3 Heritage Sites and Buildings on the Vancouver Heritage Register Outside the Downtown and Broadway Plan Area

The number of spaces required and permitted for the off-street parking of motor vehicles accessory to any development:

- (a) on a heritage site located outside the Downtown and Broadway Plan Area shall be calculated according to section 4.4; and
- (b) in a building on the Vancouver Heritage Register and outside the Downtown and Broadway Plan Area that is being converted to dwelling use may be calculated according to section 4.4.4, instead of according to the standard for the District in which the site is located, provided that the owner consents to its designation as a heritage site, without compensation, prior to issuance of any development permit utilizing section 4.4.4.

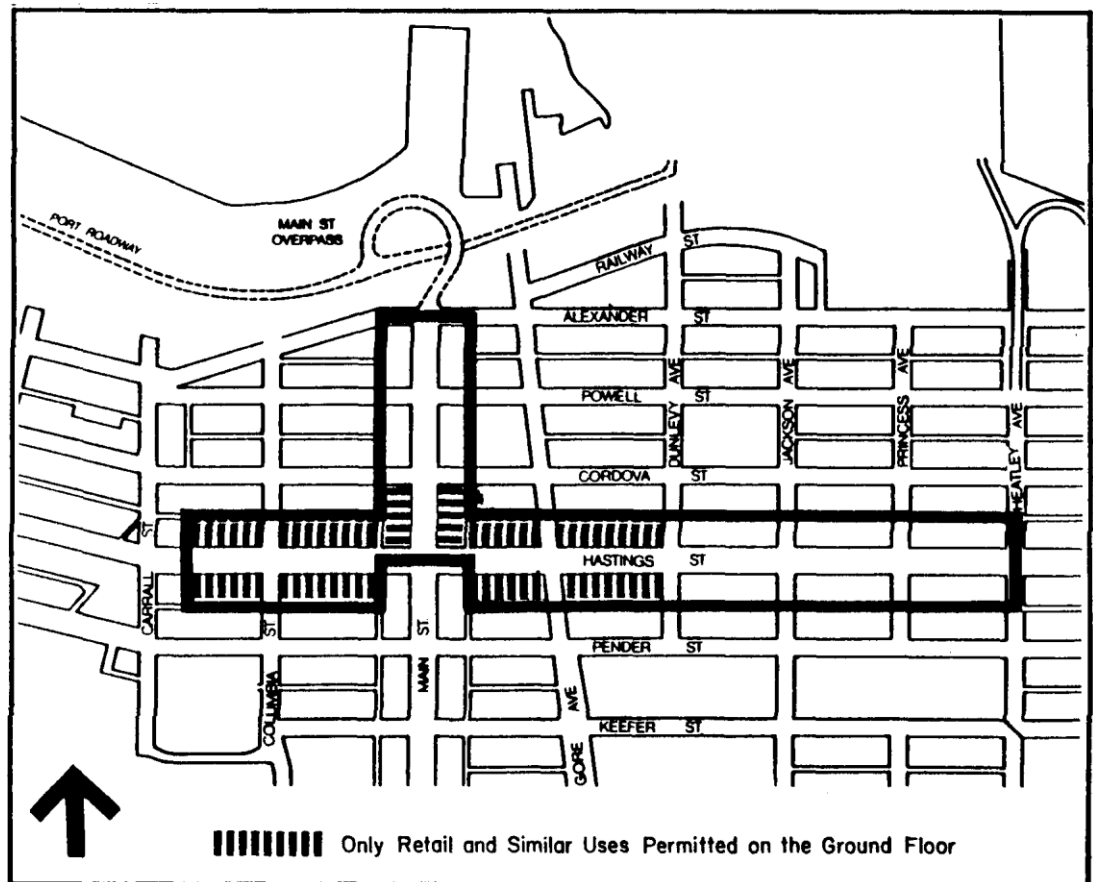
- 4.1.4 DEOD District Requirements

Except for sub-area 1 of the DEOD District, the number of spaces required and permitted for the off-street parking of motor vehicles accessory to any development in the DEOD District shall be calculated in accordance with section 4.2 and section 4.1.1~~56~~.

In sub-area 1 of the DEOD District, outlined by the heavy black line on Map 4.1.4, off-street parking for motor vehicles shall be provided as follows:

- (a) off-street parking shall not be required for any ground floor retail and similar use in the area where only these types of uses are permitted, as noted on Map 4.1.4;
- (b) the provision of parking facilities may not be required with developments, however, where parking is provided it shall be subject to the following conditions and regulations:
 - (i) office commercial, live-work, and residential uses shall require not more than one parking space for each 93 square metres of gross floor area of such uses, except that visitor parking for all dwelling uses, including live-work use, shall be calculated in accordance with section 4.1.1~~56~~;
 - (ii) other permitted uses shall require not more than the requirements set out for such uses in section 4.2, unless otherwise determined by the Director of Planning.

Map 4.1.4



4.1.5 CD-1 District Parking Requirements:

Unless otherwise provided in Schedule C or in a CD-1 By-law, the parking requirements for a CD-1 District must be calculated using the standard set out in this by-law for the area in which the CD-1 District is located as shown on the maps which form part of this by-law.

4.1.6 FCCDD District Requirements

Unless otherwise provided in an Official Development Plan, the number of parking spaces required and permitted in the FCCDD District shall be calculated according to section 4.2 and section 4.1.156.

~~4.1.7 Mount Pleasant Industrial Area and Central Broadway requirements for Non-residential uses (except Hotel)~~

~~Non-residential uses (except Hotel) in Central Broadway and Mount Pleasant Industrial area shall provide:~~

- ~~(-) at least one parking space for each 145 m² of gross floor area for the first 290 m² of gross floor area, and one additional space for each additional 70 m² of gross floor area; and~~
- ~~(-) not more than one space for each 40 m² of gross floor area.~~

~~4.1.14.1.7~~ Number of Small Car Spaces

The number of small car parking spaces on a site may not exceed 25% of the total parking spaces required for the site for all uses combined, except that:

- (a) if the parking spaces on a site are primarily reserved and clearly designated for employee parking in association with office, industrial, or similar uses, the number of such small car parking spaces may increase to no more than 40% of the total parking spaces; and
- (b) if a particular use requires only two or three parking spaces, one of them may be a small car space.

The Director of Planning, in consultation with the City Engineer, is to determine the location of small car spaces on a site.

4.1.124.1.8 Uses Not Listed

If a use is not listed in the tables, the number of parking spaces shall be calculated on the basis of a similar use as determined by the Director of Planning.

4.1.134.1.9 Multiple-Use Developments

For the purposes of this section uses with the same formula for determining required parking spaces shall be considered to be of the same class. If a development contains parking for more than one use as listed in section 4.2, the total number of parking spaces shall be the sum of the parking spaces required for the various classes of uses calculated separately and, unless otherwise permitted by the Director of Planning, in consultation with the City Engineer, taking into account the time-varying demand of uses, a parking space required for one use shall be deemed not to meet the requirement for any other use in that development.

4.1.144.1.10 Floor Area Calculation

Where gross floor area is used to calculate the number of required parking spaces, it shall be calculated in the same manner as the floor space ratio of the applicable district schedule or official development plan. For the purposes of this section, floor space ratio in the HA-1, HA-1A and HA-2 Districts shall be calculated in the same manner as in the HA-3 District.

4.1.154.1.11 Rounding of Fractional Numbers

Where the calculation of total required parking spaces results in a fractional number, the nearest whole number shall be taken. A fraction of one-half shall be rounded up to the next whole number.

4.1.164.1.12 Parking Space Requirement Exemptions

The required number of off-street parking spaces need not be provided:

- (a) where an addition or alteration to a residential building containing no more than two dwelling units and existing on March 24, 1992 would result in an increase in floor area of less than 20 percent over its floor area at that time;
- (b) where, subsequent to original construction of a building, any additions, alterations or change in use would, in total, result in an increase of less than 10 percent of the number of spaces required for the originally constructed building before any addition, alteration or change in use, except that:
 - (i) for any change of use located on a site outside the areas outlined on Map 4.3.1, where the increase over the parking required for the originally constructed building does not, in total, exceed two spaces, two spaces need not be provided except that if there are no historic records showing the parking requirements for the originally constructed building, the number of parking spaces must meet the requirements of this By-law; and
 - (ii) the number of spaces not provided under this section 4.1.123(b)(i) and section 4.1.123(d) shall not exceed two except as otherwise provided for in section 4.2;
- (c) where payment-in-lieu relief is granted in accordance with section 4.12 of this By-law and such payment has been received by the City of Vancouver; or

- (d) where dwelling use occurs with other permitted uses in a C-2 District, provided that:
- (i) the number of spaces not provided shall not exceed two required for dwelling use;
 - (ii) the number of spaces not provided under this section 4.1.123(d) and section 4.1.123(b)(i) shall not exceed two; and
 - (iii) other uses on the site shall not include a restaurant, cabaret, or any other use which, in the opinion of the Director of Planning, may be expected to be active in the evening on a regular basis.

4.1.174.1.13 Maximum Number of Vehicles on Site

Where sections 4.2, 4.3, or 4.4 prescribe a maximum number of off-street parking spaces for a site, no person shall park or place, or permit to be parked or placed, a greater number of vehicles on that site than the maximum number of off-street parking spaces prescribed, except that this section shall not apply to businesses licensed for the sale, rental or servicing of motor vehicles or to the parking of motor vehicles used in the conduct of a business provided they are not used to convey persons between their residence and the place of business.

4.1.184.1.14 Calculation of Accessible Parking Spaces

Despite anything to the contrary in this By-law or in any other by-law mentioned herein, each accessible parking space provided to satisfy the minimum required number of such spaces will count as two parking spaces for the purpose of satisfying the minimum required number of parking spaces. Use of this section will not affect any maximum parking permitted calculations.

4.1.194.1.15 Visitor Parking for Dwelling Uses including Live-Work, except in the Downtown and Broadway Plan Area

Where parking spaces are provided for dwelling uses, including live-work use, except in the Downtown and Broadway Plan Area, a minimum of an additional 0.05 parking spaces for every dwelling unit and a maximum of an additional 0.1 spaces for every dwelling unit must be provided and reserved for the use of visitors and shall be included in the calculation of any applicable maximum, except that if the provision of the minimum number of required visitor parking spaces causes the development to exceed the maximum parking permitted, the number of visitor parking spaces shall be reduced by the number required to meet the maximum.

4.2 Table of Number of Required and Permitted Accessory Parking Spaces in R-~~except for Downtown~~, C-~~except for Downtown and Central Broadway~~, M, I-~~except for Mount Pleasant industrial area~~, DEOD, and First Shaughnessy Districts, and Broadway Station Precinct shown outlined in heavy black on Map 4.5, but not the Downtown and Broadway Plan Area.

For sites within the heavy black outline shown on Map 2B, use section 4.3.

In the R-~~except for Downtown~~, C-~~except for Downtown and Central Broadway~~, M, I-~~except for Mount Pleasant industrial area~~, DEOD, and First Shaughnessy Districts and ~~in the~~ Broadway Station Precinct, but not the Downtown and Broadway Plan Area. parking spaces for any building classified in Column 1 must meet the corresponding standard listed in Column 2, except for:

- (a) sub-area 1 of DEOD;
- (b) heritage sites in First Shaughnessy District;
- (c) specified uses in Broadway Station Precinct listed in Section 4.5; and
- (d) any permitted use in a commercial or heritage zone that consists of less than 300 m², and that constitutes a change of use from the previous use in the same premises, in which case the parking standard is the lesser of the number of parking spaces listed in Column 2 for such new use and the number of parking spaces available for the previous use.

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES										
4.2.1	Dwelling											
4.2.1.1	<p>Single Detached House, Duplex, Infill Single Detached House, or Infill Duplex in the following districts: R, C, DEOD</p> <p>First Shaughnessy District</p>	<p>A minimum of one space for every dwelling unit, except that the maximum number of spaces for a site having a single detached house or duplex as the only use other than an accessory use shall be:</p> <table border="0"> <tr> <td><u>Site width at rear property line</u></td> <td style="text-align: right;"><u>Spaces</u></td> </tr> <tr> <td>less than 10.0 m</td> <td style="text-align: right;">2</td> </tr> <tr> <td>at least 10.0 but less than 12.2 m</td> <td style="text-align: right;">3</td> </tr> <tr> <td>at least 12.2 but less than 14.5 m</td> <td style="text-align: right;">4</td> </tr> <tr> <td>14.5 m or more</td> <td style="text-align: right;">5</td> </tr> </table> <p>A minimum of two spaces for every dwelling unit.</p>	<u>Site width at rear property line</u>	<u>Spaces</u>	less than 10.0 m	2	at least 10.0 but less than 12.2 m	3	at least 12.2 but less than 14.5 m	4	14.5 m or more	5
<u>Site width at rear property line</u>	<u>Spaces</u>											
less than 10.0 m	2											
at least 10.0 but less than 12.2 m	3											
at least 12.2 but less than 14.5 m	4											
14.5 m or more	5											
4.2.1.2	<p>Single Detached House with Secondary Suite</p> <p>Single Detached House with Laneway House</p> <p>Single Detached House with Secondary Suite and Laneway House</p> <p>In RT-11: Single Detached House with Secondary Suite on a site with more than one principal building</p> <p>Duplex with Secondary Suite</p>	<p>A minimum of one space for every dwelling unit, and for a building constructed before April 20, 2004, a minimum of one space.</p> <p>A minimum of one space.</p> <p>A minimum of one space.</p> <p>A minimum of 1.5 spaces.</p> <p>A minimum of three spaces, except that the maximum number of spaces for a site having a duplex with secondary suite as the only use other than an accessory use must be:</p> <table border="0"> <tr> <td><u>Site width at rear property line</u></td> <td style="text-align: right;"><u>Spaces</u></td> </tr> <tr> <td>At least 10.0 m but less than 12.2 m</td> <td style="text-align: right;">3</td> </tr> <tr> <td>At least 12.2 m but less than 14.5 m</td> <td style="text-align: right;">4</td> </tr> <tr> <td>14.5 m or more</td> <td style="text-align: right;">5</td> </tr> </table>	<u>Site width at rear property line</u>	<u>Spaces</u>	At least 10.0 m but less than 12.2 m	3	At least 12.2 m but less than 14.5 m	4	14.5 m or more	5		
<u>Site width at rear property line</u>	<u>Spaces</u>											
At least 10.0 m but less than 12.2 m	3											
At least 12.2 m but less than 14.5 m	4											
14.5 m or more	5											
4.2.1.3	Multiple Conversion Dwelling in the following districts:											

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
	<p>RT-3, RT-4, RT-4N, RT-4A, RT-4AN, RT-6, RT-7, FM-1 and sites less than 500 square metres in RM-4 and RM-4N</p> <p>R1-1, RT-5, RT-5N, RT-5A, RT-5AN, RT-8, RT-9, RT-10, RT-10N, RT-11, RT-11N, RM-1, RM-1N, RM-7, RM-7N, RM-7AN, RM-8, RM-8N, RM-9, RM-9N, RM-9A, RM-9AN, RM-10N, RM-11, RM-11N, and RM-12N</p> <p>DEOD</p> <p>Two residential units</p> <p>Three or more residential units</p> <p>RT-1, RT-2, RM-2, RM-3, RM-3A, C, (except C-5, C-5A and C-6), M, except Mount Pleasant industrial area, and sites 500 m² or larger in RM-4 and RM-4N</p> <p>Two residential units</p> <p>Three or more residential units</p>	<p>A minimum of one space for every residential unit.</p> <p>A minimum of one additional space for every dwelling unit newly created.</p> <p>A minimum of two spaces.</p> <p>A minimum of one space for each 70 m² of gross floor area, except that no more than 2.2 spaces for every residential unit need be provided.</p> <p>A minimum of two spaces.</p> <p>A minimum of 0.5 space for every dwelling unit that has less than 50 m² of gross floor area, and, for every dwelling unit that has 50 m² or more of gross floor area, at least 0.6 space for every dwelling unit plus one space for each 200 m² of gross floor area, except that, for every dwelling unit which has a gross floor area of 180 m² or greater, there need be no more than 1.5 spaces for every dwelling unit.</p> <p>For sites smaller than 500 m² or with a maximum of 1.0 floor space ratio, the lesser of the requirement set out in the preceding paragraph of this column or one space for every dwelling unit.</p>
4.2.1.4	<p>Multiple Dwelling or Infill Multiple Dwelling in the following districts, except as provided for in sections 4.2.1.8, 4.2.1.10, and 4.2.1.13:</p> <p>DEOD</p> <p>R-1</p> <p>RT-3, RT-4, RT-4N, RT-4A, RT-4AN, RT-5, RT-5N, RT-5A, RT-5AN, RT-6, RT-7, RT-8, and sites less than 500 square metres in RM-4, RM-4N and FM-1</p> <p>Sites 500 square metres or larger in RM-4 and RM-4N</p> <p>Sites 500 square metres or larger in FM-1</p>	<p>A minimum of one space for each 70 square metres of gross floor area, except that no more than 2.2 spaces for every dwelling unit need be provided.</p> <p>No requirement</p> <p>A minimum of 0.5 space for every dwelling unit that has less than 50 m² of gross floor area, and, for every dwelling unit that has 50 m² or more of gross floor area, at least 0.6 space for every dwelling unit plus one space for each 200 m² of gross floor area, except that, for every dwelling unit which has a gross floor area of 180 m² or greater, there need be no more than 1.5 spaces for every dwelling unit.</p> <p>For sites smaller than 500 m² or with a maximum of 1.0 floor space ratio, the lesser of the requirement set out in the preceding paragraph of this column or one space for every dwelling unit.</p>

	RM-1 and RM-1N	A minimum of one space for every dwelling unit.
--	----------------	---

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
	<p>Multiple Dwelling in RM-7, RM-7N and RM-7AN (not including Rowhouse)</p> <p>Multiple Dwelling in RM-8A and RM-8AN (not including Rowhouse)</p> <p>Multiple Dwelling in RM-8, RM-8N, RM-9, RM-9N and RM-9BN (not including Rowhouse)</p> <p>Multiple Dwelling in RM-9A, RM-9AN, RM-11, RM-11N, and RM-12N</p> <p>RM-10 and RM-10N</p> <p>Rowhouse in RM-7, RM-7N, RM-7AN, RM-8, RM-8N, RM-8A, RM-8AN, RM-9, RM-9N and RM-9BN</p> <p>Principal Dwelling Unit with a Lock-off Unit in RM-7, RM-7N, RM-7AN, RM-8, RM-8N, RM-8A, RM-8AN, RM-9, RM-9A, RM-9N, RM-9AN, RM-9BN, RM-10, RM-10N, RM-11, RM-11N, and RM-12N</p>	<p>A minimum of 0.8 spaces for every dwelling unit.</p> <p>A minimum of 0.8 spaces for every dwelling unit.</p> <p>A minimum of 0.5 space for every dwelling unit with less than 50 m² of gross floor area, and, a minimum of 0.6 space for every dwelling unit with 50 m² or more of gross floor area, plus one space for each 200 m² of gross floor area, except that, for every dwelling unit which has a gross floor area of 80 m² or greater, there need be no more than 1 space for every dwelling unit.</p> <p>A minimum of one space and no more than 2 spaces for every dwelling unit.</p> <p>A minimum of 0.5 space for every dwelling unit with less than 50 m² of gross floor area, and, a minimum of 0.6 space for every dwelling unit with 50 m² or more of gross floor area, plus one space for each 200 m² of gross floor area, except that, there need be no more than 1 space for every dwelling unit.</p> <p>In addition to the preceding paragraph in this Column 2, a minimum of 0.075 space for each dwelling unit and a maximum of 0.15 space for each dwelling unit for designated visitor parking unless the Director of Planning and General Manager of Engineering Services allow visitor parking off site at a location and on terms and conditions satisfactory to them.</p> <p>Visitor parking shall be part of minimum parking requirements.</p> <p>A minimum of one space for every dwelling unit.</p> <p>The principal dwelling unit is subject to the relevant parking requirements in section 4.2.1.4. There is no additional parking requirement for the lock-off unit.</p>
4.2.1.5	Rooming House	A minimum of one space for each 37 square metres of floor area used for sleeping units, exclusive of bathrooms.
4.2.1.6	Dwelling Units up to a maximum of two in a Mixed-Use Residential Building where the only non-dwelling use permitted is Neighbourhood Grocery Store	A minimum of one space for every dwelling unit.
4.2.1.7	Repealed	
4.2.1.8	Social Housing HILS Units	A minimum of 0.3 spaces per unit for units with fewer than 2 bedrooms, and a minimum of 0.5 spaces per unit for units with 2 or more bedrooms.
4.2.1.9	Three or more dwelling units designated solely as social housing low end of market units.	The rate applicable for secure market rental housing in section 4.5B1.

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
4.2.1.9A	Three or more dwelling units designated solely as shelter rate units.	1 space for every 15 units.
4.2.1.10	Residential Unit associated with and forming an integral part of an Artist Studio	A minimum of one space for every studio of 75 square meters or less of gross floor area, 1.3 spaces for every studio over 75 square meters of gross floor area and one additional space for every 12 studios on sites with 12 or more studios.
4.2.1.11	Co-op Housing.	<p>A minimum of 1.2 spaces for every dwelling unit.</p> <p>For three or more dwelling units:</p> <p>A minimum of 0.5 space for every dwelling unit that has less than 50 m² of gross floor area, and, for every dwelling unit that has 50 m² or more of gross floor area, at least 0.6 space for every dwelling unit plus one space for each 200 m² of gross floor area, except that, for every dwelling unit which has a gross floor area of 180 m² or greater, there need be no more than 1.5 spaces for every dwelling unit.</p> <p>For sites smaller than 500 m² or with a maximum of 1.0 floor space ratio, the lesser of the requirement set out in the preceding paragraph of this column or one space for every dwelling unit.</p>
4.2.1.12	<p>Seniors Supportive or Assisted Housing</p> <p>For residential units less than 50 square metres in size</p> <p>For residential units 50 square metres - 70 square metres in size</p> <p>For residential units over 70 square metres in size</p>	<p>1 space per 100 square metres of floor area used for residential units.</p> <p>1 space per 70 square metres of floor area used for residential units.</p> <p>1 space per 70 square metres of floor area used for residential units except that no more than 2.2 spaces for every unit need be provided.</p>
4.2.1.13	Unless otherwise specified in this section 4.2.1, for three or more residential units, or for dwelling units in a Mixed-Use Residential Building or located within the area bounded by Burrard Inlet, Boundary Road, Marine Drive, Kerr Street, Fraser River, the boundary between the city and the University Endowment Lands, English Bay, False Creek, Burrard Street, 1st Avenue, Lamey's Mill Road, False Creek 2nd Avenue, Main Street, Prior Street, Gore Avenue, the lane south of Hastings Street, and Heatley Street. (See Map 4.2.1.13)	<p>A minimum of 0.5 space for every dwelling unit that has less than 50 m² of gross floor area, and, for every dwelling unit that has 50 m² or more of gross floor area, at least 0.6 space for every dwelling unit plus one space for each 200 m² of gross floor area, except that, for every dwelling unit which has a gross floor area of 180 m² or greater, there need be no more than 1.5 spaces for every dwelling unit.</p> <p>For sites smaller than 500 square metres or with a maximum of 1.0 floor space ratio, the lesser of the requirement set out in the preceding paragraph of this column or one space for every dwelling unit.</p>
	Principal Dwelling Unit with Lock-off Unit in the C-2, C-2B, C-2C, C-2C1, and C-3A Districts.	The principal dwelling unit with lock-off unit, including the floor area of the lock-off unit, is subject to the parking requirement otherwise specified in section 4.2.1.13, and there is no additional requirement for a lock-off unit. However, for the purpose of calculating visitor parking requirements, Council deems a lock-off unit to be a separate dwelling unit.

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
4.2.2	Temporary Accommodation	
4.2.2.1	Hotel	A minimum of one space for every dwelling unit and one space for every two sleeping or housekeeping units.
4.2.2.3	Bed and Breakfast Accommodation	A minimum of one space
4.2.3	Institutional	
4.2.3.1	Community Care Facility – Class A; Community Care Facility – Class B; and Group Residence	A minimum of one space for each four beds.
4.2.3.2	Detoxification Centre.	A minimum of one space for each 28 square metres of gross floor area.
4.2.3.3	Hospital or other similar use.	A minimum of one space for each 93 square metres of gross floor area.
4.2.3.4	Church, chapel, wedding chapel, funeral home, place of worship, or similar place of assembly	A minimum of one space for each 9.3 square metres of floor area used for assembly purposes, except that where two or more separate areas of assembly exist within a site and are not used concurrently, the Director of Planning may require parking for only the largest of these areas.
4.2.3.5	School - Elementary or Secondary	A minimum of two spaces for every three employees in elementary schools and one and one-quarter spaces for each employee in secondary schools, except that where spaces required as the result of an extension to an existing school would diminish the existing school playground area, the Director of Planning may require a lesser number of additional spaces.
4.2.3.6	School - University or College	As determined by the Director of Planning in consultation with the City Engineer.
4.2.4	Cultural and Recreational	
4.2.4.1	Community centre, activity centre or similar place of assembly; Library, gallery, museum, or aquarium	A minimum of one space for each 18.6 square metres of floor area used for assembly purposes.
4.2.4.2	Theatre, auditorium, casino - Class 1, hall, club or bingo hall	A minimum of one space for each 9.3 square metres of floor area used for assembly purposes.
4.2.4.3	Stadium, arena, exhibition hall, rink, ring, pool, or similar place with spectator facilities	A minimum of one space for every 5 seats, or one space for each 9.3 square metres of pool or surface area used for assembly purposes, whichever is the greater.
4.2.4.4	Fitness Centre, except as provided for in section 4.2.4.7; School - Arts or Self-Improvement	A minimum of one space for each 18.6 square metres of gross floor area.
4.2.4.5	Billiard Hall or Arcade	A minimum of one space for every table or game.
4.2.4.6	Bowling Alley or Curling Rink	A minimum of three spaces for every alley or ice sheet.
4.2.4.7	racquet or Ball Court	A minimum of two spaces for every court.

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
4.2.4.8	Golf Driving Range	A minimum of one space for every stall.
4.2.4.9	Marina, Sailing School, or Boat Facilities	A minimum of one space for every two mooring berths, with additional spaces for launching facilities and sailing schools as determined by the Director of Planning having regard to design and use.
4.2.4.10	Artist Studio (non residential)	A minimum of one space for each 100 square metres of gross floor area.
4.2.5	Commercial	
4.2.5.1	Office Uses (except for Office Uses in the I-3 District) and Retail Uses, except as noted below; School - Business or; School - Vocational or Trade	A minimum of one space for each 100 square metres of gross floor area up to 300 square metres, and one additional space for each additional 50 square metres of gross floor area.
4.2.5.2	Office Uses in the following districts: FC-1	A minimum of one space for each 70 square metres of gross floor area and a maximum of one space for each 46.5 square metres of gross floor area.
4.2.5.3	Grocery Store or Drug Store, excluding Neighbourhood Grocery Store but including Small-scale Pharmacy, or Liquor Store	A minimum of one space for each 100 square metres of gross floor area up to 300 square metres, one additional space for each additional 20 square metres of gross floor area up to 2 300 square metres, and one additional space for each additional 30 square metres of gross floor area over 2 300 square metres.
4.2.5.4	Premises, or portions thereof, licensed pursuant to Provincial legislation for the regular sale of liquor, except for a Cabaret, Neighbourhood Public House, or Liquor Store	A minimum of one space for each 5.6 square metres of floor area open to the public.
4.2.5.5	Cabaret, licensed for the sale of liquor	A minimum of one space for each 9.3 square metres of floor area open to the public.
4.2.5.6	Neighbourhood Public House, licensed for the sale of liquor	A minimum of one space for each 18.6 square metres of floor area open to the public.
4.2.5.7	Except as provided in section 4.2.6.4, Laboratory; Motor Vehicle Repair Shop; Photofinishing or Photography Laboratory; Production or Rehearsal Studio; Repair Shop - Class A; Repair Shop - Class B; Work Shop	A minimum of one space for each 100 square metres of gross floor area in the building or one space for every five employees on a maximum work shift, whichever is greater.
4.2.5.8	Neighbourhood Grocery Store	No requirements.
4.2.5.9	Restaurant or Drive-in Restaurant with a gross floor area less than 250 square metres on a site less than 325 square metres	A minimum of one space for each 50 square metres of gross floor area, except that no more than 2 spaces need be provided.
4.2.5.10	Restaurant or Drive-in Restaurant in the C-3A district except for Central Broadway and except as provided for in section 4.2.5.9	A minimum of one space for each 100 m ² of gross floor area for the first 300 m ² of gross floor area, and one additional space for each additional 50 m ² of gross floor area.
4.2.5.11	Restaurant or Drive-in Restaurant, except as otherwise provided for in this By-law	A minimum of one space for each 50 square metres of gross floor area up to 100 square metres, one additional space for each additional 10 square metres of gross floor area up to 500 square metres and one additional space for each additional 20 square metres of gross floor area over 500 square metres.

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
4.2.5.12	Health Care Office; Health Enhancement Centre; Animal Clinic	A minimum of one space for each 28 square metres of gross floor area.
4.2.5.13	Farmers' Market	As determined by the Director of Planning in consultation with the City Engineer.
4.2.6	Industrial	
4.2.6.1	Except as provided in section 4.2.6.4, Manufacturing Uses; Wholesale Uses	A minimum of one space for each 93 square metres of gross floor area in the building, or one space for every five employees on a maximum work shift, whichever is the greater.
4.2.6.2	Except as provided in section 4.2.6.4, Transportation and Storage Uses, except as provided for in section 4.2.6.3; Utility and Communication Uses	As determined by the Director of Planning in consultation with the City Engineer.
4.2.6.3	Except as provided in section 4.2.6.4, Storage Warehouse	A minimum of one space for each 185 square metres of gross floor area.
4.2.6.4	Except as provided in section 4.2.6.5, the following uses in I-3: Manufacturing Uses; Office Uses; Laboratory; Production or Rehearsal Studio; Utility and Communication Uses; Transportation and Storage Uses; Wholesale Uses; Work Shop	A minimum of one space for each 57.5 square metres of gross floor area and a maximum of one space for each 42 square metres of gross floor area.
4.2.6.5	Mini-storage Warehouse	For visitors, a minimum of two spaces, situated in proximity to the office, at least one of which is a Class B loading space that meets the requirements of section 5; for office use, a minimum of one space for each 100 square metres of gross floor area up to 300 square metres, and an additional space for each additional 50 square metres of gross floor area; and, for each caretaker who resides on the premises, one additional space.

Map 4.2.1.13



- 4.3 Required and Permitted Accessory Parking Spaces in the Downtown and Broadway Plan Area**
[Additional regulations for developments located in Central Waterfront District sub-area 3 are contained in the Central Waterfront District Official Development Plan.]
- 4.3.1 Non-residential Uses ~~— Downtown and Broadway Plan Area~~
Except for accessible parking which is to be provided in accordance with section 4.8.4, and parking spaces for water based uses which are to be provided in accordance with section 4.2.4.9, all non-residential uses in the Downtown and Broadway Plan Area shall provide a maximum of one parking space for each 115 m² of gross floor area.
- 4.3.2 Residential Uses including Live-Work – Downtown and Broadway Plan Area, ~~except in the West End and Robson North Permit Area~~
Except for accessible parking which is to be provided in accordance with section 4.8.4, ~~and residential parking in the West End and Robson North Permit Area which is to be provided in accordance with sections 4.3.3 and 4.3.5~~, there is no minimum residential parking requirement for residential uses in the Downtown and Broadway Plan Area, including live-work use.
- ~~4.3.3 Residential Uses including Live Work – West End and Robson North Permit Area~~
~~Except as provided in section 4.3.5, residential uses in the West End and Robson North Permit Area, including live-work use, shall provide the lesser of:~~
- ~~() — at least one parking space for each 140 m² of gross floor area; and~~
~~() — one parking space for every dwelling unit.~~
- ~~4.3.7~~4.3.3.3 Residential Visitor Parking ~~— Downtown and Broadway Plan Area~~
Where parking spaces are provided for residential uses in the Downtown and Broadway Plan Area, the lesser of
- (a) 5% of the total number of residential parking spaces; and
(b) 0.05 spaces per dwelling unit,
- to a maximum of 0.1 spaces per dwelling unit, must be designated and reserved for the use of visitors.
- ~~4.3.8 Social Housing HILS Units and Shelter Rate Units – West End and Robson North Permit Area~~
~~Except for accessible parking which is to be provided in accordance with section 4.8.4, no parking is required for Social Housing HILS Units or shelter rate units in the West End and Robson North Permit Area.~~
- ~~4.3.10~~4.3.4 Transportation Demand Management ~~— Downtown and Broadway Plan Area~~
~~Except for sites required to provide parking under section 4.3.3, t~~The owners of all developments in the Downtown and Broadway Plan Area must provide a Transportation Demand Management Plan satisfactory to the Director of Planning.
- 4.4 Number of Required and Permitted Accessory Parking Spaces for Heritage Sites Outside the Downtown and Broadway Plan Area**

4.4.1 Non-Dwelling Uses - New Floor Space

Except as specified in section 4.4.3, all non-dwelling uses in floor space created after November 4, 1986 in heritage sites outside [the Downtown and Broadway Plan Area](#) shall provide parking in accordance with the standard for the District in which the site is located.

4.4.2 Non-Dwelling Uses - Existing Floor Space

For the purpose of this section Passive Uses (P) include vacant space, storage space, parking and warehouse space; and Active Uses (A) include all other uses. Except as specified in section 4.4.3, all non-dwelling uses in floor space existent on November 4, 1986 in heritage sites outside [the Downtown and Broadway Plan Area](#) shall provide parking as follows:

Change of Use Required and Permitted Parking Spaces

P to P	no requirement
P to A	0.4 times the minimum standard for the District in which the site is located
A to P	no requirement
A to A	no requirement

For applications considered under this section and located [in the Downtown and Broadway Plan Area](#), the parking provision shall not exceed the applicable maximum requirement.

4.4.3 Non-Dwelling Uses - New and Existing Floor Space on Small Sites

All non-dwelling uses on heritage sites outside [the Downtown and Broadway Plan Area](#) less than 325 square metres in size shall provide a minimum of one parking space for the first 750 square metres of gross floor area plus one parking space for each additional amount of floor space equal to 0.7 times the standard for the District in which the site is located. For applications considered under this section and located [in the Downtown and Broadway Plan Area](#), the parking provision shall not exceed the applicable maximum requirement.

4.4.4 Dwelling Uses

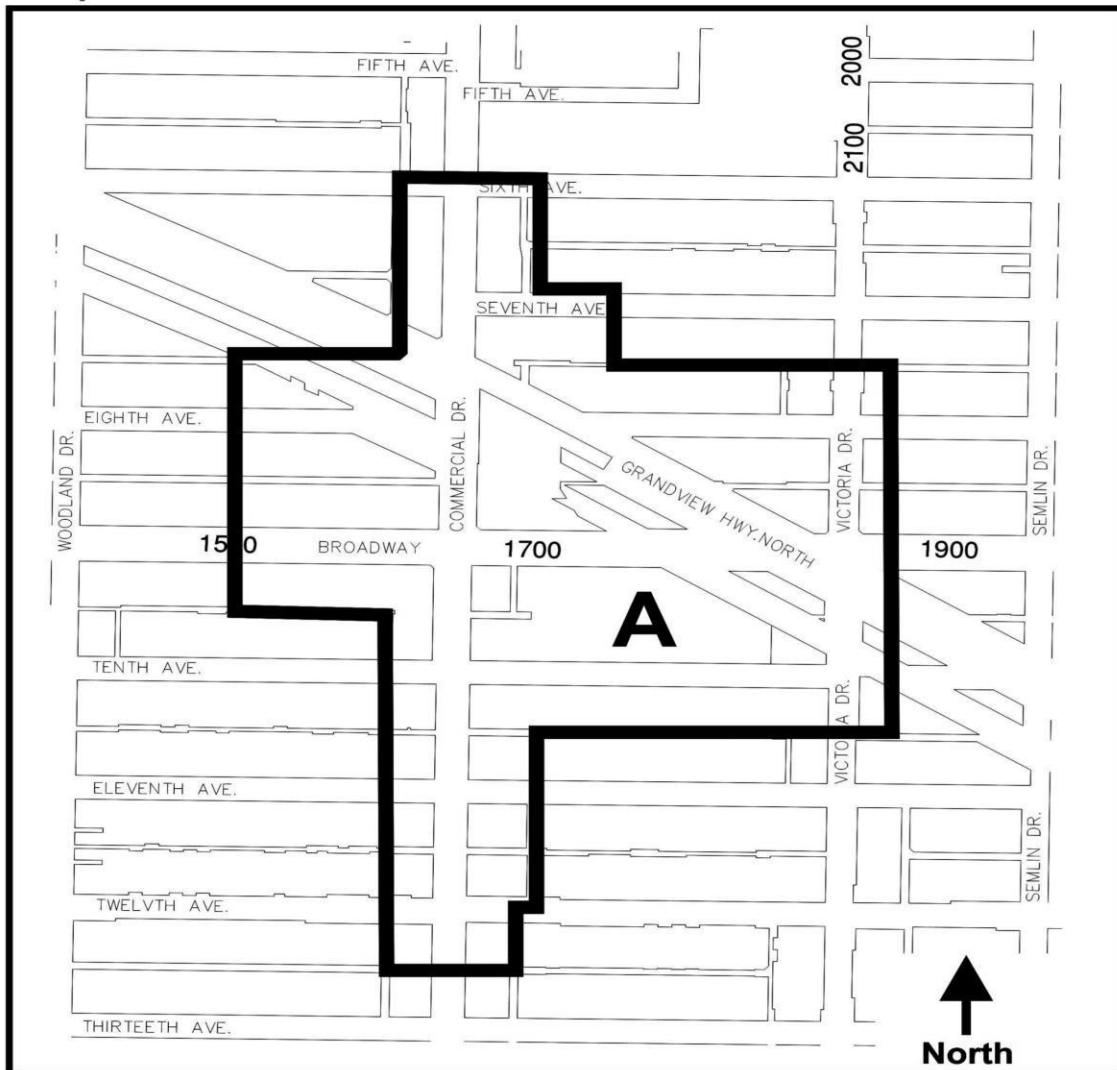
Dwelling uses on heritage sites outside [the Downtown and Broadway Plan Area](#) shall provide a minimum amount of parking at 0.75 times the parking standards otherwise applicable for that location.

4.5 Table of Number of Required and Permitted Parking Spaces for the Broadway Station Precinct shown outlined in heavy black on Map 4.5

For uses listed in this section 4.5, parking spaces will be required for any building classified in Column 1 in accordance with the corresponding standard listed in column 2.

[For uses not listed in section 4.5, see section 4.2.]

Map 4.5



	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
4.5.1	Retail, Office and Service (Area A)	A minimum of one space for each 100 m ² of gross floor area up to 300 m ² of gross floor area, and one additional space for each additional 70 m ² of gross floor area, and a maximum of one space for each 46.5 m ² of gross floor area
4.5.2	Cultural and Recreational (Area A)	A minimum of 1 space for each 100 m ² of gross floor area up to 300 m ² of gross floor area, and one additional space for each additional 70 m ² of gross floor area
4.5.3	Fitness Centre (Area A)	A minimum of one space for each 25 m ² of gross floor area
4.5.4	Health Care Office (Area A)	A minimum of 1 space for each 35 m ² of gross floor area

4.5A Table of Number of Required and Permitted Parking Spaces for Southeast False Creek shown outlined in heavy black on Map 4.5A

For uses listed in this section 4.5A, parking spaces will be required for any building classified in Column 1 in accordance with the corresponding standard listed in column 2.

[For uses not listed in section 4.5A, see section 4.2.]

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
4.5A.1	Multiple Dwelling except for Social Housing HILS Units and shelter rate units	<p>A minimum of one space per 140 m² of gross floor area or one space per dwelling unit, whichever is lesser, and a maximum of:</p> <ul style="list-style-type: none"> (a) 0.5 space for each dwelling unit that has less than 50 m² of gross floor area; (b) for each dwelling unit that has 50 m² or more up to 189 m² of gross floor area, a maximum of 0.65 space plus one additional space for each 140 m² of gross floor area; and (c) for each dwelling unit that has more than 189 m² of gross floor area, a maximum of 2 spaces.
4.5A.2	All non-residential	<p>A minimum of one space for each 145 m² of gross floor area, and a maximum of one space for each 115 m².</p> <p>Despite the preceding paragraph in this Column 2, up to 2% of the spaces for non residential uses must be designated as Shared Vehicle Parking Spaces and these designated spaces may form part of the minimum non-residential parking.</p>

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
4.5A.3	Grocery or Drug Store except for Neighbourhood Grocery Store	<p>A minimum of 1 space for each 100 m² of gross floor area or more up to 300 m² of gross floor area, and one additional space for each additional 50 m² of gross floor area</p> <p>A maximum of that number of spaces equal to the minimum required parking plus 10%</p>
4.5A.4	<p>Restaurant that has a gross floor area of 250 m² or more</p> <p>Restaurant – Drive-in</p>	<p>A minimum of 1 space for each 50 m² of gross floor area up to 100 m² of gross floor area, one additional space for each additional 10 m² of gross floor area up to 500 m² of gross floor space, and one additional space for each additional 20 m² of gross floor area over 500 m²</p> <p>A maximum of that number of spaces equal to the minimum required parking plus 10%</p>
4.5A.5	Live-Work	<p>A minimum of 1 space for each dwelling unit that has up to 250 m² of gross floor area, a minimum of 1 space for each 100 m² of gross floor area or more above 250 m² up to 300 m² of gross floor area, and one additional space for each additional 70 m² of gross floor area over 300 m²</p> <p>A maximum of that number of spaces equal to the minimum required parking plus 10%</p>
4.5A.6	Dwelling units designated solely for senior citizens' housing under the National Housing Act or other similar use	A minimum of 1 space for every 6 dwelling units, and a maximum of 1 space for every 3 dwelling units
4.5A.7	Dwelling units designated solely for families of low income under the National Housing Act	A minimum of 1 space for every 2 dwelling units, and a maximum of 1 space for every dwelling unit
4.5A.8	Social housing dwelling units other than those referred to in section 4.5A.6 and 4.5A.7	<p>A minimum of 0 space and a maximum of 1 space for every six dwelling units that have less than 37 m² of gross floor area</p> <p>A minimum of 1 space for every six dwelling units that have 37 m² or more of gross floor area and a maximum of 1 space for every three such units</p>

4.5 B Table of Number of Required and Permitted Parking Spaces for Secured Market Rental Housing

Despite anything to the contrary in this By-law, except for relaxations set out in Section 3.2, parking spaces for any building classified in Column 1 must meet the corresponding standard listed in Column 2:

	COLUMN 1 BUILDING CLASSIFICATION	COLUMN 2 REQUIRED AND PERMITTED PARKING SPACES
4.5.B1	For secured market rental housing, except <u>in the Downtown and Broadway Plan Area</u> , in the Southeast False Creek area described in the Southeast False Creek Official Development Plan By-law, or in the East Fraser Lands area described in the East Fraser Lands Official Development Plan area	<p>No requirement in an R1 district.</p> <p>A minimum of 1 space for each 125 m² of gross floor area.</p> <p>A maximum number of spaces equal to the total minimum number of spaces plus .5 spaces per dwelling unit.</p>

4.6 Location of Parking Spaces

4.6.1 R, C, M, I, First Shaughnessy District and DEOD Districts

All off-street parking spaces required or provided in R, C, M, I, First Shaughnessy District and DEOD Districts, shall be located on the same site as the development or building they are intended to serve, except that spaces accessory to uses other than dwelling uses may be located on another site within 45 m distance from the development or building they are intended to serve to be measured from the nearest pedestrian access point on the property of application to the nearest of the parking spaces provided on the site subject to the approval of the Director of Planning and provided they are secured by means satisfactory to the Director of Planning.

4.6.2 DD, CWD and HA Districts

All off-street parking spaces required or provided in DD, CWD, or HA Districts, shall be located on the same site as the development or building they are intended to serve except that:

- (a) spaces accessory to residential uses may be located on another site within 100 metres from the development or building they are intended to serve, subject to the approval of the Director of Planning and provided they are secured by means satisfactory to the Director of Planning; and
- (b) spaces accessory to non-residential uses may be located on another site within 150 metres from the development or building they are intended to serve, subject to the approval of the Director of Planning and provided they are secured by means satisfactory to the Director of Planning.

- 4.6.3 CD-1 Districts
Unless otherwise provided in any specific CD-1 By-law, the parking spaces required or provided in CD-1 Districts shall be located in accordance with section 4.6.1 or, if the site is within the heavy black outline on Map 4.3.1, in accordance with section 4.6.2.
- 4.6.4 Collective Parking
Off-street parking spaces may be located at distances greater than those specified in sections 4.6.1, or 4.6.2 from the development or building they are intended to serve provided that:
- (a) they are part of a collective parking project undertaken by Council pursuant to a Local Improvement By-law or that they were part of the former collective parking project undertaken by Assessment Property By-law No. 3808 (the South Fraser Street Collective Parking Project); or
 - (b) they are part of a parking garage or parking area and are secured by an agreement to which the City is a party that relates to land that had been acquired by the City pursuant to a Local Improvement By-law or to other land intended to provide parking in substitution for parking formerly provided on land acquired by the City pursuant to a Local Improvement By-law.
- 4.6.5 Payment-in-Lieu Collective Parking
Off-street parking spaces provided in accordance with section 4.12 of this By-law shall be located to the satisfaction of the Director of Planning, in consultation with the City Engineer.
- 4.6.6 Underground Parking
Residential parking facilities within RM-5, RM-5A, RM-5B, RM-5C, RM-5D and RM-6 Districts shall be underground except on sites of less than 630 square metres in area.
- 4.6.7 Sites Containing More Than One Parcel
Site consolidation shall be required where parking is to be provided on an adjoining parcel of the same site, except that the Director of Planning may require an alternate means to secure the parking, where he is satisfied that consolidation is not possible.
- 4.7 Access to Parking**
- 4.7.1 Access to Parking Areas in R Districts
The number and location of all points of access to parking areas located in an R district shall be subject to the approval of the Director of Planning in consultation with the City Engineer and shall not, in the aggregate, be less than 3.7 metres in width nor more than either 18.5 metres or an amount equal to 15 percent of the combined length of the street and lane frontage and flankage, whichever is the lesser.
- 4.7.2 Access to Parking Spaces in the R1-1 District
Access by a vehicle to any off-street parking space on any site in the R1-1 District must be from a lane abutting the site:
- (a) unless:
 - (i) at least 50% of other sites on the same side of the block as the site have access from the street that abuts the front boundary of the site,
 - (ii) at least one site that abuts a side boundary of the site has access from the front street,
 - (iii) if the site is a residential development, the width of the driveway that abuts the front street does not exceed 3.0 metres,

- (iv) if the site has two driveways at the front street, all parking or manoeuvring between them occurs other than between the boundary of the required front yard setback under the Zoning and Development By-law and the front boundary of the site, and
- (v) the City Engineer issues a crossing permit in conjunction with issuance of a development permit for the site; or
- (b) unless the City Engineer otherwise issues a crossing permit in conjunction with issuance of a development permit for the site;

in which case, access to the site may be from the front street.

4.7.3 Access to Parking Spaces in C-5, C-5A and C-6 Districts

Vehicular access to all off-street parking spaces in C-5, C-5A and C-6 Districts shall be taken from a lane except that the Director of Planning may permit access from a street where he, in consultation with the City Engineer, is satisfied that lane access is not possible because of site or development peculiarities.

4.7.4 Parking Access Restrictions--Central Area

Access to parking is prohibited from the streets listed below because of safety, street function, or design considerations. Access from these streets may be permitted at the discretion of the Director of Planning in consultation with the City Engineer where, due to use, site size, configuration, or other peculiarities access from a lane or alternate street is less desirable.

Burrard: Pacific to Hastings
Carrall: Keefer to Powell
Dunsmuir: Burrard to Beatty
Georgia: Chilco to Beatty
Granville: Drake to Cordova
Hastings: Burrard to lane east of Main
Howe: Granville Bridge to Davie
Main: Union to Hastings & Powell to Alexander
Nelson: Cambie to Beatty
Pacific: Burrard to Hornby
Pender: Carrall to Gore
Robson: Jervis to Beatty
Seymour: Granville Bridge to Davie
Smithe: Cambie to Pacific Blvd.
Water: Richards to Carrall

- (c) all off-street accessible parking spaces, subject to the Building By-law, must:
 - (i) be at least 5.5 metres long,
 - (ii) be at least 4.0 metres wide, except that van accessible parking spaces must be at least 5.0 metres wide,
 - (iii) have a level surface with no more than 2% grade, except that the Director of Planning, in consultation with the City Engineer, may permit a steeper grade, up to a maximum of 5%,
 - (iv) have a vertical clearance of at least 2.3 metres, and
 - (v) be labelled and located to the satisfaction of the Director of Planning.

4.8.2 Size of Small Car Spaces

All off-street parking spaces for small cars shall be a minimum of 4.6 m in length and 2.3 m in width and shall have a minimum vertical clearance of 2.0 m, except that where one side of any space abuts any portion of a fence or structure the minimum width shall be 2.6 m or where both sides abut any portion of a fence or structure the minimum width shall be 2.7 m.

4.8.2 A Size of Mechanical Parking Spaces

The Director of Planning, in consultation with City Engineer must approve the size of all mechanical parking spaces.

4.8.3 Specialized Vehicles

Where the operation of any use or development requires the parking of specialized vehicles, the Director of Planning in consultation with the City Engineer may set parking space sizes appropriate to the vehicles intended to be parked.

4.8.4 Required Accessible Parking Spaces

For each:

- (a) multiple dwelling or live-work use, there must be at least one accessible parking space for each building that contains at least seven residential units and an additional 0.034 space for each additional dwelling unit; and
- (b) non-residential uses, there must be at least one accessible parking space for each building that contains at least 500 m² of gross floor area and an additional 0.4 parking space for each 1000 m² of gross floor area;

except that, in the case of a relaxation of parking spaces for cultural and recreational uses, churches, chapels, places of worship or similar places of assembly, calculation of the required number of parking spaces is to be in accordance with section 4.2 or 4.3, as the case may be.

The first accessible parking space provided, plus every tenth accessible parking space provided, must be a van accessible parking space.

The Director of Planning, in consultation with the City Engineer, is to determine the location of all accessible parking spaces.

4.8.4 A Signage for Accessible Parking and Dual Height in Parking Areas

The owner of a site must clearly post overhead signs that state the maximum unobstructed height clearance provided for accessible parking access both at the parking entrance and within the parking area.

4.8.5 Internal Circulation

Adequate provision shall be made for access by vehicles to all off-street parking spaces by means of unobstructed maneuvering aisles which, for right-angle parking, shall be not less than 6.6 m in width, except that the Director of Planning, in consultation with the City Engineer may permit a lesser aisle width to an absolute minimum of 6.1 m for parking stalls when each of the standard parking stalls is a minimum of 2.7 m wide, except when all the parking stalls are small car spaces which shall not require more than a minimum 6.1 m unobstructed aisle width, and for other than right-angle parking may be a lesser width as permitted by the Director of Planning in consultation with the City Engineer. Access to mechanical parking access must be satisfactory to the Director of Planning in consultation with the City Engineer.

All entrances, exits, drive aisles, other access to parking spaces, and egress therefrom must be at least 2.0 metres high except for all entrances, exits, drive aisles, other access to offstreet accessible parking spaces, and egress therefrom which must have a minimum vertical clearance of 2.3 metres.

4.8.6 Setback from Site Boundaries

Except for points of access, all parking areas, parking spaces and passenger spaces with associated manoeuvring aisles not located within a structure shall be uniformly set back from the site boundaries as follows:

- (a) from the front boundary of the site, a distance equal to the required front yard for the district in which it is located;
- (b) from a flanking street a distance equal to the required side yard on such flanking street for the district in which it is located;
- (c) from a flanking lane or an interior side property line in an R district, a distance of 1.0 metre; and
- (d) from a rear property line in an R district, a distance of 1.0 metre.

4.8.7 Landscaping of Setbacks

Where a parking area in R (except RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6 and FM-1), RR-3A, RR-3B, C-1, C-2, C-2B, C-2C, C-2C1, C-7, C-8, M, I, DEOD and First Shaughnessy Districts is required to be set back from any site boundary or building, the setback area, except for points of access, shall be landscaped and maintained to the satisfaction of the Director of Planning.

4.8.8 Curbs

All parking uses shall be provided and maintained with curbs having cross-sectional dimensions above the pavement of at least 15 cm, and no more than 20 cm, located at least 75 cm, for a standard or accessible parking space and 60 cm, for a small car parking space, distant from interior or exterior fences, pedestrian circulation routes, landscaped areas, other parking spaces, and except for points of access, streets or lanes.

- 4.8.9 Surface
All parking areas in R (except RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6 and FM-1), RR-3A, RR-3B, C-1, C-2, C-2B, C-2C, C-2C1, C-7, C-8, M, I, DEOD and First Shaughnessy Districts shall be provided and maintained with a hard durable surface that does not produce dust, to the satisfaction of the Director of Planning in consultation with the City Engineer.
- 4.8.10 Temporary Parking Areas
The Director of Planning may permit parking areas in R (except RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6 and FM-1), RR-3A, RR-3B, C-1, C-2, C-2B, C-2C, C-2C1, C-7, C-8, M, I, DEOD and First Shaughnessy Districts that do not adhere to the standards in this section 4.8 if the development permit for such a use is limited in time.
- 4.8.11 Parking Space Divider Lines
All parking spaces, except for mechanical parking, in a parking area or parking garage shall be marked by permanent striping extending the full length of the spaces.
- 4.8.12 Requirements for Laneway House Parking Space
Except for sites located in the Downtown and Broadway Plan Area, On a site with a laneway house, there shall be at least one off-street parking space that is open on at least two sides.
- 4.8.13 Requirement for Duplexes and Duplexes with Secondary Suite
On a site with a duplex or a duplex with secondary suite, any uncovered parking space must have a permeable surface.
- 4.9 Design Standards for Parking Uses Located in DD, CWD, SEGS, BCPED, RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6, C-3A, C-5, C-5A, C-6, FC-1, FM-1, and HA Districts**
- 4.9.1 Parking Layout
Layout of parking areas in DD, CWD, SEGS, BCPED, RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6, C-3A, C-5, C-5A, C-6, FC-1, FM-1 and HA Districts shall be in compliance with sections 4.8.1, 4.8.2, 4.8.2A, 4.8.3, 4.8.4, 4.8.4A, 4.8.5, ~~4.8.6~~, ~~4.8.89~~ and 4.8.112.
- 4.9.2 Surface
All parking areas in DD, CWD, SEGS, BCPED, RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6, C-3A, C-5, C-5A, C-6, FC-1, FM-1 and HA Districts shall be surfaced with:
- (a) asphalt or equivalent impermeable surface on all driving and manoeuvring aisles; and
 - (b) if not surfaced as in (a) above, at least a 10 centimetre deep permeable layer of crushed asphalt on a suitable base for all parking spaces to allow for drainage.
- 4.9.3 Lighting
All parking areas in DD, CWD, SEGS, BCPED, RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6, C-3A, C-5, C-5A, C-6, FC-1, FM-1 and HA Districts shall be illuminated to the satisfaction of the City Engineer with:

- (a) average illumination levels of 11 Lux with a uniformity ratio (average level to minimum level) of 3:1;
- (b) luminaires situated in such a way so as not to directly throw light onto streets, lanes, or adjacent properties; and
- (c) a photocell or equivalent switch that will activate the lighting system when ambient light levels are 11 Lux or less.

4.9.4 Drainage

Drainage from all parking spaces in DD, CWD, SEGS, BCPED, RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6, C-3A, C-5, C-5A, C-6, FC-1, FM-1 and HA Districts shall be provided to the satisfaction of the City Engineer.

4.9.5 General Landscaping Requirements at Site Periphery

Except as provided in 4.9.7, all parking areas in DD, CWD, SEGS, BCPED, RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6, C-3A, C-5, C-5A, C-6, FC-1, FM-1 and HA Districts shall be landscaped as follows:

- (a) except for points of access at street property lines, a continuous landscape strip shall be provided having a width equal to 5 percent of the site dimension measured in the same direction, but with a minimum width of 90 centimetres and a maximum width of 1.8 metres; and
- (b) within the landscape strip
 - (i) a minimum of one high-branched tree of a minimum size of 8 centimetre caliper for every 6.1 metres of street property line with a maximum distance between trees of 12.2 metres shall be provided, and
 - (ii) ground cover with a continuous hedge or wood or masonry wall between 75 centimetres and 90 centimetres in height shall be provided.

4.9.6 Additional Landscape Requirements for Large Sites

For every parking area providing more than 100 parking spaces in DD, CWD, SEGS, BCPED, RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6, C-3A, C-5, C-5A, C-6, FC-1, FM-1 and HA Districts either:

- (a) one landscaped island having minimum dimensions of 1.8 metres by 2.5 metres shall be provided, containing at least one high-branched tree of a minimum size of 8 centimetre caliper at the time of planting for every 25 (or portion thereof) parking spaces in excess of 100; or
- (b) one high-branched tree of a minimum size of 15 centimetre caliper at the time of planting, shall be provided and suitably protected from damage by moving vehicles, for every 25 spaces in excess of 100; or
- (c) any combination of the above shall be provided.

4.9.7 Landscaping Abutting Special Design Streets

On properties that abut Georgia Street from Beatty to Chilco Streets, Robson Street from Beatty to Jervis Streets, Burrard Street from Hastings Street to Pacific Boulevard, or Granville Street from Cordova to Drake Streets, all parking areas, except for points of access, shall be landscaped along the aforementioned street property lines with:

- (a) a continuous landscape strip having a width of 10 percent of the site depth, both measured in the same direction, or 7.5 metres, whichever is greater, containing one high-branched tree of a minimum size of 8 centimetre caliper for every 1.5 metres of street property line; or
- (b) in lieu of (a) above, alternatives provided to the satisfaction of the Director of Planning.

4.10 Additional Design Standards for Parking Uses Located In or Adjacent to R Districts

4.10.1 Visual Screening

Except for developments providing no more than four off-street parking spaces and except for points of access, all motor vehicles in a parking area located on a site in or adjacent to an R district shall be screened from the view of adjacent residences by means of fencing or compact planting with a minimum height of four feet.

4.10.2 Landscaping for Large Sites

All parking areas larger than 750 square metres in size and located in an R district shall be provided with additional landscaping to the satisfaction of the Director of Planning.

4.10.3 Lighting

In any parking area located in or adjacent to an R district, luminaries shall be situated in such a way so as not to directly throw light onto streets, lanes, or adjacent properties within an R district.

4.10.4 Vehicle Servicing

Except in a case of emergency, no commercial repair work or service of any kind shall be carried on in any parking area located in an R district.

4.11 Design Standards for Parking Uses Located in CD-1 Districts

4.11.1 Unless otherwise provided in any specific CD-1 by-law, the design standards applicable in CD-1 Districts shall comply with section 4.8 or, if the site is located within or abutting DD, CWD, BCPED, RM-5, RM-5A, RM-5B, RM-5C, RM-5D, RM-6, C-3A, C-5, C-5A, C-6, FC-1, FM-1, and HA Districts, with section 4.9.

4.12 Waiver of Parking Requirements for Commercial or Residential Payment-in-Lieu Relief

4.12.1 An application, directed to the Director of Planning, together with the fee as set out in Schedule B hereto, may be made for waiver of the parking standards required by section 4.1.1, 4.1.2, 4.1.3, 4.1.4, or 4.1.5, as the case may be, of this By-law for the construction or change of use of any building, or portion thereof, used for:

- (a) commercial or industrial purposes located in the area outlined by a heavy black line in Map 4.12.1 or in the Mount Pleasant Industrial Area; or
- (b) residential purposes not designated under a heritage designation by-law or placed on a heritage list and located within the HA-1 (Chinatown), HA-1A (Chinatown South), HA-2 (Gastown) and HA-3 (Yaletown) zones or within the Downtown Official Development Plan Sub-Area C2 (Victory Square) zone.

4.12.2 The City Engineer, Director of Planning and the Director of Budget Services shall report to Council on every application received pursuant to section 4.12.1 and shall make a recommendation thereon, including an amount of money that may be accepted in lieu of the requirement to provide a certain number of parking spaces.

[Note: On December 12, 2017 Council approved an increase in the payment-in-lieu charge per parking space to \$24,700 for any application for payment-in-lieu relief made pursuant to section 4.12.1]

4.12.3 For the purpose of the recommendation referred to in section 4.12.2 the Director of Planning and the City Engineer may request such information from the applicant as deemed necessary, including evidence that as much parking as is physically and economically reasonable has been planned for and will be provided.

- 4.12.4 Council may in its discretion and after receipt of the report referred to in section 4.12.2 accept a sum of money as payment in lieu of the applicant's requirement to provide a certain number of off-street parking spaces and shall upon receipt of that sum as verified by the Director of Finance, waive the provisions of section 4.1.1, 4.1.2, 4.1.3, 4.1.4, or 4.1.5, as the case may be, to the extent determined by Council.
- 4.12.5 Where Council has agreed to accept a sum or money in lieu of parking requirements, Schedule A hereto shall be amended to list:
- (a) the property affected by the waiver;
 - (b) the extent to which the parking requirements are waived; and
 - (c) the amount of money accepted by Council as payment-in-lieu.
- 4.12.6 Where a person who has paid a sum of money pursuant to section 4.12 wishes to receive a refund, he may apply to the City Engineer who, together with the Director of Finance, shall report such application to Council who may, in its discretion, refund such money together with interest actually accrued thereon to the date of application for refund provided that:
- (a) Council has rescinded its resolution to waive the parking requirements and Schedule A has been amended to delete reference to the property for which payment was accepted; and
 - (b) the City has not yet committed the money to construct any facility or otherwise provide parking which is intended to serve a development located on the property referred to in Schedule A for which payment was accepted and
 - (i) alternative parking has been provided for the development to the satisfaction of the Director of Planning in consultation with the City Engineer, or
 - (ii) the development permit for the property for which payment was accepted is no longer valid.

Payment In-Lieu Area

MAP 4.12.1



4.13 Security Standards for Parking Garages

4.13.1 Interior Design

Parking garages and interior stairwells shall be designed for visual accessibility. Machine rooms, heating systems, elevator and stairwell shafts, building columns and other major visual obstructions shall be located to enable visual supervision of the parking spaces and stairwells. A barrier railing shall be provided and maintained to prevent parking within 1.5 metres of interior stairwell walls containing wired glass.

4.13.2 Exterior Design

All parts of a parking garage visible to sidewalk pedestrians shall be finished and lit so as not to detract from the visual amenity of the street.

4.13.3 Landscaping

Landscaping around a parking garage shall be of a type or size that permits the widest possible view from the street of all pedestrian entry and exit areas.

4.13.4 Signs

Where a parking garage is made accessible to the general public, signs within the facility shall be provided to the satisfaction of the Director of Planning to:

- (a) direct patrons to pedestrian exits;
- (b) direct patrons to vehicular exits;
- (c) identify areas so that patrons can locate their vehicle; and
- (d) advise patrons to lock their vehicle and remove all valuables.

4.13.5 Security Design

Parking garages containing 20 or more parking spaces for residents of the building only shall provide security doors, which shall be lockable or otherwise inoperable except by authorized users, at all pedestrian entrances and covering the full width and height of all vehicle entrances. Visitor parking shall not be provided within the area so secured.

4.14 Electric Vehicle Charging Infrastructure Requirements

4.14.1 Dwelling Uses

Where parking spaces are provided for dwelling uses, an energized outlet capable of providing Level 2 charging or higher must be installed in each parking space, excluding visitor parking spaces.

4.14.2 Non-Dwelling Uses (except Hotel and Bed and Breakfast Accommodation Uses)

Where parking spaces are provided for non-dwelling uses, except hotel and bed and breakfast accommodation uses, an energized outlet must be installed in at least 45% of the parking spaces provided, of which at least 5% of the total number of parking spaces provided, or two parking spaces, whichever is greater, must be capable of Level 2 charging or higher and may not implement an Electric Vehicle Energy Management System.

4.14.3 Hotel and Bed and Breakfast Accommodation Uses

Where parking spaces are provided for hotel or bed and breakfast accommodation uses, an energized outlet capable of providing Level 2 charging or higher must be installed in each parking space.

4.14.4 Other Requirements

In addition to the requirements set out in sections 4.14.1, 4.14.2, and 4.14.3:

- (a) for dwelling uses, and hotel and bed and breakfast accommodation uses, electric vehicle supply equipment must be installed in each shared vehicle parking space provided; and
- (b) for non-dwelling uses, except hotel and bed and breakfast accommodation uses:
 - (i) an energized outlet capable of providing Level 2 charging or higher and electric vehicle supply equipment must be installed in each shared vehicle parking space provided, and
 - (ii) an energized outlet capable of providing Level 2 charging or higher must be installed in at least 45% of all accessible parking spaces provided, or one accessible parking space, whichever is greater.

4.14.5 Energized outlets must be labeled for their intended use for electric vehicle charging, and installed in conformance with Sentence 10.3.1.1.(1) of Division B of the Building By-law.

- 4.14.6 The number of energized outlets required for non-dwelling uses under sections 4.14.2 and 4.14.3 may be reduced by substituting energized outlets capable of providing DC fast charging, if the total electrical capacity provided by the DC fast charging outlets meets or exceeds the total electrical capacity that would be provided by the energized outlets required under sections 4.14.2 and 4.14.3.
- 4.14.7 If a development contains parking for more than one of the uses listed in sections 4.14.1 through 4.14.3, the parking spaces provided for each use must meet the energized outlet requirements for that use.

4.15 Transportation Demand Management Plan

- 4.15.1 All development sites involving a land parcel or parcels having a total site size of 8,000 m² or more, or containing 45,000 m² or more of new development floor area, must provide a Transportation Demand Management Plan satisfactory to the Director of Planning.

4.16 Common Ownership of Accessible Parking Spaces

- 4.16.1 In a strata titled development, accessible parking spaces:
- (a) must be held in common ownership; and
 - (b) must not be assigned to any strata lot.

**APPENDIX D
TECHNICAL RATIONALE**

1. Background	2
2. Policy Context	2
3. Phase 2 Project Work	2
4. Proposed Changes	3
5. Existing Parking Supply and Demand Conditions	3
6. Impacts of Off-Street Parking	5
7. Expected Outcomes.....	6
8. Elimination of Minimum Off-Street Parking Requirements in other North American Cities.....	7
9. Review of Maximum Parking Allowances	9
10. Maximum Parking Allowances in other North American Cities.....	10
11. Updates to Transportation Demand Management for Developments	11
12. Bicycle Maintenance Facilities	13
13. Engagement Summary	14
14. Loading Rates and Design Standards	15
15. Housekeeping Update	19

1. Background

The Parking By-law prescribes rates at which parking and loading spaces are required for different land uses. The rates are presented in terms of factors that may influence the demand for parking, such as the number and size of residential units, geographic location, and zone.

Minimum off-street parking requirements began to be introduced in North American cities in the 1950s in order to help manage on-street parking demand, as neighbourhoods were concerned with parking spillover from new developments. The intent was that any vehicles related to a new development would be accommodated on the property and not impact street parking. An unintended consequence was that cities began incrementally devoting more space to parking, sometimes more than the buildings themselves. The result has been that developments have supplied an abundance of (often free) parking spaces, since minimum parking requirements generally aim to satisfy peak parking demand, which – particularly for commercial development – may only occur a few times a year. Free parking allows drivers to only consider the price of fuel in their mode choice and not have a cost associated with storing their vehicle while it is parked.

2. Policy Context

A number of supporting bulletins and documents, which do not form part of the By-law, guide its application. This includes guidelines for Transportation Demand Management, Public Bike Share stations, and supplementary design guidelines for parking and loading areas.

The City of Vancouver's long-range transportation plan, Transportation 2040 (2012), provides direction to eliminate minimum off-street vehicle parking requirements, enabling new developments to construct the amount of general-purpose parking that they choose. In response, the first phase of responding to this policy direction was taken in 2018 with the elimination of minimum requirements for general-purpose parking in the Downtown core. This policy change excluded residential developments in the West End and Robson North Residential Permit Parking Areas.

The Climate Emergency Action Plan builds on the trajectory established in Transportation 2040 and seeks to eliminate minimum parking requirements citywide. This report recommends a second phase of the elimination of minimum parking requirements, which expands the current Downtown regulations to apply to the West End and Broadway Plan Area. It also directs staff to report back in 2024 with Phase 3, and a plan for future phases.

3. Phase 2 Project Work

Elimination of minimum parking requirements beyond the Downtown core after 2018 was also supported by the [2020 Council Motion to explore Open Option Parking](#), and further bolstered by the [Climate Emergency Action Plan](#) later that year. Following that, the work on the removal of minimum parking requirements advanced in parallel with the [Climate Emergency Parking Plan](#), a proposal to introduce overnight residential parking permits and a pollution charge for more polluting vehicles, which would support opportunities to improve parking management on local streets. This work included a series of engagement events held in 2021 seeking feedback on the elimination of minimum parking requirements citywide. A summary of those engagements is provided in Section 13.

Staff brought forward recommendations for the Climate Emergency Parking Plan in fall of 2021, which Council decided not to advance. This prompted a review of the previously planned approach in CEAP to eliminate minimums citywide along with the introduction of a citywide

parking permitting. In 2022 and 2023, staff collected more data and conducted additional research, including an analysis of the economic impact of removing minimum off-street parking requirements on multi-family residential developments. Work also advanced together with the development of the Broadway Plan and its engagement, which led to the inclusion of specific references to parking minimums, maximum parking allowances, and TDM in Section [14.7.7 of the Broadway Plan](#).

With this additional data, staff are recommending a phased approach to eliminating minimum parking requirements in the West End and Broadway Plan Area.

4. Proposed Changes

The proposed elimination of general-purpose minimum parking requirements would apply to the West End and Broadway Plan area, as shown in Figure 1. The existing parking maximum allowance for non-residential development in the Downtown (1 parking space per 115 m² of non-residential floor area) would expand to apply to the West End and Broadway Plan Area, along with existing requirements for accessible parking and visitor parking.



Figure 1 Elimination of minimum parking requirements expanded to include the West End & Robson North Permit Area residential uses and Broadway Plan Area

5. Existing Parking Supply and Demand Conditions

Several studies have been conducted to understand the existing conditions for parking in these areas.

A [comparative study](#) was completed in the Downtown in 2018 to assess the non-residential parking supply and occupancy versus conditions in 2008. That study had found that parking supply decreased by 6% (from 35,100 to 33,000 spaces) in the 10 years from 2008 to 2018, while at the same time parking occupancy also decreased by 6% (from 67% utilization to 61%), indicating that demand for parking has been falling faster than supply.

The [West End Parking Strategy](#) completed in 2017 found that there was a significant excess of overall parking supply in the West End, as there were about 1.5 residential parking spaces for every vehicle registered in the West End (Figure 2 West End parking supply (from 2017 West End Parking Strategy)Figure 2). However, many of those off-street spaces are either not generally available (locked inside secure areas) or are underutilized (perhaps due to pricing variability between on- and off-street parking).

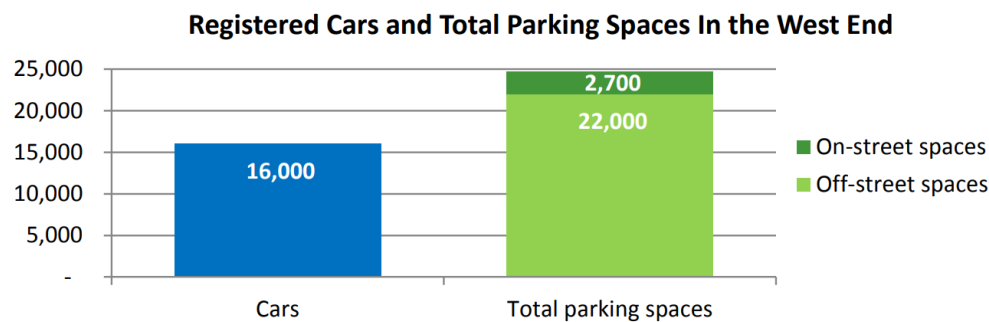
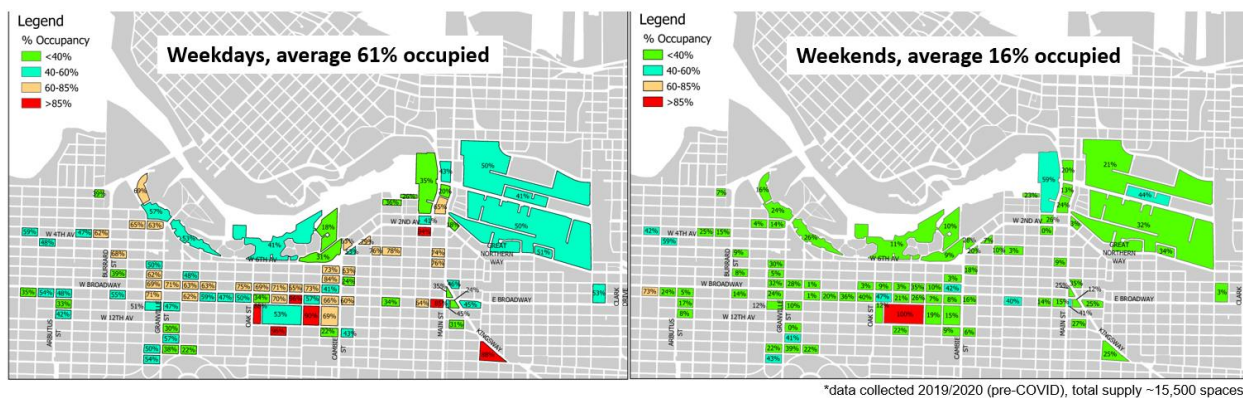


Figure 2 West End parking supply (from 2017 West End Parking Strategy)

The West End provides excellent access to frequent transit, public bike share and shared vehicles, as well as being a complete community and highly walkable community. It also has the lowest rate of private vehicle access in the City: 54% of the West End’s 29,000 households have access to a private vehicle. The Broadway Plan Area boasts similar levels of access, which will be further enhanced with five additional rapid transit stations when the Broadway Subway project is completed in 2026. In the Broadway Plan Area, 66% of households have access to a private vehicle. For comparison, citywide, 74% of households have access to a private vehicle; or 56% of households earning less than \$50,000 per year.

Similar to the West End, off-street parking supply in the Broadway Plan Area is much greater than parking demand on weekdays, and the difference is even more pronounced on weekends. This data was more focused on non-residential, and was collected in 2019/2020 (pre-COVID) in preparation for the Broadway Plan. The survey assessed about 15,500 off-street parking spaces located in publicly-accessible off-street parking lots between 10am and 4pm (Figure 3).



*data collected 2019/2020 (pre-COVID), total supply ~15,500 spaces

Figure 3 Broadway Plan Area off-street parking occupancy study

Other indicators of parking demand are presented in Appendix E, and include the following data sources:

- Registration data from the Insurance Corporation of British Columbia (ICBC)
- 2022 City of Vancouver Transportation Panel Survey data
- Institute of Transportation Engineers (ITE) data
- Data collected directly from developers on the number of parking spaces rented (at rental projects) and sold (at strata projects)

6. Impacts of Off-Street Parking

Vehicle Ownership and Transportation Behaviour

A [study](#) of New York City found that parking supply can largely dictate car ownership decisions and is a more influential determinant than either household income or demographics. Vehicle ownership and driving are also higher when parking is bundled with the cost of renting or owning an apartment, leading to increased traffic and emissions. A [recent article](#) found that the likelihood of households being vehicle-free is 50% to 75% lower than the likelihood of households without a bundled parking space. Households in central cities near transit were found to be twice as likely to not own a vehicle if they didn't have bundled parking.

A [2021 study](#) in San Francisco looked at below-market-rate housing units, which are assigned randomly by a lottery system. The chance of being successful for a particular applicant is less than 2%, meaning that residents do not choose the location of the unit they are assigned. By surveying residents who have won this lottery, it effectively randomizes the sample as participants did not select their residence based on availability or parking, proximity to transit, or other locational characteristics. Some key observations include:

- The random variation in on-site parking availability greatly impacts households' car ownership decisions and driving frequency, with fewer people using public transportation;
- Access to parking has an effect on transit use three times as large as the effect of living in a neighbourhood with good transit access; and
- More parking leads to more car ownership – buildings with no parking had a car ownership rate of 38%, compared to buildings with more than 1 parking space per unit that had a car ownership rate of 81%.

Market Impacts

The City retained Coriolis Consulting Corp. to complete a study to evaluate the economic implications of removing minimum parking requirements for residential uses as they relate to housing costs, land values, project viability and other market factors. The study is provided in Appendix E.

Environmental Impacts

Licker Geospatial Consulting Corp. has investigated how the removal of minimum parking requirements can impact carbon emissions in Vancouver. Overall it found that avoided parking stall constructions can significantly reduce the amount of embodied emissions and somewhat reduce motor vehicle ownership versus a business-as-usual scenario. For example, if all new buildings constructed 20% less parking than current practice, by 2050 there would be a cumulative 225 kilotons of carbon dioxide equivalent (CO₂e) avoided in parking infrastructure. This is roughly equivalent to almost 1 billion kilometres traveled by an average gasoline vehicle. The study is included in Appendix F.

The environmental cost of parking construction is significant, especially for underground parking. A [2022 study](#) by Greenest City Scholar Thais Ayres Rebello, which estimated the carbon contribution of the construction and operation of parking spaces, found that parking construction is an important contributor to CO₂ emissions, varying from between 5 to 85 tonnes of CO₂ equivalent per parking space based on the total square footage devoted to parking in the building. This means that the construction impact of one parking space is equal to the emissions created by driving a passenger vehicle from between 1 to 19 years. Moreover, the ventilation and heating of the parking garage also contributes between 16 to 147 kg of CO₂ equivalent per parking space per year, with both the natural gas and electrical heating scenarios producing about the same amount of emissions.

A [US study](#) (“Parking Infrastructure: Energy, Emissions, and Automobile Lifecycle Environmental Accounting”, Chester et al, 2010) created a life-cycle environmental inventory to review the energy consumption and emissions of greenhouse gases and particulate matter from raw material extraction, transport, asphalt and concrete production, and placement of parking space construction and maintenance. The inclusion of parking within the overall life-cycle inventory was found to increase energy consumption from 3.1 to 4.8 Megajoules (MJ) by 0.1–0.3 MJ and greenhouse gas emissions from 230 to 380 g CO₂e by 6–23 g CO₂e per passenger kilometer traveled. Life-cycle automobile SO₂ and PM₁₀ emissions show the largest increases, by as much as 24% and 89% from the baseline.

Impacts to Water and Underground Infrastructure

In order to protect underground spaces from water ingress, buildings are typically constructed with a drainage system around their foundation. Depending on the geology and the depth of the water table, this drainage system may only collect water infrequently, such as after a major storm event, or it may continuously collect water over the lifetime of the building. The deeper the building (i.e. with an increase in underground parking levels), the more likely the foundation drains will be installed below the water table, requiring continuous drainage of groundwater. The water collected is subsequently pumped into the City sewer system, reducing sewer capacity and increasing the fees charged by Metro Vancouver for treating this water. This diversion of groundwater also results in impacts to the environment, and because the water is not used, it is a waste of a valuable resource. Although engineered alternatives to foundation drains exist, they can be costly. A more cost-effective solution is to reduce the overall depth of a building, such as through a reduction in the number of underground levels.

7. Expected Outcomes

Removing minimum parking requirements does not preclude new developments from providing general-purpose parking spaces, and most will still do so. Eliminating minimum parking requirements will better support a market-based approach that allows developers, property owners, businesses, and residents to provide the desired amount of parking on a project-specific basis.

Simplification of Regulations and Conditions

This will provide more certainty to applicants, and is expected to simplify the application process and accelerate permit processing times. This will also enable future flexibility, as new uses move into existing spaces that may have had a different parking requirement when initially constructed.

Parking Supply Changes

The economic impact study by Coriolis (Appendix E) found that while some developments may provide less parking with the elimination of parking minimums, it is unlikely that the overall average supply of parking per unit in the City will see a significant change for many years. In terms of the anticipated changes to the market supply of parking with the elimination of minimum parking requirements:

- No significant changes are expected in new residential strata projects given that developers oversupply parking by about 22% along with the risk in marketing units without a parking space; and
- There will likely be a reduced parking supply in new market and non-market rental projects, as they are currently supplying close to the current minimum requirements.

Where developments do choose to construct fewer parking spaces, this can lead to the following positive outcomes:

- Saving costs by construction less private vehicle parking can enable more investment in walking, cycling, transit, and car share
- Reducing embodied carbon
- Increasing the number of projects that are financially attractive, especially for smaller and more challenging sites, which could help increase housing and job space supply
- Helping to reduce rents in non-market rental projects
- Lowering unit prices at particular strata projects

The risks where developments decide to construct fewer parking spaces are:

- For residential development, new residents still own vehicles but choose to park on the street, reducing availability of on-street space
- For non-residential development, people working at or visiting the sites still drive, but park on the street, placing more demand on limited street space
- Residents and other nearby stakeholders are more concerned about the impacts of new developments on their existing situations

These risks can be largely mitigated by effective management of street parking, particularly where there is an existing surplus of off-street parking spaces.

8. Elimination of Minimum Off-Street Parking Requirements in other North American Cities

Cities such as New York City, Washington, DC, Calgary, Seattle, Houston, and Regina have eliminated all or most parking minimums in their downtown cores. Full citywide removal of minimum parking requirements in North America has been gathering pace since the City of Buffalo in the state of New York became the first major city to eliminate minimums citywide in 2017. In Canada, the City of Edmonton eliminated minimums citywide in 2020 and the City of Toronto followed suit in 2021, while in the United States, Portland, Oregon, Anchorage, Alaska, and St. Paul, Minnesota have done so in the past few years. Most recently, state legislatures in Oregon and California have removed minimum off-street parking requirements for many developments close to major transit stops.

The following summarizes the changes made in comparative North American cities, and identifies any observations made to date as a result of the policy change. Due to the nature of permit approvals, construction timelines, and transportation behaviour changes, immediate observations are limited and inconclusive. However, highly localized and specific observations in other cities may help understand potential impacts that could arise in Vancouver.

Edmonton, Alberta

Edmonton was the first Canadian city to completely remove minimum parking requirements from its zoning by-law in 2020, allowing developers, businesses, and homeowners to determine the number of parking spaces they wanted to provide. Edmonton launched the '[Open Option Parking](#)' initiative in order to improve choice and flexibility for developers, improve housing affordability, remove economic hurdles for new businesses, and create more infill development. The City of Edmonton highlighted that this means parking spaces will be treated as market goods, rather than a regulated amenity.

The City undertook a Comprehensive Review of Parking Regulations with a year-long public engagement undertaken with Edmonton residents, the development industry, and business improvement associations. It was noted that most off-street parking was underutilized and not meeting utilization targets of 80-90%. The Committee directed the administration to move

forward with removal of parking minimums in order to support the goals of Edmonton's strategic plan and better achieve the city improvement outcomes in the draft City Plan.

Toronto, Ontario

In December 2021 the City of Toronto [adopted policy changes](#) to remove most requirements for new developments to provide a minimum number of parking spaces citywide, along with adding maximum parking allowances. The change was made with the goal of building healthy and sustainable communities, as well as to help manage vehicle dependency. Toronto data also indicates that fewer trips are now completed by car, and an increasing number of apartment households have become car-free. This is attributed to the high cost of car ownership and the high cost of parking construction, which is estimated between \$48,000 and \$160,000.

Toronto noted that the regulation change will help meet its environmental targets such as reduction of greenhouse gas emissions, improved livability and healthier communities. The zoning by-law update encourages residents to choose other modes of transportation such as walking, biking and taking transit. Toronto made the change to reach its climate goals as well as reduce traffic congestion and improve conditions for those who aren't driving.

San Francisco, California

San Francisco passed an ordinance eliminating parking minimums citywide for all uses in December 2018. At the time of this decision, most zoning districts in the City already had no minimum parking requirements, and the decision simply eliminated the remaining minimums.

According to estimates by San Francisco's planning department, minimum parking rules added \$20,000 to \$50,000 to the cost of an apartment in the city as well as required dangerous driveways to be built in very densely populated, walkable parts of the city. The City also cited the following benefits of removing minimum parking requirements: increasing housing production, reducing reliance on cars and better support for neighbourhood retail, increased safety for people walking and biking, supporting neighbourhood diversity, better architecture, and an improved process for small property and business owners.

Seattle

Seattle began removing minimum parking requirements in 2012, reducing or eliminating them for multi-family housing in high-density areas and near major transit corridors. This was followed in 2018 by the elimination of parking minimums near transit and for affordable housing units. At the same time, the city introduced mandates to require the unbundling of parking at new rental residential projects, to separate the cost of housing from the cost of parking. This change also introduced new regulations to enable 'flexible use parking' so that parking spaces could be leased by other users outside the building, helping to support a network of district parking resources.

Portland

Portland has been gradually rolling back minimum parking requirements since the 1980s. Minimums were first eliminated downtown as part of the Central City Plan, followed by the removal of minimums within 500 feet (152 metres) of frequent bus routes in 2002.

A development boom in the early 2010s resulted in a spike in perceived on-street parking challenges in rapidly densifying neighbourhoods, partly due to a lack of an on-street parking management program. This led to a temporary reinstatement of minimum parking requirements for new apartments with more than 30 units in 2013. However, this decision was reversed in 2016 as part of the Comprehensive Plan process, with support from housing

advocates, tenants unions, and bicycle and pedestrian organizations. A performance pricing policy for parking meters was introduced that same year.

The remaining minimum parking space requirements were removed in June 2023 to bring Portland into compliance with Oregon's Climate-Friendly and Equitable Communities standards that were approved in 2022. The purpose of the regulation is to help the city reach a state goal of reducing GHG emissions by 75% by 2050.

Minneapolis, Minnesota

After Minneapolis reduced parking requirements for certain areas of the city, the City determined that lower construction costs resulted in new studio apartments being offered at \$200 less than buildings constructed before parking reform. Minneapolis then decided to remove parking minimums from the zoning code in May 2021, aligning with the City's climate and greenhouse gas emission goals outlined in the Minneapolis 2040 plan. It replaced them with a set of guidelines around travel demand management (TDM), with a points system for developers and businesses to incentivize transit, biking and walking. The City also added parking maximums at the same time.

New York City, New York

There are no minimum parking requirements in most of Manhattan, and the City has significantly reduced minimum parking requirements in other dense neighbourhoods and for certain types of housing. Further amendments to eliminate minimum parking requirements for all new residential developments is expected to be [brought forward in spring 2024](#).

Oregon State

Beginning in January 2023, minimum parking requirements will no longer apply for 48 cities within Oregon's eight largest metro areas for certain situations, including within a half-mile (800 metres) of major transit, for homes less than 750 square feet, and for homes meeting affordability targets. At least seven cities in Oregon have removed parking minimums citywide, including Portland, Salem, Corvallis, Tigard, Bend, Albany, and Central Point.

California State

Similar to Oregon, California state law since January 2023 prohibits city and county governments from implementing minimum parking requirements for most new developments within a half-mile (800 metres) of public transit. The law is part of California's efforts to address housing affordability and reduce greenhouse gas emissions from transportation.

9. Review of Maximum Parking Allowances

Staff recommend that the current maximum parking rate for Non-Residential Uses and Hotels in the Downtown be expanded to include the West End and Broadway Plan Area. This is primarily for regulatory simplicity, rather than shaping built form or transportation patterns. This maximum rate of 1 space per 115m² gross floor area is quite high in the Vancouver context, and there have been no known instances of applicants encountering this maximum limit in recent years. Staff are recommending to report back with a comprehensive update on updated parking maximums that can help achieve the City's climate objectives.

Off-street maximum parking allowances limit construction of parking lots that are larger than necessary. This upper bound controls the amount of infrastructure and impervious surface created for parking, manages traffic and vehicle use to and from developments, and reduces GHG emissions and stormwater run-off where parking is at-grade. To be successfully established, the right mix of density, land uses, transit infrastructure, and service levels should

be supportive of sustainable transportation choices rather than private vehicle use. Parking maximums in North America have often been introduced in areas close to frequent transit and suitable for active transportation modes.

In many other jurisdictions, maximum parking allowances often simply replace minimum parking requirements when they are eliminated. Toronto, Ontario eliminated its minimum parking requirements in 2021, replacing them with maximums at the same rate. The same year, Calgary replaced its minimums with maximums in the downtown area. Other cities that have used a similar approach include Seattle, Portland, San Francisco, Minneapolis, Saint Paul, Nashville, and Raleigh, North Carolina.

The challenge with replacing minimums with maximums is that it leaves many of the same issues as previously. The rates in other cities have generally based on peak demand at suburban developments, so when these rates become maximum parking rates, they may not limit the amount of parking provided in new developments since the maximums are rarely desired by developers. Regulatory complexity also remains a concern, particularly in Vancouver where there are over 60 specific rates for minimum parking requirements, and vary based on land use, zone, district, geographic location, size, or building type.

Staff are recommending that an analysis of citywide maximum parking allowances be undertaken in 2024, which would consider a number of factors in the determination of maximum parking allowances. This would include the rationale for limiting excessive parking construction, how this should be defined (environmental impact, location, land use type), how the allowance rates should be calculated, and potential methods to limit excessive parking construction without impacting the viability of new development.

10. Maximum Parking Allowances in other North American Cities

Portland, Oregon

In 1975, in order to improve air quality, Portland instituted a 'parking lid' with a maximum of 40,000 non-residential or hotel parking spaces that could be built downtown. In 1996 this lid was removed, but in its place, maximum parking allotments were instituted for the central city. A further update in 2015 imposed maximum parking entitlements for all land uses in the central city and relaxed restrictions on how parking can be used. For example, in the downtown core the City allows a maximum of one space for every 92 to 133 square metres of office space, reflecting the major investments in light rail infrastructure there.

San Diego, CA

In 2019, San Diego set a maximum of 1 parking space per unit for new apartment and condominium projects in the downtown area. Limits were also placed on retail, commercial, office and mixed-use sites, eating and drinking establishments, and industrial zones.

Berkeley, CA

Berkeley voted in January 2021 to change its parking by-law to implement parking maximums in transit-rich areas. No more than 0.5 spaces per unit can be built within 400 metres of a high-quality transit corridor, which is defined as a major transit stop or bus stop with a frequency of 15 minutes or less in peak periods.

11. Updates to Transportation Demand Management for Developments

Transportation Demand Management (TDM) for Developments is a way for buildings to encourage reduced driving, and to promote trips by walking, biking, transit, and car share. When buildings are first constructed, occupants are already thinking about how they will get to and from the new building so it is an opportune time to influence transportation behaviour in a sustainable way. Generally, TDM programs typically consist of a variety of different measures that applicants can choose from to best suit the needs of that specific development.

Vancouver's TDM includes measures such as subsidized transit passes, enhanced bike parking beyond the basic by-law requirements, and transportation marketing services.

The TDM program is proposed to expand in areas parallel with the elimination of minimum parking requirements. Where there are no minimum parking requirements (Downtown, West End, Broadway Plan Area), a TDM Plan would be required for all development permit applications with more than 12 dwelling units (residential) or more than 500 m² of floor area (non-residential). Where parking minimums remain, a TDM Plan would continue to be optional in order to achieve a reduction in minimum parking requirements. This is consistent with the existing system.

Current TDM

The current TDM for Developments Administrative Bulletin is available on the City website [here](#).

TDM provides an opportunity for the City to accept lower parking provisions while still ensuring the needs of residents, visitors, and employees are met. TDM measures can accelerate changes in travel behaviour by incentivising individuals to choose non-personal vehicle travel.

Currently, TDM plans are mandatory for most new developments Downtown and all large sites across the City. TDM Plans are optional elsewhere for developers to receive parking reductions of up to 60%.

Challenges with Current TDM

The existing TDM policy has been met with mixed feedback. Many transportation organizations (e.g. TransLink, regional and global municipalities, academic research) see TDM as a critical tool for new developments, with many looking to Vancouver as a leader. With the development industry, as expected, there has been a learning curve as applicants become familiar with the new policy. As a result some applications have taken longer to process, primarily due to back-and forth on requirements.

Feedback that has been received from internal groups as well as applicant teams include:

- It is difficult to balance TDM points and minimum parking requirements
- The TDM program is too complicated and there are too many TDM choices
- Measures are hard to understand and there is too much discretion, leading to uncertainty for applicants and several back-and-forth communications with staff.

These concerns are particularly evident where TDM is optional to achieve a reduction in minimum parking requirements. Some of the TDM measures may impact the form of development, which may impact the parking requirements, creating a need to iterate the building design which can take additional time. When considering several variable TDM measures, this can compound quickly resulting in significant design efforts. This flexibility was

seen as a positive feature in the development of the TDM policy in 2018, however in practice it has sometimes been challenging for some applicants to implement.

Goals of the TDM program refresh

Updates to the TDM program aim to:

- Make the TDM program easier to use to incentivize applicants to choose TDM over providing vehicle parking;
- Improve certainty for applicants;
- Simplify the system and clarify expectations;
- Reduce opportunities for discretion and eliminate the need to back-and-forth questions with staff;
- Adjust the level of expectation to suit a wider range of participation;
- Reduce the need for legal agreements;
- Accelerate the process both for applicants and for review staff.

The TDM is an important tool to encourage and prioritize sustainable transportation choices over private vehicles. The refresh aims to simplify the TDM, without losing sight of its importance towards achieving the Climate Emergency Action Plan objectives around promoting more trips by walking, cycling, transit, and car share.

Anticipated Changes to the TDM

Restructure the TDM system

The updated TDM system seeks to eliminate the need to calculate point requirements/provisions. Instead, it will offer a choice of pre-selected packages of TDM measures, called 'bundles'. While applicants will be able to choose the bundle, there will be no flexibility within each bundle. This will simplify the number of options and provide more certainty to applicants.

The TDM bundles are expected to include combinations of the following TDM measures:

- Transit passes
- Public bike share (Mobi by Shaw Go) memberships
- Additional Class A bike parking spaces
- Increased proportion of bicycle lockers
- Increased proportion of oversized bicycle parking spaces
- Car share vehicles and spaces
- Unbundled or otherwise priced parking (i.e. separating the cost of parking from the primary use of the building)

These measures were selected due to their ease of application, ability to scale with development site size and intensity, and variety of impact both to the application (space requirements, cost, programmatic versus infrastructure) and to the end user (incentivizing transit, cycling, or car share rather than a private vehicle). The provision of subsidized transit passes is also enabled by the recent launch of [TransLink's Compass for Development Program](#).

Separating the Transit Proximity Reduction

Transit proximity reductions are available to some projects simply due to the virtue of the development site location. Currently, multiple levels of reductions based on distance to transit amenities.

Under the updated TDM program, transit proximity reductions are planned be simplified and maximized. Applications that are within 400 metres to the Frequent Transit Network (as defined by TransLink) or 800 metres of a SkyTrain or Canada Line Station can seek an automatic parking reduction of:

- 20% for residential rental, or
- 10% for all other land uses.

Applicants will be required to identify the transit proximity and the reduced parking requirement.

Eliminate the balance between TDM and parking provision

Staff heard feedback that it was challenging for applicants to optimize the balance between the number of TDM points provided and the built form impacts for parking and TDM measures.

The updated TDM would offer a static TDM requirement and a static parking reduction. Provision of an acceptable TDM Plan will grant the applicant a 40% reduction in parking required. Partial TDM Plans in exchange for partial parking reductions would not be accepted.

Monitoring Fund Contribution

Applicants will be no longer be required to contribute to the TDM monitoring fund.

The funds collected to date will be used to monitor the applications that have already contributed to the fund, once they have been constructed and occupied. Funds may also be used to study developments with similar land use and site characteristics that do not have a TDM plan, in order to assess the efficacy of the initial TDM program. The outcome of that initial monitoring program will inform future ongoing monitoring efforts and future changes to the TDM program.

Simplifying Requirements for Legal Agreements

Currently a TDM agreement is required, in addition to other potential legal agreements required to secure the TDM measures (e.g. statutory rights-of-way for car share spaces).

The updated TDM intends to reduce requirements for legal agreements as much as possible.

12. Bicycle Maintenance Facilities

The inclusion of a bicycle maintenance facility within new developments is currently an optional measure in the TDM, and it has consistently been the most popular measure selected by applicants. Two-thirds of TDM Plans to date have elected to include this measure. Its popularity is likely due to its low cost and low footprint so it can easily be added to a bicycle room. For illustrative purposes only, Figure 4 shows examples of bicycle maintenance facilities proposed by recent applications.

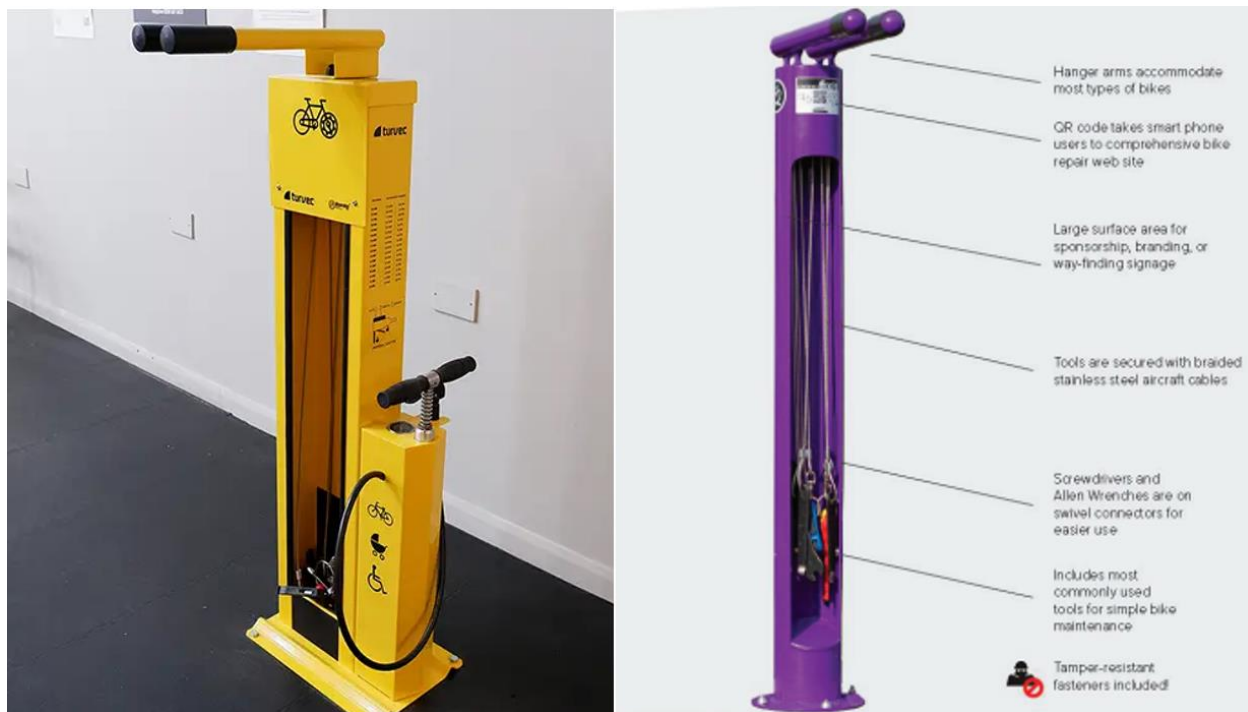


Figure 4 - Examples of Bicycle Maintenance Facilities

The proposed amendment to Section 6 of the Parking By-law makes the provision of a bicycle maintenance facility mandatory for all bicycle parking areas with greater than 100 bicycle parking spaces. The facility shall be provided in a designated, secure area within the building where sufficient workspace and provide the following features to support the performance of basic bicycle maintenance: a bicycle stand, a bicycle pump, wrenches, a chain tool, tier levers, hex keys / Allen wrenches, torx keys, screwdrivers, and spoke wrenches.

13. Engagement Summary

Due to the evolution of the project over many years, engagements have included stakeholders engaging on multiple projects at the same event. The feedback received for previous proposals that may have been slightly different is informative to the current proposal. The following summarizes stakeholder engagements (presented in chronological order), and the key themes of feedback heard from each group(s).

- Staff hosted a workshop in August 2020 with various engineering consultants focused on TDM that had experience applying the program to development projects:
 - Appreciated the goals of the program
 - Complex requirements results in complex feedback loop
 - Concerns that City feedback is uncoordinated between departments
 - Measure descriptions are unclear and expectations are complicated
 - Cost of TDM measures is not acknowledged
 - Point system needs clarification
 - Requests for a program that is more reactive to developer feedback
 - Flagged challenges with multi-phase projects, particularly when spanning multiple iterations of by-law requirements
 - Request for internal City process review to accelerate response times
- Staff presented to Transportation Advisory Committee in November 2020, January 2021 and September 2023:

- Need better data
- Interest in the Transportation Demand Management for Developments program, how it can incentivize sustainable choices
- Concern for bike security
- Questions about how this coordinates with land use planning and density-related decisions
- Staff presented to Urban Development Institute in November 2020:
 - Concerns about bike parking quantities
 - Concerns about TDM complexities
- Staff presented to the Persons with Disabilities Advisory Committee in January 2021 (included members of Seniors Advisory Committee). Themed topics of interest included:
 - Confirmed that off-street parking spaces are critical – both accessible spaces (since they can be preferable for some users over on-street accessible spaces) and general-purpose parking (since not everyone with a disability has a SPARC placard)
 - Expressed importance of visitor parking being universal, particularly for in-home care provides
 - Off-street parking is important for electric vehicle charging infrastructure
 - Concerns about the cost of parking being too expensive, many persons with disabilities are low income
- Staff presented to the Business Improvement Associations in January 2021. Themed topics of interest included:
 - How do construction cost savings get back to residents and tenants?
 - Concerns about inadequate off-street supply resulting in spillover
- Advisory Committee workshops were held in February and July 2021, with members representing Persons with Disabilities Advisory Committee, Seniors Advisory Committee, Transportation Advisory Committee, and Renters Advisory Committee:
 - Appreciated addressing the issue of paying for a parking spot when you don't have a car
 - How can current parking areas be better utilized in the future? Renovated into gardening areas?
 - Concerns about spillover
 - Preference for slow changes so people can get used to it
 - Sought support for building retrofits (not just new buildings)
- A workshop with developers was co-hosted with the consultant Coriolis in May 2023. Feedback from this session is summarized in Appendix E.
- A memo was sent to stakeholders in October 2023 providing a summary of the proposed by-law amendments, and invited feedback via email and office-hours with staff.

14. Loading Rates and Design Standards

In recent years there has been an increase in the number of variance requests for the required number of off-street service/delivery vehicle loading spaces for new development applications. These requests have sought a reduction in existing requirements for various reasons, such as the expected loading vehicle trip generation, concern regarding access constraints in the loading bay, or mixed-use developments presenting opportunities for shared loading spaces.

Binnie engineering consultants were retained to undertake a data-driven analysis of the off-street loading required for new developments with the objective of evaluating Section 5 of the Parking By-law. The purpose of reviewing the off-street loading rates and design standards is to

ensure that the by-law is consistent with actual delivery frequency and vehicles, with the outcome of either changing the requirements or validating existing requirements. This will eliminate the need for loading management plans from applicants, which are an additional cost to provide, are unenforceable, and add time to the development review process.

Fifteen sites of various land uses were observed over a three-day period to collect data on service vehicle loading occurrences. The sites were selected to be representative of the land use types of interest, and multiple cameras were used to observe the sites. Each site was observed to capture loading activity taking place in the designated off-street loading facilities, as well as from adjacent lanes and streets, and informal spaces. The vehicle size, frequency, and overlap of loading activities was recorded.

Changes to Loading Rates

Table 1 summarizes the proposed changes to the loading rates, and provides the supporting rationale based on the data collected.

Table 1 - Changes to Loading Rates

Land Use	Current loading rates	Proposed Changes	Rationale for changes
Dwelling Use (For the purpose of calculating loading spaces in the Southeast False Creek area illustrated in Map 4.5A, the number of dwelling units is to include the number of livework units under section 4.5A.5 and social housing units under sections 4.5A.6, 4.5A.7, and 4.5A.8.);	Class A: No requirement.	Class A: No requirement for less than 50 dwelling units. At least one space for 50 to 299 dwelling units; and at least one additional space for any portion of additional for 200 dwelling units.	Observations of multi-unit residential developments found that Class A vehicles were delivering to dwellings during nearly all observed time periods, and that passenger loading regularly occurred concurrently as Class A goods loading. E-commerce has been changing how goods and services are consumed, with more food, goods, and meals being delivered to homes. These trends have been accelerated by COVID-19 and are unlikely to be reversed. These goods are most commonly delivered in passenger vehicles and utility vans; not larger trucks. Providing space for these deliveries will reduce illegal parking and circling by delivery workers looking for loading locations. This is aligned with direction provided in Transportation 2040 (G2.2.2), and more information on e-commerce trends and projects can be found here . As the number of car-free households increases, the use of shared vehicles is expected to increase. Residents using shared vehicles grocery shop, carry furniture, or need to install car seats will require space in proximity to their homes to conveniently undertake loading

			activities (e.g. groceries, furniture, or children's car seats). Providing Class A loading space for residents will reduce barriers to using shared vehicles instead of private vehicles.
	<p>Class B: No requirement for less than 100 dwelling units. At least one space for 100 to 299 dwelling units; a minimum of one additional space for 300 to 499 dwelling units; and at least one additional space for any portion of each additional 200 dwelling units, except that where one or more parcels of land include multiple buildings that share a parking area or parking garage, the Director of Planning, in consultation with the City Engineer, may allow the loading requirement to be based on the total number of dwelling units in all the buildings.</p>	<p>Class B: No recommended changes.</p>	Observations of Class B sized vehicles regularly occurred at multi-unit dwellings however observations do not support changing the loading rates for this class and land use.
	<p>Class C: No requirement.</p>	<p>Class C: No recommended changes.</p>	Observations did not support including new Class C loading requirements for this land use.
Office Uses	<p>Class A: No requirement for less than 1 000 square metres of gross floor area.</p> <p>At least one space for 1 000 to 7 500 square metres of gross floor area; at least two spaces for more than 7 500 to 15 000 square metres of gross floor area; at least three spaces for more than 15 000 to 20 000 square metres of gross floor area; at least four spaces for more than 20 000 to 28 000 square metres of gross floor area; and at least one additional space for any portion of each additional 7 500 square metres of gross floor area.</p>	<p>Class A: No requirement for less than 1 000 square metres of gross floor area.</p> <p>At least one space for 1 000 to 15 000 square metres of gross floor area; at least two spaces for more than 15 000 to 20 000 square metres of gross floor area; at least three spaces for more than 20 000 to 28 000 square metres of gross floor area; and at least one additional space for any portion of each additional 7 500 square metres of gross floor area.</p>	The observations showed that Class A loading for office space is over prescribed. It is recommended to decrease the required Class A loading requirements.
	<p>Class B: No requirement for less than 500 square metres of gross floor area.</p> <p>At least one space for 500 to 5 000 square metres of gross floor area; at least two spaces for more than 5 000 to 10 000 square metres of gross floor area; at least three spaces for more than 10 000 to 28 000 square metres of gross floor area; and at least one additional space for any portion of each</p>	<p>Class B: No recommended changes.</p>	The rates for Class B loading were supported by observations of office space. No changes to Class B loading for this land use are recommended.

	additional 15 000 square metres of gross floor area.		
	Class C: No requirement.	Class C: No recommended changes.	Observations did not support including new Class C loading requirements for this land use.
Retail A new and separate category for retail uses is recommended.	Class A: No requirement.	Class A: No recommended changes.	Observations did not support including new Class A loading requirements for this land use.
	Class B: No requirement for less than 100 square metres of gross floor area. A minimum of one space for the first 465 square metres of gross floor area plus one space for any portion of the next 1 860 square metres and one additional space for each additional 2 325 square metres.	Class B: No requirement for less than 100 square metres of gross floor area. A minimum of one space for the first 2 325 square metres of gross floor area plus one space for any portion of the next 2 325 square metres.	Observations at retail sites found that Class B loading was over prescribed. A reduction in loading rates for future developments is recommended.
	Class C: No requirement for less than 2 000 square metres of gross floor area. At least one space for 2 000 square metres to 5 000 square metres of gross floor area for a manufacturing use, retail use except for a neighbourhood grocery store, storage warehouse, or wholesale use, separately or in combination; and at least two spaces for more than 5 000 square metres of gross floor area for any such use or combination of uses.	Class C: No requirement for less than 1 900 square metres of gross floor area. At least one space for 1 900 square metres to 5 000 square metres of gross floor area and at least two spaces for more than 5 000 square metres.	The observations found that Class C loading was slightly under prescribed, and a slight increase in the loading rate is recommended.
Manufacturing A new and separate category for manufacturing is recommended.	Class A: No requirement.	Class A: No recommended changes.	Observations did not support including new Class A loading requirements for this land use.
	Class B: No requirement for less than 100 square metres of gross floor area. A minimum of one space for the first 465 square metres of gross floor area plus one space for any portion of the next 1 860 square metres and one additional space for each additional 2 325 square metres.	Class B: No requirement for less than 100 square metres of gross floor area. A minimum of one space for the first 390 square metres of gross floor area plus one space for any portion of the next 1 935 square metres and one additional space for each additional 2 325 square metres.	Observations at manufacturing sites found that adjusting the gross floor area threshold to require two Class B spaces would better meet demand.
	Class C: No requirement for less than 2 000 square metres of gross floor area. At least one space for 2 000 square metres to 5 000 square metres of gross floor area for a manufacturing use, retail use except for a neighbourhood grocery store, storage warehouse, or wholesale use, separately or in combination;	Class C: No recommended changes.	The rates for Class C loading were supported by observations of manufacturing sites. No changes to Class C loading for this land use are recommended.

	and at least two spaces for more than 5 000 square metres of gross floor area for any such use or combination of uses.		
--	--	--	--

Seniors supportive or assisted living developments were also included in the study. Multiple Class A and Class B deliveries were observed each day, including delivery vehicles loading from the street rather than the designated off-street loading areas. Existing rates were found to meet the minimum loading activities and intensity, though the consultant recommended further study to further evaluate potential demand for Class A loading spaces and additional passenger loading spaces. No changes are recommended at this time.

Loading Sizes

An AutoTURN analysis was undertaken to evaluate the required dimensions for loading spaces to accommodate modern delivery vehicles. This analysis found that the Class A loading space dimensions were appropriate, while Class B and C loading space dimensions are currently inadequate for modern delivery vehicles. Recommended changes to the length and width of loading spaces for Class B and C are shown in the tables below.

Current and Recommended off-street loading space dimensions (m)			
	Class A	Class B	Class C
Width	2.7	3.0 3.4	3.5 3.6
Length	5.5	8.5 10.2	17.0 23.1
Height	2.3	3.8	4.3

15. Housekeeping Update

Amendments to the Parking By-law were enacted on October 17, 2023 which included deleting Section 4.8.6. Section 4.9.1 refers to the deleted Section 4.8.6 in error. Section 4.9.1 is being corrected by this amendment.

City of Vancouver Parking Study: Evaluation of the Potential Market Impacts and Outcomes of Reducing Residential Parking Requirements

27 October 2023

Prepared for:
City of Vancouver

By:

coriolis 
CONSULTING CORP.

 **Step One Mobility**
Planning and Engineering

 **BTY**

Table of Contents

Summary	i
1.0 Introduction	1
1.1 Background and Objectives	1
1.2 Terminology	2
1.3 Professional Disclaimer	2
2.0 Previous Research and Outcomes of Parking Reductions in Other Jurisdictions	4
2.1 Metro Vancouver Apartment Parking Study	4
2.2 Research Based on USA Data.....	4
2.3 Removal of Parking Minimums in Other Cities	5
2.4 Implications.....	6
3.0 Analysis of Parking Supply and Demand	7
3.1 Data Inputs	7
3.1.1 City of Vancouver Development Permit Information.....	7
3.1.2 City of Vancouver Transportation Panel Survey.....	9
3.1.3 ICBC	10
3.1.4 Development and Real Estate Industry Data	10
3.1.5 Public GIS Datasets.....	10
3.1.6 Data Limitations	11
3.2 Parking Required and Parking Provided at Recent Residential Developments	11
3.2.1 Parking by Housing Tenure	11
3.2.2 Projects Providing Less than Bylaw Requirements	13
3.2.3 Parking by Building Typology	14
3.2.4 Adding Parking.....	14
3.2.5 Variability of Parking Required and Parking Supplied	15
3.2.6 Impact of Site Size	15
3.2.7 Impact of Mobility Options and Neighbourhood Amenities.....	16
3.2.7.1 Approach to GIS Analysis	18
3.2.7.2 Results of Analysis.....	19

3.3 Observed Impacts of Removing Minimum Parking Requirements Downtown25

3.4 Indicators of Parking Demand25

 3.4.1 ICBC Data.....25

 3.4.2 Vehicle Ownership.....26

 3.4.3 Institute of Transportation Engineers (ITE) Data29

 3.4.4 Data from Development Projects.....29

 3.4.4.1 Market Rental Projects..... 30

 3.4.4.2 Non-Market Rental Projects..... 30

 3.4.4.3 Strata Projects 31

4.0 Parking Construction Costs 32

 4.1 Key Factors that Influence the Cost of Parking34

 4.2 Parking Construction Cost Estimates.....35

 4.3 Savings Associated with Parking Reductions37

 4.4 Transportation Demand Management (TDM)37

5.0 Market Value of Parking 38

6.0 Development Industry Input 39

 6.1 Survey Responses39

 6.1.1 Strata Projects39

 6.1.2 Market Rental.....40

 6.1.3 Non-Market Rental.....40

 6.2 Developer Workshop Notes40

 6.2.1 Strata Projects40

 6.2.2 Rental Projects.....41

 6.2.3 Non-Market Projects41

 6.2.4 General Comments.....42

7.0 Financial Impact of Parking Reductions on New Development Projects 43

 7.1 Approach to Analysis.....43

 7.2 Case Study Sites and Development Scenarios45

 7.3 Key Assumptions for Financial Analysis.....47

 7.4 Findings of Financial Analysis.....48

8.0 Findings and Implications 51

8.1 Findings.....51

8.2 Potential Implications of Eliminating Parking Requirements52

8.2.1 Development Viability and Housing Supply53

8.2.2 Housing Costs.....53

8.2.3 Changes in Parking Supply at New Developments54

8.2.4 Amenity Contributions and Affordable Housing56

8.2.5 Timing of Market Changes.....56

8.2.6 Impact on Lower Income Renter Households56

9.0 Additional Actions for Consideration 58

10.0 Attachments 59

Attachment 1: BTY Parking Construction Cost Report.....60

Attachment 2: Sources Cited61



Summary

In 2018, the City of Vancouver eliminated minimum residential parking requirements in most of Downtown Vancouver. However, minimum parking requirements still exist in the rest of the City. In 2020, Council approved the Climate Emergency Action Plan (CEAP) which aims to significantly reduce carbon pollution and reduce reliance on private automobiles.

The City is considering eliminating minimum residential parking requirements and allowing the market to determine the amount of parking provided in new projects. Requirements for loading, accessible parking and visitor parking would still be retained.

As an input to evaluating any changes to minimum residential parking requirements, the City retained a team of consultants including Coriolis Consulting, Step One Mobility and BTY Group to evaluate the economic implications for new projects of eliminating parking requirements and the potential outcomes for future parking supply at new projects. The intent of the evaluation is to better understand:

- The current demand and supply of parking at new residential or mixed-use projects.
- The cost of creating underground parking in Vancouver and how this cost varies by type of project.
- The potential cost savings to developers associated with reduced parking requirements.
- The impact of parking on new residential unit prices and rent rates.
- The impact of reduced parking requirements on the viability of new projects.
- The amount of parking likely to be provided by developers in the absence of minimum parking requirements.
- The impact of reduced residential parking requirements on the ability of new projects to provide amenity contributions or affordable housing.
- The likely timing required for the market to adjust to parking demand in the absence of parking requirements.

As input to our evaluation, we examined and considered:

- Research previously completed on parking demand and reduced parking requirements.
- Indicators of the supply and demand for parking at newer residential projects in the City and the factors that influence parking supply decisions.
- The cost of constructing vehicle parking and the potential savings associated with reduced parking.
- The market value of parking stalls.
- Input from the development community.
- The potential impact on the financial performance of new multifamily projects due to reduced parking.

The key findings of our evaluation can be summarized as follows:

1. Outside of Downtown, there is significant variation in the amount of parking provided at newer multifamily residential projects depending on tenure, with an average of:
 - 1.21 spaces per unit provided at strata projects.
 - 0.71 spaces per unit at market rental projects.

- 0.38 spaces per unit at non-market rental projects.

There is also significant variation in parking supplied per unit at projects within each tenure.

2. The average parking supplied is higher than the current bylaw parking requirements by about:
 - 0.22 space per unit at strata projects (about 22% higher than bylaw requirements).
 - 0.01 spaces per unit at market rental projects (about 1% higher than bylaw requirements).
 - 0.09 spaces per unit at non-market projects (about 31% higher than bylaw requirements).
3. Available parking demand data indicates that the average parking supplied per unit exceeds actual parking demand (vehicle ownership) at strata projects, is similar to parking demand at market rental projects (although this varies by project) and is lower than actual demand at non-market projects. Strata projects likely provide more parking than required to meet actual demand due to the risks associated with marketing new units without sufficient parking supply.
4. Underground parking accounts for a large share of the overall cost of constructing new multifamily buildings and the cost varies significantly by project.
5. There is a financial incentive for developers to consider reducing parking, particularly at sites where the cost of constructing parking is high, such as smaller sites and sites with challenging soil conditions.
6. Reducing off-street parking requirements can reduce total project costs which can:
 - Increase the number of sites that are financially attractive for redevelopment and help increase housing supply across all tenure types, particularly rental housing.
 - Help reduce rents at non-market rental projects (rents at market rental projects are unlikely to change materially as parking is typically unbundled from unit rent).
 - Lower average unit pricing at strata projects.
 - Possibly increase the opportunity for the City to negotiate increased affordable housing or amenity contributions at new projects.
7. Any Transportation Demand Management (TDM) requirements will partially offset the financial benefits of reduced parking requirements.
8. If parking requirements are reduced, developers will make site by site decisions about the amount of parking to build, so the amount of parking provided will vary from project to project. We would expect developer interest in reduced parking to be focused at:
 - Sites where the cost to construct parking is high, including smaller sites and sites with challenging soil conditions.
 - Locations that are well-served by rapid transit and/or close to large concentrations of employment space and commercial services, as there is likely less marketing risk associated with reduced parking in these locations.
 - Rental projects, as the financial viability of rental development is often more challenging than strata development.
9. Without a minimum parking requirement, we would expect:
 - Small reductions (on average) in the typical amount of parking built at new strata projects.

- Less parking to be provided at new market rental projects, in particular those sites which are well-served by transit and in amenity-rich locations.
 - Less parking (or even zero parking) to be provided at non-market projects to help keep overall project costs lower.
10. For all tenures, the removal of parking minimums will enable more new projects at smaller more constrained sites.
11. There are trade-offs between enabling additional housing through elimination of minimum parking requirements and accepting the potential for on-street parking impacts which may result from undersupplying parking on-site.

In the absence of minimum parking requirements, developers will build parking based on the economic relationship between the cost of building parking, the potential revenues that parking generates and the risks associated with marketing units without parking stalls.

This relationship is complex and influenced by unit buyer expectations, project tenure, construction costs, market uncertainty, and long term expectations about parking demand. Many of these factors vary from project to project and change over time.

Overall, if the City eliminates minimum parking requirements, we would expect developers to explore opportunities to reduce the average amount of parking provided at new developments of all tenures. This should facilitate construction of additional housing by improving project viability, particularly at sites where parking construction is challenging.

1.0 Introduction

1.1 Background and Objectives

In 2018, the City of Vancouver eliminated minimum residential parking requirements in most of Downtown Vancouver. However, minimum parking requirements still exist in the rest of the City. In 2020, Council approved the Climate Emergency Action Plan (CEAP) which aims to significantly reduce carbon pollution and reduce reliance on private automobiles.

As part of the CEAP, the City is considering eliminating minimum residential parking requirements and allowing the market to determine the amount of parking provided in new projects. Requirements for loading, accessible parking and visitor parking would still be retained.

As an input to evaluating any changes to minimum residential parking requirements, the City retained a team of consultants including Coriolis Consulting, Step One Mobility and BTY Group to evaluate the economic implications on new projects of eliminating parking requirements and the potential outcomes for future parking supply at new projects. The intent of the evaluation is to better understand:

- The current demand and supply of parking at new residential or mixed-use projects.
- The cost of creating underground parking in Vancouver and how this cost varies by type of project.
- The potential cost savings to developers associated with reduced parking requirements.
- The impact of parking on new residential unit prices, market residential rent rates and non-market residential rents.
- The impact of reduced parking requirements on the viability of new projects.
- The amount of parking likely to be provided by developers in the absence of minimum parking requirements.
- The impact of reduced residential parking requirements on the ability of new projects to provide amenity contributions or affordable housing.
- The likely timing required for the market to adjust to parking demand in the absence of parking requirements.

This report summarizes our research, analysis and findings. It was co-authored by Coriolis Consulting and Step One Mobility. The report includes the following sections:

- Section 2.0 provides an overview of research previously completed on parking demand and reduced parking requirements.
- Section 3.0 summarizes our analysis of the supply and demand for parking at newer residential projects in the City and the factors that influence parking supply decisions.
- Section 4.0 summarizes our analysis of the cost of constructing vehicle parking and the potential savings associated with reduced parking.
- Section 5.0 summarizes our research on the market value of parking stalls.
- Section 6.0 summarizes comments provided by developers.
- Section 7.0 summarizes the potential financial impact of reduced parking on new multifamily projects.

- Section 8.0 identifies the implications of our evaluation.
- Section 9.0 outlines additional actions for the City to consider.

1.2 Terminology

Some common terms used in this report are defined as follows:

Strata – Multifamily residential developments where individual units are stratified and sold to buyers. These units are part of a strata corporation which oversees the management and maintenance of the building. Strata units can be owner-occupied or rented in the secondary market.

Market Rental – Multifamily residential developments where the building or a component of a mixed-use building is owned and operated by a business or individual who rents the units to end users. This portion of the building is generally secured as market rental by the City with a housing agreement.

Below Market Rental – The City of Vancouver has policies that require building developers to include below market rental units within a new apartment project (mixed with market units) for certain types of rezonings (inclusionary rental units). These units are owned and operated by a business or individual who rents the units to end users. These units are secured as below market rental by the City with a housing agreement.

Non-Market Rental (or Social Housing) – Multifamily residential developments owned and operated by a non-profit operator (or government agency) which rents them to end users. Units are typically income tested and secured by the City under a housing agreement. These units could serve a variety of different demographics or market segments. These projects may also include units rented at market rates which are still considered part of the non-market rental development.

Lowrise – Unless otherwise indicated, lowrise buildings are considered to be 3 storeys or less and could include townhouse projects as well as apartment projects.

Midrise – Unless otherwise indicated, midrise buildings are considered to be 4 to 9 storeys.

Highrise – Unless otherwise indicated, highrise buildings are considered to be 10 storeys or more.

TDM — Transportation Demand Management (TDM) includes items such as car share vehicles, bicycle parking and other measures that are intended to reduce the demand for parking.

Downtown – When capitalized, means the Downtown Area identified in the City of Vancouver Parking bylaw Map 2B.

Bundled parking – Bundled parking stalls are stalls that are sold along with the multifamily unit as part of the purchase price or included in the monthly rental rate of a rental unit.

Parking supply – The number of parking stalls provided at a residential project.

1.3 Professional Disclaimer

This document may contain estimates and forecasts of future growth and urban development prospects, estimates of the financial performance of possible future urban development projects, opinions regarding the likelihood of approval of development projects, and recommendations regarding development strategy or municipal policy. All such estimates, forecasts, opinions, and recommendations are based in part on forecasts and assumptions regarding population change, economic growth, policy, market conditions, development costs and other variables. The assumptions, estimates, forecasts, opinions, and recommendations are based on interpreting past trends, gauging current conditions, and making judgments about the future. As with all

judgments concerning future trends and events, however, there is uncertainty and risk that conditions change or unanticipated circumstances occur such that actual events turn out differently than as anticipated in this document, which is intended to be used as a reasonable indicator of potential outcomes rather than as a precise prediction of future events.

Nothing contained in this report, express or implied, shall confer rights or remedies upon, or create any contractual relationship with, or cause of action in favor of, any third party relying upon this document.

In no event shall Coriolis Consulting Corp., Step One Mobility, or BTY Group be liable to the City of Vancouver or any third party for any indirect, incidental, special, or consequential damages whatsoever, including lost revenues or profits.

2.0 Previous Research and Outcomes of Parking Reductions in Other Jurisdictions

Research has been completed on parking demand and supply, elimination of requirements in other cities, and the impacts of eliminating those parking requirements. This section provides a high level overview of some of the research that we reviewed as input to our analysis.

2.1 Metro Vancouver Apartment Parking Study

In 2018, Metro Vancouver completed a comprehensive analysis of parking demand and supply at apartment projects in the region. Some of the key findings include:

- Apartment buildings close to frequent transit have lower utilization of parking with 0.86 – 0.97 vehicles per unit, compared to 1.09 for buildings further away.
- Residents tend to use less parking when close to frequent transit. This trend is more pronounced for smaller studio and 1 bedroom units.
- Smaller strata or market rental units (studio or 1 bedroom units, or units less than 800 sq.ft.) tend to have at most 1 parked vehicle per unit.
- For rental projects, where parking is not included in the rent (unbundled parking), both parking supply and utilization are lower compared to sites where parking is included in the rent.
- For projects in Vancouver (including UBC), surveys of underground parking indicated 0.83 parked vehicles per dwelling unit for strata buildings and 0.59 parked vehicles per dwelling unit for rental buildings (including both market and non-market).

2.2 Research Based on USA Data

While not exhaustive, a review of studies on the economic impacts of parking minimums and the factors influencing parking supply and demand (based on USA data) uncovered several key findings:

- Analysis of data from the American Household Survey indicates that “the odds of households with bundled parking being vehicle-free are 50–75 percent lower than the odds of households without bundled parking, while households in dense centre cities near transit are twice as likely to be without vehicles if they lack bundled parking.” (Manville, 2014)
- Tian, Park, and Ewing, 2019, use travel survey data from 30 regions of the United States to assess the influence of the 5D’s of compact urban design (Density, Diversity, Design, Destination Accessibility, and Distance to Transit) on vehicle ownership and trip generation. The results show that:
 - Multifamily households in the most compact neighbourhoods own 0.56 vehicles per person, compared to multifamily households in the least compact neighbourhoods which own up to 1.04 vehicles per person.
 - On a per unit basis, multifamily households in the most compact neighbourhoods own 0.74 vehicles, compared to multifamily households in the least compact neighbourhoods which own up to 1.65 vehicles.
 - Vehicle trips per person for multifamily households average 2.03 per day in sprawling neighbourhoods, but this is much lower, down to 0.88 per day, in the most compact neighbourhoods.

- Elasticities for vehicle trip making were higher than for vehicle ownership, indicating a desire to own a vehicle in more compact neighbourhoods, despite relatively less use of it.
- While several articles (Ewing & Cervero, 2017; Stevens, 2017; Handy, 2017) debate the size of the effect of compact urban form on vehicle parking and trip generation, the reviewed literature agreed that the 5 D's reduce both parking demand and trip generation.

2.3 Removal of Parking Minimums in Other Cities

Across North America at least 16 large cities have removed minimum parking requirements including Toronto, San Francisco, Edmonton, and Minneapolis/St. Paul. Many others, including Vancouver, have removed parking requirements in the downtown core, or near transit.

City of Vancouver staff completed a review of other North American cities which have implemented zero minimum parking requirements. Some of the key highlights from the review by City staff include:

- When parking minimums were reduced in central Seattle neighborhoods, developers built about 40% fewer spaces (Gabbe, Pierce and Clowers, 2020).
- An analysis of 23 multi-family developments in the Seattle area found that none of them earned enough from parking revenue to recover the costs of building, operating, and maintaining on-site parking. This resulted in an estimated 15% increase to rents (Sightline Institute, 2013).
- A survey of condominiums in Los Angeles found that bundled parking increased costs by \$40,000 per unit (Manville, 1999).
- In San Diego, in 2020, one year after comprehensive parking reform was implemented, there was a five-fold increase in the total number of homes permitted through the City's density bonus program (Curry, 2021).
- In New York City, where small buildings and small lots are exempt from minimum parking requirements, exempt projects only built 0.5 parking spaces per project (not per unit) on average with only 17% providing any parking at all (New York University, 2012).
- In Buffalo, after minimum requirements were removed, 47% of major developments included fewer parking spaces than previously permissible, while 53% included the same or more. Mixed use projects tended to provide fewer parking stalls compared to previous requirements (Hess and Rehler, 2021).

Together, the experience of other cities indicates that the removal of minimum parking requirements can reduce the amount of parking built, reduce costs, and incent the construction of new housing.

One challenge with some of these prior studies is that they conflate the costs of construction with the price paid (or rents paid) by end users, which misrepresents the market forces that determine the price of housing. Housing prices are determined by supply and demand in the market, not the cost of new construction. If costs are reduced it does not necessarily result in a direct reduction in unit prices or rents in market projects. So these studies may overstate savings to residents. However, it should be noted that reduced construction costs can support increased housing supply which (over time) can help lower the market price of housing (or limit increases in prices).

Some findings are from locations where parking is typically bundled with unit rents, or where minimum parking requirements can be up to 2 spaces per unit. Findings in these locations may overstate the impacts of changes to parking practices and requirements if applied directly to Vancouver, which already has relatively low parking requirements and where rental parking is usually separated (i.e. unbundled) from unit rent.

2.4 Implications

Decisions by residential developers will vary across jurisdictions depending on a range of factors, such as:

- Existing bylaw requirements and the parking requirement reductions.
- The demand for parking.
- The project's target market.
- The cost of constructing parking.
- The market value associated with parking stalls.
- The availability of on-street parking or alternative parking locations.
- The availability of alternative modes of transportation.
- The accessibility of major employment locations.
- The accessibility of commercial services and amenities.

Experiences in other jurisdictions may not predict the outcomes of removing minimum residential parking requirements in Vancouver. Before making decisions about changing parking requirements, the City of Vancouver requires information on the likely impacts and outcomes based on the local Vancouver context. This report aims to evaluate the potential outcomes of zero minimum parking requirements within Vancouver.

3.0 Analysis of Parking Supply and Demand

To understand the impacts of removing minimum parking requirements in the local Vancouver context, it is important to first assess parking supply and demand in new multifamily residential buildings. We completed research to understand the actual amount of parking constructed at new developments in the City, how this compares to bylaw requirements, and how parking is sold, rented and used.

In addition to statistics about the amount of parking required and provided, the analysis is informed by a GIS model that estimates the accessibility and amenity characteristics of development sites. Together, this helps evaluate factors that inform decisions by developers to build certain amounts of parking as well as the decisions by residents to own vehicles and parking spaces.

The analysis helps to answer questions about the possible outcomes of removing minimum parking requirements such as:

- How much parking is likely to be provided by developers at different types of projects and in different locations in the City, in the absence of minimum parking requirements?
- Does the amount of parking provided by developers today vary based on a project's context in a way that aligns with expected mobility needs and propensity to drive?
- How much parking will be purchased or rented by residents of different types of buildings and in different locations in the City?
- Are there situations where vehicle ownership may exceed the parking supply provided with or without minimum requirements?

3.1 Data Inputs

Several data sources were used for this part of our analysis:

- City of Vancouver development permit information.
- City of Vancouver surveys on vehicle ownership.
- ICBC vehicle registration data.
- Development and real estate industry input.
- Public GIS datasets.

3.1.1 City of Vancouver Development Permit Information

Our analysis of the amount of parking required and provided in recent development projects in the City of Vancouver is based on a sample of 71 new projects with a variety of tenures and building typologies as summarized in Table 1. Some projects include more than one tenure so the total (total including Downtown) sums to more than 71 projects.

Table 1 - Development Permit Data Sample Project Characteristics

Tenure	Lowrise (1-3 storeys)		Midrise (4 -9 Storeys)		Highrise (10+ Storeys)		Total # of Tenures within the 71 Projects*	
	Including Downtown	Excluding Downtown	Including Downtown	Excluding Downtown	Including Downtown	Excluding Downtown	Including Downtown	Excluding Downtown
Strata	21	21	16	16	10	5	47	42
Market Rental	3	3	10	9	1	0	13	12
Non-Market Rental	1	1	6	5	7	3	13	9
Total	25	25	32	30	18	8	73	63

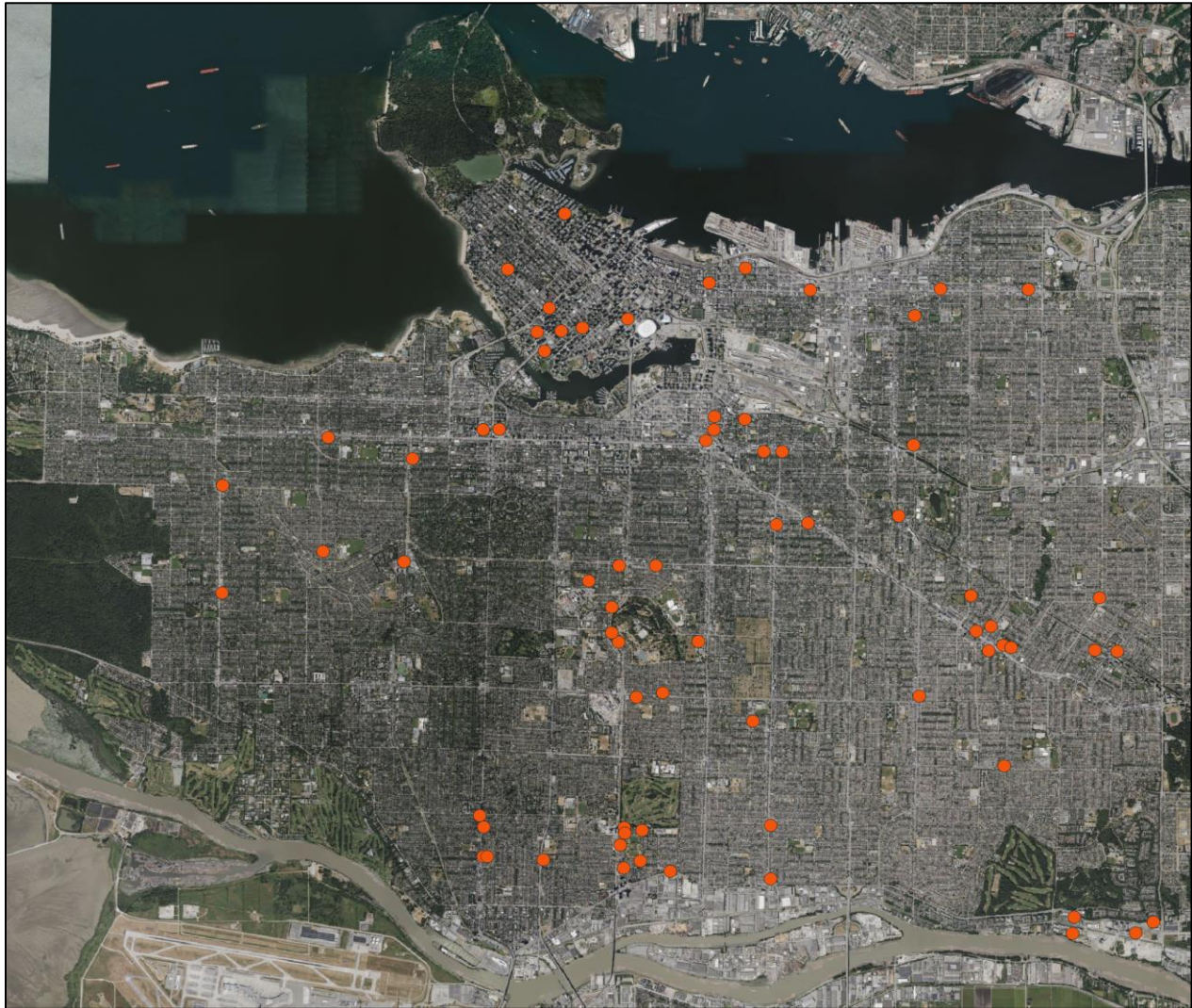
Note *: Data was examined for a total of 71 projects, but some projects include more than one tenure.

The data collected includes residential unit counts, parking supply counts, bylaw parking requirements, site areas, accessible parking supply counts, number of floors above and below grade, number of non-residential parking spaces, and other information. The amount of resident parking supply used for the analysis includes the physical number of parking spaces and excludes visitor parking spaces. For calculations related to physical parking supply, we counted each accessible parking space as one space, even though the City has a bylaw that permits double counting of accessible parking spaces in total parking counts. Where calculations relate to a variance from bylaw minimums, this double counting was included.

Project identifiers such as postal codes, addresses, permit number, and dates were also recorded. Postal codes were verified using the Canada Post online tool, since in many cases they differ from those on the original permit application.

The project locations are shown in Figure 1. Within this sample, 62 sites are located outside of Downtown and nine in Downtown. Outside of Downtown, only completed projects (i.e. not projects still under construction) were included in order to allow for collection of parking demand data for the current building residents.

Figure 1 - Development Permit Data Sample Project Locations



A separate dataset was also obtained from the City including information specific to Downtown developments approved after the 2018 parking bylaw changes went into effect. This sample included 10 residential projects of different tenures, some of which are included in the broader 71 project development permit sample data.

For non-market rental, the dataset included seniors rental, social housing projects, and micro-dwelling units/SRO replacement units.

3.1.2 City of Vancouver Transportation Panel Survey

City staff also provided data from the 2022 City of Vancouver Transportation Panel Survey, which includes information about vehicle ownership across the City for different tenures and building typologies. This data was adjusted by others based on census data to create a representative sample.

3.1.3 ICBC

The Insurance Corporation of British Columbia (ICBC) provided data on the number of vehicle registrations by postal code. This data was requested by City staff for the project sites which had unique building postal codes (i.e. postal codes which were not shared with other buildings that are not in our dataset).

This data allows estimation of the total number of vehicles parked at a site and the expected demand for parking. Commercial vehicles, and vehicles registered to an incorrect address are not included in this data. Despite these limitations and approximations, ICBC data is expected to be more accurate for estimating demand than manual counts within a parkade, since manual counts do not capture vehicles parked on street or off-site, and vehicles may not be present at the time the count takes place.

The dataset is limited, with potential for the registrations to underestimate the actual number of vehicles.

3.1.4 Development and Real Estate Industry Data

In addition to the datasets provided by the City and ICBC, we collected information from representatives of the development industry to understand parking demand factors at newer development projects. This data included development statistics, forms of development, and parking supply counts for 36 projects. For market and non-market rental development projects, information about parking pricing and the amount of parking rented was collected. For strata projects, information was collected about the current number of units and parking spaces sold, as well as pricing information where available for parking spaces that were unbundled from residential units.

Projects were generally completed in the past five years, although for rental developments some older (but modern) buildings were included.

In addition to this quantitative data, qualitative data was also collected which focused on parking supply decisions. This qualitative data is discussed in Section 6.0.

3.1.5 Public GIS Datasets

Public open data available through TransLink and the City of Vancouver were used to support our GIS analysis of parking relationships with local mobility and amenity factors.

TransLink's public dataset includes transit stop locations, and information about individual bus and train services.

The City of Vancouver's Open Data portal includes:

- Roads and lanes.
- Business licenses (including information on the type of business and location).
- School locations.
- Park locations.
- Community centre locations.
- Library locations.

3.1.6 Data Limitations

The projects datasets represent a subset of projects approved or completed within the last several years. The development industry is dynamic, with preferences and market conditions evolving. The development horizon for a new project often spans several years from identification of an opportunity to building occupancy.

Our data includes projects that have been completed in the last few years and which largely applied for development permits in 2016/2017. Since then, factors such as COVID-19, interest rate increases, market demand changes, construction cost inflation, and others, may impact more recent decisions made by those in the development industry, including decisions about parking supply at projects that are currently in the approvals process.

This work aims to demonstrate connections and relationships between factors that influence parking costs, supply, and demand in order to inform policy decisions around the removal of minimum parking requirements. However, the market factors that affect parking decisions are always evolving and some are difficult (or not possible) to anticipate.

3.2 Parking Required and Parking Provided at Recent Residential Developments

The amount of parking required and supplied at 71 new projects as reported in City of Vancouver development permit data was reviewed. We used this data to explore the relationship between parking requirements, parking supply, and project characteristics.

The data was analyzed in two different ways:

- First, project statistics were used to understand parking by tenure, building typology, and location.
- Second, projects were incorporated into a GIS model to explore relationships between parking supply, parking demand, and the mobility/amenity context of the project location (e.g., transit access, proximity to community amenities, and other neighbourhood characteristics).

This analysis provides insights into the observed outcomes of residential parking supply and demand in newer projects. The analysis also explores the impacts of certain factors which are known to influence parking demand and mobility generally, on the decisions to provide parking and on parking use.

3.2.1 Parking by Housing Tenure

The most significant pattern in both the amount of parking required and supplied is the variability by tenure:

- Looking at the data for the City as a whole (i.e. including sites in Downtown), more parking is constructed for strata housing than other forms of housing, with an average of 1.21 spaces per unit. Market rental housing includes approximately 0.65 spaces per unit, and non-market housing provides 0.35 spaces per unit.
- The results are similar whether sites in Downtown are included or excluded. Strata sites outside Downtown also provide an average of 1.21 spaces per unit while parking supplied at rental projects increases slightly with approximately 0.71 spaces per unit for market rental and 0.38 spaces per unit for non-market rental.

This tenure-based relationship is similar to the parking bylaw requirements for the different tenures, where strata parking requirements are typically higher than those for market and non-market rental. Bylaw

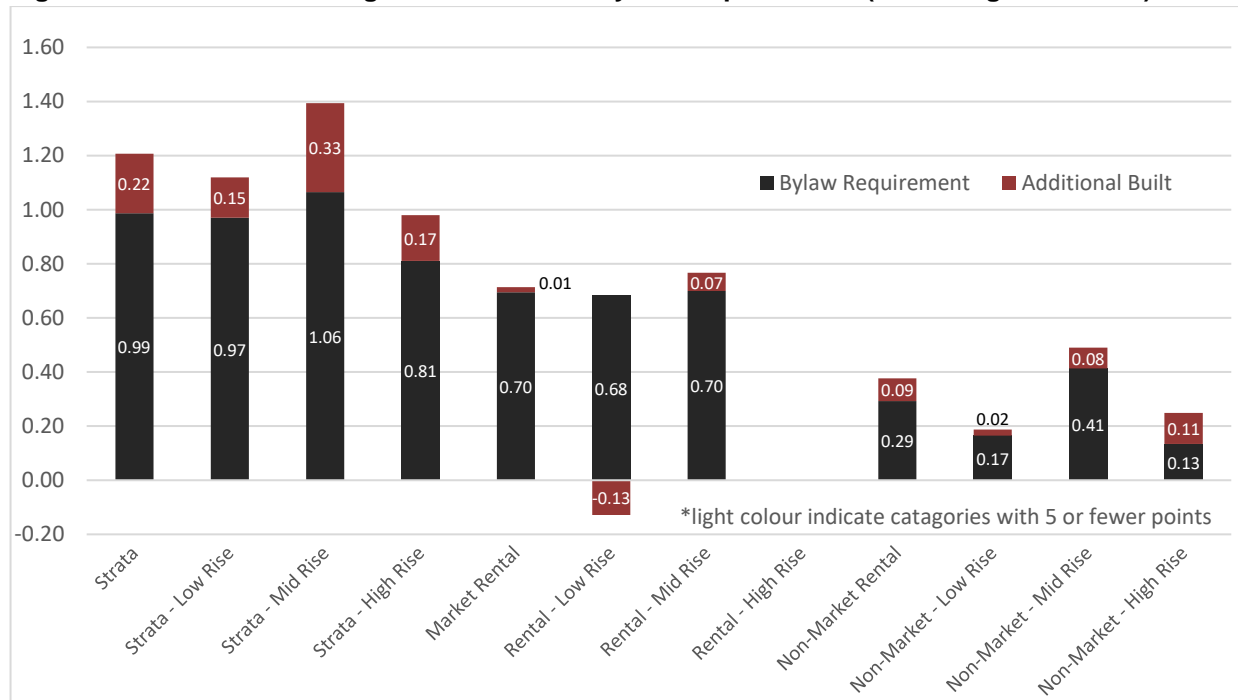
requirements at the projects we analyzed outside of Downtown are generally slightly lower than the number of parking spaces built, with the strata projects in the dataset requiring 0.99 spaces per unit, the market rental projects requiring 0.70 spaces per unit, and the non-market rental projects requiring 0.29 spaces per unit.

Generally, this data indicates that:

- There may be some strata projects where the minimum bylaw parking requirement is dictating the parking supply, but on average strata projects provide more parking than the bylaw requirement. So parking supply at strata projects is influenced by many factors, not just the bylaw requirement.
- The minimum parking requirement is an important factor in determining parking supply at market rental projects as the average supply is very similar to the bylaw requirement.
- For some non-market rental projects the bylaw minimum is dictating parking supply but not for other non-market projects.

Figure 2 shows the average project bylaw parking requirements by tenure and building typology (black), as well as the added (or in one case reduced) parking provided (orange)¹.

Figure 2 – Additional Parking Constructed vs. Bylaw Requirements (Excluding Downtown)



Since 2019, there have (generally) been no residential parking requirements in Downtown. However, some of the Downtown projects in our dataset were required to have parking stalls under the previous bylaw requirement (generally 1 space per unit or 1/140m²).

The results outlined above are on a project weighted basis, so small projects have an equal effect on the average as large projects. Therefore, we also examined the data on a per unit basis (i.e., the total number of spaces across all projects divided by the total number of units across all projects).

¹ Note that there are no highrise rental projects in our dataset, so Figure 2 does not include any figures for highrise rental.

- For strata projects outside Downtown, the average number of spaces per unit in the dataset is 1.15. This is lower than the 1.21 on a project average basis and indicates that, within the data sample, smaller projects tended to provide more parking per unit than larger projects (this may be due to higher parking per unit at townhouse projects).
- For rental and non-market projects outside Downtown, the average number of spaces per unit is 0.77 and 0.31 respectively versus 0.71 and 0.38 per unit on a project basis. This indicates that, within the dataset, smaller rental projects provide less parking, reducing the project weighted average while smaller non-market projects provide relatively more parking. This effect may be the result of some large non-market projects (near Downtown) providing very low parking ratios on a per unit basis, and the fact that none of the non-market projects in the dataset were very small (i.e. the non-market projects have a minimum of 25 units and an average of 97 units, versus the strata projects which have a minimum of 3 units and an average of 78 units, versus the market rental projects which have a minimum of 12 units and an average of 68 units).

In looking at the differences between required and provided spaces in projects located outside of Downtown, we can see that:

- Strata projects typically provide 22% more parking than required.
- Market rental projects typically provide 1% more parking than is required.
- Non-market rental projects typically provide 31% more parking than is required. However, this only amounts to 0.09 extra spaces per unit due to the low base requirements.

Said another way, for the projects we analyzed outside of Downtown:

- Strata projects provided an average of about 13 more parking stalls than required (with an average project size of about 63 units).
- Market rental projects provided an average of about 3 stalls more than required (with an average project size of 66 units).
- Non-market rental projects provided an average of 9 stalls more than required (with an average project size of 98 units).

3.2.2 Projects Providing Less than Bylaw Requirements

Most of the projects in the dataset were in the application process prior to the 2018 Parking Bylaw updates coming into effect, which formalized additional ways for projects to reduce parking (through TDM measures).

Prior to this, projects were able to provide car share vehicle(s) to enable reductions in parking. Some other sites were granted hardship relaxations, typically because of physical site constraints.

Projects in our dataset that provided less than the bylaw requirement are summarized in Table 2.

Table 2 – Projects Providing Less than Bylaw Requirements (Excluding Downtown)

	# of Sites	# Below Bylaw	Proportion Below Bylaw	Relaxed Spaces	Projects Providing TDM Measures
Strata	42	4	10%	-20	3
Market Rental	12	2	17%	-8	2
Non-Market Rental	9	2	22%	-7	2

Prior to implementation of the 2018 Parking Bylaw changes, the number of parking spaces reduced through car share or other relaxations appears to have been small compared to the overall parking provided. Only 35 spaces were relaxed compared to over 5,300 spaces provided. In comparison, in aggregate, about 21% more parking was approved than bylaw requirements across the sample set, or 682 spaces above the 3,173 stalls required.

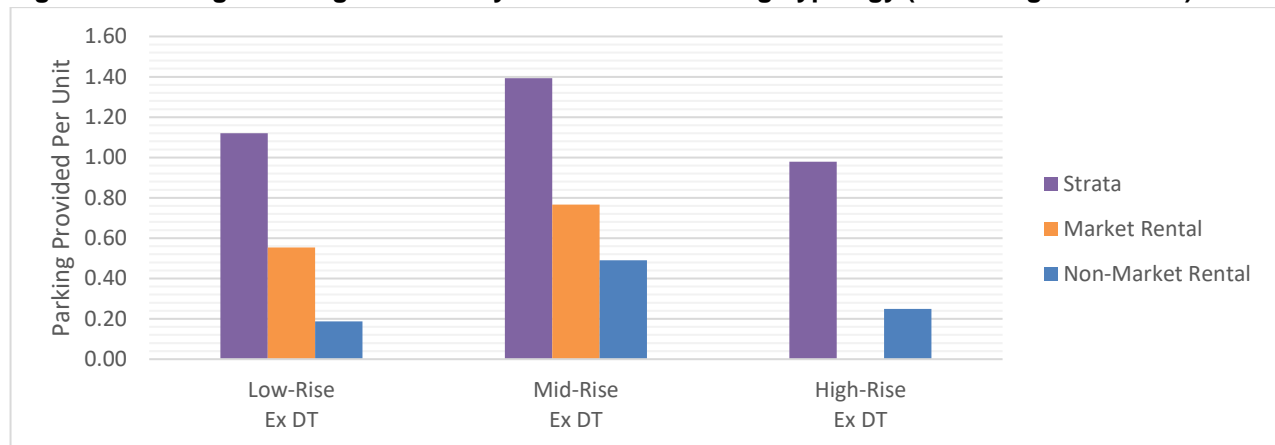
3.2.3 Parking by Building Typology

More parking is provided on a per-unit basis for midrise (4-9 storey) buildings across all tenures as shown in Figure 3 (note there are no highrise market rental projects in the dataset):

- Midrise strata and rental projects provide about 35% more parking in comparison to lowrise and highrise projects.
- Non-market projects provide about twice as much parking at midrise sites, although this is based on a small sample size.

This suggests that it is less economic to increase the parking per unit on smaller sites (often lowrise) and high-rise sites. For example, increasing parking may be challenging for smaller, low-rise (townhouse) sites due to constraints on lot area for at grade parking. For highrise projects, the costs for underground parking can increase with parkade depth, particularly if soils conditions are challenging.

Figure 3 - Average Parking Provided by Tenure and Building Typology (Excluding Downtown)



3.2.4 Adding Parking

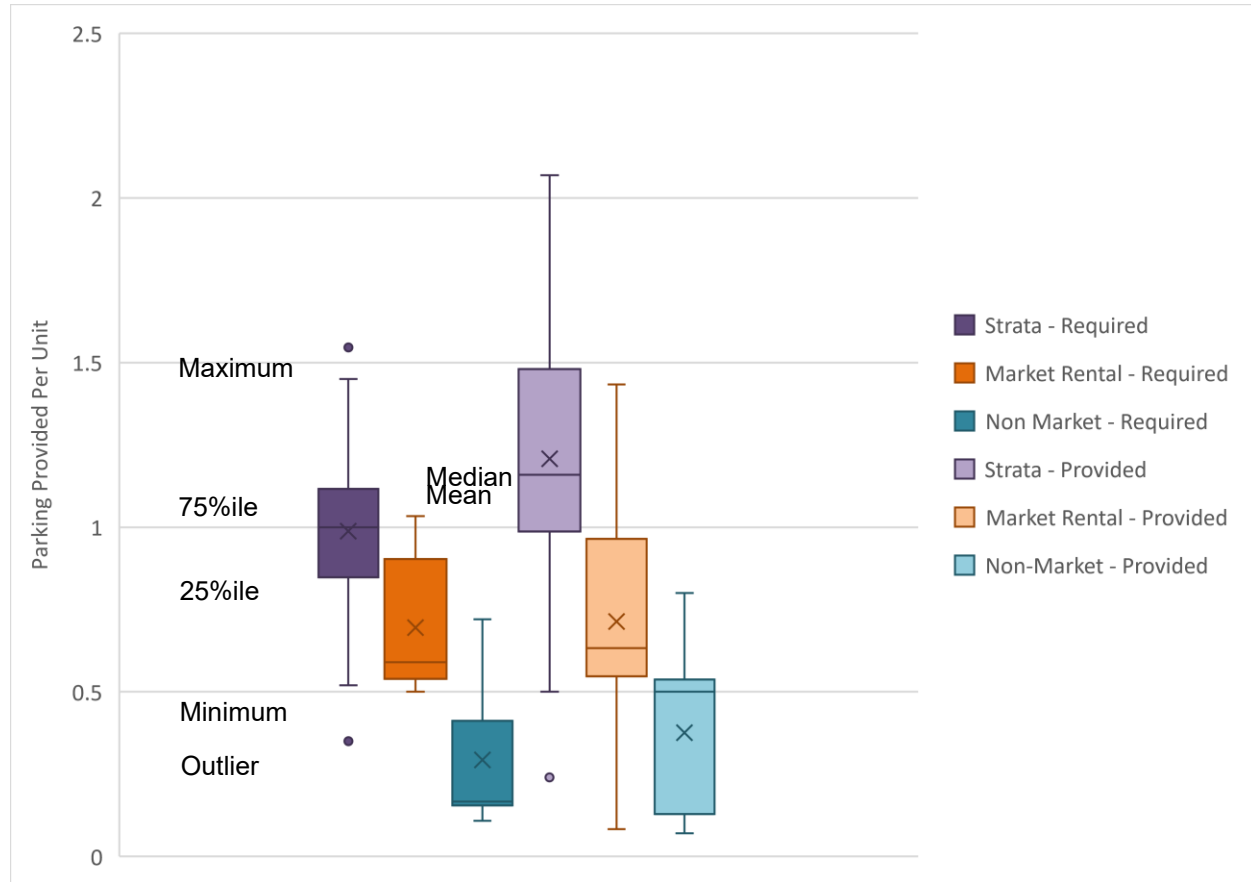
Providing an additional level of underground parking has significant fixed costs, such as added elevator stops, ramps, and building code exiting requirements. Because of this, developments tend to build out complete levels of parking (rather than partial levels).

Based on our analysis of the dataset, although parking is often provided above bylaw requirements, it is typically due to completing an underground parking level that is already needed to provide the number of required spaces under the bylaw. So this results in the lowest level of parking being a full level rather than a partial level.

3.2.5 Variability of Parking Required and Parking Supplied

In addition to variability between tenures, parking supply varies *within* tenures as well. The Interquartile Range (IQR) is the difference between the 25th percentile and 75th percentile of a dataset. It is valuable for understanding variability by focusing on the middle 50% of values making it less sensitive to outliers. Focusing on data from outside Downtown, the interquartile ranges for each tenure are 0.49 spaces per unit for strata, 0.42 for market rental, and 0.41 for non-market rental. This indicates that there is a similar and significant level of variability within parking supplied for each tenure. The box and whisker plot in Figure 4 shows the quartiles, mean, and median values for each tenure for required and provided parking.

Figure 4 - Variability of Parking Required and Provided Per Unit (Excluding Downtown)



As shown, the overall range of parking provided varies significantly from project to project. Some of the variability for the strata sites may be explained by differences in parking requirements in different parts of the City. For example, townhouse zones (e.g. RM-8) have different parking requirements than other forms of strata apartment development (e.g., C-2, and most CD-1 districts).

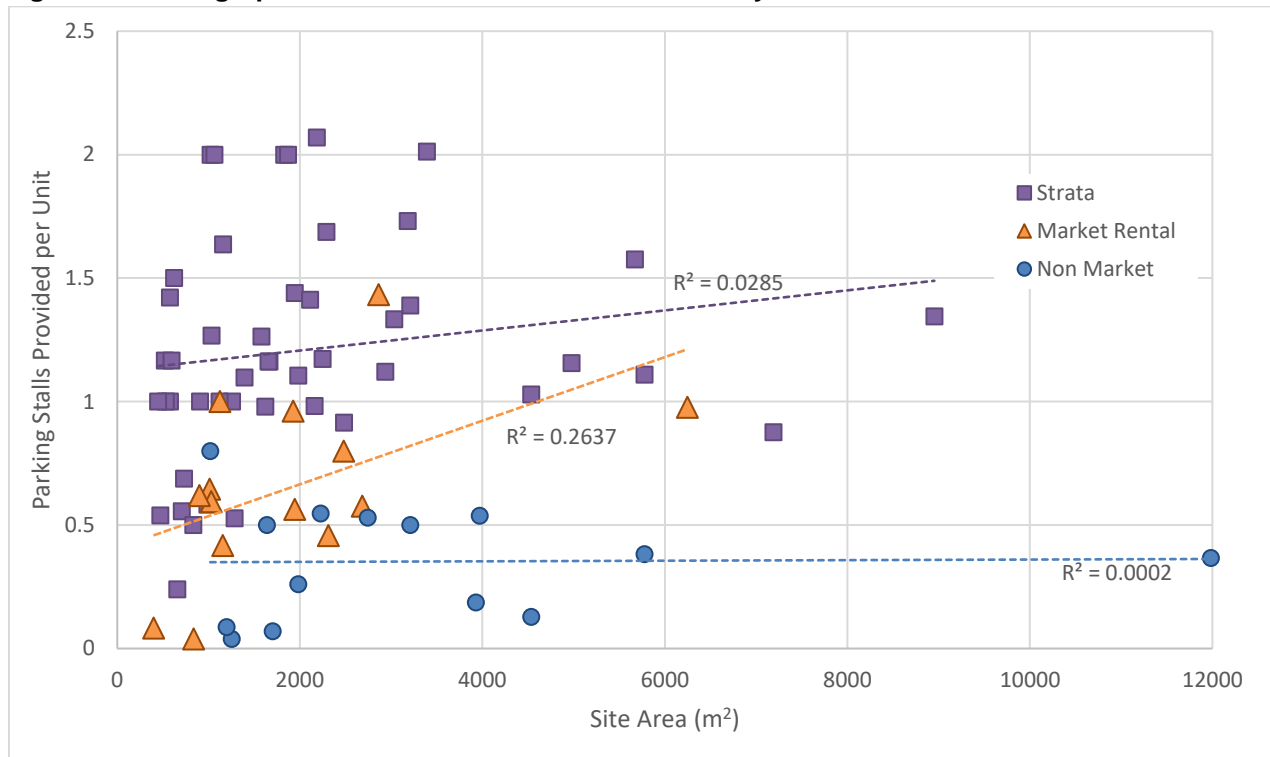
3.2.6 Impact of Site Size

Parking efficiency (i.e. the total parking area square footage per parking stall) has a significant influence on parking construction costs per space. So the efficiency of a parking layout affects the economics of providing additional parking.

Efficiency varies from site to site. For example, small sites² are typically constrained in the amount parking that can be provided per level, with ramping and circulation taking significant proportions of each level. So parking at smaller sites is usually inefficient and construction costs are relatively high per stall.

Figure 5 shows the relationship between parking provided per unit and total site size for each form of tenure.

Figure 5 - Parking Spaces Provided Per Unit vs. Site Area by Tenure



The chart shows that parking stalls provided per unit decreases at smaller sites for both strata and market rental projects, although the relationship is weak for strata. Some of the strata sites in the dataset provide high amounts of parking per unit on small sites; these are often townhouses or projects with small unit counts which is not the case for rental. Non-market rental projects do not show this relationship because parking requirements are lower overall and therefore are less impacted by site size.

3.2.7 Impact of Mobility Options and Neighbourhood Amenities

Neighbourhoods with high transportation accessibility, plentiful amenities, access to local services and jobs, and which are in close proximity to regional centres have been found to have lower parking demands. This observation has been linked to urban planning ideas such as 15-minute cities where people can accomplish their day-to-day activities without a car. This idea is also reflected in the City of Vancouver’s Climate Emergency Action Plan with the goal of “90% of Vancouver residents living within an easy walk or roll of their daily needs” by 2030.

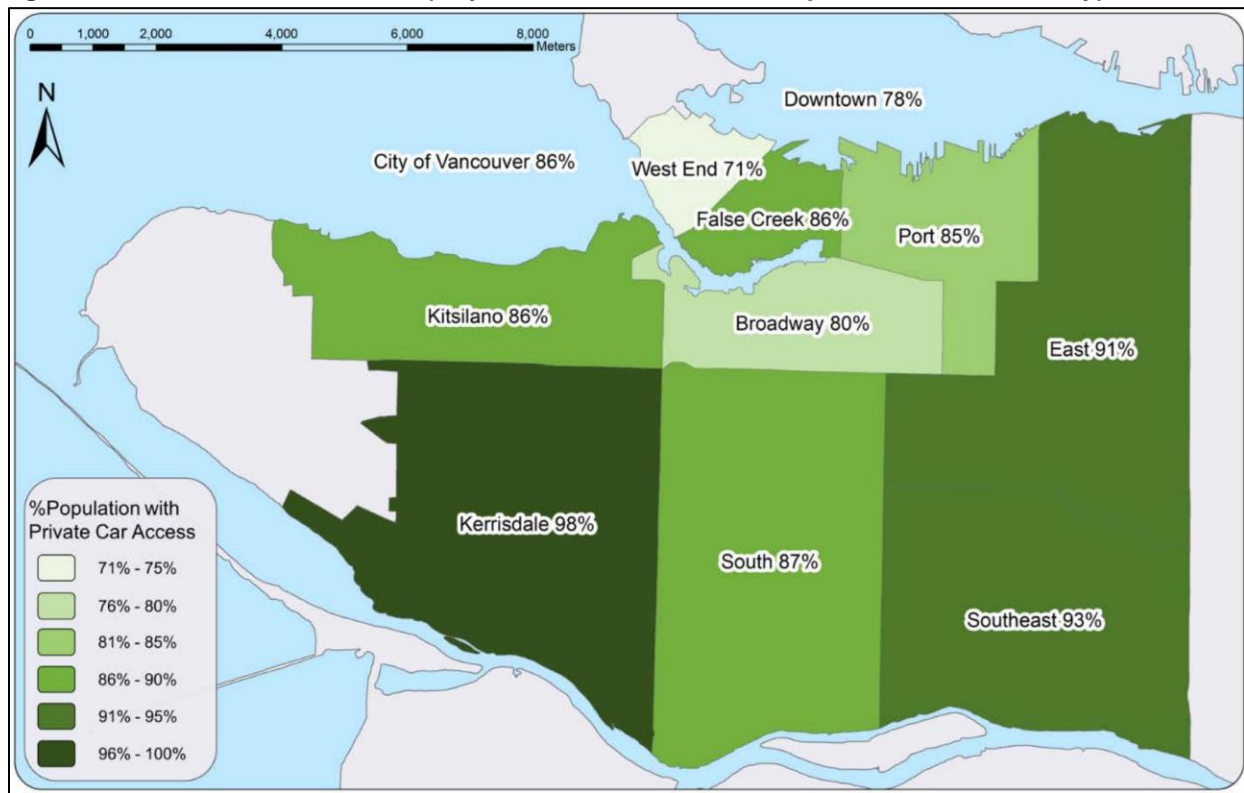
² There is no specific definition of a small site as the efficiency of the parking layout is influenced by the dimensions of the site and the number of parking levels required, not just the site size. Generally, for projects that require multiple levels of parking, a minimum site size of about 13,000 to 14,000 square is likely required for an efficient parking layout. However, sites larger than this can also be challenging if the required parkade is deep.

Prior work on compact urban design (supporting walkability and reduced auto use) highlights five factors, including: development density, land use diversity, street network design, destination accessibility, and distance to transit as important factors in evaluating neighbourhood accessibility and connectivity (Ewing & Cervero, 2010). These factors are often referred to as the “Five D’s”. In addition, demand management and demographics are sometimes also included in this list. Work by Ewing & Cervero (2017), as well as Tian, Park and Ewing (2019) demonstrates that dense urban neighbourhoods in the United States support reduced vehicle miles travelled (VMT’s) and reduced vehicle ownership.

Locations with compact urban design, including access to amenities and transportation are referred to as being “well-served”.

In Vancouver, the availability of personal vehicles (and therefore parking demand) varies across the City. This is evidenced by data from the 2019 City of Vancouver Transportation Panel Survey shown in Figure 6.

Figure 6 - Private Vehicle Access (City of Vancouver 2019 Transportation Panel Survey)³



A decreased need for parking in well-served locations is already acknowledged in City of Vancouver parking policies which do not require parking for most projects in Downtown and which reduce the parking requirements for commercial uses in denser locations along the Central Broadway corridor and Mt. Pleasant Industrial Area.

It is helpful to explore whether parking provided in new buildings aligns with the mobility and amenity context of those buildings and with the ability of residents to meet their daily needs without personal vehicles. Analyzing the relationship between mobility, amenity factors, and parking supply may help demonstrate that developers account for, implicitly or explicitly, accessibility and amenity factors in their parking supply

³ The City also conducted a 2020 Survey but the results may have been impacted by Covid-19, so the 2019 figures are used in Figure 6.

decisions today. If this is the case, then in the absence of minimum requirements, developers would be more likely to build more parking in less well-served areas and less parking in well-served areas. This also helps explore a key concern that eliminating parking minimums, that this might lead to developers not building “enough” parking.

Anecdotally, through the workshop with developers (see Section 6.0), and conversations as part of our research, developers expressed interest in building less parking in locations with excellent transit (such as near SkyTrain Stations).

Our GIS and data analysis tests whether transportation factors likely influence parking supply decisions for development projects.

3.2.7.1 Approach to GIS Analysis

The development permit dataset for 71 recent projects in the City of Vancouver was analyzed to understand the relationship between parking supply and mobility/amenity factors within 400m and 800m walking distance from each of the sites.

Transit Service - Transit stop location information and schedules were used to determine the number of individual transit service events each weekday for each stop (the number of Services), including SkyTrain. For each site, the number of Services within 400m, about a 5 minute walk, and 800m, about a 10-minute walk, were aggregated. The number of Services was used rather than the proximity to bus stops or the TransLink Frequent Transit Network since it more completely reflects the level of transit service available near a location, and since most places in Vancouver are within walking distance of transit (the Frequent Transit Network or FTN).

Rapid Transit Service - The number of rapid transit stops within 800m was assessed in addition to the total number of transit Services in order to account for the outsized impact higher order transit may have on vehicle ownership. This included SkyTrain stations but not “R” lines (rapid bus).

Services and Jobs - Business License information was broken down based on license type to remove licenses associated with residential uses (such as business licenses required for leasing a single-family home to tenants). Licenses associated with retail and service businesses were further separated from other businesses. The number of retail and service business licenses within a 400m and an 800m distance of a site was used to estimate daily shopping needs within walking distance. As a separate measure, the total number of non-residential business licenses provides an indication of the number of jobs available and a measure of land use diversity.

Civic Facilities - The total number of schools, libraries, community centres, and parks was combined to provide an estimate of access to community amenities.

Proximity to Downtown - The driving distance between each site and Downtown was determined and used to provide an indication of access to jobs and regional amenities beyond walking distance. For the purposes of the analysis, the intersection of Burrard Street at Georgia Street was used to represent the centre of Downtown.

Local Network Connectivity - The land area that is accessible within an 800m walk of each site was assessed as an indicator of the site’s connectivity to the local area. A highly connected network is associated with lower auto use.

It is expected that sites that offer more accessibility, proximity to Downtown, more transit service, and proximity to more businesses and civic amenities would have lower automobile use and, therefore, lower parking needs. However, since there are many factors that influence parking supply and demand, it is not

expected that these mobility and amenity factors alone will predict the variability in parking across developments (meaning high correlation). However, even a low level of correlation would indicate that in the absence of parking minimums, developers would likely make rational decisions about the amount of parking to provide, with more parking in relatively less accessible locations, and less parking in relatively more accessible locations.

R^2 is a statistical measure of correlation between variables. We used R^2 thresholds of 0.10 or greater to indicate some influence of a variable on parking supply, R^2 of 0.05 to 0.10 to indicate a weak relationship, and R^2 of less than 0.05 to indicate no relationship. These R^2 thresholds are useful in identifying a level of influence between parking supply and each variable where it is well understood that many factors play a role. Importantly, these variables are not intended to predict parking supply in individual developments, but to demonstrate the average impact these neighbourhood variables should have on parking supply.

3.2.7.2 Results of Analysis

Strata Projects

In general, strata parking supply exhibited a relationship with transit and civic facilities, but not with other variables:

- Transit service - Negative⁴ relationship at 800m but a weaker negative relationship at 400m.
- Business licenses - No relationship.
- Retail and service business licenses - No relationship.
- Civic facilities - Negative relationship, though stronger at 400m than 800m.
- Distance to Downtown - No relationship.
- SkyTrain stations within 800m - No relationship.
- Area of 800m walk - No relationship.

Strata parking supply seems to be insensitive to most of the amenity and mobility factors tested. Transit service and nearby civic amenities were most influential over strata project parking supply.

It is notable that of the 42 strata projects analyzed outside of Downtown, there were only six sites that provided less than about 0.85 spaces per unit. Each of these projects is built on a smaller site (less than about 13,000 square feet in area). This indicates that regardless of location factors, strata developers typically provide at least about 0.85 spaces per unit, unless there are other site constraints (such as site size or another constraint). This is the case in Downtown as well.

Market Rental Projects

Market rental parking supply exhibited relationships in line with expectations for several variables. The relationships were stronger than for the strata sites:

- Transit service - Negative relationship at 400m and 800m.
- Business licenses - Negative relationship at 400m and 800m.
- Retail and service business licenses - Negative relationship at 400m and 800m.

⁴ A negative relationship means that less parking was provided at projects near transit.

- Civic facilities - Negative relationship at 400m and 800m.
- Distance to Downtown - No relationship.
- SkyTrain stations within 800m - No relationship.
- Area of 800m walk - Negative relationship.

Parking supply at rental sites appears to be influenced by accessibility to transit and other amenities.

Non-Market Rental Projects

Non-market rental parking supply generally exhibited relationships in line with the expected relationships. The relationships were typically stronger than for strata or market rental:

- Transit service - Negative relationship at 400m and 800m.
- Business licenses - Negative relationship at 400m, weaker at 800m.
- Retail and service business licenses - Negative relationship at 400m, weaker at 800m.
- Civic facilities - Negative relationship at 800m but no relationship at 400m.
- Distance to Downtown - Positive relationship.
- SkyTrain stations within 800m = No relationship.
- Area of 800m walk shed - No relationship.

Parking supply at non-market sites appears to be influenced by transit access and neighbourhood amenities, as well as distance to Downtown.

Overall, our analysis indicates that parking supply is influenced by mobility and amenity factors, especially in rental buildings. The level of relationship is not strong enough to predict the parking supply that would likely occur in the absence of parking minimums; however, in aggregate, it provides an indication that developers are more likely to provide more parking in areas with less accessibility and fewer amenities. This is especially the case for market and non-market rental projects. Average parking provided for these tenures in Vancouver is already much lower than for strata projects, which may partially explain the sensitivity to location.

Figures 7 to 17 on the following pages summarize the analysis.

Figure 7 – Parking Supply vis Transit Services within 400m

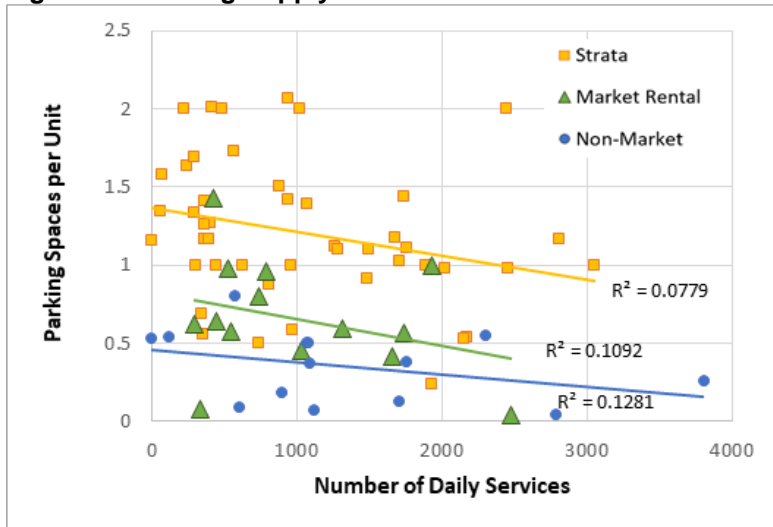


Figure 8 – Parking Supply vs Transit Services within 800m

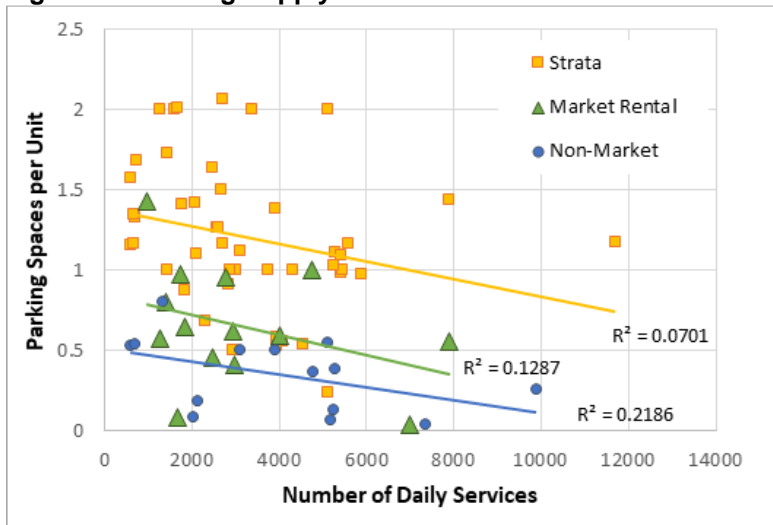


Figure 9 – Parking Supply vs Retail Businesses within 400m

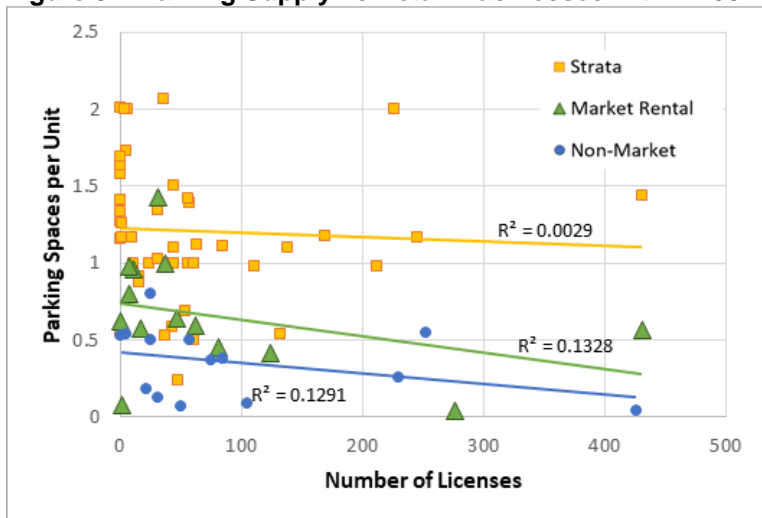


Figure 10 – Parking Supply vs Retail Businesses within 800m

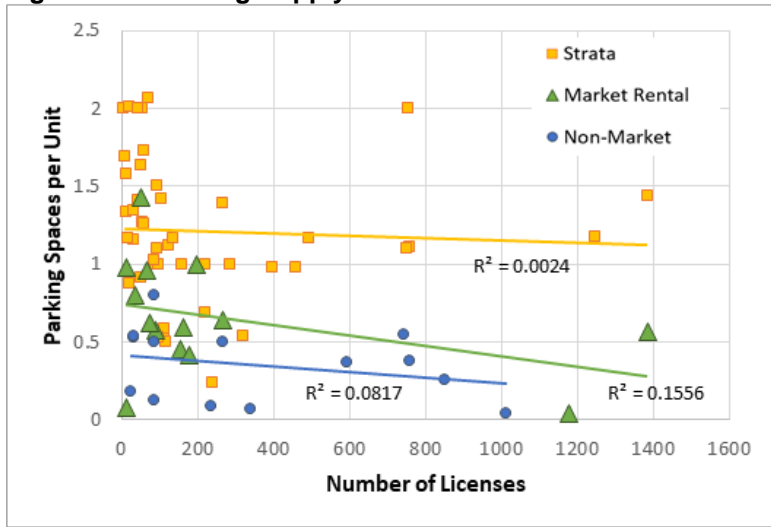


Figure 11 – Parking Supply vs Businesses within 400m

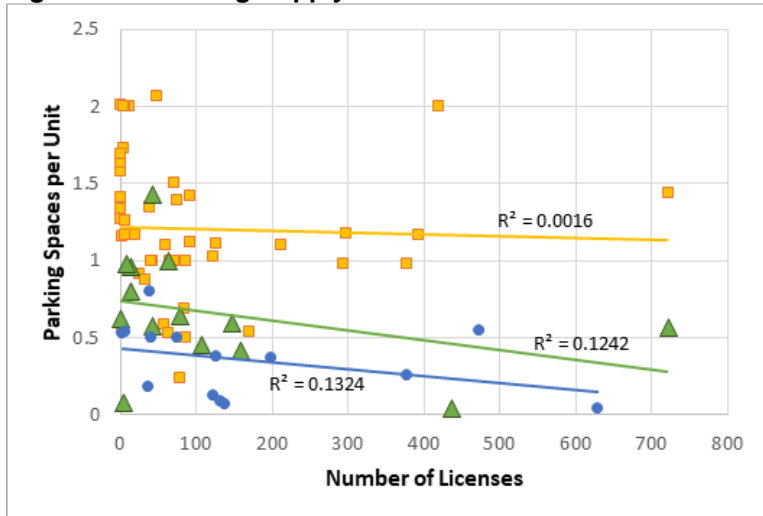


Figure 12 – Parking Supply vs Businesses within 800m

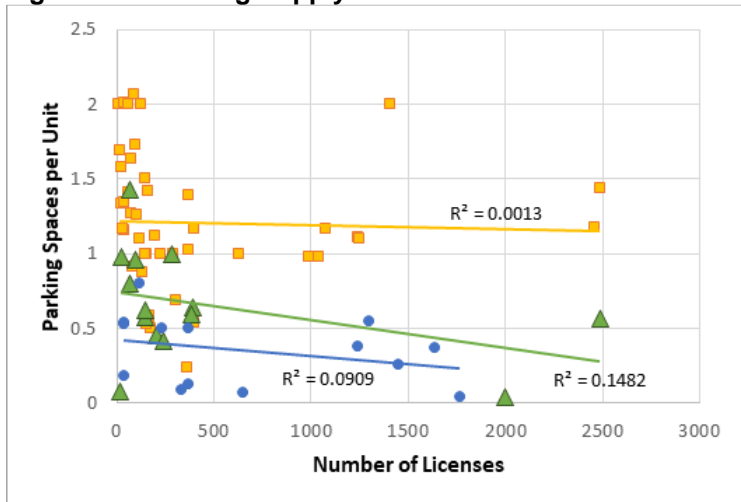


Figure 13 – Parking Supply vs Civic Facilities within 400m

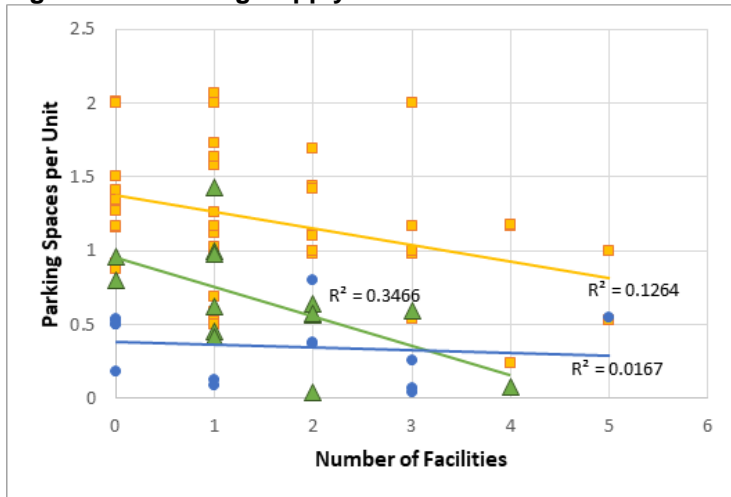


Figure 14 – Parking Supply vs Civic Facilities within 800m

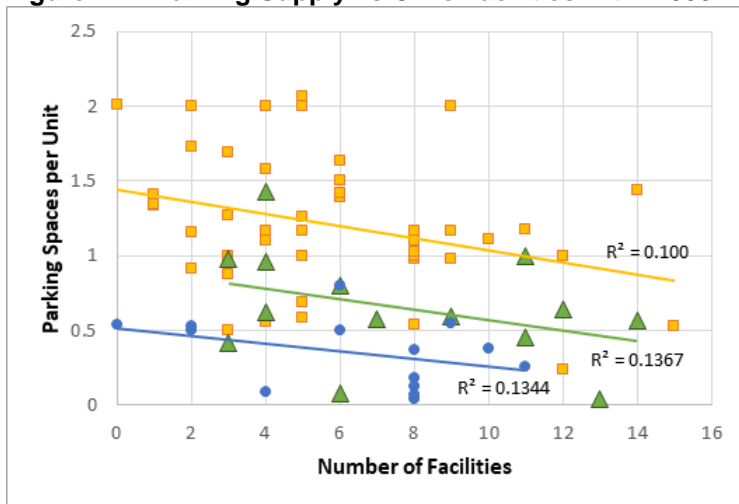


Figure 15 – Parking Supply vs Distance to Downtown

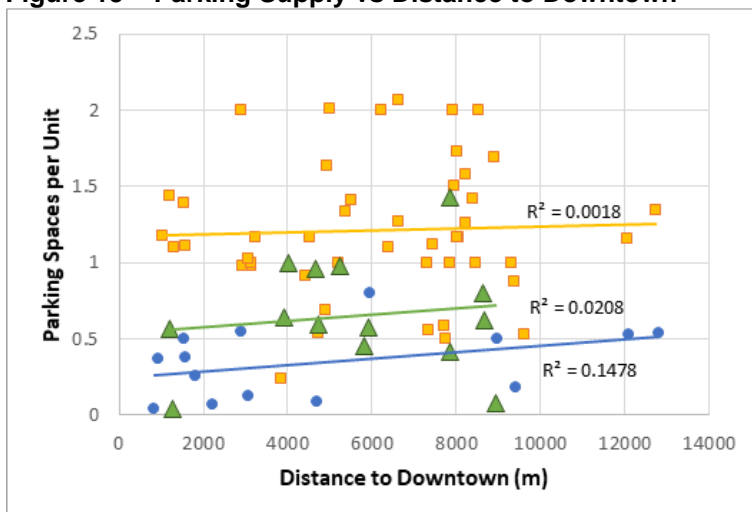


Figure 16 – Parking Supply vs 800m Walk

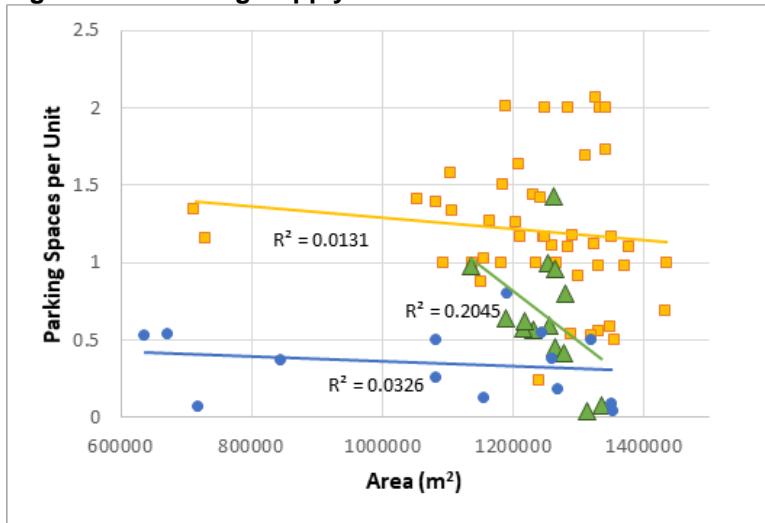
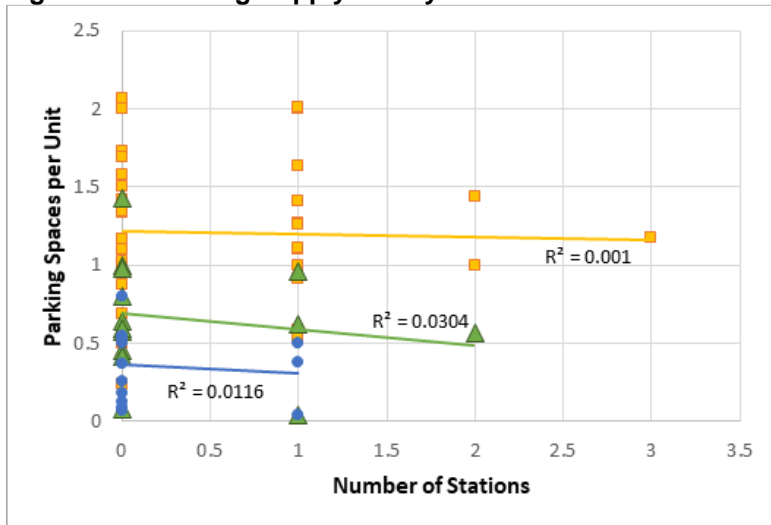


Figure 17 – Parking Supply vs Skytrain Stations within 800 m



3.3 Observed Impacts of Removing Minimum Parking Requirements Downtown

While there have been a limited number of residential projects approved in Downtown under the new 2018 Parking Bylaw (which eliminated minimum parking requirements in Downtown), some conclusions can be drawn from the projects that have been issued development permits.

Based on data provided by the City, a total of ten development permits have been issued since the 2018 Parking Bylaw requirements came into effect. These applications were submitted between January 2019 and September 2021. These projects include 1,301 residential units as summarized in Table 3 below. Some projects include more than one tenure.

Table 3 - Parking Provided Downtown with Zero Minimums in Place

Tenure	Projects containing each tenure	Units	Parking Spaces	Spaces/Unit
Strata	4	594	685	1.15
Market Rental	3	83	0	0
Non-Market Rental	6	624	34	0.09

The amount of parking provided at strata projects (or in the strata component of projects with more than one tenure) is similar to before the bylaw change. The strata parking provision of 685 total spaces is still above the theoretical pre-2019 bylaw requirement of 466 spaces.

The relatively constant strata parking rate aligns with observations of strata parking provided City-wide, which is typically about 22% above the minimum requirements and relatively insensitive to a site's location characteristics.

Parking provided for rental and non-market housing decreased substantially relative to pre-2019 requirements of 1 space/140m² for rental and 0.17 to 0.5 spaces per unit for social and non-market housing (depending on type non-market housing).

Both market and non-market rental projects are sensitive to a site's mobility and amenity context. Sites located in Downtown offer excellent access to amenities as well as many mobility options. So the low parking ratio at these rental projects is consistent with this relationship.

3.4 Indicators of Parking Demand

3.4.1 ICBC Data

Data from ICBC was obtained for a subset of 36 projects in our dataset that are outside of Downtown and have unique postal codes. Data was limited due to differences in postal codes included in the ICBC database and the Canada Post database. Based on the data available:

- Vehicle registrations in non-market buildings (7 projects) averaged 0.39 per unit, which is about 14% higher than supplied on-site parking spaces for those projects. About 57% of sites undersupplied parking.
- Vehicle registrations in rental buildings (7 projects) averaged 0.55 per unit, which is about the same as the average supplied on-site parking spaces for those projects. However, about 48% of projects had more registered vehicles than parking spaces.

- Vehicle registrations in strata buildings (17 projects) averaged 0.66 per unit, which is about 27% lower than supplied on-site parking spaces. Only about 9% of projects had more registered vehicles than parking spaces.

This ICBC data should be used with caution since it is based on a small sample size. However, it suggests that:

- There number of vehicle registrations for market rental projects is similar to the parking supply. However, the data suggests that parking supply may not meet demand for some sites under existing conditions. Residents of some market rental buildings may rely on on-street parking, which is usually unpriced or relatively less expensive compared to renting a parking stall.
- There is a relatively high number of vehicle registrations for non-market rental projects compared to parking supply. This suggests that parking supply may not meet demand for some sites under existing conditions. Residents of some non-market rental buildings may rely on on-street parking, which is usually unpriced or relatively less expensive compared to renting a parking stall.
- Parking demand at strata projects is only slightly higher than at market rental projects (about 0.11 stalls per unit). However, based on all other indicators that we reviewed, these strata registration numbers appear to be low and may not be reliable. There are a few possible reasons for this:
 - A significant share of strata units in Vancouver are occupied by renter households (which have a lower vehicle ownership rate than owner households). A high share of renters in strata building would likely reduce the number of vehicle registrations in a strata building.
 - Some projects in the dataset were recently completed, so some units may not yet be occupied.
 - Some projects in the data set were recently completed and the new residents may not yet have changed their vehicle registration address after moving into the building.
- There is a significant amount of variability in non-market rental parking demand between projects.

3.4.2 Vehicle Ownership

The 2022 City of Vancouver Transportation Panel Survey dataset includes information about the number of vehicles owned per household, as well as the proportion of households with vehicles. Table 4 below summarizes that information.

Table 4 - Vehicle Ownership Per Household by Tenure and Building Typology

	Apartment in a Highrise (5+ floors)	Apartment in a Lowrise (1-4 floors)	Rowhouse or Townhouse	Overall, Including Single family Homes and other Ground Oriented Homes
Renter Households	0.56	0.67	1.32	0.71
Owner Households	0.95	0.99	1.36	1.20

This survey data shows that owner households have significantly more vehicles per household than indicated by the ICBC registration data for strata buildings (Section 3.4.1).

Note that in this dataset, renter households may live in strata buildings and rent on the secondary market. Since renter households own fewer vehicles across all building typologies, and because some renter households may live in strata buildings, the actual parking demand in strata buildings is likely less than for owner households generally.

In apartment buildings, owner households typically own about 50% to 70% more vehicles than renter households.

Table 5 below further breaks down the vehicle ownership data by nine Transportation Zones across the City. The Transportation Zones are shown in Figure 18 along with City of Vancouver neighbourhoods.

Figure 18 – Transportation Analysis Zones with Neighbourhoods

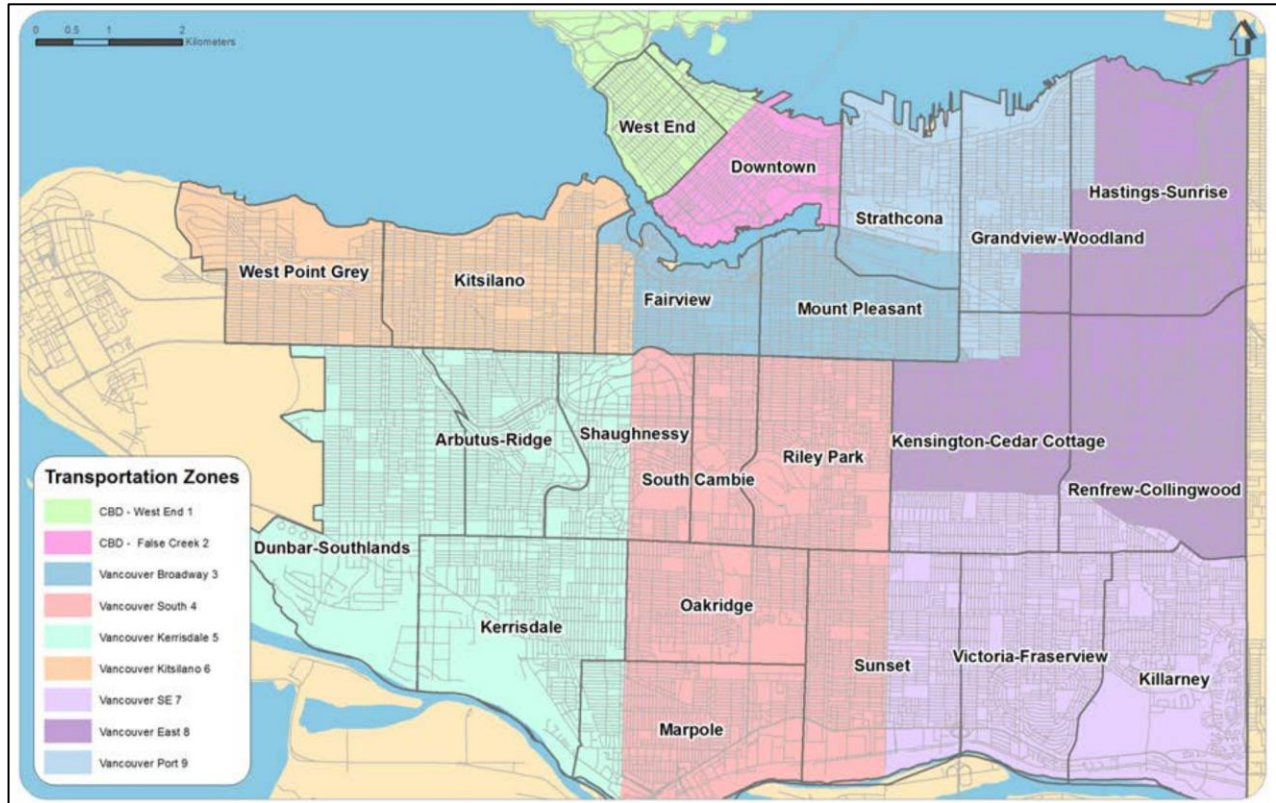


Table 5 – Vehicle Breakdown by Neighbourhood

Analysis Zone	Tenure	Highrise (5+ floors)	Lowrise (1-4 floors)	Rowhouse or Townhouse
CBD – West End	Renter Households	0.55	0.40	0.00
	Owner Households	0.94	0.83	1.31
CBD – False Creek	Renter Households	0.44	0.31	-
	Owner Households	0.99	1.00	1.09
Broadway	Renter Households	0.53	0.74	0.87
	Owner Households	0.95	1.04	1.21
South	Renter Households	0.63	0.65	1.16
	Owner Households	0.86	1.05	1.26
Kerrisdale	Renter Households	1.00	0.79	1.00
	Owner Households	1.26	0.96	1.00
Kitsilano	Renter Households	0.85	0.68	1.14
	Owner Households	1.00	0.99	1.51
Southeast	Renter Households	0.83	0.61	1.42
	Owner Households	1.07	1.17	1.50
East	Renter Households	0.65	1.13	1.13
	Owner Households	0.79	1.00	1.41
Port	Renter Households	0.46	0.51	2.02
	Owner Households	0.43	0.79	1.22

Bolded cells are less than 10 samples. Most data for rowhouse or townhouse is based on a relatively small sample size and therefore may not be reliable.

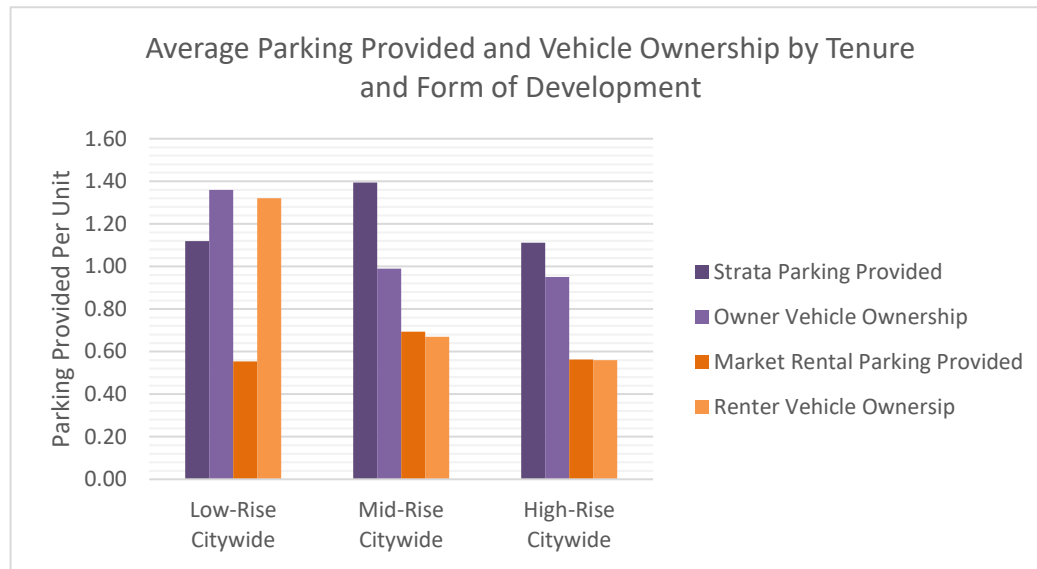
For all analysis zones with more than 10 samples, renter households own fewer vehicles than owner households.

Based on this data:

- Vehicle ownership for strata is below the rate of parking provided.
- Rental household vehicle ownership is similar to (or slightly lower than) the amount of parking provided in rental buildings (other than in townhouse projects – however, there are very few new rental townhouse projects in the City).

Figure 19 compares city-wide average parking provided and vehicle ownership data for different tenures and forms of development. Note that the definitions for tenures and forms of development vary between the datasets for parking provided and vehicle ownership. However, the resulting comparison is still illustrative of the relative differences between parking supply and demand across tenures and forms of development.

Figure 19 – Vehicle Ownership by Tenure and Form



3.4.3 Institute of Transportation Engineers (ITE) Data

The Institute of Transportation Engineers publishes the Parking Generation Manual (5th Edition) provides peak parking generation rates for a variety of residential uses for different land use contexts. Table 6 summarizes some of the relevant peak parking generation rates by type of location.

Table 6 - Average Parking Per Unit For Selected Residential Uses (ITE Parking Generation Manual, 5th Ed.)

ITE Land Use	General Urban/Suburban (no nearby rail transit)	Dense Multi-Use Urban (no nearby rail transit)	Dense Multi-Use Urban (<800m / ½ mi. to rail transit)
220 – Multifamily Housing (Low-Rise) (1-2 Levels)	1.21	0.76	0.58
221 – Multifamily Housing (Mid-Rise) (3-10 Levels)	1.31	0.90	0.71
222 – Multifamily Housing (High-Rise) (>10 Levels)	0.98	0.55	0.44
223-Affordable Housing	0.99	0.53 (No separate rate for rail provided)	

The ITE data comes from across North America, but primarily from the United States. This data supports the conclusion that parking demand is materially lower in denser, more urban neighbourhoods, and in locations close to transit.

3.4.4 Data from Development Projects

As outlined earlier, we obtained data from developers about the number of parking stalls supplied, parking demand, and pricing at a sample of recently completed development projects in Vancouver. This section summarizes the data by building tenure.

3.4.4.1 Market Rental Projects

Data about the number of parking stalls rented to tenants at rental buildings was collected from building owners to understand parking demand and pricing. This data is summarized in Table 7.

Table 7 - Parking Rental Data for Market Rental Projects

	# of Sites	# of Units	# of Parking Spaces	# of Parking Spaces Rented	Overall Rented Spaces per Unit	Average Price per month	Current Price per month	Proportion of Buildings with Vacant Stalls
Citywide	12	2,057	1,847	1,102	0.54	\$137	\$146	100%
Excluding Downtown	6	824	702	565	0.69	\$140	\$149	100%
Downtown	6	1,233	1,145	537	0.44	\$133	\$143	100%

Occupied parking in rental buildings is much higher outside of Downtown than in Downtown. Outside of Downtown, occupied parking averages about 0.69 stalls per unit at rental buildings. In all cases parking supply exceeded demand at these specific projects. However, demand closely matches parking supply on average across all of the market rental projects we reviewed outside of Downtown. The implied rate of vehicle ownership indicated in this data is higher than in the ICBC vehicle registration data for rental buildings but similar to the panel survey data for renter households.

Market rents for parking stalls average about \$145 to \$150 per month⁵, or about \$1,800 per year. Parking stall rents appear to be increasing as the reported current rates are higher than the average rates.

3.4.4.2 Non-Market Rental Projects

Data about the number of parking stalls rented to tenants at non-market rental buildings was collected from building operators to understand parking demand and pricing. The data was obtained from three projects, all of which are located outside of Downtown. This data is summarized in Table 8.

Table 8 - Parking Rental Data for Non-Market Rental Projects

	# of Sites	# of Units	# of Parking Spaces	# of Parking Spaces Rented	Overall Rented Spaces per Unit	Average Price per month	Current Price per month	Proportion of Buildings with Vacant Stalls
Outside Downtown	3	307	96	88	0.29	\$50	\$50	33% Note 2/3 have a waiting list

Demand for parking spaces in non-market rental appears to exceed supply in most cases based on this small sample of sites. Occupied only parking averages about 0.29 stalls per unit but 2 out of 3 projects have a waiting list (although parking rent rates are low).

⁵ These rents are for stalls at newer rental projects with underground parking. Parking rents can be lower at older rental buildings and at buildings where the parking stalls are not in an enclosed structure. Also, parking rents can be lower in locations where there is a large supply of low cost or unregulated on-street parking.

3.4.4.3 Strata Projects

Sales information for parking spaces at 21 recently completed strata projects across the City was obtained from developers and real estate professionals. This information is summarized in Table 9.

Table 9 - Parking Data for Strata Projects

	# of Projects	Total # of Units	Total Sold Spaces	Spaces Bundled	Spaces Sold Separately	% Unbundled	Average price of Unbundled Spaces
Citywide	21	1,466	1,698	1,576	122	7%	\$43,865
Excluding Downtown	17	1,127	1,252	1,154	98	8%	\$40,321
Downtown	4	522	446	422	24	5%	\$58,333

While the vast majority of parking spaces are sold bundled with a residential unit, about 7% of spaces at these projects were sold separately, with an additional charge to the unit buyer. On average across the entire City, the price per stall at these projects was about \$44,000. Outside of Downtown the average was about \$40,000 per stall with most priced between about \$32,000 and \$62,000.

The unbundled spaces that were sold separately often represent a second (or third) parking space for a unit and may not reflect the value of the first space for the unit (or the value of spaces sold on the secondary market after completion of a project).

4.0 Parking Construction Costs

To help determine the cost of building parking and the potential savings associated with parking reductions, we examined the cost of building parking in a variety of different types of residential projects in Vancouver, including:

- Highrise apartment projects.
- 4 to 6 storey apartment projects.
- Townhouse projects with underground parking.
- Townhouse projects with at grade garage parking.

For the parking cost analysis, we selected six projects that were recently completed in Vancouver. For each project type, BTY estimated the cost for three different parking scenarios:

- A base case scenario that matches the actual amount of parking constructed⁶ (and is consistent with bylaw requirements). For these scenarios, the parking is equivalent to between 1.0 and 1.6 stalls per residential unit (including visitor parking). For the apartment scenarios, the parking cost estimates also include the cost to build other service areas that are typically included in the underground parking levels such as bicycle parking, loading, storage units, mechanical rooms, and pedestrian circulation areas (such as elevator lobbies). So the overall parking cost estimates include the cost of the parking (stalls and drive aisles) as well as the other service areas included in the parkade levels.
- A scenario that assumes about 0.6 parking stalls per residential unit plus visitor parking, accessible parking and the service areas (similar to typical rental apartment ratios).
- A scenario that assumes a minimal amount of parking. This varies across each project, but typically only includes a small amount of resident parking (if any) plus the visitor and accessible parking requirements as well as the service areas. This typically still results in at least one level of parking. The exception is the townhouse scenarios that we evaluated which include no underground parking areas in this scenario.

The cost of constructing parking can vary based on site size and depth of the parkade, so the six projects selected include larger sites and smaller sites with differing numbers of parking levels, ranging from 1 level to 8 levels (plus one site that has grade level garage parking).

Table 10 summarizes the key assumptions for each parking scenario at each of the six sites.

⁶ One of the six projects is a market rental project with about 0.6 stalls per unit. For this site, our base case scenario assumes 1.1 stalls per unit which is similar to parking provided at strata apartment projects. The actual parking provided (0.6 stalls per unit) is then examined in the reduced parking scenario.

Table 10 - Parking Scenarios Tested

1 - Highrise (larger site)	Parking Stalls	Parking Area (sf)	Service Areas (sf)	Total Parking Area (sf)	Parking Levels
Scenario 1	254	91,330	25,970	117,300	4
Scenario 2	136	56,150	25,970	82,120	3
Scenario 3	47	22,410	25,970	48,380	2
2 - Highrise (smaller site)	Parking Stalls	Parking Area (sf)	Service Areas (sf)	Total Parking Area (sf)	Parking Levels
Scenario 1	238	92,940	25,730	118,670	8
Scenario 2	160	63,130	25,730	88,860	6
Scenario 3	40	18,415	25,730	44,145	3
3 – 6 Storey (larger site)	Parking Stalls	Parking Area (sf)	Service Areas (sf)	Total Parking Area (sf)	Parking Levels
Scenario 1	189	66,010	14,920	80,930	2
Scenario 2	91	37,110	14,920	52,030	1.5
Scenario 3	19	9,380	14,920	24,300	1
4 – 6 Storey (smaller site)	Parking Stalls	Parking Area (sf)	Service Areas (sf)	Total Parking Area (sf)	Parking Levels
Scenario 1	54	25,385	6,325	31,710	3
Scenario 2	35	17,080	4,350	21,430	2
Scenario 3	11	6,800	4,350	11,150	1
5 – Townhouse (underground parking)	Parking Stalls	Parking Area (sf)	Service Areas (sf)	Total Parking Area (sf)	Parking Levels
Scenario 1	26	9,940	1,080	11,020	1
Scenario 2	11	5,220	1,080	6,300	0.5
Scenario 3	2	780	0	780	0
6 – Townhouse (garage parking)	Parking Stalls	Parking Area (sf)	Service Areas (sf)	Total Parking Area (sf)	Parking Levels
Scenario 1	4	627	0	627	0
Scenario 2	2	418	0	418	0
Scenario 3	0	0	0	0	0

The BTY cost report is included in the Attachments. This section summarizes the key implications from the cost report, including:

- The cost of parking construction (per stall).
- The cost savings associated with reducing the number of parking stalls.

4.1 Key Factors that Influence the Cost of Parking

A wide variety of factors affect the cost of constructing parking, so parking costs per stall vary significantly from project to project. Key factors include:

1. Underground versus above-grade parking. Underground parking is much more expensive to build than surface parking. The higher cost is attributable to excavation, shoring, basement walls, waterproofing, mechanical ventilation, and other variables.
2. Soil conditions. Structures built in areas with poor soil conditions may require deeper or more expensive foundation systems like piling, raft footings, and soil stabilization. Rock and large boulders may require drilling or blasting, which increases the cost of excavation. A high water table may require substantial dewatering during excavation and/or construction of a permanent cutoff wall. When hazardous materials are present, treatment or removal to approved dump sites will be required.
3. Site size. The size of the site can determine if the excavation can be open cut or if shoring is needed. This will affect the contractor's planning of staging and stockpile areas, and the working space for operation of equipment.
4. Site dimensions and shape. Narrow or oddly shaped sites will lead to wasted space or inefficiency in the parking layout as well as in construction.
5. Efficiency of the parkade layout. The less efficient the parkade layout (more space per stall on average), the higher parking-related area (driveway plus parking stall) which results in a higher cost per stall. This is often related to site size and dimensions.
6. Excavation depth / Number of levels below grade. Generally, costs increase as excavation increases. Deeper excavation results in increased shoring cost and extra time to remove excavated material.
7. Location. It is more expensive to build in congested areas (i.e. Downtown or along busy roadways), where access and space for loading and unloading is restricted. This can lead to logistical challenges and problems associated with transportation and delivery. Also, locations further from disposal sites increase the cost of disposal of excavated material.
8. Building adjacent to existing structures. If building adjacent to an existing structure, underpinning, hand excavation and extra precautions may be required to ensure that the new construction will not compromise the stability or integrity of the adjacent building.
9. Type of shoring. Shotcrete and tie-backs are commonly used for parking construction, but there are situations where they may not be feasible. Use of alternative shoring systems may increase construction cost.
10. Design features. Design features such as lighting, security requirements, and scope of painting will also affect the costs.

In summary, the per stall cost of underground parkades on small sites and in congested locations will likely be higher than elsewhere in the City. Deeper parkades can also result in increased costs due to the logistics of access for trucks and removal of excavated material.

Although shallower parkades avoid deep excavation costs, they still must carry the cost of an entrance ramp, overhead door, and other fixed costs across a lower number of stalls which increases the cost per stall.

Because parking costs vary significantly from project to project, the financial impact on reduced parking will vary depending on the project.

4.2 Parking Construction Cost Estimates

As outlined in Section 4.1, the cost of building underground parking at a new multifamily residential project varies from project to project depending on a variety of factors.

Based on the case studies that we analyzed:

1. The current cost of constructing underground parking in the City of Vancouver typically ranges from about \$80,000 to \$120,000 per stall (at current parking ratios) assuming there are no unusual soils conditions or site constraints that affect parking costs.

It should be noted that these figures include the cost to create the other uses in the parking area such as bicycle parking areas, storage, mechanical rooms, loading areas and pedestrian circulation. So, the cost of the underground parking per stall includes more than just the parking stalls and drive aisles.

2. The construction cost can be significantly higher than \$120,000 per stall at projects with inefficient parking layouts (due to constrained site dimensions) and sites with challenging soils conditions.
3. Excluding the underground areas that are not used for parking (service areas), the cost to construct underground parking spaces (including drive aisles) is typically between \$60,000 and \$80,000 per space (at current parking ratios). This can increase to \$100,000 per stall (or more) depending on the site size and efficiency.
4. As parking ratios per unit decline, the efficiency of the parking layout decreases and there is more parking area per stall. Figure 20 shows the parking efficiency per stall for the scenarios we tested. Efficiency is closely related to the average construction cost per parking space, with the least efficient parking layouts costing significantly more to construct on a per space basis.
5. Costs per space tend to increase as spaces are removed due to layout inefficiencies and the fixed costs of some items such as parking ramps. Figure 21 shows this relationship for the scenarios we costed. Obviously, if the underground parking area is completely eliminated (with no bicycle parking, storage or other below grade areas) the cost per stall declines significantly.
6. At-grade garage parking is much less expensive to build at about \$20,000 to \$30,000 per space.
7. At current parking ratios, the cost of constructing the underground parking at apartment projects (including service areas) often exceeds 20% of the total project construction costs.

Figure 20 – Parking Area (sf) per Stall versus Number of Spaces Constructed

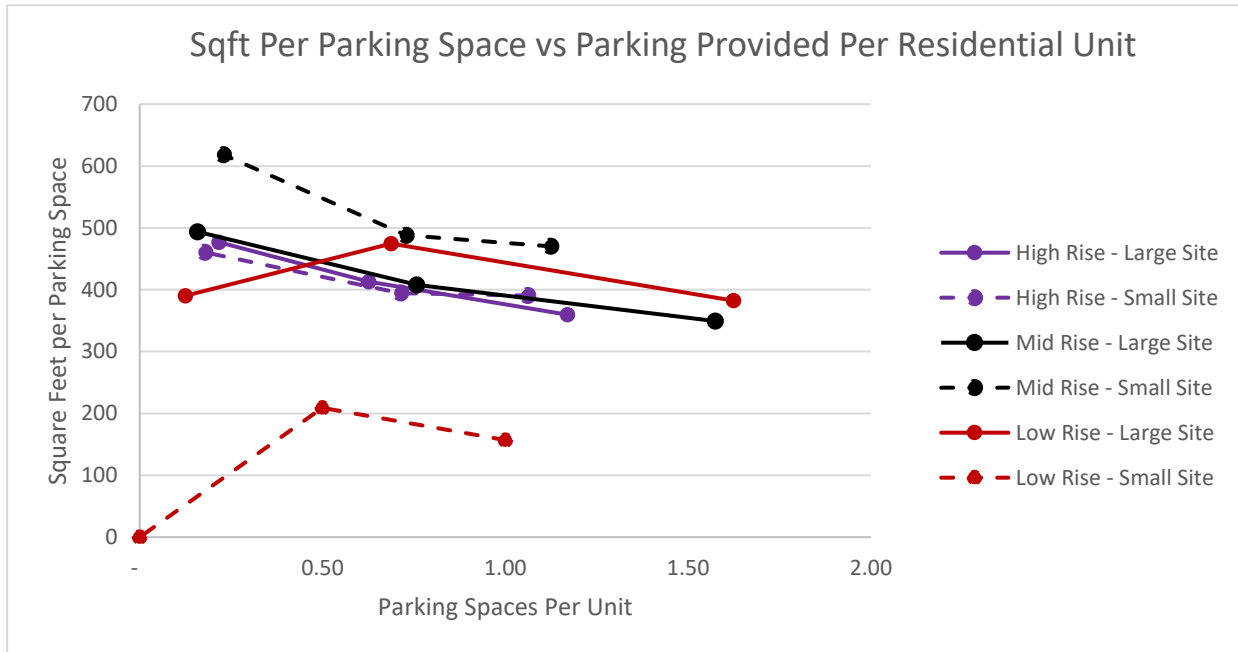
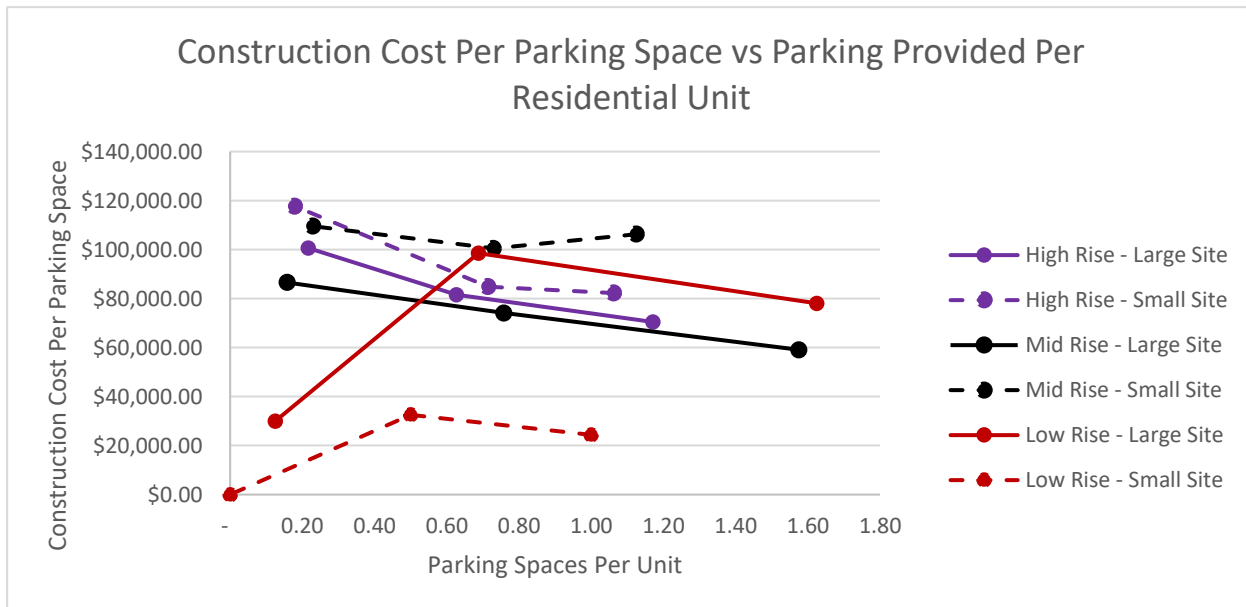


Figure 21 – Parking Construction Cost per Space vs Number of Spaces Constructed



4.3 Savings Associated with Parking Reductions

Reducing parking at a new project can result in significant construction cost savings, but the savings will vary from project to project.

Based on the case studies that we analyzed:

1. The savings associated with reduced underground parking can generally be characterized as follows:
 - \$55,000 to \$60,000 per reduced stall if one level of parking is eliminated.
 - \$65,000 to \$75,000 per reduced stall if multiple levels of parking are eliminated.
2. The savings per reduced stall can be even higher (over \$100,000 per stall savings) at smaller sites with inefficient parking layouts and at sites with difficult soils conditions.
3. The savings per reduced stall is less than the overall construction cost per stall outlined in Section 4.2 because the other facilities and services (e.g. bicycle parking, storage, mechanical rooms, circulation areas) in the parking area still need to be constructed even if the parking is reduced.
4. In addition to direct construction cost savings, there are additional savings on soft costs and project financing costs (due to shortened construction schedules). This increase savings by an additional 20% or more.

4.4 Transportation Demand Management (TDM)

Transportation Demand Management (TDM) measures include items such as car share vehicles and added bicycle parking, which support reduced vehicle ownership and use. The City has established policies for TDM in new development projects and requires TDM Downtown as part of new buildings.

The City is considering TDM requirements for new projects as part of the elimination of minimum vehicle parking requirements. This is similar to how parking minimum requirements were eliminated in Downtown in 2019. TDM measures add to the cost of new projects and reduce savings associated with reduced parking.

An estimated typical cost for TDM measures per new residential unit was determined based on prior work completed by the City of Vancouver. Costs for the different items were updated based on current market conditions and estimated construction costs.

Overall, achieving the TDM requirements is expected to add to project costs by roughly \$8,300 per residential unit for market projects and \$4,150 per unit for non-market rental projects (this is based on the City's current TDM measures).

5.0 Market Value of Parking

Parking stalls have market value to strata unit owners and to rental building owners. To estimate the current market value of parking stalls, we examined a variety of indicators:

1. We examined market evidence of parking stall sales, although the data is very limited as few buildings in the City have separately titled parking stalls. Most stalls in strata buildings are linked to a specific strata unit and cannot be sold separately. We identified ten parking stalls that have been listed and sold over the past two years (2021 and 2022). This listing and sales data indicates that parking stall pricing ranged from about \$38,000 per stall to \$56,000 per stall, with an average of about \$45,000 per stall. In addition, we are also aware of some stalls that were listed at much higher prices (over \$100,000 per stall) but these are located in luxury buildings in the Downtown core (and may not have sold). It should be noted that the \$45,000 average price may understate the value of a parking stall to a building resident as the purchasers of these ten stalls do not have direct access to the building if they are not residents. Access to the stalls is from the parking ramp or separate stairs to the parking garage.
2. We compared sales prices of strata apartment units that come with one parking stall and sales of similar sized (comparable) units in the same building that do not have a parking stall. We identified five newer buildings with a significant number of sales of units that do not include parking. Based on this analysis, units with one parking stall sold at a premium of about \$42,000 to \$68,000 more than similar sized units without parking. The average premium across the five projects was about \$50,000, suggesting that the market value of a parking stall is about \$50,000.
3. Developers in Vancouver often offer unit buyers the option to purchase a parking stall as part of the purchase of the strata unit. We obtained information from developers (and marketing representatives) about the sales price of stalls in newer strata apartment buildings in Vancouver. Based on this information, over the past few years, the sales price of parking stalls at newer projects outside of Downtown has typically ranged from about \$32,000 to \$62,000 per stall. Pricing can be much higher at high-end projects in Downtown Vancouver, reaching over \$90,000 per stall.
4. Parking stalls at rental apartment buildings are rented by the building owner on a monthly basis to tenants. We surveyed the monthly rental rates for parking stalls at newer rental apartment buildings in Vancouver. Outside of Downtown, rent for parking stalls at rental apartment buildings typically range between about \$125 and \$175 per stall per month, with an average in the range of about \$145 to \$150 per stall per month. At \$150 per stall per month, the income generated by the parking creates a value of about \$45,000 to \$50,000 per stall to the building owner (based on the capitalized rental income value)⁷.

Based on this research, the current market value of a parking stall at a strata residential project in the City (outside of Downtown) is about \$50,000. This varies somewhat by project and by location but the variance is relatively small.

The typical rental rate for a stall at a newer rental building (outside of Downtown) is about \$150 per month and the variance across the City is small.

⁷ Calculated as follows: \$150 per month x 12 months divided by 4.0% cap rate = \$45,000 per stall.

6.0 Development Industry Input

Representatives of the development industry were invited to provide input to the overall study. Input was provided two different ways:

- Developers were surveyed about parking data and information for recently completed projects.
- Developers were invited to participate in a City-led workshop exploring the demand for parking, value of parking, costs of parking in new developments, and decisions about parking supply.

Participants included representatives from both the for-profit and non-profit sectors. In Vancouver, non-market operators are often not the actual building developer. Some comments were provided from non-profit operators while others were provided from non-profit developers.

Much of the quantitative survey information provided by developers is summarized in Section 3.4.4 of this report.

This section summarizes some of the key comments and other qualitative information provided by participants. It is not meant to be a comprehensive summary of the comments provided but is intended to highlight key themes and comments that were provided.

Note that the comments provided in this section were provided by the participants and are not necessarily consistent with our opinions or findings.

6.1 Survey Responses

A survey of developers was conducted to collect information on recently completed projects. Open-ended questions were included to collect input on project specific drivers of parking supply and demand, and the amount of parking that may have been built if there were no minimum requirements. Selected written responses are summarized below, which have been edited for clarity.

6.1.1 Strata Projects

Notable comments from strata apartment developers included:

- Parking was driven by meeting minimum bylaw requirements and market expectations. In retrospect, we probably would have built fewer parking spaces as the location is well served by transit.
- The bylaw requirements drove the minimum parking and construction costs drove the maximum. We wanted to cap the number of stalls at two levels of underground to avoid the increased costs of additional levels of parkade. We would likely have constructed a similar amount of parking for the residential component of this project in the absence of a parking requirement because it is a higher end project with a high level of finishes and price point. If this was a mid-level price point, we would have constructed less parking than the current bylaw requirements as many buyers don't require, don't want, or can't afford the additional cost for parking.
- The bylaw requirement drove the number of parking stalls. We would have built less parking and offered more suites with zero parking stalls to keep prices lower for more suites.
- Parking supply was driven by balancing construction costs, meeting bylaw requirements, marketability, and taking into account the location, including nearby amenities and transit (including Canada Line).

- We would have built the same amount of parking without a minimum requirement. The project was designed during a significant run-up in construction costs along with escalating values. Escalation of value moved the project into a different category of buyer with a higher expectation of parking, so we actually added parking to address consumer demands.

6.1.2 Market Rental

Notable comments from market rental apartment developers included:

- We wanted to limit parking to two levels so we used a TDM plan with car share to make it work. Retail space in the project increased parking and created uncertainty about meeting bylaw parking requirements because the actual mix of business types drives the bylaw parking requirement. So we needed to 'overbuild' parking to account for the potential changes in the actual type of business. The extra retail parking pushed the required parking to an additional level.
- Our building was initially planned as a strata and we allowed for 1 stall per unit (except for studios). It ended up being rental and we would have built less parking if we had an opportunity to redesign it for rental.
- Bylaw requirements, construction costs, and marketability of units to tenants drove parking supply. We would have built less parking if there were no requirements.
- There is significant unused parking in the new building. However, we believe the significant volume of available on-street parking is contributing to the lack of demand for parking in the building.

6.1.3 Non-Market Rental

Notable comments from non-market rental operators included:

- I am sure the developers would have wanted to provide fewer stalls, but we would have liked more. I think we would want to continue to have a minimum parking requirement, rather than give developers this decision. I think that the minimum should be 1 stall per 6 social housing units.
- The operator did not have input into the parking supply decision. We would have liked more parking.

6.2 Developer Workshop Notes

In addition to the surveys, an online workshop was held to discuss parking requirements, supply, and demand in new projects. A summary of key comments and themes raised at the workshop are outlined below.

6.2.1 Strata Projects

Comments related to strata apartment projects included:

- Parking is required to market strata units.
- Additional parking spaces are often used as a tool to help support sales, especially of larger units which may be bundled with two or more parking stalls in some cases.
- Strategies for bundling parking stalls with unit sales can vary depending on the amount of parking available.

- The most common strategy, where parking exceeds the number of units, is to include one parking space with most units, and sell additional parking spaces for a fee to those who want them.
- For more constrained projects, only two and three bedroom units may be bundled with parking spaces. Studio and one bedroom units may have the option of purchasing a unit with a parking space for an additional fee.
- Extra parking spaces can be used as a tool to help drive sales.
- Vehicle ownership can change over time so buyers without a vehicle often want to ensure they have a stall if they need a vehicle in the future.
- Homes purchased by investors (to rent out) are less likely to need a parking space. However, investors often want a parking space due to perceived impacts on the re-sale value for units without parking.
- It was noted as desirable to limit parking to two levels for well-located projects to help reduce parking construction costs, particularly where soils conditions are challenging or site size is challenging.
- Bicycle parking requirements are space intensive and limit the ability to provide other TDM measures.

6.2.2 Rental Projects

Comments related to market rental projects included:

- While projects may over supply parking, there are concerns with the long term financial viability of a project if parking were to be reduced as tenants often want parking.
- Removing minimums may not drive much change, since marketability of units is the key that is driving the amount of parking provided and many tenants require parking.
- Projects near transit likely need less parking to be marketable.
- TDM measures can be considered an amenity to residents and are highlighted to tenants at new projects. This can create an opportunity to reallocate parking costs to other building features.
- Some developers would like to provide less than parking bylaw requirements at rental projects,
- Reducing visitor parking should be considered.
- Reducing parking requirements could improve project viability and potentially bring down costs for end users.
- Parking supply is driven by market demand not just project costs.
- It would be helpful to reconsider loading requirements as well as parking. For example, fewer large spaces and more smaller loading spaces would be helpful.

6.2.3 Non-Market Projects

Comments related to non-market rental projects included:

- There are many different types of non-market housing projects, so there are different parking strategies and needs for each.

- The mix of non-market housing rents, which can include market rate units, drives a need for more parking since many households are paying near market rents in these projects and are making substantial incomes and will not rent without parking access.
- Family housing often needs more parking.
- Most non-market projects will likely provide at most 1 level of parking if requirements are reduced.
- Car share vehicles can be a good option.
- Access to transit is key to reducing parking.
- For non-market units, renting parking stalls to residents is more about parking assignment and management, rather than creating project revenue.
- Typically, housing providers do not have a lot of input about project parking; not sure if the City recognizes the need for minimum parking at non-market projects.

6.2.4 General Comments

Some general comments that were not tenure specific included:

- Bicycle parking requirements can significantly increase construction costs because bike parking is underground. Eliminating vehicle parking requirements does not eliminate the need for an underground parking area.
- While revenue from parking does not cover parking construction costs, it is a key attraction for people who live in that building. Marketability is a key driver of parking supply for all market housing tenures.
- Higher income households and family households tend to own at least one car. Family unit requirements can drive parking needs.
- Some sites are much more challenging to incorporate parking, such as sloping sites, smaller sites, or sites with challenging soils conditions.
- Reducing requirements would bring down costs and improve project viability and could be very advantageous for a project on the financial cusp of proceeding.
- Developers have a preference to determine the appropriate amount of parking to respond to project specific needs or site constraints (such as high water table) rather than specified parking requirements.
- Under current bylaw requirements, commercial developers often over build parking to create flexibility to accommodate changing business types (as bylaw requirements change by business type). So mixed use apartment and commercial projects often have more parking than required. Simplifying commercial parking and loading requirements would be helpful.

7.0 Financial Impact of Parking Reductions on New Development Projects

The City is interested in understanding the likely changes to the financial performance of new development projects of reduced parking requirements to help evaluate the potential impacts on:

- Strata unit prices or apartment rent rates.
- The financial viability of new projects.
- Development site land values.
- The ability of new projects to provide amenity contributions or affordable housing.

We used proforma analysis to test the financial impact of reduced parking on potential new multifamily projects at a variety of different case study sites in the City, taking into account three key variables:

- Reduced project value/revenue due to fewer parking stalls.
- The cost of TDM requirements.
- Construction cost savings due to less parking. These savings vary depending on the assumed parking reduction and the cost of constructing the parking at the site.

This section summarizes the approach, assumptions, and key findings from the case study analysis.

7.1 Approach to Analysis

The methodology for the financial analysis can be broadly summarized as follows:

1. We selected case study sites for the analysis. The financial performance and viability of redevelopment varies depending on a site's location, maximum permitted redevelopment density, tenure (rental versus strata), and existing zoned value. Therefore, we identified a variety of different case study sites that are representative of the kinds of redevelopment opportunities that exist in locations anticipated to be a focus of development in the City (based on existing policy). We selected 12 sites that are suitable for a variety of different types of projects that are permitted in the City, including:

- Strata apartment development (midrise and highrise).
- Strata apartment with turnkey social housing units.
- Market rental apartment development.
- Rental apartment development with below market rental units.
- Townhouse development.
- Non-market apartment development.

Table 11 provides a summary of the location of each of the 12 sites tested.

Table 11 - Summary of Types of Case Study Sites Analyzed

Number Development Scenarios Tested	Highrise Strata Apartment or Strata with Turnkey Social Units	4 to 6 Storey Strata Apartment	Townhouse	Market Rental or Rental with Below Market Rental	Non-Market Apartment	Total
West Side Sites	2	1	1	2	1	7
East Side Sites	1	1	1	2	0	5
Total	3	2	2	4	1	12

2. We confirmed the development potential (density, height, tenure, affordable housing requirements) of each site under current City policies. We also confirmed Community Amenity Contribution (CAC) and amenity share (density bonus) requirements as well as other government fees and levies.
3. For each case study site and development concept, we analyzed the financial performance of redevelopment. For each scenario⁸ we estimated:
 - The total project revenue/value.
 - Total construction costs excluding land costs.
 - The supportable land value, prior to any additional amenity contributions or affordable housing that are required. Increased land value is an indicator of improved project viability. The supportable land value is calculated as follows: estimated revenue/value of the completed new project less all project costs (other than land), less an industry standard developer’s profit, equals the supportable land value. If supportable land value increases, it is possible that the City will evaluate the opportunity for projects to provide a higher amenity contribution, which would then off-set any increase in land value.
 - The likely profit margin, assuming the land cost is fixed (e.g., the site was already acquired before any changes to parking requirements or the market value of development sites does not change due to changes in parking requirements). Increased profit margin is an indicator of improved project viability. This is calculated as follows: project revenues less all costs (including land) divided by all project costs.
4. We completed the analysis for three different parking supply scenarios:
 - A base case that assumes typical current parking ratios at new apartment projects outside Downtown (1.2 stalls per strata unit and 0.7 stalls per rental unit, including visitor stalls).
 - A scenario that includes the cost of assumed TDM requirements, but no decrease in parking supply. This shows the financial impact of TDM on its own.
 - A scenario that includes the assumed TDM requirements plus a reduction in resident parking stalls. For the analysis, we assumed a 50% reduction in resident parking (approximately 0.55 stall reduction per strata unit, 0.3 stall reduction per rental unit, and 0.2 stall reduction per non-market unit). This parking scenario is illustrative. Depending on the site and the project, developers may be interested in smaller or larger reductions (if permitted).

As part of this step, we modelled two different parking construction cost scenarios:

⁸ We analyzed three different parking scenarios at each site and two parking construction costs at several sites, so in total we analyzed about 60 scenarios at the 12 different sites.

- For each site and each development scenario we initially assumed typical parking construction costs (i.e. a base parking cost assumption) that assumes there are no unusual costs associated with constructing parking at the site.
- For select sites, we also tested the impact of higher parking construction costs, (which results in greater savings per space reduced) to simulate a smaller site with less efficient parking layout or challenging conditions.

7.2 Case Study Sites and Development Scenarios

We analyzed development concepts at 12 different case study sites in different parts of the City. Each site is in a location that is a focus of multifamily growth in the City. A description of each site and the redevelopment scenario is outlined below (site size figures are rounded).

Site 1 – Cambie Corridor – Highrise Strata Apartment

This site is a 22,000 square foot property located in the Cambie Corridor. It is an assembly of three single family lots improved with older houses. Under the Cambie Corridor Plan, the site can be rezoned to allow 10 storey mixed use strata apartment and retail development at 3.5 FSR. The assumed rezoning concept includes about 72 strata apartment units plus grade level commercial space. This rezoning would be subject to a fixed rate Community Amenity Contribution (CAC).

Site 2 – Norquay Village – Highrise Strata Apartment

This site is a 17,000 square foot property located in Norquay Village. It is an assembly of three commercial properties zoned C-2 and improved with older low density buildings. Under the Norquay Village Plan, the site can be rezoned to allow 12 to 15 storey mixed use strata apartment and retail development at 3.8 FSR. The assumed rezoning concept includes about 72 strata apartment units plus grade level commercial space. This rezoning would be subject to a fixed rate Community Amenity Contribution (CAC).

Site 3 – Broadway Corridor – Highrise Strata Apartment with 20% Social Housing Units

This site is a 25,000 square foot property located in the Broadway Corridor. It is an assembly of four commercial properties zoned C-3A and improved with older low density buildings. Under the Broadway Plan, the site can be rezoned to allow highrise mixed use strata apartment and retail development at 7.5 FSR if 20% of the residential floorspace is dedicated to the City as social housing units. The assumed rezoning concept includes about 151 strata apartment units, 50 social housing units, and grade level commercial space. This rezoning would be subject to a negotiated Community Amenity Contribution (CAC). Any CAC would deduct the cost of providing the social housing units.

Site 4 – Cambie Corridor – 6 Storey Strata Apartment

This site is a 25,000 square foot property located in the Cambie Corridor. It is an assembly of three duplex lots improved with older duplex units. Under the Cambie Corridor Plan, the site can be rezoned to allow 6 storey strata apartment at 2.5 FSR. The assumed rezoning concept includes about 64 strata apartment units. This rezoning would be subject to a fixed rate Community Amenity Contribution (CAC).

Site 5 – Grandview Woodland – 6 Storey Strata Apartment

This site is a 20,000 square foot property located in Grandview-Woodland. It is an assembly of five single family lots improved with older homes. Under the Grandview-Woodland Community Plan, the site can be rezoned to allow 6 storey strata apartment at 2.65 FSR. The assumed rezoning concept includes about 59 strata apartment units. This rezoning would be subject to a fixed rate Community Amenity Contribution (CAC).

Site 6 – Marpole – Townhouse

This site is an 18,000 square foot property located in Marpole. It is an assembly of three lots improved with older houses that are zoned RM-8N. This zoning district permits townhouse development at a density of 1.2 FSR (assuming the specified amenity share contribution is provided). The assumed development concept includes about 18 townhouse units. The development concept assumes underground parking which is common in this location.

Site 7 – Grandview Woodland – Townhouse

This site is an 18,000 square foot property located in Grandview-Woodland. It is an assembly of six lots improved with older houses that are zoned RM-8. This zoning district permits townhouse development at a density of 1.2 FSR (assuming the specified amenity share contribution is provided). The assumed development concept includes about 23 townhouse units. The development concept assumes grade level garage parking which is common in this location.

Site 8– Dunbar – 5 Storey Market Rental Apartment

This site is a 15,000 square foot property located in Dunbar. It is an assembly of two single family lots improved with older homes. Under the Secured Market Rental Policy (SRP) the site can be rezoned to allow 5 storey market rental apartment at 2.4 FSR. The assumed rezoning concept includes about 49 market rental apartment units. No CAC is required as part of rezoning.

Site 9 – Mount Pleasant – 5 Storey Market Rental Apartment

This site is an 18,000 square foot property located in Mount Pleasant. It is an assembly of three duplex lots improved with older homes and duplex units. Under the Secured Market Rental Policy (SRP) the site can be rezoned to allow 5 storey market rental apartment at 2.4 FSR. The assumed rezoning concept includes about 60 market rental apartment units. No CAC is required as part of rezoning.

Site 10 – Killarney – 5 Storey Market Rental Apartment

This site is a 15,000 square foot property located in Killarney. It is an assembly of four single family lots improved with older homes. Under the Secured Market Rental Policy (SRP) the site can be rezoned to allow 5 storey market rental apartment at 2.4 FSR. The assumed rezoning concept includes about 50 market rental apartment units. No CAC is required as part of rezoning.

Site 11 – Broadway Corridor – Highrise Market Rental with 20% Below Market Rental

This site is a 25,000 square foot property located in the Broadway Corridor. It is an existing older low density rental apartment building on an RM-3 zoned site.

Under the Broadway Plan, the site can be rezoned to allow highrise apartment development at 6.5 FSR if 20% of the residential floorspace is allocated to below market rental units. The assumed rezoning concept includes about 185 market rental apartment units and 47 below market rental units.

Site 12 – West Side – 6 Storey Non Market Rental Apartment

This site is a 15,000 square foot property located on the West Side. It is an assembly of two single family lots improved with older homes. Under the Secured Market Rental Policy (SRP) the site can be rezoned to allow 6 storey non-market apartment development at 3.0 FSR. The assumed rezoning concept includes about 61 non-market rental apartment units.

7.3 Key Assumptions for Financial Analysis

The revenue and cost assumptions used in our financial analysis are based on market conditions as of September 2023. Revenue and cost assumptions vary by site and by development scenario based on location in the City and form of development.

The rental analysis assumes that projects are GST exempt, as recently announced by the Federal government.

The key assumptions for our financial analysis are as follows:

1. There is demand from strata unit purchasers and renters for units without parking. However, this may not be the case for all unit types (e.g. family units) in all locations in the City.
2. For strata residential scenarios, the value of a parking stall to the purchaser is assumed to average \$50,000 per stall (see Section 5.0). So a reduction in parking reduces project revenues by about \$50,000 per reduced stall.
3. For rental projects, parking stall rents are assumed to average \$150 per stall per month. So a reduction in parking stalls reduces net income by \$150 per month per reduced stall (\$1,800 per year).
4. TDM requirements are assumed to increase project costs by \$8,300 per unit for market projects and \$4,150 per unit for non-market projects.
5. Parking construction costs vary depending on the site, parking scenario, and form of development. For the base case parking scenarios (existing bylaw requirements), the cost of constructing parking (including any service areas such as bicycle parking, storage, mechanical rooms) is as follows:

Base Parking Costs Per Stall	Typical Cost Scenario	Higher Cost Scenario (challenging site)
Highrise Apartment	\$110,000	\$140,000
4 to 6 Storey Apartment	\$100,000	\$140,000
Townhouse with Underground Parking	\$90,000	not analyzed
Townhouse with Grade Level/Garage Parking	\$25,000	not analyzed

6. Estimated savings on parking construction due to reduced stalls vary depending on the site, parking scenario, and form of development. Parking stall reductions are assumed to result in the following savings per reduced stall:

Savings per Reduced Stall	Typical Cost Scenario	Higher Cost Scenario (challenging site)
Highrise Apartment	\$60,000	\$95,000
4 to 6 Storey Apartment	\$60,000	\$95,000
Townhouse with Underground Parking	\$50,000	not analyzed
Townhouse with Grade Level/Garage Parking	\$25,000	not analyzed

7. In addition to construction cost savings, the reduced parking scenarios also include allowances for reduced soft costs and reduced financing costs due to a shorter construction schedule.

7.4 Findings of Financial Analysis

This section summarizes the findings of our case study financial analysis. The summary tables show the range in estimated impacts for each of the key financial measures that we tested.:

- Total project revenue/value.
- Total construction costs excluding land costs.
- The profit margin, assuming the land cost is fixed. Increased profit margin is an indicator of improved project viability.
- The supportable land value prior to any additional amenity contributions or affordable housing that are required. Increased land value is an indicator of improved project viability.

The figures shown in the tables are the change from the base case scenario (current parking situation) and all figures are rounded to the nearest percentage point.

Separate tables are provided for our analysis of the strata apartment, rental, townhouse, and non-market scenarios.

Table 11 - Strata Financial Analysis Outcomes

Strata Apartment Case Studies (all figures rounded)	A. TDM Requirements	B. Base Parking Costs: 50% Resident Parking Reduction + TDM	C. Higher Parking Costs: 50% Resident Parking Reduction + TDM
Project Revenue (% change)	None	-1% to -3%	-2% to -3%
Total Project Costs - excluding land (% change)	+1%	-3% to -5%	-5% to -7%
Impact on Profit Margin (if land cost fixed)	-1 percentage point	+1 to +2 percentage points	+2 to +4 percentage points
Estimated Supportable Land Value ⁹	-4% to -8%	+4% to +13%	+19% to +34%

Table 12 - Market Rental Financial Analysis Outcomes

Rental Apartment Case Studies (all figures rounded)	A. TDM Requirements	B. Base Parking Costs: 50% Resident Parking Reduction + TDM	C. Higher Parking Costs: 50% Resident Parking Reduction + TDM
Project Value (% change)	None	-2%	-2%
Total Project Costs - excluding land (% change)	+1% to +2%	-2% to -3%	-4% to -5%
Impact on Profit Margin (if land cost fixed)	-2 percentage points	Less than 1 percentage point	+2 percentage points
Estimated Supportable Land Value	-5% to -15%	+1% to +2%	+10% to 28%

⁹ This is before any additional amenity contributions. The upper end of these ranges are for the highest density projects tested.

Table 13 – Townhouse Financial Analysis Outcomes

Townhouse Case Studies (all figures rounded)	A. TDM Requirements	B. Base Parking Costs: 50% Resident Parking Reduction + TDM	C. Higher Parking Costs: 50% Resident Parking Reduction + TDM
Project Revenue (% change)	None	-2% to -3%	not analyzed
Total Project Costs - excluding land (% change)	+1%	-2% to -3%	not analyzed
Impact on Profit Margin (if land cost fixed)	-1 percentage point	-2% to less than 1% percentage points	not analyzed
Estimated Supportable Land Value	-2%	-5% to +1%	not analyzed

Table 14 - Non-Market Rental Financial Analysis Outcomes

Non-Market Apartment Case Studies (all figures rounded)	A. TDM Requirements	B. Base Parking Costs: 50% Resident Parking Reduction + TDM	C. Higher Parking Costs: 50% Resident Parking Reduction + TDM
Total Project Costs - excluding land cost (% change)	+1%	-2% to -3%	-4%

The non-market summary focuses on project costs since this is the primary concern for a non-market developer (non-profit operators do not earn a profit and rents are usually set for the project to break-even).

The key findings from the case study financial analysis can be summarized as follows:

1. Reduced parking at apartment projects can lead to the following:
 - Lower average unit pricing at strata projects. Strata apartment projects that do not include a parking stall generally have market values that are about \$50,000 less than comparable units with parking.
 - Improved financial viability for strata and rental apartment projects (as shown by the increased profit margins and land values in the summary tables). The cost savings associated with reduced parking can improve project viability, particularly at sites where parking construction costs are high (smaller sites, sites with challenging soil conditions). This can increase the number of sites that are financially attractive for redevelopment and help increase housing supply. This is particularly true for rental projects as many of the rental case studies we tested are marginal from a financial perspective under current parking requirements. The strata case studies tended to perform better under current parking requirements.
 - Slightly reduced costs for non-market projects. This could help reduce the funding needed to create new non-market housing or reduce rents at non-market projects.
 - Opportunities for projects to provide additional affordable housing or amenity contributions due to cost savings, provided parking supply is reduced substantially from what is currently built.
2. For townhouse projects, the impacts depend on whether the townhouse project includes grade level parking or underground parking:
 - There is no financial benefit associated with reduced parking if the parking can already be provided at grade level as the cost savings are low but the impact on revenue can be significant.
 - There can be a financial benefit associated with reduced parking if the townhouse project includes underground parking. However, the positive financial impact is lower than for apartment projects as the construction cost savings per parking stall tends to be lower at townhouse projects than for apartment projects.

3. Any TDM requirements will partially offset the financial benefits of reduced parking requirements.
4. It is important to note that our analysis assumes that apartment purchasers and renters are interested in units without parking, and that developers elect to build less parking. However, reduced parking could create marketability risks. For example, if there is not enough parking at a project, it could result in lower strata sales prices than anticipated, longer sales periods (which increases financing costs), increased apartment vacancy, or lower apartment rents. Based on sensitivity analysis that we completed on the reduced parking scenarios (for the typical parking construction scenarios):
 - If sales prices of new strata units (without parking) are reduced by \$40,000 to \$50,000 (beyond the \$50,000 per unit cost reduction assumed in this analysis) at the strata apartment case studies we analyzed, this offsets the cost savings to developers of reduced parking.
 - If the post construction sales period is extended an additional 18 to 24 months at the strata apartment case studies we analyzed, this offsets the cost savings to developers of reduced parking.
 - If the long term building vacancy rate increases by 1.5 percentage points at the rental case studies we analyzed, this offsets the cost savings to developers of reduced parking.
 - If average monthly rents decline by about 2% at the rental case studies we analyzed, this offsets the cost savings to developers of reduced parking.

So, developers will need to balance the potential cost savings with the potential marketing risks.

5. Many developers may not reduce parking until there is market evidence that demonstrates strong interest in units without parking. This demand may be restricted to some parts of the City with better mobility/amenity access.

8.0 Findings and Implications

8.1 Findings

The key findings of our evaluation can be summarized as follows:

1. Outside of Downtown, there is significant variation in the amount of parking provided at newer multifamily residential projects depending on tenure, with an average of:

- 1.21 spaces per unit provided at strata projects.
- 0.71 spaces per unit at market rental projects.
- 0.38 spaces per unit at non-market rental projects.

There is also significant variation in parking supplied per unit at projects within each tenure.

2. The average parking supplied is higher than the current bylaw parking requirements by about:
 - 0.22 space per unit at strata projects (about 22% higher than bylaw requirements).
 - 0.01 spaces per unit at market rental projects (about 1% higher than bylaw requirements).
 - 0.09 spaces per unit at non-market projects (about 31% higher than bylaw requirements).
3. Available parking demand data indicates that the average parking supplied per unit exceeds actual parking demand (vehicle ownership) at strata projects, is similar to parking demand at market rental projects (although this varies by project) and is lower than actual demand at non-market projects. Strata projects likely provide more parking than required to meet actual demand due to the risks associated with marketing new units without sufficient parking supply.
4. Underground parking accounts for a large share of the overall cost of constructing new multifamily buildings and the cost varies significantly by project.
5. There is a financial incentive for developers to consider reducing parking, particularly at sites where the cost of constructing parking is high, such as smaller sites, sites with unusual dimensions, and sites with challenging soil conditions.
6. Reducing off-street parking requirements can reduce total project costs which can:
 - Increase the number of sites that are financially attractive for redevelopment and help increase housing supply across all tenure types, particularly for rental projects which are often less profitable than strata projects.
 - Help reduce rents at non-market projects (though rents at market rental projects are unlikely to change materially a parking is typically unbundled from unit rent).
 - Lower average unit pricing at strata projects.
 - Possibly increase the opportunity for the City to negotiate increased affordable housing or amenity contributions at new projects.
7. Any TDM requirements will partially offset the financial benefits of reduced parking requirements.
8. If parking requirements are reduced, developers will make site by site decisions about the amount of parking to build, so the amount of parking provided will vary from project to project. We would expect developer interest in reduced parking to be focused at:

- Sites where the cost to construct parking is high, including smaller sites, sites without unusual dimensions, and sites with challenging soil conditions.
 - Locations that are well-served by rapid transit and/or close to large concentrations of employment space and commercial services, as there is likely less marketing risk associated with reduced parking in these locations.
 - Rental projects, as the financial viability of rental development is often more challenging than strata development.
9. Without a minimum parking requirement, we would expect:
- Small reductions (on average) in the typical amount of parking built at new strata projects.
 - Less parking to be provided at new market rental projects, in particular those sites which are well-served by transit and in amenity-rich locations.
 - Less parking (or even zero parking) to be provided at non-market projects to help keep overall project costs lower.
10. For all tenures, the removal of parking minimums will enable more new projects at smaller more constrained sites.
11. There are trade-offs between enabling additional housing through elimination of minimum parking requirements and accepting the potential for on-street parking impacts which may result from undersupplying parking on-site.

In the absence of minimum parking requirements, developers will build parking based on the economic relationship between the cost of building parking, the potential revenues that parking generates and the risks associated with marketing units without parking stalls.

This relationship is complex and influenced by unit buyer expectations, project tenure, construction costs, market uncertainty, and long term expectations about parking demand. Many of these factors vary from project to project and change over time.

Overall, if the City eliminates minimum parking requirements, we would expect developers to explore opportunities to reduce the average amount of parking provided at new developments of all tenures. This should facilitate construction of additional housing by improving project viability, particularly at sites where parking construction is challenging.

8.2 Potential Implications of Eliminating Parking Requirements

We used the findings of our evaluation to identify the implications of eliminating parking requirement for new multifamily residential projects, with a focus on:

- Impacts on the financial viability of new projects.
- Impacts on new unit prices, market rent rates, and non-market rents.
- The amount of parking likely to be provided at different types of projects and different locations in the City in the absence of minimum parking requirements.
- The impact on the ability of new projects to provide amenity contributions or affordable housing.
- The likely timing required for the market to adjust to parking demand in the absence of parking requirements.

- The impact on lower income renter households.

The following sections provide detail on potential implications of eliminating minimum parking requirements on different types of projects in the City of Vancouver.

8.2.1 Development Viability and Housing Supply

Eliminating off-street parking requirements will increase the number of sites that are financially attractive for redevelopment and help increase housing supply.

Improvements in viability will be most impactful at sites where the cost to construct parking is the highest, such as smaller sites (e.g. say 13,000 or 14,000 square feet or less), sites with unusual dimensions, and sites with challenging soils conditions (e.g., high water table). Eliminating parking requirements will significantly improve the viability of development at these types of sites across all tenures, which will help increase the number of new housing units built in the City. This is particularly the case for rental projects which are often less profitable than strata projects.

In addition, the elimination of minimum parking requirements will improve certainty on requirements for developers and will likely reduce the length of the approvals process for projects which would currently need to seek parking relaxations.

Requirements for TDM measures will add costs to a new project, so TDM measures will partially offset the financial benefits of reduced parking requirements on project viability.

8.2.2 Housing Costs

The price of new market housing is determined by the supply and demand of product in the market, not by the cost of new construction. So lower construction costs do not lead directly to lower housing prices at new projects (particularly if the reduced costs lead to higher development site land values). However, if reduced construction costs lead to increased housing supply, this can lower the market price of housing over time.

Based on our analysis, we would expect the following impacts on new housing prices if parking requirements are eliminated:

- The purchase price of strata units that do not include parking will be lower than if the unit included a parking stall. Based on current market values, we would expect sales prices to be about \$50,000 per unit lower for units without parking.
- Parking rent is typically separated from unit rent at rental projects in Vancouver (unbundled). Therefore, monthly rents for market rental units are unlikely to change materially due to reductions in parking (unless it results in a large increase in new rental housing supply).
- Reduced construction costs at non-market rental projects would enable reduced rents for non-market units (or construction of more non-market units).

8.2.3 Changes in Parking Supply at New Developments

If parking requirements are eliminated, we would expect different outcomes depending on the project tenure and location. Generally, we would expect:

- Limited changes to the amount of parking provided at strata projects in the short term. Any reductions will likely be focused at sites where parking construction is challenging (and costly) or at sites in very close proximity to amenities or with excellent transit access.
- Reductions in parking supply to be mainly focused at market rental (including mixed market and below market projects) and non-market rental projects.

Strata Apartment Projects

Without a minimum parking requirement, we would expect small changes to the average amount of parking provided at strata projects because:

- Strata projects currently provide 22% more parking than the bylaw minimum, with many sites providing well above the minimum.
- After removing parking requirements, parking supply at new Downtown strata projects remained similar to prior levels.
- Current parking supply exhibits relatively low sensitivity to the locational factors that can impact parking demand.
- Developers that we surveyed indicated that it is important to provide sufficient parking in strata projects to meet market demand and to sell units.
- Strata projects currently tend to build more parking spaces than vehicle ownership would suggest. This supports the conclusion that parking supply decisions are primarily based on preferences of the unit purchasers (target market) as opposed to matching overall average vehicle ownership. This may shift over time if developers see successful low-parking strata projects.

Any reductions in average parking supply at new strata projects would likely be due to the following:

- A larger number of smaller development sites will be financially viable for development if parking can be reduced. So the share of development occurring at smaller sites may increase leading to less strata parking per unit on average.
- Some strata projects may eliminate the lowest parking level if it would be a partial level under current bylaw requirements which would reduce the number of projects that provide parking significantly above the current minimum requirements.
- Strata projects with excellent access to rapid transit may provide less parking. This is based on comments from developers that there was less concern with reducing parking near transit.

Market Rental (including projects with below market rental)

Without a minimum parking requirement, we would expect less parking to be provided at new market rental projects on average. Reductions would likely be focused at sites which are well served by transit and located in amenity rich areas, as well as smaller more challenging sites because:

- Developers that we surveyed indicated an interest in reducing parking at rental projects near rapid transit.
- After parking requirements were eliminated in Downtown, developers did not construct parking for new market rental units even though observed parking demand in existing market rental buildings in

Downtown is about 0.44 parking spaces per rental unit. Downtown offers access to a wide range of amenities, employment, and transit. This shows that there is market demand for new market rental units without parking in locations that offer these characteristics.

- At recently constructed rental projects outside of Downtown, there is a consistent inverse relationship between the amount of parking provided and transit service and neighbourhood amenities.

Outside of areas that are well-served by transit and amenities, new market rental projects will likely continue to provide similar amounts of parking as currently provided because developers will want to ensure rental units are marketable to vehicle owners. In these areas, reductions will likely be focused at small sites, sites with unusual dimensions, or sites with challenging soils conditions.

The availability and price of on-street parking may impact these outcomes. Vehicle registration data indicates that some newer rental projects are currently providing less parking than required by tenants. If there is a large amount of on-street parking available at low (or no) cost, rental developers may explore larger parking reductions.

Non-Market Rental

Reducing parking can significantly reduce project costs, which can improve the viability of non-market projects.

However, depending on the target market, non-market rental projects often require parking for tenants. For example, family units often require parking. Also, non-market projects that include some market rate units to help generate revenue often require parking for these units. Projects without family units or market rate units likely require less parking. This need for parking is validated by vehicle registration data.

Overall, we would expect non-market rental projects to minimize off-street parking in order to reduce construction costs, improve viability and minimize rent rates. So, we would expect less parking or even no parking to be provided at some new non-market rental projects, particularly projects that are well-served by transit and amenities because:

- In Downtown, non-market developers constructed very little (0.05 spaces per unit) parking for non-market rental units after the 2018 Parking Bylaw updates that removed minimum parking requirements in Downtown.
- At recently constructed non-market rental projects outside of Downtown, there is a consistent inverse relationship between the amount of parking provided and transit service and neighbourhood amenities.
- Non-market developers are not necessarily the operator which may result in prioritization of reduced costs rather than meeting parking demands.

If parking requirements are eliminated, it is possible that parking for residents, staff, and service providers may be undersupplied at new non-profit projects. Non-market rental projects may build less parking than the number of vehicles owned by future tenants (which, based on vehicle registration data, is already the case today).

If there is a large amount of on-street parking available at low (or no) cost, non-market rental developers may explore further parking reductions.

Townhouse Projects

For townhouse projects that can already meet required parking at grade, we would not expect interest in reducing parking as the construction cost savings are low but the impact on revenue can be significant.

For townhouse projects that currently provide parking underground to meet the bylaw requirements, developers may be interested in providing less parking. Like strata apartment projects, we would expect any

reductions to be focused at smaller sites, sites with unusual dimensions, and sites with challenging soils conditions.

8.2.4 Amenity Contributions and Affordable Housing

The City of Vancouver negotiates CACs and affordable housing as part of the rezoning process. The CAC value is linked to the increase in land value created by the rezoning.

One possible outcome of eliminating parking requirements is that it could lead to improved project viability and higher supportable land values, particularly for strata apartment projects. If supportable land values increase, this creates the potential for the City to negotiate increased affordable housing or amenity contributions during rezoning negotiations.

This opportunity would likely be limited to rezonings that involve negotiated CACs rather than rezonings that involve fixed rate CACs. It will also be limited if most strata projects continue to provide similar amounts of parking as currently provided.

8.2.5 Timing of Market Changes

Data from recent Downtown development projects shows that the elimination of parking requirements quickly led to parking supply changes at new market and non-market projects. We expect that the elimination of parking minimums would have an immediate impact on parking supply delivered for market and non-market rental projects, particularly at sites near transit and amenities.

For strata projects, we do not expect significant changes in parking supply at new projects in the short term because of risks associated with marketing new strata units in the absence of parking. Over time, this could change if vehicle ownership rates change.

It is worth noting that there are currently over 190,000 apartment units¹⁰ in the City. While individual developments may provide less parking (or even zero parking), it is unlikely that the overall average supply of parking per unit in the City will change materially for many years.

8.2.6 Impact on Lower Income Renter Households

Reducing parking requirements will:

1. Improve the financial viability of market rental projects and rental projects that include below market rental units. This should help increase the supply of new market and new below market rental units over time. This will help lower income rental households because:
 - The below market units are income tested and targeted toward lower income households.
 - An increased supply of market rental units will help mitigate upward pressure on rents in all rental stock in the City (existing units and new units). So lower income households in existing rental buildings should benefit.

¹⁰ According to the 2021 Statistics Canada Census, there were 189,935 occupied apartment units in the City.

2. Reduce the cost of creating new non-market projects. This will allow average rents to be reduced at new non-market projects (or help increase the number of units constructed). This will benefit lower income households at non-market rental projects.

9.0 Additional Actions for Consideration

Through this work, we identified opportunities to further improve the understanding of parking decisions made by the development industry, as well as opportunities to support effective parking supply decisions by the development industry.

1. **Data sharing.** In order to support decision making founded on observed demands, there is an opportunity to share data with the development community about observed parking rates and vehicle ownership. This data may encourage parking that better aligns with demand, with more explicit consideration of lower parking needs near transit and amenities.

While removal of parking bylaw requirements can support lower parking at new development projects and is expected to increase housing delivery overall, the lack of clear requirements could result in developers significantly overbuilding or underbuilding the amount of parking. In order to mitigate risks to on-street parking demand and prevent overbuilding, the City could publish an information bulletin on parking demand.

2. **On-street parking regulations.** Where significant amounts of new low-parking development projects occur, there may be opportunities to regulate on-street parking in a way that supports equity and accessibility for both existing and new residents and their visitors.
3. **Unbundling parking.** There may be opportunities to reduce the amount of parking constructed in new development projects by encouraging and facilitating unbundling of parking. This may include unbundling of parking spaces from unit ownership through separate titles for parking spaces, or elimination of ownership of parking in strata buildings and allowing residents to rent parking spaces.

Unbundling strategies have been implemented by other cities such as San Francisco, Seattle, and San Diego.

4. **Assessing TDM uptake outside of Downtown.** Understanding the propensity of new projects to reduce parking with TDM measures would help provide more information about how much parking developers may construct.
5. **Reviewing other parking bylaw regulations.** Reducing minimum parking requirements for residential units has a variety of potential benefits. Based on feedback provided by developers, there may also be significant benefits associated with reviewing and refining other bylaw requirements including loading, visitor parking, and commercial parking requirements.
6. **Evaluating parking maximums.** Strata developments will likely continue to build significant amounts of parking in the absence of minimum parking requirements. If this conflicts with City objectives, the City could consider implementing parking maximums to reduce excessive parking construction in new buildings. However, it is important to balance this with potential impacts on the marketability of new projects.

10.0 Attachments

Attachment 1: BTY Parking Construction Cost Report

Memorandum

To: Blair Erb

From: Eldon Lau /Joseph Chan /Roy Lee / Neill McGowan (BTY Group)

Re: City of Vancouver Parking Study

1.0 Background

The City of Vancouver is studying the construction cost of parking, mainly in underground parkades, for different types of residential projects in the Vancouver area. Coriolis Consulting Corporation, the lead consultant, has identified six projects for the study in the following categories:

- Building types: Highrise Apartment, Low/Midrise Apartment, Townhouse; and
- Size of site: Larger versus Smaller

The six selected projects will each have a base-case scenario (what was actually built) and two other parking scenarios that reduce the number of stalls.

The different assumed scenarios include changes and relocation of space to parkade areas to revise the parking areas and stall counts, as reviewed by the consultant.

Details of the six selected projects and the different scenarios have been summarized in Appendix 1.

BTY's role in this study is to identify the cost impacts of varying the amount of parking in each of the selected projects.

2.0 Methodology

Order-of-magnitude estimates have been prepared by BTY Group for the six selected projects to compare the construction costs for different scenarios based on the parkade layouts.

The parkade costs include the following scope:

- Apportioned foundation costs based on ratio of parkade area to Gross Building Area
- Basement parkade structure cost, including excavation, shoring and waterproofing
- Building cores, storage, elevator lobbies, stairs, and services rooms in parkade
- Mechanical and Electrical components directly servicing the parkade, including lighting, sprinklers and ventilation. (Equipment housed in the parkade, but used to service the rest of the building is excluded)
- Conventional footing foundations. No special foundations such as tanking, cut off walls, extensive dewatering, and raft foundations etc. are considered

A typical parkade plan and section is marked up in Appendix II to illustrate the scope of parking-related and non-parking related areas.

All unit costs are in current pricing [Q3 2023 dollars] and are inclusive of general conditions and general contractor's overhead and profit.

3.0 Summary of Findings

3.1 Impact of Reducing Parking on Overall Cost

The impact of reducing parking on the overall building unit rates is summarized below:

	Number of Stalls			Total Project Hard Cost / FSR		
	Base	Scenario 2	Scenario 3	Base	Scenario 2	Scenario 3
High-rise Apartment						
Mirabel (1180 Broughton)	254	136	47	\$532/ft ²	\$502/ft ²	\$474/ft ²
		(-46.5%)	(-81.5%)		(-5.6%)	(-10.9%)
Grosvenor (1382 Hornby)	238	160	40	\$544/ft ²	\$519/ft ²	\$483/ft ²
		(-32.8%)	(-83.2%)		(-4.5%)	(-11.1%)
Low/Mid-rise Apartment						
Belpark (375 W59 Ave)	189	91	19	\$480/ft ²	\$452/ft ²	\$421/ft ²
		(-51.9%)	(-89.9%)		(-5.7%)	(-12.2%)
Kits Walk (2075 W12 Ave)	35	54	11	\$509/ft ²	\$574/ft ²	\$447/ft ²
		(+54.3%)	(-68.6%)		(+12.9%)	(-12.1%)
Townhouse						
The Oak (7858 Oak St)	26	11	2	\$422/ft ²	\$384/ft ²	\$338/ft ²
		(-57.7%)	(-92.3%)		(-9.1%)	(-20%)
Victoria Dr. Townhomes (1894 E8 Ave)	4	2	0	\$321/ft ²	\$314/ft ²	\$300/ft ²
		-50%	(-100%)		(-2.2%)	(-6.5%)

Note: Percentage change over the Base case is shown in brackets above

In each of the above projects, the Base case has the largest number of parking stalls and area. It is reduced in Scenario 2 (except in Kits Walk). Scenario 3 has the fewest stalls and area.

As expected, the construction cost in \$/ft² FSR of the projects (building including parkade) is reduced as the parkade shrinks. The proportional reduction in overall cost is not the same as the reductions in parkade cost as the former is spread over the area of the entire building.

3.2 Impact of Higher Area per Stall on Parkade Cost

The parkade cost will be affected by the efficiency of the parking layout and the relative proportions of parking area and area devoted to other uses. As the number of stalls is reduced, the below-grade area used for other purposes remains relatively stable, so the overall parkade area per stall increases. This cost impact is reflected in the figures below:

	Overall Parkade Area / Stall			Overall Parkade Cost / Stall		
	Base	Scenario 2	Scenario 3	Base	Scenario 2	Scenario 3
High-rise Apartment						
Mirabel (1180 Broughton)	462 ft ²	604 ft ²	1,029 ft ²	\$103,700	\$143,700	\$280,400
Grosvenor (1382 Hornby)	499 ft ²	555 ft ²	1,104 ft ²	\$119,300	\$140,100	\$338,400
Low/Mid-rise Apartment						
Belpark (375 W59 Ave)	428 ft ²	572 ft ²	1,279 ft ²	\$81,800	\$121,200	\$312,300
Kits Walk (2075 W12 Ave)	612 ft ²	587 ft ²	1,014 ft ²	\$139,300	\$135,700	\$233,300
Townhouse						
The Oak (7858 Oak St)	424 ft ²	573 ft ²	390 ft ²	\$92,900	\$133,600	\$30,000
Victoria Dr. Townhomes (1894 E8 Ave)	157 ft ²	209 ft ²	n/a	\$24,400	\$32,600	\$0

Other factors affecting the parkade costs are stated in Section 4 below.

Details of the analysis supporting these findings are included in Appendix III.

4.0 Discussion of Findings

The cost variations of the parkade amongst the projects are likely due to a combination of factors, rather than being attributable to a single cause.

Factors impacting parkade costs include:

1. Underground versus above-grade
Underground parking is much more expensive than surface parking. The higher cost is attributable to excavation, shoring, basement walls, waterproofing, mechanical ventilation, etc.
Accordingly, the parking unit rates are lowest for surface parking in Victoria Dr. Townhomes and The Oak – Scenario 3.

2. Location
It will be more expensive to build in congested areas like downtown and along busy roadways, where access and space for loading and unloading is restricted. This can lead to logistical challenges and problems associated with transportation and delivery. For example, it may be necessary to adhere to strict timelines due to noise regulations, traffic considerations, etc. Downtown locations will also be farther from dump sites, a key element in the cost of disposal.
These additional costs will likely affect more the Grosvenor and Mirabel sites in downtown and West End locations.
3. Soil conditions
Structures built in areas with poor soil conditions may require deeper or more expensive foundation systems like piling, raft footings, soil stabilization, etc. Rock and large boulders may require drilling or blasting, which will increase the cost of excavation. High water tables may require substantial dewatering during excavation and/or construction of a permanent cutoff wall. When hazardous materials are present, treatment or removal to approved dump sites will be required.
For the purpose of this review, soil conditions have been assumed to be good for all the projects and normal excavation rates have been applied. Allowances for hazardous material removal and tanking of walls below-grade have also been excluded.
4. Size of the site
The size of the site can determine if the excavation can be open cut or if shoring is needed. It will affect the contractor's planning of staging and stockpile areas, and the working space for operation of equipment.
5. Site shape
Narrow and oddly shaped sites will lead to wasted space or inefficiency in layout as well as in construction.
6. Excavation depth / Number of levels below grade
Generally, it will be more expensive the deeper the excavation goes as there will be more shoring cost and extra time to remove excavated material.
7. Efficiency of the parkade layout
The less efficient the parkade layout is, the higher parking-related area (driveway plus parking stall) per stall will be, resulting in a higher cost per stall.
8. Building adjacent to existing structures
Underpinning, hand excavation and extra precautions may be required to ensure that the new construction will not compromise the stability or integrity of the adjacent building.

9. Type of shoring

Shotcrete and tie-backs are commonly used for basement construction, but there are situations where they may not be feasible or acceptable to neighbours. Use of alternative shoring systems may increase construction cost.

10. Design features

Other design features such as lighting, security requirements and scope of painting, will also affect the costs. It may be decided that for safety there should be separate up and down ramps.

In summary, the unit cost of underground parkades on small sites and in congested locations like Downtown Vancouver and Vancouver West will be higher than elsewhere in the city. Shallower parkades still must carry the cost of an entrance ramp and overhead door, but as the number of stalls increases the impact of these costs decreases. Deeper parkades see increased costs due to the logistics of access for trucks and removal of excavated material.

Appendix I - Project Details



Appendix I - Project Details

	Address	Total Units	Total Parking (Base)	Building Form	Site Size	Neighbourhood	Base	Scenario 2	Scenario 3
Mirabel	1180 Broughton Street, 1365 Davie Street, Vancouver	149	254	High Rise	Large	West End	19-storey, u/g garage (4 levels)	delete 1 u/g level	delete 2 u/g levels
Grosvenor Pacific	889 Pacific Street, Vancouver	224	238	High Rise	Small	Downtown	39-storey, u/g garage (8 levels)	delete 2 u/g levels	delete 5 u/g levels
Belpark	375 W 59th Avenue, Vancouver	120	189	Mid Rise	Large	Marpole	7-storey, u/g garage (1.5 levels)	delete 1/2 u/g level	delete 1 u/g level
Kits Walk	2075 W 12th Ave, Vancouver	48	35	Mid Rise	Small	Kitsilano	6-storey, u/g garage (2 levels)	add 1 u/g level	delete 1 u/g level
The Oak	7858 Oak Street, Vancouver	16	26	Townhouse	Large	Marpole	3-storey, u/g garage (1 level)	delete 1/2 u/g level	delete 1 u/g level
Victoria Drive Townhomes	1894 E 8th Avenue, Vancouver	4	4	Townhouse	Small	Grandview Woodland	2-storey, 3 garage + 1 surface stalls	delete 1 garage & 1 surface stalls	delete all

Appendix II - Scope of Parkade

Level	Residential			Class B	Residential Storage
	Horizontal	Class A Vertical	Total		
L1	27	19	46	6	-
P1	154	13	167	-	-
P2	-	18	18	-	-
P3	6	31	37	-	5
P4	-	-	-	-	26
P5	-	-	-	-	27
P6	-	-	-	-	29
P7	-	-	-	-	30
P8	-	-	-	-	30
Total:	187	81	268	6	147

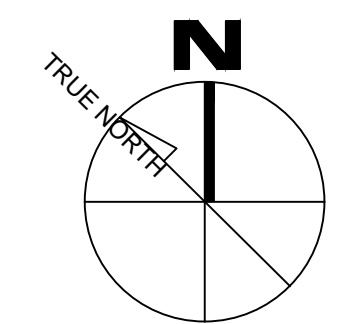
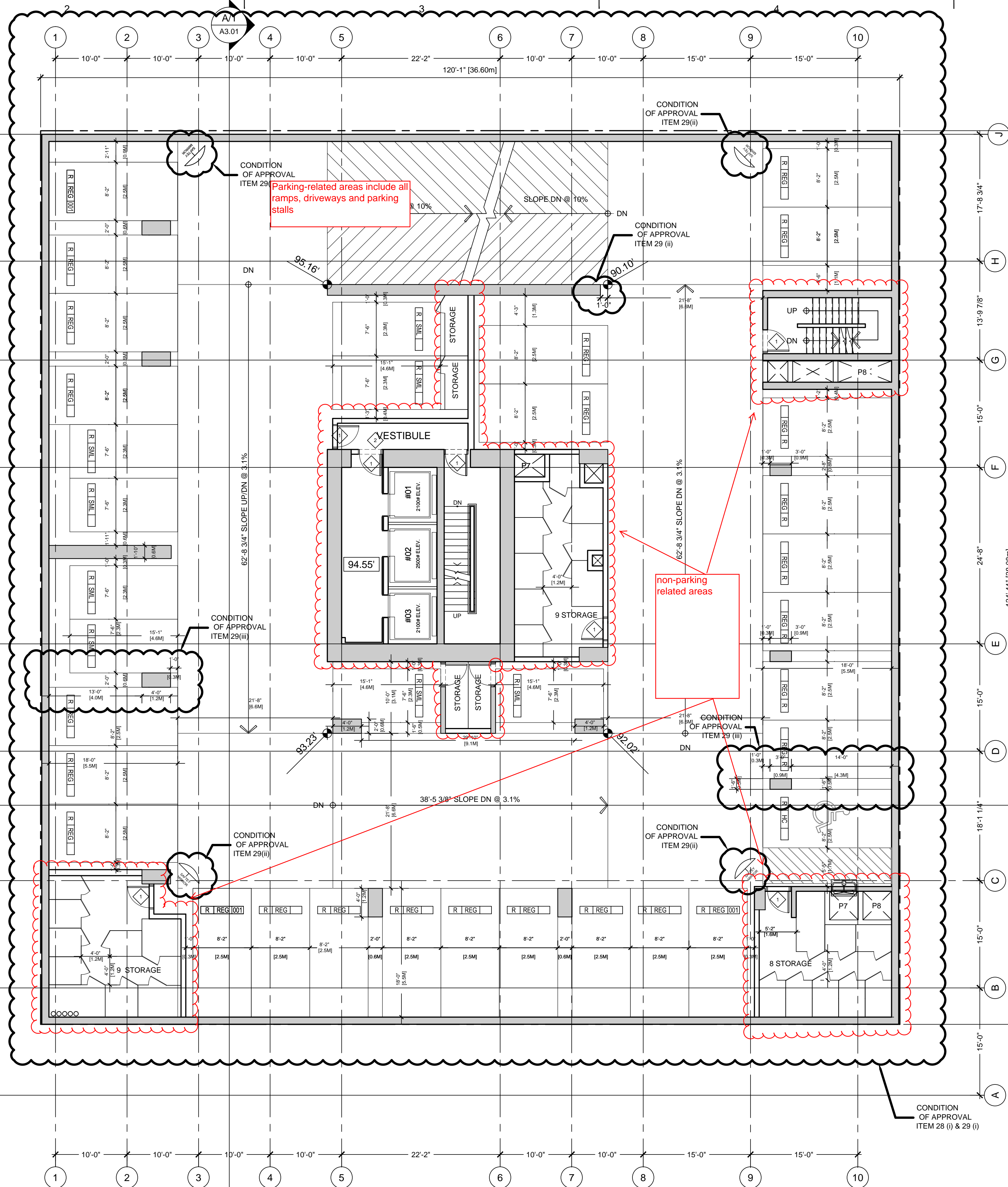
Note : Max. 30% Class A may be vertical.

Total Bicycle Parking Provided :
Class A -268 Bicycle Stalls - :81 Vertical Stalls (30%)
187 Horizontal Stalls (70%)
Class B - 6 Bicycle Stalls

Level	Residential			Commercial (Leslie House)			Overall Total Provided
	Small	Regular	Disability	Small	Regular	Disability	
L1	-	-	-	-	-	-	-
P1	-	-	-	-	0	-	3
P2	7	16	1	24	-	-	27
P3	9	25	2	36	-	-	36
P4	8	26	1	35	-	-	35
P5	8	26	1	35	-	-	35
P6	8	26	1	35	-	-	35
P7	8	26	1	35	-	-	35
P8	8	26	1	35	-	-	35
Total:	56	171	8	235	-	0	238

NOTE :
1. 20% of all off-street residential parking will be available for charging of electric vehicles (Section 13.2 CoV Energy Efficiency ByLaw 9936) - 48 EVCS required of 236 total no. of residential parking spaces
2. 25% of all cars may be small vehicles: 17% achieved

ByLaw 4.3.6
The lesser of:
At least one parking space for each 140sm of gross floor area
One parking space for every dwelling unit



GROSVENOR
2000 The Grosvenor Building
1040 West Georgia Street
Vancouver, BC V6E 4H1

COPYRIGHT:
Any reproduction or distribution for any purpose other than authorized by IBI Group is forbidden. Written dimensions shall have precedence over scaled dimensions. Contractors shall verify and be responsible for all dimensions and conditions on the job and IBI Group shall be informed of any variations from the dimensions and conditions shown on the drawing. Shop drawings shall be submitted to IBI Group for approval before proceeding with fabrication.

COPYRIGHT © 2013 IBI GROUP

NO.	DATE	DESCRIPTION
1	2015-12-21	ISSUED FOR REZONING
2	2017-03-15	ISSUED FOR DP

ISSUES

SEAL

SUB-CONSULTANT

a c d f *
ARCHITECTURE | DESIGN URBAIN | INTERIEUR
1514 Avenue de la Concorde Est, Suite 1000, Montréal, Québec H2M 1S7
Téléphone: 514 496-7711 | Télécopieur: 514 496-7714
1500, Avenue de la Concorde, Suite 304, Montréal (Québec) Canada H2T 2A4
Téléphone: 514 496-7711 | Télécopieur: 514 496-7714

ROBERT LEMON ARCHITECT INC.
3846 West 10th Avenue
Vancouver, BC V5T 1G4
Tel: (604) 224 2414

PRIME CONSULTANT

IBI GROUP ARCHITECTS (CANADA) INC.
700 - 1285 West Pender Street
Vancouver BC V6E 4B1 Canada
Tel: 604 683 8737 Fax: 604 683 0492
ibigroup.com

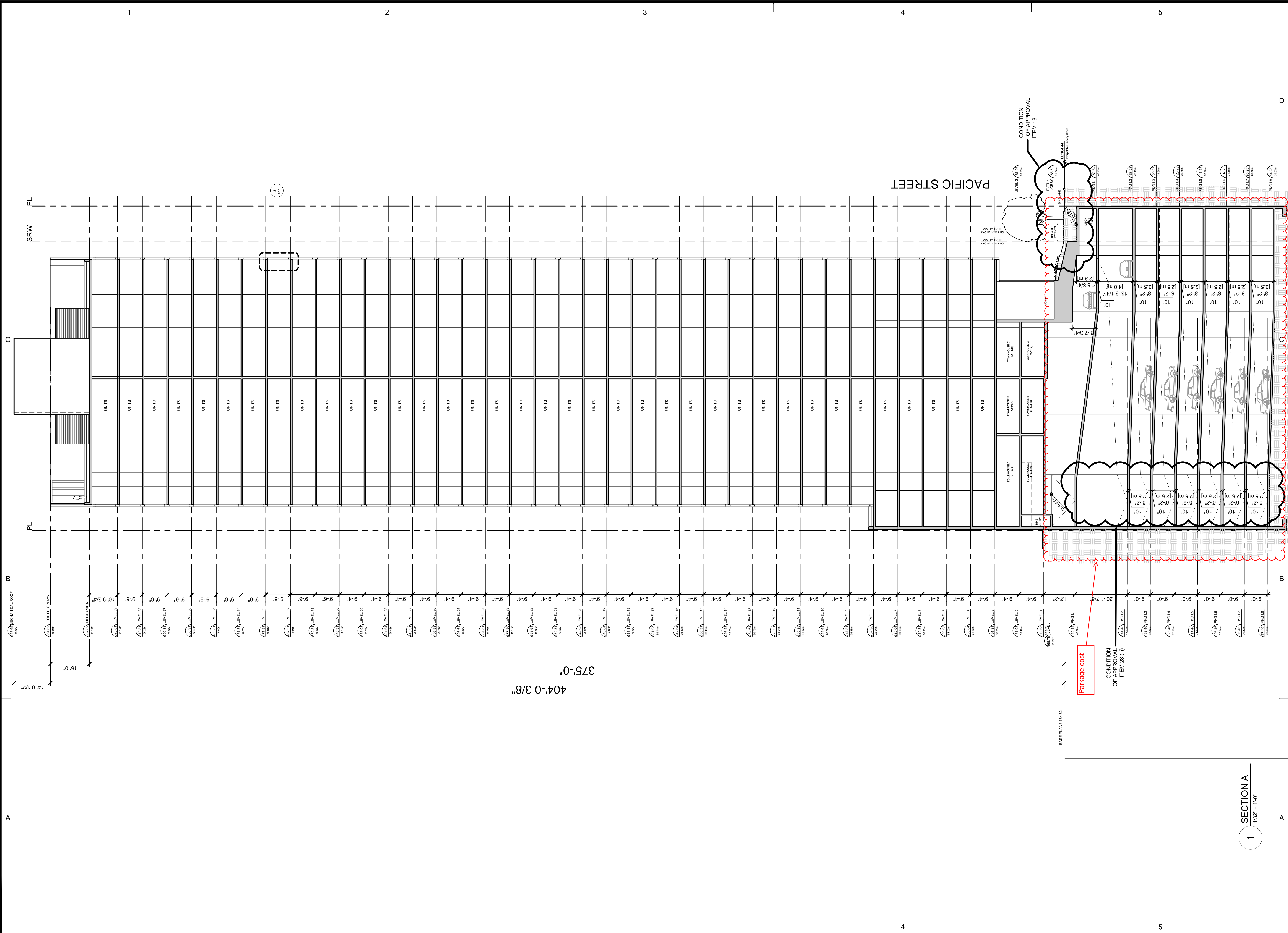
PROJECT TITLE
1380 - 1382 Hornby St.
Vancouver, BC
CaGBC Project ID#: 18322




PROJECT NO.: 37913
DRAWN BY: SDP
CHK'D BY: MB
SCALE: 1/8" = 1'-0"
DATE: March 15, 2017

SHEET TITLE
Parking Level 7 + 8
Plan

SHEET NUMBER A1.01	REV:
--	----------------------

Crime Prevention Through Environmental Design	
TAG	DESCRIPTION
1	Vision lites in doors.
2	Secured access at all points of entry.
3	Clear glazing throughout lobby keeps eyes on the street.
4	Low landscaping keeps clear lines of sight.
5	Townhome front doors face the street.



 GROSVENOR 2000 The Grosvenor Building 1040 West Georgia Street Vancouver, BC V6E 4H1		
COPYRIGHT: Any reproduction or distribution for any purpose other than authorized by IBI Group is forbidden. Written dimensions shall have precedence over scaled dimensions. Contractors shall verify and be responsible for all dimensions and conditions on the job and IBI Group shall be informed of any variations from the dimensions and conditions shown on the drawing. Shop drawings shall be submitted to IBI Group for approval before proceeding with fabrication.		
COPYRIGHT © 2013 IBI GROUP		
NO.	DATE	DESCRIPTION
1	2015-12-21	ISSUED FOR REZONING
2	2017-03-15	ISSUED FOR DP
ISSUES		
SEAL		
SUB-CONSULTANT  ARCHITECTURE DESIGN URBAIN INTERIEUR 1698, rue Courtois O., Saint-Hyacinthe (Québec) Canada J2S 2Z7 Tél: (455) 778-1111 F: (455) 778-1188 Montréal: 3505, Avenue de Capet, Inc. 304, Montréal (Québec) Canada H2T 2A4 T: (514) 456-1111 F: (514) 285-9418		
PRIME CONSULTANT  IBI GROUP ARCHITECTS (CANADA) INC. 700 - 1285 West Pender Street Vancouver BC V6E 4B1 Canada Tel: 604 683 8737 Fax: 604 683 0492 ibigroup.com		
PROJECT TITLE 1380 - 1382 Hornby St. Vancouver, BC CaGBC Project ID#: 18322		
PROJECT NO: 37913 DRAWN BY: SDP CHKD BY: MB SCALE: 1/16" = 1'-0" DATE: March 15, 2017		
SHEET TITLE Section A		
SHEET NUMBER	REV:	
A3.01	-----	

SECTION A
1/16" = 1'-0"

Appendix III - Cost Summary



Appendix III - Cost Summary

	Reference Project	Building Typology	Site Area	Site Orientation	Location	Location Challenge	Soil Condition	A	B	C	D = B+C	B/D	G	J	K = J / D	L	(G+J) / L	P	J / P
								Building Area (GFA)	Driveway & Stalls	Services Area in PK	Gross Parkade Area (GPA)	% of Parking Areas	A/G Building Cost	U/G Parkade Cost	U/G PK Rates	FSR	Total Project Hard Cost /FSR	Parking Stalls	U/G Parkade Cost/Stall
Base	Mirabel (1180 Broughton)	High-rise Condo	Large	Medium	West End	Difficult	Easy	229,713 ft ²	91,330 ft ²	25,970 ft ²	117,300 ft ²	77.9%	\$94,182,300	\$26,346,900	\$225/ft ²	226,412 ft ²	\$532/ft ²	254 no(s)	\$103,700
Sce. 2	Mirabel (1180 Broughton)	High-rise Condo	Large	Medium	West End	Difficult	Easy	229,713 ft ²	56,150 ft ²	25,970 ft ²	82,120 ft ²	68.4%	\$94,182,300	\$19,546,700	\$238/ft ²	226,412 ft ²	\$502/ft ²	136 no(s)	\$143,700
Sce. 3	Mirabel (1180 Broughton) FLR 18 & 19 2TW 4PK	High-rise Condo	Large	Medium	West End	Difficult	Easy	229,713 ft ²	22,410 ft ²	25,970 ft ²	48,380 ft ²	46.3%	\$94,182,300	\$13,177,500	\$272/ft ²	226,412 ft ²	\$474/ft ²	47 no(s)	\$280,400
Base	Grosvenor (1382 Hornby)	High-rise Condo	Small	Difficult	Downtown	Difficult	Easy	257,028 ft ²	92,940 ft ²	25,730 ft ²	118,670 ft ²	78.3%	\$105,381,500	\$28,401,500	\$239/ft ²	246,049 ft ²	\$544/ft ²	238 no(s)	\$119,300
Sce. 2	Grosvenor (1382 Hornby)	High-rise Condo	Small	Difficult	Downtown	Difficult	Easy	257,028 ft ²	63,130 ft ²	25,730 ft ²	88,860 ft ²	71.0%	\$105,381,500	\$22,411,600	\$252/ft ²	246,049 ft ²	\$519/ft ²	160 no(s)	\$140,100
Sce. 3	Grosvenor (1382 Hornby) FLR 40 1TW 8PK	High-rise Condo	Small	Difficult	Downtown	Difficult	Easy	257,028 ft ²	18,415 ft ²	25,730 ft ²	44,145 ft ²	41.7%	\$105,381,500	\$13,536,800	\$307/ft ²	246,049 ft ²	\$483/ft ²	40 no(s)	\$338,400

	Reference Project	Building Typology	Site Area	Site Orientation	Location	Location Challenge	Soil Condition	Building Area (GFA)	Driveway & Stalls	Services Area in PK	Gross Parkade Area (GPA)	A/G Building Cost	U/G Parkade Cost	U/G PK Rates	FSR	\$/FSR	Parking Stalls	\$/Stall	
Base	Belpark (375 W59 Ave)	Low/Mid-rise Apt.	Large	Easy	Marpole	Medium	Easy	173,145 ft ²	66,010 ft ²	14,920 ft ²	80,930 ft ²	81.6%	\$62,332,200	\$15,462,100	\$191/ft ²	162,166 ft ²	\$480/ft ²	189 no(s)	\$81,800
Sce. 2	Belpark (375 W59 Ave)	Low/Mid-rise Apt.	Large	Easy	Marpole	Medium	Easy	173,145 ft ²	37,110 ft ²	14,920 ft ²	52,030 ft ²	71.3%	\$62,332,200	\$11,030,500	\$212/ft ²	162,166 ft ²	\$452/ft ²	91 no(s)	\$121,200
Sce. 3	Belpark (375 W59 Ave) FLR 6 3APT 1.5PK	Low/Mid-rise Apt.	Large	Easy	Marpole	Medium	Easy	173,145 ft ²	9,380 ft ²	14,920 ft ²	24,300 ft ²	38.6%	\$62,332,200	\$5,934,000	\$244/ft ²	162,166 ft ²	\$421/ft ²	19 no(s)	\$312,300
Base	Kits Walk (2075 W12 Ave)	Low/Mid-rise Apt.	Small	Medium	Kitsilano	Medium	Easy	38,802 ft ²	17,080 ft ²	4,350 ft ²	21,430 ft ²	79.7%	\$14,162,800	\$4,874,800	\$227/ft ²	37,435 ft ²	\$509/ft ²	35 no(s)	\$139,300
Sce. 2	Kits Walk (2075 W12 Ave)	Low/Mid-rise Apt.	Small	Medium	Kitsilano	Medium	Easy	38,802 ft ²	25,385 ft ²	6,325 ft ²	31,710 ft ²	80.1%	\$14,162,800	\$7,329,500	\$231/ft ²	37,435 ft ²	\$574/ft ²	54 no(s)	\$135,700
Sce. 3	Kits Walk (2075 W12 Ave) FLR 6 1APT 2PK	Low/Mid-rise Apt.	Small	Medium	Kitsilano	Medium	Easy	38,802 ft ²	6,800 ft ²	4,350 ft ²	11,150 ft ²	61.0%	\$14,162,800	\$2,562,800	\$230/ft ²	37,435 ft ²	\$447/ft ²	11 no(s)	\$233,000

	Reference Project	Building Typology	Site Area	Site Orientation	Location	Location Challenge	Soil Condition	Building Area (GFA)	Driveway & Stalls	Services Area in PK	Gross Parkade Area (GPA)	A/G Building Cost	Parkade Cost	U/G PK Rates	FSR	\$/FSR	Parking Stalls	\$/Stall	
Base	The Oak (7858 Oak St)	Townhouse	Large	Easy	Marpole	Easy	Easy	27,131 ft ²	9,940 ft ²	1,080 ft ²	11,020 ft ²	90.2%	\$8,003,600	\$2,415,400	\$219/ft ²	24,675 ft ²	\$422/ft ²	26 no(s)	\$92,900
Sce. 2	The Oak (7858 Oak St)	Townhouse	Large	Easy	Marpole	Easy	Easy	27,131 ft ²	5,220 ft ²	1,080 ft ²	6,300 ft ²	82.9%	\$8,003,600	\$1,469,300	\$233/ft ²	24,675 ft ²	\$384/ft ²	11 no(s)	\$133,600
Sce. 3	The Oak (7858 Oak St) FLR 3 3TH 1PK	Townhouse	Large	Easy	Marpole	Easy	Easy	27,131 ft ²	780 ft ²	0 ft ²	780 ft ²	100.0%	\$8,275,000	\$60,000	\$77/ft ²	24,675 ft ²	\$338/ft ²	2 no(s)	\$30,000
Base	Victoria Dr. Townhomes (1894 E8 Ave)	Townhouse	Small	Easy	Grandview	Easy	Easy	4,667 ft ²	627 ft ²	0 ft ²	627 ft ²	100.0%	\$1,400,100	\$97,600	\$156/ft ²	4,667 ft ²	\$321/ft ²	4 no(s)	\$24,400
Sce. 2	Victoria Dr. Townhomes (1894 E8 Ave)	Townhouse	Small	Easy	Grandview	Easy	Easy	4,667 ft ²	418 ft ²	0 ft ²	418 ft ²	100.0%	\$1,400,100	\$65,100	\$156/ft ²	4,667 ft ²	\$314/ft ²	2 no(s)	\$32,600
Sce. 3	Victoria Dr. Townhomes (1894 E8 Ave) Garage 1TH	Townhouse	Small	Easy	Grandview	Easy	Easy	4,667 ft ²	0 ft ²	0 ft ²	0 ft ²		\$1,400,100	\$0	\$0/ft ²	4,667 ft ²	\$300/ft ²	0 no(s)	\$0

Attachment 2: Sources Cited

Curry, Melanie. "Parking Requirements Are Not a Useful Bargaining Chip for Increasing Affordable Housing", StreetsBlogCal, May 19, 2021.

Ewing, Reid and Robert Cervero, "Travel and the Built Environment." Journal of the American Planning Association, Volume 76, Number 3. 2010.

Ewing, Reid and Robert Cervero, "Does Compact Development Make People Drive Less? The Answer Is Yes." Journal of the American Planning Association, Volume 87, Number 3. 2021.

Gabbe, CJ, Geogory Pierce, and Gordon Clowers. "Parking policy: The effects of residential minimum parking requirements in Seattle", Science Direct, February 2020.

Handy, Susan "Enough with the "Ds" Already — Let's Get Back to "A", Transfers Magazine, Spring 2018.

Hess, Daniel Balwin and Jeffrey Rehler. "Minus Minimums: Development Response to the Removal of Minimum Parking Requirements in Buffalo (NY)." Journal of the American Planning Association, Volume 87, Number 3. 2021.

Michael Manville, 2013. "Parking Requirements and Housing Development," Journal of the American Planning Association, Taylor & Francis Journals, vol. 79(1), pages 49-66, January. Manville, Michael. "Parking Requirements and Housing Development Regulation and Reform in Los Angeles." 2014.

New York University (Furman Centre for Real Estate & Urban Policy). "Searching for the Right Spot: Minimum Parking Requirements and Housing Affordability in New York City." 2012.

Sightline Institute, "Who Pays for Parking?", Sightline Institute website, December 12, 2013.

Stevens, Mark R. "Does Compact Development Make People Drive Less?" Journal of the American Planning Association, Volume 83, Number 1. 2017.

Tian, Guang, Keunhyun Park, and Reid Ewing. "Trip and Parking Generation Rates for Different Housing Types: Effects of Compact Development." 2019.

Removal of Parking Minimums and its Impacts on Carbon Emissions in the City of Vancouver

Prepared for the City of Vancouver
October 2023



**Licker Geospatial
Consulting Co.**

2405 East Hastings St
Vancouver BC, V5K 1Y8

Table of Contents

Executive Summary	2
Acronyms	3
Introduction	4
Project Context and Previous Work	4
Modelling Assumptions and Inputs	5
General Assumptions	7
Residential Vehicle Ownership Model	10
Embodied Emissions from Vehicles	10
Operational Emissions from Vehicles	11
Embodied Emissions of Parking Stalls	11
Results and Discussion	12
Key Metrics	12
Vehicles	13
Buildings	14
Conclusion	16
Appendix A - Land Use (Buildout) Model	17
Land-Use, Demolitions, Replacements, New Construction	17
Constraints	17
Population and Employment Targets	18
Growth Area and Tier (Land Use)	19
Redevelopment Likelihood	20
Future Building Typologies	20
Replacements	25
Uncertainties & Limitations	26
Appendix B - Parking Stall Intensity Assumptions	28
Appendix C - Embodied Carbon of New Construction	30
Scope & Methodology for Estimating Emissions Factors	30



Executive Summary

Pursuant to its Climate Emergency Action Plan (CEAP), the City of Vancouver (the City) is interested in reducing operational and embodied carbon emissions in the community significantly by 2030 and near-completely by 2050. To that end, the City is exploring a policy proposal to remove parking minimums from residential and commercial properties.

The CEAP is divided into 6 “Big Move” categories, which are bundles of interdependent policy actions. Removing parking minimums theoretically addresses three of these Big Moves: Big Moves 2 and 3, which address how people move around the City; and Big Move 5, which encourages low-carbon materials and construction practices.

Licker Geospatial Consulting (LGeo) was contracted to model the impacts of removing parking minimums across these big move categories across two scenarios of uptake:

1. Medium ambition - sees a 20% reduction in parking construction compared to a Business As Usual (BAU) scenario;
2. High ambition - sees a 50% reduction in parking construction compared to BAU.

Specifically, (1) changes in vehicle ownership due to a reduction in residential parking; and (2) reduction in embodied carbon were explored for this study. Changes to driving behaviour were out of scope for this work.

The results show that the order of magnitude of annual total reductions across all modelled Big Move categories to be within the several tens of thousands of tonnes of CO₂e range. The majority of reductions are from embodied emissions from built parking stalls and vehicles. Operational emissions reductions are less significant.

Acronyms

BAU	Business-As-Usual
BEV	Battery Electric Vehicle
CoV	City of Vancouver
CEAP	Climate Emergency Action Plan
ICE	Internal Combustion Engine
LGeo	Licker Geospatial Consulting
PYE	Policy Years Earned
VanPlan	Vancouver Plan
ZEV	Zero Emissions Vehicle



Introduction

The City of Vancouver (the City) has been exploring the elimination of on-site parking minimums to reduce carbon emissions¹. Building parking necessarily requires resources and space to build which can generate significant carbon emissions². Furthermore, parking minimums unnecessarily incentivize vehicle usage - contributing to further increased emissions³. At the same time, historical and recent analyses have shown that there is an oversupply of parking spaces in rental and strata buildings in Vancouver⁴. Thus, there is a notable case for the implementation of this policy to advance the policy goals of the City.

Licker Geospatial Consulting Ltd. (LGeo) has been engaged by the City to develop estimates of potential emissions reductions of parking minimum removal from vehicle ownership (operational and embodied) and construction (building embodied emissions) in Vancouver in 2030 and 2050. This report details such work, including emissions modelling methodology, results and discussion.

The policy that the City is exploring in this work - i.e., removal of parking minimums - impacts 3 of the 6 Big Move categories in the CEAP: Big Moves 2 and 3, which address how people move around the City; and Big Move 5, which encourages low carbon materials and construction practices. For Big Moves 2 and 3 in this study, only the impact on residential registered vehicles was evaluated.

Project Context and Previous Work

LGeo has been engaged with the City on several analyses, such as evaluating the impacts of the Climate Emergency Action Plan (CEAP) and providing analyses for the Vancouver Plan. The modelling presented in this work is an extension of the previous CEAP modelling contract, which evaluated the City's progress towards CEAP targets.

The first round of the modelling⁵ evaluated policies that had been adopted by 2019 under four scenarios:

1. **Scenario 1:** Pre-CEAP / Business-as-Usual
2. **Scenario 2a:** CEAP 2020- Only Council Committed Actions
3. **Scenario 2b:** CEAP 2020 - All Actions
4. **Scenario 3:** CEAP 2020 All Actions & CleanBC

The modelling of these scenarios captured emissions reductions from the Big Move categories in the CEAP, covering all of the following sectors:

¹ <https://council.vancouver.ca/20200916/documents/cfsc4.pdf>

² <https://iopscience.iop.org/article/10.1088/1748-9326/5/3/034001>

³ https://www.itdp.org/wp-content/uploads/2021/03/ITDP_TamingTraffic_2021.pdf

⁴

<https://metrovanvancouver.org/services/regional-planning/Documents/regional-parking-study-technical-report.pdf#search=Parking%20Study>

⁵ A separate study for “gap-filling” policy analyses was also subsequently performed, but for conciseness this is not discussed here.

- 1) Land use;
- 2) On-road transportation;
- 3) Buildings;
- 4) Embodied Carbon; and
- 5) Urban Canopy.

Project Scope

Unlike the previous scope of work, which covered all Big Move categories, this work explores only Big Moves 2 and 3 and Big Move 5.

1. **Big Moves 2 and 3** - The avoided potential operational and embodied emissions from not building off-street parking infrastructure (for residential structures only, measured in terms of reduced vehicle ownership by Policy Years Earned - PYEs⁶. Modelling of changes to driving behaviour was out of scope for this work); and
2. **Big Move 5** - The avoided embodied emissions of off-street parking stall construction (for both residential and non-residential structures).

This project focuses on evaluating the potential impacts of parking given the following conditions:

- A land use scenario informed by the recently adopted Vancouver Plan Land Use Plan (VanPlan+)
 - LGeo has evaluated several land use scenarios in the past (e.g., permutations of BAU, Vancouver Plan, community land use plans). A VanPlan+ scenario reflects new changes to Vancouver's land use planning. Please see the "Land-Use (Buildout) Model" and **Appendix A** for details.
- Business as Usual (BAU) Parking Construction Materials
 - Defined as the current estimated construction emissions intensities (See the section on "Embodied Emissions of Parking Stalls" and **Appendix B & C** for details)

Modelling the specific land use effects of the Sept 2023⁷ multiplex by-law are out-of-scope for this project.

Modelling Assumptions and Inputs

As shown in Figure 1 below, this section of the report describes the general assumptions used in the modelling, the induced activity model, and the embodied carbon emissions model. The data sources used to generate the estimated impacts of the removal of parking minimums are enumerated in Table 1.

⁶ Policy Years Earned (PYE) refers to the proportion of a year that a vehicle is insured - 1 year means that a given vehicle is insured for a year; 0.5 years would mean that the car is insured for half a year (and presumably only used within that time).

⁷ <https://vancouver.ca/news-calendar/vancouver-reforms-sf-neighbourhoods.aspx>

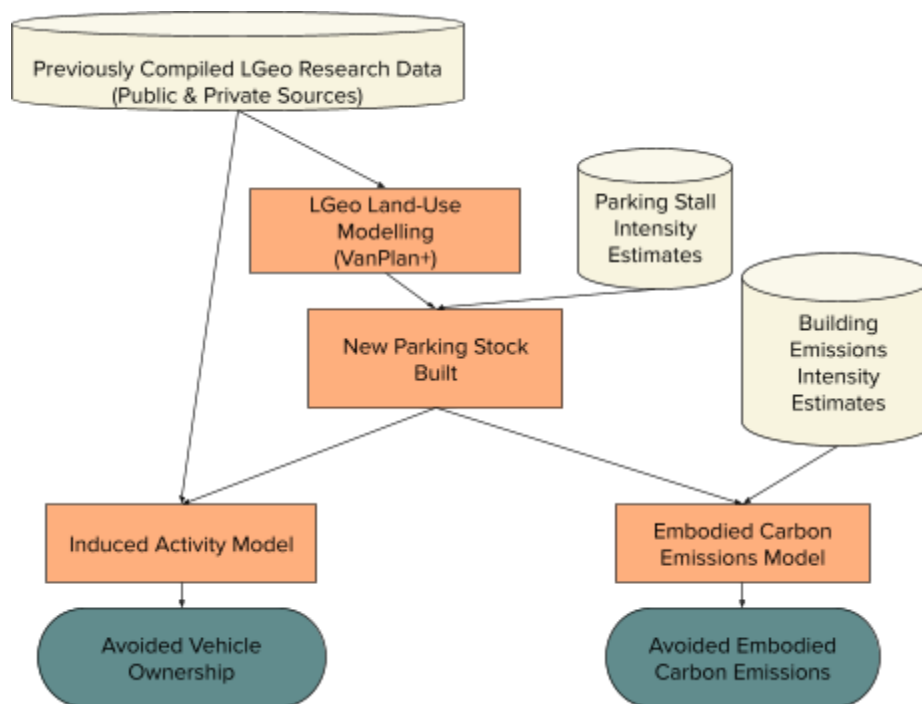


Figure 1. Simplified data path through carbon emissions modelling done in this project (starting at the top and ending at the bottom). Light yellow cylinders indicate major data sources, salmon boxes indicate processing & modelling, and green rounded boxes indicate output data.

Table 1: Major data sources for this project. See Figure 1 for a visualisation of the relationships between modelled components.

Description	Source
LGeo Land-Use and building Model Outputs	Result of previous GLeo modelling contracts
Parking Stall Intensity Per Building	City of Vancouver Staff
Building Emissions Intensity Estimates	Result of previous LGeo modelling contracts (see Appendix B & C)
Historical Vehicle Data	ICBC

General Assumptions

Definition of Baseline and Modelled Cases

For this modelling effort, the baseline is defined as the BAU buildout of off-street parking at two time frames annual avoided emissions for 2030 and 2050 (reductions in vehicle ownership and vehicular embodied emissions) and annual/cumulative avoided construction embodied emissions across two reporting periods: 2023-2030 (“2030”) and 2023-2050 (“2050”).

The BAU reflects the off-street parking built per unit of housing/commercial space given current parking buildout ratios (per residential unit or square foot of commercial space) and current construction emissions intensities (kg CO₂e/m²) that will be built under VanPlan+. Please see the “Embodied Emissions of Parking Stalls” section below and **Appendix B & C** for more details.

The two reporting periods have been subdivided into “Ambition” cases:

- Moderate Ambition (a 20% reduction in built parking spaces over BAU); and
- High Ambition (a 50% reduction in built parking spaces over BAU).

Accordingly, a total of four cases were modelled. These are presented in Table 2 below.

Table 2: Cumulative value of parking stalls built by the given year in each of the modelling scenarios.

	2030	2050
BAU	71,760	210,210
Moderate Ambition	57,410	168,160
High Ambition	35,880	105,100

Table 3 and 4 show the average number of residential parking stalls per unit in 2030 and 2050 for each modelled scenario, for Part 3 and Part 9 residential buildings. **Appendix B** shows the granular assumptions used in the modelling.

Table 3: Average residential stalls per unit for new buildings in 2030.

	BAU	Climate Case - Moderate Ambition Case (20%)	Climate Case - High Ambition Case (50%)
Part 3	1.06	0.85	0.53
Part 9	1.11	0.89	0.56

Table 4: Average residential stalls per unit for new buildings in 2050.

	BAU	Climate Case - Moderate Ambition Case (20%)	Climate Case - High Ambition Case (50%)
Part 3	1.09	0.87	0.55
Part 9	1.11	0.89	0.56

The cases were selected per discussion with City staff. Actual market response to the forthcoming policy may (or may not) align with exact values due to market dynamics and other factors (e.g., luxury apartment buyers may demand more parking spaces regardless of the existence of parking minimum by-laws). Evaluation of the viability of these scenarios was out of scope for this report.

Land-Use (Buildout) Model

A land-use (buildout) model was repurposed from LGeo’s previous work with the City on VanPlan and the Climate Emergency Action Plan (CEAP) projects. This model provides bottom-up, activity-based estimates of the City’s land development between now and 2050. It parameterizes municipal policies across several City departments to generate a blended output suitable for analyses. The analyses presented in this paper assume a Vancouver Plan+ (VanPlan+) scenario where the Vancouver Plan is implemented along with land use plans from multiple local area plans as well as specific policy areas such as the Broadway Plan and Senakw.

More details of the Land use model are available in **Appendix A**.

Parking Stall Construction Model

The parking stall construction model considers building typologies, quantity of buildings or floor areas as well as the intensity of off-street parking construction for a variety of diverse construction archetypes out to the 2050 timeframe. Presented below is the simplified equation that drives the model:

$$P_{built, building, type} = P_{intensity, building, type} * B_{type}$$

Where:

- $P_{built, building, type}$ is the number of stalls for a newly constructed building
- $P_{intensity, building, type}$ is the newly constructed building reflects current parking intensity defined below - based on building type)
- B_{type} is the number of units of housing/square footage for the building’s given type

Equation 1 Expected parking buildout, per building of a given residential or commercial type.

Equation 1 above describes how the number of stalls built for new construction is calculated. See **Appendix B** for a list of building types (commercial and residential subtypes).

Parking stall intensity (parking space intensity) refers to the number of parking stalls constructed for a given number of residential units or square feet of commercial space. City staff provided

residential numbers from a draft report detailing existing construction patterns across a variety of building types (e.g., low/medium/high rise buildings) and by building tenure (e.g., strata, rental, non-market rental). In the absence of available empirical data, commercial building parking baselines were estimated using average building sizes (e.g., office buildings) and by-law-based ratios of commercial parking⁸. This modelling combines floorspace estimates and other determinants of parking to generate sq. ft./space. See **Appendix B** for Tables on parking stall intensities.

These baseline values form the foundation of the estimated avoided emissions from induced activity modelling and from the embodied emissions of parking stall construction (see below).

Residential Vehicle Ownership Model

Future vehicle populations were estimated using linear regression over historical ICBC vehicle registration data as measured in PYEs, which indicates the proportion of time that a vehicle was insured over a year. This is the same approach that was taken for previous modelling projects executed by LGeo and the City to model vehicle ownership

While 90+ variables were originally explored, there were six high-impact attributes were selected as predictors of vehicle ownership:

- Percent Auto Mode;
- Parking per Household;
- Land Use Diversity Index;
- Gross Population Density; and
- Income.

Data was modelled at the TAZ level and the regression model had a R² value of 0.746.

Since parking per household is an input to the model, it can be manipulated to measure its impact on future vehicle ownership. This variable includes both on-street and off-street parking, but only off-street parking was evaluated in this study.

Embodied Emissions from Vehicles

A simple estimate of embodied emissions for cars is provided for reporting years 2030 and 2050 in Table 5. These use estimates from a International Energy Agency study on the expected emissions of motor vehicles⁹. This report estimates approximately 6 tonnes of embodied emissions per internal combustion engine (ICE) vehicle, and 8 tonnes per battery electric vehicle, which for the purpose of this report is used to describe ZEVs more generally.

The estimated distribution of ICE and ZEV vehicles in 2030 and and 2050 that was used to calculate embodied emissions reductions was taken from the previous CEAP modelling study

⁸ <https://bylaws.vancouver.ca/parking/sec04.pdf>

⁹

<https://www.iea.org/data-and-statistics/charts/comparative-life-cycle-greenhouse-gas-emissions-of-a-mid-size-bev-and-ice-vehicle>

that estimated the amount of vehicles that are electric vs. ICE. This work evaluated the impacts of vehicle fleet aging and probabilistic replacement over time in response to policy changes.

Other temporal effects (e.g., changes in embodied emissions of vehicle production) were out of scope for this report.

Operational Emissions from Vehicles

In addition to modelling the reduction in vehicle ownership, an estimate of the commensurate GHG reduction in operational vehicle emissions is also estimated. For the purposes of this exercise, the reduction in operational emissions from vehicles *only* accounts for reduced ownership, *not changes to driving behaviour due to reduced parking*. The latter is time intensive to model and out-of-scope for this work.

Operational GHG emissions in vehicles depend on a variety of factors exogenous to vehicle ownership, such as proportion of trips taken by sustainable mode and the amount of electric vehicle adoption. For clarity in reporting, only a single policy case is considered here:

1. Business-as-usual (historical trend) for trips taken by sustainable mode;
2. CleanBC Roadmap targets for electric vehicle uptake; and
3. CleanBC vehicle efficiency targets.

The Low Carbon Fuel Standard (LCFS) was excluded because the mechanism by which it will be achieved is uncertain and to avoid double counting.¹⁰

Embodied Emissions of Parking Stalls¹¹

The embodied carbon emissions of parking stall construction were approximated using building construction emissions factors. Emission factors per m² corresponding to a given building's type (e.g., single-family; mid-rise; high-rise; etc.) were derived based on a BAU materials intensity composition (See **Appendix C**). These emissions factors were derived from past models of similar archetypes, validated and augmented by data submitted as part of the City's rezoning applications. Embodied carbon calculations included structural building materials and building envelope, which comprise most of new construction's embodied emissions. Emissions were estimated for the following stages of a building's life cycle:

- Resource extraction;
- Manufacturing;
- Construction; and
- Occupancy/maintenance (e.g. anticipated repairs, etc.).

The estimates in **Appendix C** can be lower than other estimates (e.g., office buildings emissions intensity ~50% smaller than those of other works¹²), other estimates may roll up factors that vary

¹⁰ For instance, LCFS targets might be achieved via offsets and incentives for EV uptake, as opposed to actual changes to the fuel mix.

¹¹ Estimates awaiting validation from the City of Vancouver

¹² For instance, Priopta's BC Embodied Carbon Modelling Study estimated double the emissions per m² for high-rise and low-rise buildings (<https://www.priopta.com/downloads/bc-embodied-carbon-modelling-study>)

between methodological approaches. In this report's quality assurance process, it was shown that such differences between emissions factors can have an effect on estimated emissions. However, for methodological consistency between LGeo's work for the City, the existing assumptions in **Appendix C** were maintained.

The emissions factors were then multiplied by the parking stall area. The initial stall area was aligned with the City's definition of a standard stall¹³ - about 13.75m²/stall. In discussion City staff and compared to other estimates¹⁴, this number was deemed too low. Thus, a sample of the City's building permit database was taken to arrive at an estimated average parking stall intensity of 42.75m²/stall for use in this study.

While literature data is sparse on the embodied carbon per stall of parking constructed, the estimates in this report were compared with a previous UBC-City of Vancouver joint project on parking stall embodied carbon¹⁵. The results here were judged to be a reasonable estimate; if potentially undercounting some emissions from larger projects (e.g., the downtown core). For example, some buildings (e.g., high-rise skyscrapers) need several levels of underground parking for their residents. The excavation work and additional foundations needed are very carbon-intensive¹⁶.

Results and Discussion

Key Metrics

The results validate that emissions reductions result from this policy. Broadly, avoided parking stall construction can somewhat reduce motor vehicle ownership and significantly reduce the amount of embodied emissions (vehicular and construction). This can be seen in the 2030 and 2050 (Table 5) results.

¹³ <https://bylaws.vancouver.ca/Bulletin/P001.pdf.bak.PDF>

¹⁴

https://sustain.ubc.ca/sites/default/files/2022-057_Estimating%20the%20carbon%20contribution%20of%20parking%20spaces_Ayres%20Rebello.pdf

¹⁵

https://sustain.ubc.ca/sites/default/files/2022-057_Estimating%20the%20carbon%20contribution%20of%20parking%20spaces_Ayres%20Rebello.pdf

¹⁶

https://sustain.ubc.ca/sites/default/files/2022-057_Estimating%20the%20carbon%20contribution%20of%20parking%20spaces_Ayres%20Rebello.pdf

Table 5: Anticipated results by 2030 for avoided vehicle ownership and avoided embodied GHGs in parking infrastructure (rounded values).

	2030		2050	
	Moderate Ambition (20%)	High Ambition (50%)	Moderate Ambition (20%)	High Ambition (50%)
Annual Avoided Vehicle Ownership (in PYE)	1070	2675	3213	8030
	0.40% reduced from baseline	1.0% reduced from baseline	1.0% reduced from baseline	2.3% reduced from baseline
Annual Avoided Embodied Emissions in Vehicles (kt CO ₂ e)	7	17	25	63
Annual Avoided Operational Emissions in Vehicles (kt CO ₂ e)	2	3	0.6	1
Annual Avoided Embodied GHGs in Parking Infrastructure (kt CO ₂ e)	26	64	9	24
Cumulative Avoided Embodied GHGs in Parking Infrastructure (kt CO ₂ e)	120	300	225	840

Vehicles

In the avoided vehicle ownership modelling, the anticipated effects on the residential modelling show only a low level of reduced vehicle ownership at less than 3% reduction against the BAU in all cases (see Table 5 and Figure 2). This could be in part because in the high ambition case, it was determined that 61% of on- and off-street parking is utilised on average, indicating that even with the reduction of parking minimums there will still be remaining parking spaces in the City.

This avoided vehicle ownership can reduce the emissions from both the manufacturing and operation of vehicles. This is shown in Table 5 above and demonstrates the order of magnitude change from this modelled policy.

There is less reduction in operational emissions from vehicles in 2050 than in 2030 because of a shift to Zero Emissions Vehicles (ZEVs) by that time. For reference, the City’s emissions inventory reports 1,020 kt of emissions from transportation in 2019 from all vehicles, and an estimated 762 kt from light-duty vehicles (estimated in the previous round of CEAP modelling). Thus, the relative emissions reductions here are small.

The temporal effects of shifting towards more ZEVs (as represented by battery electric vehicles in this study) result in more reductions in 2030 operational emissions compared to 2050. At the

same time, it is assumed the manufacturing of BEVs will remain more carbon intensive than conventional vehicles¹⁷. Evaluating such changes across time is out of scope for this report.

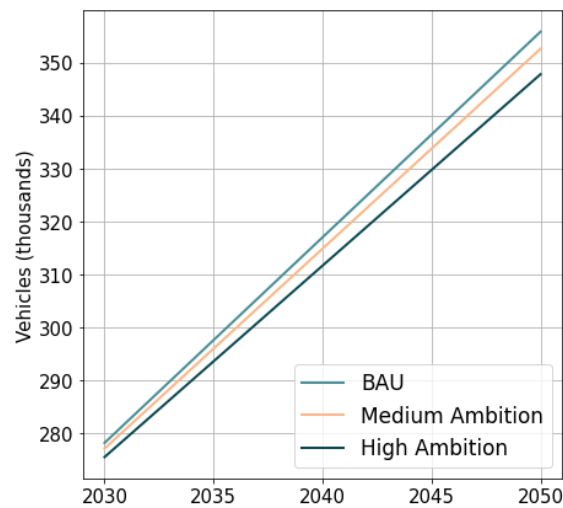


Figure 2: Comparison of vehicle ownership under a BAU, medium ambition, and high ambition reduction cases.

Buildings

Figure 3 shows the cumulative reductions in embodied parking emissions in 2030 and 2050, and Figure 4 shows annual embodied parking emissions. The results in these figures demonstrate that by reducing built parking, the increase of embodied emissions of urban densification can be blunted. This effect can be quite notable, as seen in the timeseries (Figure 4 below). As buildouts are projected to complete, the effect of reducing parking and embodied carbon emissions is amplified.

¹⁷

<https://www.iea.org/data-and-statistics/charts/comparative-life-cycle-greenhouse-gas-emissions-of-a-mid-size-bev-and-ice-vehicle>

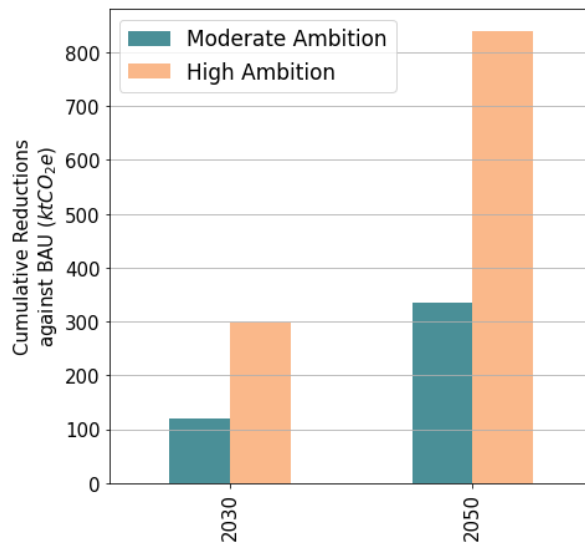


Figure 3. Estimated cumulative emissions reduction for the years 2030 and 2050 (kt CO₂e).

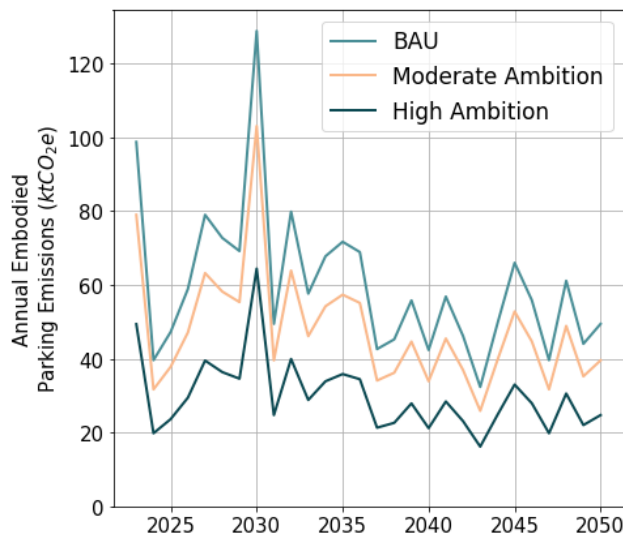


Figure 4. Estimated annual embodied emissions for the years 2030 and 2050 (kt CO₂e). The spike in 2030 reflects large developments such as Senakw (1300 Chestnut Street).

As described in the Vancouver Plan, neighbourhood design guidelines (e.g., municipal town centre, rapid transit areas, neighbourhood centres, villages, and multiplexes) encourage increased density within the City¹⁸. This can include “Missing Middle” options within lower-density

¹⁸ Vancouver Plan, page 77:
<https://vancouverplan.ca/wp-content/uploads/Vancouver-Plan-2022-09-23-1.pdf>

areas or higher-density developments along rapid transit. As seen in **Appendix C**, higher-density developments are notably more carbon-intensive in their construction. This means that there could be an outsized effect on embodied emissions if higher-density buildings do not build as much parking. This means that there could be an outsized effect on embodied emissions if higher-density buildings do not build as much parking.

A further co-benefit of this avoided construction activity could be greater affordability. As shown in previous analyses, constructing on-site parking can cost ~\$26,100 - \$58,600 (2023 inflation-adjusted 2012 dollars)¹⁹. Some recent private sector estimates put the cost at \$120,000 or more²⁰. This imposes additional costs on an already strained housing market in Vancouver^{21,22}.

Conclusion

Given (1) the projected population growth in the City; and (2) the implications of densification under the Vancouver Plan, the removal of parking spaces can blunt the increased carbon embodied carbon emissions in dense construction. The elimination of on-site parking minimums can be a meaningful way to blunt the embodied emissions of the City's forthcoming building stock while having some slight impacts on reducing vehicle ownership. Furthermore, while exact uptake and results may vary depending on exact adoption, market dynamics, and the influence of other (non-modelled/out-of-scope) effects; this initial analysis shows that this policy proposal has merit in reducing overall greenhouse gas emissions.

¹⁹

https://www2.gov.bc.ca/assets/gov/housing-and-tenancy/tools-for-government/uploads/metro_apartment_parking_study_technical_report.pdf

²⁰ <https://biv.com/article/2023/05/reducing-parking-downtown-residential-buildings-has-its-benefits>

²¹ https://thoughtleadership.rbc.com/wp-content/uploads/Housing_Affordability.pdf

²² <https://www.cbc.ca/news/canada/british-columbia/rental-housing-index-2023-1.6881939>

Appendix A - Land Use (Buildout) Model

Land-Use, Demolitions, Replacements, New Construction

The land use model, or buildout, that was developed for the City of Vancouver for use in a different project was repurposed for this study to provide forecasted building stock. The scenario assumptions described in this appendix encompass what will be referred to as "VanPlan+". These assumptions include land use associated with the Vancouver Plan, assumptions for growth within existing planned areas, and assumptions for current in-progress developments, or developments that are likely to succeed between 2023 and 2050. The change in building stock is critical for forecasting how much parking will be built. The forecasted building stock is a function of population and employment growth, future land use, which dictates the types and densities of buildings that can be built in a given area, and the developability of a parcel.

Table A1: *Developments included in the land use modelling - VanPlan+ scenario.*

Growth Area	Development Name
Jericho	Jericho Lands
Senakw	Senakw
Oakridge	Oakridge Centre
Oakridge	Heather Lands
Oakridge	Oakridge Transit Centre
Marpole Community Plan	Pearson Dogwood
Marpole Community Plan	Langara Greens
Broadway	Various
Northeast False Creek Plan	Concord 811 Carrall St

The amount of new development (new buildings) under the VanPlan+ scenario was determined through the use of population and employment targets, which were provided by the City in 2021 for specific areas of the city, referred to as Growth Areas, described further in a section below. Fundamentally, the model works by redeveloping city parcels and building new housing until a population growth target is met. Similarly, redevelopment is modelled for non-residential buildings to accommodate employment growth. Detailed assumptions applied in the land use modelling are described further in the following sections.

Constraints

The following list describes the constraints identified as preventing future redevelopment; parenthetical colours following the constraint descriptions refer to Figure A1 below. These criteria were provided by the City. Parks and greenspace (green), industrial (dark purple), institutional (dark blue), built since 2010 (brown), heritage site (pink), employment lands/other (grey)

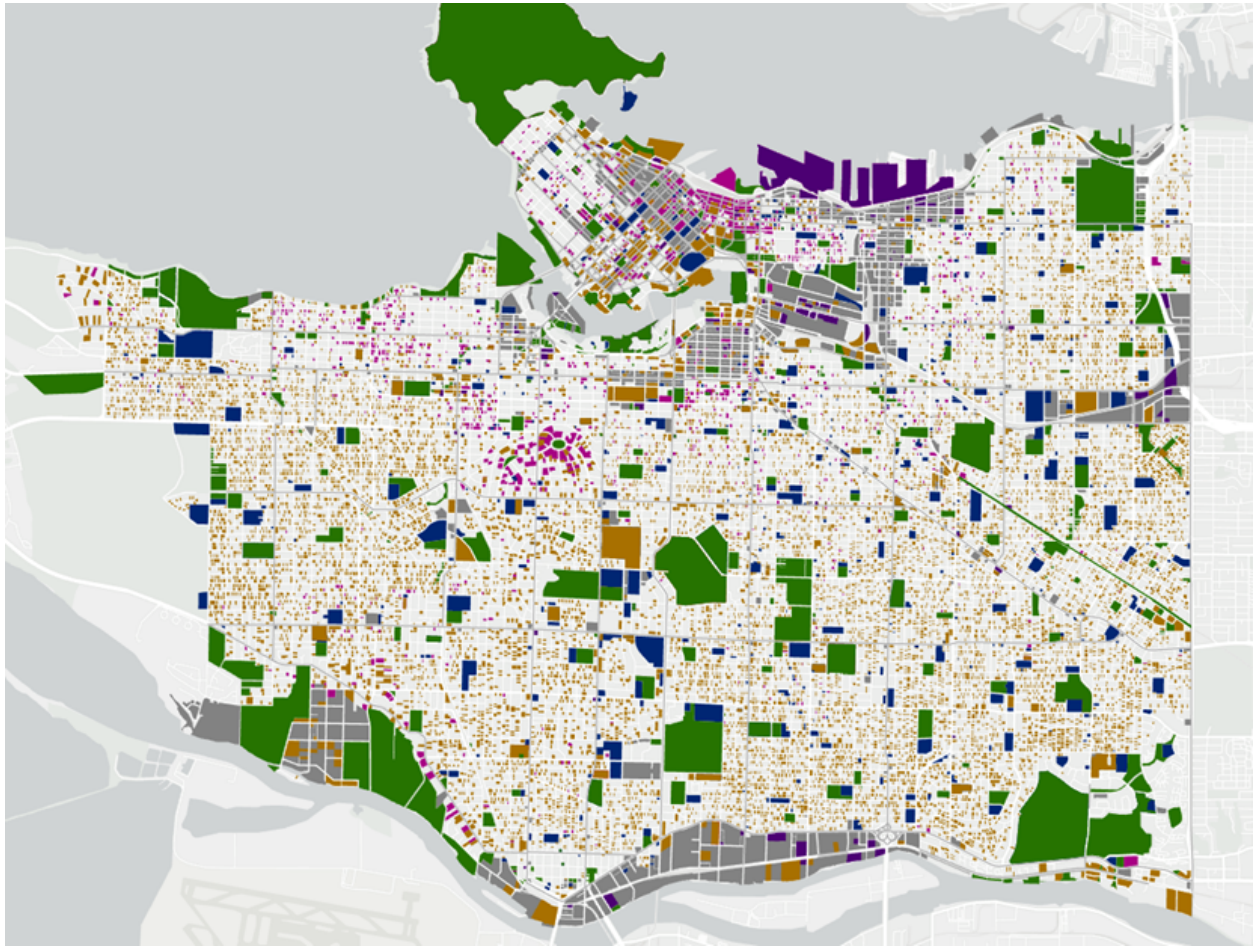


Figure A1 Constraints to future development as provided by the City of Vancouver.

Population and Employment Targets

The population target for both scenarios was 950,000 people in 2050. This target was from the most recent VanPlan modelling. This was an additional 281,890 people from the 2019 population of 668,110. Targets were not set for 2030 and were instead a function of the buildout. Employment targets were from the original VanPlan modelling and included figures from the 2020 Hemson report minus the footloose²³ employment projections (no building space needed). Spatial allocation of employment was assigned based on forecast employment densities for significant commercial area expansions such as Jericho and Oakridge. LGeo also modelled a significant increase in mixed-use development and commercial infill for residential areas. It is important to note that the total employment target was not always met as there was not enough land to accommodate growth given the density assumptions. See Table A2 for a breakdown of population and employment targets by growth area.

²³ Terminology from Hemson report, refers to workers with no fixed place of work

Table A2: Population and Employment Targets by Growth Area (VanPlan+) scenario.

Growth Area	Population	Employment
Senakw	8,389	1,500
Jericho	18,738	3,159
Northeast False Creek Plan	8,989	1,049
East Fraserlands Policy Statement	2,942	-
Oakridge	20,000	6,549
Marpole Community Plan	20,000	2,078
West End Community Plan	2,600	-
Broadway	54,700	49,331
Employment Lands	-	38,186
Metro Core	12,323	3,354
Transit Area	74,597	9,000
Neighbourhood Centre	33,302	5,250
Village	15,985	750
Other Residential	9,325	1,825
Institutional	-	19,708

Growth Area and Tier (Land Use)

Land use for the modelling parameterized as a set of density tiers as defined by the City. These are shown in Table A3 below.

Table A3: Summary of tiers by Unplanned (VanPlan) and Existing Planned Areas.

Tier	VanPlan	Existing Planned Areas (MV 2016 Land Use) excl. Broadway, Senakw, Jericho
Tier C	Ground floor within 100m along primary intersection for villages and within 400m of intersection for neighbourhood centres and transit areas	Commercial, Downtown Mixed Use, Multi-Family High-Rise
Tier 4	Within 200m of existing retail	Multi-Family Low-Rise
Tier 3	200m – 400m from existing retail	N/A
Tier 2	400m – 800m from existing retail	N/A
Tier 1	All other residential lots	One-Family Dwelling; Two-Family Dwelling

At the time of this study, the City did not have a city-wide generalised land use and consolidation of local plan area land uses was out of scope. As such, the growth within the included existing planned areas of Marpole, Oakridge, East Fraserlands, Northeast False Creek, and West End were modelled using the Metro Vancouver Generalised Land Use from 2016 and matched to the density tiers by general intended use. As exceptions, Jericho and Senakw did not utilise land use and were instead built out according to plans and phasing. As well, land use within the Broadway Plan Area was delineated from its policy plan in collaboration with the Broadway Plan team. Fundamentally, the growth area and tier assume a shift towards higher-density development. See Figure A2 for a map of land use growth areas.

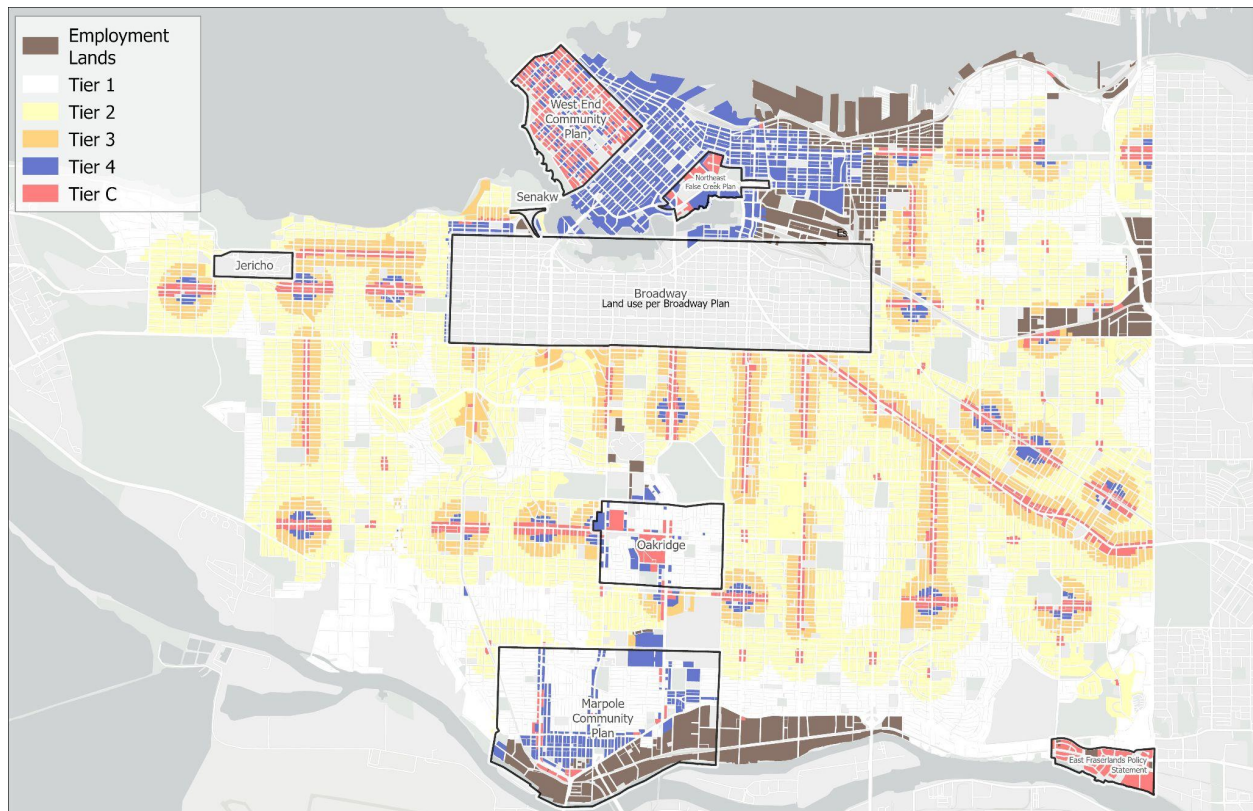


Figure A2. Land use growth areas.

Redevelopment Likelihood

To determine where in a growth area development would occur to accommodate population growth, parcels were assigned a relative ranking score across each Growth Area and Growth Tier, which were calculated using density gap (current density vs maximum allowed density under future land use), floor space ratio, improvement ratio and year built, with year built having a third of the weighting as other metrics. Functionally vacant parcels, located on a high street, or had an active building permit as of 2022 were all given a score bonus to increase their likelihood for development. The highest-scoring parcels were considered the most likely to redevelop.

Future Building Typologies

As mentioned, the types of buildings constructed between 2023 and 2050 in the buildout model were determined by the growth tier, where each tier had a preferred split of building types to be built (indicated as percentages). This split was not always achieved as each building type has its restrictions regarding lot size etc. Building typologies have assumed residential floor space ratio (FSR), average unit sizes, mixed-use FSR for ground floor offices and retail, minimum lot size (as determined by the FSR and a minimum number of units), average household size, and square footage per employee.

Assumptions regarding building typologies are shown in Tables A4 below. Moreover, some changes were made to the assumptions within the Broadway Plan Area after speaking with the

Broadway team. FSR and allowed building typologies were provided separately for the Broadway Plan Area land uses outlined in the Broadway Plan. These assumptions are also shown in Table A5 and Table A6.



Table A4: Building typology assumptions (VanPlan+)

Building Type	Construction Material	Avg Unit Size	Min Lot Size	Avg Hh size	Senakw / Jericho	Building Mix by Growth Tier					Density						
						Tier C	Tier 1	Tier 2	Tier 3	Tier 4	Employment Lands	Res. FSR	Retail FSR	Office FSR	Light Industrial FSR	Institutional FSR	Sq.Ft per Employee
4 storey mixed use	Wood	850	5,750	1.8	-	0.33	-	-	-	-	0	2.4	0.35	0	0	0	295
6 storey mixed use	Wood	850	11,500	1.8	-	0.33	-	-	-	-	0	3.4	0.35	0.35	0	0	243
12-18+ storey mixed use	Wood/Concrete	850	17,250	1.8	1.00	0.33	-	-	-	-	0	5.2	0.35	0.35	0	0	237
Single family	Wood	2,416	4,000	2.5	-	-	0.10	0.03	-	-	0	0.6	0	0	0	0	0
Single family w/ laneway	Wood	2,818	4,000	3.0	-	-	0.06	-	-	-	0	0.7	0	0	0	0	0
Duplex	Wood	1,500	4,000	2.2	-	-	0.23	-	-	-	0	0.7	0	0	0	0	0
Multiplex	Wood	1,000	4,000	2.0	-	-	0.31	0.27	0.10	0.05	0	1	0	0	0	0	0
Townhouse	Wood	1,000	4,000	2.0	-	-	0.31	0.24	0.14	-	0	1.2	0	0	0	0	0
4-5 storey apartment	Wood	850	5,750	1.8	-	-	-	0.26	0.25	0.24	0	1.8	2.5	0	0	0	0
6 storey apartment	Wood	850	11,500	1.8	-	-	-	0.20	0.20	0.19	0	2.5	0	0	0	0	0
12-18 storey apartment	Wood	850	17,250	1.8	-	-	-	-	0.30	0.29	0	5	0	0	0	0	0
18+ storey apartment	Concrete	850	17,250	1.8	-	-	-	-	-	0.24	0	7.5	0	0	0	0	0
Office Tower	Concrete	0	0	0	-	-	-	-	-	-	0.1	0	1.00	6.10	0	0.25	235
Retail Standalone	Wood	0	0	0	-	-	-	-	-	-	0.2	0	0.75	0	0	0	295
Industrial	Wood/Concrete	0	0	0	-	-	-	-	-	-	0.7	0	1.00	2.25	2.50	0.25	598
Institutional Large	Wood/Concrete	0	0	0	-	-	-	-	-	-	0	0	0.00	0.20	0	4.00	440
Hotel/Conference/Assembly >100,000 ft ²	Concrete	0	21,053	0	-	-	-	-	-	-	0	0	4.75	0.00	0.00	0.00	380

Table A5: Broadway Plan Area building typology splits by land use.

Building Type	Construction Material	Avg Unit Size	Min Lot Size	Avg Hh size	Low-Rise	Mid- to High-Rise	High-Rise	Residential Primary	Low-Rise Villages	Medium-Rise	MU Mid- to High-Rise	MU High-Rise	Shoulder Area	Station Area	Uptown	Uptown Extension	Industrial - High Intensity	Industrial - Medium Intensity	Mixed Employment - High Intensity	Mixed Employment - Medium Intensity
4 storey mixed use	Wood	850	5,750	1.8	-	-	-	0.33	0.33	0.33	0.03	0.03	0.33	0.33	-	-	-	-	-	-
6 storey mixed use	Wood	850	11,500	1.8	-	-	-	0.33	0.33	0.33	0.03	0.03	0.33	0.33	-	-	-	-	-	-
12-18 storey mixed use	Wood/Concrete	850	17,250	1.8	-	-	-	0.33	-	0.33	0.95	0.95	0.33	0.33	-	-	-	-	-	-
Single family	Wood	2,416	4,000	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Single family w/ laneway	Wood	2,818	4,000	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Duplex	Wood	1,500	4,000	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Multiplex	Wood	1,000	4,000	2	0.10	0.05	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-
Townhouse	Wood	1,000	4,000	2	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-5 storey apartment	Wood	850	5,750	1.8	0.25	0.24	0.24	-	-	-	-	-	-	-	-	-	-	-	-	-
6 storey apartment	Wood	850	11,500	1.8	0.20	0.19	0.19	-	-	-	-	-	-	-	-	-	-	-	-	-
12 storey apartment	Wood	850	17,250	1.8	-	0.29	0.29	-	-	-	-	-	-	-	-	-	-	-	-	-
18 storey apartment	Concrete	850	17,250	1.8	-	0.24	0.24	-	-	-	-	-	-	-	-	-	-	-	-	-
Office Tower	Concrete	-	-	0	-	-	-	-	-	-	-	-	-	x	x	x	x	x	x	x
Retail Standalone	Wood	-	-	0	-	-	-	-	-	-	-	-	x	x	x	x	x	x	x	x
Industrial (Employment Lands)	Wood/Concrete	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x
Institutional	Wood/Concrete	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Large Hotel/Conference/Assembly >100,000 ft²	Concrete	-	21,053	0	-	-	-	-	-	-	-	-	x	x	x	x	x	x	x	x

Table A6: Broadway Plan Area building typology density assumptions by land use (FSR).

Building Type	Low-Rise	Mid- to High-Rise	High-Rise	Residential Primary	Low-Rise Villages	Medium-Rise	MU Mid- to High-Rise	MU High-Rise	Shoulder Area	Station Area	Uptown	Uptown Extension	Industrial - High Intensity	Industrial - Medium Intensity	Mixed Employment - High Intensity	Mixed Employment - Medium Intensity
4 storey mixed use	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	-	-	-	-	-	-
6 storey mixed use	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	-	-	-	-	-	-
12-18 storey mixed use	5.20	6.50	6.00	6.25	-	3.65	7.50	7.50	8.15	8.15	-	-	-	-	-	-
Single family	0.60	0.60	0.60	-	-	-	-	-	-	-	-	-	-	-	-	-
Single family w/ laneway	0.70	0.70	0.70	-	-	-	-	-	-	-	-	-	-	-	-	-
Duplex	0.70	0.70	0.70	-	-	-	-	-	-	-	-	-	-	-	-	-
Multiplex	1.00	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Townhouse	1.20	1.20	1.20	-	-	-	-	-	-	-	-	-	-	-	-	-
4-5 storey apartment	1.83	1.83	1.83	-	-	-	-	-	-	-	-	-	-	-	-	-
6 storey apartment	2.50	2.50	2.50	-	-	-	-	-	-	-	-	-	-	-	-	-
12 storey apartment	5.00	6.50	6.00	-	-	-	-	-	-	-	-	-	-	-	-	-
18 storey apartment	7.50	7.50	7.50	-	-	-	-	-	-	-	-	-	-	-	-	-
Office Tower	-	-	-	-	-	-	-	-	-	10.15	11.65	4.65	4.00	3.00	4.00	3.50
Retail Standalone	-	-	-	-	-	-	-	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Industrial (Employment Lands)	-	-	-	-	-	-	-	-	-	-	-	-	2.00	3.00	1.00	1.00
Institutional	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Large Hotel/Conference/Assembly >100,000 ft²	-	-	-	-	-	-	-	-	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75
Mixed Use Retail	0.35	0.35	0.35	0.35	0.35	0.35	1.00	1.00	0.35	0.35	-	-	-	-	-	-
Mixed Use Office	-	-	-	-	-	-	-	-	1.00	2.00	-	-	-	-	-	-

Replacements

Replacement targets for single-family dwelling floor areas by vintage decade were derived through an analysis of 5 years of historic BC Assessment data for previous modelling. This was used to ensure that a specific amount of single-family dwelling floor area was demolished and replaced through the buildout model. The overall targets were derived using replacement rates by decade and the total existing area. For this modelling, a percentage target was set for the total single detached floor area to be demolished. After the buildout was complete, if the percentage target had not been met, additional single detached floor area was demolished to reach the target and replaced with a new single detached dwelling of an assumed size based on the decade. Table A7 below shows the replacement rate and targets by decade, as well as the assumed newly built home size. For example, the total percentage of 1940s single detached homes expected to be demolished by 2050 was 34%. If less than that target was demoed for new building types, the remaining floor area (up to 34%) was demoed and replaced with a new single detached home.

Table A7: Replacement rates and demolition targets for single-family homes in Vancouver by decade.

Vintage Decade	Replacement Rate (%)	Replacement Size (sq.ft.)	2050 Demo for Replacements by Floor Area (%)
1900s	2.25	1,915	0
1910s	2.49	2,318	15
1920s	3.76	2,510	13
1930s	3.66	2,497	36
1940s	4.35	2,403	34
1950s	4.81	2,446	50
1960s	1.73	2,420	42
1970s	0.68	2,279	19
1980s	0.27	2,985	7
1990s	0.16	2,387	3
2000s	0.13	2,181	0
2010s	0	2,169	0
2020s	0	2,169	0

Uncertainties & Limitations

As defined, the model also has various uncertainties and limitations, as listed below:

General

- For building stock forecasting, VanPlan phasing was not included. The land use put forth in the Vancouver Plan will, in reality, be implemented in phases (e.g. preferred corridors) and as such will not affect development all at once and not right away. The phasing for VanPlan is currently being developed by City staff and was not available for use in this project. For modelling purposes, the VanPlan land use is assumed to be active as of 2023.

Residential

- Senakw and Jericho are built out manually according to currently available plans and phasing information;
- Oakridge Centre is built out manually based on the proposed floor areas in the Policy Statement (see p.4). The assumed building typologies are mixed-use high-rise and the relevant employment building typologies. The built year is assumed to be 2030 for the whole lot;
- Residential buildout is done on unconstrained lots and excludes employment lands;
- Lot attempts to increase its buildable area through consolidation as above;
- Density threshold for the lot is its population. If a lot consolidates, the consolidating parcels' population is added to this threshold;
- If a lot has existing retail space, it will be redeveloped as a mixed-use building;
- A lot will only redevelop if redevelopment will increase density on the lot (i.e. accommodates more people);
- Suites are added to 50% of new single-family detached homes, indicated in the buildout result;
- Lots are capped at 1,000 people;
- 15% circulation space is added to apartment floor areas;
- If a mixed-use building is built in a Growth Area that does not have projected employment, the employment is subtracted from the Employment Lands employment target instead;
- For detached houses with laneway, the existing home is not demoed and a new laneway is simply added to the lot; and
- For each Growth Area, the buildout year is a function of the number of developments (e.g. 30 developments total equals 1 development per year).

Non-Residential (ICI)

- ICI ignores constraints except for parks, heritage sites and new construction;
- ICI only builds if development will increase employment density;
- Remaining retail and office employment that is not allocated into mixed-use buildings is developed on non-residential lots throughout the city (lots with an existing population of zero);

- The large hotel/conference centre typology is built in Metro Core and Broadway using a 1/10 coin toss if a lot is large enough to accommodate and the retail employment target is unmet;
 - Alternatively, both retail and/or office is built on the lot;
- Institutional builds the new school at Olympic Village and moves St. Paul's hospital to its new location (including retail, hotel and office according to plan summary);
- Remaining institutional is built on existing institutional lots; and
- New industrial employment is built on existing industrial lots.

Finally, and very importantly, the reader should note that the **modelling is not a crystal ball, it is a best estimate** based on the information that was provided. The modelling should give the City a general idea of trends that will occur in the future but, as with all modelling, it depends on the assumptions and might not capture all exogenous factors.

Appendix B - Parking Stall Intensity Assumptions

Parking assumptions were compiled from direct conversations with City employees (residential) and derived estimates from City by-laws (commercial).

Note: Mixed-use residential buildings had their parking allocated to residential uses only, as described in the table below.



Table B1: Assumptions on Current Parking Construction Intensity (per building type/tenure)

New Construction	Expected Spaces/Unit Strata	Expected Spaces/Unit Rental	Expected Spaces/Unit Non-Market Rental	Expected sq ft/space
12-18 storey apartment	0.98	0.54	0.24	NA
18+ storey apartment	0.98	0.54	0.24	NA
4-5 storey apartment	1.39	0.77	0.49	NA
6-12 storey apartment	1.39	0.77	0.49	NA
Single family	1.12	0.55	0.19	NA
Single family w/ laneway	1.12	0.55	0.19	NA
Duplex	1.12	0.55	0.19	NA
Townhouse	1.12	0.55	0.19	NA
Multiplex	1.12	0.55	0.19	NA
12-18 storey mixed use	0.98	0.54	0.24	NA
4 storey mixed use	1.39	0.77	0.49	NA
6-12 storey mixed use	1.39	0.77	0.49	NA
Industrial (Employment Lands)	NA	NA	NA	1013.70
Institutional	NA	NA	NA	1013.70
Large Hotel/Conference/Assembly >100,000 ft²	NA	NA	NA	1565.54
Office Tower	NA	NA	NA	589.07
Mixed Use Office and Retail	NA	NA	NA	562.16
Retail Standalone	NA	NA	NA	789.62

Appendix C - Embodied Carbon of New Construction

Broadly, the embodied carbon of new construction is the average embodied carbon intensity of different new construction building typologies (i.e., land uses) multiplied by the floor area of new construction forecasted for those land uses under VanPlan+ land use scenario (see **Appendix A**).

Scope & Methodology for Estimating Emissions Factors

Embodied carbon intensities (measured in units of $\text{kgCO}_2\text{e}/\text{m}^2$) for different archetypal construction types were applied to annual new construction buildout projections (m^2) for different land use scenarios (See Table C1).

The embodied carbon of new construction was estimated for the following stages of a building's life cycle:

- Resource extraction.
- Manufacturing.
- Construction.
- Occupancy/maintenance (e.g. anticipated repairs, etc.).

End-of-life carbon associated with the decommissioning of the building and disposal of materials was not included. It was assumed that buildings constructed during the study period will remain standing after 2050.

Embodied carbon for new construction is assigned entirely to the year in which the construction occurs (e.g., all embodied carbon for a building built in 2025 is included in the total embodied carbon projection from new construction for 2025). It should be noted that the contribution of embodied carbon from the occupancy/maintenance stage is assumed to be minor.

Embodied carbon was included for major structural (e.g., foundations, frame) and envelope (e.g., insulation, windows, cladding) materials. These materials typically make up the majority of new construction emissions. Embodied emissions from mechanical, electrical and plumbing systems were not included.

Emissions factors ($\text{kg CO}_2\text{e}/\text{m}^2$) for various archetypes were sourced from a database of building emissions factors for common construction types in BC's Lower Mainland, which Dunskey previously developed (Details available in a previous report submitted to the City of Vancouver "Energy and Emissions Baseline Scenarios City of Vancouver January, 2023" - Appendix C). These emissions factors were derived from modelling using a variety of life cycle analysis platforms, including One Click LCA, Embodied Carbon in Construction Calculator (EC3), Athena Impact Estimator for Buildings, and Building Emissions Accounting for Materials (BEAM). All tools rely on an underlying database of manufacturer-specific and industry-average Environmental Product Declarations (EPDs).

Parking stalls size assumptions are described in the report's section on the "Embodied Emissions of Parking Stalls".

Table C1: Building Archetypes, BAU Embodied Carbon Intensity (GHGI; kg CO₂e/m²), and Emissions per Parking Stall.

Building Archetype	BAU GHGI (kg CO₂e/m²)	Emissions (kg CO₂e) per Parking Stall
12-18 storey apartment	246	10517
18+ storey apartment	246	10517
4-5 storey apartment	200	8550
6 storey apartment	200	8550
Detached home	104	4446
Laneway home	125	5344
Duplex	84	3591
Industrial	213	9106
Institutional	213	9106
Hotel / conference	251	10730
12-18 storey mixed use	246	10517
4-5 storey mixed use	200	8550
6 storey mixed use	246	10517
Multiplex	64	2736
Office tower	213	9106
Retail and office	213	9106
Standalone retail	144	6156
Townhouse	69	2950