MOVING FORWARD

A Strategic Approach to Ontario's Transportation Needs

ontario chamber of commerce

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The OCC is Ontario's business advocate.

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GLOSSARY

AIRPORT EMPLOYMENT ZONE (AEZ)

The AEZ is a 15,230-hectare area straddling the borders of Toronto, Mississauga, and Brampton. The AEZ is the second largest employment zone in Canada, smaller only than downtown Toronto.

AUTONOMOUS VEHICLE (AV)

Also known as a driverless car or self-driving vehicle, an AV can sense its environment and navigate without human input. These vehicles use technologies to replace the human as the driver, such as sensors to detect obstacles, software algorithms to make driving decisions, and electronic equipment to brake, accelerate, and steer the vehicle without any human participation in the driving task.

COMMUNICATIONS-BASED TRAIN CONTROL (CBTC)

Communications-based train control is a railway signalling system that makes use of the telecommunications between the train and track equipment for traffic management and control. Since the exact position of a train is known more accurately than with traditional signaling systems, the result is a safer and more efficient way to manage railway traffic as well as increased frequency of service and capacity.

CONNECTED VEHICLE

Connected vehicles use internet connectivity to extend a vehicle's awareness beyond its physical limits and enable communication between vehicles, transportation infrastructure, mobile devices, and cloud computing platforms. Connected vehicle systems do not necessarily control the vehicle.[1]

FIRST- AND LAST-MILE

'First- and last-mile' describes challenge of getting people to and from transit stations and transit services and to and from their home or workplace, without the use of a private automobile.[2] More recently, a range of transportation options are emerging, including ride-sharing applications, bicycle-sharing, and carpooling. In the future, autonomous vehicles may be another means to address the first-and last-mile gap.

INTERMODAL FACILITY

An intermodal facility is a piece of infrastructure where goods in shipping containers are transferred between trains and trucks to move goods in and out of a region, facilitating their transport to distribution centres and retail stores.

MINIMUM HEADWAY

Minimum headway refers to the minimum operational distance between trains.

SUPERCLUSTER

A supercluster forms when a group of companies that share an industry concentrate in a geographical region, allowing resources, capital, and talent to congregate and collaborate.[3]

INTRODUCTION

Half of businesses in Ontario consider transportation infrastructure to be critical to their competitiveness.[4] Modern and interconnected transportation infrastructure helps industry move their goods to market and allows individuals to access work, school, and other priority destinations, supporting the province's growth and prosperity. However, 58 percent of business currently rates the ability of the transportation infrastructure in their communities to meet their needs as merely fair or poor.[5] Ontario suffers from disjointed transit governance, world-leading congestion, inadequate service options, and a lack of regulatory preparation for the future of transportation.

Improved planning for, and continued investment in, transportation is particularly important as the Greater Toronto and Hamilton Area (GTHA) is one of the fastest growing regions in North America. Approximately 110,000 new residents are expected every year through to 2041, meaning the GTHA's population is expected to rise to 10 million over the next 25 years.[6] This growth will put further stress on the area's already overloaded transportation systems.

While congestion is a critical policy challenge in the GTHA, inadequate and aging transportation infrastructure is limiting mobility across the province. Since 2011, infrastructure investment in Ontario [(as a percentage of Gross Domestic Product (GDP)] has fallen or remained flat.[7] This consistent underinvestment necessitates greater future investment to support a growing population and economy, as government spending is forced to play catch-up. The Canadian Centre for Economic Analysis estimates the average level of infrastructure investment will need to increase from the 2017 rate of 2.8 percent to 5.4 percent of the provincial GDP to achieve maximum growth over the next 50 years (Figure 1).[8]

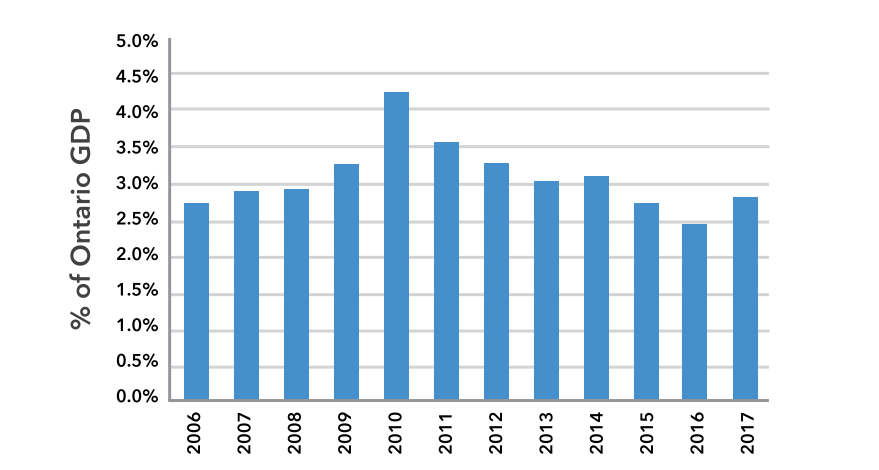
As much of the existing infrastructure in Ontario was built in the 1950s and 1960s, it is nearing the end of its useful life.[9] Factors such as underinvestment, aging assets, population growth, climate change, a habit of building to current or past needs, and technological disruption have led to a significant gap between the actual and needed infrastructure in Ontario.[10]

Given how far behind Ontario appears to be with respect to both building new and maintaining old transportation infrastructure, and that the costs associated with investment are high, how can the Government of Ontario begin to address the province's transportation needs? This report will identify near-term, pragmatic solutions that address three areas of opportunity for improving the mobility of Ontarians:

- Transit planning governance
- Moving goods and people by rail
- Autonomous vehicles

As its central premise, this report will make the case for a Long-Range Transportation Plan that can deliver a strategy for better managing the province's interconnected transportation assets, and better serving the needs of both Ontario businesses and residents.

Figure 1. Ontario infrastructure investment as a percentage of GDP



Source: Canadian Centre for Economic Analysis, 2018

SUMMARY OF RECOMMENDATIONS

1. Unlock Metrolinx's potential to improve integration between regional transit services in the GTHA.
2. Develop a multi-modal transit hub at Toronto Pearson International Airport.
3. Conduct a review of transportation assets and limitations in Northern Ontario to determine how mobility in this region can be immediately improved.
4. Support municipal governments as they develop innovative solutions to address transit challenges.
5. Establish Transportation Ontario, an independent, province-wide transportation planning authority that would advise the Ministry of Transportation and support regional transit agencies.
6. Develop a 30 to 50-year Long-Range Transportation Plan.
7. Develop a goods movement convenor framework that engages municipalities, the freight industry, relevant provincial Ministries, and the federal government where appropriate.
8. Prioritize investments with the greatest potential to provide a strong return on investment via economic growth.
9. Partner with the Canada Infrastructure Bank to secure funding for critical rail projects in both Northern and Southern Ontario.
10. Invest in state-of-the-art technology such as CBTC to address immediate capacity concerns on the TTC subway network.
11. Regularly review and update the existing AV pilot regulatory framework and evaluate existing legislation to determine if AV-relevant modernization is required.
12. Anticipate Ontario's AV future within the province's upcoming Long-Term Infrastructure Plan.
13. As the current Canadian leader in this space, the Government of Ontario should encourage the federal government to act on AV readiness.

PILLAR I

Transit Planning and Governance

Each region of this province faces challenges in efficiently and reliably moving goods and people through their jurisdiction. While insufficient investment in both new infrastructure and the maintenance of existing assets is a critical driver of these challenges, poor integration between communities, service operators, and higher-order government bodies undermines the ability to manage assets effectively.

Outside of the Ministry of Transportation, governance of transportation planning and operations is frequently the mandate of a single local government department or agency. This hinders long-term strategic thinking in order to meet immediate electoral or budgetary demands. Integration among municipal or regional transit operators is limited, and gaps in infrastructure and services are commonplace for many Ontarians.

This governance challenge takes different forms in different regions of the province:

- In the GTHA, a growing region struggles to integrate existing transportation assets and build public transit services that meet demand;
- In the North, mass transit service has been reduced or eliminated while highway projects stall, impacting economic opportunities and public health; and
- In small towns and rural areas, few or no mass transit options exist, limiting the mobility of residents.

Overall, to combat congestion, lessen our impact on the environment, and increase mobility options for millions of Ontarians, the Province needs a new approach to transportation policy planning. Meeting the changing transportation needs of Ontario's people and its economy requires a long-term, evidence-based strategy that enables improved integration between governments, between the public and private sectors, and of technology.

MANAGING DEMAND IN THE GREATER TORONTO AND HAMILTON AREA

43% of businesses in the GTHA would like to see an improvement in subways and/or light rail transit in their communities

49% consider public transit infrastructure critical to their organization's competitiveness[11]

Reforming Regional Transit Governance

The transit and transportation woes of the GTHA are well-documented, with considerable research and analysis that reveals the extent to which congestion, inadequate service, and aging assets hamper productivity and quality of life for the millions of individuals who live and work in the region. At the centre of this discussion is Metrolinx, the crown agency founded under the *Metrolinx Act, 2006*. Metrolinx was originally established to provide leadership in the co-ordination, planning, financing, development, and implementation of an integrated, multi-modal transportation network as well as operate the GO commuter network.[12]

In 2008, Metrolinx introduced *The Big Move*, the first plan for the GTHA focused on transforming transportation in the region through the completion of nine "Big Moves" (or rapid transit projects) totalling $30 billion in investments. Ten years later, the agency released the *2041 Regional Transportation Plan*, focused on five strategies with the goal of achieving an integrated transportation system: completing current regional transit projects; connecting more of the GTHA with frequent rapid transit; optimising the transportation system; integrating transportation and land use planning; and preparing for an uncertain future that includes the deployment of new transportation technologies, including autonomous vehicles (AVs).[13]

Within the 2018 Fall Economic Statement, the Government of Ontario announced its intention to introduce amendments to the *Metrolinx Act, 2006*. Subject to approval by the Legislature, the Act would adjust the agency's focus to merely providing 'leadership' with respect to regional transit delivery and service, while the Ministry of Transportation would develop a transportation plan for the Greater Golden Horseshoe to guide Metrolinx's work.[14] This proposed change addresses one of the shortcomings attributed to Metrolinx in the past, namely that its dual mandate (co-ordinating transportation planning and transportation systems) was incompatible as transit plans are influenced by the government of the day and, thus, inherently political.[15]

As the Ministry of Transportation increases its power over transportation planning under Schedule 25 of the proposed *Bill 57, Restoring Trust, Transparency and Accountability Act, 2018*, these changes raise questions about whether future transportation investments and priorities will be evidence-based, long-term in scope, and/or include adequate municipal engagement to deliver seamless region-wide mobility.

Among the proposed changes is an explicit statement that Metrolinx's transportation plan for the region is subject to approval from the Minister of Transportation. Metrolinx will also be expected to carry out consultations as it develops, reviews, or prior to making amendments to its transportation plan as directed by the Minister of Transportation. The Minister may also recommend a provincial representative to attend and participate in meetings of Metrolinx's Board.[16]

Eliminated from the original Act under Schedule 25 is the clause that requires Metrolinx's transportation plan to make use of intelligent transportation systems and other innovative technologies, and work towards reducing transportation-related emissions and greenhouse gases in the regional transportation area.[17]

The proposed changes under Bill 57 also increase the regional transportation area covered by Metrolinx to include 15 additional counties, cities, and municipalities. This is a step forward for improved regional service integration. But as the number of municipalities increases, so too does the need to improve municipal representation on Metrolinx's Board. In the past, Metrolinx proposed increasing its Board from 13 to 18 members, with a new director nominated by each of the six regions the agency represents.[18] With more communities under its purview, comes a greater need to consider an integrated and multi-modal transportation network. However, Schedule 25 removes the requirement that Metrolinx's plan for the region take into consideration both these factors. Instead, Metrolinx would only be required to provide leadership with respect to the co-ordination, planning, financing, development, and implementation of an integrated transit network in its regional transportation area.[19] Given the need for greater connectivity between different modes of transportation, this proposed amendment could limit the ability of the Province to address existing and future transit challenges.

A MULTI-MODAL APPROACH TO SERVICING COMPLEX DEMAND

Transit integration is commonly understood to mean fare, schedule, and route integration; however, a critical component is also integrating different modes of transportation. Currently, the most used and most regionally critical transportation hub is Toronto's Union Station, offering connections to the Toronto Transit Commission (TTC) subway network, GO trains and buses, Union-Pearson (UP) Express train to the international airport, the Ontario Northland train, and VIA and Amtrak national and international passenger rail. Yet this station was designed with the assumption that passenger demand in the GTHA is hub-and-spoke – travel is largely to and from downtown Toronto.

Transit needs have changed in the last thirty years. While commuters historically travelled into downtown Toronto in the morning for work and outwards from the city in the evening, new commuting patterns have emerged. Today, with the rapid growth of communities outside Toronto and the development of employment opportunities and amenities across the GTHA, transit and traffic move in all directions inside and outside of the region.[20] Extensive residential development both within the City of Toronto and across the entire GTHA means that the geographic area in which public transit must serve is also expanding.[21] Addressing transit demand for the region requires more than increasing the capacity

of the existing system, but also extending that system to service a wider geographic area and its distinct commuting patterns.[22] This requires more multi-modal transportation integration, and new hubs to serve alternative transportation centres outside of downtown Toronto.

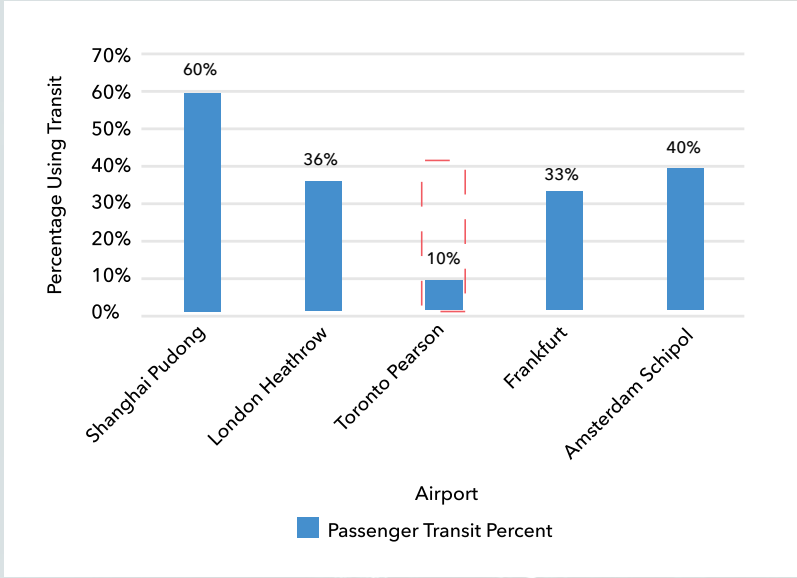
The construction of infrastructure to service new passenger streams requires the investment of considerable time and resources, largely at the provincial level. Given current fiscal limitations and the lack of a long-range transportation plan, immediate government action is limited. However, looking at existing infrastructure assets, geographic and economic importance, and concentration of passengers, a multi-modal hub at Toronto Pearson International Airport is a feasible long-term project.

As Canada's largest airport, Toronto Pearson not only connects Canadians to the rest of the world, it is also a critical economic enabler for Ontario. The airport generates approximately $42 billion in economic activity annually – or 6.3 percent of the provincial GDP.[23] Its Airport Economic Zone (AEZ) is home to more jobs than the central business districts of Vancouver, Montreal, or Calgary. Approximately 49,000 people are directly employed by the airport, and it enables or facilitates a total of 332,000 jobs in Ontario.[24]

However, what distinguishes the AEZ from Canada's other major employment clusters is its limited transit connectivity to the surrounding region—both airport travellers and employees have few transportation options.[25] The UP Express is the only higher-order transit that provides access from Toronto Pearson to downtown Toronto (all other service is by bus), and that service alone is insufficient to meet airport passengers' needs.

Moreover, available ground modes are not swift, direct, or integrated enough to allow connections through the airport to other local and regional destinations, particularly those outside the GTHA.[26] As a result, only about 10 percent of passengers and employees use public transit to access the airport.[27] (Figure 2). In comparison, 36 percent of air passengers and employees at London Heathrow, 40 percent at Paris-Charles de Gaulle, and 63 percent at Hong Kong International airports use public transit.[28] Similarly, 93 percent of AEZ employees drive to work, alongside commuters moving through a busy exchange that connects Highways 401, 427, 27, 403, 409, and 407.[29]

Figure 2: Use of public transit at select international airports



Source: Toronto Pearson International Airport, 2016

Within the world of transportation planning, the concept of connectivity includes the objective of increasing capacity within one asset in order to release capacity in another. Increased capacity on the highways neighbouring Toronto Pearson is beneficial to passenger mobility, but it also benefits goods movement, much of which either originates from, or is destined for, the airport.

While the highways surrounding the airport are among the most congested in the region, they also carry the highest value goods on any roadway in Canada.[30] Air cargo is a significant and growing part of Toronto Pearson's business, and it impacts road and rail transportation. Every day, approximately $3 billion worth of goods travel into and out of the Toronto-Waterloo region, Canada's busiest transportation corridor. Much of that volume is imports and exports, primarily shipped by ground to and from the US, but a significant volume is transported in the bellies of passenger aircraft.[31]

With the rise of global supply chains, air cargo has grown increasingly important, particularly for high-value products, such as cellphones, pharmaceuticals, auto and aircraft parts, and specialized agricultural products. Toronto Pearson facilitates 15 percent of the province's exports and six percent of all Canadian exports.[32]

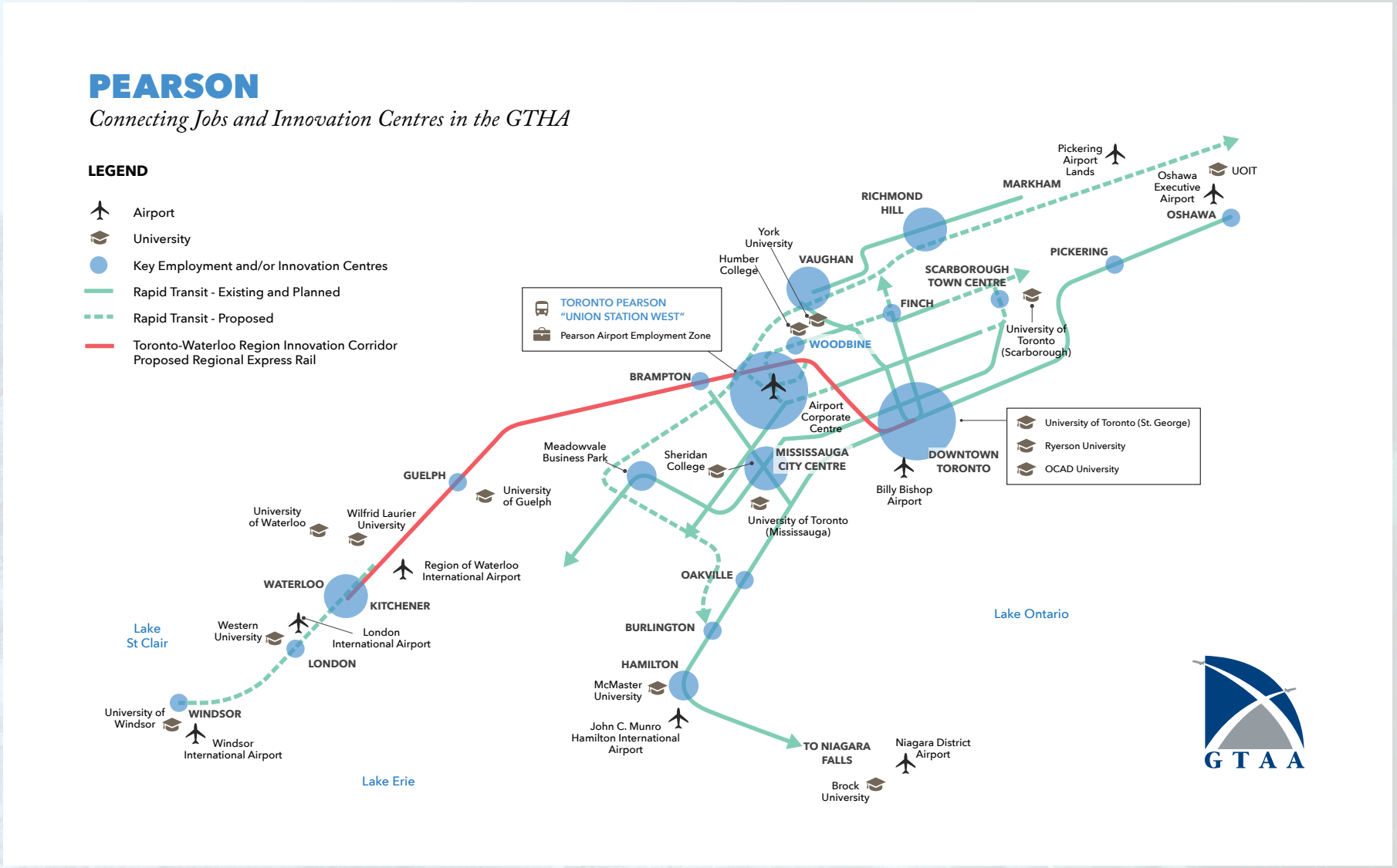
In 2016, nearly half of all international air cargo leaving or entering Canada (450,000 tonnes) passed through the airport. This volume is expected to rise to 1 million tonnes by 2035.[33] In light of this situation, improving transit infrastructure around the airport would have an impact beyond commuters, by making it easier for high value goods to get to market.[34]

Recognizing the opportunity such a multi-modal hub presents, Toronto Pearson and the Greater Toronto Airports Authority (GTAA) have developed a proposal that would be comparable in scale and economic impact to Toronto Union Station, and comparable to the transit services characteristic of top tier, globally-competitive airports.

This proposed hub (dubbed 'Union Station West') would connect the airport to the city and surrounding area through a network of buses, rapid transit, and regional/national trains.[35] (Figure 3). It would move air travellers to and from the airport, support AEZ commuters, and integrate transportation modes.[36] Additionally, the hub could provide better local connections between Toronto and the '905' municipalities, and create connections between those municipalities where they currently do not exist.[37]

A second GTHA multi-modal hub comes with tremendous benefits to both passenger and goods movement. However, such a project requires prudent administration. Given that the AEZ straddles the borders of Brampton, Mississauga, and Toronto, transit solutions at Toronto Pearson must be developed in partnership with regional stakeholders. Furthermore, integration of existing and future transportation links requires long-term planning based on best evidence, risk management, and stakeholder consultation. While the 'Union Station West' proposal is a pragmatic solution to many GTHA transportation challenges, transit governance in Ontario must be reformed to ensure that the opportunity it represents is not wasted.

Figure 3: Proposed 'Union Station West'



Source: Greater Toronto Airports Authority

THE FORGOTTEN FIRST- AND LAST-MILE

Even as the need for large-scale transportation projects within the GTHA is clear, an issue that often goes overlooked and underserved is the first- and last-mile problem. This describes the challenge of moving passengers between public transportation sites and their first or last destination—usually workplaces and homes—without the use of private automobiles.[38]

Commuters in the GTHA may use two or three local and regional transit systems on their way to and from work, and yet are still unable to reach their destination with public transit alone. Transit stops and stations are not always close to one's home or place of work, while parking is not always available near one's destination. Owning a vehicle is not always feasible and walking or cycling is not always safe or convenient. This can result in a mobility gap. [39]

More often than not, commuters in the GTHA choose to use their private vehicles to solve the first- and last-mile problem. Nearly 60 percent of GO Train users drive to their stations, while 14.7 percent are dropped off or picked up by a private vehicle.[40] Unfortunately, this practice contributes to congestion[41] and negative environmental outcomes.

Given that building transit infrastructure in every neighbourhood may not be physically or fiscally feasible, and adding more parking lots promotes congestion, other practical solutions to the first- and last-mile problem are needed. Along with building low-cost infrastructure to support active transportation (i.e., cycling, walking) and carpooling, the provincial government should examine how new transportation models such as ridesharing, and new technologies such as AVs, could solve the first- and last-mile challenge.

The most notable first- and last-mile partnership in the GTHA is a collaboration between Uber and Metrolinx that encourages airport travellers to use ridesharing services to meet their first- and last-mile needs in conjunction with the UP Express. To facilitate this, dedicated Uber pick-up zones were created at the Union, Bloor, and Weston UP stations. This partnership between a private company and an arms-length provincial agency is an example of how government can provide services without resource-intensive investments in new infrastructure.

The next stage in first- last-mile solution development is likely to come from AVs, either personally-owned or shared. In 2017, Bloomberg Philanthropies and the Aspen Institute conducted an online survey of 38 cities actively working on an AV strategy. The survey revealed that the most commonly anticipated role for AVs is bridging existing gaps at the edge of transit systems—also known as the first- and last-mile. Nearly every municipality in the survey indicated interest in using AVs for first- and last-mile solutions and, for most, it was the highest priority.[42]

Reducing congestion, increasing multi-modal connectivity, and filling the gaps in existing transit service are all goals that require enhanced integration between the diverse municipalities and regions of the GTHA. The Government of Ontario should empower existing institutions to deliver services in new ways and deliver improved accountability to commuters through mechanisms such as capacity-building, targeted investment support, and incentives for innovative solutions.

INCREASING MOBILITY IN THE MISSING MIDDLE

In the GTHA, the provincial government has made significant investments in public transit systems, including developing an increasingly integrated transportation system of traditional rail, subways, light-rail transit, and buses. However, the small- and medium-sized municipalities in the middle of the province lack adequate mass transit infrastructure and often wait years for strategic transportation projects to be approved or funded. This reality puts these communities at a disadvantage when it comes to attracting and retaining industry, talent, and investment, as well as limits the everyday mobility of residents. Furthermore, as the middle of the province ages, it becomes critically important that alternatives to personal vehicles are available to residents. [43]

The Town of Innisfil, with a population of 37,000, elected to take an innovative approach to address the transit needs of its residents, as local leaders recognized that funding for traditional transit services was not available to them. In 2017, the Town partnered with Uber to create a substitute public transit system, the first in Canada. Partnering with a ride-sharing service was deemed more affordable and efficient than building traditional fixed-route bus services. Residents use their smartphones to book rides on-demand and the town pays an average subsidy of five dollars for every trip—versus the $33 per-rider subsidy calculated for bus service.[44]

When a seven-month trial period exceeded expectations, Innisfil signed a further agreement with Uber to expand their partnership by adding two new flat fare destinations. This out-of-the box solution saved the Town over $8 million in its first year.[45] While Uber has over 35 partnerships with public transit agencies across the world, Innisfil's program is unique in that this ride-hailing program stands in for, rather than supplements, a traditional municipal transit system.[46]

The initiative demonstrated by Innisfil—to seek out technology and a private partner to fill a service gap—should be a model for other municipalities in Ontario. The challenge they may face is that novel solutions are generally rolled out as local pilots and lack resources or support to scale into permanent programs or expand into other communities.

Recognizing that all regions of Ontario require transportation solutions – but that it is not routinely feasible for municipal governments to invest in major infrastructure projects or for the provincial government to substantially subsidize every community's transit agenda – the Province could act as an empowering force. More specifically, the province could develop approaches for socializing and supporting the use of technology solutions and public-private partnerships by municipalities.

RENEWING TRANSPORTATION INFRASTRUCTURE IN THE NORTH

In recent years, mass transit service within Northern Ontario has been significantly reduced or cancelled, limiting mobility in a region already underserved compared to the rest of the province. In 2012, the Northlander passenger rail service came to an end, followed in 2018 by the cancellation of inter-city Greyhound routes as well as those that link the North to Western Canada. Ontario Northland in Northeastern Ontario recently expanded some bus passenger service but it still provides no connections to the Northwest. The lack of transportation options outside of personal vehicles hampers mobility for residents and visitors, leaves communities disconnected from one another, and limits Northerners' ability to access jobs and business opportunities.

In Northern Ontario, transit is not merely a convenience or development issue, it is also a public health issue. In Northwestern Ontario alone, every year nearly 60,000 residents leave their communities to access health care that is not available in their municipality. Of those trips, nearly 16,000 were to medical services in Winnipeg and over 33,000 were to Thunder Bay. The majority of people travelled by private vehicle as no mass transit service was available to meet their needs. The difficulty this creates in accessing health care has prompted some seniors who cannot drive or who lack access to a private vehicle to leave their communities and move to Thunder Bay and other urban centres throughout the region.[47]

Perhaps more concerning is the trend of doctors requesting Emergency Medical Services (EMS) to transport non-emergency patients to medical centres when patients do not have the ability to transport themselves. Common Voice Northwest estimates that between 60 and 70 percent of these patients could be transported by a properly scheduled inter-community bus service. When ambulances are used as a taxi service, it ties up valuable medical resources that can leave communities vulnerable should a crisis occur.[48]

Even as bus and rail service disappeared across the North, investment in road infrastructure lagged. As an example, Highway 69 is a vital transportation corridor that acts as the connective roadway between Northern and Southern Ontario, and is part of the Trans-Canada Highway linking Ontario to Western Canada. Yet the route remains a dangerous and underfunded thoroughfare which, in its current state, negatively impacts residents, businesses, and the supply chain of the entire province.

Highway 69 was designed at a time when commercial and industrial goods were largely transported by rail, so it was not constructed to accommodate heavy trucks. Damage to the structure of the road from trucks, coupled with harsh weather conditions, leads to collisions and the need for regular repairs. As a result, the highway is frequently closed for hours at a time, negatively impacting inter- and intra-provincial trade and forcing drivers to take detours, adding several hours to commute times.

Plans to expand Highway 69 were originally announced in 1991 and, since that point, the project has been paused, modified, and forgotten by successive provincial governments.[49] Over the past 15 years, approximately $850 million has been spent expanding 132 kilometres of the roadway, with plans to complete the entire project by 2021. Construction is ongoing for a 14 kilometre section. When complete, this will leave 68 kilometres that would still need to be four-laned, which is estimated to cost $200 million.

The experience of Northern Ontario reveals the need for governance that integrates all modes of transportation and identifies when and where investment is needed to prevent fatal gaps in service. Given the harsh climate, residents in Northern Ontario require additional transportation options when roads are closed or flights are cancelled. If capacity is reduced in one asset, it must be increased in another to preserve mobility and connectivity.

Today, the region requires investment that will support the needs and ambitions of its residents. The provincial government currently subsidizes transportation in Southern Ontario by funding Metrolinx for service in the GTHA.[50] Taking a similar approach to Northern Ontario—in combination with a long-term regional strategy for alleviating specific transportation challenges and their spill-over effects—would be both principled and productive. A good starting point, would be to include strategies already outlined in the *Draft 2041 Northern Ontario Multimodal Transportation Strategy*.

BEST PRACTICES IN PLANNING

While improved planning practices is a clear solution to integration and connectivity challenges, it should be noted that developing transportation plans involves managing trade-offs—such as cost, ridership projections, and distribution of resources—that present new challenges to both system operators and elected representatives as they seek to best serve passengers.[51]

Recognizing the inherent limitations of managing long-term assets like infrastructure on short-term political cycles, other jurisdictions have chosen to divorce planning from operations and mandate an independent body that can provide expert advice to governments seeking the best return on their investment.

Uploading transportation asset management and operations to a provincial authority is costly and disruptive and will likely exacerbate existing challenges with accountability and authority. However, a provincial planning authority could deliver evidence-based forecasting and direction, informed by consideration of other government plans such as an economic growth strategy, that would support improved responsiveness, integration, and connectivity.

Models of similar authorities currently exist, although they tend to include all infrastructure assets within their scope. Ontario is home to one such model: Infrastructure Ontario (IO). IO develops solutions, creates public-private partnerships, and manages assets in service of improved ROI for public infrastructure spending. Its projects are award-winning, and its development and championing of Alternative Financing and Procurement (AFP) options have made it a leader in its space.

Alongside IO, the examples of Infrastructure Australia and the UK's National Infrastructure Commission also provide insight into how an authority tasked with optimizing the value of existing and future transportation assets could improve outcomes for Ontario.

Infrastructure Australia

Infrastructure Australia (IA) was established in 2008 as an independent statutory body. IA provides research and advice to all levels of government, as well as investors in and owners of infrastructure, on the projects and reforms needed to address the country's infrastructure gaps. It assesses the economic merits of projects with fully developed business cases.

In May 2015, IA released the first-ever Australian Infrastructure Audit, which reviewed Australia's nationally significant infrastructure and assessed the nation's infrastructure needs. The findings from the audit in turn informed IA's 15-year Australian Infrastructure Plan released in February 2016, which will be updated by IA at least every five years. Based on the findings from the Infrastructure Audit, as well as input from governments, stakeholders, and communities, IA released an Infrastructure Priority List that specified national and state-level priorities where it believes governments and the private sector should focus their investments. As of 2018, this list contains 93 nationally significant infrastructure projects (valued at over $55 billion) that IA's Board recommends the Australian government invest in over the next 15-years.[52] As a living document, it is updated regularly with IA also sharing the priority list and status of on-going projects with the public on its website.

As an independent body, the Minister for Infrastructure is not to give directions about the content of any audit, list, evaluation, plan, or advice provided by Infrastructure Australia. While infrastructure funding decisions are ultimately made by Australian governments or the private sector, IA developed a list of 11 principles to guide government decision-making as it pertains to identifying, prioritizing, funding, and delivering infrastructure projects that are in the public's interest and represents the best value for taxpayers' money.[53]

Some of the proposed projects reflect similar needs to that of Ontario. For example, the development of a Western Sydney Airport to support growing air passenger demand in the Sydney Basin made Infrastructure Australia's 2016 Priority List. This project is currently under construction and set to open in 2026. Another project that has been deemed a high priority is the 30.5 kilometre, high frequency rail connection between Chatswood and Bankstown to increase capacity on the rail network servicing Sydney's central business district.[54]

The UK National Infrastructure Commission

Established in 2015, the UK National Infrastructure Commission (NIC) is a permanent body that operates at arm's length from government as an executive agency of Her Majesty's Treasury. The NIC provides the government with impartial, expert advice on major, national, long-term infrastructure priorities and challenges.[55] As an independent authority, the NIC has complete discretion over its work programme, methodologies, recommendations, and the content of its reports and public statements.[56]

To ensure the NIC supplies actionable recommendations, the government provides the NIC with a public letter that outlines how much money will be spent on infrastructure in a given period, thereby ensuring recommendations are costed and feasible. The NIC is responsible for producing:

- A national infrastructure assessment once every Parliament following public consultations, which outlines the NIC's assessment of long-term infrastructure needs and provides recommendations to government;
- Specific studies on pressing infrastructure issues; and
- An annual monitoring report that assesses government's progress in areas where the government has committed to acting on the NIC's recommendations.[57]

The government has between six months and one year to respond to the NIC's assessments and studies.[58] Recommendations made by the NIC are not a statement of government policy as Ministers are ultimately responsible for determining whether to support the recommendations and how to move them forward.[59]

The July 2018 National Infrastructure Assessment set out the NIC's plan for the country's infrastructure over the next 10 to 30 years. Among the recommendations were the development of a national standard for flood resilience and charging infrastructure to meet projected consumer demand for electric vehicles.

IA's commitment to transparency, the NIC's commitment to accountability, and both organizations' commitment to evidence-based decision-making echo the Ontario Chamber of Commerce's recommendations for improved infrastructure planning and investment in *Building Better: Setting up the Next Ontario Long-Term Infrastructure Plan for Success*.[60] The principles

of transparency, accountability, and evidence-based decision-making are similarly critical to transportation system planning, funding, and operations.

As such, Ontario would benefit from the creation of an independent, province-wide transportation planning authority ('Transportation Ontario') that would advise the Ministry of Transportation and support regional transit agencies. In accordance with a clear mandate, this authority could provide the provincial government with forward-thinking, expert, and strategic advice on long-term transportation infrastructure challenges and opportunities, backed by rigorous evidence. The Ministry would remain the ultimate authority on provincial transportation policy and delivery decisions, supported by the analysis and advice of this independent body.

However, the establishment of an independent transportation planning authority is a long-term solution to the challenges identified in this report. Given the immediate need to integrate transportation planning and operations, the Government of Ontario should, in the meantime, proceed with a 30 to 50-year Long-Range Transportation Plan. This Plan should be integrated with the Long-Term Infrastructure Plan and both regional and provincial economic development strategies.

Without an existing Ontario-wide transportation plan, current regional plans do not adequately manage the intra-provincial movement of goods and people, nor do they reflect the interconnected and interdependent markets, industries, and economies of this province. As it stands today, Ontario is out of step with competitor jurisdictions, as state-level transportation planning is required by US federal law.[61] These mandatory plans are 20 to 30 years in scope, are updated every five years, and reflect all modes of transportation. The proposed Long-Range Transportation Plan would not only improve outcomes within Ontario but make the province more internationally competitive.

RECOMMENDATIONS

1. **Unlock Metrolinx's potential to improve integration between regional transit services in the GTHA.**
   - Clarify and formalize Metrolinx's span of authority over planning and operations vis-à-vis the Ministry of Transportation, municipalities, and transit agencies, with the primary goal of increasing efficient and seamless service delivery.
   - Improve accountability to local governments and residents by adding municipal representation to the Metrolinx Board.
   - Integrate the regions served by Metrolinx into one seamless transit network with a universal fare system and co-ordinated routes and schedules, under the authority of Metrolinx.
2. **Develop a multi-modal transit hub at Toronto Pearson International Airport.**
   - In partnership with Toronto Pearson, the Greater Toronto Airports Authority, Metrolinx, and local municipalities, further develop the plan for a multi-modal hub that will connect passengers and goods to the GTHA and beyond.
3. **Conduct a review of transportation assets and limitations in Northern Ontario to determine how mobility in this region can be immediately improved.**
   - This review should consider, among other factors: both goods and passenger movement, private mass transit services, urban public transit, and public health and safety concerns related to inadequate transportation infrastructure.
   - Based on the findings of the review, investment priority should be given to projects that are near completion or can be developed using existing infrastructure assets.
4. **Support municipal governments as they develop innovative solutions to address transit challenges.**
   - Support municipal action on the first- and last-mile problem and other gaps in transit service through the development of less resource-

intensive projects such as pedestrian, cycling, and carpool infrastructure, via capacity-building, incentive programs, and targeted funding.

- Empower municipal use of public-private partnerships (P3s) by building awareness of successful P3s, developing guidelines for scaling local projects and converting pilots into permanent services, and creating a platform for municipal governments that wish to duplicate initiatives found in other communities.

5. **Establish Transportation Ontario, an independent, province-wide transportation planning authority that would advise the Ministry of Transportation and support regional transit agencies.**

   This body should be governed by the principles of transparency, accountability, and evidence-based decision-making, and tasked with responsibilities that include:

- Anticipating trends, such as demographic shifts, climate change, and technological disruptions, that will impact transportation assets and services;
- Acting as an information repository, collecting, analysing, and disseminating data in support of both public and private sector decision-making;
- Long-range transportation planning that includes regional economic development considerations;
- Identifying how government of all levels can optimize existing assets and prioritize projects that have the potential to yield a significant return on investment;
- Engaging municipal and regional governments, industry, community groups, and other stakeholders through consultation, joint-solutioning activities, and formal partnerships;
- Supporting the integration of transit services and operations;
- Providing guidance to local governments on procuring innovative transportation solutions, entering into public-private partnerships, and scaling pilot projects; and
- Reporting back to the public on the status of investments and the progress of projects currently underway.

6. **Develop a 30 to 50-year Long-Range Transportation Plan.**
   This plan should include:

- Both goods and people movement within its scope, with an emphasis on their points of interaction;
- Short-, medium-, and long-term investment objectives spanning the 30 to 50-year scope of the Plan;
- A review of existing public and private transportation assets, including comprehensive mapping of multi-modal connections;
- Pathways for integration with municipal official plans and regional growth plans;
- Dedicated sub-strategies for:
  - Airports;
  - Maritime transportation; and
  - Northern mass transit, including urban public transit;
- An approach for catalyzing the Canada Infrastructure Bank into action, including proposed projects for collaboration;
- A financing plan for consistent improvement and maintenance projects;
- Substantive stakeholder engagement and consultation, including the use of stakeholder data and analysis during plan development; and
- Space within the plan for innovative approaches such as joint-solutioning, commissioning, alternative service delivery (ASD), and alternative financing and procurement (AFP).

PILLAR II

Moving Goods and People by Rail

Rail transportation—including subways and LRT, as well as heavy rail—is critical to the movement of both people and goods across Ontario. Yet freight and passenger rail frequently share lines, causing delays and limiting productivity. Existing assets are at capacity, and service limitations fail to meet the demand of growing regions.

Given the established benefits of rail—robust carrying capacity, solid safety record, and a comparatively low environmental impact—the Government of Ontario should revisit this mode of transportation as a means of creating new opportunities for mobility and trade.

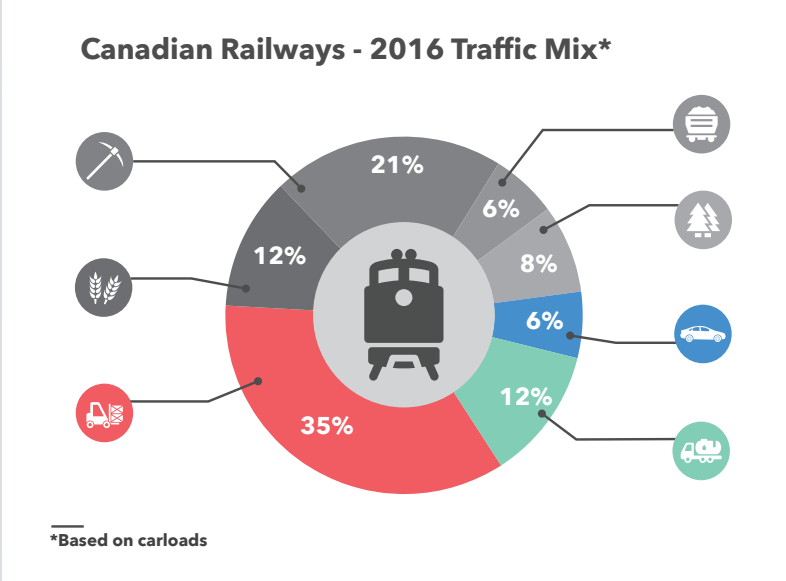
While the province requires greater rail infrastructure and service options, such investments can be costly. Fortunately, Ontario currently possesses both technical and strategic options for improving capacity and reliability in the near-term—without time or resource-intensive outlays from the Provincial budget.

MOVEMENT OF GOODS

Road congestion and the need for greater connectivity are issues relevant not only to the movement of people in Ontario, but also the movement of goods. As the province's population grows, demand for goods and the capacity to move those goods also grows.[62]

Rail offers options for managing this increasing demand. One railcar can hold as much as three to four conventional truckloads of goods, and a single train can easily haul the equivalent of 300 trucks.[64] A more environmentally friendly mode of transportation, rail accounts for only one percent of Canada's greenhouse gas emissions.[65] Intermodal facilities help facilitate trade, create jobs, and generate revenue for the municipalities in which they are located.

Figure 4: In 2016, over 45 million tonnes of freight were transported by rail in Ontario[63]



Source: Railway Association of Canada, 2016

Mitigating Demand Challenges by Shifting Capacity

The busiest region of Ontario with respect to goods movement is the GTHA. With its comprehensive, multi-modal network, goods flow by air through two major international airports (Toronto Pearson International Airport and Hamilton International Airport), marine ports, road (particularly the provincial 400-series highways), and intermodal rail terminals operated by CP and CN.[66]

Road-based goods movement remains the most dominant form of goods movement in the GTHA as almost everything sold is transported by truck for at least part of its journey.[67] With the rise of e-commerce, goods movement now involves smaller consignments, single orders, and higher delivery frequency, changing the nature of freight transportation.[68] As a result, truck traffic has generally grown in absolute volumes and shifted into suburban regions, with deliveries increasingly made in between peak and off-peak hours.

As a result, Ontario faces several challenges related to goods movement. First, congestion hinders the movement of goods efficiently and reliably. Second, land use planning does not always incorporate goods movement, which can lead to conflicts with residential and other land uses. Third, the environmental impact of goods movement is becoming increasingly important as freight emissions (across all modes of transportation) are expected to surpass passenger emissions by 2030 in Canada due to the overall increase in freight activity.[69] Fourth, there is no single source of comprehensive data pertaining to trucking, such as volumes, routes, origins, and designations; without good baseline information, it is difficult to understand urban freight demands and identify appropriate solutions.[70] Finally, the trucking sector itself is struggling to meet the projected demand for professional drivers due to its aging workforce.

Rail infrastructure has a critical role to play in mitigating the challenges of overreliance on truck transportation. To shift freight transportation from truck to rail, however, another type of infrastructure is required: intermodal facilities. Intermodal refers to the movement of containerized goods using more than one mode of transportation, including truck, rail, and/or ship. Intermodal facilities transfer shipping containers between trains and onto short-haul trucks to efficiently move goods in and out of a region. It is a safe, efficient, and environmentally responsible way to move goods. Without intermodal facilities, containers are more likely to move by long-haul trucks rather than rail which contributes to the congestion on regional highways and generates four times more greenhouse gas emissions per container.[71]

Across Ontario, as demand for both goods and passenger rail service grows with the population, new sites for intermodal facilities are required. Presently, CN Rail services the region through its Brampton Intermodal Terminal. As Canada's busiest and largest inland intermodal terminal, a million containers pass through this terminal every year, but it is nearing its container capacity.[72] CN is therefore proposing to build and operate a $250 million, state-of-the art intermodal terminal in Milton. The proposed Milton Logistics Hub aims to meet the increasing demand for goods in the GTHA, facilitate goods movement throughout the region, and improve trade linkages across North America. This hub is expected to support regional exporters and create more than 1,000 direct and indirect jobs in Halton Region.[73] Should the hub be approved, it would handle four intermodal trains per day, which is equivalent to removing over 1,000 long-distance heavy trucks on the 400-series highways.[74] The project is critical to both the Ontario and Canadian economies and should therefore be supported by the federal and provincial governments.

Given the reality of shared tracks, proposals for increased volume of freight movement in southern Ontario should reflect the increasing demand for passenger rail service across that same region. As much-needed intermodal facilities are proposed, these projects present opportunities for the provincial government to consider the connectivity of goods and passenger rail; how they may successfully shift capacity from one asset to another. The Government of Ontario should convene railway owners, passenger rail service providers, and municipalities to review regional growth projections, land use plans, and existing assets to determine if rail connectivity options could be expanded by the construction or re-location of intermodal facilities. Collaboration at this level could improve local buy-in, as well as result in projects that are a collective win for Ontario commuters and consumers.

Integrating Goods Movement into Municipal Planning

Developing solutions that reflect goods and passenger rail connectivity should be a priority for both the Ontario government and private stakeholders. A critical third stakeholder is municipal government; without guidance and empowerment, barriers such as insufficient planning and weak governance could halt progress.

Based on a survey of 23 municipalities across Ontario, a 2017 report by the Pembina Foundation found that freight is not a top transportation concern for most municipalities, even though municipal governments plan and regulate land use, manage road design, establish local truck routes, regulate parking, and more.[75] While over half of the respondents included goods movement policies in their official plans and/or transportation master plans, only one municipality in the survey reported developing a standalone freight plan.[76] When respondents were asked what would support future goods movement planning, municipalities had

a range of responses, including improved data collection and analysis, investment or guidance from higher levels of government, and stronger partnerships between municipalities and major freight companies.[77]

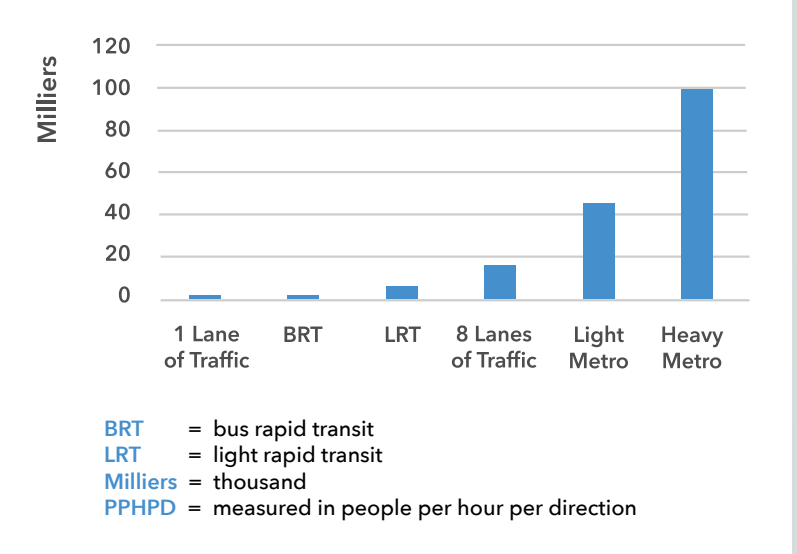
These findings echo Metrolinx's 2011 *GTHA Urban Freight Study*, which includes 17 stakeholder recommendations to improve the efficiency, and minimize the impact, of urban goods movement.[78] Among the recommendations was a need for greater collaboration between all levels of government, improved data collection and sharing on freight vehicles, routes, and activities, and enhanced land use planning.[79]

Given that Ontario's rail network is operated, served, and used by (or under the jurisdiction of) several levels of government and various private sector organizations,[80] the provincial government has a role to play as a convenor. Such a role could be characterized by developing municipal transportation planning capacity, mediating relations between municipal or regional governments and private rail firms, initiating joint-solutioning activities for common challenges, serving as a data repository and analysis centre, and proactively engaging both public and private stakeholders in its own transportation planning. By taking this approach, the Province could ensure that goods movement strategies reflect not merely transportation and infrastructure policy planning, but also economic development, municipal relations, environmental goals, and overall quality of life considerations.

MOVEMENT OF PEOPLE

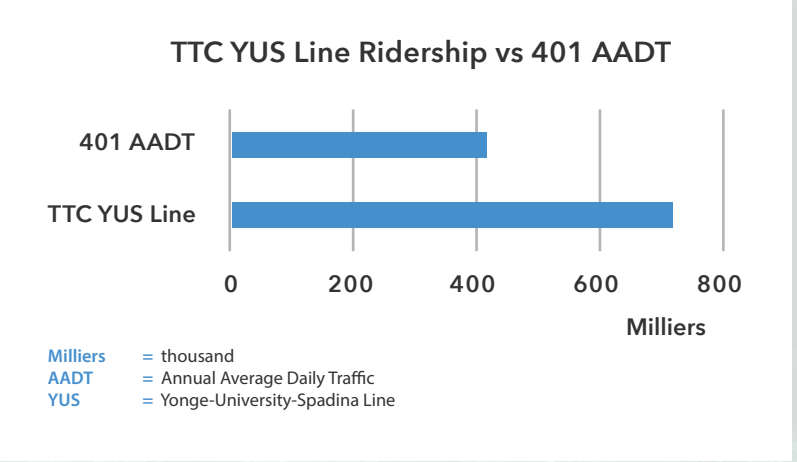
When it comes to moving the most amount of people in an urban setting, rail transportation has a superior carrying capacity in comparison to all other modes of transit. A subway line has greater potential passenger carrying capacity than eight lanes of highway traffic travelling in the same direction (Figure 5 and 6). Rail systems are also unique in their efficient use of real estate in an urban context given the number of passengers who can be carried by every square metre of space. It also boasts the highest safety record of any ground-based mode of travel, is reliable in all weather conditions, and has the lowest environmental impact per passenger kilometre outside of walking or cycling.[81] Rail is therefore essential to meet the needs of Ontario's growing population.

Figure 5: Transport capacity by mode, measure in people per hour per direction[82]



Source: Bombardier Transportation (forthcoming publication)

Figure 6: Each weekday, the Yonge-University subway transports more people than Highway 401



Source: Bombardier Transportation (forthcoming publication)

Combating Congestion and Increasing Capacity with Technology

The oldest and most-used light rail system in Ontario is the TTC's subway and streetcar network. Unfortunately, rapid development and population growth in the city and surrounding communities have resulted in numerous routes regularly operating at or above capacity. While a subway extension was recently completed, and the Eglinton Relief Line is well on its way, additional assets are required to meet demand. Further projects are likely to lack available and sufficient funding and may take years to complete due to the time required to acquire land and complete construction. As an immediate response to the TTC's capacity challenges, government should consider adopting cost-effective, technology-based solutions that leverage existing infrastructure investments.

With the exception of the Yonge-University-Spadina extension from Downsview Park to Vaughan Metropolitan Centre, the TTC's subway lines largely run on a traditional, fixed-block signalling system to ensure trains on the same track are kept at a safe distance from one another. With fixed-block signaling, rail tracks are divided into segments (or blocks). The block lengths determine how far apart the trains will be kept from each other and how many trains can pass through the system.[83]

Each block is protected by signals that dictate movement and prevent a train from entering an occupied track. A block is considered occupied even if only a small part of the train is in it. Since the system cannot determine a train's precise position within the block, a buffer is used to ensure trains do not run too close together.

Unfortunately, not enough headway leads to unsafe trains and an increased potential for accidents, while having too much headway (or space in-between each train) leads to longer wait times on the platform and increased congestion. As a result, fixed block systems are inefficient because they do not optimize existing tracks to their full ability.[84]

In contrast, communications-based train control is an advanced signaling technology used worldwide to optimize existing railway infrastructure by shortening the distance between trains and increasing capacity. CBTC systems are used in urban railways (both light and heavy), commuter lines, and automated people movers. The TTC currently employs CBTC on the 8.6 kilometre Yonge-University-Spadina Line extension, with an upgrade for the entire line not yet completed.

With CBTC systems, the trains continuously calculate and communicate their status via radio or GPS, including the exact position, speed, travel direction, and braking distance of the train. Trains continuously communicate with other nearby trains to adjust their speed and distance depending on the information received.[85]

The telecommunications between the train and the track equipment allows for an accurate calculation of headway between trains, which allows trains to run closer together. The buffer that ensures safe spacing is no longer fixed. CBTC technology thus uses existing track space more efficiently by reducing the minimum headway or space between operating trains, allowing trains to travel quicker, and allowing lines to host more trains per hour.[86]

CBTC technology has its origins in Ontario. The first successful demonstration of CBTC occurred in 1985 on the Scarborough Rapid Transit, followed by the first driverless system on the Vancouver SkyTrain also in that year. The CBTC technology continues to work well on the Scarborough Rapid Transit; while this line only has six, four-car trains, it is capable of running more trains per hour than what is currently in service.

Other cities have been in a similar position as Toronto is today. In the late 1980s, the Market Street Tunnel was San Francisco's transit bottleneck, with only 23 trains running per hour. The city faced two options to increase capacity: dig another tunnel or use a train control solution. The automated train control system chosen was one-sixteenth the cost of building a new tunnel and therefore saved the city approximate $1.3 billion USD. The modernized system can support up to 60 trains per hour.

For subway and light-rail assets in the GTHA, a CBTC upgrade would optimize capital investments in existing transportation infrastructure and equipment, increase capacity, and allow for more frequent service without compromising safety. CBTC systems have differing Grades of Automation, ranging from manual protected operation to fully automated operation. Full automation adds additional capacity on trains while reducing labour costs. CBTC is also independent of the vehicle manufacturer, so it can be implemented in any train, regardless of the supplier.

Implementing a technical solution like CBTC typically represents the smallest investment when compared to the cost of land, civil construction, electrical and mechanical equipment, and operations and maintenance for rail infrastructure. Adopting this technology to modernize existing assets would optimize investments made by previous provincial governments. Moreover, implementing the technology is a less disruptive solution for passengers and businesses, as well as a speedier solution to increasing operational capacity on subways, when compared with digging new tunnels.

VANCOUVER SKYTRAIN

The Vancouver SkyTrain is the oldest and one of the longest automated, driverless light rapid transit systems in the world. BC Transit chose to incorporate CBTC for its two lines–the initial Expo Line and subsequent Millennium Line–that connect Vancouver with Burnaby, New Westminster, and Surrey. The subsequent increases in capacity and frequency resulted in ridership rising from 16 million passenger trips in 1990 to 42 million in 2007.[87] Since the SkyTrain is automated, Vancouver saves $1 million in annual operating costs.

LONDON'S JUBILEE, NORTHERN, AND PICCADILLY LINES

The London Underground is one of the oldest and largest subway systems in the world. Due to growing passenger demand, the subway's train control and signalling system was upgraded to CBTC in 2003. Although attendance drivers remain on board, the system allows for automatic train operation and supervision, with operators tracking and controlling train movements and routes, automatically launching more trains at peak service times. Resignalling the 50-station, 106 train Northern Line alone led to an additional 11,000 passengers per hour and reduced journey times by 18 percent while, for the most part, leveraging existing infrastructure.[88]

The budgets and savings described in the above case studies are valued in accordance to when the respective projects were developed.

Unlocking Intra-Provincial Rail Potential

Looking beyond Toronto, passenger rail service is a common mode of mass transportation for both urban and rural Ontarians. These long-distance trips have, in recent years, prompted public discussion about the possibility of introducing high-speed rail (HSR) to major routes, including Toronto-Ottawa-Montreal and Toronto-Kitchener/Waterloo. HSR refers to a rail service that can achieve significantly faster speeds than conventional rail by operating at or above 250 kilometres per hour on dedicated tracks, or at 200 kilometres per hour on existing tracks. As a result, HSR allows commuters to travel smoothly and speedily over longer distances.[89]

While HSR lines would benefit Ontarians by linking workers to jobs, capital to entrepreneurs, and customers to products and services, such projects require an output of resources and time that is difficult for the government to shoulder and does not address the immediate needs of passengers. In April 2016, the provincial government announced an initial investment of over $11 billion to begin the construction of the first HSR line in Canada, with a total of seven stops along the Toronto-Windsor corridor. This investment was earmarked for the first phase of the project, which included service to London, Kitchener, Guelph, and Toronto Union Station, with a connection to Pearson International Airport.[90]

The electric-powered trains would move at speeds of up to 250 kilometres per hour on a combination of existing track and a new dedicated rail corridor,[91] and would cut travel times between Toronto and Windsor from over four hours to just over two hours.[92] This phase was projected to begin carrying passengers by 2025, with the second phase adding stops in Windsor and Chatham by 2031. Given the hefty price tag ($20 billion), soft estimated return on investment,[93] concerns about the impact on farmlands, and the current fiscal climate in Ontario, this HSR line may no longer be a feasible solution.

Looking at the near-term needs and priorities of Ontario commuters, the government should instead consider cost-sensitive alternatives that make use of existing infrastructure rather than those that would require the purchase of land and construction of new rail lines.

One such alternative is VIA Rail's High Frequency Rail (HFR) proposal. HFR is a strategic solution to the problem that much of Ontario's passenger rail network faces: the inability to increase speeds and frequencies of service due to track-sharing with freight transportation as both freight and passenger rail are increasingly in demand.

VIA Rail operates on a 12,500 km rail network; however, 97 percent of that network is owned and operated by railway partners, with only three percent owned and operated by VIA.[94]VIA Rail currently uses freight track for most of its passenger rail service between Toronto, Ottawa, Montreal, and Quebec City. As a result, it must negotiate access and compete for track capacity with freight companies on one of the busiest routes. The current situation impacts performance and frequency, with regular delays and a limited number of services per day. VIA is therefore proposing a new, dedicated passenger rail line, separate from freight rail lines, connecting its largest travel markets.

The dedicated passenger track would involve optimizing and upgrading existing track infrastructure that is currently underused and owned by a freight company. These upgraded tracks would connect with existing VIA Rail infrastructure to link Toronto with Ottawa, Montreal, and Quebec City through a more direct route by way of Peterborough and Trois-Rivières. This dedicated track would allow for high frequency rail services across the existing and new Corridor network; that is, more frequent service and improved travel times. With HFR, the trains could run at their full speed (up to 200 kilometers per hour) on the dedicated track because they would no longer share the tracks with freight trains, which currently receive priority at bottlenecks.

The proposed route between Ottawa and Toronto that runs through Peterborough would better link that growing region to Ontario's political and financial centres, as well as Toronto Pearson International Airport. With express city-to-city trains on a new northern track, existing train services sharing freight track infrastructure can make more frequent stops at intermediate communities such as Cobourg, Belleville, and Port Hope. The introduction of a hub in Kingston would also facilitate the introduction of new early morning and evening trains that can allow commuting and day trips, the demand for which is growing as Prince

Edward County transforms into both a popular tourism destination and a pseudo-bedroom community of Toronto.

Offering passengers along one of Canada's busiest travel corridors with a more efficient and reliable rail option would reduce dependence on personal vehicle travel, potentially increasing productivity while reducing congestion, road wear-and-tear, and negative environmental impacts. With construction expected to be complete within four years of project approval, High Frequency Rail is a timelier alternative to a HSR line. Upon completion, HFR could enhance inter-city rail travel in Ontario and set the stage for future improvements in Southwestern Ontario.

The proposed HFR line is expected to cost $4 billion and could be funded by a combination of private and public sources and the expected increase in ridership – from 4.1 million to 9.9 million by 2030.[95] Given that this project includes a revenue-generating component, it is ideal for the Canada Infrastructure Bank (CIB). Established in 2017, the CIB is a Crown corporation that operates at arm's length from the federal government, with a mandate to fund revenue-generating infrastructure in the public interest with investments from the private sector and institutions.[96] Its stated commitment to exploring projects with revenue-generating potential could unlock new sources of funding for infrastructure, as well as help build more infrastructure projects, faster.[97]

Although VIA Rail is a Crown corporation, both the provincial and federal governments should be receptive to new ways of financing rail infrastructure. Using private capital for infrastructure investments has the potential to improve the scrutiny of project proposals, accelerate the pace of project development, and deliver projects more cost-effectively.[98]

Moving Innovation in the Toronto-Waterloo Corridor

The past decade has seen an incredible transformation in the Kitchener-Waterloo region, with its reputation and influence as a high-tech cluster expanding beyond Canada's borders. (Figure 7) What is now referred to as the "Innovation Corridor"—consisting of downtown Toronto, Brampton, Guelph, and Waterloo Region—has the potential to become a world-class technology supercluster.

However, recent analysis conducted by McKinsey & Company identified seven barriers that must first be addressed before the region can achieve supercluster status. Among these is the lack of connectivity between the corridor's urban centres, as existing commuter rail and highways are insufficient to facilitate consistent and rapid movement.[99]

The Toronto-Waterloo Innovation Corridor is often compared to Silicon Valley, commonly understood as the San Francisco-San Jose region. It is Canada's largest tech cluster, measured by equity value, at more than $148 billion (in comparison to the Valley's $411 billion).[100]

The distance between San Francisco and San Jose is approximately 90 kilometres, with a combined population of 4.3 million people. In comparison, the Innovation Corridor is 110 kilometres in length and contains a population of 6.2 million.[101] Toronto-Waterloo represents a similar distance with a greater population, yet it lacks the regular train service that links tech entrepreneurs to business opportunities throughout the Valley.[102] Instead, the technical prowess of Waterloo Region is cut off from the financial centre of Toronto by bedroom-community train schedules and a wall of congestion on the 401.

GO Transit currently provides four weekday morning and four weekday afternoon rail trips between Kitchener and Toronto Union station—a trip that can take two hours each way. Waterloo Region was originally promised all-day, two-way GO trains in 2007 with service expected to be implemented by 2025. For both businesses and commuters in the Innovation Corridor, this is too long a timeline. As a stopgap, some private companies charter cars and buses to shuttle their employees between destinations. However, this solution offers limited capacity and only contributes to the congestion on Highway 401, highlighting the immediate need for regular rail service.[103]

Increased passenger rail service would contribute to a more seamless innovation ecosystem that could compete directly with Silicon Valley and other global clusters.[104] Since clusters flourish when entrepreneurs and partners can build relationships and collaborate, greater rail service would better facilitate the movement of people, ideas, and expertise.[105] This would, in turn, allow companies in the corridor to recruit from the larger

talent pool in the Toronto area, attract venture capitalists and foreign direct investment, and help workers efficiently travel between urban and regional offices.[106] Diverting commuters from the 401 using passenger rail is also expected to reduce environmental impacts, accidents, and maintenance costs.[107]

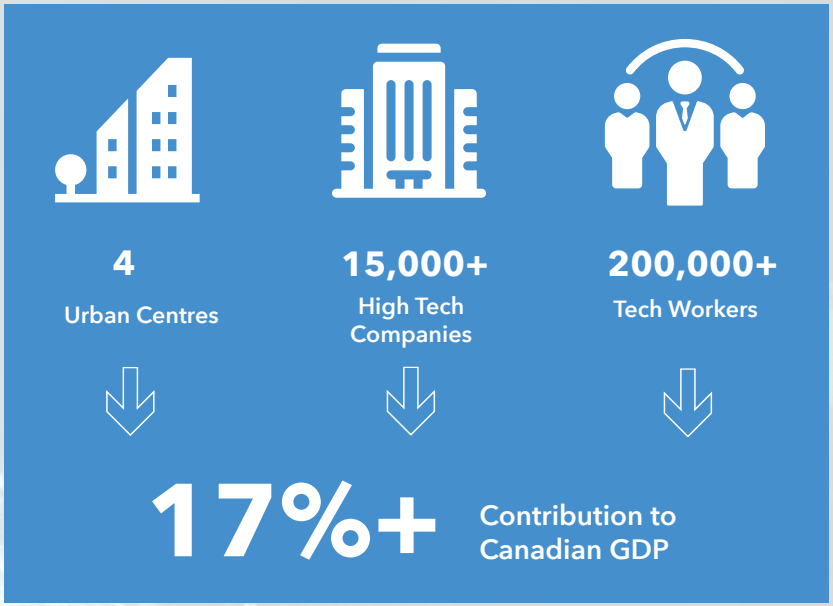
Investing in rail in the corridor would not only support the high-tech sector, but also the manufacturing, insurance, financial services, and transportation sectors in the region. The Innovation Corridor is also Canada's largest transportation corridor, with approximately $3 billion worth of goods (or 1 million tonnes) moving on the region's roads daily.[108] Trucks along the corridor transport everything from raw materials to food and consumer products, provide last-mile connectivity for other modes of transportation, and transport containers to and from various terminals.[109] Congestion and delays result in drivers spending more time on the road, which increases operating costs for trucking companies[110] and costs Canadian businesses and consumers an estimated $500 to $650 million per year in higher prices for goods.[111]

In 2014, the Government of Ontario announced its intention to build a HSR line in the Toronto-Windsor corridor, commencing with an environmental assessment to determine the most appropriate route,[113] the appointment of a Special Advisor on High Speed Rail in 2015 to assess the project's feasibility,[114] and $15 million in preliminary design work coupled with a comprehensive environmental assessment in 2017.[115] While faster rail service in the Innovation Corridor is important, as previously mentioned, the HSR project is both capital- and time-intensive. To address immediate needs, the Province should accelerate plans to bring two-way, all-day GO Transit rail service to Kitchener-Waterloo.

In 2014, two-way, all-day service was estimated to cost $600 million. However, the City of Kitchener notes that expanding GO service would generate $567 million in personal income taxes, far exceeding the initial or ongoing operating costs of the service.[116] Similarly, McKinsey estimates that by addressing various barriers facing the Toronto-Waterloo Innovation Corridor, including transit connectivity, the corridor could contribute $17 billion to the national GDP and create 170,000 new jobs over the next ten years.[117]

The municipalities that constitute the Innovation Corridor have long recognized the competitive benefits that two-way, all-day GO service would bring to the Ontario economy, yet without strategic action from the provincial government, barriers to the cluster's success have remained. Appropriate provincial transportation planning should include mapping economic growth and cluster development, identifying for decision-makers where resources can be deployed to support wealth and job creation.

Figure 7: The Innovation Corridor represents over 17% of Canada's GDP[112]



Source: McKinsey & Company, 2016

RETURNING RAIL TO NORTHERN ONTARIO

As has been noted in this report, Southern Ontario's rail needs are related to battling congestion and improving the speed of existing connections. In Northern Ontario, work must be done to build and re-build critical rail connections.

From 1976 to 2012, the provincially-owned Ontario Northland Transportation Commission (ONTC) operated the Northlander passenger train service, which ran from Toronto through North Bay to Cochrane.

Since freight trains took precedence over passenger rail on shared lines, Northlander trains would stop for hours to allow freight to pass.

Although the comfort of the train was appealing to many passengers, the fact that the Northlander was frequently late when arriving in Toronto ultimately challenged its utility. Despite both the demand for service and the opportunities that passenger rail service to and within Northern Ontario could provide, the service's unreliability was a significant barrier for those travelling to medical and business appointments. The Northlander was discontinued in 2012 by the provincial government, citing the high per-passenger subsidy and low usage.

The story of the Northlander is characteristic of the limited mass transit options for residents of Northern Ontario, as outlined earlier in this report. However, the return of passenger rail to Northern Ontario represents a unique opportunity for the entire province. As a regional economic development tactic, new rail service could open markets and create opportunities for trade and export, as well as further develop the North's tourism industry.

Developing viable rail options in Northern Ontario—a region that spans over 800,000 square kilometres and accounts for almost 90 percent of Ontario's land mass[118]—would be a significant undertaking for the provincial government. Given that the expansion of passenger rail in Northern Ontario would generate revenue through fares, it presents another potential project for the Canada Infrastructure Bank. As noted earlier, the Canada Infrastructure Bank combines federal seed funding with potential investments from the private sector to build infrastructure projects. Partnering with the federal government through the CIB would help reduce the cost to the Ontario government while making considerable strides towards improving the social and economic opportunities in the largest region of this province.

RECOMMENDATIONS

7. **Develop a goods movement convenor framework that engages municipalities, the freight industry, relevant provincial Ministries, and the federal government where appropriate.**

- This framework should govern:
  - Capacity-building for municipal transportation planning, to ensure it includes freight;
  - Processes of stakeholder engagement, including consultation and joint-solutioning;
  - Assessments of interoperability and interconnectivity with other transportation assets, whether public or private;
  - Co-ordination with passenger service operators to optimize flows for both goods and passenger rail movement, including planning for future assets such as intermodal and multi-modal hubs; and
  - Data sharing on urban freight movements to understand demand and assist with planning.
- Such a framework would ease the development of proposals such as the CN Rail Logistics Hub in Milton, which is a priority project for improving the flow of goods in the GTHA and across North America, and should therefore be supported by the provincial and federal governments.

8. **Invest in state-of-the-art technology such as CBTC to address immediate capacity concerns on the TTC subway network.**

- The government should support the completion of CBTC upgrades on the Yonge/University-Spadina Line, and work with the City of Toronto to develop a plan to convert existing fixed-block signal systems as rapidly as possible.
- As the primary funder of transit projects, the Province should use the

procurement system to optimize future light rail assets and deliver greater value for public dollars. RPFs should include performance requirements (such as throughput, availability, and headway) thereby ensuring technical solutions that allow for future ridership growth are incorporated at the outset of a project.

9. **Prioritize investments with the greatest potential to provide a strong return on investment via economic growth.**

- In collaboration with Metrolinx, move quickly to establish two-way, all-day GO Train service between downtown Toronto and Kitchener.
- Support the VIA Rail High Frequency Rail proposal, which will increase passenger rail capacity and link growing regions of Ontario to financial and political centres.

10. **Partner with the Canada Infrastructure Bank to secure funding for critical rail projects in both Northern and Southern Ontario.**

- Seek options for the development of the VIA Rail High Frequency Rail project, as well as high-speed or high-frequency rail needs in Southwestern Ontario.
- Develop a plan for the restoration of passenger rail in Northern Ontario, beginning with a review of existing assets to determine their viability, such as the lightly used CP tracks and Northlander infrastructure between Toronto and Moosonee.

PILLAR III

Autonomous Vehicles

Driverless technology has the potential to completely change major facets of our society, altering personal mobility, the built environment, productivity levels, and the composition of our workforce. According to the Conference Board of Canada, the widespread adoption of autonomous vehicles is not a matter of "if" but rather "when."[119]

Ontario has taken several steps to position itself as a leader in this space, including becoming the first jurisdiction in Canada to introduce a pilot AV regulatory framework and make significant investments in technology development and demonstration zones. Yet continued policy and regulatory development is necessary if the province is to capitalize on its first-mover status and adequately prepare for the future of mobility.

DEFINING AUTONOMOUS TECHNOLOGY

In order to replace (and replicate) a human driver, connected and autonomous vehicles (C/AVs) rely on hardware such as communication devices, cameras, GPS, ultrasonic sensors, radars, and light detection and ranging (LIDAR), as well as software that allows vehicles to make driving decisions.[120]

Figure 9. Five Levels of Vehicle Autonomy[120]

Level 0
No automation: the driver is in complete control of the vehicle at all times

Level 1
Driver Assistance: the vehicle can assist the driver or take control of either the vehicle's speed through cruise control or its lane position through lane guidance.

Level 2
Occasional self driving: the vehicle can take control of both the vehicle's speed and lane position in some situations, for example on limited-access freeways.

Level 3
Limited self driving: the vehicle can take full control in some situations, monitors the road and traffic and will infrm the driver when he or she must take control.

Level 4
Full self driving under certain conditions: the vehicle can take full control for the entire trip ij these conditions such as urban ride-sharing.

Level 5
Full self driving under all conditions: the vehicle can operate without a human driver or occupants.

Source: Siemens, 2018

Simple automation features, like cruise control, braking assist systems, lane monitoring, and parking assistance, are common today. Advanced driver assistance systems such as pre-collision braking, traffic-aware cruise control, lane changing, and self-parking are also entering the market.

While C/AVs share some of the same technologies, the terms are not one and the same. Connected vehicles use internet connectivity to extend a vehicle's awareness beyond its physical limits and enable communication between vehicles, transportation infrastructure, mobile devices, and cloud computing platforms. Connected vehicles do not necessarily control the vehicle. AVs, however, can sense their environment independently and navigate without a human driver.[121]

In 2016, the Society of Automotive Engineers (SAE) defined five levels of vehicle automation (Figure 9). At Level zero, a human manages all driving tasks, while at Level 5 all driving tasks are locally or remotely controlled by computers. Currently, vehicles available to consumers are primarily at Level 1 or 2 automation. It is likely that Level 3 AVs be on public roads in the 2020s, while the deployment of Level 4 and 5 vehicles will not be commonplace until the 2030s or 2040s.[122] IHS Markit expects that the annual worldwide sales of AVs in 2040 will exceed 33 million units—up from a projected 51,000 in 2021.[123]

While the public AV conversation tends to focus on personal AVs, the technology can be used for other applications. Besides one- or two-person pods replacing the standard four- to six-passenger vehicles common today, AV shuttles, coach buses, or transit buses could potentially be incorporated into existing transit networks. A variety of commercial AVs are being used in pilots and trials around the world, including AV delivery robots and long-haul trucks that can move freight. AV garbage trucks and snow plows are also in testing, with the goal of providing more efficient and safe services.[124]

CANADA'S AV READINESS

With forecasts predicting that Canadian roads will see Level 5 vehicles in only 20 years, it is imperative that governments of all levels begin to prepare for the disruption that will follow and ensure the conditions for success are in place (Figure 10).

Where does Canada stand on AV readiness today and in comparison to other countries? The 2018 KPMG Autonomous Vehicles Readiness Index (AVRI) evaluated the preparedness of 20 countries as it relates to the introduction of self-driving cars. KPMG's analysis was based on four pillars: policy and legislation, technology and innovation, infrastructure, and consumer acceptance.[126]

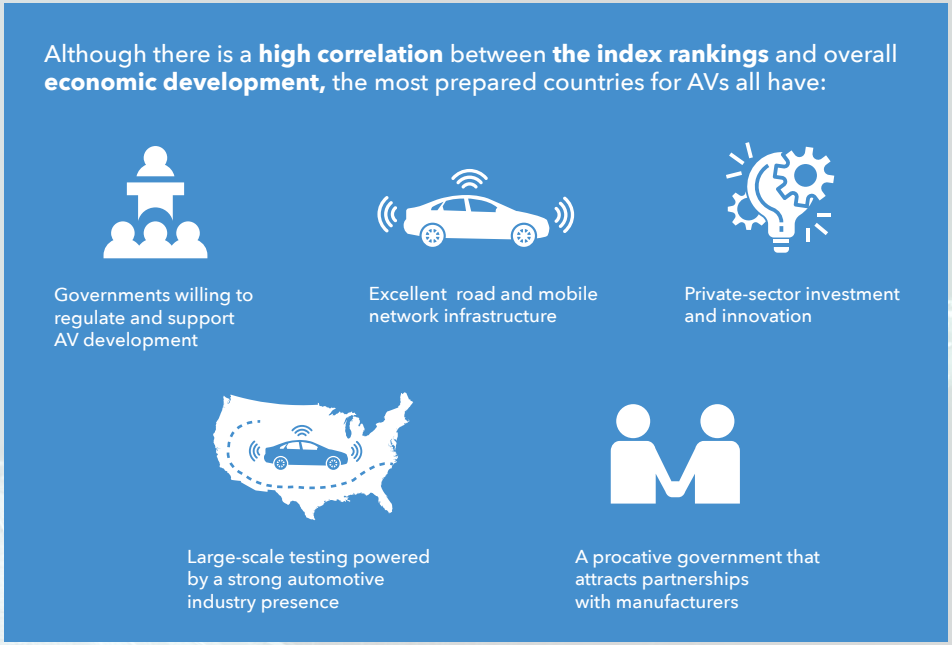
Despite Ontario's forward-looking approach to AV regulation, Canada ranked seventh out of 20 in overall AV readiness, falling behind Germany, the United Kingdom, Sweden, the United States, Singapore, and the Netherlands. For a look at how other countries are preparing for a driverless future (Figure 11).

The Netherlands took the top spot because it performed strongly across all four pillars, particularly on infrastructure. The Netherlands possesses AV-friendly road infrastructure, the highest density of electric vehicle charging points in the world, and high-quality wireless networks. It also excelled in regulations and government investment in AV infrastructure. The Netherlands first approved AV road testing in 2015, with updates made to its legislation in 2017 to allow for testing without a driver.[127]

In contrast, Ontario first issued permits for road testing in 2017 and is currently the only Canadian province or territory to have done so. The AVRI found Canada rates well on technology and innovation, with the highest possible score for industry partnerships and high scores on both research and development hubs and AV technology company headquarters.

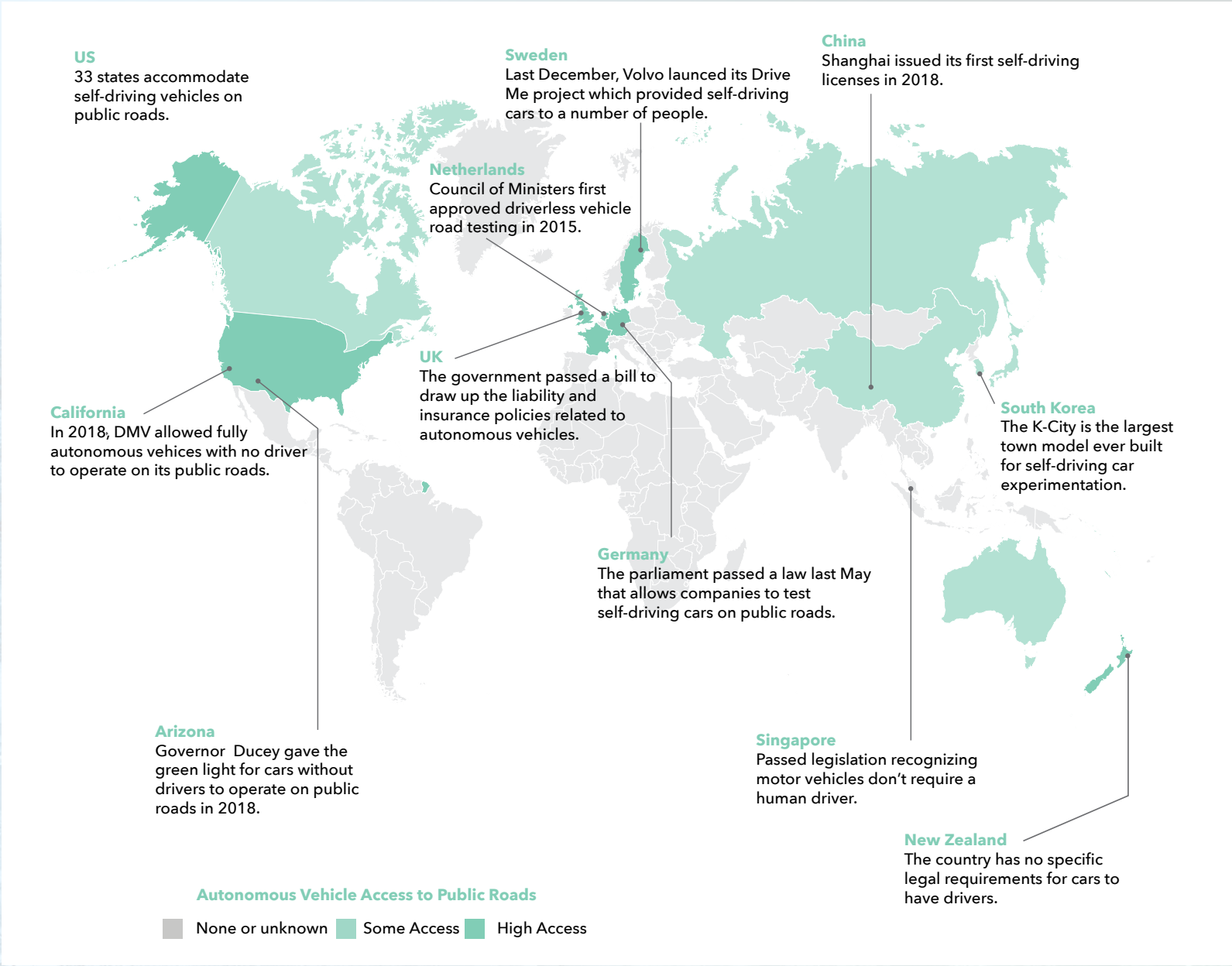
On infrastructure, Canada is well-rated for roads and mobile networks, and we are leading in terms of people living in an AV test area, which impacts consumer acceptance. We also received maximum marks on government-funded AV pilots, although Ontario is currently the only jurisdiction to have issued permits for AV testing on public roads. Unfortunately, Canada lags on patents, indicating that we may be a host for AV innovation, but not a creator of that innovation.

Figure 10. Conditions for Success[125]



Source: KPMG International, 2018

Figure 11. Autonomous vehicle access to public roads[128]



Source: Medium.com, 2018

ONTARIO'S AV LEADERSHIP

On January 1, 2016, Ontario enacted Regulation 306/15, Pilot Project – Automated Vehicles. This pilot regulatory framework allows for the testing of AVs on public roads under strict conditions, making Ontario the first jurisdiction in Canada to allow for the testing and demonstration of automated driving systems. The Province also provided $2.95 million in funding to support industry and academia through the Ontario Centres of Excellence Connected Vehicle/Automated Vehicle Program.

The pilot project:

- Is restricted to testing purposes only;
- Includes only vehicles manufactured and equipped by approved applicants;
- Includes vehicles that operate at SAE Level 3, 4, or 5;
- Requires a driver to hold a full class license for the type of vehicle being operated;
- Requires a human driver to remain in the driver's seat at all times and monitor the vehicle's operation;
- Requires participants to have insurance of at least $5,000,000 to cover any damages;
- Requires participants to abide by all current Highway Traffic Act rules; and
- Is planned to run for a 10-year period with evaluations.[129]

Ontario's pilot regulatory framework opened the door for the creation of the Autonomous Vehicle Innovation Network (AVIN) in 2017, a Government of Ontario initiative delivered by the Ontario Centres of Excellence. AVIN builds upon Ontario's position as a vehicle manufacturing and supply leader and leverages the large cluster of information and communication technology companies operating in the province.

AVIN supports Ontario-based small- to medium-sized enterprises (SMEs) with C/AV-related technology in light and heavy-duty vehicles, transportation infrastructure, intelligent transportation systems, and transit-supportive systems to develop, test/validate, pilot, and demonstrate their products.

The Network's Demonstration Zone is located in Stratford, Ontario and is one of AVIN's regional sites. It was chosen in part for its unique and comprehensive connectedness via an integrated fibre/Wi-Fi platform that provides internet connectivity anywhere in the city. This site allows companies with C/AV technologies to test, validate, and showcase innovative products to potential customers and partners in a controlled environment and in accordance with applicable laws and regulations.

According to AVIN, there has been increased interest in development projects, testing, pilots, and the commercialization of leading-edge technologies and solutions in Ontario by municipalities, regions, transportation and transit authorities, entrepreneurs, and SMEs.

This success prompted consultations regarding proposed amendments to the existing regulation, held in December 2017,[130] but action has yet to be taken on the recommendations proposed by stakeholders, including testing driverless vehicles.[131] Preventing driverless testing of AVs in Ontario reduces our attractiveness as a development locale, pushing innovation, investment, and jobs to jurisdictions with less rigid regulations.

AV READINESS IN THE UNITED STATES

In contrast, Canada's closest competitor ranked third on the KPMG AVRI. The US leads in AV innovation and is ranked at the top of the technology and innovation pillar. It scored maximum or near-maximum ratings on industry partnerships, research and development hubs, AV technology company headquarters, and investments. The United States has the largest number of AV companies, as well as auto-makers, ridesharing companies, and intermodal innovators involved in research.[132]

In the United States, each state is responsible for its own autonomous vehicle regulation. As of 2017, 33 states had either passed legislation, issued executive orders, or announced legislation to accommodate self-driving vehicles on public roads. Notably, some of these decisions have included permission for fully autonomous vehicles (Levels 4 and 5) to operate on public roads.

A number of states have not only developed AV readiness laws and regulations but have also updated them to meet the progress of technology. These states are now attracting automakers and technology companies that are looking for a supportive and adaptable regulatory environment to effectively test their vehicles. Lawmakers, therefore, have a clear role to play in supporting the development, advancement, and adoption of AV technology. Without government permits, testing self-driving vehicles on public roads is almost universally illegal, hampering the ability of manufacturers to experiment, innovate, and succeed.

At a national level, work to establish AV standards is on-going. In 2017, the United States Department of Transportation and the National Highway Traffic Safety Administration (NHTSA) released *Automated Driving Systems: A Vision for Safety 2.0*, their latest voluntary guidance framework for industry and states with respect to automated driving systems (serving as an update to the 2016 Federal Automated Vehicles Policy).

A Vision for Safety 2.0 contains no compliance requirement or enforcement mechanism. Instead, it is meant to help designers of automated driving systems identify, analyze, and resolve safety considerations prior to deployment.[133] Within the document, the NHTSA outlines 12 safety elements it recommends manufacturers consider and address when developing, testing, and deploying automated driving systems on public roadways. It also clarifies federal and state roles and responsibilities, and provides best practices and technical assistance for policymakers.[134]

WHY DOES ONTARIO NEED TO BE AN AV LEADER?

Reducing Congestion

Given the GTHA's status as one of the most congested regions in North America, the potential for AVs to solve this problem should be top-of-mind for politicians and policymakers. The congestion-mitigation potential of AVs is significant, given their ability to reduce spacing between vehicles, increase average vehicle occupancy through ride-sharing, and anticipate traffic patterns.[135] AVs could also help to avoid the inefficient start-and-stop traffic conditions from human drivers as they can travel at a more constant, steady pace.

However, since AVs are computer-controlled and operate with sensors and software that can react to hazards faster than human drivers, these vehicles can safely travel closer together, which may increase the number of vehicles on existing roads. It should be noted that optimizing the capacity of existing roads may reduce the need to expand roadways and/or build new ones.[136]

In dense travel corridors, the need for traditional mass transit during peak periods will likely continue, as it remains an efficient method of moving many people relatively quickly.[137] AV and public transit are not in competition, however; if short AV trips can solve the first- and last-mile issue, the technology could lead to an increased use of transit.[138] It is also likely that we will see AV technology applied more widely to subway, light rail, and bus infrastructure.

Reducing the Need for Parking Lots

A further benefit associated with AVs is the expected reduction in the need for parking lots and structures, particularly in central urban areas. This owes to the fact that AVs can relocate to an area of free parking, regardless of distance from their passenger's destination. Alternatively, an automated taxi could pick up its next ride or a commuter could send the car home for a family member to use. As a result, land currently dedicated to parking could be converted for more productive uses, such as commercial, residential, green, or community spaces.[139]

Increasing Safety

The same technologies that can mitigate congestion could also contribute to safer roads. In Canada, a person dies every four hours or is admitted to hospital every 90 minutes as a result of a traffic collision.[140] Estimates put the total cost of collisions in Canada at approximately $46.7 billion per year.[141] Over 90 percent of these crashes are caused by human error[142] due to factors such as speeding, driver age, alcohol and/or drug impairment, fatigue, and distraction, to which AVs are not susceptible. Automated features also have the potential to reduce behaviours such as delayed reaction time, tailgating, and other forms of distracted driving.[143] Self-driving cars have the potential to significantly reduce collisions and related deaths, as well as the costs associated with property damage, injuries, and loss of future earnings.

Improving Mobility and Productivity

AVs have the potential to improve quality of life in other ways, such as increasing access to mobility for a significant number of Ontarians, specifically children and youth, seniors, low-income groups, people with disabilities, individuals located in remote or rural areas, and those who lack access to mass transit.[144] Improved mobility can increase personal independence, reduce social isolation, improve access to essential services, and link individuals with employment and training opportunities.[145]

According to the Conference Board of Canada, Canadians spend at least five billion hours a year in their cars.[146] Since individuals will not have to focus on driving in an AV, this will free up time to pursue other activities, whether work, leisure, or a combination of the two.

Capitalizing on Our Competitive Advantage

Beyond its first-mover status in Canada with respect to AV regulation, Ontario possesses the necessary ingredients to play a leading role in the development of C/AV technologies, and thus reap the economic benefits of doing so.[147] Our current advantages include:

- The Toronto-Waterloo Innovation Corridor, which is the second largest IT cluster in North America after Silicon Valley, with over 20,000 IT companies and 280,000 IT workers;
- A presence from all five top automakers: Fiat Chrysler Automobiles, Ford, GM, Honda, and Toyota, collectively producing over 2.3 million vehicles each year;
- 700+ automotive parts manufacturers based here, along with more than 500 tool, die, and mould makers producing high-quality automotive parts and components; and
- 44 colleges and universities, which graduate 40,000 students each year in STEM disciplines.[148]

This list of advantages, and the environment that produced them, is unique. Capitalizing on our status could offer Ontario economic and social benefits beyond those directly related to the AV revolution.

ESTABLISHING GOVERNMENT READINESS

The widespread adoption of AVs will impact the shape of communities, the use of public infrastructure, and the composition of the labour market. What should government at all levels anticipate to ensure Canada is ready for an autonomous future?

Reimagining Roads

Automakers are currently developing AVs to operate on today's roads without modifications to existing transportation infrastructure.[149] Much

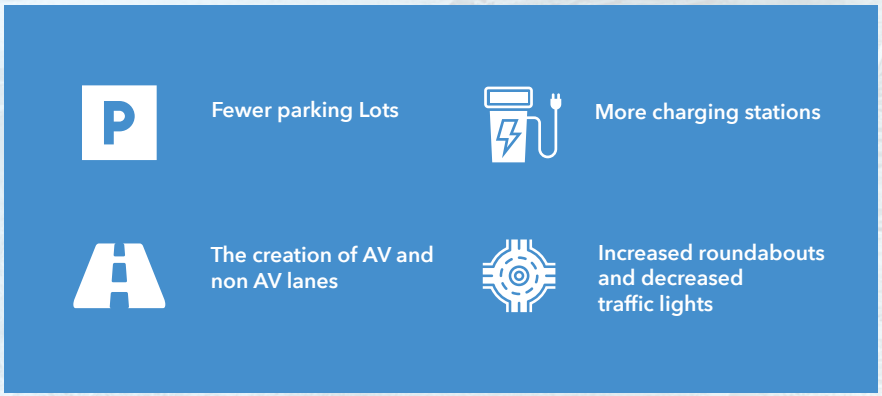
like human drivers, AVs require clear and visible lane markings, roadways clear of snow and debris, and a well-maintained road surface.

Soon, however, more substantive changes to road infrastructure will be required (Figure 12). In the short-to-medium term, increased digital representation of road infrastructure will be necessary. During the transition from majority conventional to majority driverless vehicles, some roads may be re-striped to create AV and non-AV lanes.

In addition, as the number of AVs increase, signalized intersections are likely to be replaced with roundabouts, which are more efficient for AVs than traffic signals. With increased automation, signage to assist human drivers may be eventually phased out and replaced by local transmitters that send data directly to the vehicles.[150] Smart roadway infrastructure that enables vehicles to communicate with traffic lights, border crossings, grade crossings, and each other will have to become the norm.[151]

This switch from traditional to smart infrastructure will not only present a challenge to governments as they plan and fund improvements, they will also have to manage imbalanced transitions at their borders. Harmonization and standardization of signage and technology between provinces and countries will be required so that AVs can process information correctly and journeys will be seamless for travellers and goods.

Figure 12: Changes to infrastructure



Source: Conference Board of Canada

FAR-REACHING INTER-GOVERNMENTAL COLLABORATION

Within Canada, all three levels of government will need to work together to make the introduction of AVs on public roads a success, as the technology will impact federal, provincial, and municipal domains:[152]

- **FEDERAL:** Transport Canada is responsible for holding vehicle manufacturers accountable for safety, standards compliance, and emissions requirements. The federal government would, therefore, be responsible for establishing a national AV policy and regulatory framework. Additionally, with primary jurisdiction over trade and international affairs, the federal government should take the lead on establishing norms and harmonizing standards across international borders.
- **PROVINCIAL/TERRITORIAL:** Provincial and territorial governments are responsible for driver licensing, vehicle registration and insurance, rules of the road, and highway infrastructure–all of which will be disrupted by autonomous technology. This level of government is responsible for creating the legislative framework that allows for AV testing and deployment on the majority of public roads.
- **MUNICIPAL:** Municipalities execute the legislative and regulatory framework created by the provinces and territories, including AV safety enforcement. They will require consultation and capacity-building to accurately and effectively implement policy from other levels of government.

ONTARIO-MICHIGAN MOU ON C/AV TECHNOLOGY

In 2017, Ontario and Michigan signed a Memorandum of Understanding (MOU) to collaborate on testing, developing, and marketing of C/AV technology. The signing of the MOU was marked by the completion of North America's first cross-border AV test drive–commencing in Detroit, continuing from Windsor to Sarnia, and then crossing back over the border into Traverse City, Michigan. This is the kind of partnership that can be built upon to ensure a smoother transition to AV-friendly infrastructure on roads and at the border, and through which governments can develop best practices to be shared with other jurisdictions.

Expanding Electric Vehicle Infrastructure

Since AV technology and electric vehicle (EV) technology go hand-in-hand, commercial, residential and public destinations will require more EV charging points.[153] As AVs become a shared service on demand, rather than personal vehicles, they will travel more kilometers more frequently and thus require multiple charging events per day.[154] Electric utilities will, therefore, need to consider utility pricing structures that reward charging at times and in locations with low power demand to help manage the anticipated impact on the electrical grid.[155]

As electric utilities prepare to accommodate this anticipated increased load, charging providers and other stakeholders will have to consider where EV infrastructure is situated. Currently, charging ports are found in locations where people spend considerable time, or locations with amenities for drivers as their vehicles are charging, such as hotels, malls, and workplaces. However, the convenience of human drivers may no longer be the primary consideration when charging infrastructure is installed for a driverless future.[156]

Modernizing Insurance Regulation

AVs will undoubtedly impact auto insurance regulations currently prescribed in provincial law. Since Ontarians who purchase an AV in the near future will expect appropriate insurance to be available and the relevant legislation already in place, this is an especially timely issue for government.

The current *Ontario Insurance Act, 1990* puts responsibility—and, hence, liability—with respect to collisions on the human driver. However, AVs will shift liability towards vehicle manufacturers and technology providers, which will result in more product liability claims. In Canada, these types of claims are usually more complex and can take several years longer to resolve than the two to four years associated with the average vehicle collision liability claim.[157] Members of the Insurance Bureau of Canada (IBC) have expressed concern that some individuals injured in collisions caused by AVs may not receive timely compensation, prompting IBC to advocate in favor of Canadian provinces and territories adopting the UK's Single Insurance Policy.

In light of the various concerns associated with AV product liability litigation, the UK passed the *Automated and Electric Vehicles Bill, 2017-2019*, establishing a single insurance policy.[158] After receiving Royal Assent on July 19, 2018, the Bill became the *Automated and Electric Vehicles Act, 2018*. Under the single insurance policy, the insurer covers the driver's use of a vehicle *and* the AV technology that may operate the vehicle.[159]

The policy requires auto insurers to compensate individuals injured in collisions caused by AVs, regardless of whether the human driver or automated technology was at fault.[160] After compensating the injured person, an insurer can try to recover any liability payments from the party responsible for the collision, such as the vehicle manufacturer, technology provider, or another party that caused or contributed to the collision.[161] The policy, therefore, protects injured persons by ensuring they are compensated quickly, rather than waiting for the result of a legal action taken against large commercial stakeholders such as an auto or AV technology manufacturer. [162]

Disruption in Automotive-Related Occupations

Predictably, occupations dependent on human drivers will be most impacted by AV technology and will be increasingly phased out and eventually displaced. Sectors dependent on current transportation models, such as vehicle manufacturing, taxi services, and auto insurance, will be impacted by the emergence of this technology.[163]

However, that scenario seems to be a distant future when we examine current transportation occupation trends. The Canadian Trucking Alliance anticipates a shortage of 34,000 professional truck drivers in Canada by 2024.[161] According to the Conference Board of Canada and CPCS Transcon, this number could increase to 48,000 based on a combination of factors, including the fact that the trucking industry has one of the oldest workforces in the country.[165]

In the meantime, Canada's C/AV industries are expected to see a rise in employment that will total 248,000 workers by 2021—an increase from 213,300 workers in 2016.[166] Many of these will be in entirely new job categories, both in the tech sector and across the economy.[167] As some job categories become obsolete, there will be a need for industry to offer training opportunities to support the automated technology. Mechanics, for instance, will require upskilling and/or retraining to provide the necessary services to AVs.[168] AVs will also necessitate the redesign of communities, creating demand in the public planning, urban planning, and construction industries. AV-related occupations will also facilitate the need for technically-skilled talent to design, develop, and deploy the technology safely and effectively.[169]

Ultimately, the impact on the labour market due to technological developments like AVs is part of the broader discussion on the disruptive potential of automation and artificial intelligence. Proactive policies from government to address the skills mismatch and provide training and re-training opportunities to workers are critical to ensuring Ontario's economy remains competitive and Ontarians are prepared for tomorrow's labour market.

RECOMMENDATIONS

11. Regularly review and update the existing AV pilot regulatory framework and evaluate existing legislation to determine if AV-relevant modernization is required.

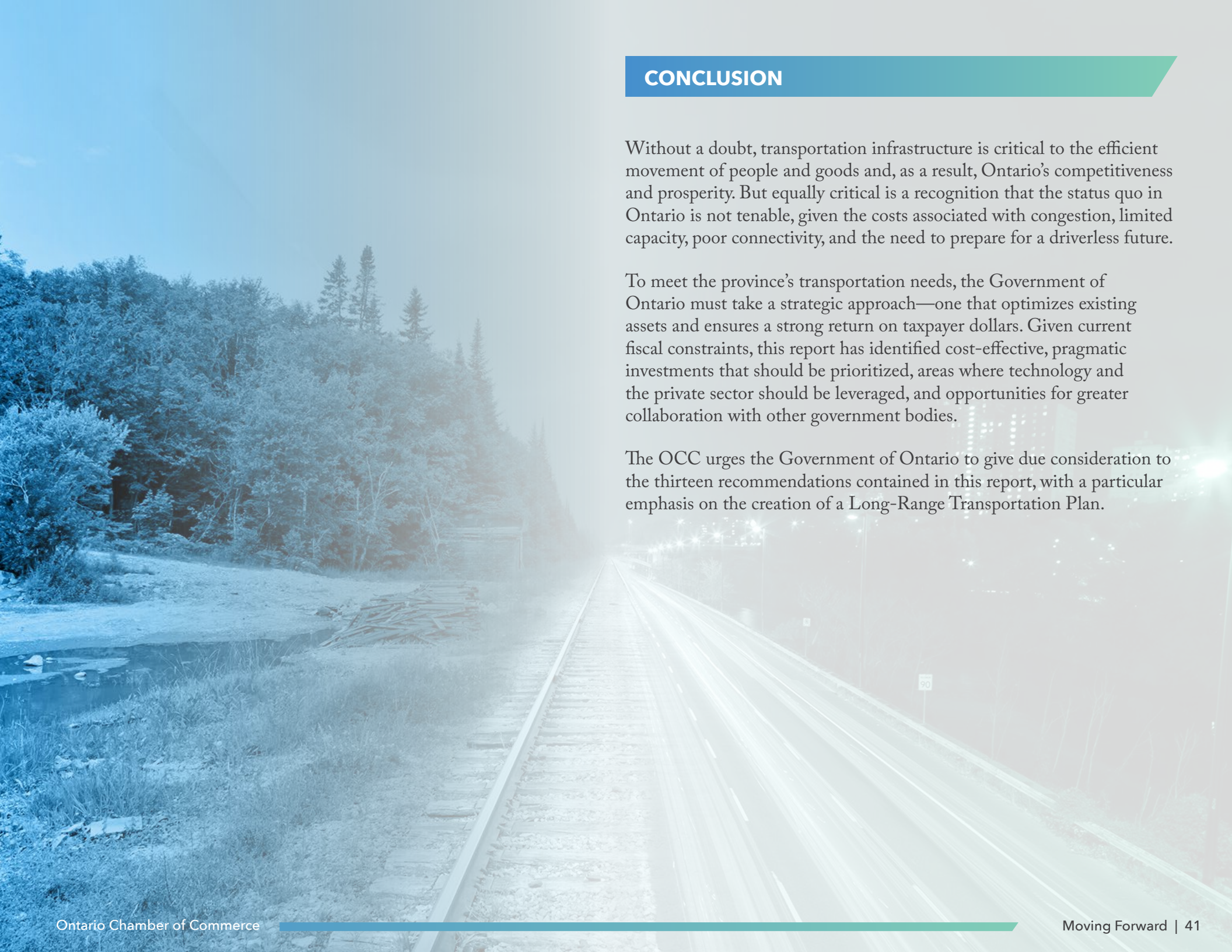
- Ontario's Regulation 306/15 should be moved out of pilot status and reviewed at least annually to ensure it is both competitive and reflective of the current state of technology.
  - The review should include a scan of similar regulations in competitor jurisdictions, as well as consultation with sector stakeholders.
  - Updates to the regulation should allow Ontario to attract and retain firms engaged in AV development, testing, and/or manufacturing. This should include permitting driverless testing of AVs Level 4 and 5.
- The government should continuously consult with insurers, autonomous technology firms, auto manufacturers, and consumer groups to ensure current liability and fault determination regulations in Ontario are appropriate and effective.

12. Anticipate Ontario's AV future within the province's upcoming Long-Term Infrastructure Plan.

- In developing the plan, the Province should consult auto manufacturers and other stakeholders to determine necessary short-term, physical infrastructure modifications (e.g. signage, lane markings, and AV and non-AV lanes) as well as long-term investments such as digital roadway infrastructure.
- Relevant transportation infrastructure projects that receive provincial funding should be required to submit an AV impact assessment study to ensure major investments consider the potential effect of AVs on their viability.[170]
- Investments in future EV charging infrastructure should consider the charging needs of automated EVs to accommodate this charging and prepare for the anticipated electricity demand.[171]

13. As the current Canadian leader in this space, the Government of Ontario should encourage the federal government to act on AV readiness.

- Ontario should request that Transport Canada develop an AV policy-guiding document, similar to the American *Automated Driving Systems: A Vision for Safety 2.0*. This document would delineate and clarify the responsibilities of provincial/territorial governments and the federal government, as well as outline expectations for manufacturers developing and deploying AVs.
- Ontario should encourage the federal government to develop common, Canada-wide AV regulations and standards to ensure AVs can travel across provincial and territorial boundaries.
- Ontario should demonstrate leadership by re-committing to the Michigan MOU on collaboration in testing, developing, and marketing of C/AV technology. This partnership should be used to align Canada's AV regulatory framework with that of the US to support trade opportunities.



CONCLUSION

Without a doubt, transportation infrastructure is critical to the efficient movement of people and goods and, as a result, Ontario's competitiveness and prosperity. But equally critical is a recognition that the status quo in Ontario is not tenable, given the costs associated with congestion, limited capacity, poor connectivity, and the need to prepare for a driverless future.

To meet the province's transportation needs, the Government of Ontario must take a strategic approach—one that optimizes existing assets and ensures a strong return on taxpayer dollars. Given current fiscal constraints, this report has identified cost-effective, pragmatic investments that should be prioritized, areas where technology and the private sector should be leveraged, and opportunities for greater collaboration with other government bodies.

The OCC urges the Government of Ontario to give due consideration to the thirteen recommendations contained in this report, with a particular emphasis on the creation of a Long-Range Transportation Plan.

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