MOTT MACDONALD

Phase 1-3 Summary Report

UBC Campus Vision 2050 | Transportation

September 2023

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UBC Campus Vision 2050 | Transportation

September 2023

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Executive summary

UBC is continuously developing and implementing strategies, policies and programs that prioritize active and sustainable modes of transportation, including walking, rolling, cycling, and public transit. Over the past two decades (1999-2019), transit trips to/from UBC have more than tripled (from 23,000 to 80,000 trips) while single occupancy vehicle trips have stayed relatively constant (from 48,000 to 47,000 trips), despite the campus daytime population increasing by three-quarters (from around 46,000 to 80,000 people). UBC aims to continue this trend through integrated land use and mobility plans that ensure the vast majority of new trips generated by campus growth will be by active and sustainable modes. Campus Vision 2050 is an ambitious long-term plan that includes new local transit service, improved walking/rolling/cycling connections throughout campus, and transformative investments in regional transit service to campus including the Millennium Line SkyTrain extension to UBC and future rapid transit along Southwest Marine Drive and 41st/49th Ave. These changes are expected to help UBC meet its 2040 two-thirds sustainable mode share target and, combined with a broader transition to zero-emission vehicles, support UBC in making progress toward its Climate Action Plan 2030 (CAP2030) target of a 45% reduction from 2010 levels of extended impact emissions, which includes commuting to and from campus. The Neighbourhood Climate Action Plan (NCAP 2030) is also underway and will set climate action targets for UBC's neighbourhoods.

UBC retained Mott MacDonald to provide a range of transportation planning and advisory services as part of its long-range planning process, Campus Vision 2050. The purpose of this report is to summarize transportation planning services provided as part of Campus Vision 2050, to inform more detailed analysis and technical work as part of the 10-Year Campus Plan update and future neighbourhood plans.

Two key modelling approaches were used to establish a baseline and assess concept options and the draft Vision:

- Regional Transportation Model (RTM) – developed by TransLink and used by municipalities across the region to model high-level changes in travel behaviour associated with significant land use changes and/or changes to the transportation network, providing data on 2017-, 2035- and 2050-time horizons.
- Access Measurement – developed by Mott MacDonald and used to assess connectivity options to major nodes and future SkyTrain stations, to maximize station area potential and guide supportive investments.

In interpreting the results of this work, it is important to consider the limitations of the RTM. RTM and other regional models are oriented towards long-distance trips and as such they are less well-suited to estimating short-distance walking and cycling trips. Particularly in walkable urban settings like UBC where trip lengths tend to be shorter, shifts to active modes are most commonly linked to the provision of small-scale infrastructure (e.g., crosswalks, cycle tracks, etc.) and behaviour-change policies. It is the author team's view that RTM presents a conservative estimate of future active mode trips, which can be increased through policy and infrastructure interventions.

Study Background

The UBC Vancouver campus covers 402 hectares of land on the tip of the Point Grey Peninsula and is surrounded by Pacific Spirit Regional Park. UBC has a daytime population of around 80,000 people, and a nighttime population of 29,000 people. Growth proposed in Campus Vision 2050 would see UBC house 24,000 more people on campus over the next 30 years, for a daytime population of over 100,000 people and a nighttime population of 53,000 in 2050.

A review of relevant regional and campus transportation policies and plans demonstrates that regionally, organizations are prioritizing higher sustainable mode share targets similar to UBC planning and policy, which includes:

- UBC's 2014 Transportation Plan — at least two-thirds of all trips to and from UBC made by walking, cycling, and transit, with 50% of trips being made by transit by 2040.
- UBC's Climate Action Plan 2030 – achieve a 45% reduction from 2010 levels of extended impact emissions, which includes commuting to and from campus by 2030. Similar targets for UBC's neighbourhoods are expected via the Neighbourhood Climate Action Plan (currently underway).

In order to meet the sustainable transportation targets in UBC's plans, new trips to/from the campus from increased campus growth will need to be made primarily by transit. Within the 2050 horizon, there will be significant investments in network and service improvements to, from, and around UBC that will support sustainable travel, including:

- An extension of the Millennium Line from Arbutus Street to UBC (included in TransLink's *Transport 2050: 10-Year Priorities* plan approved by the Mayors' Council in June 2022).
  - With full funding committed by 2025, SkyTrain could be in service at UBC by the early 2030's.
- 41st Avenue / 49th Avenue Rapid Transit (included in TransLink's *Transport 2050* plan).
- New active transportation infrastructure on roadways to and from campus under the jurisdiction of the Ministry of Transportation and Infrastructure (MoTI) and the City of Vancouver.

Transportation Baseline

The existing regional and local mobility networks and travel demand was reviewed to identify baseline challenges and opportunities for setting 2050 transportation strategies and meeting the adopted targets. Identified challenges and opportunities included:

- Location and topography of campus, which separates UBC from the rest of Metro Vancouver making transit, rather than cycling or walking, the most desirable sustainable travel mode to reach campus for those who live further away.
- The Millennium Line UBC Extension Regional Base Scope provides an initial concept of station locations, including one station at the UBC Trolley Bus Loop and provision for potential future infill station within the UEL, and a potential extension to a second UBC station near West 16th Avenue and East Mall.
  - An important consideration moving forward will be the decisions and implications of where and when an infill station investment is feasible and the related phasing for UBC development.
- The arrival of the Millennium Line UBC Extension provides an opportunity to re-think on-campus transportation networks, including the potential to provide improved intra-campus transit service.
- Improvements to cycling facilities on corridors to/from campus anticipated by MoTI should correlate to locations for on-campus facilities, including secure bike parking and end-of-trip facilities.
- The addition of protected cycling facilities to UBC's road network is essential to support safe and efficient active travel through campus.
- Accommodating access by large delivery vehicles to all buildings on campus takes up valuable right-of-way (ROW).
  - A central receiving system or new policy on maximum vehicle sizes on campus may make roads safer for active travel modes and facilitate a more people-focused public realm.

Opportunities for innovation in sustainable mobility over 30 years

A range of case studies were reviewed that showcase innovative solutions to deliver sustainable mobility through reducing trip length (or the need to travel at all), prioritizing sustainable modes and improved energy efficiency. These case studies include:

- **A 15-minute city** - each neighbourhood is planned or redeveloped to contain all the basic needs residents have for living and working, enabling people to reach all the destinations they frequently require within a 15-minute walking or rolling trip.
- **A low vehicle traffic neighbourhood** – design or policy decisions that both encourage the use and access of sustainable modes and reduce vehicle traffic within the neighbourhood.
- **Distribution Centres and Last-Mile Delivery** – a system that reduces the number and size of large delivery vehicles in neighbourhoods by re-directing deliveries to a central distribution centre to then be distributed to home addresses by smaller vehicles.
  - **Robotic Deliveries** – provide zero emission, contactless, last mile delivery solution. Current robots can function in all seasons and can hold up to three grocery bags at a time.

Transportation Opportunities for Concept Options

Potential transportation concepts were documented as part of the UBC Campus Vision 2050 planning process. Potential opportunities for UBC's primary movement corridors were developed to support conversations around redevelopment opportunities and implications/trade-offs of different options.

A potential future street function map of UBC's primary movement corridors was developed to capture emerging considerations for UBC's future street functionality, which support Campus Vision 2050 and more detailed mobility network planning as part of the 10-Year Campus Plan update and future neighbourhood plans.

Key future opportunities include:

- West 16th Avenue (between Wesbrook Mall and Southwest Marine Drive) should consider optimization for transit and active travel use, with dedicated and separated lanes for each travel mode.
- East Mall has been identified as a potential shared 'people first' street, where transit and active travel modes and ROW are prioritized and general purpose motor vehicles may be restricted on some portions, particularly as the ROW narrows north of Agronomy Road.
  - With the exception of accessibility, emergency, and operational vehicles.

The street function work was 'rolled-up' into a framework which classifies the network based on the types of street environments desired, and the balance between the type of movement and activity that occurs on different parts of the network.

Regional Transportation Model Forecasts

Future transportation behaviour and demand was investigated using TransLink's Greater Vancouver Regional Transportation Model (RTM) Phase 3.[1] The RTM was used to explore mode share, travel volumes and GHG emissions related to implications of the Campus Vision 2050 land use assumptions under three rapid transit scope scenarios:[2]

- Scenario 1: Single SkyTrain station at the Trolley Loop (Regional Base Scope)
- Scenario 2: Scenario 1 + a second SkyTrain station in the UEL near Lelem/Acadia
- Scenario 3: Scenario 1 & 2 + a third SkyTrain station near West 16th Avenue and East Mall

A 2050 scenario with no SkyTrain was not modelled. This scenario was modelled by TransLink as part of the Rail to UBC Rapid Transit Study (2019), with findings of that study summarized below. The Millennium Line UBC Extension project has since been confirmed as a near-term regional priority and the Province of BC is

[1] The RTM has limitations with respect to forecasting land use and transportation interactions into the longer-term future: the model typically underestimates walkability and proximity benefits and overestimates the vehicle trips generated by denser land use in the future. These models generally do not reflect robust walking and cycling modelling and results reported here should not be used as a reflection of walkability

[2] Each scenario also includes two new intra-campus routes (EW Shuttle and NS Shuttle) with 15-minute frequency.

actively advancing development of a Business Case. A scenario where SkyTrain is not extended to campus by 2050 is therefore highly unlikely.

All scenarios also include increased residential, student and employment population in 2050.

2050 Forecasted Travel Demand

The following summarizes the key takeaways for 2050 as estimated by the RTM:

- With the arrival of SkyTrain (1, 2, or 3 stations), modelling indicates that UBC will meet or exceed its target of at least two-thirds of all trips to and from UBC made by cycling, walking and transit, with over 50% of trips being made by transit (see Regional Transportation Model Forecasts).
  - This is an important target of UBC's Transportation Plan that also plays a key role in achieving UBC's climate goals for extended impact emissions.
- The 20% increase in academic space and 100% increase in neighbourhood housing (representing a 20% increase above the current Land Use Plan allocation) proposed by Campus Vision 2050 is anticipated to result in approximately 80,000 additional daily trips to and from campus compared to today (212,000 in 2050 compared to 132,000 in 2017). The vast majority of these trips (70,000 or 87.5%) are expected to be made via transit, and only 8,000 or 10% of these additional trips are anticipated to be made by auto (67,000 in 2050 compared to 59,000 in 2017) (See Table 7.3).
- The RTM estimates up to 50% higher traffic volumes (including commercial vehicles) on the major roads to and from UBC relative to 2017, noting this represents only a 10% increase in overall trips to/from campus, with this growth concentrated on W 16th Avenue, Southwest Marine Drive, and University Boulevard (see Table 7.6 and Section 7.1.1 for limitations of the RTM)
- At a corridor level, the existing roads to / from UBC can accommodate the anticipated increase in traffic from Campus Vision 2050 growth, and measures can be implemented to manage increased congestion during peak periods (see 2050 Forecast Travel Demand).
- Further transportation network analysis and planning is needed as part of the update to the 10-Year Campus Plan and future neighbourhood plans to better understand changes to the experience of pedestrians, cyclists, transit-users, and drivers.

Access Analysis

Access was measured for the UBC campus using available data to understand how access to services and retail on campus will change in 2050 given the proposed changes to the transportation network and land use distributions.

- The results demonstrate that the proposed 2050 land use concepts significantly contribute toward the Campus Vision 2050 principles, including making the campus more inclusive and accessible, strengthening connectivity, and addressing climate change.
- The percentage of residents with exceptional access[3] to retail and services is expected to increase ninefold in the 2050 land use scenario.

Access to the future Millennium Line UBC Extension was also evaluated across the three station scenarios, by measuring walking distance from residential buildings.

- Across the entire campus, the average travel time by walking or rolling from residential buildings (weighted by population) to the SkyTrain station is 18 minutes in Scenario 1.
- An infill station near Acadia/Lelem reduces the average travel time by 14% to 15 minutes and increases the percentage of residents within a 10-minute walk by 64% compared with Scenario 1.
- A third station near West 16th Avenue and East Mall reduces average travel time by 38% to 9 minutes and more than doubles the percentage of residents living within a 10-minute walk of a station, compared with Scenario 2.

[3] Exceptional access is defined as access to more than 35 buildings with retail or services within a 10-minute walk or roll.

Greenhouse Gas Emissions

Transportation related greenhouse gas (GHG) emissions have been calculated using vehicle-kilometres-travelled (VKT) derived from the RTM, fleet composition, and fuel efficiencies to establish a baseline and to investigate the impact of increased population and visitors in 2050.

- Baseline GHG emissions were estimated to be 60,500 tonnes of CO2e.
- Annual total VKT for trips to and from campus and within campus were modeled to increase by 37% by 2050, compared to today.
- GHG emissions in 2050 were estimated to increase 5% by 2050 despite a VKT increase of 37%.
  - This is attributed to a shift to more trips by transit and an expected shift in fleet composition towards zero emission vehicles (ZEVs) by 2050.

1 Introduction

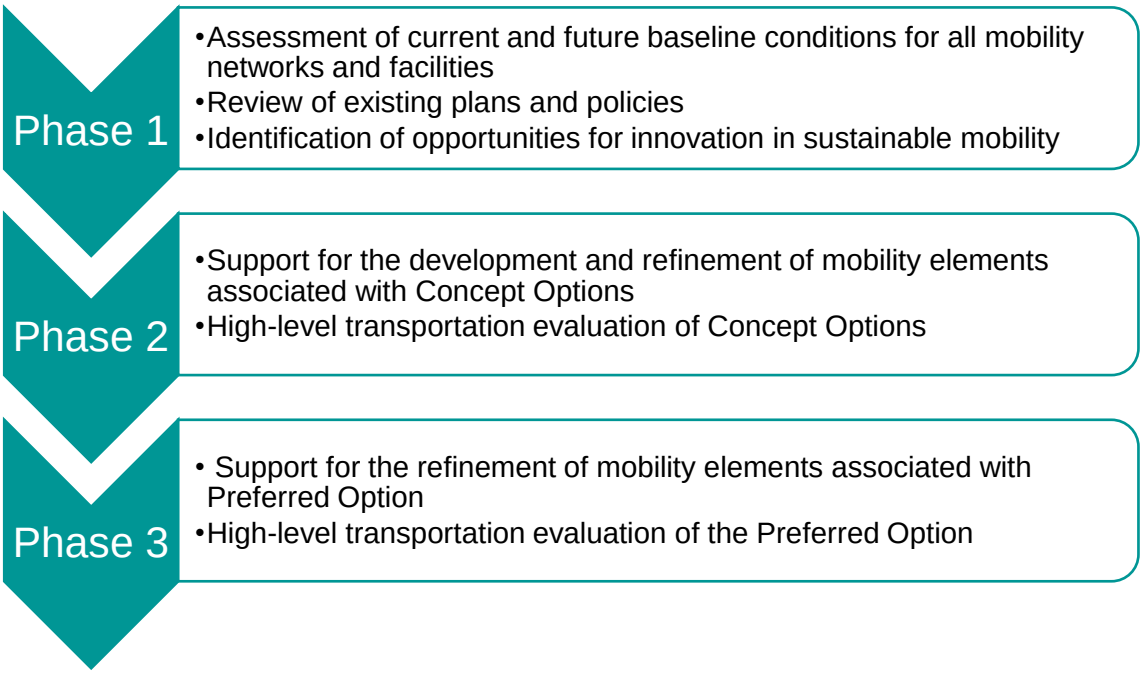
The University of British Columbia retained Mott MacDonald to provide a range of transportation planning and advisory services as part of the Campus Vision 2050 process. The objective of this report is to summarize transportation analysis and findings for: the needs and aspirations (Phase 1); the development and refinement of mobility elements associated with 30-Year Options (Phase 2); and refinement of the preferred option for the Final Vision (Phase 3). This work will inform further detailed analysis and technical work as part of the 10-Year Campus Plan update and future neighbourhood plans.

1.1 Background and Study Purpose

The planning process for Campus Vision 2050 is a comprehensive, two-and-a-half-year public planning process, which will culminate with the first major update in a decade of UBC's Land Use Plan, the Vancouver Campus Plan, and will inform future neighbourhood plans. Campus Vision 2050 is being developed through comprehensive engagement with the campus community and Musqueam, informed by existing UBC policy, principles, future space needs and societal imperatives. The general scope and process for Campus Vision 2050 is set out in a Terms of Reference, which serves as the 'goal posts' for the development and testing of a range of options for Campus Vision 2050. Further transportation network analysis and planning will be required as part of the update to the 10-Year Campus Plan and future neighbourhood plans.

The transportation planning and advisory services to support the Campus Vision 2050 are broadly categorized into three phases, as illustrated in Figure 1.1. This report summarizes work carried out during Phase 1, 2, and 3.

Figure 1.1: Campus Vision 2050 Transportation Planning Scope of Work



1.2 Report Structure

This report has been organized as follows:

- **Section 2: Background** presents opportunities and parameters for the study based on a review of relevant regional and campus policies, plans and demographics. This section establishes a common understanding of UBC's demographics, existing conditions, and policy framework.
- **Section 3**: **Transportation Baseline** establishes the regional and local mobility networks and travel demand baseline. Understanding the current transportation demand and behaviour of the UBC community helps to identify challenges and opportunities for setting 2050 transportation strategies and meeting the adopted targets.
- **Section 4: Guiding Principles for Transportation Opportunities** provides a synthesis of how the Campus Vision 2050 Guiding Principles are aligned with local UBC and regional transportation policy mapped to the gaps and opportunities identified in the previous section. From this, transportation principles were developed, which informed Campus Vision 2050 and will be considered in the 10-Year Campus Plan and future neighbourhood plans.
- **Section 5: Future Innovation Opportunities in Sustainable Mobility** presents considerations for future mobility and uncertainty, as well as case studies on innovation in mobility.
- **Section 6: Transportation Opportunities for Concept Options** outlines transportation-related input for the development of planning options from technical and design analysis and participation in multidisciplinary charettes and workshops.
- **Section 7: Regional Transportation Model Forecasts** provides an overview of the anticipated travel demand, mode share and GHG emissions associated with proposed changes to the UBC transportation network, land use, or demographics.

2 Study Background

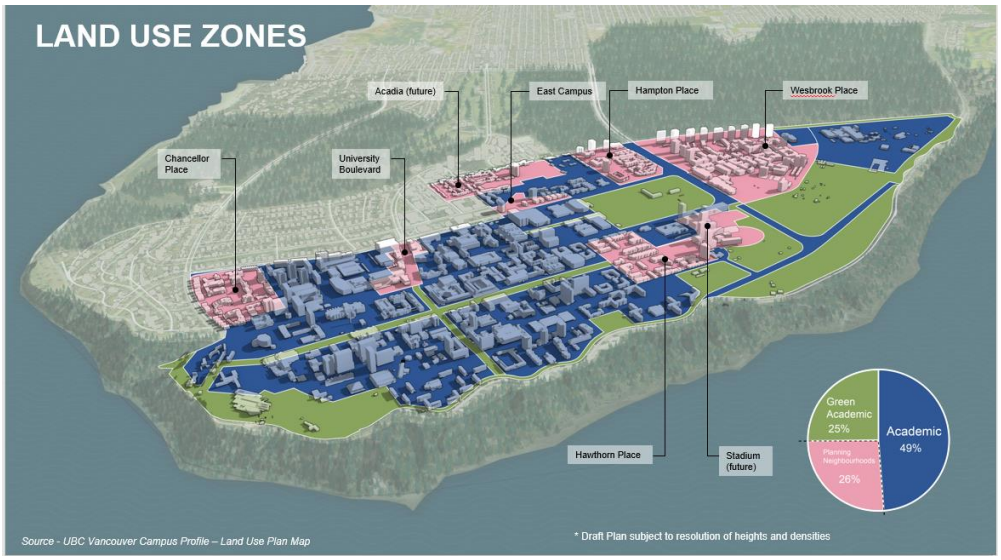
2.1 Study Area

The UBC Vancouver campus is situated on the traditional, ancestral and unceded territory of the xwməθkwəy̓əm (Musqueam) people. The campus is situated adjacent to the University Endowment Lands and is located west of the City of Vancouver.

The UBC Vancouver campus covers 402 hectares of land on the tip of the Point Grey Peninsula and is surrounded by Pacific Spirit Regional Park (Figure 2.1). The size of the campus is so vast that its land area is more comparable to Downtown Vancouver than any other major Canadian campus (UBC Vancouver Campus Profile, 2021). The campus land uses can broadly be categorized as academic, green space, and neighbourhood residential land (Figure 2.2).

Figure 2.1: UBC's Positioning on the Point Grey Peninsula (Source: UBC Vancouver Campus Profile, 2021)

Figure 2.2: Existing Campus Land Uses



As shown, distances vary between some neighbourhood housing areas, academic and green academic uses, which can create challenges for people who are traveling through the campus who need to travel across campus to access these different areas (e.g., work, shopping, daycare, school).

2.2 Roadway Jurisdictions

All roads to and from UBC are the jurisdiction of BC Ministry of Transportation and Infrastructure (MOTI). As a result, any changes proposed to MOTI roadways will require coordination and advocacy with the province. All local roads are owned and maintained by UBC, with the exception of neighbourhood roadways which are maintained by the University Neighbourhoods Association.

2.3 Plan and Policy Review

A review of relevant regional and campus transportation policies and plans was carried out to identify a range of gaps and opportunities which may be addressed or realized through the Campus Vision 2050 planning process.

The review demonstrates that regionally, organizations are prioritizing higher sustainable mode share targets (i.e., travel by transit, walking, cycling) through policy and infrastructure investments. These regional goals align with UBC planning and policy. However, the physical separation of the campus from the rest of the region, both by distance and topography, makes commuting by walking or cycling challenging. In order to meet the sustainable transportation related targets in UBC's plans, new trips to/from the campus, caused by campus growth, will need to be made primarily by transit.

A summary of reviewed policies and plans is provided below, and the full review may be found in **Appendix A**.

2.3.1 Municipal/Regional Plans

TransLink, Metro Vancouver, and the City of Vancouver plans and policies set detailed strategies, investments, and timelines that continue to advance goals for sustainable transportation. Regionally, organizations are prioritizing higher sustainable mode shares through policy and infrastructure investments. Some key examples include:

- TransLink's Transport 2050 plan includes a headline target that, by 2050, active modes and transit will account for at least half of all passenger trips, with taxi, ride-hailing and carshare accounting for most of the remaining passenger trips.
- The City of Vancouver's Climate Emergency Action Plan accelerated their previous Transportation 2040 target for two-thirds of all trips to be active modes and transit from 2040 to 2030. The Plan also introduced a more aggressive 80% walk/bike/transit mode share target for areas close to rapid transit stations.

To align with these regional and nearby local targets, urban areas, especially those served by rapid transit, will need to increase their mode shares for sustainable modes (transit, bike, walk). The City of Vancouver's Climate Emergency Action Plan is one example of where these regional principles have been implemented at a municipal scale. UBC also has an important role to play in making progress towards these regional goals.

Within the 2050 horizon, there will be significant investments in network and service improvements to, from, and around UBC that will support sustainable travel. These improvements include:

- New cycling infrastructure (ranging from protected bike lanes to shared use lanes) on roadways under the jurisdiction of the MoTI that connect to or are within the UBC Campus (Southwest Marine Drive, West 16th Avenue, University Boulevard, Chancellor Boulevard, and Northwest Marine Drive).
- The Broadway Subway Project, which will extend the SkyTrain Millennium Line from VCC Clark Station to Arbutus Street, is planned to be completed in 2025. TransLink's Transport 2050 and 10-Year Priorities identifies a further extension of the Millennium Line from Arbutus Street to UBC. The business case phase of planning was endorsed by the TransLink Mayors' Council in 2022 and is currently underway, led by the Province of BC. With full funding committed by 2024, SkyTrain could be in service at UBC by the early 2030s.
- The 41st/49th Avenue RapidBus connection has been identified in TransLink's Transport 2050 as part of the key expansions required for the 2050 Reliable & Fast Transit Network. The technology and level of grade-separation for the 41st Avenue/49th Avenue rapid transit route has yet to be determined.

2.3.2 UBC Plans

UBC is continuously developing and implementing strategies, policies and programs that prioritize active and sustainable modes of transportation, including walking, rolling, cycling, and public transit. Over the past two decades (1999-2019), transit trips to/from UBC have more than tripled (from 23,000 to 80,000 trips) while single occupancy vehicle trips have stayed relatively constant (from 48,000 to 47,000 trips), despite the campus daytime population increasing by three-quarters (from around 46,000 to 80,000 people). UBC has several adopted plans that shape the direction of campus growth over the next 30 years. These plans include the Climate Action Plan, the Community Energy and Emissions Plan (currently being updated as the Neighbourhood Climate Action Plan), the Vancouver Campus Plan, and the Transportation Plan. Additional guiding documents include the Campus Plan Design Guidelines, the Development Handbook, the Cycling Network Plan, and the U Boulevard Area Plan, which led to the recent upgrades to Wesbrook Mall.

UBC's Climate Action Plan 2030 (CAP 2030) sets targets to fast track the university's path to significantly reduce GHGs and achieve a 45% reduction from 2010 levels of extended impact emissions (Scope 3) which includes commuting to and from campus. The Neighbourhood Climate Action Plan (NCAP 2030) is also underway and will set climate action targets for UBC's neighbourhoods.

UBC's 2014 Transportation Plan outlines the long-term transportation goals and strategies for UBC's Vancouver Campus. The policies in this plan address issues that are under both direct campus and regional control. The transportation goals/objectives include:

- By 2040, at least two-thirds of all trips to and from UBC will be taken on foot, bicycle, or transit, with 50% of trips being made by transit.
- Reduce single-occupant vehicle (SOV) travel to and from UBC by 20% from 1996 levels. Reduce SOV trips per person to and from UBC by 30% from 1996 levels.
- Maintain daily private automobile traffic (SOV or high-occupancy vehicles, excluding buses and commercial vehicles), at or less than 1997 levels.

In order to meet the mode share targets in UBC's transportation plan, new trips from campus growth will need to be made primarily by transit. Leveraging network investments outlined in the preceding section will be critical to this.

Adopted in 2010, the Vancouver Campus Plan informs the physical shaping of the campus over a 20-year period. The Plan sets policies related to sustainability, open space, land use, the public realm, and transportation (a selection of which are summarized below).

- Construction of new surface parking lots will be discontinued.
- Existing surface lots will be used as future building sites or for recreational uses.
- New parking structures will only be constructed once surface lots are used for infill.
- Roadways between the pedestrian priority zones and the campus perimeter will be transformed into shared streets.
- Motor vehicle access in pedestrian priority zones will be limited to emergency and service vehicles and disabled access privileges.

2.4 Demographics

2.4.1 Residents

UBC is home to 15,000 people who live in neighbourhood housing areas. Compared to Metro Vancouver, UBC's community is younger, has a smaller average household size, and a higher median after-tax income (Table 2.1). The population growth from 2016 – 2021 has also been more than double that of Metro Vancouver (Statistics Canada, 2021).

Table 2.1: Demographic Comparison Between UBC and Metro Vancouver (Source: Statistics Canada, 2021)

	UBC [Designated Place]	**Vancouver [Census Metropolitan Area]**
Population change (2016 – 2021)	+17.5%	+6.5%
Age		
0 to 14	15.5%	14.1%
15 to 64	73.4%	68.5%
65 and over	11.1%	17.4%
Average household size	2.2	2.5
Median After-Tax Personal Income	$30,000	$27,000

2.4.2 Students, Faculty, and Staff

In addition to the 15,000 neighbourhood residents in the UBC community, UBC is also home to a large student population. In 2021, there were 60,000 students enrolled, and there are a total of 13,000 student beds currently at UBC (UBC Vancouver Campus Profile, 2021).

UBC Vancouver also employs 24,000 people, consisting of:

- 4,000 faculty members
- 12,000 staff members
- 8,000 student employees

The total daytime population of UBC, including residents, students, faculty, and staff, is approximately 80,000 people. This compares to the approximate residential population of 100,000 people in Downtown Vancouver[4] and an employee base of 150,000 people in 2016.[5] Growth proposed in Campus Vision 2050 would see UBC house 24,000 more people on campus over the next 30 years, for a daytime population of over 100,000 people and a nighttime population of 53,000 in 2050. Given this significant population of people traveling to and through campus, it is imperative that a highly functional and multi-modal mobility network be in place to serve the current (and future) UBC population.

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[4] 2016 Census – residential catchment area as defined as the Downtown peninsula to Main Street.

[5] https://www.dtvan.ca/wp-content/uploads/2018/12/BIZMAP_2016_Downtown-Neighbourhood.pdf

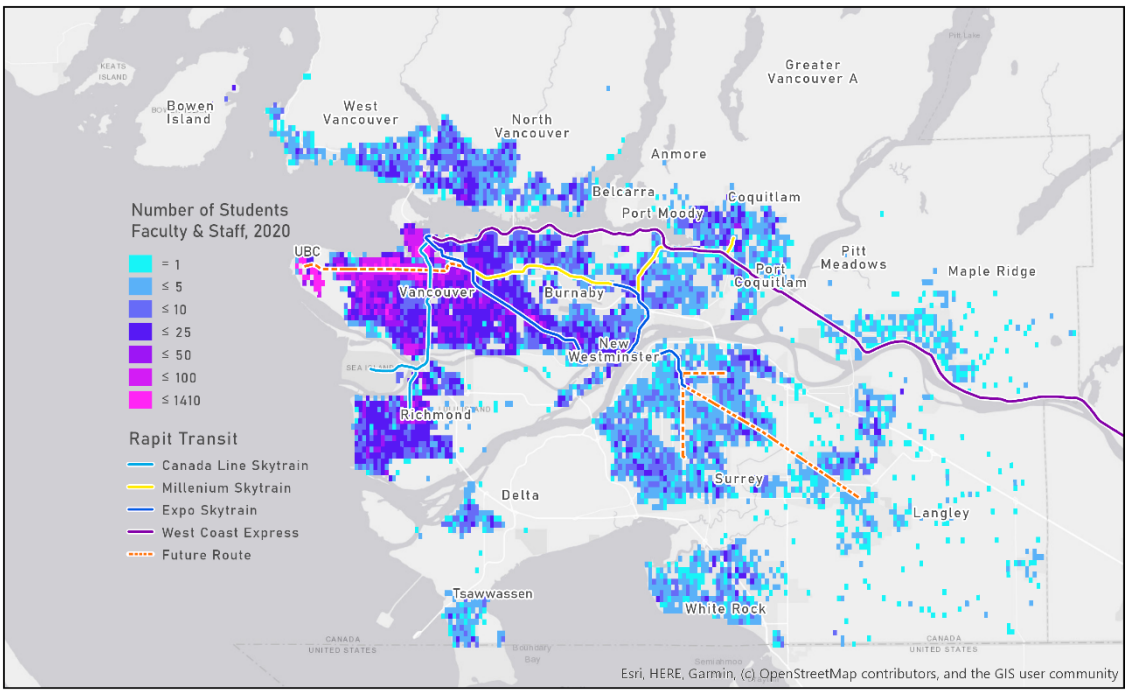
3 Transportation Baseline

3.1 Introduction

To meet both UBC and regional transportation targets, as described in Section 2, new trips generated from future campus growth will need to be made primarily by transit, biking, or walking. The following section establishes the regional and local mobility networks and travel demand baseline. Understanding the current transportation demand and behaviour of the UBC community will help to identify challenges and opportunities for setting 2050 transportation strategies and meeting the adopted targets.

UBC students, faculty, and staff live within the campus, across Metro Vancouver and beyond. As shown in Figure 3.1, a high concentration of the UBC community lives within the Campus (12%) and the City of Vancouver (45%), with the highest concentration of student, faculty, and staff living on Campus, along the Broadway Corridor and Downtown Vancouver. A significant number of UBC community members also live in North Vancouver, Richmond, Burnaby, and New Westminster (22% combined). Significant numbers of students, faculty and staff live in municipalities further from campus such as Surrey, Delta and Coquitlam (13% combined). This emphasizes that much of the UBC community has a long commute to campus, heightening the role of transit for 2050 transportation strategies.

Figure 3.1: Where UBC Lives (2020)

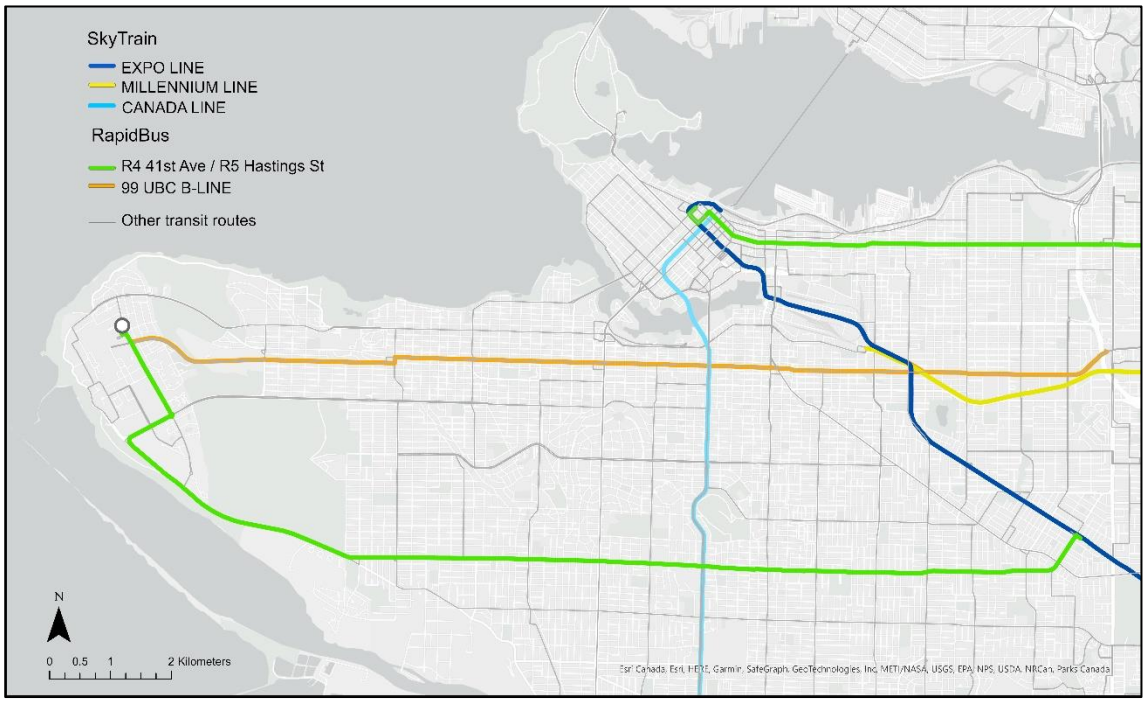


3.2 Regional Mobility Networks

3.2.1 Regional Transit Network

UBC's regional travel demand is currently served (indirectly) by three SkyTrain routes, three RapidBus routes and many other bus transit routes with service at least once per hour during the daytime all week (Figure 3.2). However, UBC is only connected directly to the regional rapid transit network through the R4 and the 99 B-Line bus transit routes. UBC is also served by a range of other bus transit connections, which are later presented in Section 3.3.1.

Figure 3.2: Existing Regional SkyTrain and RapidBus Network



In the future, UBC will have direct rapid transit connections to the regional transit network with the anticipated delivery of the Millennium Line UBC Extension and rapid transit route along the 41st Avenue and 49th Avenue corridors between the University of British Columbia campus and Metrotown.

The 99 B-Line RapidBus bus route that connects to UBC via Broadway is one of the busiest bus routes in North America, and one of Metro Vancouver's most consistently overcrowded bus routes.[6] The route also correlates with one of the highest concentrations of where UBC students, faculty, and staff live. The extension of the Millennium Line from VCC-Clark to Arbutus Street (the "Broadway Subway Project") will replace a portion of this service and is planned to be completed in 2026.

TransLink's Transport 2050 and 10-Year Priorities identify further extending the Millennium Line to UBC (as shown in Figure 3.3). The combination of the Millennium Line extension to Arbutus Street and to UBC will reduce transit travel times dramatically, increase capacity, and provide a more reliable and enjoyable service for people to commute to and from the UBC campus.

[6] https://www.translink.ca/plans-and-projects/projects/rapid-transit-projects/millennium-line-ubc-extension

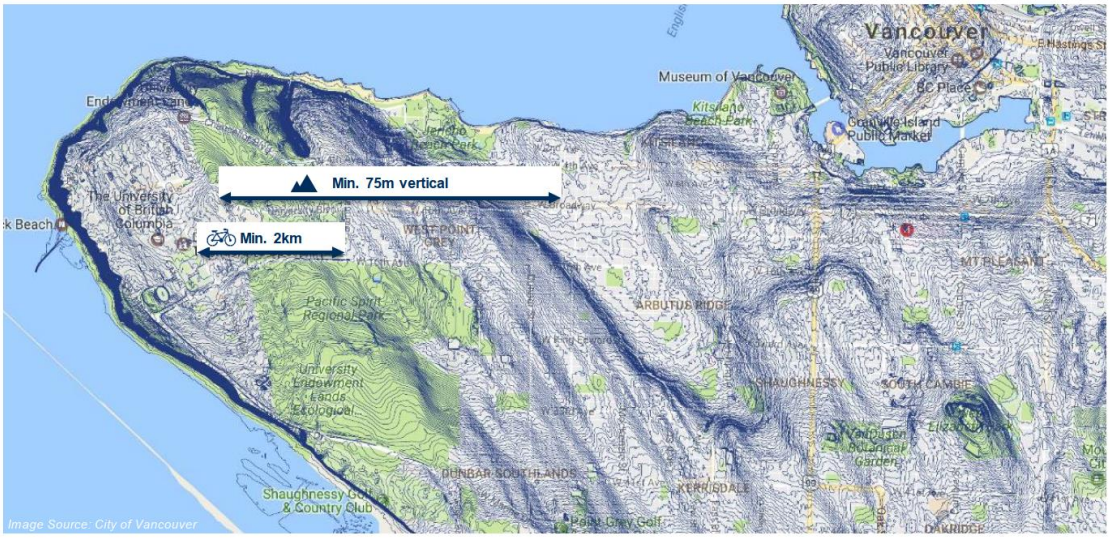
Figure 3.3: Broadway Subway Project Alignment and Stations and Future UBC SkyTrain Extension (Source: UBC Vancouver, Campus Profile, 2021)

The Mayors' Council endorsed the Regional Base Scope in 2022, which provides an initial concept of station locations, including one station at the UBC Trolley Bus Loop and provision for potential future infill station within the UEL, and a potential extension to a second UBC station near 16th Avenue and East Mall.

3.2.2 Regional Active Transportation Network

UBC's location at the western periphery of Metro Vancouver and significant elevation increases from the City of Vancouver moving west towards the Campus (as depicted on Figure 3.4) makes commuting by active transportation challenging.

Figure 3.4: Distance and Elevation Change for Regional Trips by Active Modes



However, active commuting to campus may increase as electrified modes gain popularity and coverage. The City of Vancouver is serviced by the Mobi by Shaw Go bike share system. Mobi recently launched 500 e-bikes across Vancouver, with plans to release more in the future. The North Shore is serviced by the all-electric Lime bike share system. At the time of this report, UBC is not included in the coverage of these programs. However, Mobi recently expanded its service area westward to Alma Street, and north of West Broadway. UBC's bike share is discussed in the following section.

Transport 2050 presented a suggested major bikeway network of 850 kilometres of traffic-protected ("Comfortable for Most") bikeways intended to be built by 2050. This proposed network will help to fill some

gaps in the existing cycling network, where some routes connecting to UBC are not yet protected. See **Appendix B** for more information.

3.2.3 Regional Road Network

This section illustrates how the road network is used for those arriving to/leaving UBC today, as a background for future considerations for changes to the network.

As shown in Figure 3.5, the regional vehicle network connecting to UBC consists primarily of arterials: Chancellor Boulevard, University Boulevard, West 16th Avenue, and Southwest Marine Drive. Collectors form a loop around the main campus, with local streets providing access within the academic campus and UBC neighbourhoods.

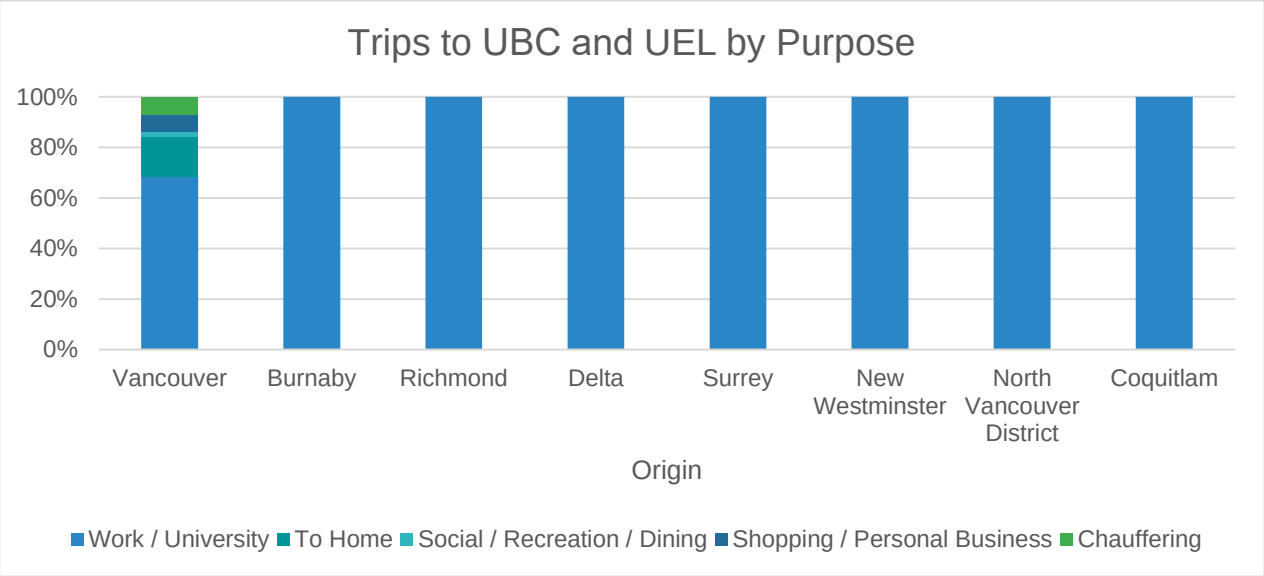
The typical (2019) two-way, evening peak hour person trips via transit and automobile travel modes on the arterials are summarized in Appendix B. The data indicates Southwest Marine Drive and University Boulevard carry over two-thirds of the overall travel demand. In the future, with the arrival of the Millennium Line UBC Extension, the option of walking or taking a bus to the central campus station may become a more attractive transit option for south campus residents, increasing transit demand to/from the south campus.

Figure 3.5: UBC Vehicle Network

3.2.4 Travel Purpose

Output from TransLink's Trip Diary (2017) is presented in Figure 3.6 below to identify the main travel purpose for trips from other municipalities to UBC. As shown, the majority of those surveyed are coming to UBC for work or university. However, those who start their trip in Vancouver are more likely to come to UBC for other purposes, then those living elsewhere in Metro Vancouver.

Figure 3.6: Why People Come to UBC and UEL (Source: TransLink Trip Diary, 2017)



3.2.5 Travel Mode Share

UBC regularly collects transportation data by manual observation and automatic tube counters at the five entry corridors to UBC: Northwest Marine Drive, Chancellor Boulevard, University Boulevard, West 16th Avenue, and Southwest Marine Drive. In 2021, there was an average of 130,000 person trips per day to and from UBC on weekdays (UBC, Transportation Status Report, 2021).

Table 3.1 summarizes the mode shares that were recorded in Fall of 2019 and 2021 at the five data collection locations. These represent all travel demand observed (which includes neighbourhood residents, UBC student and staff and travelers for other uses such as primary/secondary school) to and from the campus. In 2019, most trips were made by transit (54%). Of the trips made by motor vehicle, 74% were made by a single occupant vehicle (SOV), with the remaining made by a high occupancy vehicle (HOV). Approximately 2% of trips were pedestrian and bicycle trips, and 1% of trips were trips by trucks & motorcycles (UBC, Transportation Status Report, 2019).

In Fall of 2021, the transit mode share fell by 5 percentage points, and the SOV mode share increased by 5 percentage points. (UBC, Transportation Status Report, 2021) This change is related to the COVID-19 pandemic. During the COVID-19 pandemic, more than half of the workers in Metro Vancouver transitioned to remote working.[7] For trips that still needed to be made, an increased number of people used personal vehicles in lieu of transit where ridership fell by half.[8]

Table 3.1: Mode Share To/From UBC in 2019 and 2021

Year	Transit	Single Occupancy Vehicle	High Occupancy Vehicle	Bicycle	Pedestrian	Truck & Motorcycle
2019	54%	32%	11%	2%	1%	1%
2021	49%	37%	11%	1%	0%	1%

[7] TransLink Transport 2050 Regional Transportation Strategy

[8] TransLink Buzzer May 13, 2022: highest ridership recovery levels among large transit systems in Canada and the U.S.

3.2.5.1 Travel by UBC Neighbourhood Community

Table 3.2 shows the commuting mode share for Electoral Area A (definition provided in **Appendix B**) collected by the 2021 Canadian census. Commuting by car, truck, or van as a driver had the biggest mode share, followed by walking, transit, and biking.

Table 3.2: Mode Share of UBC Vancouver, Unincorporated Place (Statistics Canada, 2021)

Year	Transit	Car, Truck, or Van as Driver	Car, Truck, or Van as Passenger	Bicycle	Pedestrian	Other
2021	18%	40%	5%	9%	25%	3%

3.2.6 Regional Baseline Conclusions

Location and topography separate UBC from the rest of the Metro Vancouver making transit the most desirable sustainable travel mode to reach campus for those who live further away. Further, transit must play a critical role in future transportation behaviour to meet UBC's adopted mode share targets.

The Millennium Line UBC Extension will provide a faster and more reliable connection to UBC, with additional capacity for future demand. The Regional Base Scope provides an initial concept of station locations, including one at the UBC Trolley Bus Loop and provision for potential future infill station within the UEL, and a potential extension to a second UBC station near West 16th Avenue and East Mall. An important consideration will be the decisions and implications of where and when an infill station investment is feasible and the related phasing for UBC development.

The arrival of the Millennium Line UBC Extension provides an opportunity to reassess how on-campus transportation networks function, including:

- Local transit and shuttle routes
- First/last mile options by active modes
- Bike and ride facilities
- Shared micromobility

3.3 Local Mobility Networks

Over the past decade, the campus lands have evolved into a complete community with a supportive transportation network that caters to the many functions and needs of those traveling to and through UBC. This section examines the multimodal transportation network of UBC in greater detail, as a foundation for the development and refinement of mobility elements associated with the Campus Vision 2050 Concept Options.

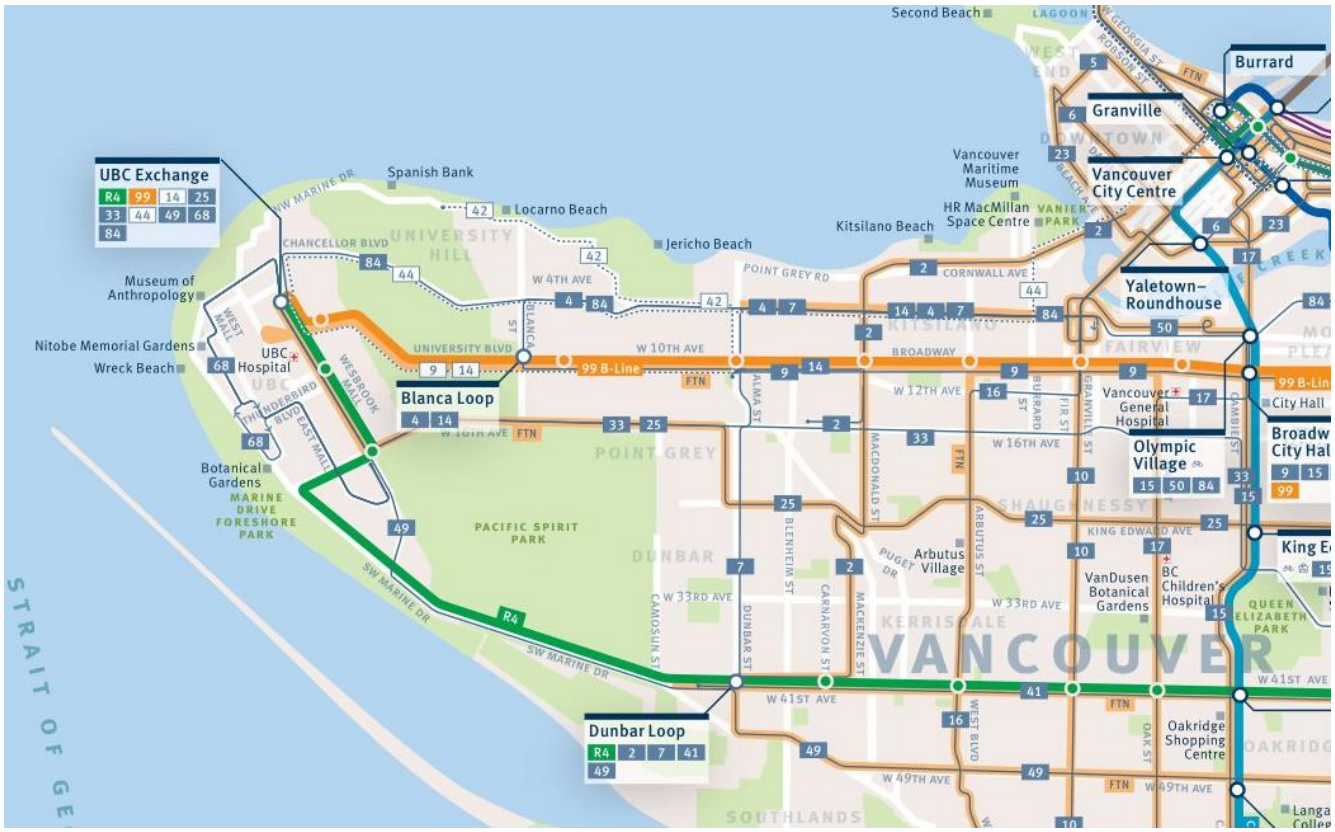
3.3.1 Transit Network

UBC is currently serviced by 12 bus transit routes, which are illustrated in Figure 3.7 and described below:

- Nine regular routes, with service at least once per hour during the daytime all week:
  - Routes 4, 9, 14, 25, 33, 44, 49, 68, 84
    - Route 68 provides intra-campus connections, with service provided every 20 minutes.
- Two RapidBus routes – The R4 and 99 B-Line – that connect UBC to the regional SkyTrain and RapidBus network.
  - The R4 has transit priority along 41st Avenue; the 99 B-Line has some transit priority measures such as bus lanes during peak hours, though this is in flux with the Broadway Subway Project construction.
  - The 99 B-Line will be partially replaced in 2026 with the completion of the Broadway Subway Project

  - 99 B-Line is intended to continue its service in 2026 from the new Arbutus Street terminus station to UBC until the Millennium Line is further extended to UBC.
- One Night Bus Route
  - The N17 connects UBC campus to Downtown Vancouver.
- Express routes 258 (West Vancouver – UBC) and 480 (Bridgeport Station – UBC) were suspended in September of 2021
  - Former users of these services are now expected to use alternative routes requiring additional transfers.

Figure 3.7: Bus Transit Routes Serving UBC (Source: TransLink, 2023)[9]



As shown, while UBC is served by transit services that connect the campus to elsewhere in the region, intra-campus transit services are limited.

Figure 3.8 and Figure 3.9 present the weekday average daily alighting and boarding for transit stops at UBC, sourced from TransLink's 2019 Transit Service Performance Review.[10] The ten stops with the highest average total alighting/boarding are provided in the table in each figure.

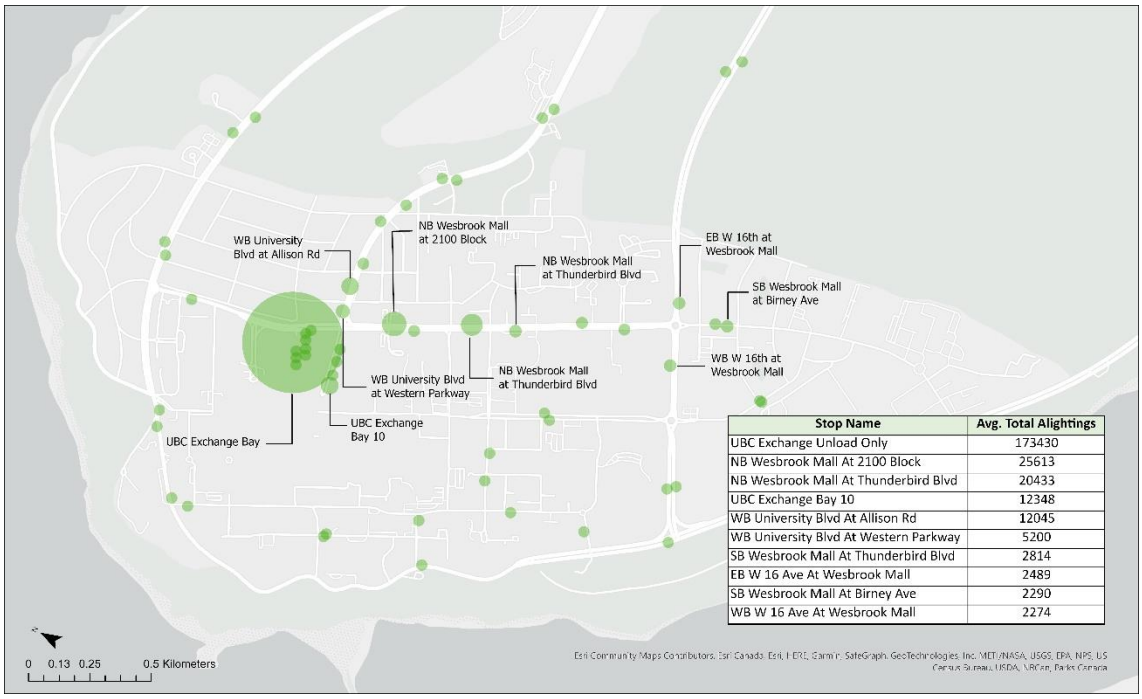
The stop with highest average alighting is the 'Unload Only' stop at the Exchange Bay, where an average of 170,000 daily alighting occurs. The other stops with the most alighting occur along Wesbrook Mall, West 16th Avenue, and University Boulevard.

[9] Transit Maps by Region: Vancouver, TransLink (2023). Retrieved from: https://www.translink.ca/-/media/translink/documents/schedules-and-maps/transit-system-maps/regional-maps/2023/september-2023/v.pdf

[10] At the time of this work, data from the 2022 TransLink Transit Service Performance Review was not yet published. Data from the 2019 Performance Review was preferred to 2021 due to uncertain affects from the COVID-19 pandemic.

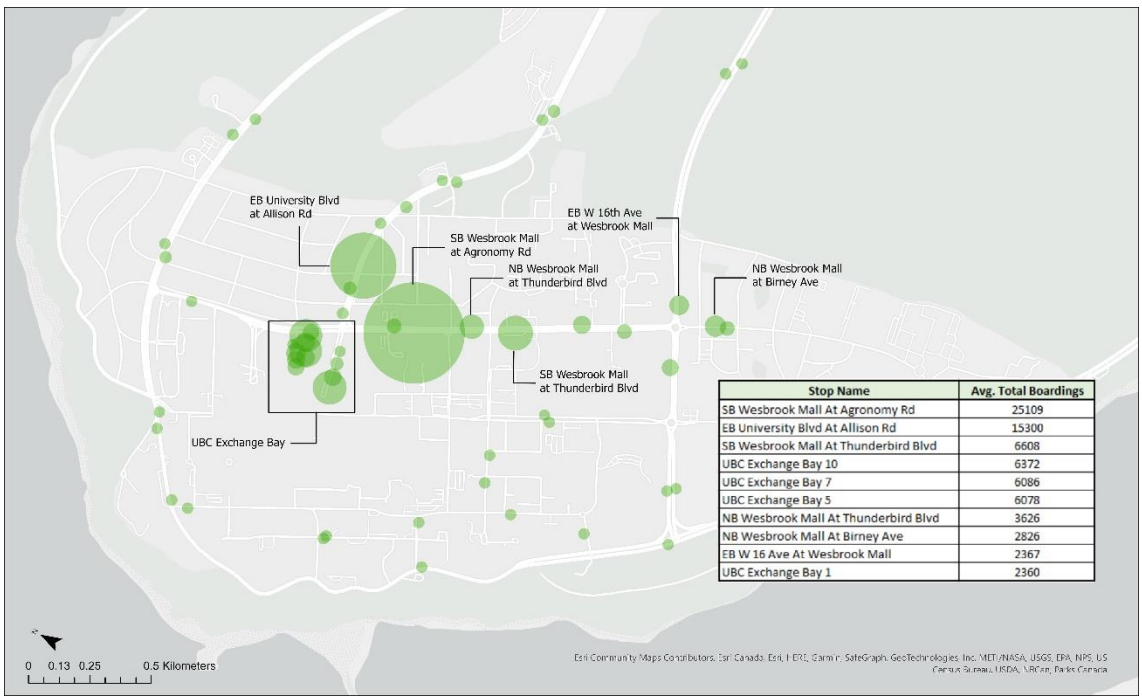
The stop with the highest average boardings is at Wesbrook Mall and Agronomy Road. Transit lines 25, 33, 41, 43, 49, 68, and 480 use this stop. The other stops with the highest average boardings occur primarily on Wesbrook Mall, as well as West 16th Avenue and University Boulevard.

Figure 3.8: Average Daily Alighting (Source: TransLink Transportation Service Performance Review, 2019)



Stop Name	Avg. Total Alightings
UBC Exchange Unload Only	173430
NB Wesbrook Mall At 2100 Block	25613
NB Wesbrook Mall At Thunderbird Blvd	20433
UBC Exchange Bay 10	12348
WB University Blvd At Allison Rd	12045
WB University Blvd At Western Parkway	5200
SB Wesbrook Mall At Thunderbird Blvd	2814
EB W 16 Ave At Wesbrook Mall	2489
SB Wesbrook Mall At Birney Ave	2290
WB W 16 Ave At Wesbrook Mall	2274

Figure 3.9: Average Daily Boardings (Source: TransLink Transportation Service Performance Review, 2019)



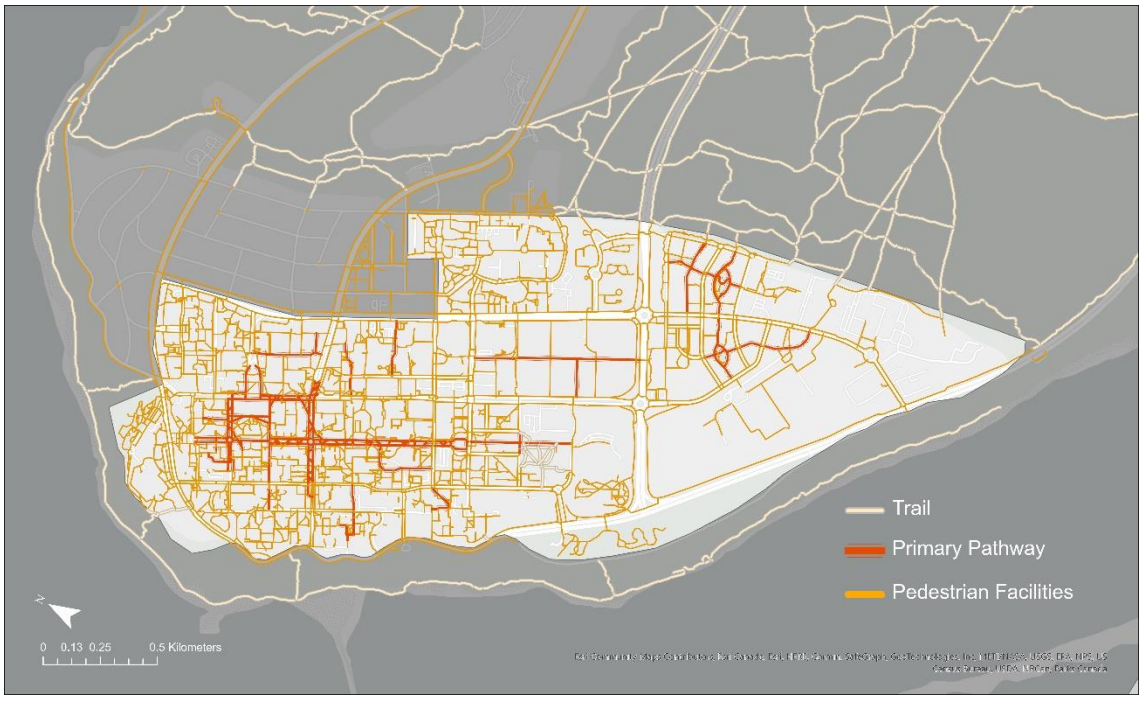
Stop Name	Avg. Total Boardings
SB Wesbrook Mall At Agronomy Rd	25109
EB University Blvd At Allison Rd	15300
SB Wesbrook Mall At Thunderbird Blvd	6608
UBC Exchange Bay 10	6372
UBC Exchange Bay 7	6086
UBC Exchange Bay 5	6078
NB Wesbrook Mall At Thunderbird Blvd	3626
NB Wesbrook Mall At Birney Ave	2826
EB W 16 Ave At Wesbrook Mall	2367
UBC Exchange Bay 1	2360

3.3.2 Active Transportation Network

The active transportation network supports walking and rolling across the campus. The campus has gentle grade in the north south direction with slightly steeper conditions at the west of campus between Northwest Marine Drive and Main Mall.

The pedestrian network, shown in Figure 3.10**,** consists of primary (paved) pathways which are car-free corridors, trails, and other pedestrian facilities, including sidewalks, local pathways, and crosswalks. Due to the large size of the campus some trip journeys can exceed typical walking thresholds. For example, there is an approximate walk time of 25-30 minutes and 2.2 kilometers to walk from the UBC bus loop to Wesbrook Village.

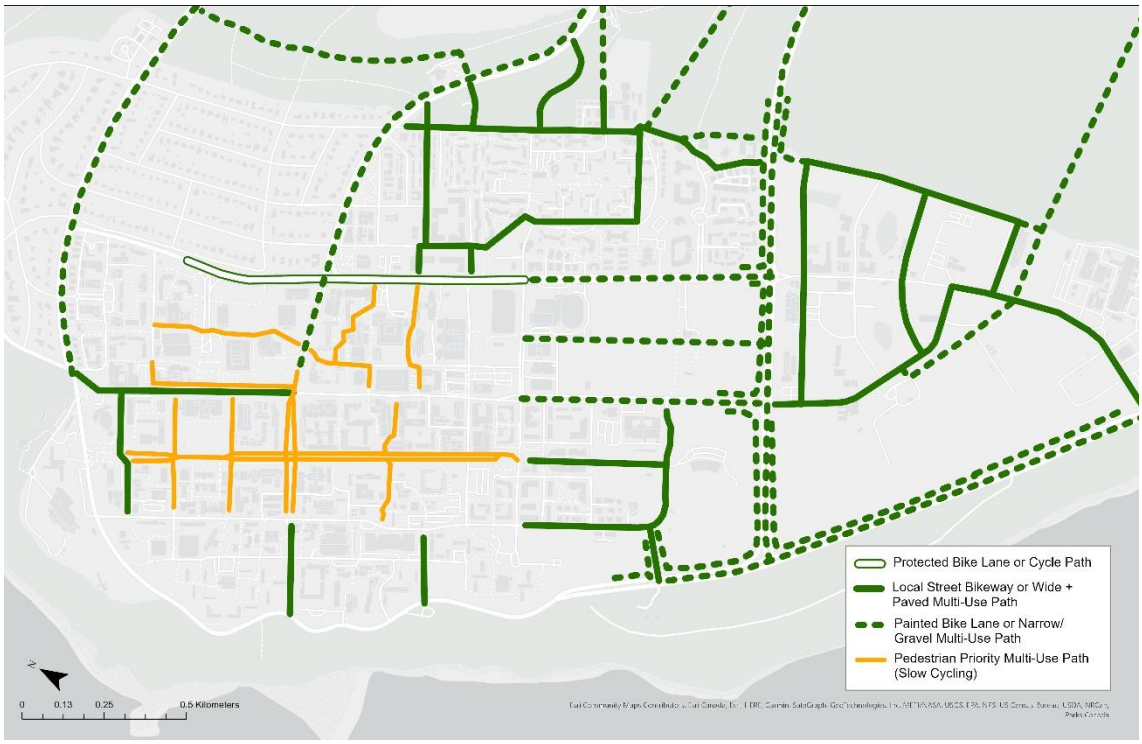
Figure 3.10: UBC Pedestrian Network



The cycling network provides comfortable routes for those biking within and across campus. Figure 3.11 shows the protected facilities, local street bikeways, painted bike lanes, and the pedestrian priority multi-use pathways. The cycling network also includes shared use lanes, not shown in Figure 3.11, as those facilities are typically not comfortable for all ages and abilities.

UBC is served by HOPR Bike Share, with 200 dockless bikes on campus. Plans are underway to extend the service area of the City of Vancouver's station-based e-bike share program to campus as early as 2023.

Figure 3.11: Current UBC Cycling Network



3.3.3 Parking and Accessibility

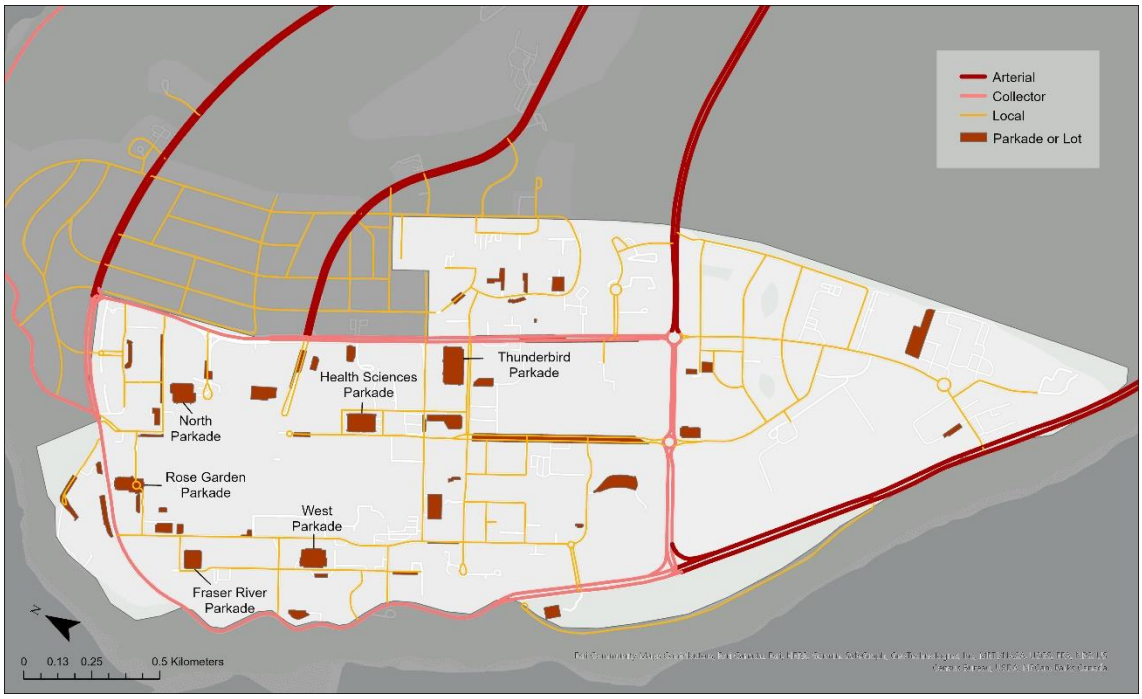
Public parking at UBC is provided in parkades, underground, along streets, and in surface lots. Some of the campus community also park outside of campus (West 16th Avenue and Marine Drive) and then walk in. Figure 3.12 shows the location of parkades and parking lots across campus.

UBC has several plans and policies currently aimed at reducing driving and parking on campus, including:

- UBC has over 160 dedicated free parking spaces for car share vehicles (Modo and Evo) to encourage car sharing. Overflow parking on roof levels of parkades is also free for these vehicles.
- UBC has historically increased daily parking rates in surface lots and for parking permits over time.
- UBC's Climate Action Plan 2030 stipulates a short-term action to transition parking permit fee structures to daily permits only (eliminating monthly, term, and annual permits), and offer a discount/subsidy for monthly transit passes for eligible staff.
- UBC has supported carpool programs, including the use of the Liftango app and incentives for carpool drivers.

The university facilitates disability-related accommodations and programming initiatives designed to remove barriers for persons with disabilities and ongoing medical conditions. This includes a free shared accessibility shuttle and accessible parking spaces across the campus for those with a SPARC decal or for those who have been assigned spaces due to long term or temporary mobility challenges.

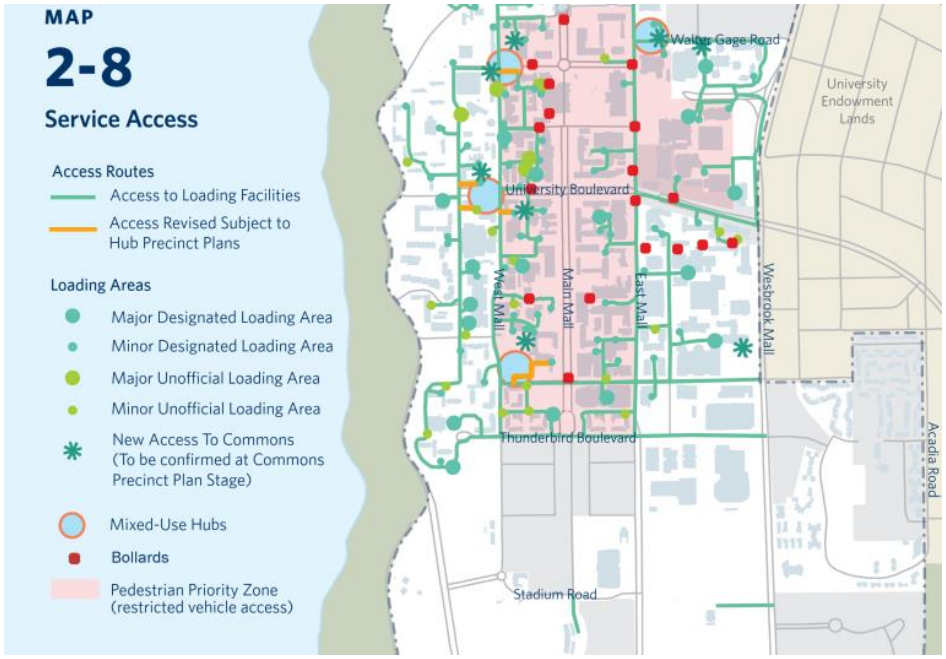
Figure 3.12: Existing UBC Parkades and Parking Lots



3.3.4 Loading and Servicing

Academic and research uses have a range of unique loading and servicing requirements (which may be comparable to light industrial use) that require a thoughtful strategy for consideration of loading and servicing in a pedestrian-oriented environment, and a street network without a laneway grid. UBC's Vancouver Campus Plan outlines a defined network for the movement of service and delivery vehicles (a portion of which is illustrated in Figure 3.13).

Figure 3.13: Existing UBC Service Access (Source: Vancouver Campus Plan, 2010)



As shown, the pedestrian priority centre of campus includes a dense network of service access lanes, which are reliant on vehicular access from East and West Mall to accommodate service vehicles at each building. Potential implications of this system exist, should the ROW or function of East or West Mall change and servicing continued to be provided by larger vehicles. These service access lanes can compromise the attractiveness of the public realm, as highlighted in Figure 3.14 on Agronomy Road.

Figure 3.14: Servicing off Agronomy Road

3.3.5 Local Mobility Conclusions

- Future planning at UBC will build upon the success of pedestrian priority zones and active travel networks but will need to continue to integrate and accommodate accessible parking requirements.
- While UBC benefits from a number of transit services that connect to the region, there is currently a limited intra-campus transit service. As UBC is a large campus, walking and rolling may not be reasonable for some individuals or trip purposes.
- The addition of protected cycling facilities on Ministry roads connecting to UBC's road network is essential to support safe and efficient active travel through campus. Provision of safe cycling routes, along with secure bike parking, can encourage an increase in cycling mode share on campus. The presence of dedicated cycling facilities may reduce ROW allocation for vehicular travel and/or vehicle parking.
- UBC's academic uses involve a range of unique loading and servicing requirements for campus buildings that must also support a safe pedestrian-oriented environment.
- A significant share of campus land is designed for large servicing vehicles which may be reduced with a shift to small (even autonomous) delivery vehicles (i.e., e-cargo bikes), or a central receiving system near the periphery of campus.

4 Guiding Principles for Transportation

This section provides a synthesis (in Table 4.1) of how the overall Campus Vision 2050 Guiding Principles align with local UBC and regional transportation policy (**Section 2**), mapped to the gaps and opportunities identified in **Section 3** to inform Transportation Principles for guiding Campus Vision 2050, the 10-Year campus plan, and future neighbourhood plans.

Note, some guiding principles which are not directly related to transportation have been excluded, namely those relating to academic mission and Musqueam.

Table 4.1: Guiding Principles for Transportation

Campus Vision Guiding Principles	UBC and Regional Policy	Transportation Principle
Confront the affordability crisis. Provide and support convenient access to services and amenities for daily needs and wellbeing.	• By 2050, no households spend more than 45% of their income on combined transport and housing costs (TransLink, Transport 2050).	• Prioritize frequent/rapid transit access and shared mobility options over personal vehicle access. • Mixed land use planning in areas of high residential density. • Unbundling and/or reduction of costly off-street underground parking and loading.
Make campus more inclusive, accessible, and welcoming. Develop a compact campus that prioritizes walking and rolling.	• Double the percentage of trips taken using active modes of transportation by 2030 (MoTI, Active Transportation Strategy). • By 2050, half of trips are conducted using active modes of transportation, with taxi, ride hailing, and carshare (TransLink, Transport 2040. • Existing UBC policy for SPARC pass and incorporating space for more spaces, make more visible and intuitive for who can use (app to show designated spaces). Considering monitoring program to confirm sufficient capacity.	• Maximize universal access via sustainable modes. – Faster and easier transit access across campus and to other parts of the region. – Transit servicing to accommodate needs of those with accessibility challenges. – Right of way allocation that prioritizes walking and rolling. • Expand the pedestrian priority zone in the campus core while preserving access for essential services and accessible parking for people with mobility challenges. • Maximize accessibility levels of sustainable modes.
Take bold action to address climate change and enhance campus ecology. Embed a climate justice lens that recognizes privilege and inequality in land use plans and practices. Develop a transit-oriented campus that reduces the reliance on cars.	• Achieve a 45% reduction in commuting emissions from 2010 levels by 2030 (UBC, Climate Action Plan). • By 2040, at least two-thirds of all trips to and from UBC will be made by walking, cycling or transit (UBC, Transportation Plan). – Maintain at least 50% of all trips to and from the campus on transit (UBC, Transportation Plan). • Replace 34% of current diesel bus fleet with electric buses or buses that run on natural gas (TransLink, 2022 Investment Plan). • By 2030, greenhouse gas (GHG) emissions from light-duty vehicles have reduced by 65% from 2010 levels. By 2050, GHG emissions from light-duty vehicles have been eliminated (TransLink, Transport 2040).	• Reduce vehicular volumes through existing and future neighbourhoods so that people who live in those neighbourhoods are exposed to minimal vehicle emissions (e.g., fuel, tire dust), noise, and collisions. – Minimize vehicle use in neighbourhoods. – Minimize through trips through neighbourhoods/traffic calming. – Prioritize frequent/rapid transit access over personal vehicle access. • Pursuing strategies that accelerate achievement of UBC's existing 2040 Transportation Targets (e.g., by 2030) in service of meeting our Climate Action Plan 2030 emission reduction targets (and emerging NCAP targets).

Campus Vision Guiding Principles	UBC and Regional Policy	Transportation Principle
Strengthen connectivity. Plan for SkyTrain, including enabling academic growth, housing options and research and community partnerships. Prioritize the use of active and sustainable transportation modes on campus and respond to future mobility trends. Create a safe and comfortable transportation network that is easy to navigate.	• Reduce single-occupant vehicle (SOV) travel to and from UBC by 20% from 1996 levels. Reduce SOV trips per person to and from UBC by 30% from 1996 levels (UBC, Transportation Plan). • Maintain daily private automobile traffic (SOV, or high-occupancy vehicles, excluding buses and commercial vehicles), at or less than 1997 levels (UBC, Transportation Plan). • Identify appropriate on-campus routes for heavy trucks and explore opportunities to reduce trips by heavy trucks (UBC, Transportation Plan). • Implement traffic management initiatives along select routes and restrict all service vehicles to a defined servicing route (UBC, Vancouver Campus Plan). • Serious traffic injuries and fatalities are to be reduced by 5% per year. By 2050, zero serious traffic injuries or fatalities occur (TransLink, Transport 2040).	• Supporting/demonstrating need for Millennium Line UBC Extension including a station near the Trolley Bus Loop as identified in the Regional Base Scope, a UEL infill station, and potential further extension to a south campus station, as well as TL 2050 identified rapid transit connection via south campus to 41st/49th. • Create car light and/or car free corridors to facilitate active mode access to the future rapid transit stations (above). • Plan for intra-campus transit to provide a high level of service and connectivity to the regional transit network, especially for mobility impaired travelers. • Plan for integration of rapid transit corridor(s) and station(s) on campus.
Ensure the campus lands benefit the UBC community today and for generations to come. Optimize sustainability and livability in supporting a compact, livable, and integrated campus.	• Create a barrier-free environment through pathway and connectivity improvements (UBC, Vancouver Campus Plan). • Parking for vehicles traveling to campus to be located within parkades or below-grade facilities, along the perimeter of the campus (UBC, Vancouver Campus Plan). • Construction of new surface parking lots will be discontinued. Existing surface lots will be used as future building sites or for recreational uses (UBC, Vancouver Campus Plan). • Increase supply of rental and below-market price housing within the existing density provisions for each neighbourhood under development since 2012 (UBC, Housing Action Plan, 2018).	• Consider intelligent multimodal transportation ROW to provide options for future generations. • Preservation of space for flexibility/future proofing (e.g., for 41st rapid transit). • Decrease the impact of off-street parking and loading provision on the public realm. • Explore redevelopment of parkade for better land use/transportation integration and mixing of uses. • Explore centralized, green, autonomous distribution centre for last mile delivery.

5 Future Innovation Opportunities in Sustainable Mobility

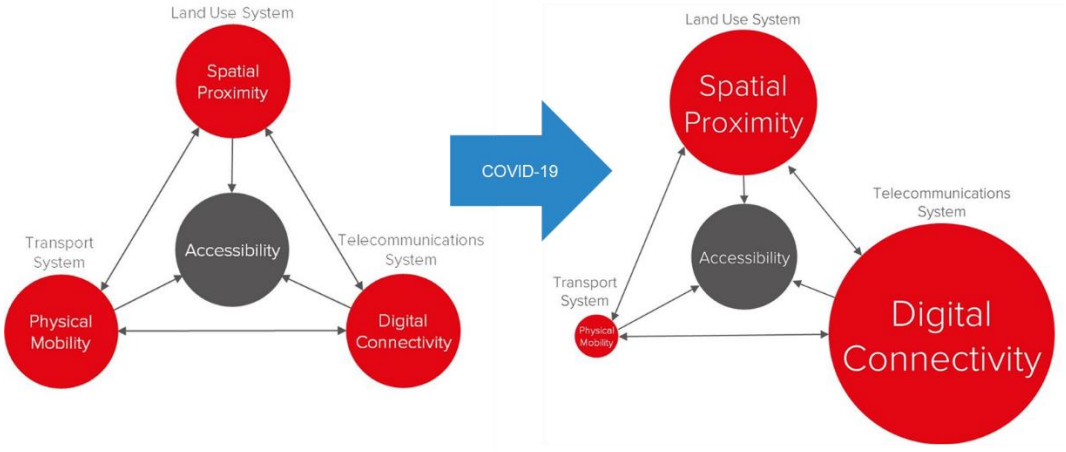
5.1 Background

UBC's Campus Vision 2050 must carefully respond to identified challenges, critical needs, and disruptions, all while anticipating future uncertainty and a growing metropolitan region. Future mobility considers new transportation opportunities and the implications of current trends.

We are part of a changing society in which we can reach people, goods, employment, services, and opportunities through physical mobility (transport system), spatial proximity (land use system), and digital connectivity (telecommunications system). A schematic example of the system is illustrated in Figure 5.1for 'typical' and COVID-19 pandemic context distribution.

It is important to consider how this system 'ideally' looks on UBC's campus. Compared to a typical city, there may be further value to in-person connections on campus (experiential elements, social development, innovation, collaboration, etc.).

Figure 5.1: Triple Access System



Sustainable mobility considerations should ensure equal access to transport services in a way that does not threaten environmental sustainability. Actions typically include:

- Reduce the need to travel.
- Modal shift to transit and active travel.
- Reduce trip lengths.
- Improve efficiency of the system (energy use and emissions).

Planning for future mobility needs to reflect a vision for the society we want to live in, and then find the right mix of physical transportation, land use planning and digital connectivity to get there.

5.2 Case Studies

This section presents a range of case studies which showcase innovative solutions to improve sustainable mobility. When considering innovation, it is important to also understand:

- What policy changes are necessary to enable innovation?

- How much ROW is required for changes to the transport network?
- How can short- and long-term solutions help achieve a future mobility solution?
  - Lifecycle duration:
    - Short: technology products or mobility trials
    - Long: buildings and infrastructure

5.2.1 A '15-20 minute City'

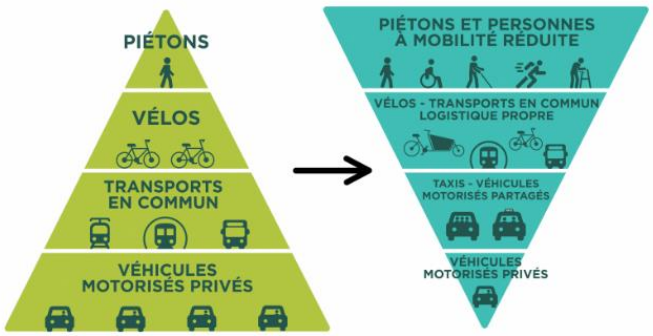
A 15-minute (or an X-minute) city is a decentralised planning model where each neighbourhood is planned or redeveloped to contain all the basic needs residents have for living and working. This enables people to reach all the destinations they frequently require within a 15-minute walking or cycling trip. This is accomplished in part by accommodating mixed use neighbourhoods, rather than separate uses, which reduces the need for unnecessary travel and car ownership as well as strengthens the sense of community.

Cities around the world have begun to approach policy and plans in-line with the 15-minute city approach. Melbourne is proposing self-contained communities within an 800-meter radius as part of their 20-Minute Neighbourhoods Plan.[11] Portland has been pursuing complete community development since 2012 with the adoption of the Portland Plan, and their current Climate Action Plan calls for more vibrant neighbourhoods in which 90% of the residents can walk or bike to fulfill their daily needs.[12]

However, a global lead in this concept is Paris, whose mayor when re-elected in 2020 pledged to turn Paris into a 15-minute City with policy to build a city intended for people, not cars (Figure 5.2). Access to locally grown food is one of the focus points of the 15-minute city and programs, such as "Les Parisculteurs project," to encourage and facilitate local food production. This builds upon previous initiatives in Paris to promote active mobility in lieu of cars, including a ban on high polluting vehicles, a reduced speed limit of 30 km/hour for vehicles, and the addition of 50 km's of bike lanes since 2020.

Figure 5.2: Paris' 15-Minute City

Seine Riverfront



5.2.2 Car Reduced or Car Free Neighbourhoods

A low vehicle traffic neighbourhood is an area which encourages the use and access to sustainable mobility, through the reduction or removal of vehicle traffic through the neighbourhood. The advantages of this initiative go beyond transportation, benefiting quality of life. The health of those who live and work in the neighbourhood are subject to less vehicle related noise, emissions, and accidents & injuries.

[11] https://www.planmelbourne.vic.gov.au/__data/assets/word_doc/0003/515289/20MN-Creating-a-more-liveable-Melbourne-ACCESSIBLE.docx

[12] https://www.portlandonline.com/portlandplan/index.cfm?a=288098&c=52256

From a planning perspective, the success of car-reduced neighbourhoods depends on the implementation of both restrictive and supportive measures to simultaneously reduce the attractiveness of the car and to increase the attractiveness of sustainable modes, as well as to revive the social functionality of the streets.

Brussels has recently adopted the Good Move Plan, which will create 50 low-traffic neighbourhoods across the region over ten years.[13]

Multiple German towns/cities (ex. Vauban) have also made this transition to reduce car dependence by becoming a 'city of short distances' (Figure 5.3). The design of the neighbourhoods makes it easier to walk or bike (or walk to the tram) than to go to the parking garage at the edge of the development and drive on streets that prioritize pedestrians. Streets do not have parking spaces, and while cars are allowed on the road to access pick-up/drop-off spaces, they must travel at the pace of pedestrians (15 km/hour).

Figure 5.3: Vauban, Germany

Source: https://expmag.com/2021/09/this-german-neighborhood-has-everything-except-cars/

5.2.3 Distribution Centres and Last-mile Delivery

One way to optimize delivery in city centres and in car free neighbourhoods are distribution centres. Distribution centres represent a central point in the transport chain, which significantly reduce the number and type of delivery vehicles that would deliver to the city centre. Deliveries to home addresses are maintained, but the goal is to fill a freight vehicle's capacity before it reaches a distribution centre, to reduce the number of vehicles that enter an area.

[13] https://lowtrafficneighbourhoods.brussels/basics

Figure 5.4: Malaga "Last Mile" Delivery System

Malaga has had a unique "last mile" system for the transport of goods in the historic centre, by means of electric vehicles with charging points in several parking lots in the city centre (Figure 5.4).

In Seattle, a Neighbourhood Delivery Hub serves as a testbed for innovative sustainable urban logistics strategies on the ground in Seattle's dense Uptown neighbourhood. Providers can test and evaluate new technologies, vehicles, and delivery models.

5.2.4 Robotic Deliveries

Aalto University (Otaniemi, Finland) uses robotic deliveries for a last mile delivery solution with a fleet of 60 robots across the 400-hectare Otaniemi campus (Figure 5.5**)**. These robots offer zero emission contactless delivery in all four seasons; with a transport box that can hold up to three grocery bags at a time.

Using artificial intelligence, the robot plans the most suitable route to the delivery address and sets off. The route travels along pedestrian pathways and the robot recognizes potential obstacles as well as people and vehicles and can operate in traffic. When the robot reaches its destination, the customer receives a notification on their phone informing them that the order has arrived. The application also allows you to track the progress of the transport in real time.

Figure 5.5: Robots in Otaniemi

Source: Uusi Suomi 2022 Robotit alkavat kulkea Espoon kaduilla – Kuusivetoista kauppakassiroboa ei lumi pysäytä, mutta se saadaan etähallintaan koska tahansa

6 Transportation Opportunities for Concept Options

6.1 Introduction

The final Campus Vision 2050 provides a high-level description of the campus that includes conceptual plans and diagrams. The process explored and assessed a range of development scenarios that optimize value and benefit to the university, the community, and the land. Campus Vision 2050 aims to continue UBC's trend towards sustainable transportation modes through integrated land use and mobility plans that ensure the vast majority of new trips generated by campus growth will be by active and sustainable modes. Campus Vision 2050 includes new local transit service, improved walking/rolling/cycling connections throughout campus, and transformative investments in regional transit service to campus including the Millennium Line SkyTrain extension to UBC and future rapid transit along Southwest Marine Drive and 41st/49th Ave.

Mott MacDonald supported the development of planning options with technical and design analysis and participation in multidisciplinary charettes and workshops. This section summarizes a range of transportation analyses that supported this process, which align with the transportation principles developed in **Section 4** that have informed Campus Vision 2050 and will guide the update to the 10-Year Campus Plan and future neighbourhood plans.

6.2 Road Network

This section presents emerging considerations for UBC's future street functionality. Potential opportunities for UBC's primary movement corridors are presented, with the objective that this information be used to support conversations around redevelopment opportunities and implications/trade-offs of options.

6.2.1 Street Function Opportunities

The existing characteristics of UBC's streets, as well as future planned infrastructure changes are summarized in **Appendix B.5**.

Figure 6.1illustrates a detailed potential future street function map of UBC's primary movement corridors, which captures input discussed in the transportation workshop (July 21, 2022). A description of the functional typology used in Figure 6.1, as well as how the proposed function relates to UBC's current road classification is summarized in Table 6.1. The information conveyed below served as inputs into Campus Vision 2050 discussions and mobility network mapping.

Figure 6.1: Potential Future Detailed Street Functions of UBC's Primary Movement Corridors

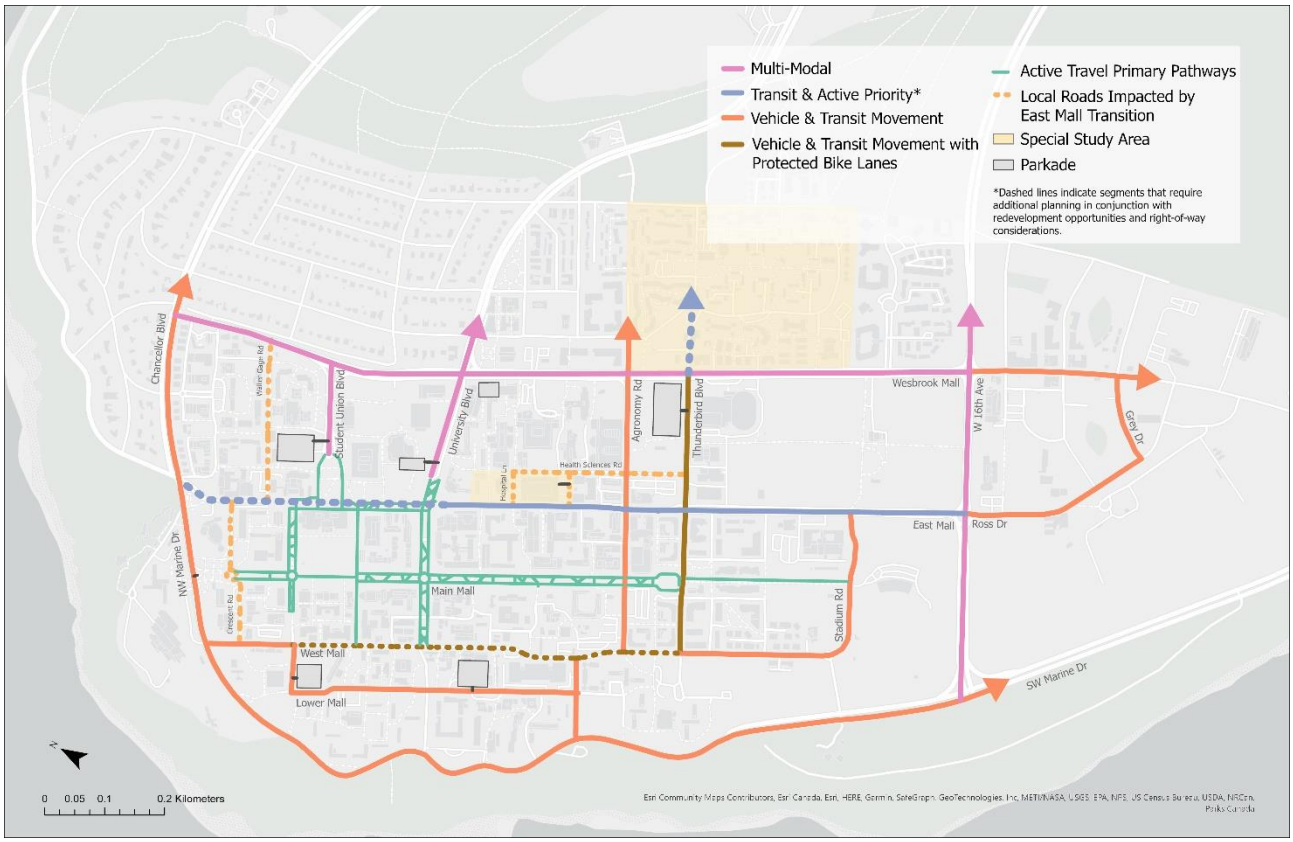


Table 6.1: Future Potential Street Function Descriptions and Existing Classifications

Future Proposed Street Function		**Existing Classification**
Proposed Function	**Description**	
Multi-Modal	Optimizes movement of transit and active modes with dedicated & separated lanes for each travel mode (transit, motor vehicles, cycling, and walking & rolling).	Collector
Transit and Active Priority	Serves transit, cycling, and walking & rolling. Motor vehicles may be accommodated, but their movement would not be prioritized (i.e., vehicles as guests).	Local
Vehicle and Transit Movement	Shared ROW for motor vehicles and, where applicable, transit (i.e., no dedicated bus lanes). Cyclists are accommodated in a variety of facilities along these roadways.	Primarily local, except for Southwest Marine Drive which is a collector
Vehicle and Transit Movement, with Protected Bike Lanes	Shared ROW for motor vehicles and, where applicable, transit (i.e., no dedicated bus lanes), as well as protected bike lanes.	Local
Active Travel Primary Pathways	Paved multi-use pathways for cycling, walking, and rolling.	Primary pathway
Local Roads Impacted by East Mall Transition	Remaining uncategorized local roads that intersect East Mall. These roads will likely serve a greater importance (regarding servicing, emergency access, accessible parking) given a future transition of East Mall that reduces or prohibits motor vehicle access.	Local

As shown in Table 6.1, the proposed future functions overlap with UBC's existing road classification, whereby the 'Multi-modal' function relates to existing collectors, and the remaining vehicular functions (transit, service, or personal vehicles) correspond to local roads.

The exception to this is Southwest Marine Drive / Chancellor Boulevard, which are collectors. The street functions expressed in Figure 6.1 are for the most part consistent with *UBC's Campus Cycling Network Plan - Future Vision (2032+),* which indicates 'painted bike lane or narrow / gravel multi use path' for Southwest Marine Drive / Chancellor Boulevard, as opposed to a protected cycle lane.

Two major changes from existing conditions that are illustrated in Figure 6.1 are summarized below.

- West 16th Avenue (between Wesbrook Mall and Southwest Marine Drive) should consider optimization for transit and active travel use, with dedicated & separated lanes for each travel mode (transit, motor vehicles, cycling, and walking & rolling). This segment of West 16th Avenue currently accommodates high volumes of transit person trips (1,800 average peak hour person trips, compared to 1,070 average peak hour vehicle person trips). TransLink's proposed future 41st/49th rapid transit may also be routed along this segment, with a potential station location near the northeast corner of East Mall and West 16th Avenue. The Stadium Plan states that West 16th Avenue will remain a major vehicular access route, providing access to new underground parking to service the stadium.
- East Mall has been identified as a potential shared, "people first" street, where transit & active travel modes and ROWs are prioritized and general purpose motor vehicles may be restricted on some portions, particularly as the ROW narrows north of Agronomy Road. Accessible parking requirements would be provided on perpendicular streets. Future ROW decisions will need to consider the existing pedestrian zone where East Mall intersects University Boulevard and central on-street parking is provided.

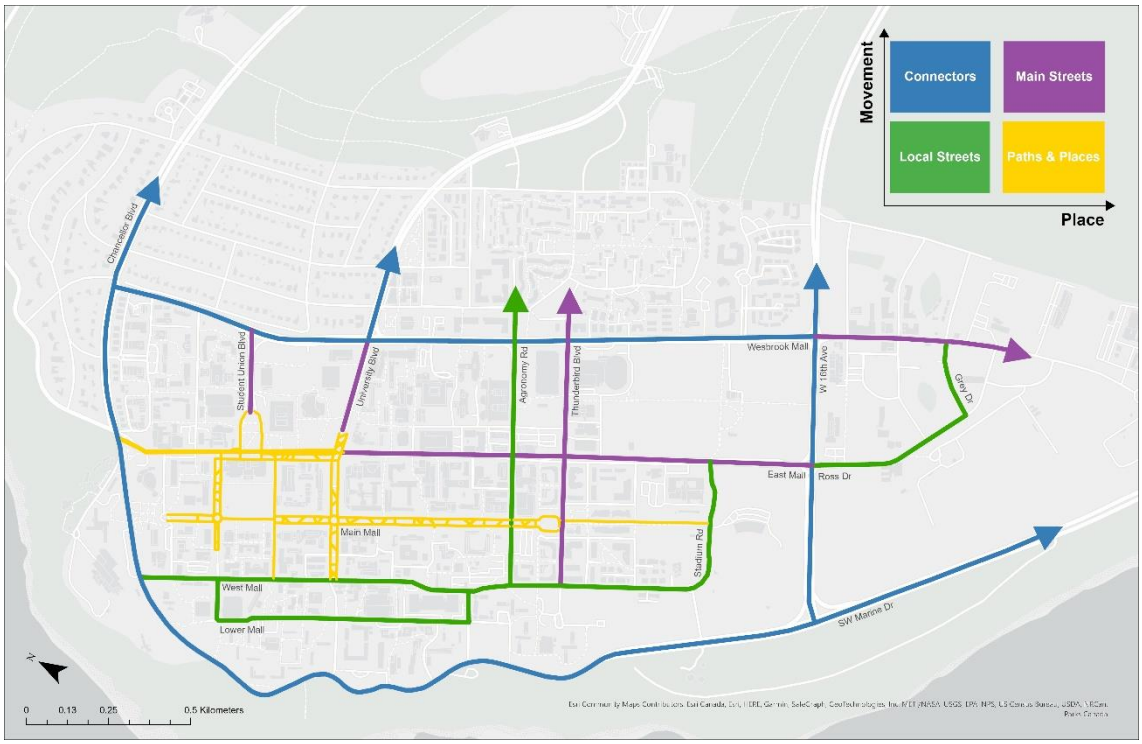
Other areas requiring further investigation (though not necessarily as part of the Campus Vision 2050 process) are included in Figure 6.1 and summarized below.

- Thunderbird Boulevard, between Wesbrook Mall and Crooked Branch Road, is currently proposed as a transit priority street in the emerging Acadia neighbourhood concepts.
- Walter Gage Road, Crescent Road, Health Sciences Mall, and Hospital Lane are currently local streets, which will likely serve a greater importance with regard to servicing, emergency vehicle access, and on-street accessible parking should East Mall transition to an active/transit priority street.

6.2.2 Movement & Place

In support of the Fall 2022 public engagement process, the detailed street function work summarized in the preceding **Section 6.2.1** was 'rolled-up' into a framework which classifies the network based on movement and place, shown in Figure 6.2. This was developed to support discussions about the types of street environments desired, and the balance between the type of movement and activity that occurs on different parts of the network.

Figure 6.2: Movement and Place Network



While the street network is classified based on the typical characteristics of connectors, main streets, local streets, and paths and public places, the intention is not to develop a corresponding set of rules or definitions. Rather, the framework is intended to balance the different demands on roads and support the (current and future) functions and priorities in each location.

6.3 Intra-Campus Transit

One or more new intra-campus transit routes are recommended to (1) address the distance and grade challenges to/from Lower and West Mall, and (2) address the accessibility gaps presented by the existing intra-campus transit network.

The routing of new intra-campus transit service should abide by four principles:

1. Implementation of emerging models of Intelligent Traffic Systems (ITS)
2. Consideration of significant points of interest or destinations (St. John Hospice, Museum of Anthropology, Botanical Garden, etc.)
3. Physical campus requirements for new technologies and increased demand
4. Aggressive pursuit of autonomous shuttles to enable higher frequency of service at lower operating costs and reduce service design constraints associated with providing operator facilities

Three approaches, summarized in Table 6.2, informed Campus Vision 2050 and will be considered in the update to the 10-Year Campus and future neighbourhood planning processes. These approaches convey varying levels of service and corresponding trade-offs.

Table 6.2: Transit Service Approaches

Approaches	Achievement
Smaller service area, but fast and frequent service	Support a car-free campus, integrated with proposed services
Larger service area, but reduced frequency	Cover a larger area to better support those with accessibility needs all across campus
Mid-sized area, moderate frequency	Strike a balance between providing service to those with mobility needs and providing an attractive service to those who want to quickly move across campus

High level spatial concepts are illustrated in Figure 6.3 and Figure 6.4, which could be considered separately or combined, in alignment with the street functions presented in Section 6.2, particularly for East Mall. A more detailed level of transit service planning would be considered for a shorter time horizon, with more information of future land use changes and integration with the future rapid transit station in the core academic campus.

Figure 6.3: Intra-Campus Transit – Spatial Concept 1

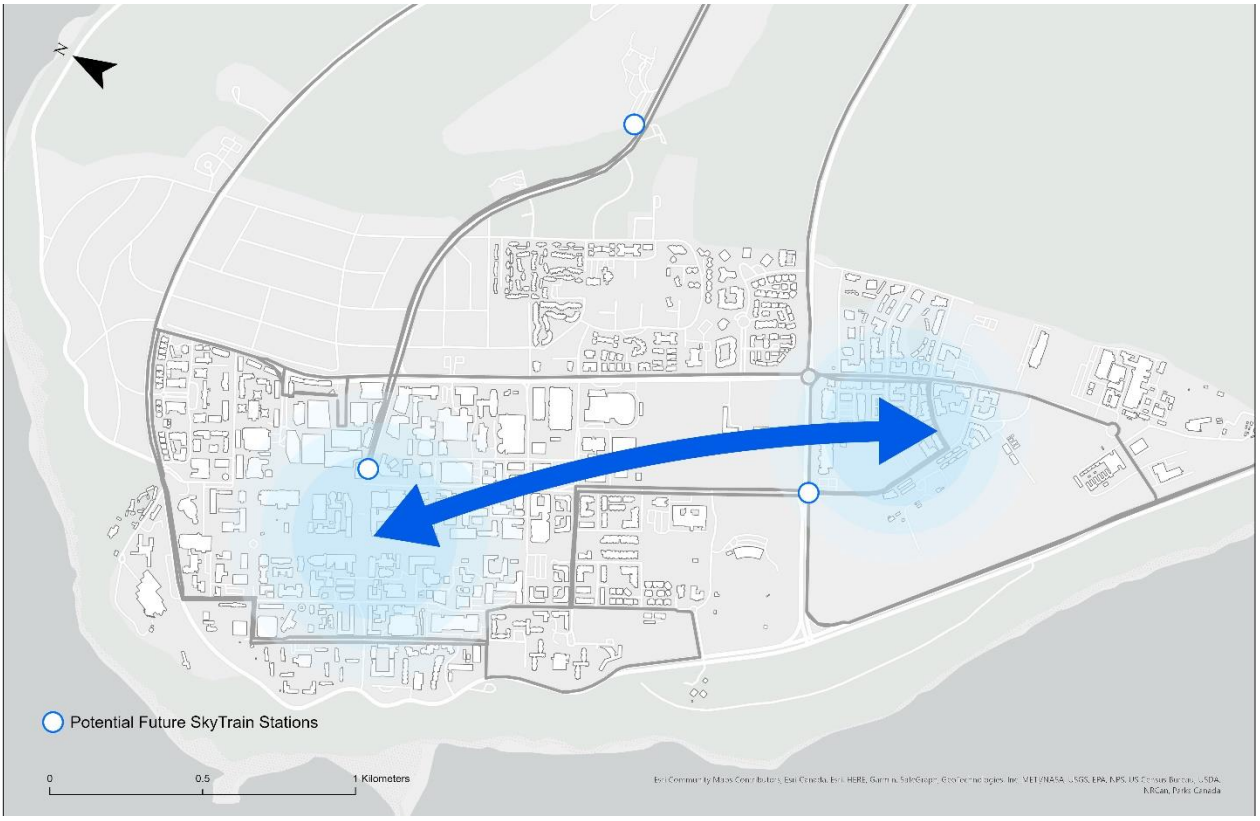
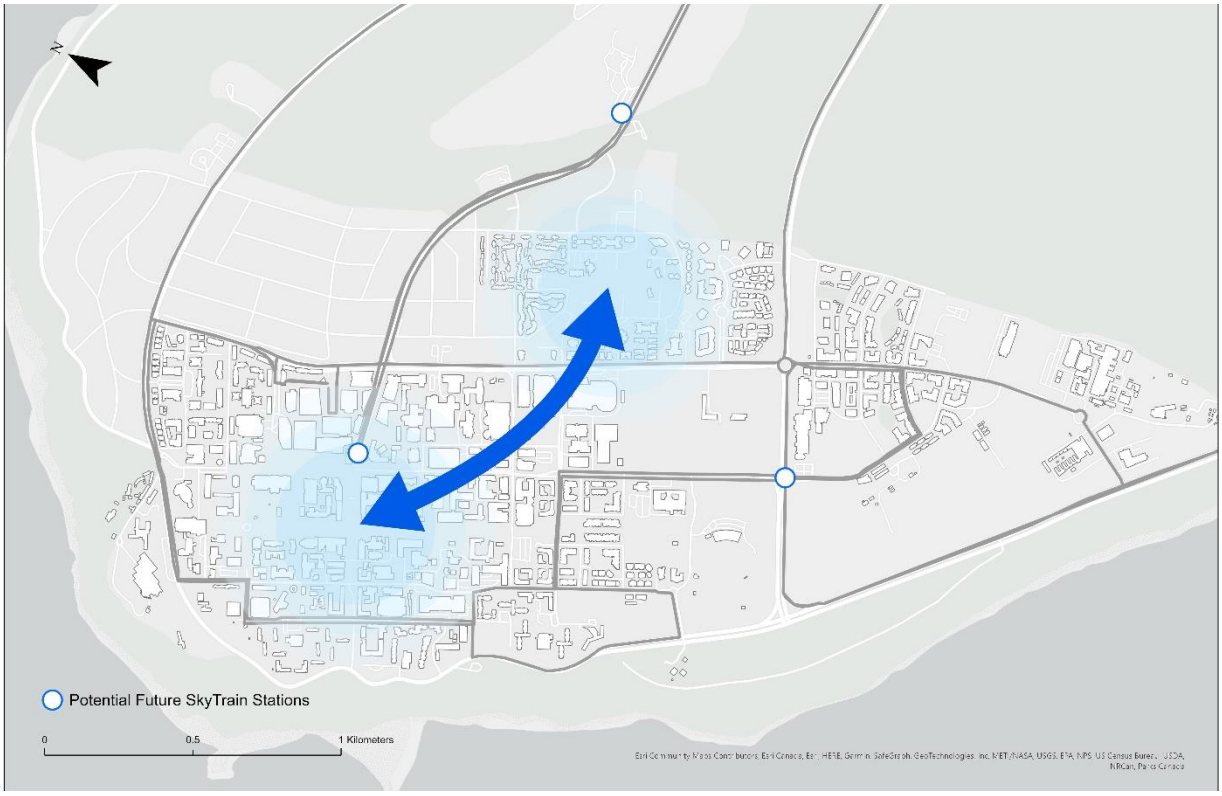


Figure 6.4: Intra-Campus Transit – Spatial Concept 2

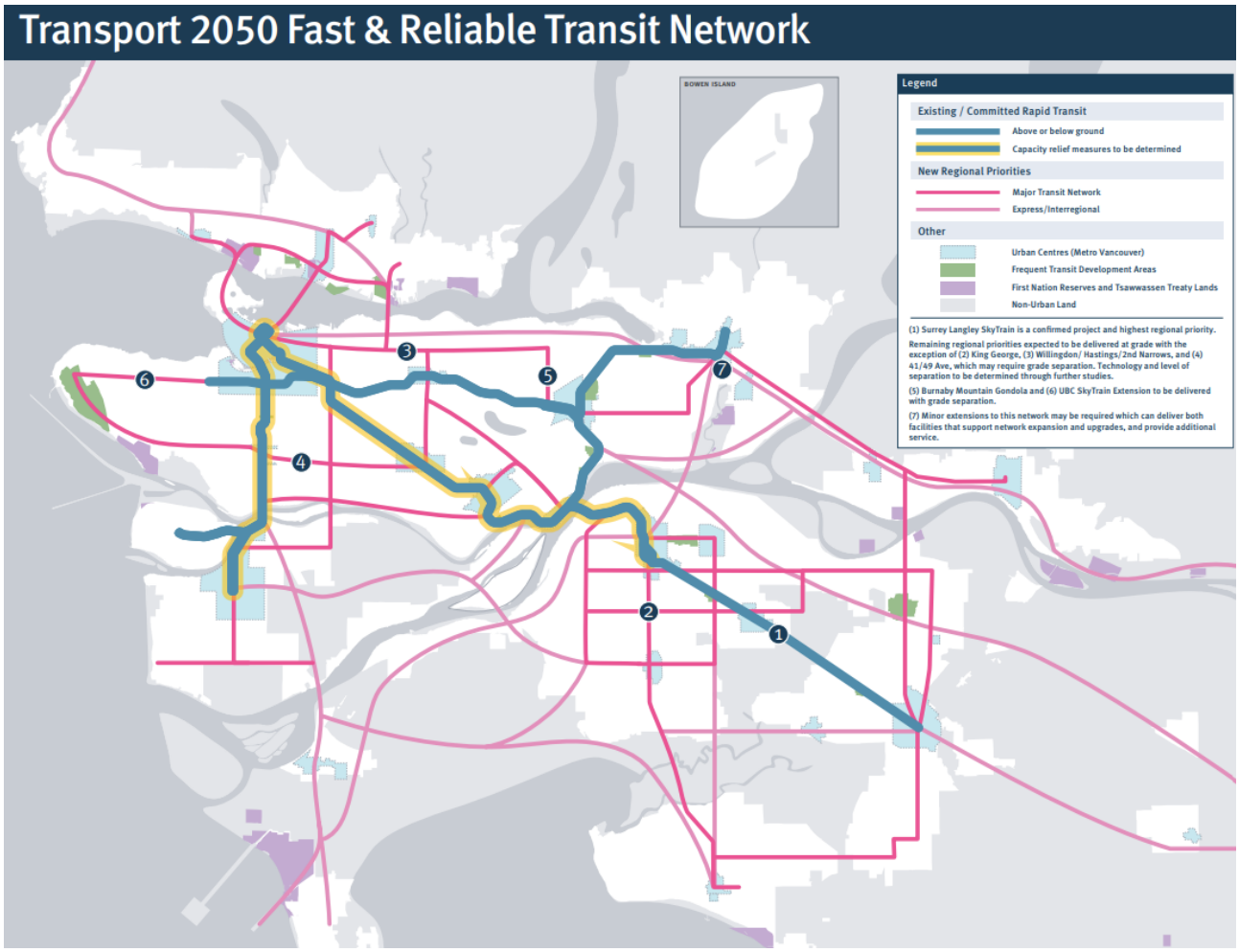


6.4 East Mall

Early within the planning process, East Mall emerged as a critical corridor for Campus vision 2050, namely regarding the following two opportunities:

- To provide improved multi-modal access between the academic core and growing south campus neighbourhoods, including the future Stadium Neighbourhood (timing and proposed form of development to be determined as part of this process)
- To accommodate a second UBC station as part of the Millennium Line UBC Extension and/or facilitate a transit connection between the future rapid transit route along 41st / 49th Avenue and the core of UBC campus (Figure 6.5).

Figure 6.5: Transport 2050 Fast and Reliable Transit Network (Source: TransLink Transport 2050)



Discussion and workshop participation with the UBC Campus Vision 2050 project team (July 21, 2022) yielded the following considerations for the future form and function of East Mall and a transit connection.

- A previously conducted noise and vibration study indicated adjacent buildings north of Thunderbird Boulevard have highly sensitive basement instruments, which would be impacted by a below grade transit connection. A surface transit solution (streetcar/light rail) may be suitable as its impacts more closely mimic other vehicles, but more study is required. An elevated transit solution has not been considered due to unsuitability along this corridor.
- Regardless of the transit connection technology and/or whether rapid transit is connected to the Millennium Line UBC Extension or the 41st/49th Avenue future rapid transit, preserving the ROW for transit use is paramount.
- A transit solution could transition over the 30-year time horizon from Bus Rapid Transit to Light Rail Transit with grade separation in some locations.
- As East Mall would represent a transit terminus, the speed can be slower on campus and speed up on West 16th Avenue and/or Southwest Marine Drive.
- Wesbrook Mall is currently considered a people mover; East Mall could be a friendly and shared 'people first' street.

This role of East Mall to accommodate transit service in the future has implications on the adjacent network, namely for Health Sciences Mall, to play a greater role with respect to loading & servicing, especially as the vehicular function of Hospital Lane may be reduced.

6.5 West 16th Avenue

As identified in **Section 3.2**, West 16th Avenue accommodates a significant proportion of UBC's transit demand, including the R4 service, via layby transit stop configurations. It also includes two roundabouts at East Mall and Wesbrook Mall (Figure 6.6).

Figure 6.6: West 16th Avenue (East of East Mall)

The original intent of bus layby stops was to minimize disruption to the general traffic stream while buses were loading/unloading customers. They were implemented at a time when it was assumed that most people would or could drive private vehicles. Whether deliberate or unintended, this resulted in lower priority to bus passengers and less efficient bus operations.

Over the past couple of decades, in-lane bus stops have re-emerged as a key bus priority measure. Most large transit agencies that publish their own bus infrastructure and priority guidelines now recommend the use of in-lane stops. This includes TransLink, BC Transit, the Toronto Transit Commission, Transport for London, Auckland Transport Authority, Zurich Transport Association, and many others.

The 2019 TransLink Transit Priority Toolkit recommends in-lane stopping (via the provision of bus bulges) to improve transit travel times and reliability. The toolkit notes a benefit of up to 7% in bus speeds, and potential to reduce dwell times by 15 to 30 seconds at in-lane stops. The toolkit does note that there may be potential safety concerns and additional conflicts with other street users.

Roundabouts, which serve to accommodate and balance vehicular demand, present challenges for people walking, biking and rolling. While there are pedestrian activated flashing lights for the crossings across 16th Avenue, pedestrians must make sure vehicles are stopping before crossing travel lanes. This presents challenges for those with visual impairments, children, and those who move at a slower speed.

Although roundabouts are challenging for active modes, at the intersection of Wesbrook Mall and 16th Avenue a more typical signalized intersection would likely create longer delays for all modes including longer queues for vehicles. Further exploration is required on how to safely get people walking, biking and rolling across W 16th Avenue that does not create longer delays for transit. This will be carried out in the update to the 10-Year Campus Plan and Neighbourhood Plan updates.

There is an opportunity along the corridor between Southwest Marine Drive and Wesbrook Mall to consider allocating one lane of general-purpose travel to transit priority and reconfiguring the intersections. In-lane bus stops and reconfigured intersections would optimize this corridor for transit and active modes. However, this

road falls outside of the jurisdiction of UBC; and its inclusion in the Campus Vision 2050 process would be from the perspective of advocacy to MoTI.

6.6 Acadia

The Acadia area is anticipated to accommodate a significant amount of the 30-year residential growth, and corresponding amenities and services. Acadia was included as part of Campus Vision 2050 engagement and detailed neighbourhood scale planning will follow through a future neighbourhood plan process.

Discussion and workshop participation with the UBC Campus Vision 2050 project team yielded the following considerations for a road network that complements both potential forms of development and other guiding principles, such as ecology and accessibility.

This work is ongoing, however draft network plans were developed for internal discussion that supported two different draft development concepts: Eco City (Figure 6.7) and City of Learning (Figure 6.8).

Figure 6.7: Conceptual Eco City Road Network

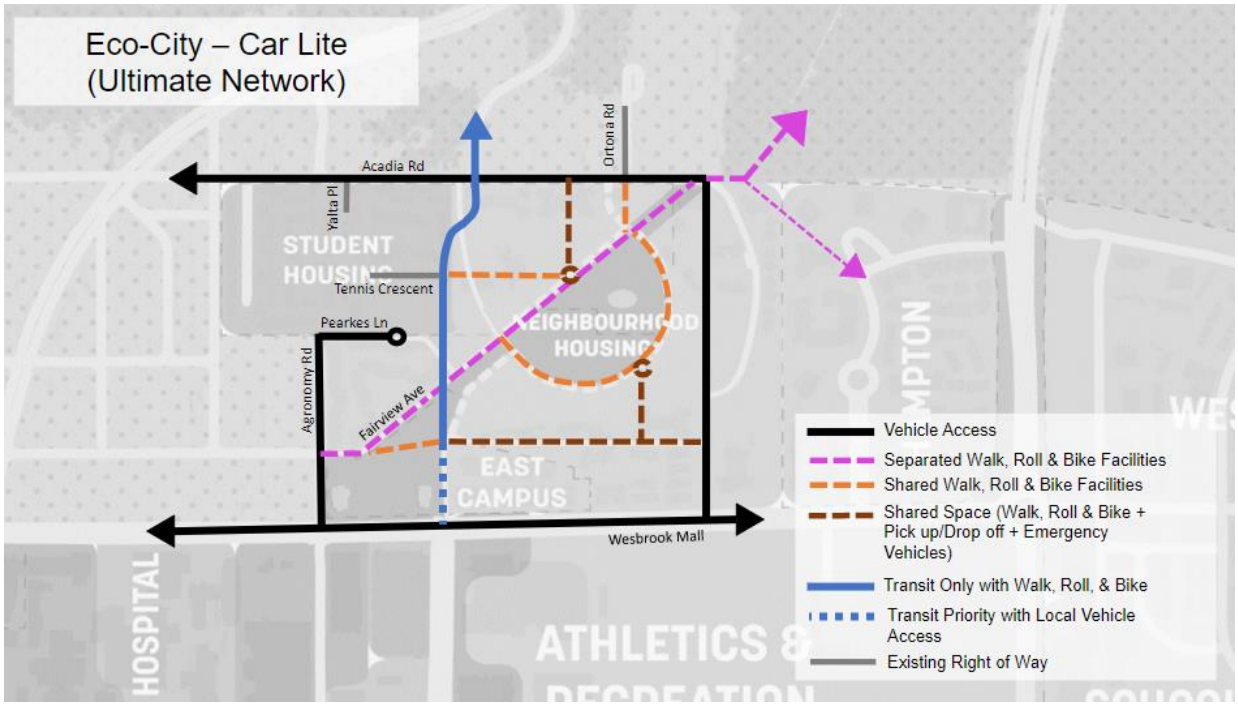
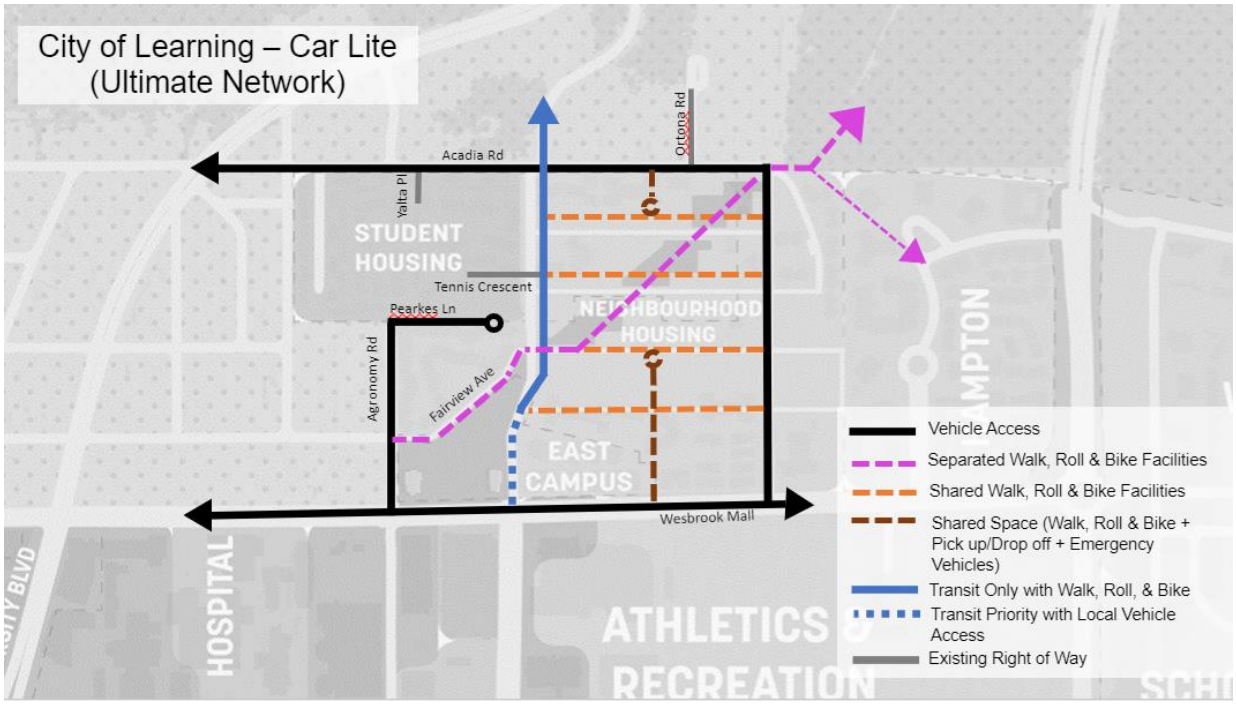


Figure 6.8: Conceptual City of Learning Road Network



Both concepts include the following and will be furthered explored as part of a future neighbourhood planning process:

- **Diagonal Connector**
  - Linking Pacific Spirit Regional Park to the forest overlooking Wreck Beach, this new ecologically rich landscape will draw in the surrounding forest. New wetland and climate adaptive plantings will capture, clean, and manage rainwater. This connector will provide people and wildlife passage across campus that is surrounded by nature.
- **Zero-emission intra-campus local transit service**
  - Route 1: North-South Service between University Centre / Rose Garden and Wesbrook Village along East Mall and Ross Drive, connecting to both on-campus SkyTrain stations (not pictured).
  - Route 2: East-West Service between Armories Commons and Acadia along Lower/West Mall & Thunderbird Boulevard, connecting to a future SkyTrain station in the UEL.

7 Regional Transportation Model Forecasts

7.1 Introduction

UBC's 2014 Transportation Plan established the target to have two-thirds of all trips to and from UBC be conducted via sustainable travel (walk, cycle, transit) by 2040. A key objective of the transportation analysis is to understand the trajectory UBC is on in terms of meeting this target. Further, for UBC to meet the Climate Action Plan 2030 goal of a reduction in GHG's from commuting by 45% from 2010 levels, it will require the campus to meet their 2040 mode share target on an accelerated timeline (by 2030).

Future transportation behaviour and demand is investigated using TransLink's Greater Vancouver Regional Transportation Model (RTM) Phase 3. In interpreting the results of this work, it is important to consider the limitations of the RTM as well as its inherent tendency towards overestimating auto trips and generally underestimating walking and cycling trips, particularly in walkable, dense, transit-oriented urban settings like UBC where trip lengths tend to be shorter. The uniquely high proportion of residents that both live and work/study on campus is also not very well reflected in the RTM, so forecast trips to/from campus and particularly auto trips and corridor volumes are likely overestimated. See further description of limitations in section 7.1.1.

The RTM is used to explore mode share, travel volumes and GHG emissions related to implications of the Campus Vision 2050 land use assumptions under three rapid transit scope scenarios. Growth assumptions in Campus Vision 2050 and the updated Housing Action Plan would see a 20% increase in academic space, and a 100% increase in housing space (representing a 20% increase above the current Land Use Plan allocation), translating into a population of 24,000 more people on campus over the next 30 years, for a total student housing and neighbourhood population of 53,000 in 2050.

Transportation behaviour and demand has been investigated under three 2050 Millennium Line UBC Extension scenarios that build upon the baseline scenario:

Scenario 1: Single SkyTrain station at the Trolley Loop (Regional Base Scope)

Scenario 2: Scenario 1 + a second SkyTrain station in the UEL near Lelem/Acadia

Scenario 3: Scenario 1 & 2 + a third SkyTrain station near West 16th Avenue and East Mall

Not modelled: No SkyTrain (this was modelled by TransLink as part of the Rail to UBC Rapid Transit Study (2019), with findings of that study summarized below). The Millennium Line UBC Extension project has since been confirmed as a near-term regional priority and the Province of BC is actively advancing development of a Business Case. A scenario where SkyTrain is not extended to campus by 2050 is therefore highly unlikely. Each scenario also includes two new intra-campus routes (EW Shuttle and NS Shuttle) with 15-minute frequency. All scenarios also include increased residential, student and employment population in 2050 (consistent with the emerging land use assumptions of Campus Vision 2050), which results in increased total daily person trips generated by the campus, as summarised below in Table 7.1. This demand is reflected in each scenario.

Table 7.1: Daily Trip Generation (Person Trips).

	2017	2050 Scenario 1	2050 Scenario 2	2050 Scenario 3
Within Campus	31,700	53,600	53,700	53,700
To/From Campus	132,000	212,000	212,000	213,000
Total (All Trips)	163,700	265,600	265,700	266,700

The stepwise methodological approach described above allows the marginal affect of each station investment on the future transportation behaviour and demand to be isolated, especially regarding adjacent proposed residential density (Acadia and Stadium neighbourhoods).

7.1.1 Limitations

The limitations of this work are driven by the transit network assumptions within the RTM Phase 3 model that was used. The base model does not include regional investments anticipated by Transport 2050, including 41st/49th Avenue Rapid Transit, North Shore Rapid Transit, Surrey-Langley SkyTrain, etc. All of which are likely to impact the UBC modal split given UBC's identity as a regional destination.

It is also acknowledged that the RTM (and macroscopic demand modelling software packages generally) have limitations with respect to forecasting land use & transportation interactions into the longer-term future: the model typically underestimates walkability and proximity benefits and overestimates the vehicle trips generated by denser land use in the future. These models generally do not reflect robust walking and cycling modelling and results reported here should not be used as a reflection of walkability. UBC is proposing growth in residential and student enrollment as part of Campus Vision 2050, as well as more on-campus services to support daily needs (grocery, daycare, other retail). This improvement in access to opportunities from land use changes also cannot be fully reflected in the RTM.

7.2 2050 Forecast Travel Demand

7.2.1 Mode Share

The volumes presented in the previous section are expressed in this section as mode shares to examine how future vehicle and transit mode shares compare to policy objectives. UBC's 2014 Transportation Plan includes the target to have at least two-thirds of all trips to and from UBC made by walking, cycling, and transit, with 50% of trips being made by transit. UBC's Climate Action Plan 2030 sets targets to fast track the university's path to significantly reduce GHGs and achieve a 45% reduction from 2010 levels of extended emissions which includes commuting to and from campus. The Neighbourhood Climate Action Plan (NCAP 2030) is also underway and will set climate action targets for UBC's neighbourhoods.

7.2.1.1 All Trips (To/From Campus & Within Campus)

Figure 7.1 and Table 7.2 illustrate the travel mode share allocation expected with the additional 100,000 daily person trips expected by 2050, compared to existing conditions. The modes described consist of transit, auto (including commercial vehicles), walking, and biking.

In Scenario 1, the transit mode share is expected to increase by 11 percentage points from 2017 to 2050 (from 46% to 57% of all trips) and the auto & commercial mode share is expected to decrease by 11 percentage points (from 42% to 31%). However, because the total number of daily person trips are expected to increase significantly by 2050, the absolute number of daily person trips by auto & commercial are still expected to increase by approximately 20% from 2017 to 2050 (from 69,000 daily person trips to 83,000).

Figure 7.1: Estimated Mode Share Comparison (All Trips)[14]

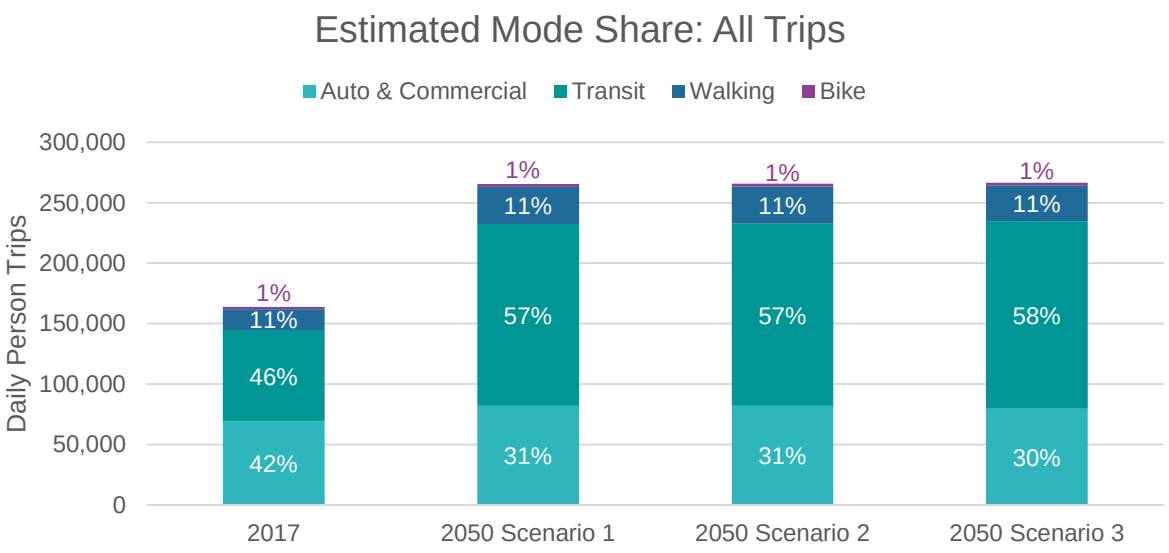


Table 7.2: Modal Daily Person Trips (All Trips) [16]

	Daily Person Trips			
Mode	**2017**	**2050 Scenario 1**	**2050 Scenario 2**	**2050 Scenario 3**
Auto	67,000	78,300	78,300	76,000
Commercial	2,000	3,700	3,700	3,700
Transit	75,800	150,500	150,700	155,100
Walking	17,400	30,800	30,700	29,600
Bike	1,600	2,400	2,400	2,300
Total*	**163,800**	**265,700**	**265,800**	**266,700**

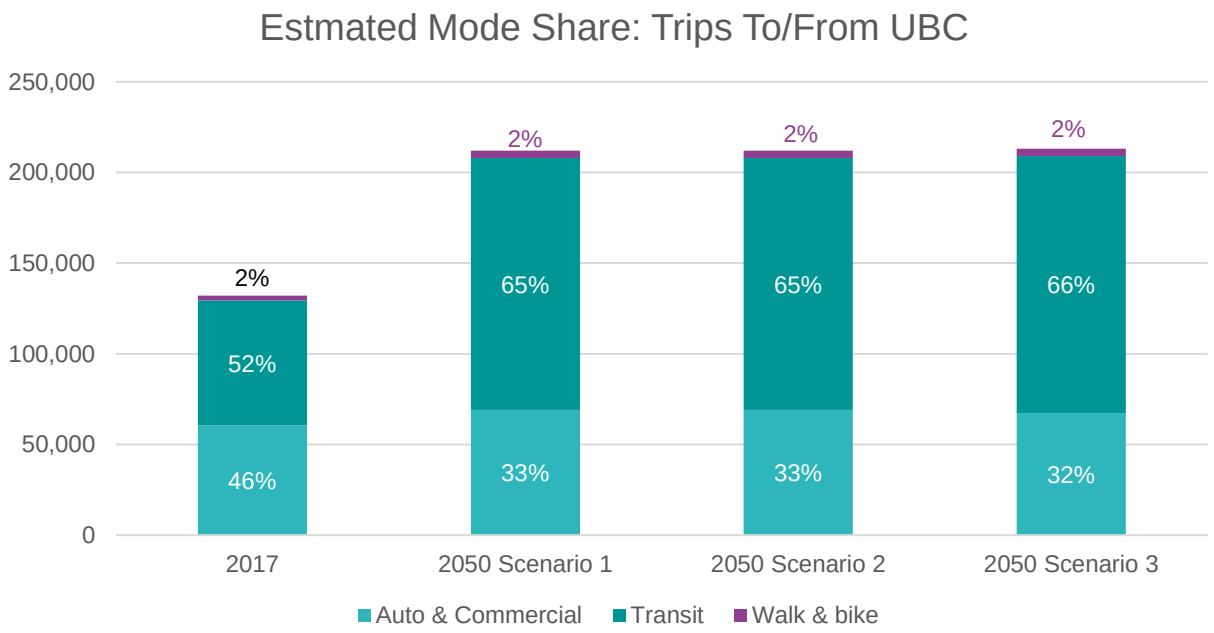
*totals may differ from Table 7.1 due to rounding

7.2.1.2 Trips To and From Campus

Figure 7.2 and Table 7.3 illustrates the daily person trips and mode shares for trips to and from campus only.

[14] The RTM has limitations with respect to forecasting land use & transportation interactions into the longer-term future: the model typically underestimates walkability and proximity benefits and overestimates the vehicle trips generated by denser land use in the future. For example, Scenario 2 estimates increased volume in auto volumes due to a station at Lelem, which would increase travel times to UBC by SkyTrain. In reality, this change in behaviour (more people choosing to drive rather than take SkyTrain, due to 1 more station being added to the network) is unlikely. The RTM may not fully account for the relationship between the residential population at UBC and the university, assuming people who live at UBC travel to destinations all over the region rather than disproportionally work or study at UBC. An example of evidence that UBC populations may not align with regional travel patterns is UBC's 2021 Transportation Status Report that cites relatively flat, and in some cases declining, vehicle volumes over the past 20 years despite increased student enrollment and residential development.

Figure 7.2: Mode Shares for Trips To / From Campus



The regional transportation model predicts that the transit mode share to and from campus is expected to increase from 52% in 2017 to 65% in 2050 Scenario 1. This mode share shift towards transit reduces auto & commercial mode shares from 46% in 2017 to 33% in 2050.

Scenario 1 represents the replacement of the 99 B-Line RapidBus bus route with rapid transit. As a result, the modelled change in transportation behaviour reflects only a marginal improvement to the speed and reliability of the transit service as represented in the model, rather than a new transit service overall (as there is frequent transit currently in place); the RTM is limited in its ability to capture the relative attractiveness of SkyTrain compared with frequent buses. Research also suggests that demand forecasts for rail transit systems are often under-estimated by macroscopic models. Several benefits of rail and important factors in peoples' travel decisions are excluded from transportation models – including reliability, information availability, safety and security, comfort, and ease of use.[15] Therefore, the RTM may be under-estimating the potential mode shift towards transit. The RTM base model also did not include regional investments anticipated by Transport 2050, which are likely to further favourably impact UBC's modal split. Even with these limitations, the RTM predicts that, given the emerging land use and transportation network assumptions of Campus Vision 2050, UBC will meet or exceed its sustainable mode share target of having two-thirds of all trips to and from campus made by walking, cycling or transit.

Previous modeling of a No-SkyTrain Scenario completed as part of the Rail to UBC Rapid Transit Study (2019) predicted that without a SkyTrain connection, UBC would fall short of achieving its 2040 mode share targets, with just 61% of trips to and from campus made by walking, cycling, or transit through 2045. This scenario was not explored through the current work as the likelihood of SkyTrain not being extended to campus by 2050 is very low given its inclusion in TransLink's *Transport 2050: 10-Year Priorities* plan and active work by the Province of BC to advance development of the project Business Case.

[15] Scherer, M. (2010). Is light rail more attractive to users than bus transit?: Arguments based on cognition and rational choice. Transportation Research Record, 2144(1), 11-19.

Table 7.3: Modal Daily Person Trips (To / From Campus)

Mode	2017	2050 Scenario 1	2050 Scenario 2	2050 Scenario 3
Auto	59,200	67,000	67,000	65,200
Commercial	1,300	2,000	2,000	2,000
Transit	68,800	139,000	139,000	141,800
Walking	1,400	2,400	2,400	2,300
Bike	1,200	1,600	1,600	1,600
Total*	**131,900**	**212,000**	**212,000**	**212,900**

*totals may differ from Table 7.1 due to rounding

7.2.2 Total Daily Volumes

TransLink's daily expansion factors were used to extrapolate peak period (morning, mid-day, and evening) volumes to total daily auto and transit volumes. Screenline volumes were extracted for Southwest Marine Drive, West 16th Avenue, University Boulevard, and Chancellor Boulevard. Screenline data was captured where each corridor intersects Wesbrook Mall. Total daily auto volumes are presented in Table 7.4 for each 2050 scenario with percentage change from 2017 provided in brackets for each scenario and corridor.

Table 7.4: Total Daily Auto Volumes (PCE/Day) (% Change from 2017 in Brackets)[16]

	2017	2050 Scenario 1	2050 Scenario 2	2050 Scenario 3
Southwest Marine Drive	15,000	22,500 (+50%)	22,500 (+50%)	22,000 (+47%)
West 16th Avenue	10,700	19,100 (+78%)	19,000 (+77%)	18,400 (+72%)
University Boulevard	8,000	11,300 (+42%)	12,200 (+53%)	11,900 (+50%)
Chancellor Boulevard	8,400	8,300 (-1%)	9,600 (+14%)	9,500 (+13%)
Total	**42,000**	**61,200 (+46%)**	**63,300 (+50%)**	**61,800 (+47%)**

Note that Table 7.4 presents expected volumes of vehicles on roads rather than expected trips to campus. Passenger vehicles on roads typically carry more than one passenger but also vehicles also include commercial and delivery vehicles, which are expected to increase with growth at UBC irrespective of transit and active transportation options.

The model demonstrates that, despite a projected 120% increase in floor space at UBC and doubling of nighttime population, less than a 50% increase in auto volumes (Passenger Car Equivalent (PCE)/day) is expected, noting this represents a 10% increase in overall trips to/from campus. Additionally, UBC's 2021 Transportation Status Report cites relatively flat, and in some cases declining vehicle volumes over the past 20 years, despite increased student enrollment and residential development. The difference in total daily auto volumes between 2050 scenarios is nominal.

Higher auto volumes are expected to occur primarily on Southwest Marine Drive, West 16th Avenue, and University boulevard. The greatest increase is expected to occur on West 16th Avenue (78% increase from 2017 to 2050 Scenario 1). Nearly no change is expected to occur on Chancellor Boulevard in 2050 Scenario 1. Overall, daily auto volumes in 2050 Scenario 1 are estimated to be approximately 50% higher than 2017 volumes, which can be accommodated safely, at a corridor level, by the existing road network capacity.

[16] The model limitations noted previously, which discussed the model's conservative estimate of walking and cycling trips and underestimate of attractiveness of SkyTrain compared to buses are applicable here. For example, Scenario 2 estimates an incremental increase in auto volumes due to the inclusion of a SkyTrain station at Lelem, which would increase travel times to UBC by SkyTrain slightly. In reality, this change in behaviour (more people choosing to drive rather than take SkyTrain, due to increased travel time of adding 1 more station to the network) is unlikely. The RTM also does not account for the relationship between the residential population at UBC and the university assuming people who live at UBC travel to destinations all over the region rather than considering the percentage of residents who are likely to work or study at UBC in the future.

Total daily transit volumes (passengers/day) are presented in Table 7.5 for each scenario. In all three scenarios, a significant transit volume increase is expected to occur on University Boulevard (a 270% increase in 2050 Scenario 1). Transit volumes are predicted to be reduced on Southwest Marine Drive and Chancellor Boulevard, and volumes on West 16th Avenue are predicted to stay similar to 2017 levels. Overall, daily transit volumes in 2050 Scenario 1 are expected to be 67% higher than 2017 volumes.

Table 7.5: Total Daily Transit Volumes (Passengers/Day)[17]

	2017	2050 Scenario 1	2050 Scenario 2	2050 Scenario 3
Southwest Marine Drive	36,150	19,490 (-46%)	19,650 (-46%)	19,620 (-46%)
West 16th Avenue	10,190	10,920 (+7%)	10,635 (+4%)	9,660 (-5%)
University Boulevard[18]	31,100	115,740 (+272%)	111,880 (+260%)	115,950 (+273%)
Chancellor Boulevard	12,370	7,370 (-40%)	9,782 (-21%)	9,530 (-23%)
Total	**91,827**	**153,520 (+67%)**	**151,947 (+65%)**	**154,760 (+69%)**

7.2.3 Scenario 1 Peak Hour Demand by Corridor

This section examines the peak hour demand by corridor for the 2050 Scenario 1 conditions. Corridor volumes for Scenarios 2 and 3 were not found to significantly vary from Scenario 1 (as demonstrated in Table 7.4 and Table 7.5) and are thus not presented here.

Table 7.6 illustrates the auto and transit volumes side-by-side for AM inbound (towards campus) and PM outbound (leaving campus) volumes for 2017 and 2050 Scenario 1. The table most notably illustrates the redirection of transit volumes to University Boulevard because of the SkyTrain extension to UBC and lack of rapid transit on 41st/49th avenue in the model despite its inclusion in Transport 2050.

Table 7.6: 2017 and 2050 Scenario 1 Peak Inbound and Outbound Volumes

	2017 AM Peak (inbound)		2050 AM Peak (inbound)	
	Auto (PCE)	**Transit (Passengers)**	**Auto (PCE)**	**Transit (Passengers)**
Chancellor Boulevard	610	1,630	600	780
University Boulevard	610	2,130	600	9,668
West 16th Avenue	510	820	550	470
Southwest Marine Drive	1,270	1,980	1,100	1,200
	2017 PM Peak (outbound)		**2050 PM Peak (outbound)**	
	Auto (PCE)	**Transit (Passengers)**	**Auto (PCE)**	**Transit (Passengers)**
Chancellor Boulevard	420	820	490	590
University Boulevard	500	2,180	610	7,880
West 16th Avenue	720	640	670	510
Southwest Marine Drive	1,210	1,610	1,110	950

Table 7.7 compares 2017 total volume (vehicles/hour) during the PM peak period to 2050 Scenario 1. PM peak hour volumes are shown here as this represents the period with the highest overall demand. Table 7.7 suggests an increase of at most 7 vehicles per minute for each corridor.

[17] The model limitations noted previously, which discussed the model's potential to conservatively estimate walkability and proximity benefits, are applicable here.

[18] Screenline for University Boulevard includes SkyTrain users.

Table 7.7: PM Peak Hour Corridor Total Volumes (Vehicles/Hour)[19]

	Total Volume (Vehicles/Hour)			
	2017	**2050 Scenario 1**	**Change (per hour)**	**Change (per minute)**
Southwest Marine Drive				
North-bound	390	780	+390	+6.5
South-bound	1,130	1,160	+30	+0.5
West 16th Avenue				
East-bound	700	680	-20	-0.3
West-bound	480	860	+380	+6.3
University Boulevard				
East-bound	420	590	+170	+2.8
West-bound	200	400	+200	+3.3
Chancellor Boulevard				
East-bound	390	500	+110	+1.8
West-bound	200	310	+110	+1.8

7.3 Conclusion

The following summarizes the future transportation behaviour and demand using the RTM.

As with the rest of the region, car traffic to, from and around UBC is expected to increase, particularly during peak periods. While the capacity of the road network at UBC is expected to handle this increase, improvements along 16th Avenue and Wesbrook Mall are likely required, particularly to prioritize sustainable transportation modes. The update to the 10-Year Campus Plan will explore roadway and intersection improvements that prioritize walking, biking, and transit, which will include a detailed exploration of improvements along 16th Avenue and Wesbrook Mall. UBC will coordinate closely with TransLink, UEL and the BC Ministry of Transportation and Infrastructure on any future transportation improvements.

- An additional 100,000 daily person trips are predicted to occur to, from, and within campus in 2050 compared to existing (2017) conditions, with 20,000 of these trips occurring within campus.
- Of the 80,000 additional daily person trips to and from campus, 70,000 (or 87.5%) are anticipated to be made via transit.
- The number of daily person trips made by transit is estimated to increase by a minimum of 65% by 2050.
  - The transit mode share (all trips) is expected to increase by 11 percentage points (from 46% in 2017 to 57% in 2050).
  - The auto & commercial mode share (all trips) is expected to decrease by 11 percentage points (from 42% in 2017 to 31% in 2050).
- The RTM estimates that 67% of trips **to and from** campus will be made by walking, cycling, or transit, with 65% of trips being made by transit by 2050 (Scenario 1 & 2).
  - This achieves UBC's 2014 Transportation Plan target to have at least two-thirds of all trips to and from UBC made by walking, cycling or transit, with 50% of trips being made by transit.

[19] The model limitations noted previously are applicable here. The RTM has limitations with respect to forecasting land use & transportation interactions into the longer-term future: the model typically underestimates walkability and proximity benefits and overestimates the vehicle trips generated by denser land use in the future. Overall, daily auto volumes in 2050 Scenario 1 are estimated to be approximately 50% higher than 2017 volumes, which can be accommodated safely by the existing road network capacity.

  - Future work to support the update to the 10-Year Campus Plan and updated Transportation Plan will explore the feasibility of achieving this target on the accelerated timeline required to meet the emission reduction targets of the Climate Action Plan 2030.
- At a corridor level, the existing roads to / from UBC can safely accommodate the anticipated 50% increase in daily traffic volumes. This equates to an increase in 3-7 vehicles / minute during peak periods along affected corridors (University Boulevard, W 16th Ave, and Southwest Marine Drive).
- Auto volumes on Chancellor Boulevard are estimated to remain relatively similar to 2017 levels.
- The more detailed transportation analysis to determine intersection and corridor improvements required to meet future traffic demands will occur as part of the 10-Year Campus Plan, Transportation Plan, and neighbourhood plans.

7.4 Access Analysis

For the most part, mobility is a means to an end, and not an end in and of itself. Residents and visitors often desire the activity at the end of their trip, such as services or retail. It is important that access is explicitly measured to work towards a campus that meets residents daily needs without the need to travel too far.

Access is also an important metric for linking land use with mobility. Providing exceptional pedestrian (walk & roll) access to services and retail will be crucial to reducing the auto mode share for trips within campus in the future and thereby reducing campus GHGs. Reducing the auto mode share for the campus, in general, also supports those who rely on vehicular access by minimizing congestion and maximizing the availability of parking.

Access was measured for the UBC study area in the existing and future scenarios. The analysis uses data available to answer the following questions:

1. How does existing access to services and retail on campus compare to future access – given the proposed changes to the transportation network and land use distributions?
2. How does access to UBCx SkyTrain line compare across the three station scenarios. This considers walking distance from residential buildings.

This analysis considers high-level access metrics, but future analysis may consider other related questions:

1. Are all buildings on campus within an X-minute walk of a bus stop?
2. Do all buildings have access to accessible parking within X meters?
3. To what extent is an X-minute neighbourhood being achieved?

7.4.1 Access to Retail & Services

Access to retail and services (such as restaurants, grocery stores, medical offices, childcare facilities, etc.) was measured for the current and proposed 2050 land use.[20] Access was measured from each building on campus to provide an indication of how far people on campus might need to walk or roll to reach retail and services. Having more services closer to where people live, work and study makes it easier for all to independently access the things they need – especially those experiencing mobility challenges.

Access is measured in this analysis by counting the number of buildings with retail or services that can be reached within a 10-minute walk or roll based on an assumed speed. Building population data (student and neighbourhood) was used to further this analysis by considering the number of people who fall under each access category. This methodology captures changes to access across campus between scenarios considering the data availability limitations of the land uses proposed for the 2050 scenario. Future analyses

[20] Land use information for 2050 (building footprints and location of retail and services) was based on data available at the time of analysis. The analysis and figures capture most of the proposed land use changes for 2050, but some proposed buildings or locations for retail and services may not be reflected in the analysis.

may consider the actual number of retail or services that can be reached within 10-minutes (i.e., by capturing the number of unique retail or service opportunities within each building).

A 10-minute walkshed was created around each building using the pedestrian network (sidewalks, pathways, crosswalks, etc.) and a walking speed of 3.6 kilometers/hour (equivalent to 1 meter/second), as recommended by the BC Active Transportation Design Guideline. This walking speed accounts for the general population, including children, seniors, and those who use mobility aids.

The colour of buildings in Figure 7.3 and Figure 7.4 represent the degree of access that users of each building (e.g., residents, students, workers, etc.) have to nearby retail and services. Buildings that are coloured dark blue offer their users the greatest access to retail and services (access to over 35 buildings with retail or services), whereas light green buildings offer their users the least access (access to 10 or fewer buildings with retail or services). A consistent legend between the two figures is used to compare the existing and future scenario. Table 7.8 also provides the proportion of buildings and residents that fall under each access category.

Table 7.8: Existing & Future Access to Retail & Services – Proportion of Buildings and Residents

Number of Buildings with Retail or Services Accessible within a 10-minute Walk	**Buildings**		**Residents**	
	Existing	**Future (2050)**	**Existing**	**Future (2050)**
0 – 10 **(Poorest Access)**	22%	20%	16%	17%
10.1 – 20.0	38%	28%	40%	40%
20.1 – 35.0	37%	30%	43%	34%
> 35.0 **(Greatest Access)**	13%	21%	1%	9%

Figure 7.3: Existing Access to Services & Retail

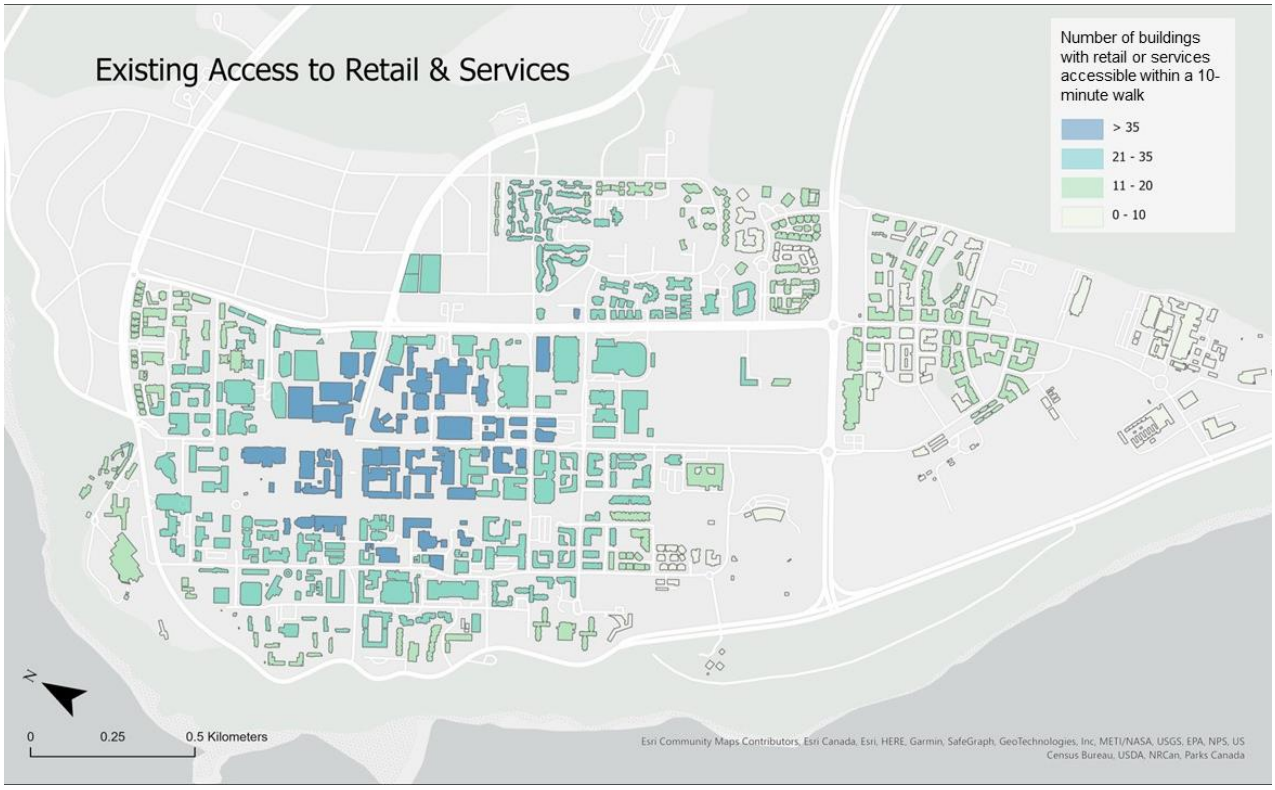
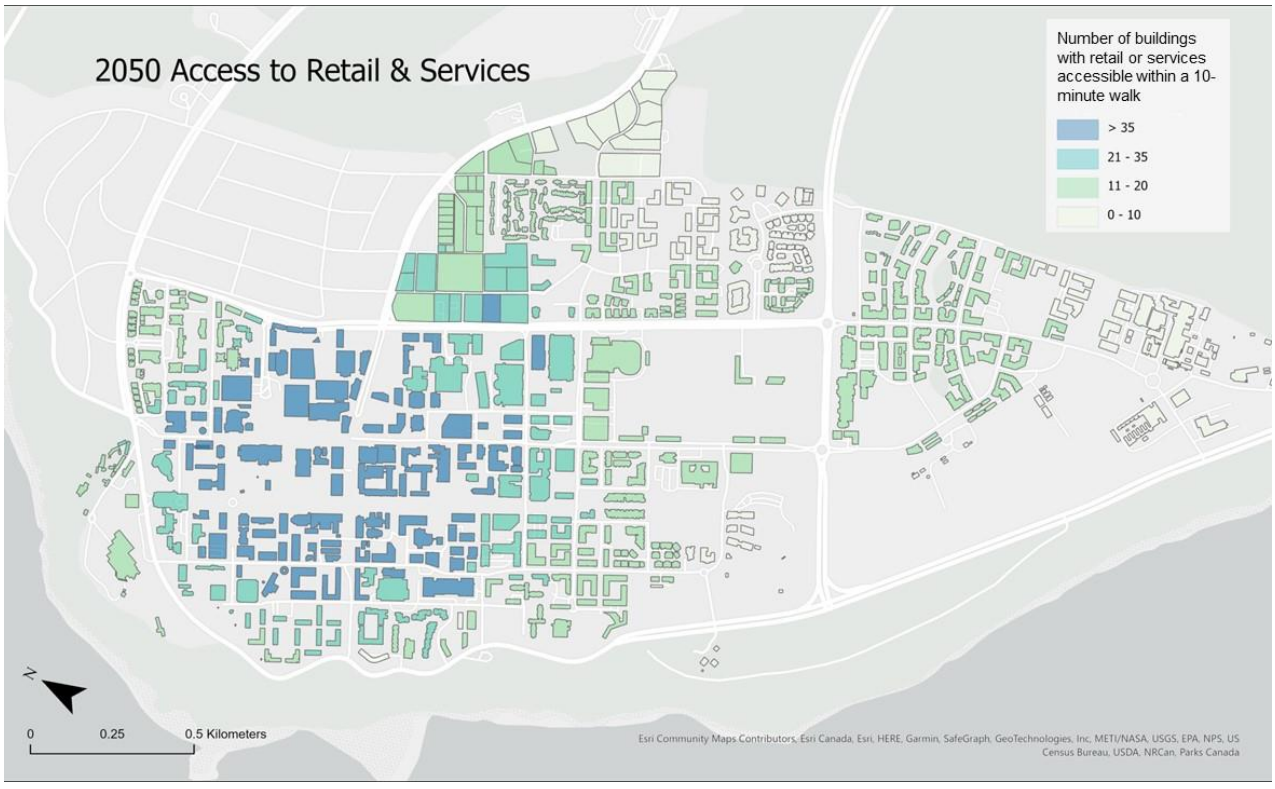


Figure 7.4: 2050 Access to Retail & Services



A comparison of Figure 7.3 and Figure 7.4 and information in Table 7.8 demonstrate:

- The percentage of buildings that offer exceptional access to retail and services (dark blue) is expected to nearly double in the 2050 scenario.[21]
  - Today, 13% of the campus buildings fall in the highest access category – providing access to over 35 buildings with retail or services within a 10-minute walk.
  - In 2050, 21% of campus buildings are expected to fall in the highest access category.
- The percentage of buildings in the lowest access category remains approximately the same between the two scenarios.
  - Today, 22% of campus buildings offer access to 10 or fewer buildings with retail or services.
  - In 2050, 20% of campus buildings are expected to offer access to 10 or fewer buildings with retail or services.
- The percentage of residents (student and neighourhood) with exceptional access to retail and services is expected to increase nine-fold.
  - Today, 1% of residents fall in the highest access category.
  - In 2050, 9% of residents are expected to fall in the highest access category.

The results of this access analysis demonstrates that the proposed 2050 land use concepts significantly contribute toward the campus vision principles, including making the campus more inclusive and accessible, strengthening connectivity, and addressing climate change.

7.4.2 Station Access

Access to the Millennium Line UBC Extension was assessed under three scenarios (consistent with the RTM analysis):

Scenario 1: Single SkyTrain station at the Trolley Troop (Regional Base scope)

Scenario 2: Scenario 1 + a second SkyTrain station at Lelem/Acadia

Scenario 3: Scenario 1 & 2 + a third SkyTrain station at West 16th Avenue and East Mall

For each scenario, walksheds were created around each station in intervals of 10-minutes, and the number of residential buildings within each walkshed was counted. The lightest colour in Figure 7.5**,** Figure 7.6**,** and Figure 7.7 represents the area that can be reached within a 10-minute walk. The darkest colour represents the are that can be reached within a 50 – 60 minute walk. This information is also tabulated and presented in Table 7.9 below.

[21] Exceptional access is defined as access to more than 35 buildings with retail or services within a 10-minute walk or roll.

Figure 7.5: Scenario 1 Walk Shed

Note: Station locations are approximate, final station locations to be determined.

Figure 7.6: Scenario 2 Walk Shed

Note: Station locations are approximate, final station locations to be determined.

Figure 7.7: Scenario 3 Walk Shed

Note: Station locations are approximate, final station locations to be determined.

Table 7.9: Access to Stations within Travel Time Ranges

Travel Time (Minutes)	Percentage of Resident Population		
	Scenario 1	Scenario 2	Scenario 3
0 – 10	25%	41%	56%
10 – 20	42%	34%	44%
20 - 30	16%	9%	0%
30 – 40	17%	16%	0%
40 – 50	0%	0%	0%
50 – 60	0%	0%	0%
Average Travel Time (Minutes)	18	15	9

Table 7.9 provides the percentage of residents that fall within each walkshed for each of the three scenarios. Within a 10-minute walk, 25% of residents have access to a Millennium Line UBC Extension station in Scenario 1, 41% in Scenario 2, and 56% in Scenario 3.

- In Scenario 2, the number of residents within a 10-minute walk of a station increases by 16 percentage points (25% to 41%).
- In Scenario 3, the number of residents within a 10-minute walk of a station increases by a further 15 percentage points (41% to 56%).

Across the entire campus, the average travel time from residential buildings (weighted by population) to a SkyTrain station is 18 minutes in Scenario 1. This is reduced to 15 minutes in Scenario 2 (or – a 14% travel time reduction) and to 9 minutes in Scenario 3 (or – a 38% travel time reduction, compared with Scenario 2).

The station access analysis indicates that the provision of an infill station near Acadia/Lelem would increase the percentage of residents living within a 10-minute walk to 41% and an additional station near East Mall & 16th Avenue would further increase this to 56%.

7.4.3 Conclusion

- The results of the access analysis demonstrate that the proposed 2050 land use concepts significantly contribute toward the campus vision principles, including making the campus more inclusive and accessible, strengthening connectivity, and addressing climate change.
  - The percentage of residents with exceptional access to retail and services is expected to increase nine-fold in the 2050 land use scenario.
- Across the entire campus, the average travel time by walking or rolling from residential buildings (weighted by population) to a SkyTrain station is 18 minutes in Scenario 1.
  - An infill station near Acadia/Lelem reduces the average travel time by 14% (from 18 to 15 minutes).
  - A third station near West 16th Avenue and East Mall reduces average travel time by an additional 38% (from 15 minutes to 9 minutes).
- The provision of an infill station near Acadia/Lelem would increase the percentage of residents living within a 10-minute walk to 64% and an additional station near East Mall & 16th Avenue would more than double the percentage.

7.5 Greenhouse Gas Emissions

Transportation related greenhouse gas (GHG) emissions have been calculated using vehicle-kilometres-travelled (VKT) derived from the RTM, fleet composition, and fuel efficiencies to establish a baseline with which future transportation and land use scenarios can be compared against.

7.5.1 Data

Data sources for this exercise include:

1. Vehicle-kilometres-travelled (VKT) from the 2017 TransLink RTM for 2017 and 2050 Scenario 1.
2. To convert average daily VKT to average annual VKT, annual expansion factors published in the TransLink RTM manual were used.
3. Metro Vancouver fleet composition was obtained from ICBC's 2021 passenger and commercial vehicle population data.
4. Average fuel efficiencies for light-duty vehicles and light-duty trucks were obtained from Table 25 of the published '2020 Best Practices Methodology for Quantifying Greenhouse Gas Emissions' (BC Ministry of Environment and Climate Change Strategy, 2020).
5. Average fuel efficiencies for heavy-duty trucks were verified from two documents: (1) 'Fuel Efficiency Benchmarking in Canada's Trucking Industry' (Government of Canada, 2019) and (2) 'Literature Review: Real-World Fuel Consumption of Heavy-Duty Vehicles in the United States, China, and the European Union' (The International Council on Clean Transportation, 2015).
6. Emission factors by vehicle and fuel type were obtained from Table 7 of the published '2020 Best Practices Methodology for Quantifying Greenhouse Gas Emissions' (BC Ministry of Environment and Climate Change Strategy, 2020).

7.5.2 Methodology

The methodology for calculating GHG emissions relied on outputs from the RTM, ICBC vehicle population data, and industry standards emission factors published by the provinces and other sources.

Annual total VKT was calculated by summing the average annual weekday VKT for each mode and multiplying the summation by its respective expansion factor to account for weekend travel.

Fleet composition (vehicle and fuel type) was multiplied by the annual total VKT to obtain the annual total VKT specific to each combination of vehicle and fuel type. For each vehicle and fuel type combination, the calculated annual total VKT was multiplied by the vehicle's fuel efficiency to obtain total fuel consumption. Total fuel consumption was then multiplied by the emission factors to obtain emission units.

GHG emissions are also estimated for 2050 Scenario 1 using modeled RTM output. To estimate GHG emissions in 2050, assumptions regarding the shift in fleet composition towards zero-emission vehicles (ZEVs) is made. While additional factors, such as increasing fuel efficiencies or renewable contents in fuel, may also impact emissions over time, their impact and trajectory are not yet explicitly known. Therefore, this analysis only includes policy targets adopted at the time of analysis.

7.5.3 Baseline Fleet Composition

Baseline fleet composition from ICBC's 2021 Vehicle Population dataset for Metro Vancouver is provided in Table 7.10. For passenger vehicles, the ICBC dataset indicates if the vehicle is electric or hybrid but does not indicate the type of fuel the vehicle consumes. For that reason, all passenger vehicles that were not tagged as electric or hybrid were considered 'gasoline' vehicles. For commercial vehicles, the ICBC dataset indicates the type of fuel the vehicle consumes. However, due to unknown fuel efficiencies of some fuel types, vehicles that consumed natural gas, multi-fuels, or 'other' fuel types were grouped with gasoline vehicles.

Table 7.10: Baseline Fleet Composition

	Gasoline	Diesel	Propane	Hybrid	Electric
Light-Duty Vehicles	38.8%	0.5%	0.02%	1.9%	1.2%
Light-Duty Trucks (includes Vans and SUVs)	45.5%	4.1%	0%	1.1%	0.5%
Heavy-Duty Vehicles	1.0%	5.6%	0%	0%	<0.1%

7.5.4 2050 Fleet Composition

To account for a future shift in fleet composition towards zero-emissions vehicles (ZEVs), the ZEV sales targets set in the CleanBC Roadmap to 2030 were used. These targets are as follows:

- 26% of new light-duty vehicle sales by 2026
- 90% by 2030
- 100% by 2035

The sales targets for ZEVs only applies to new light-duty vehicles sales[22]. The sales targets were multiplied by the percentage of the fleet that are new models in any given year to obtain the increase in ZEVs year over year. In 2021, 1% of all vehicles were new models, therefore this is the value that is multiplied by the ZEV sales targets. The growth in ZEVs, as a percentage of the total fleet composition, is then evenly taken from light-duty gasoline vehicles and trucks[23].

As an example, in 2021, light-duty electric vehicles comprised 1.2% of the fleet. This is assumed to stay the same until 2026, when the first sales target is introduced. In 2026, the light-duty electric vehicle percentage is calculated as:

$$Previous\ year\ \% + (Sales\ Target\ \% \times \%\ of\ new\ models\ registered) = current\ year\ \%$$

[22] The CleanBC Roadmap states that targets for heavy-duty vehicles may be set in 2023. Only established policy is included in the assumptions for this analysis, therefore the heavy-duty vehicle fleet composition is assumed to remain consistent through 2050.

[23] The percentage difference is not taken from any of the other light-duty vehicle and truck fuel types because their percentages would be reduced to 0% before 2050, which would require an additional assumption around which vehicle and fuel types reach 0% first. Subtracting the percentage difference only from light-duty gasoline vehicles and trucks in intended to simplify the fleet projection.

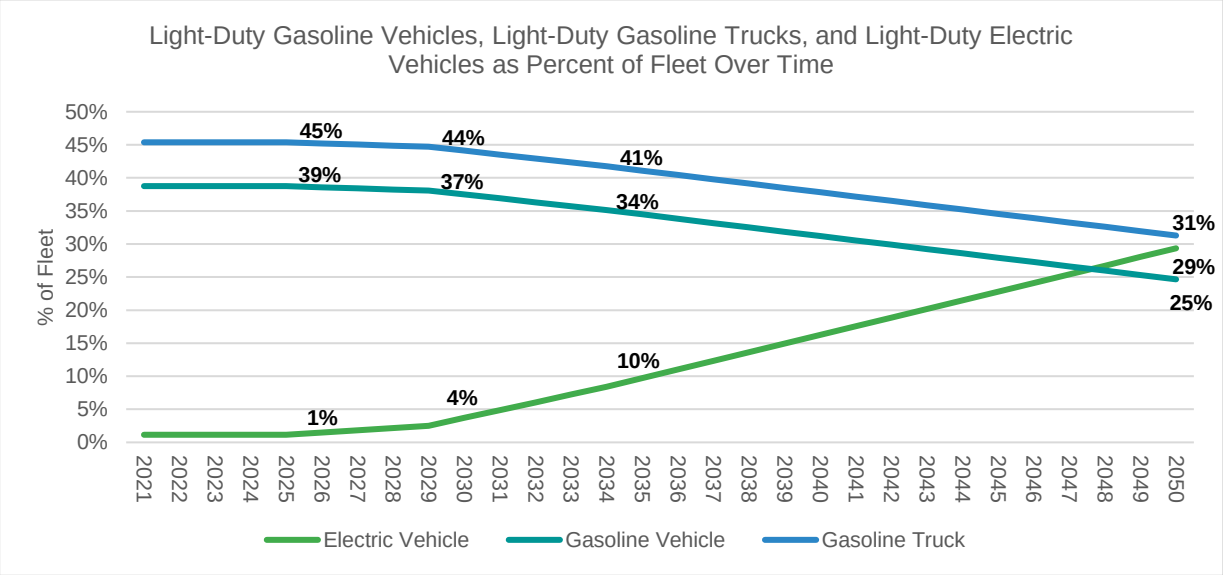
$$1.2\% + (26\% \times 1\%) = 1.5\%$$

The difference in the light-duty electric vehicle percentage ($1.5\% - 1.2\% = 0.3\%$) is then subtracted evenly from the light-duty gasoline vehicle & truck percentages. The process was repeated year by year to obtain a 2050 fleet composition provided in Table 7.11. The assumed fleet composition for light-duty gasoline vehicles, light-duty gasoline trucks, and electric vehicles is illustrated in Figure 7.8.

Table 7.11: 2050 Fleet Composition

	Gasoline	Diesel	Propane	Hybrid	Electric
Light-Duty Vehicles	24.7%	0.5%	0.02%	1.9%	29.3%
Light-Duty Trucks (includes Vans and SUVs)	31.3%	4.1%	0%	1.1%	0.5%
Heavy-Duty Vehicles	1.0%	5.6%	0%	0%	<0.1%

Figure 7.8: Assumed Change in Fleet Composition Over Time



7.5.5 Baseline Annual Emissions

Baseline annual emissions in tonnes of CO2e are provided in Table 7.12. Total emissions were calculated to be 60,500 tonnes of CO2e. The majority (98%) of emissions are a result of trips to and from campus, while trips that start and end within campus contribute 2% of total emissions.

Table 7.12: Baseline Annual Emissions

Origin	Destination	Annual Total VKT	Emissions (tonnes of CO2e)
UBC	UBC	3,513,633	1,052
UBC	Region	126,454,569	37,871
Region	UBC	72,118,639	21,599
Total		**202,086,841**	**60,536**

7.5.6 2050 Annual Emissions

Annual emissions for 2050 Scenario 1 are provided in Table 7.13**.** Total emissions were calculated to be 63,400 tonnes of CO2e. For trips within campus, GHG emissions are projected to increase by 30%, while for trips to and from campus, GHG emissions are projected to increase by 4%, due to a shift to more trips by transit and an expected shift in fleet composition towards zero emission vehicles (ZEVs) by 2050.

These findings differ from UBC's Climate Action Plan (CAP) estimates for future annual emissions, which focus on institutional commuter trips and do not include UBC neighbourhood trips and may use different methodologies. CAP estimates indicate a decrease in future emissions. The Neighbourhood Climate Action Plan (underway) will estimate emissions for the neighbourhoods to round-out the analysis.

Table 7.13: 2050 Emissions

Origin	Destination	Annual Total VKT	Emissions (tonnes of CO2e)
UBC	UBC	5,998,752	**1,373**
UBC	Region	132,732,145	**30,387**
Region	UBC	138,132,304	**31,623**
Total		**276,863,202**	**63,383**

7.5.7 Conclusion

The future transportation and land use (2050 Scenario 1) emissions have been compared against the existing baseline to investigate the impact of an increase in 38% of UBC's total daily person trip generation.

- Baseline GHG emissions for trips to / from and within campus is estimated to be 60,500 tonnes of CO2e.
- Annual total VKT for trips to / from and within campus are modeled to increase by 37% by 2050.
- 2050 GHG emissions for trips to / from and within campus are projected to increase by 5% to 63,400 tonnes of CO2e.
- 2050 GHG emissions for trips to / from campus only are projected to increase by 4%.
- The 2050 GHG emissions are likely because of a shift to more trips by transit and an expected shift in fleet composition towards zero emission vehicles (ZEVs) by 2050.

A. Plan and Policy Review

A.1 UBC Plans

UBC has several adopted plans that shape the direction of the Campus over the next 30 years. These plans include Campus Vision 2050, the Land Use Plan, the Vancouver Campus Plan, various Neighbourhood Plans, the Transportation Plan and climate action plans for the academic campus and the neighbourhoods. Additional guiding documents include the Vancouver Campus Plan Design Guidelines, the Development Handbook, the Cycling Network Plan, and the U Boulevard Area Plan, which lead to the recent upgrades to Wesbrook Mall. The 2050 Campus Vision Terms of Reference is reviewed first with attention to the guiding principles.

A.1.1 Campus Vision 2050 Terms of Reference

The Campus Vision 2050 Terms of Reference sets the scope and process for Campus Vision 2050, including preliminary guiding principles (Figure A.1) and growth assumptions. Those principles and growth assumptions informed Campus Vision 2050 including transportation principles and strategies. Transportation related principles are reviewed in detail in Section 4.

Figure A.1: Campus Vision 2050 Guiding Principles

A.1.2 The Land Use Plan

Adopted in 2010, and amended in 2011, 2012 and 2015, the Land Use Plan for UBC Point Grey Campus (the “Vancouver Campus”) will be updated in line with Metro Vancouver’s Metro 2050 Regional Growth Strategy and UBC’s Campus Vision 2050. It sets objectives for land use and transportation, particularly in relation to non-institutional development (in the neighbourhoods). The 2010 Land Use Plan aligns with Metro Vancouver’s Livable Region Strategic Plan (1996), including “to manage transportation in favour of a transit oriented and automobile restrained transportation system” and “support sustainable transportation choices”.

The Land Use Plan includes policies for creating a complete community for “living, working, and learning”, including a high-level street network and transit map that distributes traffic onto several arterials and is “designed to be less auto-dominated, and […] more favourable to the needs of pedestrians, cyclists and transit”, and Transportation Demand Management policies to reduce single occupant vehicle travel from 1996 levels by 20% (this policy now replaced by Transportation Plan targets).

A.1.3 Vancouver Campus Plan

Adopted in 2010, The Vancouver Campus Plan informs the physical shaping of the campus over a 20-year period. The Plan sets policies related to sustainability, open space, land use, the public realm, and transportation. The Plan also guides the site selection protocol required for all new building projects on campus. This plan is to be replaced by the Campus Vision 2050 Plan.

Transportation goals/objectives

- Parking for vehicles traveling to campus will be located within parkades or below-grade facilities, along the perimeter of the campus.
- Construction of new surface parking lots to be discontinued. Existing surface lots will be used as future building sites or for recreational uses.
- New parking structures will only be constructed once surface lots are used for infill. New parking structures can be constructed at an academic building at Main Mall and Agronomy Road or in the south campus research precinct.
- Roadways between the pedestrian priority zones and the campus perimeter will be transitioned to shared streets. Motor vehicle access in pedestrian priority zones will be limited to emergency and service vehicles and disabled access privileges.
- Discourage commuter-use of shared streets.
- Permanent bus facilities and a future rapid transit station will be created. UBC will work with TransLink to increase and amend the community shuttle bus services.
- Create a barrier-free environment through pathway and connectivity improvements.
- Implement traffic management initiatives along select routes and restrict all service vehicles to a defined servicing route.

Relevance to Campus Vision

- Approved locations and structure types for new parking and repurposing of existing surface lots.
- Location of planned shared streets.
- Permanent bus facility is completed.

A.1.4 Vancouver Campus Plan Design Guidelines

The Design Guidelines were adopted alongside the Vancouver Campus Plan in 2010. These guidelines set the long-term character objectives for the Campus, including design considerations related to sustainability, universal accessibility, architecture, open spaces, surface infrastructure, and site furnishings.

Transportation goals/objectives

- No surface parking, except to provide accessible parking spaces.
- Walkways should follow desire lines.

Relevance to Campus Vision

- Permitted locations and structure types for new parking and repurposing of existing surface lots.
- Considerations for walkway connectivity improvements.

A.1.5 UBC Development Handbook

The UBC Development Handbook describes the process of obtaining approval for development. The Handbook also outlines additional requirements for developments within the specified development area.

Transportation goals/objectives

- Sets the parking requirements for new developments, change of use developments, or enlargement of existing developments. Parking maximums are given for market and non-market housing (as per below). Minimums given for visitor and accessible parking and developments with commercial uses.
  - Market Housing- Maximum of 1.8 – 2 spaces per dwelling unit
  - Non Market Housing (faculty staff and student) – maximum of 0.25-1 spaces per bed or 1 space per unit.
- The Residential Environmental Assessment Program (REAP) is a UBC-specific green building rating system. All new multi-unit residential neighbourhood construction in the neighbourhoods must achieve a minimum REAP Gold certification.

  - Compared to standard residential buildings, REAP ensures lower consumption of water, energy and resources, and higher-quality indoor environments and construction practices. REAP building standards also reduce the environmental impact on both the building site and the larger community.

Relevance to Campus Vision

- Parking requirements for different uses

A.1.6 UBC Wesbrook Place Neighbourhood Plan

The Wesbrook Place Neighbourhood Plan was adopted in 2005, and most recently amended i 2020. It interprets the Land Use Plan's policies and development requirements to the plan area (Wesbrook Place). Each neighbourhood plan documents the goals and objectives of the community for the neighbourhood, and includes a detailed plan of land uses, design guidelines, development controls, transportation strategies and servicing strategies.

The Wesbrook Place Neighbourhood Plan describes how Wesbrook Place will add vitality to campus, create a mixed-use neighbourhood that emphasizes pedestrian and bicycle travel and access to transit, provide a range of housing types including housing for faculty and staff, create a complete community on campus and more. The circulation system aims to reduce environmental impact, be safe, accessible, convenient and enhance transportation choice.

Transportation objectives

- Support objectives of reducing automobile travel and increasing the use of other modes, including transit, walking, and cycling.
- Create a multi-modal transportation system by designing roads to accommodate all modes of transportation — pedestrians, cyclists, transit, goods movement, automobiles, service vehicles and emergency services.
- Establish a hierarchical road network that integrates with the road network on campus, so that roads are designed consistent with their intended functions of providing mobility and/or access.
- Create a redundant circulation network — incorporating a fine-grained pattern of streets and pedestrian ways — to disperse traffic, minimize travel distances and maximize pedestrian and cycling opportunities.
- Encourage walking by providing a continuous network of pedestrian facilities and incorporate appropriate crossing treatments on collector and arterial roads.
- Provide direct connections to pedestrian facilities elsewhere on campus, and connections to trails within Pacific Spirit Regional Park in consultation with Metro Vancouver Parks.

- Encourage cycling by providing on-street bicycle facilities on collector and arterial roads, complemented by a network of off-street pathways and greenways.
- Provide direct connections to bicycle facilities elsewhere on campus and to trails within Pacific Spirit Regional Park in consultation with Metro Vancouver Parks.
- Accommodate full-size transit buses along Wesbrook Mall south of 16th Avenue, and mini-buses on other roads within the neighbourhood, in a manner that
- provides convenient access for users, efficient transit operation and safety for all road users.
- Incorporate traffic calming features as appropriate to maximize safety for all road users (pedestrians, cyclists and motorists), and enhance the liveability of the neighbourhood by discouraging speeding and short-cutting traffic.
- Support UBC transportation programs, including a community transportation pass, car sharing, community bicycles and campus shuttle services.
- Ensure that road design considers the following performance criteria — safety, ecology, community building, aesthetics and long term investment in high quality materials.

A.1.7 UBC Transportation Plan

The 2014 Transportation Plan outlines the long-term transportation goals and strategies for UBC's Vancouver Campus. The policies in this plan address issues that are under both direct and regional control.

Transportation goals/objectives

- By 2040, at least two-thirds of all trips to and from UBC will be taken on foot, bicycle, or transit, with 50% of trips being made by transit.
- Reduce single-occupant vehicle (SOV) travel to and from UBC by 20% from 1996 levels. Reduce SOV trips per person to and from UBC by 30% from 1996 levels.
- Maintain daily private automobile traffic (soc or high-occupancy vehicles, excluding buses and commercial vehicles), at or less than 1997 levels.
- Expand car share parking locations and electric vehicle charging stations.
- Identify appropriate on-campus routes for heavy trucks and explore opportunities to reduce trips by heavy trucks.

Relevance to Campus Vision

- Mode share targets.
- Network planning for heavy trucks.
- Electric vehicle charging infrastructure.

A.1.8 Climate Action Plan 2030

In response to UBC's 2019 Declaration on the Climate Emergency, UBC's Climate Action Plan 2030 (CAP 2030) sets targets to fast track the university's path to net zero emissions for buildings and energy supply for 2035 as well as to significantly reduce greenhouse gas emissions for extended impact areas over the next 15 years. The Climate Action Plan covers UBC Vancouver campus' institutional / academic areas, while the Community Energy Emissions Plan (CEEP), currently being updated as the Neighbourhood Climate Action Plan address UBC Vancouver's neighbourhood areas.

Transportation goals/objectives

- Campus Operations (Scope 1 and 2) - incorporate a Zero Emissions Vehicle and Equipment First (ZEV First) requirement into existing fleet policy for all new vehicles and equipment.
- Extended Impact Emissions (Scope 3) – achieve a 45% reduction from 2010 levels include commuting to and from campus.

CAP Actions

- Continue to pursue a SkyTrain connection to campus.
- Explore funding via a “Sustainable Transportation Levy” as part of parking permit fees, to fund sustainable transportation initiatives.
- Transition parking permit fee structure to daily permits only.
- Improve cycling experience through secure storage, dedicated lanes, and integration e-bike share with the City of Vancouver.

Relevance to Campus Vision

- Charging Infrastructure and network planning.
- Growth in transit mode share is constrained until the UBC X rapid transit connection is in place, expected after 2030. Before then, the single occupant vehicle mode share may increase, as will emissions and public health impacts and equity considerations.
- Renewed sense of urgency and need to accelerate work to achieve existing Transportation Plan targets sooner than initially planned (i.e., 2030 vs 2040). Will flow better with sequencing changed as per comment above.

A.1.9 UBC Community Energy Emissions Plan (CEEP)

The Community Energy Emissions Plan (CEEP) was adopted in 2013 and is currently being updated as the Neighbourhood Climate Action Plan, to address climate action for UBC Vancouver’s neighbourhood areas. CEEP explores strategies to reduce emissions in line with BC Provincial targets and UBC’ Climate Action Plan targets. The plan recommends a gradual approach to energy efficiency implementation and emissions reductions.

Transportation strategies / targets:

- Vehicle kilometres travelled: Existing vehicle kilometres travelled maintained
- Mode split:
  - Off-campus walking trips increase from 0% to 3% by 2050; on-campus walking trips increase from 68% to 76%.
  - Off-campus cycling increases from 11% to 17% by 2050; On-campus cycling increases from 12% to 20%.
  - Off-campus transit increases from 30% to 45% (including RRT trips
- Vehicle type: Average fleet fuel efficiency increases to 40 km/l of gasoline by 2050 reflecting an increase in electric vehicles in the fleet. Vehicle mode share decreases as walking, cycling and transit mode shares increase.

Transportation recommendations:

- Implement a transportation behavior change program for students that is integrated with behavior change programs for UNA residents.
- Implement a behavior change program to support mode shifting away from vehicles using the model of the Smarter Travel Choices Program.
- Determine the UNA's role in contributing to the implementation of a rapid transit system in conjunction with TransLink, City of Vancouver and MetroVan, and perform further UNA transportation surveys.

A.1.10 U Boulevard Area Planning - Wesbrook Mall Upgrades

Wesbrook Mall from 16th Avenue to Chancellor Boulevard has undergone significant recent upgrades. The corridor was redesigned to prioritize active and public transportation by introducing new intersections, improved pedestrian facilities, and separated cycling facilities. The four-phase project began in 2019 and is currently in Phase Three.

Relevance to Campus Vision

- Completed construction involved:
  - addition of protected bikeways
  - improved pedestrian facilities
- Ongoing work involves:
  - A new roundabout at the intersection of Wesbrook Mall and Chancellor Boulevard
  - New multi-use pathways between Chancellor Boulevard and Iona Drive

A.2 Municipal / Regional Plans

This section summarizes several municipal plans that set detailed strategies, investments, and timelines that continues to advance the needs of sustainable transportation and is working toward street designs that prioritize walking, cycling and transit. These plans also demonstrate alignment to UBC/ goals/ objectives and Campus Vision guiding principles.

A.2.1 Vancouver Climate Emergency Action Plan

Transportation goals/objectives

- Reduce carbon pollution 50% from 2007 levels by 2030. Become carbon neutral by 2050.
- 50% of vehicle-kilometres traveled (VKT) on Vancouver roads be conducted by zero emission vehicles (ZEVs).
- 90% of people live within an easy walk or cycle of their daily needs.
- 80% of trips be made on foot, bike or transit by 2030 around rapid transit stations.

Relevance to Campus Vision

- Pollution reduction target.
- Mode share and VKT target.
- Walkability / access to daily needs target.

A.2.2 The City of Vancouver's Transportation 2040 Plan

Transportation 2040 outlines the City of Vancouver's long-term transportation goals and strategies. The Plan includes transportation policies and actions related to seven sub-categories: (1) land use, (2) walking, (3) cycling, (4) transit, (5) motor vehicles, (6) goods, services, and emergency response, and (7) education, encouragement, and enforcement.

Transportation goals/objectives

- By 2040, at least two-thirds of all trips will be taken on foot, bike, or transit (alignment with UBC Transportation Plan)
- Hierarchy of modes: walking, cycling, transit, taxi / commercial transit / shared vehicles, private automobiles.
- Major destinations / trip generators to be located along transit corridors or at rapid transit stations.

- Cycling routes should be suitable for all ages and abilities. Bicycle parking should be abundant and convenient. Enforce a 30km/hr speed limit on bike routes.
- Implement rapid transit along 41st/49th Avenue.
- Eliminate off-street parking near rapid transit stations. Unbundle parking from housing costs. Approach parking as a shared resource. Reduce congestion by providing better information about location and availability of parking.

Relevance to Campus Vision

- Mode share targets and hierarchy of modes.
- Land use considerations near rapid transit stations.
- Potential rapid transit line along 41st/49th Ave to UBC.
- Progressive parking policies.

A.2.3 Broadway Plan

The Broadway Plan was adopted by council on June 22, 2022. The plan provides a 30-year area plan for Broadway between Clark Drive and Vine Street, focusing on housing, jobs, and amenities. The Broadway Subway Project is an extension of the Millennium Line, which will provide better connections to the eastern regions of Metro Vancouver (Burnaby, Coquitlam, Surrey) and will eventually connect west to UBC. The extension also improves connections from Richmond and the Vancouver International Airport by connecting to the Canada Line.

Transportation goals/objectives

- Work with stakeholders to extend Millennium Line to UBC.
- Cross-section drawings for typical station and non-station blocks.

Relevance to Campus Vision

- Considerations for cross-sections of arterials near potential future rapid transit or subway stations on campus.

A.2.4 TransLink's Regional Transportation Strategy – TransLink 2050

TransLink's Transport 2050 plan sets broad transportation policies for Metro Vancouver. The Plan sets the goals that transportation in Metro Vancouver will be convenient, reliable, affordable, safe & comfortable, and carbon-free by 2050.

Transportation goals/objectives

- By 2050, half of trips are conducted using active modes of transportation, with taxi, ride hailing, and carshare accounting for most of the remaining passenger trips.
- By 2050, travelers spend 20% less time in congestion.
- By 2050, no households spend more than 45% of their income on combined transport and housing costs.
- Serious traffic injuries and fatalities reduce by 5% per year. By 2050, zero serious traffic injuries or fatalities occur.
- By 2030, greenhouse gas (GHG) emissions from light-duty vehicles have reduced by 65% from 2010 levels. By 2050, GHG emissions from light-duty vehicles have been eliminated.
- Proposed major transit network along 41st / 49th Ave and Broadway to UBC.

Relevance to Campus Vision

- Targets for mode shares, congestion, affordability, safety, and GHG emissions.
- Proposed future rapid transit corridors including extension of the Millennium Line to UBC.

A.2.5 Metro Vancouver's 10-year transportation plan

The 10-Year Transportation Plan considers the 30-year Regional Transportation Strategy and focuses on the strategies and investments required for the first 10 years. Phase One of the Plan was approved in 2016, and Phase Two was approved in 2018. The remaining projects were to be refreshed and implemented after the adoption of TransLink's Transport 2050 Plan in 2022.

Transportation goals/objectives

- Five remaining new B-Line projects
- $180M remaining for major road network projects
- $68M remaining for walking & cycling projects
- Mobility pricing to be implemented in Phase Three

Relevance to Campus Vision

- Expected future regional investments and B-Line projects.

A.2.6 MOTI Active Transportation Study

The BC Ministry of Transportation and Infrastructure commenced their Active Transportation Study in 2021. The Study assesses Ministry owned roadways that connect to or are within the UBC Campus and identifies preferred areas to receive active transportation improvements.

Transportation goals/objectives

- Recommended to construct cycling facilities along Southwest Marine Drive, West 16th Avenue, University Boulevard, Chancellor Boulevard, and Northwest Marine Drive.

Relevance to Campus Vision

- Network planning

A.2.7 B.C.'s Active Transportation Strategy

As part of the province's CleanBC plan, the Active Transportation strategy outlines steps the province will take to promote active transportation over the next 30 years. The plan sets a mode share target for 2030, discusses incentives and programs that will be used to promote active travel, and highlights a plan to create policies and plans to support active transportation networks in the province.

Transportation goals/objectives

- Double the percentage of trips taken using active modes of transportation by 2030 (2.5% to 5%).

Relevance to Campus Vision

- Provincial mode share target.

B. Background Data

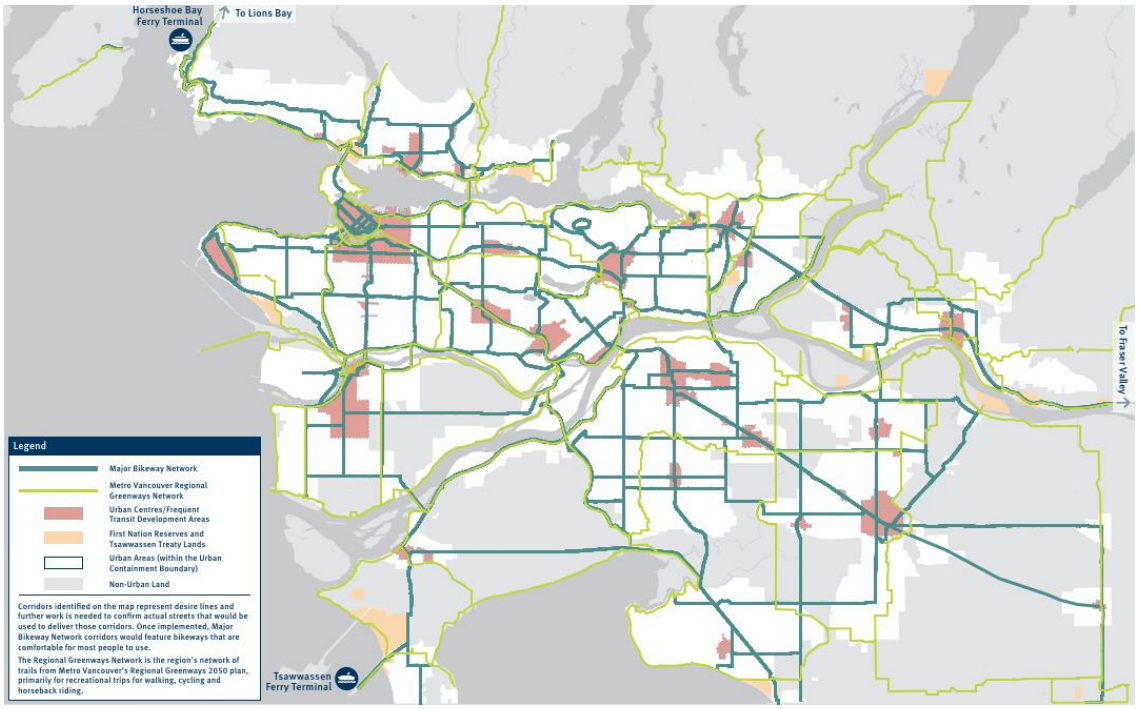
B.1 Electoral Area A

UBC Campus is part of the census subdivision of Electoral Area A, which also includes the University Endowment Lands, Barnston Island, Howe Sound communities, and Indian Arm/Pitt Lake communities. Electoral Area A is one of 23 Metro Vancouver members. Most of the Electoral Area A population resides in UBC (81%) or on the University Endowment Lands (17%)

B.2 Transport 2050 Regional Cycling Network

Transport 2050 presented a suggested major bikeway network, shown in Figure B.2, of 850 kilometres of traffic-protected ("Comfortable for Most") bikeways intended to be built by 2050. This proposed network will help to fill some gaps in the existing cycling network, where some routes connecting to UBC are not yet protected. Building out 75% of the major bikeway network is part of TransLink's 10-Year Priorities.

Figure B.2: Transport 2050 Regional Cycling Network (TransLink, 2022)



B.3 2019 Person Trip Volumes on UBC Arterials

Figure B.3, Figure B.4, and Table B.1 presents the two-way, 2019 PM peak hour person trips via transit and automobile travel modes on the arterials. As shown, Southwest Marine Drive and University Boulevard carry 65% of the travel demand.

Table B.1: 2019 Peak Hour Person Trips by Corridor (UBC Transportation Status Report, 2019)

Corridor	**Vehicles**		**Transit**		**Combined**	
	Person Trips	*%*	Person Trips	*%*	Person Trips	*%*
Chancellor Boulevard	1,100	*20*	890	*10*	1,990	*15*
University Boulevard	750	*15*	3,100	*40*	3,850	*30*
West 16th Avenue (East of Campus)	1,680	*30*	960	*10*	2,640	*20*
Southwest Marine Drive (South of Campus)	1,780	*35*	2,980	*40*	4,760	*35*
	5,310	*100*	7,920	*100*	13,240	*100*

Figure B.3: 2019 Peak Hour Vehicle and Person Trips

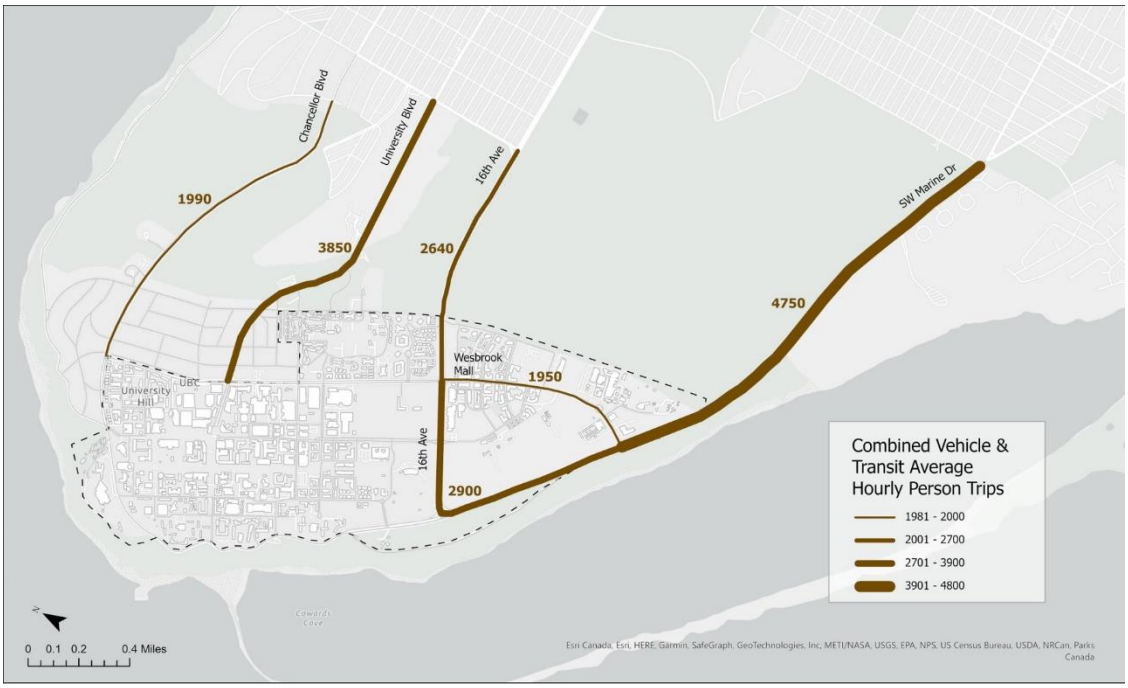
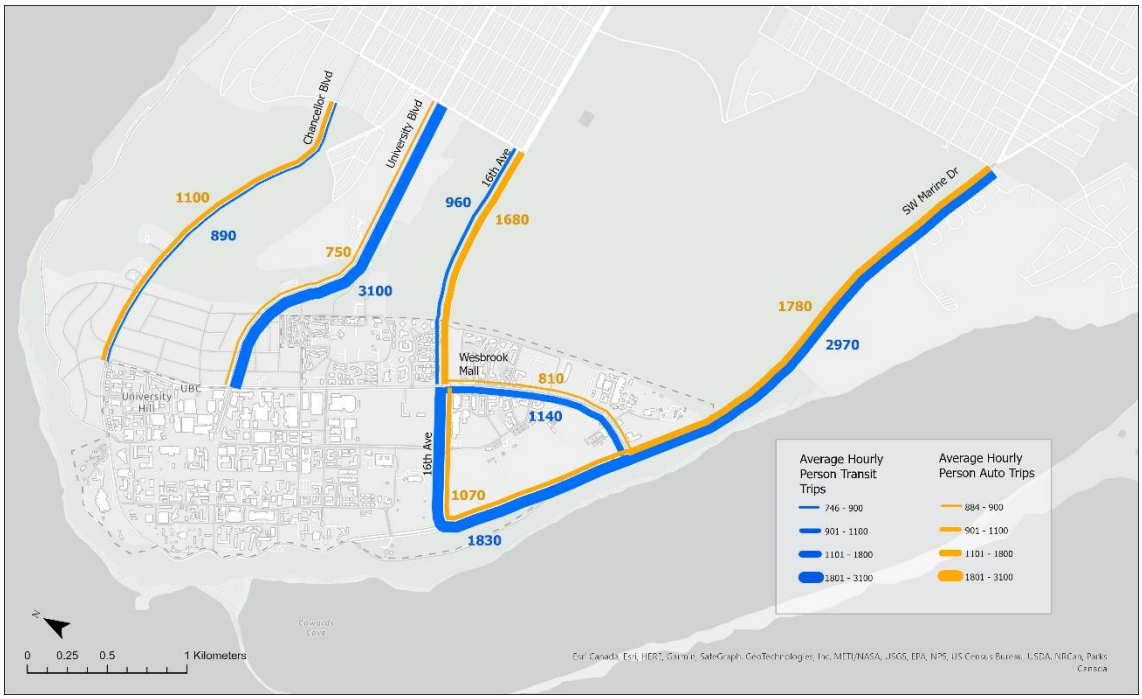


Figure B.4: PM Peak Hour Corridor Volumes



B.4 Regional Transportation Facilities and Technology

The provincial government incentivizes e-bike purchases with a scrap-it program. Individuals can receive a $750 rebate for their e-bike purchase when they scrap a qualifying truck or car, and businesses can receive $1700 for the purchase of a cargo e-bike. The provincial government has also recently eliminated PST on the purchase of e-bikes.

Electric and zero-emission vehicles are another technology of interest. The provincial government incentivizes electric car purchases with rebates. The province also has mandated sales targets for light-duty zero-emission vehicles (ZEVs):

- 26% by 2026
- 90% by 2030
- 100% by 2035

To accompany the increase in electric and zero-emission vehicles, the province is planning to install 10,000 public electric-vehicle charging stations across the province by 2030 (Clean BC: Roadmap to 2030, 2018).

B.5 Existing Street Characteristics and Future Considerations

The following Error! Reference source not found. presents a summary of the existing characteristics of the s treets considered, as well as future planned infrastructure changes. The table also includes a column indicating a potential opportunity for future street function, which correlates to the typology shown in Section 6.2

Table B.2: Existing Street Characteristics and Future Considerations

Segment	Image	Walking & Rolling	Cycling	Transit	Motor Vehicles	Adjacent Land Uses	Proposed Future Function
Thunderbird b/w Wesbrook Mall and West Mall		- Sidewalks	- Painted bike lane to East Mall, then shared use lane to west Mall - Planned to continue having a painted bike lane / shared use lane	- Route 68 operates between East Mall and West Mall	- One travel lane in each direction - Left / Right turning lanes east bound - Street parking on south side west of Larkin Dr - Driveway access to Thunderbird parkade	– Thunderbird parkade – Winter sports Arena – Skate Park/Basketball court – Surface lot – Academic building – Tennis bubble	Vehicle & Transit Movement with Protected Bike Lanes
Agronomy Road b/w Wesbrook Mall and West Mall		- Sidewalks	- Shared use lane - Planned for shared use lane	- No transit	- One travel lane each direction - Pockets of on-street parking	– Housing – Academic buildings – Surface parking lots	Vehicle & Transit Movement
Wesbrook Mall b/w West 16th Avenue and Chancellor Boulevard[24]		- Sidewalks	- Painted bike lane b/w 16th and Thunderbird & Thunderbird and Student Union Blvd - Shared use lane to b/w Student Union Blvd and End - Protected facility planned	- Dedicated bus lanes - Potential future rapid/intra-transit route	- One travel lane in each direction - Left turning lanes - On-street parking on both sides from W 16th to Thunderbird	– Track – Acadia/Hampton housing – Fields – Winter sport arena – Thunderbird parkade – Academic buildings – Surface lot – Bus loop	Multi-Modal
East Mall b/w 16th and Thunderbird		- Sidewalks	- Painted bike lane b/w 16th and Thunderbird - Planned to have protected facility	- Route 68 operates between Thunderbird and 16th Avenue - Potential future rapid/intra-transit route	- One travel lane in each direction - Left turning lanes - On-street parking on both sides	– Sport fields – Housing – Tennis bubble	Transit & Active Priority

[24] "The Wesbrook Mall improvements focus on the bus, pedestrian and cyclist environment in order to help create a positive arrival experience to campus for the more sustainable modes of transportation. The first two phases are now complete and provide improved pedestrian facilities, fully repaved roadways, and new, separated, bike lanes for cyclists. New dedicated bus lanes are also in place to provide priority for those taking transit to and from UBC" (Wesbrook Mall Re-Design)

Segment	Image	Walking & Rolling	Cycling	Transit	Motor Vehicles	Adjacent Land Uses	Proposed Future Function
East Mall b/w Thunderbird and Northwest Marine Drive		- Sidewalks	- Shared use lane b/w Thunderbird and University Blvd - Local Street bikeway b/w University Blvd and End - Planned to have a protected facility up to University Blvd, then local street bikeway to end	- No transit - Potential Rapid/Intra-Transit route	- One travel lane in each direction - Two parkade driveways - One block of parking between Hospital Ln and University Blvd - Then none passed the pedestrian zone - Driveway access for Health Sciences parkade	– Academic buildings – Health Sciences parkade – IKB	Transit & Active Priority
West 16th Avenue		- Sidewalks	- Painted bike lane - Planned for protected facilities	- Heavy transit - 41st/49th rapid transit planned to be aligned at least in part along this segment	- Two travel lanes in each direction - No parking	- Sport fields - Secondary school (set back) - UBC Farm	Major Multi-Modal Access Route
University Boulevard		- Sidewalks	- Painted bike lane - Planned for local street bikeway	- Heavy transit - 3100 AHPT trips - Future SkyTrain alignment	- One travel lane in each direction - Time-restricted on-street parking and loading zones - Driveway access to University Blvd Parkade	– Commercial – Bus loop – University Blvd Parkade	Major Multi-Modal Access Route
Student Union Boulevard		- Sidewalks	- Shared use lane - None planned	- No transit	- One travel lane in each direction - On-street parking on both sides - Driveway access to North parkade	– Housing – North parkade – Life Building – Recreation Centre	Major Multi-Modal Access Route
Chancellor Boulevard		- Sidewalks	- Painted bike lane - Planned to continue as painted	- Moderate Transit - 890 AHPT trips	- One travel lane in each direction - Light vehicles - 110 AHPV trips - No parking	– Housing	Vehicle & Transit Movement

Segment	Image	Walking & Rolling	Cycling	Transit	Motor Vehicles	Adjacent Land Uses	Proposed Future Function
Northwest Marine Drive		- Narrow sidewalks or gravel sidewalks	- Shared use lane - Planned for painted bike lane	- Route 68 serves part of NW Marine Drive	- One travel lane in each direction - On-street parking on east side - Driveway access to Rose Garden Parkade	- Student residences - Chan Centre - Museum of Anthropology	Vehicle & Transit Movement
Southwest Marine Drive to West 16th Avenue		- Pathway / trail on east side	- Painted bike lane - Planned for protected facility	- Heavy Transit b/w Wesbrook Mall and W 16th Ave -	- High volumes (highest of the four major access routes) - No parking	– UBC Farm – Trails	Vehicle & Transit Movement
West Mall		- Sidewalks	- Local street bikeway b/w Stadium and Thunderbird - Shared use lane b/w Thunderbird and End - Planned for local street network b/w Stadium Rd and Thunderbird - Planned for protected b/w Thunderbird and Memorial Rd - Planned for shared use b/w Memorial and End	- Route 68 on a portion of the street	- One travel lane in each direction - Pockets of on-street parking northwest of University Blvd and southeast of Agronomy	- Academic buildings - Surface lot - Housing - Orchard Garden	Vehicle & Transit Movement Vehicle & Transit Movement with Protected Bike Lanes Reduction to one travel line, one direction
Lower Mall		- Sidewalks on one or both sides	- None - None planned	- Portion of route 68	- One travel lane in each direction - Pockets of on-street parking - Driveway access to West Parkade - Driveway Access to Fraser River Parkade on *Memorial Rd**	- Nitobe garden - Fraser River Parkade - Housing/Residences - UBC West Parkade	Vehicle & Transit Movement

Segment	Image	Walking & Rolling	Cycling	Transit	Motor Vehicles	Adjacent Land Uses	Proposed Future Function
Stadium Road[25]		- Sidewalk on one or both sides	- Local street bikeway - Planned for local street bikeway	- No transit	- One travel lane in each direction - No parking	- Thunderbird Stadium - St. John Hospice - Future: mixed-use residential	Vehicle & Transit Movement Re-alignment of road to become straight
Wesbrook Mall b/w W 16th and Grey Avenue		- Sidewalks	- Shared use lane - Planned for shared use lane	- Yes transit – two routes	- One travel lane in each direction - Parking on both sides	- Commercial - Mixed-use - Residential	Vehicle & Transit Movement
Ross Drive		- Sidewalks	- Local street bikeway - Planned for local street bikeway	- Yes transit – two routes	- One travel lane in each direction - Parking on both sides	- Housing	Vehicle & Transit Movement
Gray Avenue		- Sidewalks	- Local street bikeway - Planned for local street bikeway	- Yes transit – two routes	- One travel lane in each direction - Parking on both sides	- Housing	Vehicle & Transit Movement
Hospital Lane b/w End and Health Sciences Mall		- Sidewalk on one side	- None	- No transit	- One travel lane, not delineated	- UBC Hospital - Academic building	Local Road Impacted by East Mall Transition

[25] "Stadium Road (Local) will serve local traffic and have a right of way of 22 metres with one travel lane in each direction, bike lanes, parking bays and rain gardens co-located in each direction, and pedestrian facilities that will interact with the street-facing ground floor residential and commercial units of the neighbourhood. Curbside space on stadium road will be limited to pick-up / drop-off, carshare, and servicing and delivery vehicles" (Stadium Plan).

Segment	Image	Walking & Rolling	Cycling	Transit	Motor Vehicles	Adjacent Land Uses	Proposed Future Function
Hospital Lane b/w Health Sciences Mall and End		- Sidewalk on one side	- None	- No transit	- One travel lane in each direction - No parking	- Health services - Academic buildings - Health sciences parkade	Local Road Impacted by East Mall Transition
Health Sciences Mall		- Sidewalks	- None	- No transit	- One travel lane in each direction - No parking - Driveway access to Health Sciences parkade	- Surface lot - Life Sciences - Academic buildings - Health Sciences parkade	Local Road Impacted by East Mall Transition
Walter Gage Road		- Sidewalk on one or both sides	- Shared use lane - Planned for shared use lane	- No transit	- One travel lane, not delineated - Perpendicular parking on both sides for one block - Pockets of parking	- Housing	Local Road Impacted by East Mall Transition
Crescent Road		- Sidewalks	- Local street bikeway - Planned for local street bikeway	- No transit	- One travel lane in each direction - No parking	- Chan Centre - Rose Garden - Koerner's Pub	Local Road Impacted by East Mall Transition
Main Mall		- Pedestrian Priority Multi-use Path	- Multi-use pathway b/w Thunderbird and Chancellor - Local street bikeway b/w Stadium and Thunderbird - Planned to stay the same	- No transit	- Only service access - No parking	- Academic buildings - Beaty Biodiversity Museum - Koerner Library - Rose Garden	Active Travel Primary Pathways

Segment	Image	Walking & Rolling	Cycling	Transit	Motor Vehicles	Adjacent Land Uses	Proposed Future Function
Acadia Road		- Sidewalks	- None	- No transit	- One travel lane in each direction - Parking on both sides	- Housing - Lelem Village - Norma Rose Point School	Special Study Area
Western Parkway		- Sidewalks on one side	- None	- No transit	- One travel lane in each direction - Parking on east side	- Housing - Surface lot	Special Study Area
Osoyoos Crescent		- Sidewalks	- Shared use lane	- No transit	- One travel lane in each direction - Parking on both sides	- Housing - Daycares - Green space	Special Study Area