Regional Long-Range Growth and Transportation Scenarios

SUMMARY REPORT

APRIL 19, 2019

metrovancouver

TRANSLINK
# Table of Contents

Executive Summary ................................................................. 4  
What Sort of Future Are We Planning For? ........................................... 5  
What is Scenario Planning? ............................................................ 6  
Climate Change ............................................................................. 8  
Understanding the Scenarios .............................................................. 10  
Four Possible Futures Compared—2050 Scenarios ........................................ 11  
Scenario A: Trend Forward .............................................................. 12  
Scenario B: Automation-Driven Decline ................................................. 14  
Scenario C: Self-Sufficiency ............................................................... 16  
Scenario D: Automation-Driven Boom ............................................... 18  
Next Steps ....................................................................................... 20  
Appendix A: Detailed Scenario Summary Table .......................................... 22  
Appendix B: Key Facts Supporting Scenario Development ......................... 26  
Endnotes ......................................................................................... 27  
References ....................................................................................... 29
Executive Summary

When we plan for the future, what sort of future are we planning for? Our current regional strategies are all premised on a future that looks much like the past. Recognizing that the future is always uncertain, the scenarios described in this report instead lay out four distinct futures, each considering what the year 2050 may look like in the Metro Vancouver region. Metro Vancouver and TransLink will use these four scenarios as a tool to better account for uncertainty and help to identify land use and transportation strategies that will be effective in a wider variety of circumstances.

The Long-Range Growth and Transportation Scenarios project began with an assessment of 25 key external forces that will likely influence the future of the region and narrowed down to the two with both the highest potential impacts and also the highest degree of variability: Technology and Automation and Economy and Trade.

These two forces provide the basis for four divergent but possible future scenarios:

**Scenario A: Trend Forward** which looks a lot like the current trajectory that we’re on today – with a prosperous and diversified regional economy and steady population and job growth.

**Scenario B: Automation-Driven Decline** where foreign investment in a now highly automated economy keeps the regional economy going – despite higher unemployment and growing income inequality.

**Scenario C: Self-Sufficiency** where declines in global trade and a subsequent weakening of the national economy leads to federal restrictions on immigration and lower population and job growth. The regional economy re-orientates to be more focused on local production and self-sufficiency.

**Scenario D: Automation-Driven Boom** where Canada’s more open immigration policy attracts a highly mobile global workforce to Metro Vancouver. Population and employment grow much faster as a result.

Each scenario presents opportunities the region could leverage and challenges the region might want to mitigate against. For example, high automation might improve our productivity but could also displace many livelihoods and worsen income inequality. Increasing global trade barriers might slow the national economy but could also create opportunities for new local production and manufacturing.

The scenarios also acknowledge that over the coming decades our region may see much more or much less population and employment growth, economic growth, federal investment, housing affordability, goods movement, and volume of passenger trips to name just a few key indicators. As we collectively plan for the future of the region, these scenarios will serve as a useful tool to help us make better decisions today in the face of uncertainty about the future.
What Sort of Future Are We Planning For?

Metro Vancouver is known for its natural beauty and world-class livability. Home to Canada’s biggest seaport and gateway to the Pacific, as well as growing creative and knowledge-based industries, the region enjoys one of the fastest growing economies in the country. As a result, Metro Vancouver remains an attractive place to live, work and play and has continued to experience significant population growth fuelled by immigration from abroad as well as migration from the rest of Canada.

Metro Vancouver 2040: Shaping our Future, the regional growth strategy, the Regional Transportation Strategy and the Mayors’ 10-Year Vision for Transit and Transportation provide a shared vision for managing regional growth and transportation over the coming decades. These regional plans assume a future where social, economic and environmental forces continue to look much like they do today. Some of the emerging trends and new realities facing the region, such as climate change and automation (i.e. new technologies such as artificial intelligence and robotics), were not thoroughly explored in these strategies, but have the potential to dramatically shape the future of the region.

Recognizing that the future is always uncertain, Metro Vancouver and TransLink have collaborated on this project to explore possible futures, along with the opportunities and challenges that result, to provide a new common starting point for long-range planning in the Metro Vancouver region.

While typical planning processes assume that past trends will continue forward, scenario planning allows the exploration of different potential futures that consider difficult-to-predict and new variables. With this approach, we can better manage uncertainty and identify strategies that will be more resilient.

Approaches to Planning for the Future

<table>
<thead>
<tr>
<th>WHAT WE KNOW TODAY</th>
<th>FUTURE</th>
</tr>
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<tbody>
<tr>
<td>Point Forecast</td>
<td>Planning for a single future by extrapolating from the recent past.</td>
</tr>
<tr>
<td>Risk Management</td>
<td>Planning for a single future with contingency planning to account for modest variations.</td>
</tr>
<tr>
<td>Scenario Planning</td>
<td>Planning for multiple plausible futures that may be quite different from the present.</td>
</tr>
</tbody>
</table>
What is Scenario Planning?

In scenario planning, stories are crafted to represent a range of potential but realistic futures that could come about because of forces beyond our control. Broadly defined, external forces are trends and disruptors that could impact the future of the region in significant ways, change the availability and ways in which land might be used, and affect the ways in which people travel.

Scenario planning in Metro Vancouver

The scenario planning process began by identifying and exploring a list of these external forces. As a globally-connected metropolitan region, there are many external forces that will have potential impacts on Metro Vancouver. For many forces, we have a pretty good idea of scale of impact and how they are likely to unfold. For others, we know the impacts will likely be significant, but we have less ability to predict exactly how these impacts will play out in our region.

For the scenario building exercise, 25 external forces were identified. The external forces include emerging trends in technology, the economy, society, the environment, the nature of work and more. Both impact and variability for each external force were explored – looking at the degree to which each force is likely to impact the region as well as the variability in how and when the impacts may unfold.

25 external forces considered:

1. 3D Printing
2. Advanced Building Construction Technology
3. Aging Population / Changing Demographics
4. Agricultural Productivity & Food Security
5. Artificial Intelligence & Autonomous Things
6. Biotechnology & Gene Therapy
7. Changing Attitudes & Preferences
8. Climate Change & Natural Hazards
9. E-Commerce & Blockchain
10. Electric Mobility
11. Federal Immigration Policy
12. Federal Infrastructure Funding
13. Gig Economy & Precarious Employment
14. Global Outsourcing & Re-shoring
15. Green Energy Transition
16. Internet of Things & Digital Connectivity
17. Local Government’s Growing Role
18. Nanomaterials
19. Quantum Computing
20. Real Estate Market Dynamics
21. Shared-Use Mobility
22. Sharing / Platform Economies
23. Shifting Global Economy & Trade
24. Urbanization
25. Virtual Reality / Augmented Reality
The Four Scenarios
The external forces were then grouped together into the two categories of forces with the highest impact and the highest degree of variability. These categories helped shape the four scenarios described below. The two categories are:

Automation & Technology - which will likely have profound impacts across every sector of the economy, but in ways that we cannot yet reliably predict; and

Economy & Trade, which is entering a period of greater uncertainty driven by changes in technology and global political developments.
Climate Change

Climate change is one of the greatest challenges of our time, and one that is already impacting the world and our region. In Metro Vancouver we are experiencing hotter and drier summers and warmer, wetter winters – both trends which are expected to become more severe. Detailed climate change projections have been completed for the region and significant work is underway to understand the impacts, including increased flood risk.

There is a higher level of confidence projecting climate change impacts for the region between now and 2050. As a result, all four scenarios presented assume that the impacts of climate change will reflect the higher end of accepted global (International Panel on Climate Change) and local (Pacific Climate Impacts Consortium) projections.

Globally, the impacts of climate change have been seen to lead to an increasing number of water shortages, crop failure and food shortages, flooding, famine and armed conflict. These factors are likely to result in increased number of migrants seeking to come to Canada and the region.

Potential Coastal Flood Extent (with a 1 Metre Sea Level Rise)²
Regionally, anticipated local climate change impacts could include:

- Rising sea levels and faster snow melt increasing the risk of flooding in low-lying areas, especially those along the coast and the Fraser River;
- More extreme rainfall events, especially during the wettest parts of the year, increasing the risk of localized flooding in streets, businesses and homes;
- Increased strain on the region’s existing water supply during times of the year when there are high temperatures and water is in high demand;
- Native species of plants, trees, and animals that have historically thrived in the region will be impacted. Rising temperatures will shift the types of crops that can be grown; rising temperatures may also increase pest and disease issues;
- Warmer winters with less ice and frost may improve road safety and increase opportunities to walk and cycle; and
- An increased number and duration of summer wildfires will impact air quality in the region, affecting the health of the community and may reduce the desire to walk and cycle.

Of the climate change impacts anticipated in this region, flooding will have the greatest potential to impact land use and transportation systems. The map above shows the potential extent of a major coastal flood event assuming one metre of sea level rise.

While the above climate impacts are embedded in all four scenarios, each scenario has different assumptions around the ability to afford measures to adapt to climate impacts.

**PROJECTED CHANGES IN HEAT IN METRO VANCOUVER**

<table>
<thead>
<tr>
<th></th>
<th>Past</th>
<th>2050</th>
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</thead>
<tbody>
<tr>
<td>Summer Days (# of days &gt;25°C)</td>
<td>22</td>
<td>55</td>
<td>2.5X increase</td>
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<tr>
<td>Heat Days (# of days &gt;30°C)</td>
<td>2</td>
<td>14</td>
<td>7X increase</td>
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Understanding the Scenarios

To help illustrate how the region could get from the present day to each of the four different futures presented in the scenarios, the following pages offer conceptual storylines describing fictional, but plausible paths that could lead the world and the region into each of these four different futures.

Each scenario is driven by a different set of assumptions that impact the region's population growth, where people live and work, their type of employment, income, and how they move around. Metro Vancouver and TransLink collaborated with partners and subject matter experts and conducted research to ensure that the scenarios are reasonable, internally consistent, and plausible given current data, research and thinking.

This exercise is not about choosing a preferred future, or about proposing a set of policy actions. The purpose of the project is to describe and understand divergent but possible futures for the region to the year 2050. The results will help us and decision makers better understand and prepare for the potential challenges and opportunities in each future.

To that end, each of the four scenarios assumes that existing policies, regulations, and investments remain consistent with Metro Vancouver 2040: Shaping our Future, and the Mayors’ 10-Year Vision for Transit and Transportation.
### Four Possible Futures Compared—2050 Scenarios

Each indicator is defined in Appendix A: Detailed Scenario Summary Table

<table>
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<tr>
<th>Indicator</th>
<th>Today</th>
<th>SCENARIO A: Trend Forward</th>
<th>SCENARIO B: Automation-Driven Decline</th>
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<th>SCENARIO D: Automation-Driven Boom</th>
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<td>2.57 million</td>
<td>+40% (3.6 million)</td>
<td>-0% (2.6 million)</td>
<td>+20% (3.1 Million)</td>
<td>+80% (4.6 million)</td>
</tr>
<tr>
<td>Distribution of Housing</td>
<td>55% in Urban Centres and Corridors</td>
<td>More dispersed</td>
<td>More concentrated</td>
<td>More concentrated</td>
<td>No change</td>
</tr>
<tr>
<td>Total Jobs</td>
<td>1.34 million</td>
<td>+35% (1.8 million)</td>
<td>-20% (1.1 million)</td>
<td>+10% (1.5 Million)</td>
<td>+60% (2.1 million)</td>
</tr>
<tr>
<td>Distribution of Jobs</td>
<td>--</td>
<td>More concentrated</td>
<td>More concentrated</td>
<td>More dispersed</td>
<td>More dispersed</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>4.3%</td>
<td>No change</td>
<td>↑↑</td>
<td>No change</td>
<td>↓</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>$73,000</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>No change</td>
</tr>
<tr>
<td>Income Equality</td>
<td>--</td>
<td>↓</td>
<td>↓↓</td>
<td>↑</td>
<td>No change</td>
</tr>
<tr>
<td>Daily Travel Demand</td>
<td>2.8 trips per person/day</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
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<tr>
<td>Trip Length</td>
<td>Average length 9 km</td>
<td>↑</td>
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<tr>
<td>Share of Passenger Vehicles that are Autonomous</td>
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<td>30%</td>
<td>70%</td>
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<tr>
<td>Flood Risk</td>
<td>--</td>
<td>Significant increase</td>
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Globally by 2050, artificial intelligence and automation have had significant, diverse impacts on economic competitiveness and employment across sectors and countries. Some countries have harnessed AI to enhance their workforces while others, whether due to caution, popular opposition, or limited investment resources, have incorporated automation in more limited ways.

In the region by 2050, automation is common in repetitive, labour-intensive jobs such as farming, primary manufacturing, and in many retail and service industries. The trends we see today will continue to materialize as expected.

Improved productivity from automation and continued growth in consumer demand overseas results in increasing global trade through Metro Vancouver. Regional goods movement also continues to grow because of economic and population growth, regionally, and the steady growth in e-commerce and just-in-time deliveries. Privately-owned automated vehicles (AVs) become more common in the region.

Overall, the region continues to focus growth in urban centres and corridors, in line with current regional and local plans. Clusters of specialized creative industries and labour, in the areas of film, social media or high-value food and beverage production, are increasingly distributed throughout Metro Vancouver.

### IMPLICATIONS

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<tr>
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<td>Mode Share</td>
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<td>Private motorized: ↑↑ Shared motorized: ↓ Active: ↓</td>
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<tr>
<td>Federal Gov’t Funding</td>
<td>--</td>
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<tr>
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OPPORTUNITIES AND CHALLENGES

Automation improves job productivity and creates new jobs in some sectors, but impacts low-income workers and small businesses.

• New jobs in technology, creative, and care provider professions are created.
• The region’s population increases at historical rates through strong immigration.
• Automation disproportionately impacts lower-income workers predominantly performing repetitive mechanical tasks, decreasing equity.
• Small businesses are less able to adopt automation due to the costs, and some struggle to keep pace with larger corporations.
• Short-term contract work (i.e. gig work) continues to become more common.

Autonomous vehicles may not increase efficiency, and could even increase congestion.

• People are generally less concerned about being caught in traffic as in-vehicle time becomes usable for work, sleep, or entertainment.
• Gridlock persists as many AVs travel empty without passengers, and road supply remains limited.

• Longer travel distances combined with regional population growth continue to increase traffic congestion and overcrowding on roads and transit.
• Walking and cycling decreases, partly as a safety precaution with the significant uptick of vehicles on the road.

People choose or are forced to seek housing outside the region and commute longer distances.

• Continuing challenges with housing affordability lead to more people living in more affordable places like the Fraser Valley, Sea-to-Sky corridor, the Sunshine Coast and even Vancouver Island.
• The region continues to be an attractive place to live, however the cost of living and housing remains high.

People continue to locate in flood prone areas which increases vulnerability.

• Population continues to grow in flood prone areas which increases vulnerability during flooding from rivers and due to sea level rise.
Globally by 2050, automation is common across most economic sectors. Artificial intelligence (AI) and advanced robotics are regular parts of the workplace. Workers move beyond repetitive, labour-intensive jobs into professions like teaching, healthcare delivery, and research & development. No job types are left untouched by AI and robots.

In the region by 2050, automation in the workplace has resulted in significant job displacement. A small number of foreign companies have automated entire supply chains in BC’s abundant natural resources sector in the areas of forestry, mining, and oil and gas. From resource extraction to shipping, a small number of workers will do the work that previously employed thousands. Similarly, in retail and services, companies have continued to automate most jobs and online retailing continues to dominate local businesses.

While the owners and investors of the major companies operating in BC have profited, overall wealth in the region has declined. Median household income has decreased due to limited and precarious employment opportunities for most people. This also has created an unbalanced trade market, with far more wealth and goods leaving the region, compared to what is being invested and consumed locally. There is a higher volume of export-oriented goods movement traffic through the region, primarily of raw materials shipping overseas. There is less regionally-focused economic activity, and so local goods movement is primarily oriented around consumer goods and e-commerce deliveries. There is an increasing share of automated trucks on the road, as there is still significant movement of goods from the few companies that have automated their supply chains.

With decreased employment and wealth in the region, there is less trip demand and congestion. Transport equity is of concern, with an increased emphasis on transit, but limited ability to provide transit services across the region due to decreased government funding.

### SCENARIO B: Automation-Driven Decline

**Automation-driven job losses and outmigration result in a regional economy in decline**

#### IMPLICATIONS

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**Scenario B: Automation-Driven Decline**

Regional Long-Range Growth and Transportation Scenarios: SUMMARY REPORT

14
OPPORTUNITIES AND CHALLENGES

With lower population and employment, the region struggles to provide essential services.

- With fewer employment opportunities available, regional population growth slows as immigration rates decrease sharply. In addition, residents move to other regions/provinces with lower costs of living and better employment opportunities.

- A high proportion of remaining residents are over 65 years old, and the labour force shrinks. The aging population requires additional services, including higher demands on the health care system. But a reduced tax base decreases investments in social programming and reduces benefits and services for retirees.

- With declining population and employment, reduced government revenues make climate change adaptation more challenging.

Housing affordability improves, but wealth inequity persists.

- Slower population growth allows the housing supply to catch up with demand and housing prices stabilize.

- Income inequality remains high owing to precarious employment and low wages for the majority. Automated production increases value to the regional economy, but there are fewer jobs and lower incomes, and most wealth is captured by a limited few.

There is less travel throughout the region, but some individuals need to travel a lot more.

- With decreased employment and wealth in the region, there are fewer trips occurring. However, some workers travel significantly more, tying multiple contract jobs together in a day.

- Trips to multiple jobs are generally undertaken by a reduced-service transit system or by privately-owned automated vehicles.

- Some lower-income households require owning a vehicle to work multiple jobs.

Automation allows for cheaper goods production and movement.

- There is a higher volume of export-oriented goods movement traffic through the region, primarily of raw materials shipping overseas.

- Local goods movement is primarily oriented around e-commerce deliveries. There are more automated trucks on the road, as there is still significant movement of goods from the companies that have automated their supply chains.
Globally by 2050, in response to discontent about rising unemployment and income inequality, many countries adopt policies that restrict trade and limit immigration. These political shifts, combined with technological developments such as 3D printing, support the return of manufacturing to Canada, but in the form of smaller, more localized production. Small-scale artisans, makers, and producers deploy automation to enhance their productivity.

In the region by 2050, there is increased pressure to diversify the economy as the region has previously relied on international trade for many goods and services. Some trade continues, though heavy tariffs make importing and exporting more expensive.

A decline in global inter-connectedness changes how business is conducted. Changes to global immigration policies reduce opportunities for migrants seeking refuge from climate change impacts. Canada continues to rely on immigration and it remains a driver of growth in Metro Vancouver. Median household income is relatively flat, with a higher cost of goods due to new import tariffs and a weakened Canadian dollar. Economic growth continues at a sustained pace.

With less global trade, there is greater incentive to transition to a more sustainable circular economy that uses fewer resources and produces less waste. Access to imported goods and services are impacted. New technologies such as automation and 3D printing are leveraged, enabling local manufacturing and more distributed production. Many local workers are required to shift their occupations, particularly those who worked for companies elsewhere in the world, as well as those who worked in jobs dependent on international trade. Short-term contract work (i.e. gig work) is more common.

There are fewer truck kilometres travelled on the road owing to less global trade and more integrated regional production. There is a lower AV adoption rate due to lack of global investment here and limited manufacturing capabilities to advance the technology within Canada.

### IMPLICATIONS

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OPPORTUNITIES AND CHALLENGES

Protecting agricultural land becomes more essential.

• Regional food supply may be compromised by increased trade barriers. Agricultural lands become more important in meeting the region’s food needs as the cost of food imports increase.

• Climate change impacts may further stress the ability to produce food and threaten food security in the region.

Repurposing industrial lands.

• With less need for port and trade-enabling lands, demand for locally-serving commercial and industrial land increases along with local production.

Motor vehicle travel becomes more expensive and shared-use travel increases.

• Motorized vehicle travel is relatively more expensive due to rising fuel costs, and there is a lower AV adoption due to lack of global investment here and limited manufacturing capabilities to advance the technology within Canada.

• At the same time, there is a greater focus on self-reliance and low-cost solutions that leads to an increase in demand for active and shared-use modes.

Housing becomes more affordable and infrastructure becomes overbuilt.

• With slowing population growth, housing affordability improves in the region, as housing supply catches up with demand and recalibrates to local wages.

• Existing infrastructure becomes overbuilt relative to the reduction in global trade, especially marine-based trade infrastructure. Provincial and national trade increases, requiring more land-based trade infrastructure.
Globally by 2050, advances in digital connectivity and immersive technologies like virtual reality have reshaped where people choose to live and work. It is common to live in one region while working for a company elsewhere in the world. Major advances in zero-marginal-cost renewable energy systems combined with high levels of automation across most sectors dramatically improves productivity and consumption and global trade increases accordingly.

In the region by 2050, Metro Vancouver remains an attractive place to live relative to much of the world and is sought after for its livability. It continues to attract a larger share of a now highly mobile global workforce welcomed to Canada through a more ambitious federal immigration policy. While population and employment both grow significantly as a result, much of the primary work that people do is for larger knowledge and creative sector companies headquartered elsewhere in the world.

Some workers displaced by automation struggle to find a new job in emerging sectors. Senior levels of government steps in to provide a type of guaranteed income, but the amount is generally not enough to improve income equality. Jobs in this new economy are more distributed around the region – closer to peoples’ homes resulting in somewhat shorter commutes. The increase in wealth also means that some people choose to privately own AVs but many more choose to subscribe to their mobility needs as a service, taking advantage of the many shared-use options.

There is an increase in on-demand delivery of goods and services, reducing personal trips but increasing local delivery traffic. There are also more (non-work related) discretionary trips resulting from the increased wealth in the region.

**SCENARIO D: Automation-Driven Boom**

Automation drives a new economic boom led by new creative & knowledge sectors

### IMPLICATIONS

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>TODAY</th>
<th>SCENARIO D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional Population</td>
<td>2.57 million</td>
<td>+80% (4.6 million)</td>
</tr>
<tr>
<td>Distribution of Housing</td>
<td>55% in Urban Centres and Corridors</td>
<td>No change</td>
</tr>
<tr>
<td>Total Jobs</td>
<td>1.34 million</td>
<td>+60% (2.1 million)</td>
</tr>
<tr>
<td>Distribution of Jobs</td>
<td>--</td>
<td>More dispersed</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>4.3%</td>
<td>↓</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>$73,000</td>
<td>No change</td>
</tr>
<tr>
<td>Income Equality</td>
<td>--</td>
<td>No change</td>
</tr>
<tr>
<td>Daily Travel Demand</td>
<td>2.8 trips per person/day</td>
<td>↓</td>
</tr>
<tr>
<td>Trip Length</td>
<td>Average length 9 km</td>
<td>↓</td>
</tr>
<tr>
<td>Share of Passenger Vehicles that are Autonomous</td>
<td>None</td>
<td>70%</td>
</tr>
<tr>
<td>Mode Share</td>
<td>Private motorized: 73% Shared motorized: 15% Active: 12%</td>
<td>Private motorized: ↓ Shared motorized: ↑↑ Active: ↑↑</td>
</tr>
<tr>
<td>Federal Gov't Funding</td>
<td>--</td>
<td>↑</td>
</tr>
<tr>
<td>Flood Risk</td>
<td>--</td>
<td>Significant increase</td>
</tr>
</tbody>
</table>
OPPORTUNITIES AND CHALLENGES

Growing population and changing work locations increases demand on infrastructure and services.

• Significant population growth provides more resources for major infrastructure upgrades. These resources greatly help to adapt to climate change and invest in transportation.

• At the same time, infrastructure like roads, stormwater management and sewage treatment struggle to match the pace of population growth.

• Distributed work locations require more distributed infrastructure to support it through expanding transportation networks, utilities, fibre optics and high-speed internet.

Housing affordability and income equality issues persist.

• The increase in professional global workers that call Metro Vancouver home contributes to a higher average income, while the median household income remains relatively flat.

• However, significant population growth and a higher share of high-income earners results in continued housing affordability issues. This is further exacerbated with an increased wage gap between professional workers and those with lower incomes or receiving guaranteed incomes, driving more social equity challenges.

Congestion and overcrowding continue but is more spread throughout the day.

• People use shared mobility for most of their travel, which, despite the significant population growth, results in relatively similar traffic congestion to decades prior.

• Global workers operate on other time zones for companies headquartered elsewhere, reducing peak travel congestion in the region, but also require more 24-hour services. The 9-5 work pattern is still seen but is less emphasized from previous decades.

• With decreased vehicle traffic, particularly at peak periods, parts of the road network (and parking lots) are repurposed for higher and better uses, creating opportunities for wider sidewalks, and protected cycling lanes.
The Long-Range Growth and Transportation Scenarios project considers a range of external forces, identifying and exploring those which are likely to have the most significant and least predictable impacts on the future of the region. The scenarios focus on external forces related to economic change, automation and technology, and our changing climate, each with implications for population, employment, where people live and how they travel. Moving forward, the region will need to consider the following:

- Vulnerability of people locating in flood prone areas and impacts to the region’s land supply, agriculture and food security, and infrastructure from climate change.
- Potential impacts of automation on different job sectors with a particular focus on lower-income workers and small businesses.
- Potential strategies for proactively transitioning the regional economy and workforce and engaging senior governments regarding universal basic income.
- Changes in the economy and technology including automation, that will alter trip patterns for people and goods, and could result in more traffic congestion and longer commutes.
- Housing affordability and income inequality which may be exacerbated by changes in the global and regional economy.

TransLink and Metro Vancouver are now better positioned to shape a more resilient vision for growth and transportation in the region and to begin updating or drafting new long-term transportation and growth management plans.
## Appendix A: Detailed Scenario Summary Table

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Today</th>
<th>A: Trend Forward</th>
<th>B: Automation-Driven Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regional Population</strong>&lt;sup&gt;3&lt;/sup&gt;</td>
<td>2.57  million</td>
<td>+40% (3.6 MILLION)</td>
<td>~0% (2.6 MILLION) &lt;br&gt;Population remains stable as natural increases are offset by outmigration driven by fewer employment opportunities and more severe climate change impacts relative to other parts of Canada.</td>
</tr>
<tr>
<td><strong>Distribution of Housing</strong>&lt;sup&gt;4&lt;/sup&gt;</td>
<td>55% in Urban Centres and Corridors</td>
<td>MORE DISPERSED &lt;br&gt;As a result of affordability challenges and behaviour changes associated with autonomous vehicles there is increased pressure to located outside of urban centres.</td>
<td>MORE CONCENTRATED &lt;br&gt;People concentrate near urban centres, as travel by vehicle is an added cost and climate impacts reduce the size of some urban areas.</td>
</tr>
<tr>
<td><strong>Total Jobs</strong>&lt;sup&gt;5&lt;/sup&gt;</td>
<td>1.34 million</td>
<td>+35% (1.8 MILLION)</td>
<td>-20% (1.1 MILLION) &lt;br&gt;There is a decrease in employment in many sectors across the region due to automation displacing jobs including in retail, service, and knowledge-based positions.</td>
</tr>
<tr>
<td><strong>Distribution of Jobs</strong>&lt;sup&gt;6&lt;/sup&gt;</td>
<td>--</td>
<td>MORE CONCENTRATED &lt;br&gt;Growth in retail, service, and knowledge-based jobs increases demand for workers in urban centres and corridors.</td>
<td>MORE CONCENTRATED &lt;br&gt;Jobs are primarily located in urban centres and corridors. Some office and institutional employment remain outside these areas.</td>
</tr>
<tr>
<td><strong>Unemployment Rate</strong></td>
<td>4.3%</td>
<td>NO CHANGE (4.3%)</td>
<td>Unemployment increases significantly due to automation. Short-term contract-based employment becomes far more prevalent.</td>
</tr>
</tbody>
</table>

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<sup>2</sup> Regional Long-Range Growth and Transportation Scenarios: SUMMARY REPORT

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<sup>3</sup> Regional Long-Range Growth and Transportation Scenarios: SUMMARY REPORT
### C: Self-Sufficiency

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Change</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+20% (3.1 MILLION)</td>
<td>Slower growth occurs in the region due to changing global immigration policies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MORE CONCENTRATED</td>
<td>There is increased densification in urban centres and along corridors to accommodate gradual growth.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+10% (1.5 MILLION)</td>
<td>Some jobs are lost with decreased global trade, but other jobs are created to develop a more diversified regional economy. There is also a push for local manufacturing. Service and knowledge sectors remain unchanged from today.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MORE DISPERSED</td>
<td>Local manufacturing and added industrial activity lead to a more dispersed distribution of jobs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO CHANGE (4.3%)</td>
<td>While the rate of unemployment does not change, there is growing underemployment. Workers resort to taking on multiple gigs to make ends meet.</td>
<td></td>
</tr>
</tbody>
</table>

### D: Automation-Driven Boom

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Change</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+80% (4.6 MILLION)</td>
<td>Population increases, driven by the region’s attractiveness, increases in the federal immigration rate and increased labour mobility.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO CHANGE</td>
<td>While a significant share of new housing units are located in urban centres, with less commuting there is also significant demand for more dispersed development.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+60% (2.1 MILLION)</td>
<td>Repetitive tasks are increasingly automated. There is a significant increase in “professional” workers as workers choose where they live to suit their lifestyle, and then digitally connect for work to companies located elsewhere.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MORE DISPERSED</td>
<td>More people work from home, cafes, or co-working locations, and there is a shift away from office towers and business parks among the professional class.</td>
<td></td>
</tr>
</tbody>
</table>

↓

There is less unemployment with more global workers coming to the region. This increases demand in the service sector.
# Appendix A: Detailed Scenario Summary Table (continued)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Today</th>
<th>A: Trend Forward</th>
<th>B: Automation-Driven Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>Median Household Income&lt;sup&gt;7&lt;/sup&gt;</td>
<td>$73,000</td>
<td>$↑</td>
</tr>
<tr>
<td>$</td>
<td>Income Equality&lt;sup&gt;8&lt;/sup&gt;</td>
<td>--</td>
<td>$↓</td>
</tr>
<tr>
<td></td>
<td>Daily Travel Demand&lt;sup&gt;9&lt;/sup&gt;</td>
<td>2.8 trips per person/day</td>
<td>$↑</td>
</tr>
<tr>
<td></td>
<td>Trip Length&lt;sup&gt;10&lt;/sup&gt;</td>
<td>Average length 9 km</td>
<td>$↓</td>
</tr>
<tr>
<td></td>
<td>Share of Passenger Vehicles that are Autonomous&lt;sup&gt;11&lt;/sup&gt;</td>
<td>None</td>
<td>50% AVs become more common across the region and beyond.</td>
</tr>
<tr>
<td></td>
<td>Mode Share&lt;sup&gt;12&lt;/sup&gt;</td>
<td>Private motorized: 73% Shared motorized: 15% Active: 12%</td>
<td>Private motorized: ↑↑ Shared motorized: ↓ Active: ↓</td>
</tr>
<tr>
<td></td>
<td>Federal Government Funding&lt;sup&gt;13&lt;/sup&gt;</td>
<td>--</td>
<td>$↑</td>
</tr>
<tr>
<td></td>
<td>Flood Risk</td>
<td>Significant increase</td>
<td>$↓</td>
</tr>
</tbody>
</table>

Median income increases for some with the increase in automation and more 'high tech' jobs, but in general average wages have not increased or kept pace with the cost of living. Lower-income workers performing repetitive tasks are impacted by automation adoption.

Median income decreases with fewer employment opportunities. Automation reduces the bargaining power of most professions.

Private AVs and robo-taxis result in more trips being taken. A more dispersed population leads to longer trip distances.

With decreased employment and decreased overall wealth, there are fewer work-based trips, and fewer discretionary trips in the region. Some trip-linking occurs for those who travel to multiple jobs in a day. Trip lengths decrease with people and jobs more concentrated in urban centres.

Availability of AVs allow people to use their time for work, sleep, or for entertainment. Slow travel times are not an issue. Walking and cycling are less preferred with the high amounts of vehicle traffic and congestion on the roads.

With decreased employment and wealth in the region, more people travel by transit, walking and cycling. Vehicle mode share decreases, shared AVs are more frequent, again to save cost.

A relatively strong economy with stable employment provides ample resources.

Unemployment Stagnant population growth and declining employment, along with a shrinking labour force, reduces funding.
### C: Self-Sufficiency

- **Home (House):** $↓$
- **$ (Economy):** $↑$

There is less global investment in the region, reduced trade and higher import tariffs meaning higher costs of goods due to reduced comparative advantage. This places downward pressure on income in the region. Housing affordability and income equality improves with less demand.

- **Location (Travel):** ↑

There is a slight increase in travel with some workers combining multiple jobs in a day. Trip lengths increase due to more dispersed job locations.

- **30%**: There is lower adoption of AVs due to lack of global investment and limited manufacturing of AVs within Canada.

- **Private motorized:** ↓
- **Shared motorized:** ↑
- **Active:** ↑

Lower incomes lead to a preference for active and shared-use modes.

- **Slow population and employment growth limits the availability of resources available.**

### D: Automation-Driven Boom

- **Home (House):** No change
- **$ (Economy):** No change

An increase in the professional class results in mean incomes increasing and the median household incomes remaining relatively flat. Housing affordability and income equality does not improve due to an increased wage gap between professional and lower-income workers.

- **Location (Travel):** ↓

There is a major decrease in work-related trips and length of most trips with more people working from home or nearby.

- **70%**: There is high adoption AVs with the advancement of technology and growth of the knowledge sector.

- **Private motorized:** ↓
- **Shared motorized:** ↑↑
- **Active:** ↑↑

There are fewer owned vehicles. Transit becomes highly used as it reflects more of a ride-share style. Walking and cycling to nearby amenities are more popular.

- **A relatively strong economy with a large employed population supports an increase in funding.**

Significant increase
Appendix B: Key Facts Supporting Scenario Development

Automation

- Increasing automation is anticipated to increase productivity by up to 1.4% annually over the next 50 years, with many companies already witnessing a growth in jobs after adopting robotics technologies.¹

- Jobs without specific mental or creative skill requirements are most likely to be automated, followed by manufacturing agricultural, forestry, and fishery jobs. Highly-specialized, highly-skilled jobs in science, technology, engineering, and mathematics (STEM) are anticipated to be among the least automatable.² ³ ⁴ ⁵ ⁶

Global Trade and Economy

- “Gig work” describes the shift to more short-term employment. While some may prefer more freedom, gig work is also characterized by those working multiple jobs that are often low paid, temporary, and provides limited benefits, shifting risk from the employer to the employee or contractor.⁷

- Between 2011 and 2016, Canada added close to 1 million workers to its labour force, 90% of whom were immigrants. With decreased immigration, Canada would face constrained economic growth and increased social costs.⁸

- More than three-quarters of Canada’s exports are traded with the United States.⁹

- BC currently produces approximately half of all food consumed here. Agricultural production would need to increase substantially to feed everyone in the Province and Metro Vancouver region.¹⁰

- Companies in Canada are moving towards an agile workforce with more flexibility and a less conventional workplace – 20 to 30% of workforce is “non-traditional” already. It’s anticipated that this trend will continue with improved technology and connectivity.¹¹ ¹²

Transportation

- Autonomous vehicle adoption could reach ~50% by 2050 with many researchers anticipating an increase in vehicle kilometres travelled and possibly more congestion as a result.¹³ ¹⁴ ¹⁵

- Off-peak delivery studies have shown a decrease in congestion and travel time savings for road users, and reduced time and cost-saving for carriers when compared to daytime deliveries.¹⁶

As automation adoption increases, it is anticipated that transport jobs will be among those highest at risk of automation and could see 50% automation by mid-2030s.¹⁷

- The Japanese government started the “Telework Days” initiative in Tokyo, in an effort to ease congestion during the 2020 Olympics.¹⁸ In 2018, 300,000 workers took part in the initiative, leading to a -3% average decrease in commuters.¹⁹

- Car ownership is decreasing in Metro Vancouver and more Canadians are choosing public transit as their primary mode of commute, representing a near 60% increase since 1996.²⁰ ²¹

Housing

- High demand and low supply of housing continue to drive up housing prices around the world, particularly in metropolitan regions such as Vancouver, Toronto, Hong Kong and London.²² Some cities in Canada, such as Edmonton and Montreal, have managed to bring in more supply to balance rising prices and combat rising affordability issues.²³
Endnotes


2. Flood extent data was provided by the Fraser Basin Council as part of the Lower Mainland Flood Management Strategy. The scenario assumes a 1:500 Annual Exceedance Probability Stillwater ocean state and a 0.6 metre wave allowance with 1 metre of sea level rise (flood level 4.40 GSC). Topographic data obtained from a variety of sources was used to create a Digital Elevation Model (DEM) for the study area. The DEM horizontal resolution was 5 metres. The flood levels are based on a generalized water surface. The accuracy of the flood extent boundary is limited by the resolution of the DEM and the flood level assumptions. The maps are intended for an overview level assessment of flood vulnerabilities described by NHC et al. (2015). They do not represent floodplain mapping and should not be used as such. Northwest Hydraulic Consultants Ltd. (NHC), assisted by Thurber Engineering Ltd. (TEL), carried out an overview assessment of 74 dikes in the Lower Mainland to evaluate the level of protection provided by the dikes and to identify major deficiencies. The work formed a desktop study utilizing information from BC Ministry of Forests, Lands and Natural Resource Operations (MFLNRO), various Diking Authorities and existing reports. No field investigations were carried out. More information on the Lower Mainland Flood Management Strategy can be found at https://www.fraserbasin.bc.ca/water_flood.html

3. Assumptions for regional population in 2050 account for changes to immigration and in-migration, as well as natural increase and mortality. The percentage change by 2050 is relative to the closest census year (2016).

4. Distribution of Housing refers to where dwelling units are located within the region. This indicator identifies the share of dwelling units located in Urban Centres and along the Frequent Transit Network. A more concentrated distribution refers to an increase in the % of total dwellings located in Urban Centres and along the Frequent Transit Network, whereas a more dispersed distribution refers to a larger % of dwellings located outside Urban Centres and off of the Frequent Transit Network.

5. Total Jobs is aligned with how Statistics Canada captures these in the Census. This measures employed persons and does not differentiate between part and full-time employment. Assumptions for total jobs numbers in 2050 relate to the regional population size as well as the broader economic conditions described in each scenario. The percentage change by 2050 is relative to the closest census year (2016).

6. Distribution of Jobs refers to where jobs are located within the region. Specifically, this refers to job location in Urban Centres and along the Frequent Transit Network. A more concentrated distribution refers to a general trend towards jobs locating in Urban Centres and along the Frequent Transit Network, whereas a more dispersed distribution refers to a general trend towards jobs locating outside Urban Centres and not along the Frequent Transit Network.

7. Median Household Income marks the midpoint in a distribution of income for households in Metro Vancouver. The directional change presented in the table indicates a change from a median household income of $73,000 for the closest census year (2016).
8. Income Equality represents the extent to which incomes are evenly distributed across the population. An increase in income equality suggests a greater parity between the households with the highest income relative to households with the lowest income. A decrease in income equality suggests greater disparity across income earners in the population.

9. Trip Demand captures the average number of trips that a person makes on a typical day. The trip demand presented for today reflects the results of the TransLink 2011 Regional Trip Diary (results of the 2017 Regional Trip Diary were being tabulated at the time of writing).

10. Trip Lengths reflect the average distance of travel in Metro Vancouver across all trip purposes and modes. The length of a trip can be indicative of the modes of transportation suitable for accomplishing a specific trip. While shorter trips may be more conducive to active modes such as walking and cycling, longer trips may be more easily completed by motorized modes of transportation such as public transit or automobile. The average trip length presented for today reflects the results of the TransLink 2011 Regional Trip Diary (results of the 2017 Regional Trip Diary were being tabulated at the time of writing).

11. Share of passenger vehicles that are autonomous refers to the expected degree to which motorized passenger vehicles are automated vehicles (AV). The Society of Automotive Engineers (SAE) has set out a six-level standard (0 to 5) to describe the levels of driving automation (SAE J3016). Level 0 refers to no automation while level 5 refers to full automation. Each subsequent level in the standard represents a passing of responsibility from driver to automated driving system. Low levels of automation (1 to 2) already exist in vehicles on roads today in the form of driver assistance systems such as automated braking/acceleration, lane-centering, and adaptive cruise control. In the context of this work, AVs is used to describe only vehicles that are highly automated (levels 4 and 5). Level 4 is characterized as full automation under limited conditions and geographical locations, while level 5 is characterized as full automation under all conditions everywhere.

12. Mode Share captures the proportion of trips made in Metro Vancouver using the various modes of transportation available (e.g. auto, transit, cycle, walk), represented as a percentage. The mode share values presented for today reflect the results of the TransLink 2011 Regional Trip Diary (results of the 2017 Regional Trip Diary were being tabulated at the time of writing). Private motorized refers to single occupant vehicles (SOV) and carpools. Shared motorized refers to transit. Active refers to walking and cycling.

13. Federal Government Funding captures the estimated amount of funding provided by the Federal government for infrastructure projects and service delivery within Metro Vancouver. Generally this is assumed to reflect the state of the national economy and the revenue generated by the Federal government from various taxes and fees.
References


