Leveraging cycling data for better decision making in Vancouver

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Introduction

The City of Vancouver has long been committed to promoting sustainability and has taken leadership in implementing green initiatives. Guided by the Greenest City Action Plan, and more recently, the Climate Emergency Action Plan, the City of Vancouver is taking concrete steps to reduce emissions and promote sustainability in all sectors. Cycling is the most sustainable mode of transportation in cities after walking (Buehler & Pucher, 2021) as it enjoys a close to zero carbon footprint. With the same energy expenditure per minute rate as walking, one can travel longer distances to access more amenities, jobs, and opportunities.

The Transport 2040 and the Climate Emergency Action Plan, which outline the long-term strategic vision of the City on "how we move," greatly emphasize cycling as a sustainable mode of transportation in the present and future of the City. Cycling mode share is targeted to increase to 12% by 2040 in the City. Many policies and actions are planned to achieve the mode share target mentioned earlier, such as expanding and improving the cycling network to be perceived as comfortable by people of all ages and abilities (AAA). The current cycling network is not complete and connected; however, it will be eventually complete. Due to the lumpy nature of investments in infrastructure and the fact that a fully connected AAA cycling network cannot be built overnight, spatial disparities are inevitable. Engineers and planners in the City must ensure the disparities in the distribution of benefits that stem from investment in cycling infrastructure are not inequitable.

One of the leading causes of unjust cycling infrastructure is inequitable data collection which then informs investment and decision makings in the City. For instance, cycling data collection in Vancouver is heavily biased towards downtown and recreational facilities along the seawall. Traditionally, cycling data collection has been biased towards city cores and employment centers because governments tend to collect data for areas assumed to warrant interventions (Buehler & Pucher, 2021). The traditional cycling data collection practices and the current state of cycling data collection in Vancouver ignore cyclists in areas with lower density and low income. As a result, cycling activities in under-monitored areas of the City are not observed as if they do not exist. Such cycling activities are called "shadow trips," and cyclists who take these trips are called "invisible cyclists" in the literature because they are not studied by the city decision-makers. Shadow trips are usually short-distance trips within residential areas, off-peak trips, trips from inner-city neighbourhoods to the suburban job centers. Invisible cyclists are usually the city's marginalized population, such as children, caretakers, blue-collar workers, low-income workers, racial and ethnic minorities, the homeless, unregistered workers, and undocumented immigrants.

In the absence of data on cycling trends, governments do not invest in cycling infrastructure unless there is pressure from cycling advocates and enthusiasts. Due to inequities in societies, cycling advocates are generally the most vocal segment of the population with higher political power and dominance. As a result, the cycling investments in undermonitored neighborhoods, will become biased and favour the cycling advocates and enthusiasts more than the general population. This phenomena futher exacerbates cycling inequities in cities.

Having a data collection program that includes everyone will support "increased funding, improved policy, planning, and engineering" (Buehler & Pucher, 2021) in the City and ensure that everyone has equitable access to cycling and its benefits. The objectives of this study are to 1) review the Transport 2040 plan and the Climate Emergency Action Plan to determine the motivations for cycling data collection, 2) conduct a literature review of best practices in cycling data collection to achieve spatial

and temporal representation in the City, and 3) conduct a gap analysis of cycling data collection in the City of Vancouver, and provide recommendation for future data collection practices in Vancouver.

Method

This study reviewed the Transport 2040 plan and the Climate Emergency Action Plan to investigate the importance and motivations of cycling data collection in Vancouver. An extensive list of journal articles, reports, and books was created by searching keywords like cycling, traffic, data, monitoring, count, and equity. Furthermore, a list of documents containing information on traffic monitoring guides was created by the researcher. Document selection for inclusion in the literature review was based on the recommendation of the project mentor and the author's judgment. The selected documents were studied for guidelines regarding spatial and temporal representation in cycling data collection in the City.

All sources of cycling data were identified with the help of the project mentor and the data team staff in the City for cataloguing and investigation. Data sources were visualized using Python scripts written in Jupyter Notebooks. Maps were created to visualize spatial and temporal gaps in data collection. In addition, recommendations for future improvements in the cycling data collection program in the City are provided.

Traffic Monitoring Guides

There are many reasons for having a cycling data collection program in the City of Vancouver, some of which have been mentioned in the introduction. As an example, cycling data is used to promote cycling in the City and justify funding for cycling infrastructure, promoting more cycling. Furthermore, equity analysis of cycling data will help us move towards a future where cycling is equitably accessible to everyone.

Traditionally, data collection programs only involved automobiles as they are the most dominant mode of transportation due to the city planning practices of the last century. Transportation agencies have created traffic monitoring guides that help municipalities develop a traffic monitoring program for their automobile traffic. With the popularity of cycling in the cities and increased understanding of their minuscule environmental impact compared to automobiles, traffic monitoring guides sensed the need for the data collection on cycling (non-motorized traffic). In the past years, sections related to cycling data collection have been added to the traffic monitoring guides or new guides expressly for cycling data collection have been developed.

While the sections of the traffic monitoring guides on motorized traffic list applications of data collection such as calculating volume to capacity ratio, improving traffic flow, pavement design and maintenance, developing traffic signal timings, and measuring noise and emissions, the applications of cycling (or non-motorized traffic) data collection, in general, is not clearly defined (Transportation Association of Canada, 2017) in the guides. The general applications are that cycling data can be used to promote cycling and justify funding for the development and maintenance of cycling infrastructure. In

addition, cycling data collection is necessary for proper planning, design, operations, and maintenance of a convenient and safe cycling network.

According to the Transportation Association of Canada (2017), the types of cycling data desired by practitioners in cities are also not clearly defined. Because of the unclear applications of cycling data collection, traffic monitoring guides encourage practitioners to collect data that is not useful for promoting cycling. As an example, some traffic monitoring guides mention "extent of helmet use" as an example of desirable information by practitioners (Federal Highway Administration, 2016; Michigan Department of Transportation, 2019; Transportation Association of Canada, 2017); while, studies have shown that helmet legislation is not associated with reduced hospitalization rates for cycling collision injuries, indicating that factors other than helmet laws such as presence of separated bicycle facilities have more influence on injury rates (Teschke et al., 2015).

The lack of attention to important determinants of safety in cycling and diverting attention towards helmet laws in traffic monitoring guides is an indicator that the non-motorized section of the guides is not fully established based on scientific evidence. That is why I believe the City must approach the traffic monitoring guide with a healthy degree of skepticism when looking for guidance on its cycling data collection program.

Unlike safety data, traffic guides provide an abundance of information regarding cycling count (traffic volume) data collection at a particular location, for instance, at intersections or mid-block. Various technologies such as pneumatic tubes, inductive loops, magnetometer, pressure sensors and mats, seismic sensors, microwave sensors, automated video imaging, active infrared, and manual data collection methods are studied in detail in the traffic monitoring guides. Information on the installation of the sensors and methods for manual data collection are discussed. Discission of count data needs, such as annual, monthly, weekly, daily, and hourly traffic patterns, spatial traffic patterns, and the effects of environmental factors such as weather and large public events are also present in the guides. The clear, elaborate, and established guidelines regarding cycling traffic volume monitoring at single locations allow practitioners to create a cycling traffic monitoring plan for a location; however, there are still existing limitations regarding cycling data collection planning at the city scale.

Cycling traffic volume monitoring typically includes:

1. Permanent data collection locations where continuous data is collected 24/7
2. Temporary data collection locations where short-term data is collected (mainly at peak hours
3. Ad-hoc data collection locations when requested by stakeholders of a project (Michigan Department of Transportation, 2019).

While information regarding data collection methods for each of the above items is abundant, no quantitative method exists to help select the appropriate location for cycling data collection, according to Federal Highway Administration (2013). While this limitation still exists today to some extent, the most recent version of the above guides added more information on this topic that helps

1. Select the appropriate number of permanent cycling data collection locations, and
2. Select the specific location of the permanent cycling data collection locations (Federal Highway Administration, 2016).

Traffic group patterns need to be created in cities using the hourly traffic volume data available from permanent and short-term counts stations. As an example, Regehr et al. (2015) created six traffic pattern groups in the City of Winnipeg, Manitoba, Canada, using

a. “a statistical analysis that identifies predominant hourly traffic patterns”,
b. “identification of variables that explain the patterns”, and
c. “application of engineering judgement”.

While acknowledging that the number of specific permanent cycling count locations is dependent on the city budget, Federal Highway Administration (2016) recommends 3 to 5 permanent cycling count stations to be installed in each traffic pattern group zone in the non-existence of budget constraints.

Furthermore, information regarding collecting data other than cycling volume is non-existent in traffic manuals. Some traffic monitoring guides have briefly mentioned collecting demographic data such as gender and age (Minge et al., 2017; Oregon Department of Transportation, 2014) as part of manual count data. It is important to note that this method has a remarkable limitation since the errors in determining the gender and age of a person cycling are highly affected by the biases of the traffic assistant collecting data. In addition, it is more accurate to name these variables of interest perceived expression of gender identity and perceived age. Some traffic monitoring manuals do not provide information on data other than the volume of cyclists (Federal Highway Administration, 2016; National Cooperative Highway Research Program, 2014; Transportation Association of Canada, 2017). In sections regarding developing traffic pattern groups, the Federal Highway Administration (2016) states that intercept surveys are the “absolute” best method for determining trip purpose. This statement is accurate, and moreover, surveys, in general, are a great way to collect information other than the volume of cyclists such as gender, age, race, trip purpose, etc. One of the early works to point out the importance of surveys besides traffic volumes for studying cyclist behaviour was by Griffin et al. (2014). Griffin et al. (2014) elaborate on the use of multimodal surveys, specific pedestrian and bicycle travel surveys (separate from the general trip diary survey), stated preference surveys, intercept surveys, and bikesharing surveys as crucial tools for understanding travel behaviour among cyclists.

Table 1 summarizes the list of guidebooks and research papers studied in this project along with information on their general focus, and whether they included information on site selection for data collection or guide on collecting other sources of cycling data.

Table 1. list of guidebooks and research papers studied in this project

No.	Year	Organization	Document name	General focus on count data and related equipment?	Guide on site selection for count data?	Guide on other sources of cycling data? (Such as demographic)
1	2014	Oregon Department of Transportation	Design and implementation of pedestrian and bicycle-specific data collection methods in Oregon	Yes	Limited (general recommendations in ~2 pages + acknowledgement of knowledge gap)	Limited (mention of age, gender, and behaviour in two instances)
2	2014	Transportation Research Board's E-Circular 183	Monitoring Bicyclist and Pedestrian Travel and Behavior: Current Research and Practice	Yes	No	Yes (monitoring travel behaviour through multimodal surveys, pedestrian and bicycle travel surveys, stated preference surveys, intercept surveys, bikesharing surveys, and count data through the emerging sources of data such as GPS, Bluetooth, and video processing
3	2014	National Cooperative Highway Research Program	Guidebook on Pedestrian and Bicycle Volume Data Collection	Yes	Limited (general recommendations in ~2 pages and referral to the Federal Highway Administration Traffic Monitoring Guide)	No
4	2016	Federal Highway Administration	Federal Highway Administration Traffic Monitoring Guide	Yes	Limited (general recommendations in ~1 page)	No
5	2017	Minnesota Department of Transportation Research Services & Library	Bicycle and pedestrian data collection Manual	Yes	Limited (general recommendations in ~2 pages)	Limited (mention of age, gender, and helmet use in two instances)
6	2017	Transportation Association of Canada	Traffic Monitoring Practices Guide for Canadian Provinces and Municipalities	Yes	Limited (visual guide on preferred and sub-optimal arrangement of data collection sites)	No
7	2019	Michigan Department of Transportation	Non-motorized data collection and monitoring	Yes	Limited (general recommendations in ~1 page)	Limited (mention of use of mobility aid, helmet use, and salmoning in one instance)

How Should the City of Vancouver Collect Data?

An important step in delivering the Transport 2040 and Climate Emergency Action Plans is monitoring progress, learning as new information comes to light, and adapting accordingly. The three steps mentioned above require regular data collection during the implementation of the plans (City of Vancouver, 2012; Vancouver City Council, 2020). That is why it is crucial to explicitly know what the goals and aspirations of the City are to be able to collect the right data that can track our progress towards that goal. Even though the traffic monitoring guidebooks provide detailed information on collecting count data from a particular location, they do not provide enough information to help the City create a comprehensive data collection program that encompasses all the goals of Transport 2040 and the Climate Emergency Action Plans. For instance, very little information exists on site selection for a volume data collection program to ensure equitable spatial representation of city neighbourhoods in the observed volume data. The City must devise an ad-hoc cycling data collection program that ensures accountability while working to reach the 2030 and 2040 goals

For instance, as part of Big Move 2 of the Climate Emergency Action Plan, the City aims to foster a mode shift towards active modes of transportation and ensure that two-third of trips are made on foot, bike, or transit by 2030. The City must collect data on the mode of travel of all persons in Vancouver to track progress towards this end outcome of two-thirds active mode share. In addition, the City must collect data on actions that will support the movement towards this end goal. The former will inform us of how close we are to reaching the target, and the latter will inform us of the extent to which each of our actions accounts for the progress toward the target.

The following actions are listed under Big Move 2 of the Climate Emergency Action Plan to improve active transportation mode share:

- Implement Transport Pricing in the Metro Core
- Expand and Improve Our Walking/Rolling, Biking Network
- Improve Bus Speed and Reliability
- Encourage More Walking, Biking and Transit Use
- Promote Remote and Flexible Work Options
- Eliminate Parking Minimums and Introduce Parking Maximums in New Developments
- Implement Residential Parking Permits City-Wide

In this list, the second and the fourth action are directly related to cycling and should be measured to ensure that they are managed. If progress in each of the listed actions is objectively measured, along with mode share of active transportation, the marginal effect of each action on mode share can be estimated using statistical tools. For instance, the marginal effect can tell us how mode share of active transportation changes when the size of the bicycle network changes. This information is substantially valuable for policymaking to reaching to city goals.

Table 2 lists the goals, actions, targets, and recommendations directly related to cycling from the Transport 2040 Plan and the Climate Action Emergency Plan. This table is perhaps not exhaustive of all the goals, actions, targets, and the table also provides a recommended type of data that needs to be regularly collected to ensure progress in each item. The recommended data are not the only means of tracking progress, and they can be changed by City staff depending on their performance measure of interest.

Table 2. List of policies, actions, and targets related to cycling in City of Vancouver's Transport 2040 and Climate Emergency Action Plan

Document	No	Policies/Actions/Targets/Considerations	Type of data needed to track progress
Transport 2040	1	12% of trips to be made by bicycles by 2040	Mode share of cycling
	2	Upgrade and expand the cycling network to efficiently connect people to destinations	Map of bicycle network with construction and upgrade date for each segment of the road
	3	Build cycling routes that feel comfortable for people of all ages and abilities	AAA status for each segment of the bicycle network
	4	Maintain bikeways in a state of good repair	Maintenance record of each segment of the bicycle network
	5	Make the cycling network easy to navigate	Database of signage and pavement marking on the cycling network
	6	Provide abundant and convenient bicycle parking and end-of-trip facilities	Database of bicycle parking and end of trip facilities on the cycling network
	7	Make it easy to combine cycling with other forms of transportation	AADBT on bus and Skytrain lines
	8	Provide a public bicycle system	Demand and usage for the Mobi bikeshare system
Climate Emergency Action Plan	1	Big Move 2: Two-thirds of trips taken by active transportation and transit by 2030	Mode share of cycling
	2	Two-thirds of staff commuting trips will be by active transportation or Transit by 2030	Mode share of cycling among City staff
	3	Expand and Improve Our Walking/Rolling, **Biking** Network	Map of bicycle network with construction and upgrade date for each segment of the road
	4	Encourage More Walking, **Biking** and Transit Use	Bicycling traffic count - AADBT
	5	Collect data beyond daily commute	Data on invisible cyclists, shopping trips, weekend activity, etc.
	6	Equity mandate: Answer the "who benefits and who stands to lose" questions	Disaggregate data on gender, age, indigeneity, race, language, immigration, physical ability, education, income/wealth, families/dependents, geography, home rentership/ownership in the panel survey

It is also worth noting that this table is perhaps not an exhaustive list of all the policies, actions, targets, and considerations since, due to ambiguity of the text, personal views and background of the author affected the final list. The City staff must work collaboratively with diverse staff and researchers from various backgrounds to analyze the plans and develop suitable performance measures that help the progress in the right path.

Current Data Collection Practice in Vancouver

One of the most important sources of data upon which all other sources are mapped on is the map of the cycling network in the City. Figure 1 presents the cycling network in Vancouver neighbourhoods, and Figure 2 demonstrates the cumulative length of AAA and non-AAA cycling networks constructed since 1986 in Vancouver, an example of how progress can be tracked. Transparency in the data with columns with variables such as AAA status, date of construction, date of upgrade, etc. allows us to study progress towards item number 2 in Table 2.

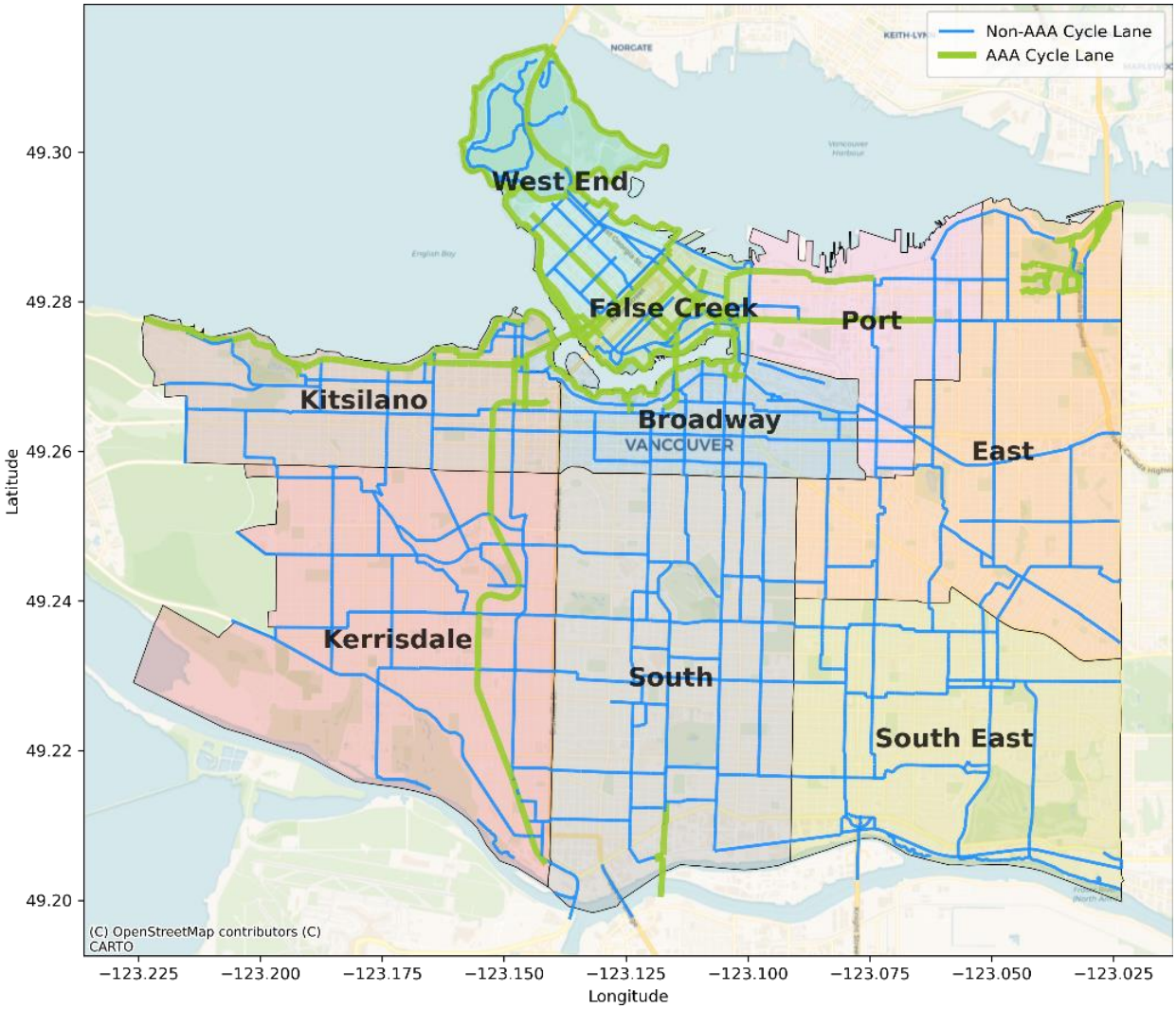

Figure 1. Vancouver neighbourhoods along with the cycling infrastructure and AAA status

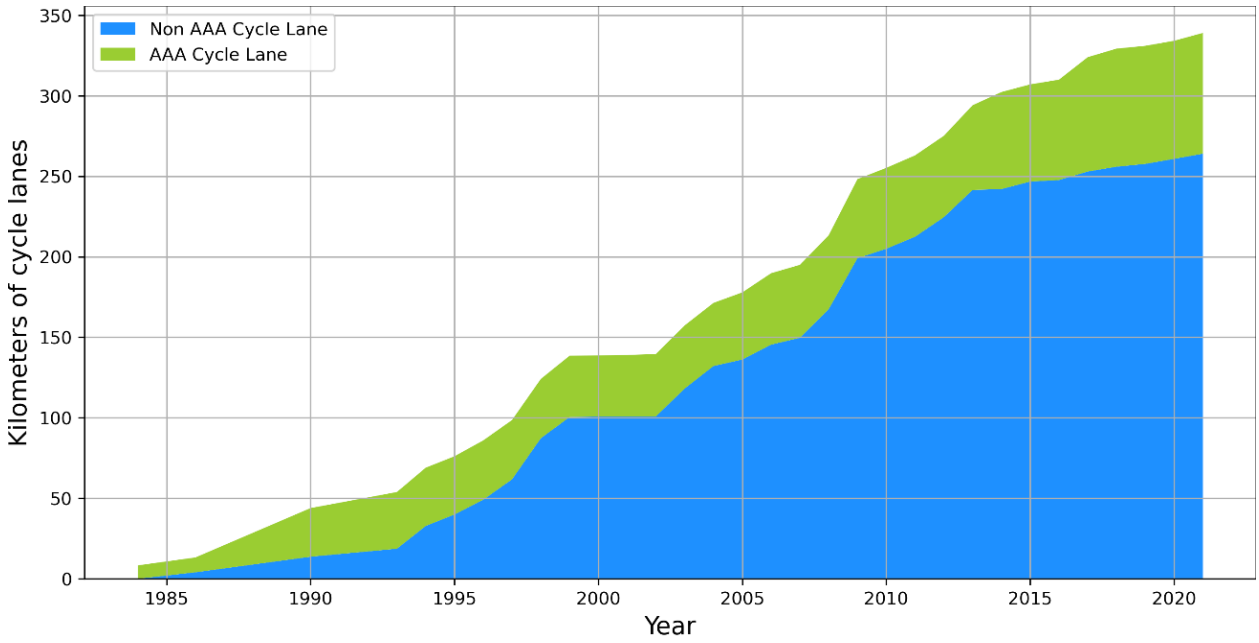

Figure 2. Cumulative length of AAA and non-AAA bike network constructed since 1986 in Vancouver

The City began installing permanent (automated) bicycle counters in 2009. The daily count measurements at the automated bicycle counter sites are reported quarterly to the public (City of Vancouver, n.d.-a). The COV uses three methods to collect quantitative and qualitative data on traffic in bike lanes: 1) permanent count stations, 2) temporary count stations, and 3) panel survey (City of Vancouver, n.d.-b).

Permanent Count Stations

Permanent count stations provide hourly bicycle traffic using inductive loops at 25 stations in the City of Vancouver. This data is invaluable in tracking long-term growth trends whereby volume profile can be examined for different routes and changing travel behaviour as a result of weather, or other events can be tracked. These also provide a baseline reference for the extrapolation of short-term counts. Figure 3 presents the permanent bicycle counters in the City along with cycling facilities by type.

Short-Term Counts

Short-term counts are used to provide data on count, speed, and classification of cyclists where permanent count stations. Short-term counts provide a cost-effective means of obtaining location-specific data without the need to invest in the installation of permanent count stations. Furthermore, installing permanent counters is not practical at all locations (such as local streets with a wide width); therefore, a regular temporary count program is necessary to obtain cycling data from diverse facility types. Short-term data, supplemented by trends from permanent count stations where available, is used to inform location-specific infrastructure improvements and track utilization of the cycling network across the City. The current temporary count program proposed by the City staff is presented in Figure 4. Data are planned to be collected biannually and biennially at Tier1 and Tier 2 temporary count locations, respectively. Methods of short-term bicycle traffic count data collection include:

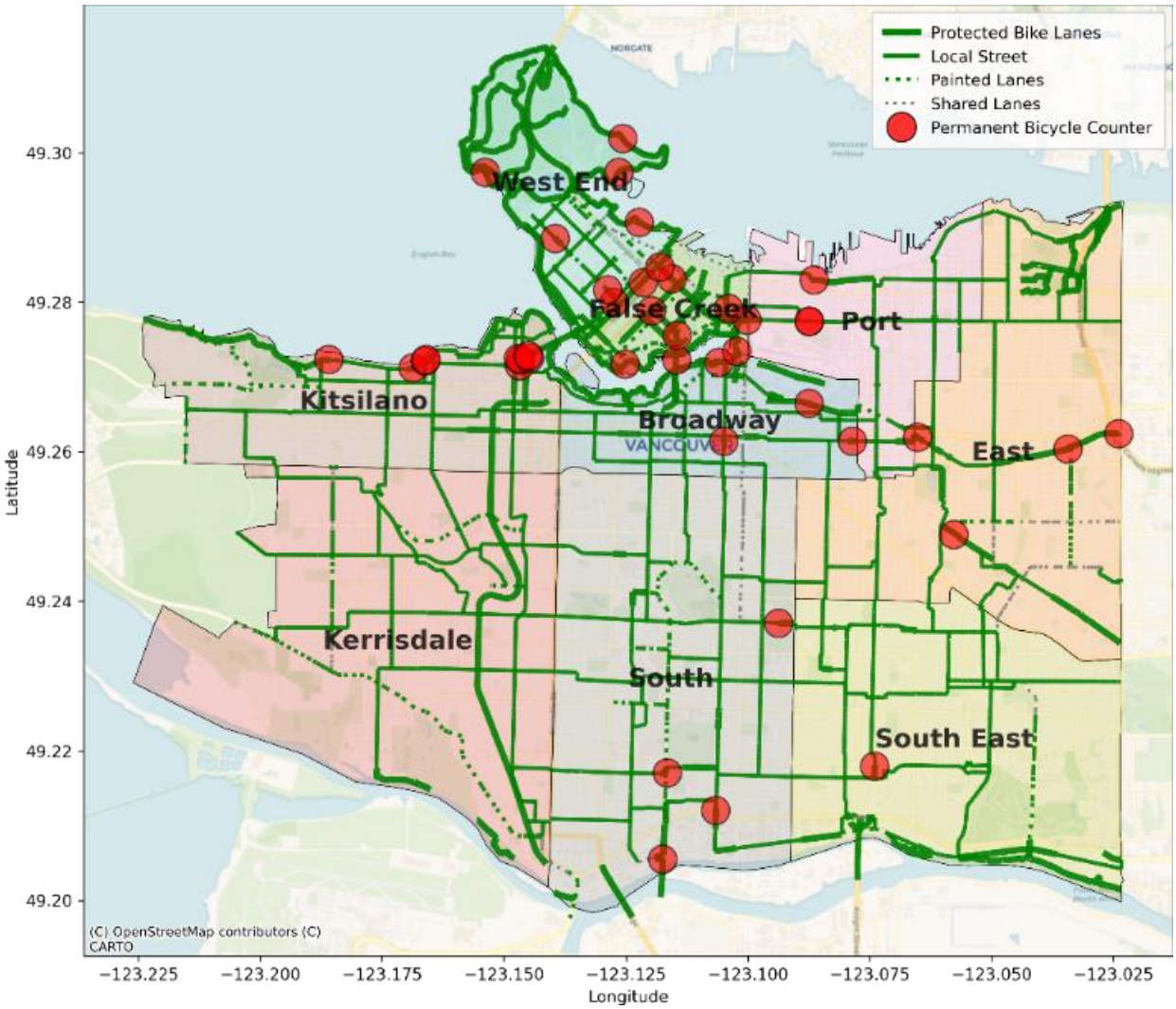

Figure 3. Permanent bicycle counters in Vancouver

- **Pneumatic road tube (hose) counts**

By placing a pair of parallel rubber tubes connected to a counter perpendicular to the road, cyclist traffic counts are measured. The counter records air pulses as cyclists ride on the tubes in either direction. Pneumatic tubes are usually placed mid-block between two intersections and count traffic for each direction.

- **Intersection turning movement counts**

Turning movement counts at intersections are conducted manually using electronic count boards by traffic assistants. Traditionally this method of data collection was specifically used for motorized traffic (automobiles), but information on cyclists is also collected to provide insight on non-motorized travel as well. The counts are conducted at signalized and unsignalized intersections, typically during the morning and afternoon rush hours collecting left turns, right turns, and through-movements in every lane of the intersection. For more extended count data collection, mobile cameras are used to record the traffic flow which allows the counts to be conducted later on a computer by a traffic assistant manually.

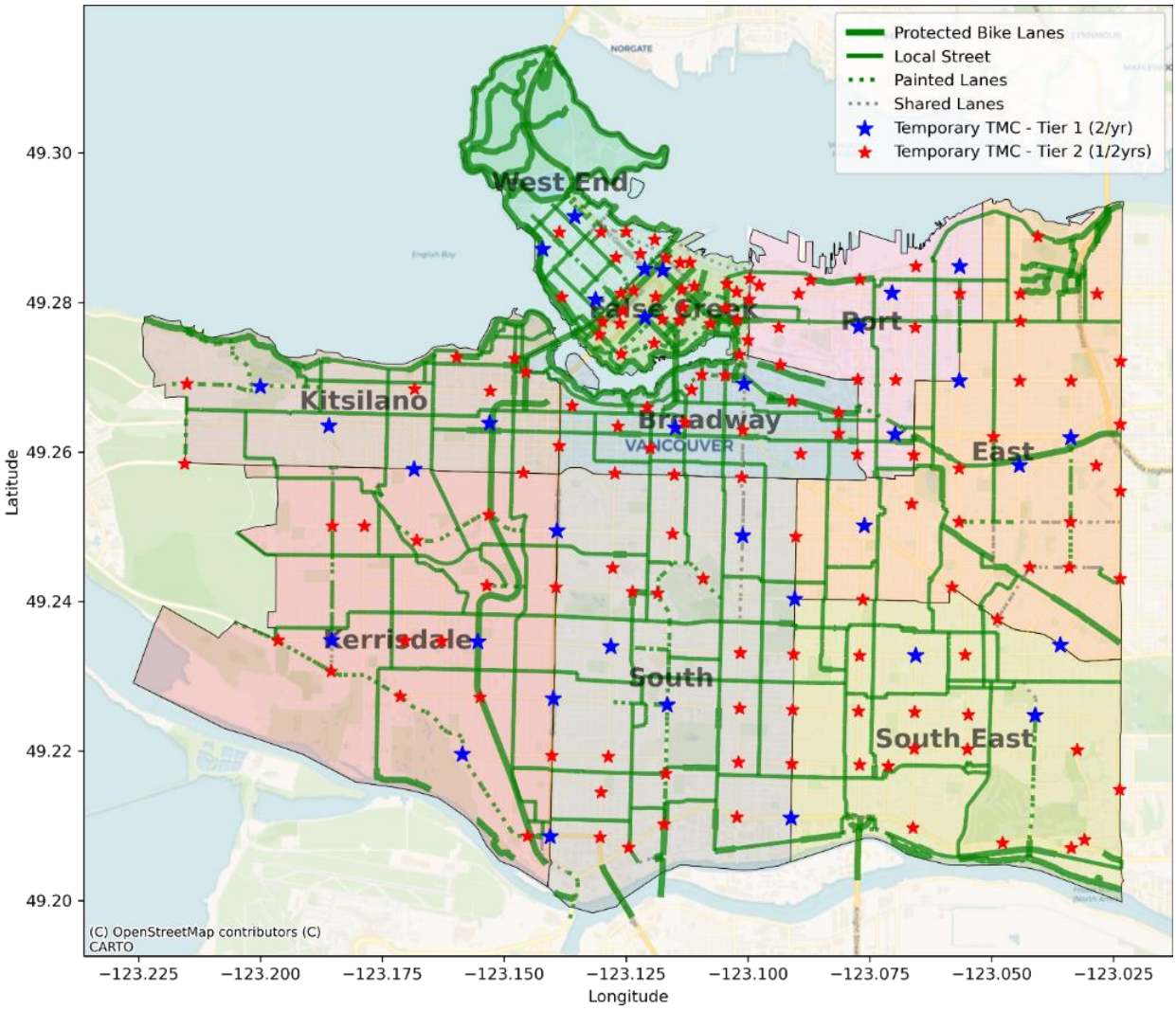

Figure 4. Proposed temporary count locations in Vancouver

Active travel demographic counts

A manual count using electronic count boards, similar to intersection turning movement counts, is done at the mid-block location, focusing on the demographic of the cyclists. This data collection method, which usually happens during morning and afternoon rush hour, the direction of travel, position, approximate age, and perceived gender expression of the cyclists are recorded.

Panel Survey

The City conducts annual panel surveys since 2013 to track changes in travel behaviour and patterns. The survey acts as a travel diary where individuals record the trips that they make on a given weekday as well as answer questions related to their trips, such as mode of travel, travel time, social interaction, and safety. Cycling-related data collected in this survey include demographic data (age, gender, ethnicity, income, education, occupation) as well as modal choice, trip purpose, departure time, and duration.

As the City looks to improving and modernizing its data collection practices, it is important to highlight the existing gaps and identify both the changing behaviour of travellers and the changing needs of decision-makers. As data becomes more abundant and accessible, it serves as an increasingly valuable tool enabling sound and transparent decision-making. It is anticipated that the recommendations in this report will provide City staff with relevant reference guidelines as well as actionable recommendations to improve their growing data collection program.

Discussions and Recommendations

Identifying the best practices of data collection often times collapses down to the question of which technology to use for higher accuracy in count data. A review of the cycling data collection guides reveals this limitation as majority of them include many pages of information on pneumatic tubes, inductive loops, magnetometer, pressure sensors and mats, seismic sensors, microwave sensors, automated video imaging, active infrared, and manual methods of data collection. This limitation was fortunately well understood by the City staff since the objectives of this project explicitly excluded technology of data collection from the research questions.

Recommendation #1: It is recommended to adapt data collection technology to the purpose and the site of data collection rather than adapting the purpose and site of data collection to the existing technology.

We must not forget that the data collected using any of the technologies mentioned is collected to serve a purpose. That purpose must not be overlooked due to the specifics of the technology. The focus on technology is so pervasive in the guides that, in some cases, it primes the importance of data collection at a particular location. For instance, the Michigan Department of Transportation (2019) says: “Specific sites for installation should be carefully selected based on the specifics of the technology to be used. The ability to shift the site by a block may greatly improve accuracy.” I disagree with this and believe that the specifics of the technology to be used should be selected based on the specifics of the selected site for data collection. For instance, if data collection (count, speed, comfort, etc.) is necessary for planning for a location with mixed traffic (i.e. pedestrians and cyclists), data must be collected at the exact locations. Although the accuracy of the data collection equipment may increase significantly by shifting the data collection location a block where cyclists and pedestrians are separated, this approach is not recommended as the data collected would not help with the planning objectives of that location.

Recommendation #2: It is recommended to allocated future funding for permanent bicycle counters in the City to neighbourhoods without permanent bicycle counters.

Much of the literature regarding cycling data collection is focused primarily on manual and automated count data collection. Various commercially available counting technologies are discussed in detail, with their strengths and limitations established. However, very little information regarding the spatial distribution of data collection sites in cities is available in the literature. This limitation is perhaps why cycling data collection is heavily biased towards the downtown area and high-traffic recreational areas such as the seawall. Figure 5 illustrates the insufficiency of cycling data collection by permanent bicycle counters in Vancouver. Even though Kerrisdale has the longest stretch of bicycle lanes in Vancouver, this

neighbourhood does not have any permanent bicycle counters. South, south-east, and east Vancouver also suffer from the same problem; just to a lesser degree.

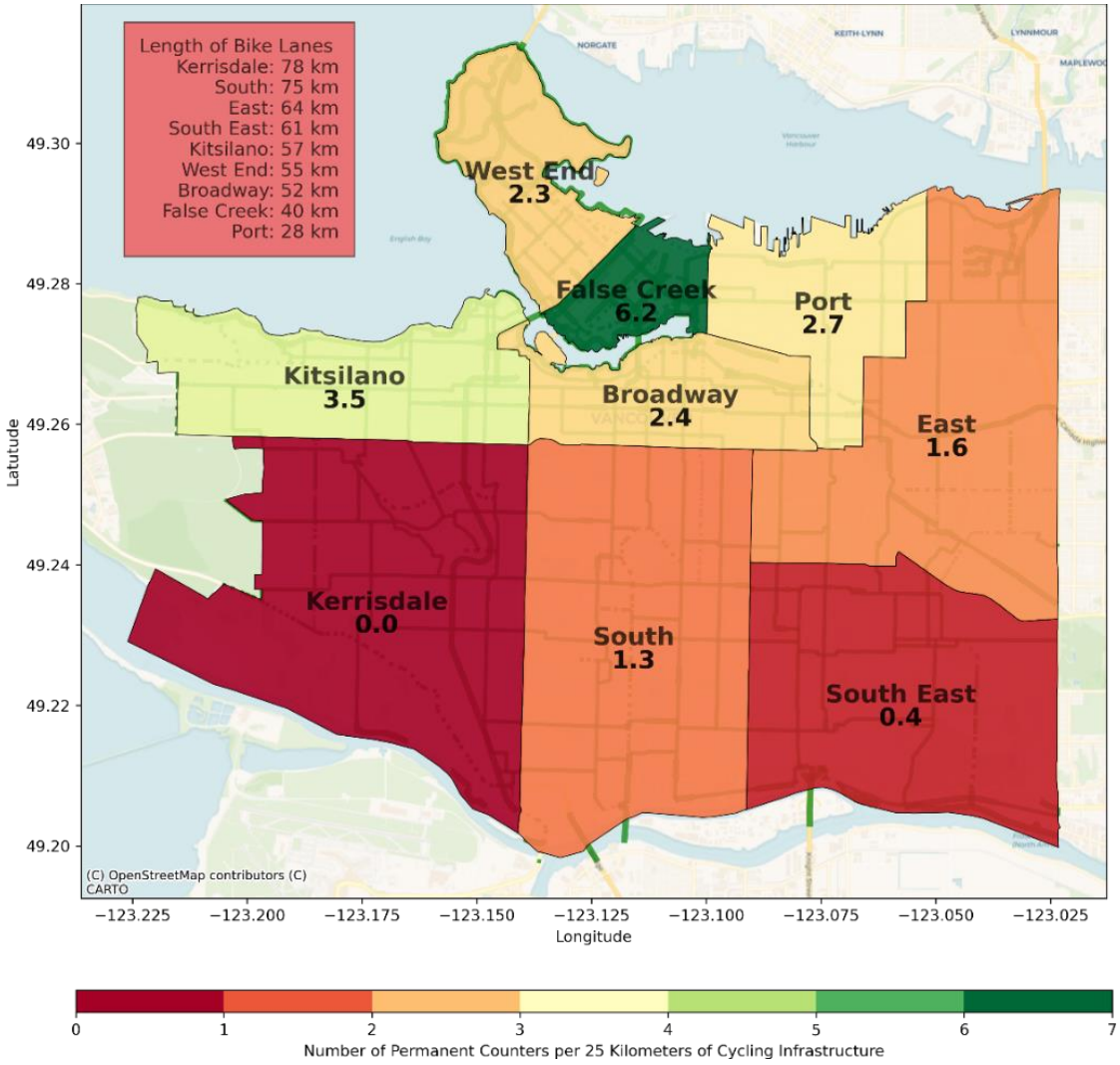

Figure 5. Number of permanent counters per 25 kilometres of bicycle lane in each neighbourhood

Recommendation # 3: It is recommended to develop and implement a temporary cycling data collection program with appropriate frequency and length.

In the absence of bicycle counters, temporary counts are a valuable source of data for planners and engineers. They are a necessity to expand the geographic coverage of the information collected from the network. Temporary counts should be conducted periodically at target locations where the installation of permanent count stations would be difficult (lack of separated cycling facilities) as well as locations where no historical data is available. Candidate locations include cycling routes crossing major arterials at cyclist-activated signals, whereby turning movement counts collected at these locations can provide insight into both cycling volumes as well as motor vehicle volumes on these major corridors.

Federal Highway Administration (2016) recommends a minimum of 7 days of data collection with a preferred length of 12 hours (minimum 4-6 hours) each day to ensure accurate annualization of the counts. With higher coverage data, a multimodal volume map can be created to help inform City-wide infrastructure planning, and safety analysis.

Recommendation #4: It is recommended to develop traffic pattern groups for all routes each neighbourhood in Vancouver and ensure that each traffic pattern group contains 3-5 permanent bicycle counters.

With the help of the existing permanent and temporary bicycle count data traffic pattern groups can be created in the City. Traffic pattern groups are an essential tool for the conversion of short-term counts to long-term annual counts. This can be achieved using statistical clustering methods on the temporal variation of bicycle traffic volume at each location as well as practical knowledge of underlying variables (such as land use) that account for the formation of each cluster (Regehr et al., 2015). According to the Federal Highway Administration (2016), each traffic pattern group should have 3-5 permanent bicycle counters. Suggested clustering for routes with permanent bicycle counters in the City of Vancouver included 3 clusters, recreational, multipurpose, and commuter routes. Routes with short-term data should also be studied to fit into the current clusters or studied to develop new clusters.

Recommendation #5: It is recommended that the City create an index of performance measures to help identify the necessary data to be collected to track progress towards goals and targets in the Transport 2040 and the Climate Emergency Action Plan.

Even without implementing the recommendations above, Vancouver is one of the leading cities in cycling volume data collections in North America. Cycling count data are collected at numerous locations across the City, validated by the data team staff, and shared publicly for practitioners, researchers, and others to observe and study. However, a city that aims to promote cycling as a crucial mode of transportation for its future has data needs that are not answered merely with count data. For example, to ensure equity of access to cycling, disaggregate data on demographics of those who cycle and those who do not are necessary. The Climate Emergency Action Plan outlines the importance of answering the question of “who benefits and who stands to lose?” (the equity mandate) due to city-wide actions and policies. The City still lags in collecting such data and needs to acquire more data to answer the aforementioned question. The data include various disaggregate demographics data such as gender, age, indigeneity, race, language, immigration, physical ability, education, income/wealth, families/dependents, geography, home rentership/ownership of those who travel with a bicycle.

An exhaustive list of data needs can only be developed if the City looks closely at its targets, goals, and actions in the Transport 2040 and the Climate Emergency Action Plan. To ensure that all the data needs are addressed, all targets, actions, and recommendations in the Transport 2040, and the Climate Emergency Action Plan that are directly or indirectly related to cycling should be studied and listed (see Table 2). Appropriate performance measures must be created for each target, goal, or action to assist the City in developing data collection programs that meet the needs beyond what the regular count data collection program can satisfy. As discussed earlier in this document, types of cycling data desired by practitioners in cities are also not clearly defined in the literature, and the main focus of the guidebooks is on count data. Therefore, at the moment, only creation of an ad-hoc performance measure list can help the City track its progress toward its goals.

Recommendation #6: It is recommended to increase qualitative data collection and reporting through ad-hoc surveys in the City.

Majority of the non-count data necessary to estimate the performance measures created above will be collected through surveys such as panel surveys, specific bicycle travel diary surveys (separate from the general multimodal trip diary survey), stated preference surveys, intercept surveys, and bikesharing surveys etc. Due to the absence of a national household travel survey (similar to the national travel survey in the U.S.), the City can only rely on local travel surveys. The annual panel survey currently administered by the City helps to track progress towards Transportation 2040 goals for mode share targets (two-thirds of trips by sustainable modes by 2040), and vehicle-kilometres travelled (20% reduction from 2007 levels) as well as Climate Emergency goals (two-thirds of trips by sustainable modes by 2030). Additionally, the panel survey collects demographic and trip diary information for cyclists; however, the data is limited and on few dimensions of demographics. For instance, in the panel survey, the participant's type of house is asked but not if they are the owner or renter. It is recommended to use the panel survey or consider an additional cycling data collection survey to better understand the barriers to cycling, whether they may be related to accessibility, safety, health, availability of secure parking, bicycle theft, or any other factors to better understand the opportunities for improving cycling utilization and equitable representation. This can include creating representative metrics reflecting equitable cycling outcomes, public knowledge about cycling, and cycling utilization (annual BKT). Furthermore, the City can also partner with TransLink to use their regional trip diary survey for better decision making in the City.

Lastly, as increased data collection requires a larger amount of investment, it is important to continue investigating cost-effective means of collecting data. The development of customized mathematical models enabling the extrapolation of available count data will improve both the public and decision-makers' knowledge about City-wide cycling uptake and utilization. Additionally, alternative data sources are now available utilizing third-party data from GPS, cellular, or Bluetooth devices. While the research to date has not successfully validated these tools on a broad scale, this may become a viable supplementary source of data that provides broader geographic coverage as well as more detailed data.

Reference

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