Transportation

Discussion Paper to Support Climate 2050 and Clean Air Plan

Reducing emissions and increasing climate resilience for transportation in the Metro Vancouver region over the next 10 to 30 years

December 2019

SERVICES AND SOLUTIONS FOR A LIVABLE REGION
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Introduction

Planning for the Future

*Climate 2050* and the *Clean Air Plan* will be the key climate change and air quality planning documents for Metro Vancouver to support a transition to a carbon neutral and resilient region, while continuing to improve air quality to protect public health and the environment.

*Climate 2050* is an overarching long-term strategy that will guide our region’s policies and collective actions to transition to a carbon neutral and resilient region over the next 30 years. Metro Vancouver is implementing *Climate 2050* through 10 issue area *Roadmaps* (see Figure 1), which will describe how the region can reduce greenhouse gas emissions and adapt to climate change impacts. Implementation of the *Roadmaps* will be driven by Metro Vancouver’s management plans and other policies, including the *Clean Air Plan*.

The *Clean Air Plan* is the near-term action plan that will set Metro Vancouver’s direction for air quality and greenhouse gas management for the next 10 years. The Plan will outline actions to reduce emissions of *air contaminants*, including greenhouse gases, from all regional sources. The *Clean Air Plan* will primarily be organized around six issue areas (see Figure 1).

This discussion paper is about the *transportation* sector, and is intended to promote discussion and enable feedback that will be used in the *Clean Air Plan* and the *Climate 2050 Transportation Roadmap*. The feedback will also inform other planning documents such as *Metro 2050* (the update to the regional growth strategy) and Metro Vancouver’s corporate operations. (More information on the relationship between the *Clean Air Plan*, *Climate 2050* and the associated discussion papers is available in the *Clean Air Plan Backgrounder.* ¹)

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¹ Visit [www.metrovancouver.org](http://www.metrovancouver.org) and search “Clean Air Plan Backgrounder.”
Meeting Long-term Targets for the Region

Metro Vancouver, together with its member jurisdictions, has been taking action on air quality and greenhouse gases for decades. But actions must be accelerated to reduce our impacts on global climate change, and to protect public health and the environment. The region also needs to adapt to the anticipated impacts from a changing climate.

There is significant overlap between the sources of greenhouse gases and common air contaminants, so actions that address emissions reductions to protect public health can often (but not always) reduce greenhouse gases, and vice versa. Metro Vancouver aims to maximize co-benefits by focusing on policies and programs that reduce both greenhouse gases and common air contaminants.

Climate Change Targets

Climate change is directly associated with greenhouse gases, primarily carbon dioxide. While emissions are global, we all have a shared responsibility to take local action. The major sources of greenhouse gases in this region are transportation, buildings and industry, with smaller contributions from waste and agriculture. Climate change projections for this region by the year 2050 include longer, hotter and drier summers, warmer and wetter fall and winter seasons with decreased snowpack, and more extreme weather.

Metro Vancouver has adopted the following regional climate change targets:

1. reduce regional greenhouse gas emissions by 45% from 2010 levels by 2030;
2. become a carbon neutral region by 2050; and
3. ensure our infrastructure, ecosystems, and communities are resilient to the impacts of climate change.

Although the region has made progress over the past 15 to 20 years, we need to accelerate our climate actions to meet these targets and avoid dangerous impacts of climate change. More information on climate change in our region is available on the Climate 2050 website.²

We need to accelerate our climate actions to meet these targets and avoid dangerous impacts of climate change.

Air Quality Targets

Health researchers have found that there are no known safe levels for some common air contaminants, including fine particulate matter, ground-level ozone and nitrogen dioxide. Health Canada estimates that at least 1,600 British Columbians die prematurely every year due to common air contaminants and many more live with the associated health effects.³

As part of the Clean Air Plan, Metro Vancouver has proposed two new regional air quality targets for 2030:

1. ambient air quality in the region meets or is better than ambient air quality objectives and standards set by Metro Vancouver, the BC Government and the Government of Canada; and
2. increase the amount of time that visual air quality is classified as excellent.

Please consider if these are the right air quality targets for the region.

² Climate 2050 website. http://www.metrovancouver.org/climate2050
Residents in the region generally experience good air quality, but additional emission reduction actions are needed to continue protecting human health and the environment.

More information on the health and environmental impacts of air contaminants is listed in the Glossary (page 25) and on the Metro Vancouver website.4

Additional emission reduction actions are needed to continue protecting human health and the environment.

We Need Your Feedback

The purpose of this transportation discussion paper is to enable feedback on the key air quality and climate change issues facing transportation in the region and the ways in which we can reduce emissions and adapt this region’s transportation sector to a changing climate. This discussion paper is intended for the public, stakeholders and other governments, including First Nations.

The goals, metrics, targets and actions identified herein are considered potential opportunities for the region’s transportation sector. We must take action to reduce transportation emissions and ensure people and goods movement are resilient to a changing climate, and we need your help to figure out the best way forward.

Climate change and degraded air quality impact some neighbourhoods, households and individuals more than others. Also, some households are better able to prepare for and protect themselves from climate change and air quality impacts. A priority of both the Clean Air Plan and Climate 2050 is to incorporate the voices and needs of a full range of communities into program and policy design to ensure that fairness and equity are reflected in the actions that Metro Vancouver implements or advocates for. Policies and programs that reduce emissions should support an equitable distribution of benefits and costs, such as increased economic opportunities in a low emission and carbon neutral economy, affordable housing and more diverse transportation options. Issues of intergenerational equity will also be considered.

Specific opportunities to provide feedback are described under Feedback and Engagement Process, on page 24.

Linkages to Other Issue Areas

There are many linkages between transportation and other issue areas. Metro Vancouver is exploring which linkages must be considered when developing policies and actions. Some of the related issue areas for transportation include:

- **Land-use and growth management** – policies that support more compact, complete communities influence the form and location of the transportation network, how people move and how goods are transported;

- **Infrastructure** – the regional transportation network includes infrastructure such as roads, rail lines, bridges, and bike paths;

- **Energy** – availability of clean, renewable energy to power regional transportation;

- **Human health and well-being** – active transportation modes improve public health; and

- **Industry** – delivery of goods and provision of services impact the amount and types of transportation that take place in the region.

These issues will be explored in discussion papers of their own. As papers are developed, they will be made available on the Metro Vancouver website.5

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4 Visit [www.metrovancouver.org](http://www.metrovancouver.org) and search “Air Quality and Climate Change Basics.”

5 Visit [www.metrovancouver.org](http://www.metrovancouver.org) and search “Clean Air Plan” and “Climate 2050.”
Regional Transportation Emissions and Air Quality

Emission Sources and Trends

The region’s transportation system plays a vital role in serving and shaping our region’s communities and economy as they grow and change. Roads, rail lines, shipping lanes, flight paths, transit networks and bike paths link our neighbourhoods, communities and businesses.

The movement of people, goods and services – whether by car, truck, train, plane or boat – is the largest source of greenhouse gas emissions in this region, accounting for 44% of the regional total (see Figure 2). The transportation sector also generates 100% of diesel particulate matter, 62% of nitrogen oxides, 39% of sulphur oxides, and 18% of volatile organic compounds generated by all sectors in the region.

Personal vehicles are the major source of transportation-related greenhouse gas and volatile organic compound emissions (see Figure 3 on next page). Marine vessels operating in the Metro Vancouver region’s rivers and marine areas are the largest regional contributors of nitrogen oxides and diesel particulate matter from transportation. Aircraft are the largest source of sulphur oxides from transportation, followed by marine vessels.6

Opportunities to reduce emissions of these air contaminants include cleaner fuels and engines; more compact, complete communities; shifting to lower emission modes of transportation (e.g., cycling, walking and transit) and electrification.

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6 Emission estimates are from Metro Vancouver’s 2015 regional emissions inventory, completed in 2017, which describes the types and amounts of air contaminants, including greenhouse gases, emitted in the region. http://www.metrovancouver.org/services/air-quality/emissions-monitoring/emissions/emission-inventories/
TransLink

TransLink is the transportation authority responsible for planning, managing, and operating the regional transportation system. From now through to the Fall of 2020, TransLink is leading the development of *Transport 2050*, a strategy for transportation in the Metro Vancouver region for the next 30 years. This long-term regional transportation strategy will set out the vision, goals, strategies, and key initiatives for the region.

TransLink and Metro Vancouver are working together to develop a shared vision for the future of this region and to align goals, targets, and actions across each organization’s planning initiatives to support a carbon neutral and sustainable transportation network. TransLink assisted in the creation of this discussion paper and will incorporate feedback on the ideas in this paper into its planning work.

Current Actions to Reduce Transportation Emissions

Metro Vancouver, together with its member jurisdictions and other agencies such as TransLink and the Vancouver Fraser Port Authority, has been taking action to reduce emissions from transportation for decades. Some significant current actions on transportation in our region are outlined below.

(Additional information on the actions is listed in the web links shown.)

**Active Transportation and Transit**

1. **Transit expansion** will be supported by more than $10 billion in funding for transit and transportation investments across the Metro Vancouver region to achieve the Mayors’ 10-year Vision for Metro Vancouver Transit and Transportation (TransLink).
2. Low Carbon Fleet Strategy will reduce emissions from transit vehicles across the region, to help achieve TransLink’s environmental sustainability targets: to reduce greenhouse gas emissions by 80% by 2050, and to utilize 100% renewable energy in all operations by 2050. As part of strategy development, TransLink is evaluating low and zero emission vehicles, such as battery electric buses (TransLink).

3. Focusing regional growth in urban centres and along the frequent transit network ensures that more homes and workplaces are built within walking distance of frequent transit and other day-to-day destinations, reducing the need for private automobiles (Metro Vancouver, local municipalities).

4. Transit-Oriented Affordable Housing Study aims to better understand the opportunities and constraints for building new affordable rental housing in transit-oriented locations across the region (Metro Vancouver and partners).

5. Active Transportation Strategy will support creating community-specific active transportation networks that are safe, accessible and convenient for pedestrians, cyclists, transit riders and motorists (BC Government).

6. Regional Cycling Strategy provides guidance on how to encourage more cycling and safer cycling in the Metro Vancouver region (TransLink).
Cleaner Fuels and Engines

7. North American Emission Control Area requires lower marine fuel sulphur content for ships entering North American waters and has led to an 80% reduction in regional sulphur oxide emissions since 2012. New marine diesel engines are also required to comply with more stringent emission standards for nitrogen oxides when operated in an emission control area (Government of Canada).

8. Short Sea Shipping Study explored the opportunities to reduce emissions by shifting goods movement within the region from heavy duty vehicles to marine vessels (Metro Vancouver).

9. Low Carbon Fuel Standard will require a 20% improvement in the carbon intensity of transportation fuels by 2030 (BC Government).

10. Engine emission and fuel economy standards set stringent limits for greenhouse gases and common air contaminants from cars and trucks, heavy duty vehicles, rail locomotives and marine vessels (Government of Canada).

11. BC SCRAP-IT Program reduces greenhouse gas emissions and improves air quality by providing incentives for an electric vehicle or other low emission alternative by scrapping a high-polluting vehicle (BC SCRAP-IT Program).

12. Dual-fuel ferries will reduce common air contaminant and greenhouse gas emissions by using liquefied natural gas instead of marine bunker fuel (BC Ferries).

13. EcoAction Program provides discounts on harbour dues for marine vessels that go beyond existing requirements to reduce emissions and other environmental impacts (Vancouver Fraser Port Authority).

14. Truck Licensing System requires container trucks that access the port to meet minimum environmental requirements for engine age and emission controls; beginning in 2022, no truck in the fleet older than 10 years will be permitted to access the port (Vancouver Fraser Port Authority).
15. **Zero Emission Vehicle Act** requires that automakers sell an escalating annual percentage of new zero emission cars and trucks each year, reaching 100% of sales by 2040 (BC Government).

16. **Electric vehicle outreach programs** (Emotive, EV Condo and EV Workplace) raise public awareness of electric vehicles and provide information to support electric vehicle owners, strata councils, property managers, and businesses to expand their electric vehicle charging infrastructure (Metro Vancouver).

17. **Clean fuelling station investments** expand the charging and fuelling networks for electric cars and trucks, electric heavy duty vehicles and other lower emission vehicles (BC Government, Metro Vancouver, BC Hydro, local municipalities).

18. **Electric vehicle charging bylaws** require that new developments include electric vehicle charging infrastructure to future-proof buildings (some local municipalities).

19. **Electric seaplanes** offer a zero emission alternative for commercial aviation (Harbour Air).

20. **Hybrid-electric ferries** run on a diesel-electric battery power generation and propulsion system and in the future can be converted to full electric operation when the shore power infrastructure is in place (BC Ferries).

21. **Electrification Roadmap** will help guide equipment upgrades at port operations (Vancouver Fraser Port Authority).

22. **Shore power** at three port terminals in the region allows marine vessels with the necessary equipment to shut off their auxiliary engines at berth and connect to the electricity grid to reduce emissions (Vancouver Fraser Port Authority).

23. **Northwest Ports Clean Air Strategy** renewal is proposing a long-term vision, guiding principles and technology shifts for port operations, to support emissions reductions (Vancouver Fraser Port Authority and regional port partners).

24. **Corporate business travel emissions offset program** takes responsibility for emissions associated with corporate business travel (Harbour Air).

25. **Corporate commute trip reduction strategies** encourage employers to support employees to reduce their commuting emissions by using lower emission modes such as cycling, public transit, carpooling and electric vehicles (Vancouver Police Department).
Roles and Responsibilities in Transportation Emission Reductions

Under authority delegated by the BC Government in the *Environmental Management Act*, Metro Vancouver is responsible for managing and regulating air quality and greenhouse gases in the region, including emissions from transportation sources. Metro Vancouver is also responsible for developing, implementing and stewarding *Metro Vancouver 2040: Shaping our Future*, the regional growth strategy. *Metro 2040* contains Metro Vancouver’s greenhouse gas reduction targets, and includes a goal to create compact, complete communities that promote walking, cycling, transit, carpooling and reduced trip distances, all of which reduce emissions from transportation.

Air quality management and climate action require close coordination among all levels of government, as well as businesses, utilities, institutions and residents. The roles of key partners in reducing transportation emissions are outlined below.

- **Government of Canada** sets vehicle emission and fuel standards for cars and trucks, and in collaboration with international partners, also sets emission standards for marine, aircraft and rail engines. It also helps communities fund transportation infrastructure.

- **BC Government** oversees the highway network, provides funding for transportation projects and sets emission standards for vehicles and fuels.

- **First Nations** operating under a Treaty or Land Code can set land use and buildings policies that influence the type and location of homes and buildings constructed in their communities which in turn influences the way people travel.

- **Municipalities** have authority over local land use and transportation decisions, including parking and electric vehicle charging requirements. They also invest in local roads and infrastructure that serve pedestrians and other active transportation options.

- **TransLink** is the transportation authority responsible for planning, managing and operating the regional transportation system. It is responsible for long-term investments in regional public transit as well as road and bridge infrastructure.

- **Vancouver Fraser Port Authority** oversees federal port lands in the region. It facilitates Canada’s trade objectives, ensuring goods are moved safely by ship, rail and truck, while protecting the environment and considering local communities.

- **Vancouver Airport Authority** oversees the Vancouver International Airport, and follows federal regulations for its own operations and operations of its tenants.

- **Rail companies** such as CN and CP move goods and passengers through the region, and follow federal regulations for rail lines.

- **Energy utilities** (e.g., BC Hydro, FortisBC) provides rebates, infrastructure and energy for transportation.

- **Local businesses** move people, goods and services, and can affect emissions through, for example, their fleet decisions, investments and business locations. They rely on the regional transportation network for their businesses and employees.

- **Local residents** move around the region for work, play and school, and make choices on their travel mode, time and frequency, based on cost, convenience and other factors. These choices can affect emissions, as well as congestion within the region.
Our Emissions Reduction Opportunity

Transportation emissions at the community scale are driven in part by zoning and land use policies that support whether communities are complete, compact, and transit oriented. When people live closer to where they work, study and play, more opportunities exist to travel by active transportation and public transit, both of which reduce emissions from cars and trucks, particularly greenhouse gases and volatile organic compounds.

Technological opportunities exist to reduce emissions and exposure to them, such as expanding the use of electric cars and trucks for passenger transportation, as well as retiring older, high-polluting vehicles. New private and shared mobility options, such as car-share, electric-assist bikes, and electric scooters, can connect residents and businesses to their destinations and to public transit, thereby reducing emissions from cars and trucks. Ride-hailing services expand transportation service areas and offer users a new level of convenience, but they may also reduce transit use and contribute to increased traffic congestion and emissions.

As our economy grows, goods movement within and through the region will continue to grow. Policies that expand the use of clean fuels and low and zero emission technologies will be critical to reducing emissions of common air contaminants and greenhouse gases from goods movement. These and other policies can also reduce exposure for communities affected by emissions of nitrogen oxides and diesel particulate matter from heavy duty vehicles, rail locomotives and marine vessels. Building denser industrial development near the goods movement network will support logistics improvements and reduce emissions. Achieving significant emission reductions in the marine, aviation and rail sectors is challenging; progress will depend on advancements in fuel and engine technologies as well as commitments from other levels of government.

Electric vehicle charging station, Coquitlam
Photo courtesy of BC Hydro
Transitioning to Clean, Renewable Energy

Achieving significant emission reductions will mean switching from fossil fuels to clean, renewable energy, which is low or zero emission energy that is replenished over days or years.

In Metro Vancouver, clean, renewable energy will be primarily electricity from renewable sources such as hydro or solar power. Other forms of renewable energy, such as wood waste, biofuels and renewable natural gas, have a lower carbon footprint than comparable fossil fuels and are expected to support a transition to a carbon neutral region. However, they still produce emissions of common air contaminants, which have potential negative impacts for public health and the environment.

Discussion:
Reducing Transportation Emissions

The following sections outline proposed goals, example targets, example actions, and potential Big Ideas to reduce transportation emissions.

Proposed Long-Term Goals for Transportation Emission Reductions

Long-term goals describe a desired future state for low emission and carbon neutral transportation, with expected achievement in 2050 and beyond. Long-term goals will help identify and prioritize new actions to achieve the deep emission reductions required from the transportation sector. Emission reduction goals for the transportation sector in this region are the responsibility of multiple organizations, including Metro Vancouver, TransLink and others.

To achieve regional climate and air quality targets shown on page 2 over the long term—the next 30 years—more stringent transportation goals must be adopted by the relevant agencies.

Please consider the following long-term goals proposed for transportation in our region. Will these goals help us reach our vision for the region?

1. All travel within the region is made by active transportation or using zero emission technologies powered by clean, renewable energy.
2. All heavy duty trucks, marine vessels and rail locomotives operating within the region use zero emission technologies powered by clean, renewable energy.
3. All aircraft operating in the region use low emission technologies powered by clean, renewable energy.

Example Transportation Emission Reduction Targets

Near-term targets are milestones to support achievement of the long-term goals and will be included in the Climate 2050 Transportation Roadmap and the Clean Air Plan.

Please consider the following near-term targets from other jurisdictions. Are any of these the right milestones to help us reach our long-term goals? What should our near-term targets look like?

(Additional information on the targets is listed in the web links shown.)

By 2023:

1. Reduce port-related emissions (Port of Los Angeles – Long Beach)
2. Reduce nitrogen oxides by 59%
3. Reduce sulphur oxides by 93%
4. Reduce diesel particulate matter by 77%
By 2030:

5. 80% of residents can easily walk or bike to meet all basic daily non-work needs and have safe pedestrian or bicycle access to transit (Portland)

6. 30% of commercial vehicles are powered by renewable energy (Victoria)

7. 50% of the kilometres driven on city roads will be by zero emission vehicles (Vancouver).

By 2033:

8. Eliminate diesel use (San Francisco area)

By 2050:

9. 100% of vehicles will use renewable energy (Toronto, Victoria)

10. 80% of travel will be by foot, bicycle, or public transit (New York City)

11. Corporate shipping will produce net zero carbon dioxide emissions (Maersk)

12. Reduce shipping sector’s greenhouse gas emissions by 50% (International Maritime Organization)

Example Transportation Emission Reduction Actions

Actions are the policies and programs, including regulations, incentives and educational outreach campaigns, which will lead to emission reductions. Actions will be included in the Clean Air Plan and the Climate 2050 Transportation Roadmap. In addition to existing actions (see page 5) we need new actions to address the many opportunities we have to further reduce emissions and meet our near- and long-term targets.

Please consider the following actions from other leading jurisdictions, which show a range of actions that could be implemented to reduce emissions. Could any of these help us further reduce emissions to reach our goals? What should new, additional actions look like?

(Additional information on the actions is listed in the web links shown.)

Active Transportation and Transit

1. Bike share programs make cycling a convenient and accessible option for more trips (Minneapolis, Beijing, Buenos Aires).
2. **Regional Parking Strategy** will optimize parking space requirements to encourage switching to modes other than single occupancy vehicles (**Halifax**).

3. **Cycling highways** enable cyclists to reach their destinations faster (**Netherlands**).

4. **Vehicle Anti-Tampering Regulation** reduces tampering with vehicle emission control systems, to help ensure their effectiveness (**Ohio**).

5. **Vehicle emission inspection programs** such as the Heavy Duty Vehicle Inspection Program for heavy duty diesel trucks and buses, and the Smog Check Program for cars and trucks, identify high-polluting vehicles and enforce mandatory repairs (**California**).

6. **Gasoline and diesel vehicles bans** in city centres on certain days of the week, or outright, are being explored in many congested cities around the world to combat degraded air quality and drive greenhouse gas emission reductions (**Madrid, Rome, Paris**).

7. **Carbon tax for aviation** is being considered for flights within Europe (**European Union**).

8. **Rail electrification** to move people and goods using low emission electricity instead of diesel fuel (**Europe, Japan and Russia**).

9. **Zero emission delivery truck pilot** will explore the viability of zero emission trucks for local delivery (**Houston**).

10. **All-electric passenger ferries** can reduce congestion, support local tourism, and provide zero emission commutes along waterways (**New York City, Niagara Falls, Finland**).

11. **Delivery microhubs** reduce freight emissions by bundling goods in urban centres and supporting final delivery by zero emission modes, including cargo bikes and small electric delivery vans (**Berlin, Montreal**).

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Electric cargo truck


Strategies and Guidance

12. **Drive to Zero** partnership works with governments and industry to accelerate the early market for zero and near-zero emission trucks, buses and equipment (California).

13. **Community Risk Reduction Plans** require particulate matter filtration for new developments near major roadways and preferential deployment of clean air transit vehicles in hotspot areas, along with other measures to reduce exposure to transportation-related common air contaminants (San Francisco area).

14. **European Shortsea Network** promotes short sea shipping through guidance, idea exchange and identification of common problems (Europe).

Potential Big Ideas for Transportation Emission Reductions

To achieve a cleaner, healthier, more equitable future, we need to think big and act quickly. Metro Vancouver has identified several **Big Ideas** to accelerate emission reductions. The Big Ideas were selected for different reasons, including potential for significant reductions of air contaminant emissions (including greenhouse gases), ease of implementation or their foundational nature (i.e., they are needed to support other actions). The Big Ideas are generally examples from other leading jurisdictions around the world.

*Please consider the following Big Ideas. Could any of these help us drive significant emission reductions to reach our goals? What other Big Ideas should Metro Vancouver consider?*

**Big Idea 1: Reduce emissions through mobility pricing**

Metro Vancouver is a rapidly growing region with limited road space and worsening congestion issues. Congestion in the Metro Vancouver region is expected to increase by about 40% by 2030, which could increase fuel consumption and cause local air quality impacts.

Mobility pricing refers to how we pay to get around. Some types of mobility pricing (e.g., congestion charging, low emission zones) are used to manage demand for roads and reduce emissions. TransLink and the Mayors’ Council are continuing to study the potential of mobility pricing for the region.

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Mobility pricing can offer several anticipated benefits:

- **reduced emissions** – charging more to drive at specific times or on specific routes motivates drivers to switch to lower emission modes of transportation (e.g., carpool, transit, walking, cycling);

- **reduced traffic congestion** – charging more to drive at specific times or on specific routes motivates drivers to use another route, use alternate modes of transportation (e.g., carpool, transit, walking, cycling), or simply avoid travelling during peak periods; and

- **investments in transportation infrastructure** – mobility pricing can provide a stable source of funding for the transportation network.

Public support for mobility pricing will depend on how the policy design considers affordability challenges, improvements in transit access, and equitable ways to mitigate impacts.

Mobility pricing policies have proven effective in many jurisdictions around the world. Some examples of jurisdictions using mobility pricing and low emission programs are outlined below.

- **Ultra Low Emission Zone** requires vehicles to meet stringent emission standards to access certain parts of the city, or drivers must pay an emissions fee. This reduces emissions in the heavily populated urban core and the funding helps pay for investments in zero emission public transit and active transportation infrastructure (London, UK).

- **Off-peak delivery pilots** allow truck traffic companies to complete goods deliveries at night or other off-peak hours to improve urban freight logistics and reduce congestion and emissions (Stockholm, Region of Peel).

- **Congestion Pricing Program** is the first pricing system in the USA that will charge motorists for entering a specific city zone. Tolls will raise revenue for the local transportation authority to improve transit service (New York City).

**Big Idea 2: Broaden the accessibility of zero emission transportation options**

Many Metro Vancouver residents and businesses cannot yet afford to use low or zero emission vehicles. Despite a number of incentives available in the region for the purchase of low emission transportation options (e.g., Federal iZEV Program, Clean Energy Vehicle Program for BC, BC SCRAP-IT Program, and BC Specialty-Use Vehicle Incentive Program), purchasing, owning, or operating an electric vehicle or other electric mobility option, such as an electric bike, is still out of reach.

Metro Vancouver could work with the federal and provincial governments to expand or adjust existing programs or develop new programs to make zero emission transportation options available for more people.
Broader accessibility of zero emission transportation options offers several anticipated benefits:

- **reduced emissions** – newer vehicles generate less emissions than older vehicles; and

- **promotion of equity** – making zero emission transportation options accessible to more households, including low income households, will help reduce inequities as the region transitions to a low emission and carbon neutral economy.

Increasing accessibility of zero emission transportation options has proven effective in many jurisdictions around the world. Some examples of jurisdictions using equity-focused programs are outlined below.

- **Clean Vehicle Assistance Program** and companion programs like Drive EV in Sonoma County provide incentives for clean vehicle purchases. Incentive eligibility is based on household income and emissions profile of the vehicle (California).

- **Clean Cars for All** is a vehicle scrappage program that provides incentives for trading in an old vehicle. The incentive is based on income and the emission profile of the replacement transportation option. Participants can receive transit passes valued up to $7,500 or an electric vehicle incentive up to $9,500 (San Francisco area).

- **Blue LA** provides a zero emission transportation option for underserved residents by making electric vehicle car sharing accessible to low income neighbourhoods (Los Angeles).
Regional Transportation Adaptation to Climate Change

Expected Climate Hazards and Impacts

Transportation networks allow people and goods to move safely and reliably within the region and beyond. These networks function smoothly due to infrastructure including roads, street lights, traffic signals, rail lines, bridges, drainage systems and dikes.

Transportation infrastructure lasts for decades and has not always been designed to accommodate the anticipated impacts of climate change. Climate change adaptation needs to be considered during design and repairs to protect existing transportation infrastructure and avoid creating vulnerabilities that make adaptation more difficult and expensive in the future.

Our regional transportation networks may be impacted by the following climate hazards.

- **Severe weather** such as more intense rainfall, storms and high winds, which can lead to localized flooding, slope failures, power failures, and disruptions to the transportation network.

- **Sea level rise combined with storm surges** threaten the low-elevation parts of the transportation network with flooding.

- **Heat waves** are expected to increase in frequency, duration and intensity that will disproportionately impact the region’s most vulnerable populations, in addition to increasing cooling demands to residents and workers while travelling.

- Other hazards include **severe wildfire seasons**, which could damage transportation infrastructure.

These hazards could cause impacts to this region’s transportation networks in numerous ways, including those outlined below.

- **Provincial highways** and **municipal arterial roads** around the Fraser River and Burrard Inlet may be susceptible to flooding that could disrupt emergency services, delay goods movement, and isolate residents and workers. Wildfires and landslides pose additional threats by affecting transportation access in and out of the region.

- **Public transit** across the region could be impacted by flooding through disruptions to services and infrastructure for SkyTrain, West Coast Express, SeaBus terminals, and roads used by transit buses which would prevent residents and workers from travelling for work, school, health care and recreation.

- The **Vancouver International Airport** is located at sea level so its runways, terminal grounds, and access roads are vulnerable to flooding. Flooding could also impact smaller regional airports such as Boundary Bay Airport, Pitt Meadows Airport and Delta Heritage Air Park.

- **Truck routes** and **rail lines** servicing the Vancouver Fraser Port Authority and industrial lands in the region could be damaged or disrupted by flooding, sea level rise, storm surges and heat waves, which could have cascading effects for supply chains.

- **BC Ferries terminals** in Tsawwassen and Horseshoe Bay could be susceptible to flooding and increased delays from high winds, impacting passenger transportation as well as goods movement.

- **Local roads** in many local municipalities and First Nations reserves and treaty lands are vulnerable to flooding.
Transportation Discussion Paper to Support Climate 2050 and Clean Air Plan

Current Actions to Adapt Transportation to Climate Change

Metro Vancouver, together with its member jurisdictions and other agencies, has been taking action to adapt to the expected impacts of climate hazards on transportation. Some proposed, planned or current actions for transportation in our region are outlined below.

(Additional information on the actions is listed in the web links shown.)

1. **Updated long-term transportation plans** incorporate risk assessments for transportation infrastructure so owners and operators of critical transportation infrastructure have the appropriate information to implement adaptation measures (City of North Vancouver).

2. **Local coastal flood adaptation strategies** identify the impacts of climate change on coastal floodplains and develop strategies to reduce coastal flooding risks now and into the future (Surrey, Delta, Vancouver).

3. **Rainwater management plans** identify green infrastructure tools such as rain gardens and porous paving to reduce flood risk (Vancouver, Delta, Richmond).

4. **Professional Practice Guidelines** are being developed for engineers to consider climate change implications in infrastructure design (Engineers and Geoscientists BC, BC Ministry of Transportation and Infrastructure).

5. **Real time information on extreme weather conditions** improve provincial highway safety (Ministry of Transportation and Infrastructure).

6. **Raising the height of dikes** protects against major floods (Vancouver International Airport).

Roles and Responsibilities in Transportation Adaptation to Climate Change

Across the region, many different organizations are taking early action to understand and act upon different areas of vulnerability, but everyone has a role to play in preparing for a changing climate. Regional adaptation initiatives will require the cooperation and support of all levels of government. As the regional government, Metro Vancouver can act as a regional forum in facilitating collaboration with local municipalities and others to create efficiencies and improve alignment of adaptation strategies and actions.

Our Adaptation Opportunity

By proactively adapting our transportation networks to climate change and incorporating climate risk into land use planning, we can significantly reduce risks to health and safety as well as reduce severe financial loss. For example, creating redundant alternatives for critical transportation corridors would ensure the transportation network can continue to function if one corridor is damaged by a climate hazard (e.g., if a storm surge floods a critical road).

Climate resilience must be integrated into all transportation infrastructure, throughout its lifecycle. This requires a continuous and iterative process that incorporates emerging best practices supported by current climate science.
Discussion: Transportation Adaptation

The following sections outline proposed goals, example metrics, example actions, and a potential Big Idea to adapt to climate change impacts.

Proposed Long-Term Goal for Transportation Adaptation

Long-term goals describe a desired future state for a climate resilient transportation network, with expected achievement in 2050 and beyond. Long-term goals will help identify and prioritize new actions to achieve the adaptations required from the transportation sector. Adaptation goals for the transportation sector in this region are the responsibility of multiple organizations.

To achieve a climate resilient region over the long term—the next 30 years—more stringent transportation adaptation goals may need to be adopted by the relevant agencies.

Please consider the following long-term adaptation goal proposed for our region’s transportation sector. Will this goal help us ensure the region is resilient to climate change?

1. All regional transportation networks are resilient to the impacts of climate change expected during their life cycle, including higher temperatures, severe weather, floods and wildfire impacts.

Example Transportation Adaptation Metrics

To support achievement of the long-term adaptation goal, it is important to measure progress towards a climate resilient transportation network. How climate resiliency is measured is an emerging field of research and our region will be learning alongside other local jurisdictions. Adaptation metrics will be included in the Climate 2050 Transportation Roadmap.

Please consider the following proposed, planned or in-use adaptation metrics from other leading jurisdictions. Could any of these help us measure progress toward reaching our long-term goal? What should adaptation metrics look like for our region?

(Additional information on the metrics is listed in the web links shown.)

Transit and Transportation Network

1. Percent of transportation assets adapted for climate change resiliency (New York City).

2. Number of injuries/medical emergencies to workers and riders by temperature and rainfall (Los Angeles Transit Authority).

3. Percent of transportation facilities and vehicles with cool roofs to reduce cooling energy loads (Los Angeles Transit Authority).

4. Percent of bus stops with shade (Los Angeles Transit Authority).

5. Number of transit stops (including high-speed rail) providing service to vulnerable or low income populations (California).

6. Average time to clear selected surface transportation facilities of weather-related debris after weather impact (US Federal Highway Agency).

7. Percent of rail stations, bus yards and other critical facilities with back-up generator capacity (Los Angeles Transit Authority).

Roads

8. Miles of transportation network impacted by coastal and/or inland flooding (California).

9. Percent of state-owned roads that have a climate change vulnerability assessment (California).

Example Transportation Adaptation Actions

Actions are the policies and programs, including requirements, incentives and educational outreach campaigns, which will lead to a more climate resilient transportation network. Actions will be included in the Climate 2050 Transportation Roadmap. In addition to existing actions (see page 17), we need new actions to address the many opportunities we have to increase resilience and meet our long-term goals.

Please consider the following proposed, planned or underway actions from other leading jurisdictions. Could any of these help us increase resilience to reach our goal? What should new, additional actions look like?

Transit and Transportation Network

1. **Increase transportation network redundancy** to improve the ability to adapt to unexpected events and increase the resiliency of the transportation network (New York City).

2. **Enhance design standards** to require transit station entrances to be 50-110 cm above the 200-year flood level (Taipei, Taiwan).

3. **Double the capacity of ventilation shafts** in subways to provide more cooling air flow (London, United Kingdom).

4. **Plan for temporary transit services** in the event of climate-related disruptions (New York City).

5. **Develop a strategy** to reduce chronic flooding that reduces travel lane capacity on major transit routes (Seattle).

6. **Identify climate impacts to disadvantaged communities** who rely upon the transportation system (San Francisco).
7. **Surat Climate Change Trust** coordinates flood management adaptation actions between a dozen different agencies, including city officials, natural resource authorities and state disaster management authorities (India).

8. **Improve cycling safety** as more residents travel by bicycle in warmer weather (Berlin).

9. **Room for the River strategy** gives more space for water to spread out during a flood by, for example, moving dikes inland, widening rivers and raising bridges (Netherlands).

**Roads**

10. **Strengthen insurance coverage** for new road concessions to enhance financial protection for infrastructure (Colombia).

11. **Retrofit traffic signals** to LED lights with back-up batteries, which reduce energy use and prevent signal outages during power outages (Sacramento County).

12. **Implement more aggressive forest and vegetation management** next to critical highway or transportation infrastructure to minimize impacts to transportation network from wildfires (California).

13. **Green Infrastructure pilot** identifies conceptual design plans for how green infrastructure can protect coastal highways from extreme weather and other climate impacts (Oregon).

14. **Explore the suitability of different porous asphalts** to reduce impacts from flooding (London, United Kingdom).

15. **Develop standard plans** for implementing mandatory high-occupancy vehicle requirements following extreme weather to reduce traffic congestion (New York City).

16. **Culvert prioritization criteria** identify aspects such as risk of catastrophic failure, culvert condition, maintenance frequency, maintenance difficulty, traffic volume, and risk to public safety, among other factors (Oregon).

**Marine and Rail**

17. **World Bank Maritime Investment Project** improves the safety, efficiency and climate resilience of marine infrastructure in Pacific islands which depend on transport by boat for everything from education to health care (Marshall Islands).

18. **Reduce rail locomotive speeds** when temperatures reach 32 degrees Celsius to minimize track deformation at high temperatures (Port of Long Beach).

19. **Install constant-tension power wires** for trains to resist heat-related damage (Amtrak).

**Potential Big Ideas for Transportation Adaptation**

To respond to the accelerating impacts of climate change, we need to think big and act quickly. Metro Vancouver has identified one Big Idea to improve regional resilience. The Big Ideas were selected for different reasons, including potential to significantly advance climate resilience of the transportation network, ease of implementation or their foundational nature (i.e., they are needed to support other actions). The Big Ideas are generally examples from other leading jurisdictions around the world.

Please consider the following Big Idea. Could this help us to significantly advance climate resilience for the transportation network? What other Big Ideas should Metro Vancouver consider?

**Big Idea 1: Conduct a comprehensive transportation climate change vulnerability assessment**

The transportation sector faces distinct vulnerabilities due to its size, complexity and the need for long-term planning that considers uncertain impacts from climate hazards.

A comprehensive climate change vulnerability assessment for the transportation network could support adaptation planning by identifying transportation infrastructure that is most likely to be impacted by climate change hazards.
Vulnerability assessments offer several anticipated benefits:

- **Early identification of specific regional vulnerabilities** will help understand the economic costs to communities, economies, infrastructure and ecosystems from climate change; and

- **Development of policy solutions** – assessments inform climate resiliency requirements, such as updated design criteria, that could be applied to new major transportation projects or retrofits of existing transportation infrastructure.

Various agencies have completed or are planning vulnerability assessments and updates to design criteria to help make our transportation infrastructure more resilient. Some local examples are shown below.

- The Fraser Basin Council is leading the Lower Mainland Flood Management Strategy to help identify the most significant regional flood vulnerabilities and estimate the potential structural, economic and social impacts of major flood scenarios.

- TransLink is incorporating climate change vulnerability assessments into asset management planning to manage risks related to existing and new infrastructure.

- The BC Government has completed vulnerability assessments for highway systems and requires infrastructure design work for the Ministry of Transportation and Infrastructure to include climate change implications.

There is an opportunity to develop a comprehensive vulnerability assessment for the entire transportation network, rather than each agency focusing only on their specific jurisdiction. As a regional forum, Metro Vancouver could help coordinate with various organizations to conduct a comprehensive vulnerability assessment for the regional transportation network.
Feedback and Engagement Process

Metro Vancouver invites feedback from diverse viewpoints to help shape Climate 2050 and the Clean Air Plan and will carefully consider all input. Feedback is welcome by email at CleanAirPlan@metrovancouver.org or Climate2050@metrovancouver.org, or by telephone at 604-432-6200.

To ensure your comments are considered please provide feedback by April 30, 2020.

Participation Opportunities

Metro Vancouver will provide a variety of engagement opportunities to hear input on this discussion paper. The public, stakeholders, and other levels of government can participate via the following:

- online public survey;
- open comments to a dedicated email account;
- public dialogue or forum;
- public webinars; and
- direct feedback to Metro Vancouver staff.

Details about events will be posted on the Clean Air Plan and Climate 2050 websites (see blue box on this page).

Feedback on any part of this discussion paper is welcome at any time through the engagement period. Initial events will focus on proposed goals and example targets, and initial identification of potential actions. Later events will include consideration of the potential emissions pathways need to reach our regional climate change and air quality targets.

How Feedback Will Be Used

With revisions, content from this discussion paper will form the basis of the transportation section of the Clean Air Plan and the Climate 2050 Transportation Roadmap, both of which will be available for comment and feedback before they are finalized. (Note that actions identified in the final Clean Air Plan and any of the Climate 2050 Roadmaps that could result in significant changes to existing air emission regulations or new regulations may require an independent public engagement process before any regulations or amendments are adopted.)

Where appropriate, Metro Vancouver will share feedback with TransLink, to support the development of Transport 2050. Comments and suggestions will be compiled into a summary report for consideration by the Metro Vancouver Board, and will be made publicly available in 2020.

Metro Vancouver staff will treat personal information with confidentiality; please note that comments you submit may be provided to a third party if a freedom of information request is made under the Freedom of Information and Protection of Privacy Act. If you have any questions or comments regarding the consultation process, please call 604-432-6200.

Thank you for taking the time to provide your valuable feedback.

For more information, visit www.metrovancouver.org and search “Clean Air Plan” or “Climate 2050”, or call 604-432-6200.
Glossary

Active transportation includes self-powered modes of transportation such as walking, biking, skateboarding, in-line skating/rollerblading, jogging and running, wheel chairing, snowshoeing and cross-country skiing.

Air contaminants are any substances emitted into the air that do or could a) harm public health (including material physical discomfort) and property, b) damage the environment, including the climate, c) impede normal business operations, or d) impair visual air quality.

Ambient air quality objectives and standards are health-based targets which define the acceptable outdoor concentration of key air contaminants. Metro Vancouver and the federal and provincial governments adopt objectives and standards that become more stringent over time, to drive continuous improvement in air quality.

Carbon neutral region is a region that has achieved the deepest greenhouse gas emissions reductions possible across all economic sectors, and removes or captures sufficient carbon dioxide to balance any remaining regional greenhouse gas emissions.

Climate change adaptation means anticipating, planning for and responding to the adverse effects of climate change and taking appropriate action to prevent or minimize the damage it can cause, or taking advantage of opportunities that may arise. It has been shown that well planned, early adaptation action saves money and lives later.

Climate resilience describes the capacity of ecosystems, economies, infrastructure, and communities to absorb the impacts of climate change while maintaining essential services and functions needed to support health and well-being. In some cases, climate resilience involves changing services and functions so they are more sustainable.

Common air contaminants are air contaminants that can harm public health and reduce residents’ quality of life and life expectancy by causing heart and lung diseases, cancer, asthma, and other impacts. Some air contaminants have odorous characteristics. Common air contaminants include fine and coarse particulate matter, diesel particulate matter, ground-level ozone, nitrogen dioxide, sulphur dioxide and volatile organic compounds.

Diesel particulate matter is a form of particulate matter from diesel engines that is classified as carcinogenic.

Fine particulate matter (PM2.5) is made up of tiny solid or liquid particles that float in the air and can penetrate deep into the lungs and even into the bloodstream. Fine particulate matter can damage people’s health by aggravating existing lung and heart diseases, increasing the risk of cancer and reducing life expectancy.

Greenhouse gases are air contaminants that trap heat and are the cause of climate change. Greenhouse gases include carbon dioxide and nitrous oxide, as well as short-lived climate forcers such as methane, halocarbons, black carbon and ozone. Limiting or preventing greenhouse gas emissions and removing these gases from the atmosphere is critical to avoiding catastrophic climate change (sometimes referred to as climate change mitigation).

Ground-level ozone (O3) can have harmful impacts on everyone, especially children, seniors, and people with lung and heart conditions. It is primarily formed when nitrogen oxides and volatile organic compounds react in the air on hot and sunny days.

Hazard refers to a dangerous phenomenon, substance, human activity, or condition. In this context, hazards are caused or made worse by climate change. Examples include rainstorms, extreme weather, wildfires, storm surges, and landslides.

Impacts refers to the consequences of realized risks on ecosystems, economies, infrastructure and communities. Impacts may be referred to as consequences or outcomes, and can be adverse or beneficial.

Nitrogen dioxide (NO2) can damage people’s health by aggravating existing lung diseases like asthma and bronchitis, and reducing immunity to lung infections. It is formed during high-temperature fuel combustion.
Nitrogen oxides (NO\textsubscript{x}) are a group of gases, which includes nitrogen dioxide, that are produced during high-temperature fuel combustion, and can contribute to the formation of ground-level ozone and fine particulate matter.

Sulphur dioxide (SO\textsubscript{2}) is emitted during the combustion of sulphur-containing fuels. Exposure to high levels of sulphur dioxide can damage people’s health by aggravating asthma and increasing respiratory symptoms.

Sulphur oxides (SO\textsubscript{x}) are a group of gases, which includes sulphur dioxide, that are emitted during the combustion of sulphur-containing fuels. They can also react with other substances in the air to form particulate matter.

Visual air quality is how clear the air looks to the average observer. Metro Vancouver and its partners measure visual air quality on a scale from "very poor" to "excellent" at five sites in the Lower Fraser Valley.

Volatile organic compounds (VOC) are compounds that easily become vapours or gases; they are emitted during fuel combustion and from many consumer products. They have direct and indirect impacts on human health and contribute to the formation of ground-level ozone.

Vulnerability is the degree to which ecosystems, economies, infrastructure and communities are susceptible to, or unable to cope with, the adverse effects of climate change. Vulnerability varies based on exposure, sensitivity and adaptive capacity. Geographic location, socio-economic conditions, and other factors can impact susceptibility to harm and adaptive capacity.

Vulnerability assessments identify areas or populations most likely to be impacted by projected changes in climate and build an understanding of why these areas are vulnerable, including the interaction between climate change, non-climatic stressors and cumulative impacts. Assessments evaluate the effectiveness of previous coping strategies and target potential adaptation measures.
Metro Vancouver is a federation of 21 municipalities, one Electoral Area and one Treaty First Nation that collaboratively plans for and delivers regional-scale services. Its core services are drinking water, wastewater treatment and solid waste management. Metro Vancouver also regulates air quality, plans for urban growth, manages a regional parks system and provides affordable housing. The regional district is governed by a Board of Directors of elected officials from each local authority.

Member jurisdictions of Metro Vancouver include:

- Village of Anmore
- Village of Belcarra
- Bowen Island Municipality
- City of Burnaby
- City of Coquitlam
- City of Delta
- Electoral Area A
- City of Langley
- Township of Langley
- Village of Lions Bay
- City of Maple Ridge
- City of New Westminster
- City of North Vancouver
- District of North Vancouver
- City of Pitt Meadows
- City of Port Coquitlam
- City of Port Moody
- City of Richmond
- City of Surrey
- Tsawwassen First Nation
- City of Vancouver
- District of West Vancouver
- City of White Rock