POST IMPLEMENTATION

Fort Street protected bicycle lane launch, Victoria, B.C.

I.1

CELEBRATING + LAUNCHING

Innovative and engaging education and outreach efforts can help to celebrate and build support for active transportation projects and encourage their use. Incorporating a communication and education strategy into a project's capital budget can help to continue community engagement after the project is completed. This chapter outlines some of the tools and techniques that can be used to ensure the community is engaged in the planning, development, and installation of a project from start to finish, and that they are excited and aware of the project upon completion and opening.

PROJECT PLANNING AND DESIGN

Engaging with residents and stakeholders on the planning and design of active transportation facilities is a critical component to the success of a project. It is essential that the engagement undertaken is intentional and effective at gathering input and providing information. One way of elevating public support is by providing opportunities for community members to interact with and assess the impacts of new potential designs through the use of pilot projects, as discussed below. Community awareness and support throughout the process can help to build excitement and identify community champions.

It is important to identify, review, and confirm the engagement goals for a project. Based on these goals, a series of engagement strategies should be identified to be used during the different phases of a project. The establishment of goals upfront provides a framework to reflect on the benefits and challenges of a proposed project, and to prioritize different proposed alternatives. Documentation of the outreach process can help elected officials understand the level of effort put forth and support a design or plan when it is brought before them for adoption.

Pop-Up Protected Bike Lane, Windsor, ON

PILOT PROJECTS

Pilot or 'pop-up' projects can provide community members with the opportunity to experience a project design during the engagement process and/or before construction begins. Pilot projects are quick-build strategies that can be used to trial operational changes, including: different lane configurations, pavement markings, traffic control changes, introduction of new materials, or other streetscape features. Showcasing potential infrastructure changes allows community members to learn about and interact with the proposed design concept in the actual space, and provides an opportunity to share concerns that can be used to refine the final design.

Pop-Up Protected Bike Lane, Winnipeg, MB

Examples of treatments that can be used for pilot projects include using plastic bollards or planters to delineate a temporary bicycle facility, or creating curb extensions using planters to highlight what a road may feel like with more space for people walking.

Pilot projects can also be paired with community festivals or events to encourage community members to try out the facility.

These strategies typically create excellent publicity for a project and generate the community buy-in needed to support final design and construction.

LAUNCH AND CELEBRATIONS

Upon the installation of a new active transportation facility, it is important to inform residents and stakeholders that were involved in the planning and design process that the project is complete and ready for use. It is also important to ensure that the broader public is also made aware of the new active transportation facility. There are a number of methods and strategies that communities can use to celebrate the installation of new active transportation projects through website material, videos, posts on social media, and events that raise awareness and get people excited about active transportation changes in their community. This component of the project should be considered as part of the overall budget at the start of a project and not as a later add on.

Launch events are organized to mark the official opening of a new active transportation facility. They are intended to celebrate the new facility and raise awareness within the community with a 'ribbon cutting' type event. They can be attended by elected officials, members of the media, stakeholders, and the public. They are intended to be fun but also educational in nature.

Salton Road Pedestrian and Cycling Bridge Celebration Event, Abbotsford, B.C.
Source: City of Abbotsford


Salton Road Pedestrian and Cycling Bridge Celebration Event, Abbotsford, B.C.
Source: City of Abbotsford


Salton Road Pedestrian and Cycling Bridge Celebration Event, Abbotsford, B.C.
Source: City of Abbotsford

Case Study

Fort Street Roll Out, Victoria, B.C.

In May 2018, the City of Victoria hosted a celebration party – referred to as the 'Fort Street Roll Out' – to celebrate the opening of new protected bicycle lanes and streetscape improvements on Fort Street The celebration party featured live music, family activities, interactive stations, safety ambassadors, photo stations, and free bicycle rentals. The event featured activities on each block with a 'passport' designed to encourage walking and cycling on the corridor. Visitors were encouraged to visit stations to get a stamp and enter to win one of four new bicycles and other draw prizes. The event was held in conjunction with a variety of community partners, including Fabulous Fort, the Downtown Victoria Business Association (DVBA), and PARC Retirement Residences.

Safety tips and project information were displayed, and road user education activities, including free cycling safety courses were offered throughout June, July and August 2018.

INFORMATION AND EDUCATION

A lack of education and familiarity of new infrastructure can be a barrier to use. A lack of understanding of what its purpose might be or how it is supposed to be used can prevent people who are 'interested but concerned' about active transportation from trying out new facilities. Some new facilities, such as coloured pavement markings, bicycle boxes, and protected bicycle lanes can be confusing to people when they are first implemented.

Ensuring that an education component is included as part of the launch plan for any new active transportation infrastructure can help introduce a community to the new facilities. The educational materials can be created by the jurisdiction responsible for implementation or as part of a partnership between community and cycling groups or other organizations or agencies with an interest in active transportation. Educational material can be available at community meetings, shared through community media streams, and/or be a component of a programmed event, as discussed in more detail below.

Examples of ways in which communities can provide and share information about active transportation include:

- **On-line,** including providing information on a dedicated project webpage with supporting resources, videos, and social media;
- **Published materials** can be provided on-site, handed out by ambassadors, available in community facilities or businesses; and
- **Signage** can be provided on-site to show examples of how to use a new active transportation facility.

Signage indicating how to use a zebra crosswalk to cross a protected bicycle lane, Vancouver, B.C.

Signage indicating where to park adjacent to a parking protected bicycle lane, City of North Vancouver, B.C.

Case Study

Educational Brochures, Calgary, AB

In 2015, the City of Calgary implemented a network of protected bicycle lanes in its downtown core. The City had not previously installed protected bicycle lanes, and the treatments were unfamiliar to many road users. To help raise awareness of the new infrastructure, the City developed a brochure providing information for all road users about the new downtown bicycle network, including an overview of the new types of infrastructure along with tips and maps illustrating how to use the new infrastructure for all road users, including people driving, cycling, and walking. The brochure was made available at kiosks at multiple locations on the downtown bicycle network and on-line.

BICYCLES AMBASSADORS AND MAYORS

A number of communities, including the City of Winnipeg, City of Edmonton, and City of Calgary have had 'bicycle ambassadors' on the ground at new facilities to answer community questions and concerns, distribute educational materials to community members at key destinations, and facilitate bicycle rides along new facilities while teaching safe habits. These can be municipal employees or summer students, or be part of a collaboration between local organizations, such as local business improvement associations. Ambassadors should be highly visible and recognizable in bright, coloured, branded clothing, and should have a positive attitude to help all road users. To help raise visibility of its ambassadors, the City of Edmonton used a branded cargo bike that ambassadors used to travel along the bicycle network to answer questions. Ambassadors can be present along the facility as well as go to major employers and community events to help share information. Ambassadors can also make use of existing resources and programming. For example, in Winnipeg, the city partnered with existing

Bicycle ambassador using branded cargo bike, Edmonton, AB

business improvement associations who already had a broader ambassador program in place to equip its ambassadors with information about new cycling facilities. These ambassadors can answer questions and support all road users.

Many communities around the world, including the City of Victoria, are also creating 'bicycle mayor' positions. Bicycle mayors are volunteers who can be used to help identify and lead projects that increase cycling to uncover economic, health, and environmental benefits.

ONGOING COMMUNITY PROGRAMMING

Programming can be an effective tool to continue to build support and raise awareness for active transportation and showcase active transportation facilities as a community asset. By continuing to showcase active transportation projects through community engagement, a municipality or governing body can continue to raise awareness and excitement for existing projects. Potential activation programs include:

- **Open Street Events:** These events temporarily close streets to motor vehicle traffic, so that communities can use them for any activity, except for motor vehicle travel. Community members can experience the street in a new way using the space to bike, walk, dance, lounge, and celebrate, among many other activities. Locating such an event in proximity to a new active transportation facility will provide additional exposure. Open Streets events can range from a one-day event or span a season. They can help pilot a permanent open streets installation.

Case Study

Educational Guide, Vernon, B.C.

The City of Vernon recently adopted a new Traffic Bylaw, which updated regulations about how residents get around the city by car, by foot, by bike, and using 'small-wheeled transportation,' a term that covers skateboards, longboards, foot-operated scooters and children 12 and under riding bicycles.

The city has developed an educational guide called 'This is How We Roll' to introduce residents to the rules about small-wheeled transportation and to help residents navigate Vernon's transportation network.

This guide was developed in a graphic, engaging format and is available on-line. The guide introduces residents to the different types of facilities people will see around Vernon and what they need to know to navigate them.

Calgary, Alberta

- **Community Festivals:** Communities often host festivals or events a few times per year. These provide great opportunities for community members to learn about changes in their community while having fun. Sharing information on new active transportation projects and events through the distribution of informational flyers or setting up a booth is a simple way of generating interest and excitement for a project.
- **Community Bicycle Rides:** Events like community bicycle rides create opportunities to bring a variety of community members together for a bicycle ride to share an experience on new or existing bicycle infrastructure. This type of event can encourage individuals new to cycling a chance to experience cycling in the city in a safe and inviting environment.

This chapter outlines the value of benchmarking and monitoring active transportation activity within a municipality and along corridors, the different types of data that can be collected, and examples of how the data can be reported back to the public and other stakeholders.

Case Study

Bicycle Ambassador Program, Calgary, AB

Every year since 2015, the City of Calgary's Bicycle Program has hired summer students as bicycle ambassadors to deliver cycling education, encouragement and engagement for the various bikeway projects throughout Calgary. The principle goals of the bicycle ambassadors are to:

- Educate road users on the safe and proper use of cycling infrastructure;
- Encourage people cycling to set a good example for others and to follow the rules of the road; and
- Encourage Calgarians to try the bicycle facilities in Calgary.

The Bicycle Ambassadors use a variety of engagement methods to support a robust education program that suits a variety of learning types. Throughout the summer the team created key messages, provided resources, and developed interactive activities to encourage more meaningful engagement.

Each summer, bicycle ambassadors participate in hundreds of conversations with Calgarians. In these conversations, the team uses several key messages to educate the public on safe cycling, encourage best practices, and address comments and concerns. Key messages include:

- Protected bicycle lanes and other bikeway projects give Calgarians more transportation options.
- Bicycle facilities provide dedicated spaces for people who bike, while maintaining spaces for those who walk, drive or take transit.
- The city works closely with stakeholders and residents to plan, design, and implement bike projects in Calgary.

In the summer of 2017, the bicycle ambassadors attended 41 events and interacted with 3014 Calgarians. These conversations took place at a variety of venues including festivals, office road shows, on-street pop up events, on-street outreach, community events and more.

Case Study

Saanich Cycling Festival, Saanich, B.C.

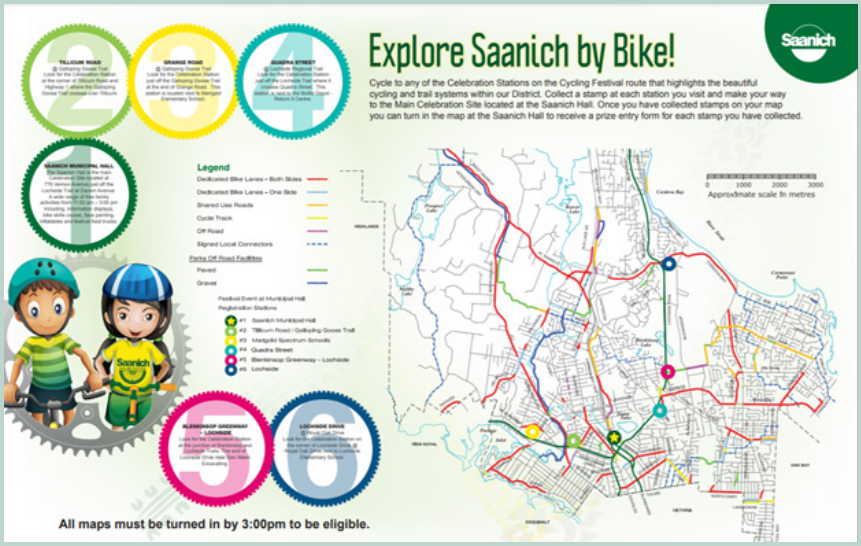
Every year, the District of Saanich hosts the Saanich Cycling Festival. The festival included a main celebration site at municipal hall with a range of booths and free family activities, including:

- Bike Rodeo;
- Cycling Obstacle Course and Skills Challenge;
- Kids Decorated Bike Parade;
- Face Painting;
- Inflatables;
- Interactive Information Booths;
- Bike Safety Tent;
- Festival Food Carts; and
- Concessions.

The event also includes a festival route that includes a number of community celebration stations, where participants can collect stamps on an event map. Participants can return their completed event map to win a variety of prizes.

The festival also includes a kids' decorated bicycle ride, with a choice of either a 1.5 km or 2.2 km route.

Saanich
CYCLING FESTIVAL



Source: District of Saanich


Source: District of Saanich

Source: District of Saanich


Source: District of Saanich

Bicycle counter with display, Galloping Goose Regional Pathway, Victoria, B.C.

I.2

MONITORING + REPORTING

This chapter outlines the value of benchmarking and monitoring active transportation activity within a municipality and along corridors, the different types of data that can be collected, and examples of how the data can be reported back to the public and other stakeholders.

DATA COLLECTION AND MONITORING APPROACHES

Evaluation is one of the 'Five Es' that makes up a comprehensive approach to active transportation planning and design, along with engineering, education, encouragement, and enforcement. Monitoring active transportation usage, patterns, and trends allows for evaluation to take place. This is critical to improve a community's understanding of the use of its active transportation facilities and can allow municipalities to plan for necessary improvements to their active transportation networks. This chapter outlines a comprehensive approach to monitor active transportation, including data collection, evaluation, and reporting.

Monitoring trips made by active transportation, and the use of active transportation facilities, is important to enhance a community's understanding of overall patterns and trends for trips made by active modes. Monitoring helps to determine the impact investments in infrastructure are having on attracting users. It helps to understand trends and changes in use, including hourly, daily, seasonal, and annual variations. It can help to determine if a community is achieving its goals related to active transportation. It provides communities with information on the usage of different facility types which can help support future design options and implementation decisions in the future. Finally, monitoring also allows communities to assess the need for infrastructure improvements such as widening facilities, providing new or alternative routes, and monitoring route safety and changes in collision rates based on before and after collision data.

Establishing an active transportation data collection and monitoring program provides an objective, systematic, consistent, and ongoing way to count and monitor active transportation usage, patterns, and trends. Monitoring active transportation activity and the impact of investments in infrastructure requires a strategic perspective and a detail-oriented approach. As the collection of data can sometimes be considered expensive, coordinating counts with the collection of other data can allow opportunities to reduce costs and effort, while increasing the ability to integrate and use different existing datasets together to create further value.

The approach to data collection and monitoring of active transportation activity is determined by the goal of the data collection program. Understanding why data is being collected, the application of data, and the needs of the end user are critical to identifying the appropriate data collection and monitoring approach. Needs are likely to vary significantly between communities and agencies within the province. For example, while some municipalities and agencies may have formalized, ongoing, comprehensive active transportation count programs, many municipalities have only collected and/or used bicycle and pedestrian data on a sporadic basis or have never collected this data in the past.

There are several elements that should be considered when designing an active transportation data collection and monitoring approach or strategy. These elements include:

- **Selecting count locations** (these may vary depending on the mode that is being counted);
- Selecting a consistent **count time period;**
- Selecting appropriate **data collection materials, technology, and equipment;**
- Developing a clear data collection **methodology;**
- Supporting opportunities for volunteer counts by **developing consistent materials;**
- Developing **data archival formats;**
- Establishing **data analysis techniques;**
- **Providing training** for both counting (where applicable) and analysis; and
- Developing a **data reporting methodology.**

TYPES OF DATA

The types of data that can be collected as part of an active transportation monitoring program are discussed below.

Overall Usage Levels

There are many data sources to assess participation in active transportation at the city-wide or neighbourhood scale, and at the corridor scale.

City-wide or neighbourhood scale data looks at transportation patterns at a macro scale. It does not look at specific corridors but can be used to understand overall trends and patterns. This data is generally large-scale and can be quite labour intensive. Examples include:

- **Travel Diary Surveys:** Origin and destination travel diary surveys are conducted in many communities to gather overall travel patterns and behaviour data of residents in a municipality or region for all modes of transportation, typically over a 24-hour or longer period. The travel information collected consists of data such as mode of transportation, origins and destinations, trip purposes, trip start and end points, and day of travel. Travel diary surveys are typically conducted as part of a broader data collection program every four to five years and typically include all modes of transportation. Specifically, for active transportation related monitoring programs, travel diary surveys typically provide information about the total number of walking and cycling trips, walking and cycling mode share, purpose of walking and cycling trips, distance of trips made by walking and cycling, and demographic information such as age, gender, and income. This information can be used to determine the effectiveness of active transportation-related investments and relative trends of walking and cycling at a city-wide or neighbourhood-scale but cannot be used to monitor use on individual corridors.
- **Census Data:** Statistics Canada conducts the Canada Census every five years. The Census includes questions related to 'journey to work,' which provides data similar to travel diary surveys. However, this is typically of a much larger sample size with less detail and data collected per sample. An important limitation of census data is that it only includes commute trips to work or school, whereas travel diary survey data typically includes trips for all purposes. Similar to travel diary surveys, this Census data can be used to determine the effectiveness of active transportation-related investments and relative trends of walking and cycling at a city-wide or neighbourhood-scale but cannot be used to monitor use on individual corridors.
- **Civic Census:** This presents an opportunity to include questions about travel patterns to obtain city-wide data on a more frequent basis. Municipalities can include a 'journey to work' question in their own local census — ideally, this question should be asked every year, although every two years is also acceptable.
- **Household Telephone Surveys:** Household telephone surveys can be conducted to obtain representative, statistically significant information specifically targeted towards active transportation. Unlike travel diary surveys, which objectively report actual travel patterns over a 24-hour period or longer, telephone surveys are intended to capture information about self-reported typical travel patterns. Telephone surveys can also be very effective in creating understanding of broader barriers and motivators to active transportation, which can be important to help inform the planning and design process.
- **Cordon Counts:** Establishing a cordon or boundary around a designated area and collecting data on how people travel into and out

of the cordon during a set period. For example, a community may consider conducting a yearly cordon count of its downtown core. To do this, a community can perform manual counts at screenline locations around the cordon over a set time period during the same time of year on an annual basis. Each screenline location may only be counted on a single day, so it may not be appropriate to compare one year to the next at any given location given that weather can impact the number of people walking and cycling. However, because the entire area count takes place over the same span of time, it is possible to compare the overall cordon count year to year because the weather averages out. Corridor-specific data can also be collected along specific corridors, as discussed in further detail below.

Safety

In addition to capturing use, monitoring of active transportation should also include surveillance for safety issues.

The safety of vulnerable road users is often a variable that is tracked as part of an active transportation monitoring program. For both people walking and cycling, safety is a critical issue mainly due to the vulnerable nature of people walking and cycling relative to motor vehicles.

In B.C., safety data is often based on insurance data collected and provided by the Insurance Corporation of British Columbia (ICBC) or collision data collected and provided by police. This data includes reported collisions between motor vehicles and people cycling or walking.

The Limitations of Collision Data

Reported collision data is often the primary source of data that is used to analyze and report on the safety of active transportation. However, reported collision data does not provide complete information on collisions involving other active transportation users. Additionally, this data often under reports actual safety issues, as it does not include unreported collisions between people driving and people walking or cycling; collisions between people walking or cycling and other road or pathway users; other types of incidents resulting in injuries; or near misses that did not result in an actual collision. As a result, it is important to try and capture safety data when conducting other interactive data collection.

Research Note

Cycling Safety - Findings from The Cyclists' Injuries & The Cycling Environment Study:

Collisions and injuries that are a result of cycling are often underreported. The Cycling in Cities Program at the University of British Columbia conducted the Cyclists' Injuries & the Cycling Environment (BICE) study. The study found that only 37% of cycling injury crashes were a result of collisions with motor vehicles, including 8%, which were a result of a collision with a motor vehicle door. A further 12% were a result of a fall to avoid a collision, including 10% to avoid a motor vehicle and 2% to avoid another type of collision. The study found that just under half (47%) of recorded cycling injury crashes were a result of an interaction with a motor vehicle. The remaining cycling injury crashes (53%) resulted from collisions with surfaces (such as potholes, gravel, leaves, tracks, roots, icy or wet surfaces), infrastructure (such as bollards, furniture, curbs, fences, speed bumps, stairs), or other route users (such as pedestrians, other bicycle users or animals). This has important implications for the type of data that is often collected, as it is important to recognize that reported collision data is likely only providing a small snapshot of the overall causes contributing to cycling collisions and injuries. 1

1. Kay Teschke et al., Bicyclists' Injuries and the Cycling Environment study (Cycling in Cities Program, UBC).

Other Types of Safety Data

There are other ways communities have been monitoring active transportation safety. BikeMaps (BikeMaps.org) collects data on cycling trouble spots from people using the network (see **Figure I-151**). The data is crowd-sourced and self-reported. The platform collects data on cycling safety, hazards, and locations where bicycle theft occurred. The website includes a mapping system that is designed to allow citizens to map locations of cycling incidents and provide more detail about the event itself and what occurred. As the data is self-reported, it allows for people to provide input on near-misses and collisions that do not involve motor vehicles that are not included in ICBC data. The data has been used by municipalities in a number of ways. For example, the District of Saanich used data from ICBC and BikeMaps.org to identify their top safety locations for spot improvements. Other communities that have used BikeMaps.org have found opportunities to adjust infrastructure based on the early reporting of near misses and hazards. Researchers have also been looking at the value of collecting data on injuries that occur on active transportation trips.

While there are currently several sources of safety data, there are opportunities to develop more robust datasets and to continue to consolidate, study, and review data as it is available.

The availability of active transportation-related safety data is limited for any given location due to the relatively low number of reported incidents involving active transportation users, particularly people cycling. In order to develop an evidence-based process that can be used to make crucial investment decisions it is important to be sure that the data provided is current, accurate, and has been compiled from a number of sources.

In addition to collision data, injury data can be used to assess active transportation safety. Injuries can be reported through Health Authorities, especially for non-motor vehicle related incidents (such as collisions between people walking and cycling, including collisions on off-street pathways). Some jurisdictions have focused on enhancing this type of data collection. It is recommended that active transportation collision and injury data both be collected and that they be harmonized so that it can be more effectively and efficiently used in active transportation safety analyses. Data is also required regarding injury severity to better understand how these injuries impacted the active transportation users in the short and long term. This would require an organized recording and sharing of active transportation injury data between multiple organizations.

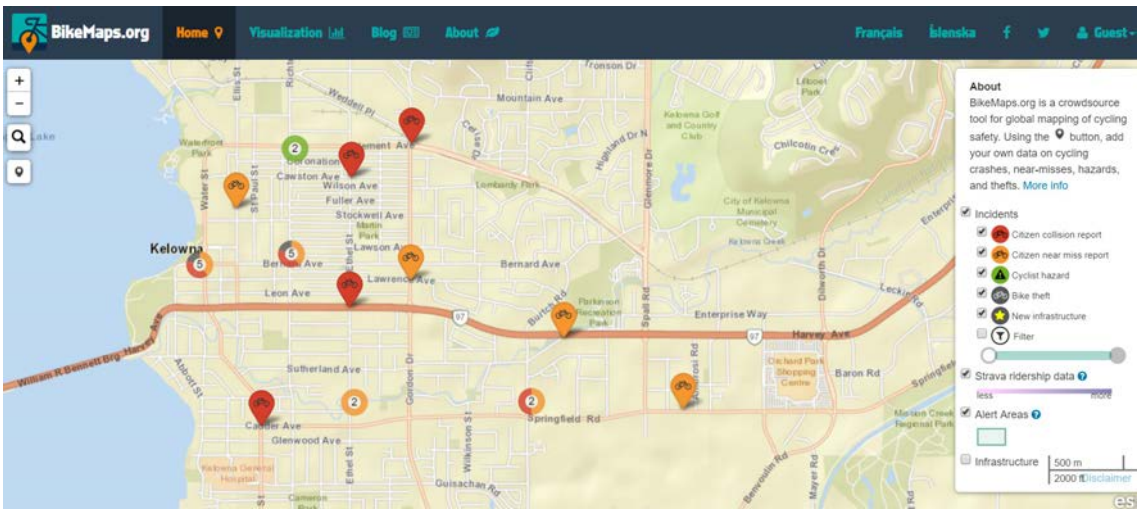


Figure I-151 // Example of self-reported data that can be collected through BikeMaps.org

Source: bikemaps.org

The historical safety information of a specific corridor or network should be compiled prior to any installation and monitored annually following the installation of new active transportation facilities. This allows for an evaluation of any safety benefits of the facility.

An important consideration with safety data is to understand absolute changes in collisions, as well as changes in collision rates. Collision rates can be developed by comparing monthly or annual collision rates along a given corridor before or after a change in infrastructure. Collision rates can also be developed based on exposure, which could include the number of active transportation collisions per unit of motor vehicle trips and/or active transportation trips. This type of collision rate calculation would require motor vehicle and/or cycling and/or pedestrian count data.

Infrastructure

It can beneficial to monitor and report on key metrics on active transportation infrastructure development. This can include factors such as the development of bicycle network kilometres (as well as the total kilometres of proportion of the network that is considered comfortable for people of all ages and abilities), new sidewalks, off-street pathways, bicycle parking supply, and the quality of bicycle facilities. Tracking types of infrastructure development can allow municipalities to assess what facilities are most effective at increasing ridership, and how other key metrics may influence people's decision to walk or cycle.

Other Measures

Additional measures such as the potential economic impact of installing active transportation infrastructure, can help to strengthen the case for installing active transportation infrastructure and dispel some common myths associated with the impact of cycling facilities at the micro-scale (corridor) and/or macro-scale (neighbourhood, city, or region). Other additional measures include, multi-modal level of service (MMLOS), changes in traffic congestion or travel time, individual business trip surveys, or observations pertaining to sidewalk cycling or one-way riding can also be collected as part of a monitoring program. These examples would likely require in-person interviews, surveys or manual observations. They can be helpful measures to compare before and after results of infrastructure installation.

Counting Active Transportation Users

Active transportation count data involves the collection of pedestrian and bicycle traffic volumes along key corridors and at specific locations throughout a community. This is vital to the establishment of a long-term active transportation monitoring program and the evaluation of projects and policies.

Many communities only collect active transportation data through short duration counts, often as part of established motor vehicle count programs. These short duration counts are often collected only for a few hours on a given day, once every several years. Short duration counts are typically intended to be a snapshot in time, but can be significantly affected by the effects of seasons, time of day, and weather conditions. These factors all have a significant impact on active transportation trips and can make comparing short count data collected one year to another problematic.

Count data should be collected before the installation of a new or enhanced active transportation facility. This is likely most applicable for cycling facilities, but can also apply to multi-use pathway upgrades or corridors without existing pedestrian facilities. It is recommended that permanent, automatic bicycle and pedestrian counters, where applicable, be included in the capital cost of all new active transportation facility projects and be installed in conjunction with the construction of new facilities. Ongoing operational costs should also be considered and budgeted for.

Case Study

The Economics of Cycling - Bikenomics - A Primer on the Economic Impact in the Capital Region , Greater Victoria, B.C.

The Capital Regional District initiated a study to better understand the economic impact of cycling. Communities within the region identified several key goals including increasing local jobs and economic activity. They identified priorities that included attracting tourists, knowledgeable workers, and supporting local businesses. The region recognized that active transportation can play a role in achieving these goals.

This report highlighted several key statistics and interviews with business and community leaders in the capital region that acknowledge the positive economic impact cycling has on communities.

The report highlighted the economic benefits from the following areas:

- Cycling Tourism: Over 3 million visitors spend almost a billion dollars when visiting Greater Victoria each year. Five percent of visitors (150,000 people a year) who come to the Greater Victoria area cycle while visiting, and 24,000 passengers arrive via ferry each year with their bicycles.
- Technology Sector: The region has seen a boom in the technology sector and in 2015 was home to over 884 tech firms. With so many high tech firms there is a strong demand for highly qualified professionals. The report looked at some of the major attraction factors for talent, and found one strong factor was having flexible commuting options that allow people to walk and bike to work. Candidates were also looking for easy access to outdoor recreation, including mountain biking.
- Bicycle Shops: There are 32 bicycle retailers in Greater Victoria, which is four times more than the per capita national average. In 2015, these stores had almost 200 employees and $4.5 million in direct economic impact (through wages, rent, and buying local goods and services).
- Jobs: Jobs directly related to cycling contribute to economic stimulus. The economic impact of cycling is often more about the indirect impact than the direct jobs that it provides. Building cycling facilities and having more people riding bikes has a long range effect on a city's, quality of life, sense of place and in attracting people to live, work, visit and shop.

https://www.crd.bc.ca/docs/default-source/regional-planning-pdf/Pedestrian-Cycling-Master-Plan/crd_bikesed-booklet-version.pdf?sfvrsn=4c194fca_2

Case Study

Economic Impact Studies, Toronto, ON

The City of Toronto has conducted studies to understand the economic impacts of the installation of cycling infrastructure on specific corridors. Economic impact studies have been conducted on Bloor Street including the most recent *Bloor Street West Bike Lane Pilot Economic Impact Study*. The study was originally commissioned by the Bloor Annex BIA, the Korea Town BIA, and the Metcalf Foundation in October 2015. The study was completed by The Centre for Active Transportation, which partnered with academic researchers from the University of Toronto to collect and analyze the data. The study was commissioned in anticipation of the pilot bicycle lane being installed on Bloor Street the following summer. The intent of the study was to investigate the economic impacts – positive, negative or neutral – of the bicycle lane, as well as its effect on the travel patterns and attitudes of visitors and merchants.

The key findings of the study were broken into four themes below and includes sample of the data presented:

- Customer Counts: 'The number of businesses that reported 100 customers or more per day increased in the study area on both roads. On both roads, locals (those living or working in the area) were 2.6 times more likely than those coming from further away to spend at least $100 per month.'
- Customer Frequency: 'People who arrived on foot or on bike visited Bloor the most often, and people who drove or took transit visited nearly four days less per month.'
- Shifts in Travel Patterns and Parking: 'The percentage of customers cycling to Bloor nearly tripled (from 7% to 20%), a substantially higher increase than on Danforth Avenue, which has no bike lane. The majority of merchants believed that at least 25% of their customers are driving to Bloor; however fewer than 10% of customers reported arriving by car.'
- Perceptions on Safety and Feedback on the Bicycle Lane: 'After the installation of the bike lane, the proportion of visitors who perceived Bloor Street as safe for cycling more than tripled (from 17% to 61%) and doubled among merchants (from 13% to 27%), while perceptions of safety on Danforth dropped (from 22% to 10%).'

https://www.tcat.ca/wp-content/uploads/2017/10/Bloor-Economic-Impact-Study-Full-Report-10-11-2017.pdf

In addition, if short duration counts for active transportation are collected as part of motor vehicle count programs, the locations selected may also not be the preferred locations to monitor active transportation. In addition, short duration counts should avoid being undertaken during special events such as festivals or holidays which may skew the data. Unlike motor vehicle traffic, some types of walking and cycling facilities may see greater use on evenings or weekends than during traditional morning and afternoon peak periods for motor vehicles. This is particularly true if the use is more recreational in nature.

As such, where possible, ongoing permanent counts are preferred over short duration counts for active transportation. Multiple technologies can be used to improve the robustness of the data collection program.

If it is not feasible to install a comprehensive network of automatic, permanent counters throughout a given community, these can instead be installed at select strategic locations to obtain permanent count data that can then be used to develop adjustment factors based on considerations such as season, month, time of year, or weather. These adjustment factors can be used to extrapolate trends from short duration counts. In addition, multiple technologies can be used to help validate the accuracy of the data, such as using pneumatic tubes in addition to inductive loops to ensure the inductive loops are properly calibrated. Finally, by using multiple technologies, practitioners can help gather additional data, such as using infrared and inductive loops together to distinguish and gather data for both people walking and cycling.

Table 1-47 summarizes various active transportation traffic count technologies including some of the benefits and challenges of each. A comprehensive summary of various count technologies can be found in the following Transportation Research Board (TRB) National Cooperative Highway Research Program (NCHRP) documents:

- *Guidebook on Pedestrian and Bicycle Volume Data Collection;* and
- *Methods and Technologies for Pedestrian and Bicycle Volume Data Collection.*

Selecting the proper counting technology is critical for either people walking or cycling, particularly now that other active modes of transportation are emerging. For example, the operating performance of some pedestrian counting technology varies depending on winter, extreme heat, or rainfall conditions. Areas with high occlusion also determines the counting technology of choice. In addition, some technologies come with software that allows for watching its operating performance live. This allows for the ability to determine margin of error and validate the data. Some technologies also come with basic statistical analysis packages.

Intercept Survey

The purpose of an intercept survey is to obtain information about people walking or cycling along a specific corridor or route. The information is gathered in person and goes beyond simple observations. This type of survey collects data and includes non-residents such as visitors in the sampling, providing a more complete picture of a corridor's overall users and their behaviour. This can also be an opportunity to ask people walking and cycling how they arrived at their destination. This can often be useful for projects in commercial areas that may have impacts on on-street parking, as this can provide the municipality as well as the business community an opportunity to understand what mode of transportation people are using to arrive at their destinations.

Travel Time Survey

A travel time survey is used to collect trip travel time data between origin and destination points, and points along the travelled route. This information allows for the definition of a baseline indication of travel times, delay, and general congestion within and across a community. This methodology would be less applicable to walking trips but can be used for cycling trips.

Table I-47 // Active Transportation Count Technologies

TECHNOLOGY	MODE OF TRANSPORTATION	BENEFITS	CHALLENGES
Manual Counts Manual Counts are taken by field data collectors to count the number of people walking and cycling based on observations. Manual counts are typically short-term.	**Walking** **Cycling**	■ High level of accuracy ■ Allows for additional observations (gender, turning movements, etc.) ■ No technology is required ■ Can count all modes including both people walking and cycling and other forms of active transportation such as skateboarding, in-line skating, etc ■ Suitable for shorter counts	■ Accuracy of data may be impacted at high volume locations ■ Labour intensive and requires significant resources ■ Can be expensive ■ Weather and seasonal variations may limit accuracy ■ Limited duration and frequency ■ Due to variability and short duration, it is difficult to compare manually counted data by year
Video Through the use of video cameras, counts are conducted as changes occur across the video scene. Video cameras can include thermal imaging that can count based on the temperature signatures of different road users.	**Walking** **Cycling**	■ High resolution ■ High accuracy ■ Video can also be used to analyze safety and behaviour ■ Cameras with thermal capabilities can count in all conditions ■ Can be used for long or short counts	■ May be affected by visibility ■ Can be extensive and manually intensive to install and relocate
Infrared Infrared devices (Active and Passive) detect an object passing through an infrared beam. Active devices have a transmitter and a receiver, an infrared beam travel between the two. Passive devices project an infrared beam from a fixed point.	**Walking** **Cycling**	■ Relatively high accuracy ■ Active infrared can distinguish between people walking and cycling ■ Can distinguish direction ■ Can be easy to move and relocate ■ Little maintenance required	■ Passive infrared can not distinguish between people walking and cycling ■ Can be subject to vandalism ■ Accuracy can diminish when groups are counted

TECHNOLOGY	MODE OF TRANSPORTATION	BENEFITS	CHALLENGES
Piezoelectric Piezoelectric strips or pads that can detect a change in pressure on the pad. The technology can be embedded in the ground or used for short term counts.	**Walking (some vendors)** **Cycling**	■ Can record speed ■ Can distinguish direction of travel ■ Relatively high accuracy	■ Has a relatively short battery life and storage capacity ■ Can be subject to vandalism ■ Expensive
GPS Enabled Route Trackers GPS enabled route trackers such as Strava and Ride Report allow app users to track distance travelled, speed and route. Data can be purchased to provide a sense of trip patterns and route choice. In addition, GPS enabled public bike Share bicycles can also provide opportunities to track detailed travel information.	**Walking (depends on technology)** **Cycling (more typical)**	■ Data can be used to create easy to read heat maps of heavily used routes ■ Potentially high number of users ■ Best used when combined with other traffic count data	■ Potential bias towards recreational riders ■ Limited to users of the app ■ Concerns over accuracy and challenges deciphering the data
Pneumatic Tubes Pneumatic tubes are pressure sensing devices that are laid across a path of travel to record pressure on the tube. They are typically used for short-term counts.	**Cycling**	■ Relatively high accuracy ■ Operate effectively in all light conditions ■ Easy to move and relocate ■ Ideal for short/temporary traffic counts ■ Direction of travel can be determined ■ Relatively inexpensive	■ Installation and location selection may take time ■ Can not count pedestrians ■ Accuracy may diminish with groups ■ Difficult to maintain or relocate as they are embedded ■ Some may not detect bicycles that have low amounts of metallic content
Magnetometre and Radar Sensors Magnetometres can be embedded in the pavement to detect bicycles as they pass the respective sensor. Radar sensors are installed on structures above the pavement to detect a change in a radar beam, and can count at night with the use of infrared cameras above ground.	**Cycling**	■ Typically used on pathways ■ Radar sensors are more commonly used on roadways	■ Accuracy can diminish with groups ■ Difficult to maintain ■ Challenges counting pedestrians

For example, this data can be used to assess the travel time impacts of a new cycling route and can be employed to provide key information that may otherwise not be available from other methods. GPS enabled route trackers can be an inexpensive tool for gathering this type of data.

REPORTING METHODS AND COMMUNICATION

A clear reporting methodology is required to ensure that the active transportation data collected is analyzed, presented, and reported to staff, decision-makers, and the public in a systematic and consistent fashion over time. This will allow for the clear monitoring of active transportation trends as well as progress towards achieving transportation related goals.

An important part of collecting data is ensuring that it is analyzed and that the findings are communicated to the general public in a format that is transparent, visible, and easy to understand.

This can involve installing visual bicycle count displays at prominent locations along the bicycle active transportation network, so the numbers are easily viewed by both people walking, cycling, and people driving. In addition, Some cities, including the City of Kelowna, publish their bicycle network traffic count data on-line, which allows members of the public to view the results. Both of these tools help dispel myths that people might have about whether the bicycle network is well-used.

As another mechanism for sharing data, several communities in Canada and internationally have developed report cards or yearbooks that report back statistics and provide updates on the current state of active transportation within a community. These documents are often considered both a way to report back on statistics and figures and also as a community-wide marketing and communication campaign.

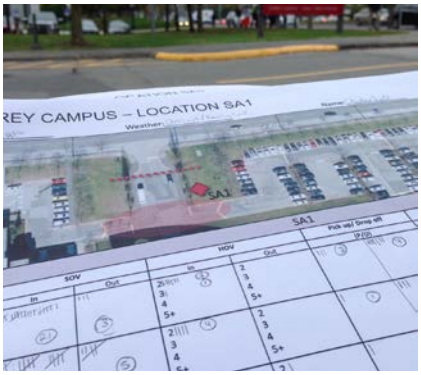
Case Study

Walking + Cycling Report Card, Vancouver, B.C.

A report card is a tool to monitor and present information about the current state of walking and cycling to residents and stakeholders in an engaging and graphic format. It can be used to assess if a community is achieving its active transportation objectives and report on important public input that can be used and incorporated into the active transportation planning process.

The City of Vancouver has published a Walking + Cycling Report Card annually since 2015. The report card highlights key statistics related to active transportation in Vancouver. The format of each of the report cards includes an overview of trends and highlights, and highlights the policies that are influencing active transportation in Vancouver. The report card presents statistics on mode share (city-wide and by neighbourhood), trip purpose, trip distance, and safety. Each report card also highlights some key active transportation infrastructure projects the city has been working on over the previous year. The document also outlines statistics on improvements to accessibility and multi-modal transportation integration, and highlights some of the promotion and education initiatives the city has undertaken.

Additionally, sharing bicycle and pedestrian count, travel survey data, and other data collected on-line promotes transparency and allows the public to monitor trends over time. For example, in many cases, bicycle count data is reported as a change from before and after a bicycle facility was implemented. It should be noted that using percentages to report increases or decreases on routes that have low usage can be seen as controversial by some people if baseline data is low. It is important to consider how the reporting back of active transportation data is messaged.



Manual Count Form


Pneumatic Tubes


Inductive Loops


Bicycle counter with display

Video

City of Vancouver, B.C.
Source: Mike Zipf

I.3

MAINTENANCE

While providing new infrastructure to promote walking and cycling is often seen as a top priority, ongoing rehabilitation and maintenance of existing infrastructure needs to be an equally important focus. Maintenance needs to be considered at all stages of the planning and the design process. Maintenance is necessary to keep active transportation facilities functional and usable throughout all seasons, which ensures that facilities are universally accessible throughout the year. In some situations, however, maintenance can be overlooked or neglected due to tight operating budgets, large outstanding maintenance needs, or an insufficient inventory of active transportation maintenance issues.

Bicycles are generally more sensitive to the condition of a facility as compared to motor vehicles. As a result, relatively small debris or obstructions can create safety issues for people cycling. Hospital records indicate that 50 to 70% of treated cyclist injuries are non-motor vehicle related[2] . Studies have shown that the most common types of non-motor vehicle injury crashes were a result of bicycle users crashing because of surface conditions (holes, bumps, roots, debris, leaves, etc.), colliding with infrastructure (curbs, bollards, posts, etc.), or colliding with a person cycling, person walking, or animal[3].

Providing a high level of maintenance throughout all seasons ensures that jurisdictions that invest in active transportation facilities can anticipate that many people will choose to walk and cycle year-round.

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2. Lopez, D. S., D. B. Sunjaya, S. Chan, S. Dobbins, and R.A. Dicker, R. A. (2012). Using Trauma Center Data to Identify Missed Bicycle Injuries and Their Associated Costs. Journal of Trauma and Acute Care Surgery, Vol. 73, No. 6, pp. 1602-1906.

3. City of Vancouver. (2015). Cycling Safety Study. *https://vancouver.ca/files/cov/cycling-safety-study-final-report.pdf*

WINTER MAINTENANCE

Studies have found that people will be more willing to walk and bicycle year-round if facilities are maintained throughout the winter months. Studies in Sweden, Montreal, Minneapolis, and Calgary have shown that an estimated 20 to 25% of the existing cycling population continues to cycle in the winter. It is estimated that improved winter maintenance could lead to an additional 12 to 24% mode share retention[4]. The key to ensuring people can walk and cycle in winter months is the provision of well-established, high-quality programs that prioritize maintaining routes year-round.

Sidewalk Snow Clearing

Sidewalk snow removal practices vary between communities. In some cases, property owners are responsible for clearing the sidewalks outside their homes and businesses. In other communities, the city or jurisdiction is responsible for clearing all or most sidewalks within the community. There can be variations of this as well. In most cases, a municipality or jurisdiction will clear sidewalks that are located adjacent to its property.

If a community is responsible for sidewalk snow removal, it typically identifies priority snow clearing routes. Prioritization is typically based on road classification, whether the corridor is a transit route, and its proximity to destinations such as schools, hospitals, and community centres. Typically, snow clearing is required to be completed within 24 to 48 hours of a snow event.

A municipal bylaw typically regulates sidewalk snow removal. The bylaw should outline responsibility, timeline for snow removal, and guidance on where cleared snow should be stored to address drainage, accessibility, and bus stop access. Enforcing sidewalk snow removal bylaws is an important component to ensure that people are able to travel safely and comfortably along sidewalks year-round. Established penalties for infractions and what steps the community will take to ensure sidewalks are kept clear need to be outlined and made transparent to all parties.

Bicycle and Pathway Network Snow Clearing

Snow Clearing Prioritization

To manage the resources and expectations for winter maintenance, maintaining the bicycle network should be treated in the same way as the rest of the road network. This means that the highest demand bicycle facilities would receive the highest priority snow clearing treatment, and other bicycle routes being treated subsequently depending on their network importance. Typical practice is that the highest priority route(s) would provide network connections and each subsequent priority will then help to fill out network density.

The desired pavement condition after plowing and de-icing should be identified for each priority level and facility type. Three facility priority levels are recommended for snow clearing purposes along bicycle routes:

- **Priority I bicycle routes**: These include all on-street and off-road bicycle facilities that have high daily bicycle traffic volumes and provide important connections across the bicycle network. These routes provide connections to

4. Fisher, Cara. (2014). Cycling Through Winter. *http://www.cip-icu.ca/Files/Awards/Plan-Canada/Cycling-Through-Winter*

schools, transit, high density neighbourhoods and business districts. Typically, the highest quality bicycle facilities, such as protected bicycle lanes, would make up Priority I bicycle routes. These routes should be plowed within 24 hours of the end of a snow event. On-street bicycle facilities should be cleared to bare pavement, and off-road pathways should be maintained to a compacted snow surface for graveled pathways and to bare pavement for paved surfaces. Snow piles should be stored sufficiently away from the bicycle facility, and care should be taken to ensure that snow melts do not lead to ponding or icing on the bicycle facility. Gaps in the snow piles may be required periodically to allow for drainage, or in some areas snow removal may be required.

- **Priority II bicycle routes:** These include bicycle routes with medium daily bicycle traffic volumes, and their connections. These routes should be plowed and/or salted within 48 hours of the end of snowfall. On-street bicycle facilities should be cleared to bare pavement, and off-road pathways should be maintained to a compacted snow surface for graveled pathways and to bare pavement for paved surfaces.
- **Priority III bicycle routes:** These are routes with low daily bicycle traffic volumes. These routes should be plowed within 72 hours of end of snowfall to a bare pavement.

To encourage cycling as a mode of commuting to work, communities should strive to ensure that the winter bicycle network is cleared of snow in the morning. This allows people to comfortably and reliably commute to work and/or school by bicycle each day.

A jurisdiction's prioritization for clearing bicycle facilities can be done separately from snow clearing for roads. For example, a local road that is a low priority for motor vehicles may contain a high priority bicycle route. In this case, the bicycle facility along with the road might be cleared prior to other higher classification roads without bicycle facilities.

Where bicycle facilities such as off-street pathways are in areas under the jurisdiction of different departments or agencies, they may be cleared by a different maintenance team than those clearing on-street bicycle facilities. In this case, winter maintenance priorities should be co-ordinated to ensure a consistent level of service, both in timing and extent of clearing. Considerations can be made to consolidate maintenance responsibilities for the network under one group or department. Having maintenance responsibilities under one group or department can result in efficiencies and improved service.

It is important to ensure that if a high-quality bicycle facility is cleared adjacent to a sidewalk, the sidewalk should be cleared as quickly as the bicycle facility. If a bicycle facility is cleared and an adjacent sidewalk is not cleared, pedestrians may choose to walk in the bicycle facility of the sidewalk.

Bicycle Facility Design for Efficient Snow Storage

Snow storage can present a significant challenge along bicycle facilities. Bicycle lanes often become the area for snow storage on the road, making the bicycle facility narrow or unusable. One of the most effective ways to mitigate snow storage and clearing is through careful consideration of maintenance during the planning and design process.

There are several road planning and design elements that can be considered:

- **Design roads and facilities with sufficient space for snow storage: Figure 1-152** shows undesirable designs for snow storage, which cause snow to collect in the bicycle lane, decreasing its width. On new streets or street rehabilitation projects that include both protected or unprotected bicycle facilities (or may include them in the future), sufficient space should be provided to allow for a desired 1.8 metre bicycle facility and a 1.8 metre storage space for snow on the side of the road or in the Furnishing Zone between the Pedestrian Through Zone and the bicycle facility. This will allow typical truck-mounted snowplows to plow snow into the designated storage space rather than the bicycle lane. A 1.8 metre width also allows some narrowing of the bicycle lane due to snow build up while still maintaining its functionality.

  Where feasible, a wide bicycle lane buffer can also be provided to increase the amount of storage space for snow (**Figure 1-153**). Alternatively, a protected bicycle lane may be used, providing

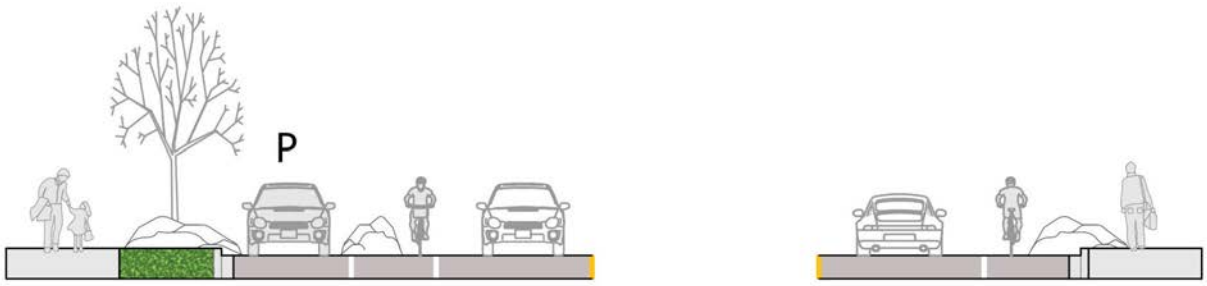

Figure I-152 // Undesirable Designs for Snow Storage

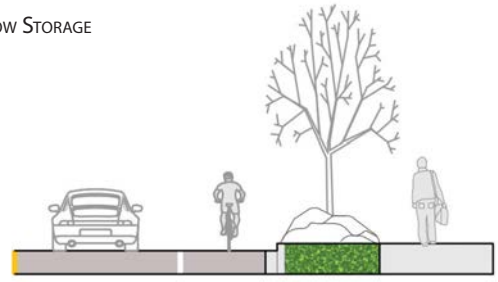

Figure I-153 // Desirable Design for Snow Storage - Painted Bicycle Lane

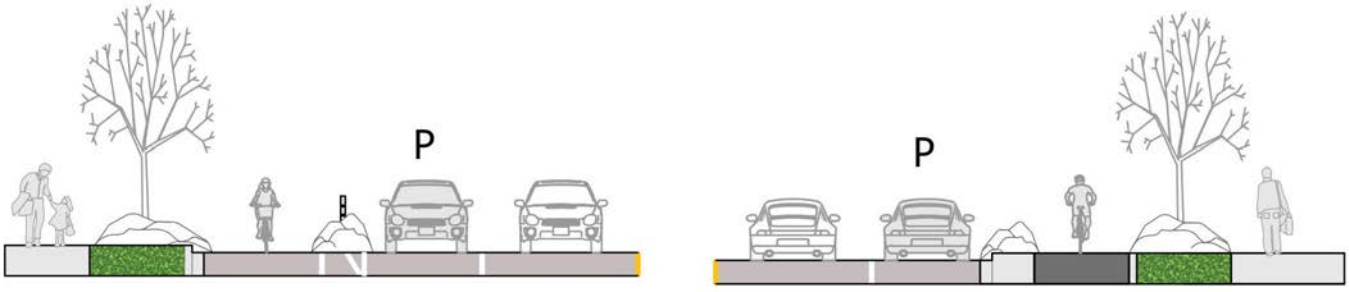

Figure I-154 // Desirable Design for Snow Storage - Protected Bicycle Lane

even more snow storage (**Figure 1-154**). A minimum 0.6 metre buffer is recommended to accommodate moderate amounts of snowfall with minimum encroachment upon the bicycle lane. If the bicycle lane is protected, this design will require the use of a narrower snowplow to clear the facility. When storing snow in an on-street buffer, room for snow melt and sufficient crossfall needs to be designed to ensure that icing does not occur across the bicycle facility.

- **Provide a wide buffer on sidewalks:** Buffer space should be provided along the Furnishing Zone in order to allow the Furnishing Zone to be cleared without pushing the snow into any adjacent bicycle facility.
- **Remove snow from the storage locations:** Snow storage can be located in the centre of the road along medians, in the boulevard and sidewalk buffer, and, in the case of protected bicycle lanes, in the road buffer. Snow removal from these temporary storage locations may be necessary as part of efforts to reduce icing over of the bicycle facility due to freeze/thaw cycles. Snow removal can be particularly important in urban and city centre environments and can be completed using a variety of equipment including loaders.
- **Consider the type of separation used and how it can be maintained during the winter:** If flexible delineators are used to provide physical separation and are bolted down to the road, freeze thaw cycles may result in higher maintenance costs. Using epoxy to fix delineators to the road (rather than bolting directly to the road), has not been shown to be an effective alternative in winter cities. In most cases, the delineators should not be removed in winter due to the need to rehabilitate bolt holes and the need to re-bolt delineators into the road at the end of winter.

  Other types of separation, including curbs, medians, barriers, and planters, may require specialized equipment for snow maintenance crews to work around them. If planters are used as a measure to provide physical separation between a bicycle facility and a road, the planters should be removed over the winter in order to facilitate snow removal or snow storage and to minimize damage to the planters. Where low curbs or medians may be covered by snow and invisible to snow clearing crews, a visible vertical element, such as a flexible delineator or snow pole, should be considered to draw attention to the hidden element. Depending on the size and shape of the medians or curb bulbs, the placement of three vertical elements can help better define the curve or edge of the median.
- **Consider providing walking and cycling facilities at the same vertical level:** When considering facilities at a different vertical level than the road, consider using sidewalk-level (protected bicycle lanes). This may allow for both facilities to be cleared at the same time and may reduce or eliminate the need for specialized equipment. However, the ease of maintenance should be balanced with pedestrian safety and the function of the facility. The shared space would need to accommodate people with visual disabilities, who may have trouble distinguishing between the sidewalk-level protected bicycle lane and the sidewalk.
- **Restrict on-street parking during snow events:** Where a bicycle facility is located between on-street parking and the motor vehicle lane, parking along the road can be restricted during snow events to allow this space to become temporary snow storage space. While this may not be an option for all roads, it could be utilized along priority bicycle routes in the winter. When motor vehicles are parked in the road during snow clearing the snow can accumulate in the bicycle lane but can also create a barrier making it challenging for smaller vehicles to exit their parking spot.

Bicycle Route De-Icing Considerations

There are two primary strategies for de-icing roads in winter maintenance programs: reactive and proactive. An approach that is reactive is characterized as applying de-icing material to the road surface after the snow event. The snow or ice is plowed off the surface and the de-icing material is applied to the road to break the bond between the ice and the road. A proactive or anti-icing approach is where the de-icing material is applied to the road before an expected snow event (approximately two hours). This is the more effective de-icing strategy and usually means that less de-icing material and snow clearing is needed. Following the snow event, the road is cleared, and additional de-icing material is added as necessary.

The section below provides an overview of the common types of de-icing materials used on roads and bicycle facilities along with their advantages and disadvantages.

- **Road Salt** is applied to the road and needs to be crushed by tires to dissolve most effectively. The dissolution of the salt creates a brine that prevents ice from bonding to the road. As bicycles have skinner tires and are lighter than motor vehicles, they do not crush ice as effectively. The disadvantages of salt are that it is a highly corrosive material and salt-infused stormwater runoff can cause environmental damage. Bicycles with exposed gears are especially susceptible to corrosion caused by road salt.
- **Pre-Wetted Salt** is road salt that is sprayed down with a brine solution. This occurs either upon application or in storage prior to being loaded in trucks. Some advantages of using pre-wetting over dry salt include quicker reaction times, less material, and improved application accuracy. This type of treatment may require special equipment and additional labour to prepare. Pre-wetted salt is also corrosive to bicycles and gears.
- **Sand and Gravel** are primarily used to provide traction but have little ability to melt ice. The application of sand is usually done in conjunction with other de-icing treatments. While sand is good for providing traction and to help salt stay in place, too much sand can pose a hazard for people cycling. Sand can get trapped in the bicycle's mechanisms, it can be hazardous to bicycle tires, and wet sand can get on a bicycle user's clothes. Sand, particularly if combined with salt, can also have a negative environmental impact. If sand is applied to a road with a bicycle facility, it should be cleared as soon as possible when the threat of snow and ice has subsided. Gravel is not recommended for use along roads with on-street bicycle facilities.
- **Beet Juice Additive** has been used by some jurisdictions as an additive to other de-icing applications to reduce the number of de-icing applications required and reduce costs. It is an inexpensive additive that improves the adherence of salt and sand to the road and lowers the freezing temperature of the ice. Beet juice adheres well to the road, and it is less corrosive than using plain road salt. Beet juice still has a negative environmental impact.
- **Cheese Brine Additive** can be used as an additive to salt. The brine helps the salt adhere to the road and has a lower freezing temperature. Cheese brine additive is also more environmentally friendly than pure salt applications or beet brine and can provide cost savings to municipalities by reducing salt expenditures. Cost savings will vary depending on the proximity to local production sources, as transportation is a major cost factor of supplying the additive.

- **Heated bicycle paths** have been installed in European cities such as Amsterdam, Netherlands and Umea, Sweden. Heating the bicycle facility can help prevent the formation of ice and the accumulation of snow, resulting in cost savings from snow clearing and de-icing materials. However, installation and ongoing heating costs will be higher than regular bicycle facilities.
- **Warm Wetted Sand**: This material is applied using a specialized truck with a water tank, water heater, and separate sand storage. The sand and hot water are mixed upon application and a spreader is used to apply it to the road. Wet sand provides better traction than dry sand and reduces the overall amount of sand needed on the road. Similar to sand, warm wetted sand can get caught in bicycle gears and riders' clothing.

Jurisdictions should consider piloting different de-icing techniques to see which will work best and may consider evaluating the use of sand and gravel along their on-street bicycle facilities. If sand and gravel are used, they should be swept periodically to avoid accumulation on bikeways. All roads with on-street bicycle facilities should be swept for winter debris as soon as the threat of snow has passed.

Snow Clearing Vehicles

The different types of active transportation facilities have unique dimensions and characteristics, meaning that a variety of snow clearing vehicles may be required to maintain the active transportation network throughout the winter.

During the planning and design process, jurisdictions should work with their maintenance crews to ensure they have the equipment and resources available to maintain and clear new active transportation facilities. These considerations early in the process can help to ensure designs are consistent and lessen the need for specialized equipment and training. As new active transportation facilities are installed, jurisdictions should be prepared to dedicate additional resources to clearing snow, ice, and debris from bicycle facilities, especially facilities that may be too narrow for traditional snow removal vehicles. The preferred practice is to design protected bicycle lanes and off-road pathways so that typical truck-mounted plows can clear them. In order to do this, the protected bicycle lane and buffer or pathway should have at minimum 2.4 metres of clear space (2.7 metres preferred).

Many jurisdictions that experience snow and ice in the winter have a fleet of small, specialized snow clearing vehicles and attachments that can be mounted to pick-up trucks, All terrain vehicles (ATVs), or other small utility vehicles. Some vehicles can serve both as snow clearing equipment during the winter and road sweepers throughout the rest of the year. Sweepers are typically very effective at clearing to the bare pavement, especially when combined with a brine de-icing solution. Sweeper attachments can be mounted on most existing snow clearing equipment, and some vehicles can be outfitted with both a plow and a sweeper.

FACILITY SWEEPING

To ensure active transportation facilities are safe, comfortable, and attractive for people, they must be kept clear of debris. Gravel, broken glass, leaves, or other debris can act as a barrier to both walking and cycling. They can create a slipping or collision hazard, puncture bicycle tires, and be blown or be kicked up by users.

Sidewalk Facilities

Like snow and ice, in many jurisdictions sweeping sidewalks of leaves and debris is the responsibility of the property owner and is regulated through a bylaw. This bylaw needs to be enforced by the jurisdiction to ensure compliance.

Bicycle and Pathway Facilities

Jurisdictions should develop a regularly scheduled inspection and maintenance program for road sweeping that helps ensure that road debris is regularly swept and cleared. Recommended guidance for road sweeping includes:

- Incorporate bicycle facilities into established road sweeping programs and ensure that special considerations for these facilities are followed. This includes ensuring debris is picked up in curbed sections of the roadway or sweep debris into gravel shoulders for sections without curbs;
- Establish a schedule that prioritizes sweeping roads with bicycle facilities seasonally. Jurisdictions may need to perform additional sweeping in the spring to remove debris from the winter;
- Sweep bicycle facilities whenever there is an accumulation of debris that may pose a hazard on the facility;
- Pave gravel driveway approaches to minimize loose gravel on paved road shoulders; and
- Perform additional sweeping in the fall in areas where leaves accumulate.

Off-street pathways can be maintained by a separate team than those sweeping and clearing the roads. Therefore, a separate inspection and maintenance program may need to be developed for off-street pathways.

Example of poor surface condition - poor drainage.

Example of poor surface condition - ponding.

SURFACE CONDITIONS AND QUALITY

Sidewalk Facilities

Many communities and jurisdictions do not have defined processes for assessing existing sidewalk facilities to determine when they need to be repaired or replaced. Typically, jurisdictions receive most of their input on facility quality from residents and address maintenance issues through a complaint-based system. By developing a sidewalk and pathway assessment program that includes a regularly scheduled assessment and maintenance program, a more objective and systematic process can be developed to identify infrastructure improvements.

Bicycle Facilities

Cracks, potholes, depressions, catch basin grates, and ponding can all be hazardous to people cycling. The impacts of cuts in surface material due to construction activities (saw cuts and excavation for utility work) in bicycle facilities need to be considered. Cuts in surface materials results in locations where there can be an inconsistent riding surface. Construction activities can also result in surface material issues due to backfilling and compaction that includes uneven surfaces. Recommended guidance for surface conditions includes the following:

- Maintain a smooth surface clear of cracks, potholes, depressions, or bumps to reduce hazards for all users;
- Establish a spot improvement program for bicycle facilities that allows people cycling to report specific problems using a smartphone app, website, and/or by texting or calling a dedicated number;
- Include extra width on new bicycle facilities in locations that are prone to surface quality issues such as potholes, cracks, or frequent debris, to allow people cycling to avoid problem areas;
- Maintain pavement so ridge buildup does not occur at the gutter-to-pavement transition or adjacent to railway crossings;
- Inspect the pavement two to four months after trenching construction activities are completed

Example of poor surface condition - longitudinal cracks.

Example of clear surface condition, Castlegar, B.C.

to ensure that excessive settlement has not occurred;

- Utilize bicycle-friendly pavement preservation alternatives to chip seals to create more stable surfaces. Alternatives include microsurfacing and slurry seals;
- If chip sealing is to be performed, use the smallest possible chip size on bicycle facilities. Sweep loose chips regularly following application;
- During chip seal maintenance projects, if the pavement condition of the bicycle facility is satisfactory, it may be appropriate to chip seal the travel lanes only. However, use caution when doing this so as not to create an unacceptable ridge between the bicycle facility and travel lane;
- Ensure facility surfaces are clear of water and have proper drainage;
- Ensure all new drainage grates be bicycle-friendly, including grates that have horizontal or diagonal slats on them or no grate, so that bicycle tires and assistive devices do not fall through the vertical slats. Consider creating a program to inventory all existing drainage grates and replace hazardous grates as necessary; temporary modifications such as installing rebar horizontally across the grate should not be an acceptable alternative to replacement;
- Consider gutter to pavement transitions and ensure that the difference between the gutter and pavement at transition points is no more than 6 millimetres. To provide additional seamless space along the bicycle facility, when paving is taking place as part of surface overlay and/or re-construction projects, the gutter pan can 'buried'. If the gutter pan is 'buried', care should be taken to ensure that the drainage pattern for the road is maintained, including adjustments to drainage structures (if required) to match the new pavement surface elevation to avoid abrupt vertical changes; and
- Pavement overlays are important opportunities to improve conditions for people cycling, if done carefully. A ridge should not be left in the area where people are riding (this occurs where an overlay extends part-way into a bicycle facility).

VEGETATION MANAGEMENT

Landscaping and vegetation management can be important along active transportation facilities, as facilities can become inaccessible due to overgrown vegetation. It is important to ensure that all landscaping is designed and maintained to ensure compatibility with the intended users. Jurisdictions should monitor facilities to ensure they are clear of encroachment by vegetation, such as overgrown grass, bushes, or tree branches. Signage, signal heads, and sightlines should not be obstructed by vegetation. After major damage incidents such as a flood or major storm, bicycle facilities should be checked, and debris should be removed as quickly as possible. Root barriers can be installed during construction as a preventative measure to mitigate surface damages and hazards caused by plant roots.

MAINTENANCE OF SIGNAGE AND PAVEMENT MARKINGS

The visibility of signage and pavement markings is required to help identify the facility type to all road users, allow or restrict certain types of vehicles, warn users of potential conflict zones, and provide wayfinding for users. Regular inspection of signage and pavement markings, including intersection and crosswalk treatments, is necessary to ensure they are kept in good condition. Pavement markings with paint should be refreshed annually, or twice a year if needed. Pavement markings using thermoplastic last longer and may not need to be refreshed annually. Reapplication of pavement markings also varies depending on the location of the marking.

The choice of material for pavement markings is important and typically depends on the type of users. For example, markings under motor vehicle traffic wear out faster than other markings. The material used should be durable, highly visible, and should provide adequate traction in all road conditions. Coloured pavement along bicycle facilities can either be in the form of an overlay on the existing pavement or it can be embedded into the pavement itself by mixing coloured pigment into asphalt. Glass beads can also be mixed into the pavement markings to increase retro reflectivity.

Overlay treatments include paint, epoxy (including Durable Liquid Pavement Markings (DLPM) and Methyl Methacrylate (MMA), thermoplastic, and tape. For roadways under MOTI jurisdiction, transportation professionals should review the MOTI *Recognized Products List* (April 1st 2019 Edition).

- Paint is the least expensive and most widely used treatment but is non-durable and is easily worn off by motor vehicle traffic and the elements, especially in winter climates. Its lifespan is typically 12 to 48 months. Paint has a low level of retroreflectivity. Care also needs to be taken to ensure friction is maintained in wet and winter conditions.
- Epoxy (including: DLPM and MMA) DLPM can be applied as a paint or spray but is sensitive to moisture and temperature (requiring longer dry times). MMA is a durable but more expensive product that consists of a two-part liquid application that can be installed at a wide range of temperature. These products have a lifespan of 12 to 48 months, are more expensive than paint, and have a medium level of retroreflectivity. They can be combined with abrasive materials to ensure friction is maintained.
- Thermoplastic and tape are durable plastic materials that can be pre-formed and assembled, making them easier to apply and more durable than MMA. Thermoplastic markings and some preformed marking tapes need to ensure steps are taken to ensure friction is maintained with wear, which may be an issue for cyclists. Skid-resistant materials may be mixed into the thermoplastic or applied on top of the markings. They have a longer life span (thermoplastic 48 to 72 months, tape 36 to 96 months). The life span varies depending on the amount of snow and ice, as well as the number of motor vehicles travelling over them. Primer-sealers can be applied prior to the application of most thermoplastic to increase the durability and strength.

Winter is an important consideration when discussing bicycle pavement markings. Recessing pavement markings has been shown to increase marking life expectancy in cold weather climates. Markings are recessed by milling the area of pavement 3.0 millimetres in depth where pavement markings are applied. While this installation method is more expensive, it may save maintenance costs over the long-term if the facility is located on a road that receives heavy plowing.

TEMPORARY AND SPECIAL EVENT CONSIDERATIONS

During special events, construction, and maintenance work, it is imperative that people walking and cycling are adequately accommodated to ensure facilities are still accessible. Jurisdictions should consider developing a Road Maintenance Management Plan to accommodate people walking and cycling during these events.

Route closures and major detours for people walking and cycling should be avoided wherever possible. Instead, the walking and/or cycling facility should be continued through the affected area using temporary designated facilities. It is not recommended to divert people walking and cycling to other corridors or even requiring them to cross the road. Temporary facilities should maintain the constrained limit width of the desired walking and cycling facility.

If the affected area involves a construction site with hoarding, the hoarding structure should be constructed to accommodate people walking and cycling. If this is not possible, it may result in shared - use conditions, where people cycling, and walking may need to share the facility. In such cases, signage should be provided to indicate to people walking and cycling that conditions have changed, and their behaviour needs to change. This includes signage indicating that people walking and cycling should share the space, and advising people cycling to travel slowly or to dismount.

If constrained limit widths cannot be achieved to accommodate people walking and cycling, Dismount and Walk signage (MUTCDC RB-79,RB-79T; B.C. B-R-101-2 Series) can be considered, as shown in **Appendix B**. However, it should be recognized this may result in low compliance. The TAC *Bikeway Traffic Control Guidelines for Canada* indicates that the Dismount and Walk sign should only be used in exceptional circumstances.

If route closures cannot be avoided, people must be warned of these closures in advance and given adequate detour information to bypass the closed section. Users should be warned using standard signage approaching each affected section. For example, Bicycle Lane Closed Sign (MUTCDC TC-68; B.C. B-C-002 Series) accompanied by Bicycle Lane Detour Markers (MUTCDC TC-70, TC-71; B.C. B-C-004 Series) where appropriate), including information on alternate routes and dates of closures. These signs are included in **Appendix B** for reference. Signage should never be placed within the bicycle facility, as this forces people cycling to use the road or sidewalk.

Alternative routes should provide reasonable directness, equivalent traffic characteristics, and be signed. Recommended guidance for detour routes includes:

- Provide fire and police departments with map of bicycle route system, along with access points to gates/bollards;
- Enforce speed limits and other rules of the road; and
- Enforce all trespassing laws for people attempting to enter adjacent private properties.

Construction Management, Vancouver, B.C.
Source: Rod Preston

Protected bicycle lane and sidewalk diversion, Vancouver, B.C.

Painted bicycle lane diversion, Vancouver, B.C.

Vancouver, B.C.

ANNUAL MAINTENANCE PROGRAM AND LIFE-CYCLE CONSIDERATIONS

Communities should develop an ongoing maintenance program that will maintain active transportation facilities year-round. Regularly scheduled maintenance will ensure that these facilities are safe and comfortable for all users at all times of the year. At minimum, semi-annual maintenance should be conducted in the spring and fall to clean up debris and repair any damage that has occurred as a result of seasonal changes.

Creating and maintaining an inventory of maintenance issues along active transportation facilities is a useful way to track maintenance concerns and identify problem areas that may require additional mitigation or more frequent maintenance. Creating a scheduled maintenance program can also help track annual operational costs by facility type, aid in establishing future budgets and inform future design choices.

It is important for jurisdictions to consider active transportation facilities as assets and to appropriately manage them. Since many of these facilities, particularly bicycle facilities, are new, communities should:

- Track and update their inventory of assets;
- Schedule maintenance, repair and preservation activities;
- Develop maintenance standards (for items such as signage, pavement surface quality, pavement marking replacement timeframes, or snow clearance time);
- Inspect facilities and track them against maintenance targets; and
- Set and adjust maintenance budgets as necessary to meet maintenance targets (or adjust maintenance targets to match budgets).

Event zone signage, City of Vancouver, B.C.
Source: Dylan Passmore

It is also important to consider life-cycle cost, accounting for other components of active transportation facilities, such as bollards, ramps, planters, pavement markings, lighting, and surface materials. This information can then be used to compare different materials, installation techniques, and maintenance practices. Having a better understanding of the cost of active transportation facilities can help to enhance financial planning and costing out future projects.

Windsor, ON.