High Speed Rail in Ontario:

Transforming mobility, connecting communities, integrating centres of innovation and fostering regional economic growth and development

Special Advisor for High Speed Rail: Final Report

December 2016

December 2, 2016

Dear Minister,

Just over a year ago, the Government of Ontario asked me to be Special Advisor on its commitment to establish High Speed Rail service in the Toronto-Windsor corridor. Throughout the past year I have worked with a dedicated and talented team of officials from the Ministry of Transportation on the concept, preliminary business case, governance structure, financing, and next steps for delivery of High Speed Rail (HSR).

Over the course of this work I have engaged widely with local municipalities, Indigenous communities and public and private sector stakeholders to obtain their advice and considerations on how HSR should be implemented. I have drawn from the experiences other countries have had with HSR, including the United States, United Kingdom, France, Germany, Spain, Japan and China. There have been thorough market soundings with the private sector, organized by Infrastructure Ontario. All of this work has led me to the conclusion that a business case exists for HSR in the corridor, which would connect Toronto, Pearson Airport, Guelph, Kitchener-Waterloo, London, Chatham and Windsor. I have also concluded that there are opportunities to engage the private sector in financing and delivering the project.

I encourage the Government of Ontario to proceed with: detailed project planning; the environmental assessment process; further engagement with Indigenous communities, and key stakeholders including municipalities, the two national freight railway companies, VIA Rail, Metrolinx (GO Transit) and regulatory bodies at both the Ontario and federal level; evaluation of appropriate financing and delivery models; and seeking financial approvals.

I wish to thank you and your colleagues for your cooperation throughout the mandate and wish the Government well in delivering its bold commitment to create Canada's first High Speed Rail service.

Yours sincerely,

Honourable David Collenette, P.C., F.C.I.L.T.

High Speed Rail in Ontario –
Report by the Special Advisor for High Speed Rail

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Executive Summary

Mandate

On October 30, 2015, the Honourable David Collenette, Privy Councillor (PC) and Fellow of the Chartered Institute of Logistics and Transport (FCILT), was appointed as Special Advisor for High Speed Rail (HSR) to assist the Province in bringing HSR to the Windsor, London, Kitchener-Waterloo, and Toronto corridor.

Tasked to work with public and private stakeholders as well as Indigenous communities, the Special Advisor was asked to identify economic development opportunities, assess international HSR experience in HSR, explore potential financing and delivery models, and provide advice on a preliminary business case for HSR in the corridor. The Special Advisor's advice and recommendations to government are contained in this final report for what would be the first implementation of an HSR service in Canada.

From October 2015 to November 2016, Mr. Collenette has worked to fulfil this mandate, supported by officials from the Ministry of Transportation (MTO). His work included the tasks outlined above, to consider the opportunities and challenges associated with HSR in the Toronto to Windsor corridor, and to make recommendations for implementing an HSR system that meets the needs of Ontarians. The services of Steer Davies Gleave (SDG) were procured to complete a preliminary business case, which laid the groundwork for the development of these recommendations. With the support of the Province's agency, Infrastructure Ontario (IO), a market sounding was conducted with stakeholders representing the financial, engineering, construction, railway operations and equipment sectors, to discuss financing and delivery model considerations that would promote innovation and ensure value for money.

This report reflects the key lessons gathered over the course of this mandate and recommends a path forward for the Province to bring HSR to Ontario.

Vision: High Speed Rail in the Toronto-Windsor Corridor

The Toronto-Windsor corridor is one of Ontario's most diverse and vibrant regions. It is home to more than 7 million people and accounts for 3.4 million jobs and over 50% of Ontario's GDP. It also includes the province's *Innovation SuperCorridor*, with its dense pockets of start-ups, research institutions and world-class talent, as well as leading manufacturing and agricultural hubs.

The Special Advisor's work was governed by the principle that implementing HSR would enhance Southwestern Ontario's strengths and increase its global competitiveness. The goals and objectives for his work are reflected in the following vision statement:

"To transform mobility in Southwestern Ontario in order to connect communities, integrate centres of innovation, and foster regional and economic growth and development."

This vision is supported by three foundational principles for developing HSR in the region, which are reflected throughout this report, and illustrated in Figure ES.1:

- Transform mobility choice in Southwestern Ontario.
- Catalyze economic development.
- Support regional integration and development.

Every community the Special Advisor engaged with expressed a view that HSR would be a transformative project with the potential to support and deliver economic growth. HSR could benefit Southwestern Ontario by providing communities with fast, reliable, intercity connections. It would alleviate pressure on Highway 401 between Toronto and Windsor and support Lester B. Pearson International Airport (Pearson Airport) by freeing up capacity now taken up by short-haul flights. It would also create opportunities for regional development, help shape transportation planning in cities and towns throughout the corridor, and improve interconnectivity and mobility options across Southwestern Ontario. HSR would provide a distinct service on a corridor shared with other passenger services, which requires consideration of how they are aligned to provide the most effective, efficient range of transportation options for travellers.

Figure ES.1: Foundational Principles

Graphic Produced by Steer Davies Gleave

Connecting Communities

The Special Advisor engaged with public and private stakeholders and Indigenous communities throughout his term. He held engagement sessions in each of the four main station-area communities (Toronto, Kitchener-Waterloo, London and Windsor) in February 2016. Attendees included elected officials and/or staff representatives across all levels of government as well as people representing chambers of commerce, boards of trade, academic institutions and key regional industry groups. The Special Advisor met with Indigenous communities in March, April, and May 2016.

Overall, communities along the corridor expressed significant enthusiasm for HSR. Stakeholders and Indigenous communities at the engagement sessions acknowledged that frequent, efficient and fast public transportation between regional hubs is essential to the prosperity and long-term growth of the corridor. However, this initial engagement also highlighted the need for the Province to demonstrate a clear case for HSR and to work in close partnership with communities to ensure that the project is integrated with regional economic and transportation priorities.

All communities would like to be informed of the HSR business case results as the project develops and be engaged, with an emphasis on collaboration, transparency and information-sharing.

Indigenous communities emphasized their desire to be considered true economic partners, as well as the importance of ensuring a project of this nature is constructed in an environmentally-sensitive way.

Key recommendations to pursuing HSR include ensuring that municipalities and Indigenous communities are included in the economic opportunities associated with HSR, and that the Province works closely with partners at all levels on HSR planning, development, and implementation.

This should include identifying opportunities to integrate local transit to ensure first-mile/last-mile connections are made.

Implementation of HSR

Preliminary Business Case

As informed by the preliminary business case analysis, it is recommended that HSR in the Toronto-Windsor corridor be implemented in two phases. Phase One would connect Toronto with Kitchener-Waterloo and London, while Phase Two would extend the route to Windsor.

In addition to the government's commitment to advancing HSR between Toronto, Pearson Airport, Kitchener-Waterloo, London and Windsor, the preliminary business case also demonstrated the value of additional HSR stations at Guelph and Chatham. HSR stations in these cities would increase ridership and intercity connections in the corridor.

HSR Costs and Benefit-Cost Ratio (BCR)

To assess the viability of HSR in the Toronto-Windsor corridor, the preliminary business case examined two HSR scenarios:

- **Scenario A:** Electrified HSR service operating primarily on a dedicated right-of-way and capable of achieving a top speed of 300 km/h.

- **Scenario B:** Electrified HSR service capable of achieving a top speed of 250 km/h operating on a combination of mixed conventional and dedicated railway.

To compare the scenarios, a detailed assessment of Benefit-Cost Ratios (BCR)[*] was undertaken to compare the net benefits that each scenario would yield in relation to its costs. The assessment found that Scenario A yielded a BCR of 0.36 for Phase One (Toronto-London) and a BCR of 0.17 for

[*] The BCR is a value for money indicator and compares the net benefits of HSR against the net costs of the project. BCRs greater than one indicate that the project will yield economic benefits above its costs. BCRs below one indicate that a project's costs outweigh its total net benefits. The BCR is calculated using "uplifted" capital costs.

Phase Two (London-Windsor), and was therefore not a viable option. Scenario A's low BCR was due to extensive tunnelling requirements, yielding base direct[*] and base uplifted capital[†] costs of over $19 billion and $56 billion respectively for the full Toronto-Windsor corridor.

In contrast, Scenario B was found to have a BCR of 1.02 for Phase One and a BCR of 0.24 for Phase Two. The difference in BCRs was due to the relatively higher levels of HSR ridership in the Toronto-London segment. Costs for this scenario were also found to be significantly lower compared to Scenario A, at approximately $7.5 billion base direct costs and $21 billion base uplifted capital costs for the full Toronto-Windsor corridor.

A key conclusion from this analysis is that Scenario B is the preferred option for HSR. Additionally, the business case for HSR is strongest between Toronto, Kitchener-Waterloo and London. This part of the corridor demonstrates high levels of economic and population growth and is one of Canada's most innovative regions. This portion of the HSR line would generate significant ridership and benefits, and it is therefore recommended that it be delivered in a first phase with operations targeted to start as soon as 2025.

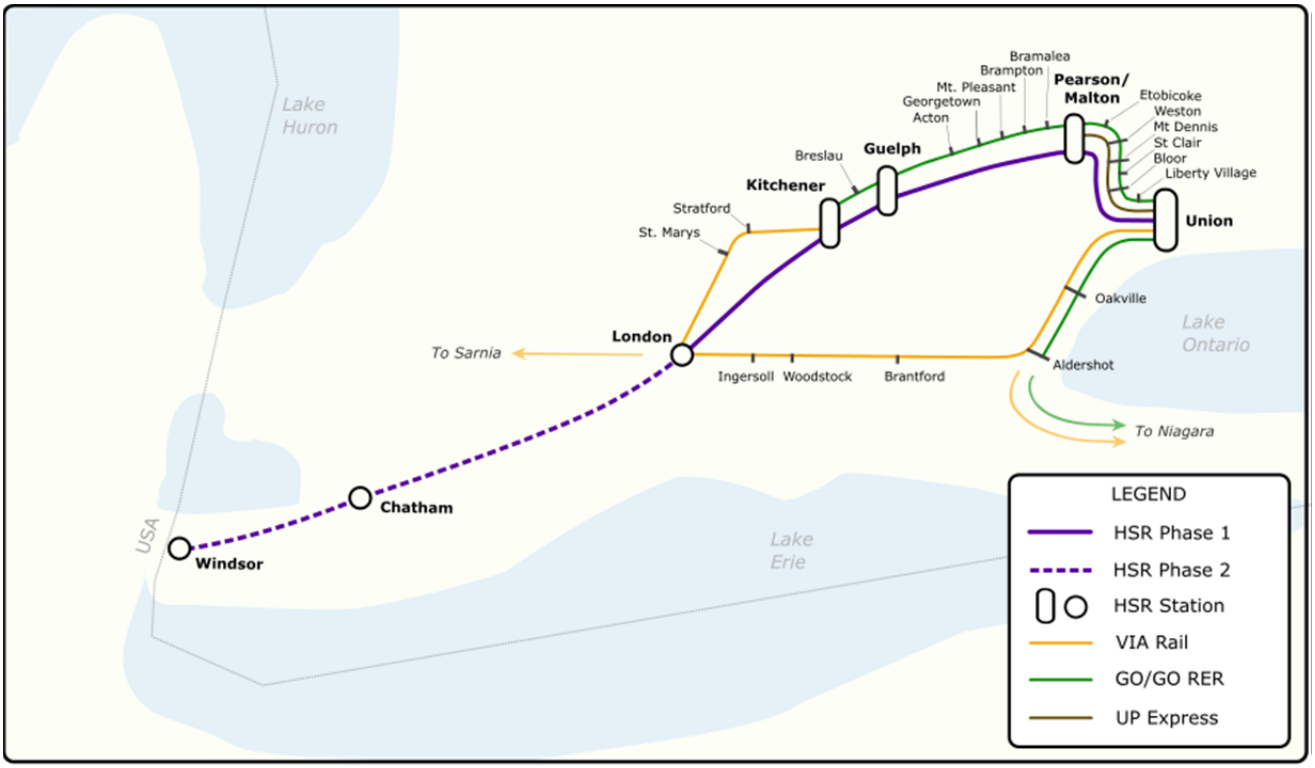
Between London and Windsor, the case for HSR can be recommended on socio-economic and regional development grounds. The preliminary business case results demonstrated that this portion of the service is best built in a second phase, once ridership to London and revenues have been established. The business case for a Windsor connection could also be strengthened once future international connections to the United States rail system through Detroit to Chicago are considered and planned.

The following figure illustrates the Special Advisor's proposed future Southwestern Ontario passenger rail network with a 250km/h HSR system. Recommended phasing, station locations and alignment are described further below.

[*] Base direct costs do not include a contingency and reflect the total gross costs of implementing HSR within one year.

[†] Uplifted capital costs include several cost contingencies based on assumptions for as-yet unknown expenditures. These costs also include a contingency of 66%; it should be noted that other transportation projects in Ontario apply a contingency ranging from 10% to 50% depending on the stage of the project.

Figure ES.2: Proposed Future Southwestern Ontario Passenger Rail Network



Phasing and Service

General Service Overview

The HSR corridor is currently shared with GO Transit to Kitchener-Waterloo, with VIA Rail beyond that to London and Windsor, and with freight traffic. HSR service levels must be customer-focused and well-integrated with existing services to ensure a range of complementary travel options.

In order to achieve service optimization, HSR and RER will interoperate between Toronto and Kitchener. It is also proposed that HSR replace VIA Rail on the Kitchener corridor, in order to ensure the route is not over-served; however, VIA Rail would still maintain a number of services in Southwestern Ontario. A codesharing agreement between VIA Rail and HSR would ensure that the rail system in Southwestern Ontario is seamless and integrated.

Phasing and Service by Segment

Toronto to Kitchener Segment (Phase 1)

Departing from Toronto's Union Station, HSR trains would travel along GO Transit's Kitchener corridor, stopping at Malton for Pearson Airport, and at Guelph station. HSR trains would share the corridor with the Union Pearson (UP) Express before it branches off to Pearson Airport, and with GO

RER services on the corridor to Kitchener. This service interoperation is likely to require a number of infrastructure upgrades; the initial assumptions, subject to further detailed capacity analysis, are described in the preliminary business case. Since track upgrades, expansions, speed improvements and electrification of the Kitchener corridor will be implemented under the GO RER plan, there are opportunities to share costs between the two services. HSR operating speeds are planned to be up to 250 km/h, however HSR interoperation with other services on these upgraded lines will restrict the areas where this speed will be possible (subject to operational modelling). In terms of frequencies on this segment, the proposed HSR service would offer three trains per hour during peak periods, and two trains per hour off-peak.

Kitchener to London Segment (Phase 1)

Westward from Kitchener-Waterloo's planned multimodal station HSR trains would travel on newly-built dedicated tracks to London. This new two-track corridor would be constructed from Kitchener to London adjacent to the existing hydro corridor. This would require extensive engagement and study with Hydro One and various stakeholders, Indigenous communities, and landowners to ensure public safety and the proper functioning of the infrastructure in relation to the hydro right-of-way. Building dedicated tracks for HSR would allow the trains to achieve sustained speeds of 250 km/h for the majority of the segment, significantly improving travel times.

London to Windsor Segment (Phase 2)

From London to Windsor, HSR would operate on a new bi-directional, electrified track adjacent to the existing CN and CP corridors.

Stations

The following recommendations provide guidance on where the HSR stations should be located, the infrastructure improvements that would be necessary at station locations, and how the service should be operated to maximize value. In general, HSR trains would require level boarding platforms at all stations to provide seamless accessibility for all passengers.

HSR Phase One: Toronto to London

Union Station, Toronto: The eastern terminus for HSR would be located at Union Station, providing a key connection to downtown Toronto and allow connection to the GO RER network and municipal transit. To accommodate HSR and its riders, Union Station would need to address capacity constraints. Metrolinx is currently exploring capacity options to provide services for GO RER.

Pearson Airport: Initially, the airport would be served from an expanded Malton GO Station. The Province would work with the Greater Toronto Airports Authority (GTAA) to provide a people-mover system linking HSR riders to Terminals 1 and 3 and to parking facilities. In the future, the Province could work with the GTAA to provide direct access for HSR to support their plans for the Pearson Airport multimodal hub.

Guelph: The historic multimodal terminal would be expanded to accommodate an HSR stop. This would require station and track expansion, including the construction of an additional platform, as well as a third passing track.

Kitchener-Waterloo: The City of Kitchener has plans underway to build a new multimodal station slightly to the west of the existing VIA Rail station. HSR would stop at this new station, connecting the system to local services such as Waterloo's ION Light Rail Transit (LRT) and Grand River Transit buses.

London: A new multimodal station constructed at downtown London's existing VIA Rail station would be part of the city centre's multimodal hub development. Once completed, this hub would include two new HSR platforms, three VIA Rail platforms for continued Toronto-London service via the CN South Main line and local service to Kitchener via Stratford, as well as connections to the London Shift Bus Rapid Transit (BRT) service and other local bus services.

HSR Phase Two: London to Windsor

Chatham: HSR would be extended westward from London to Chatham. The existing VIA Rail station in Chatham would be refurbished and a second platform would be built to accommodate the new HSR service.

Windsor: A new station would be constructed in Windsor. The station would be most suitably situated at a point somewhere on the CP main line near the downtown, which would reasonably allow for future expansion of HSR service to Detroit through the existing rail tunnel under the Detroit River. HSR service could eventually connect to Chicago.

Benefits of HSR

HSR will present a significant change to the transportation landscape in the Toronto-Windsor corridor. In 2041, over 10 million travellers annually are forecast to use HSR and the service will capture an 11% mode share in the corridor, taking more than five million cars off of Southwestern Ontario's highways.

This will support the Province in reducing the carbon footprint of passenger transportation in the corridor and improving transportation efficiency. Overall, HSR will yield over $20 billion in economic benefits over 60 years from passenger travel time savings, automobile operating cost savings, GHG reduction benefits, benefits from reduced congestion on roads, and other wider economic benefits.

One of the most significant benefits of HSR will be travel time savings. HSR is anticipated to offer savings of between 40% and 60% over current average journey times. In particular, HSR will nearly halve existing average travel times between city pairs along the Toronto-Windsor corridor. For example, travel times between Toronto and Kitchener-Waterloo will be reduced to a minimum of 48 minutes with HSR, down from the current average of 74 minutes by automobile. Travel times

between Kitchener-Waterloo and London will be reduced to a minimum of 25 minutes from the current average of 46 minutes by automobile.

In terms of environmental benefits, it is estimated that HSR in the Toronto-Windsor corridor will reduce greenhouse gas (GHG) emissions by over 7 million tonnes over a 60-year time horizon.

HSR will also generate wider economic benefits (WEBs) stemming from the increased labour mobility and connectivity between companies within a geographic area.

Governance

Good governance is critical to project success and a key determinant of whether projects are completed on time and on budget, and whether they fulfill the government's objectives for the project. When implemented, HSR will present a new form of transportation in Ontario distinct from any other mode of travel. The Special Advisor therefore recommends the development of a new governing entity for HSR.

A dedicated governance system for HSR will not only ensure that the service meets the Province's objectives but also that the needs of communities in the Toronto-Windsor corridor are considered. It will provide the right expertise to deliver service on a complex system that is partially shared with GO RER commuter services.

Under this recommended model HSR would be authorized by statute, which would establish a new entity, High Speed Rail Corporation (HSRCO), with an appointed Board of Directors.

The intention is that HSR design and the environmental assessment (EA) process will be advanced by MTO. As the project moves into construction and procurement, HSRCO will comprise a larger team of dedicated rail professionals, both from government and the private sector to ensure the project's success. This model has been successfully used most recently to create the High Speed Two (HS2) Limited Company in the U.K. and the California High-Speed Rail Authority in the U.S.A.

Financing and Delivery

HSR will represent the largest infrastructure project undertaken by the Province. Consideration for how it will be financed and delivered is therefore critical, especially to ensure that the risks and costs of the project are managed. As is often the case for public transportation and other works for public good, capital costs for HSR systems are generally not fully recoverable through fares and other operating revenues alone. Although revenues typically cover operating and maintenance costs for HSR systems internationally, reliable financing and funding are always required to deliver the capital infrastructure.

To support the development of financing and delivery recommendations, the Special Advisor, with support from MTO, undertook an analysis of models applied internationally and a market sounding of private-sector interests, with the support of IO. The IO-facilitated market sounding showed that private-sector interest in the project is high overall, but the results and an analysis of international experience both indicated that deciding on a specific model at this point in the project would be premature. It is reasonable to agree in principle that an Alternative Financing and Procurement (AFP) model is a viable option for aspects of the program to finance and deliver HSR; however, a full value for money (VfM) analysis will need to be conducted during the EA process. A VfM analysis would compare traditional procurement models to the different options available under an AFP in order to determine the optimal model that will manage risks and costs, deliver innovation, and ensure on-budget and on-time delivery.

It is suggested that the Province continue to engage key private-sector partners throughout the HSR project. This could include engaging in a follow-up market sounding once more project details become established. This should include re-engaging participants and potentially broadening to other private-sector interests as well.

Next Steps

In parallel to the work the Special Advisor has conducted over the course of the past year, MTO has continued to advance the planning work for HSR in the Toronto-Windsor corridor. This has included supporting the Special Advisor with the development of the preliminary business case, as well as undertaking modelling and forecasting work and early preparations for the EA process.

To support MTO in advancing the project and to reach a target operational date for HSR of 2025, the Special Advisor recommends that the Province undertake a number of key next steps. These include the following phases:

1. Planning.
2. Approvals and Design.
3. Design and Construction.
4. Maintenance and Operation.

Additionally, parallel work streams will be pursued throughout the project including the analysis of financing and delivery models, linkages to GO RER planning, and extensive engagement. Steps to advance this work should be taken in the near term.

Following the completion of this report and the preliminary business case analysis, MTO should continue to pursue planning work by undertaking preliminary investigations into appropriate Building Information Modelling (BIM), HSR infrastructure and rolling stock standards, procurement strategies, and research potential vehicle specifications and regulatory frameworks.

After completion of the planning phase, the next major step is the approvals and design phase. This includes procurement of EA approvals, engineering design, land acquisition support, as required, and construction monitoring. EA approvals will include the federal process through the Canadian Environmental Assessment Agency and the provincial Transit Project Assessment Process.

As part of ongoing engagement throughout the HSR project, it will be important for MTO to engage extensively with Indigenous communities and municipalities, among others, as detailed in Chapter 2 of this report. In addition, MTO should pursue early engagement and or/ working-group activities with Metrolinx and Transport Canada. Hydro One is also an important partner, as MTO will need to engage with the company on power grid access and supply. Furthermore, it is proposed that HSR run adjacent to the existing hydro right-of-way between Kitchener and London, which will require working closely with Hydro One as well. CN and CP are also critical stakeholders that will need to be engaged since HSR will interface with the CN and CP corridors west of London.

The "Design and Construction" and "Maintenance and Operation" phases will be pursued in the future. Design and construction should ideally start by 2022 to reach a target operational date of 2025.

Introduction

This section introduces the concept of high speed rail (HSR) by providing an overview of HSR systems around the world, and describes the ongoing work to develop HSR in Ontario.

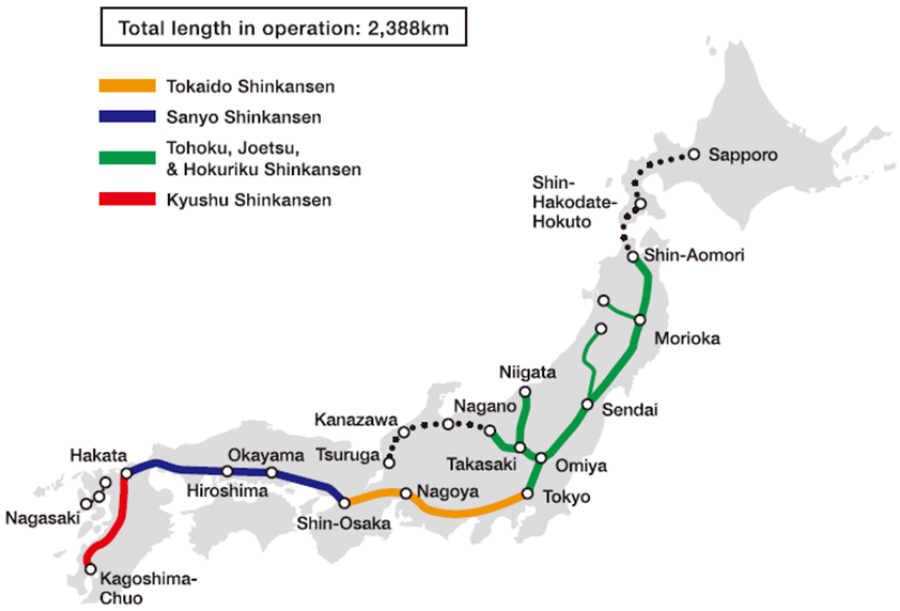
High Speed Rail (HSR)

High Speed Rail (HSR) is a form of passenger rail transportation that operates at significantly faster speeds than conventional train technologies. The Paris-based Union of International Railways (UIC) references the European Council definition of HSR as systems that operate at speeds on the order of 200 km/h on upgraded, existing corridors and at speeds equal to or greater than 250 km/h on new corridors.[1]

Although the above definition has become widely accepted internationally, standards and definitions of HSR are still variable and dependent on regional and national contexts; HSR systems vary around the world in terms of train length, speed, type and technologies. Most are described as falling within one of the following general categories: dedicated, mixed conventional, or fully mixed.

Dedicated	These HSR networks are purpose-built for HSR trains only, are fully electrified and feature dedicated tracks and advanced signalling systems to allow for faster speeds and higher service frequencies. They typically cover long distances and link major metropolitan areas. The Japanese *Shinkansen* ("bullet train"), linking major urban centres across Japan with operating speeds of up to 320 km/h, best exemplifies this model (see Figure I.1).
Mixed Conventional	These networks feature a mix of conventional passenger rail and HSR operating on shared corridors. One such example includes France's *Train à Grande Vitesse* (TGV), an integrated network featuring 300+ km/h systems on dedicated tracks with traditional 200+km/h lines on conventional tracks (see Figure I.2).
Fully Mixed	These HSR networks feature a combination of HSR and conventional passenger and freight rail on the same corridor. The German Intercity-Express (ICE) is based on this model as is Amtrak's Acela Express in the U.S. (see Figures I.3 and I.4).

Figure I.1: The Shinkansen System, Japan



Source: The Government of Japan

Figure I.2: The Train à Grande Vitesse (TGV) System, France

Source: EURail

Figure I.3: The Intercity-Express (ICE) System, Germany

Source: EURail

Figure I.4: The Acela Express System, United States

Source: Amtrak

Every high speed rail system is different since each system must take city population sizes and the distances between cities, topography and existing infrastructure into account. Tracks for conventional trains can be used by high speed trains but if train speeds are planned to exceed 200 km/h, increasingly intensive maintenance is required. As well, signalling systems along the tracks where trains are travelling at speeds higher than 200 km/h need to be replaced with systems installed on the trains themselves. Because mixed train fleets with large differences in average speeds reduce track capacity, an HSR strategy that supplements the capacity of networks when they reach their limits is often implemented.

High speed travel requires specialized trains that comfortably transport passengers and meet aerodynamic, system reliability and safety requirements.

Other Jurisdictions

Many countries, recognizing the benefits of moving people at fast speeds over great distances, are upgrading existing tracks and building new dedicated ones to create HSR networks. Of particular note are those planned or already under construction in France, Spain, Germany, China and the United Kingdom, where the planned new High Speed Two (HS2) line will link the North of England to London and improve connectivity to the existing High Speed One (HS1) line and the Channel Tunnel link to continental Europe. The common theme across jurisdictions is that these projects will expand interconnectivity between economic and population hubs, as well as to wider transportation networks.

In North America, Amtrak is the only railroad currently operating and maintaining tracks over 160 km/h; Amtrak's Acela Express, which achieves a top speed of 241 km/h (150 m/h) serving the Boston-New York-Washington corridor, is the only HSR system currently in operation in North America.[2] Many factors have limited HSR's development on this continent including geography, long distances between cities, mixed corridor ownership, the primacy of freight over passenger services, the public preference of car travel over rail; and, perhaps most important, the political willingness to support the huge investment over more than one election cycle.

To further reduce trip times, Amtrak recently announced a USD $2.45 billion investment (CDN $3.2 billion) to improve infrastructure and introduce new European-designed rolling stock (the vehicles that operate on the railway track) that can achieve top speeds of 300km/h, a major departure from normal North American practice.[3] The U.S. Department of Transportation's Federal Railroad Administration (FRA) has always had higher thresholds for passenger train crashworthiness than European standards. FRA standards were developed because passenger trains in North America share rail corridors with longer, heavier freight trains.

Given the integration of American and Canadian freight rail operations, this country's rail safety regulator, Transport Canada, has always adhered to FRA standards. Now the FRA has modified its regulations in consultation with Amtrak, recognizing that modern train signalling and safety measures have made the interoperation of traditional freight trains and passenger vehicles much safer. The new Amtrak-FRA agreement will have positive implications for passenger rolling stock acquisition in Canada and particularly for high speed rail.

HSR investments are also being made in California, where North America's latest HSR project is currently under construction. Once completed, phase one will link San Francisco to Los Angeles and phase two will link Sacramento to San Diego. Operations are anticipated to commence in 2029.[4] Other potential HSR corridors are being studied in the U.S., including New England, Florida, Texas, Pennsylvania, and Colorado/New Mexico.

High Speed Rail in Ontario

Canada is the only G8 country that does not yet have an HSR system under construction or in operation. However, the concept has been considered and studied for a number of years in Ontario. Most recently, in 2014, the Government announced its decision to pursue further study of HSR between Toronto and Windsor in Southwestern Ontario. Specifically, the Minister of Transportation's 2014 mandate letter committed to "advancing environmental assessments for high-speed rail—building on the GTHA's forthcoming Regional Express Rail network—which will link Toronto, Lester B. Pearson International Airport, and Waterloo Region and London, as well as London and Windsor." This commitment was reiterated in Budget 2015.

To advance this mandate, in October 2015, former federal transport and defense minister the Honourable David Collenette, Privy Councillor (PC) and Fellow of the Chartered Institute of Logistics and Transport (FCILT), was appointed as Special Advisor for High Speed Rail (HSR) to the Minister of Transportation to continue to advance HSR in the province.

The Special Advisor was tasked to provide advice to government on the implementation of HSR service between Toronto, Lester B. Pearson International Airport (Pearson Airport), Kitchener-Waterloo, London and Windsor, generally referred to as the Toronto-Windsor corridor. Mr. Collenette's mandate included working with public- and private-sector stakeholders and Indigenous communities to identify economic development opportunities associated with high speed trains, assessing international experience with HSR, and providing advice to government about a preliminary business case and financing and delivery models.

Over the course of the past year Mr. Collenette, supported by officials from the Ministry of Transportation (MTO), undertook the following key tasks:

- Oversaw a preliminary business case analysis for alternative service scenarios, to identify travel time, ridership and other economic benefits associated with HSR.
- Worked with the Premier's Business Advisor, the Ministry of Economic Development and Growth, and other ministries to ensure HSR is aligned with the government's economic development agenda.
- Held engagement sessions with public- and private-sector stakeholders, as well as with Indigenous communities, to identify the opportunities and challenges associated with HSR in the Toronto-Windsor corridor and to build a relationship with communities early in the HSR project.
- Assessed HSR experience in other countries and compiled key lessons that could be applied to support a system that meets the needs of Ontarians.
- Conducted a market sounding with the support of Infrastructure Ontario (IO) to engage stakeholders representing the financial sector, engineering and construction firms, and operators and equipment providers to discuss key considerations with regard to financing and delivery models that will promote innovation and ensure value for money.

Budget 2016 referenced the Special Advisor's report under the section "Supporting Ontario's Innovation SuperCorridor," which underscores the importance of HSR from the perspective of economic development.

It is also important to note that, in parallel with the Special Advisor's work, MTO has been undertaking several additional tasks to advance the environmental assessment (EA) process for HSR. This includes starting work on a demand forecasting model, as well as planning for the procurement of technical and design studies. The Special Advisor's recommendations and advice will ultimately help to guide the direction of HSR work for the Province.

The Province has been studying the feasibility of HSR for more than two decades. In 1991, it implemented the Ontario/Quebec Rapid Train Task Force, whose findings provided a basis for studies conducted in 1993 and 1995. In 2011, a detailed study on the feasibility of HSR between Windsor and Quebec City, referred to as the EcoTrain report, was conducted jointly by MTO, Transport Canada, and the Ministère des Transports du Québec (MTQ).

In 2014, the Province retained the British transportation consulting firm First Class Partnerships (FCP) to conduct a pre-feasibility study of HSR on a specific segment of the previously studied corridor between Toronto and London. This segment forms a key area within Ontario's Innovation SuperCorridor, whose dense pockets of start-ups, research institutions and world-class talent comprise one of Canada's most innovative regions.

These two recent studies determined that HSR service in Ontario is conceptually feasible and has the potential to realize benefits for the Province.

The Special Advisor's extensive engagement, research and business case analysis over the past year have taken these previous studies of HSR to the next level, demonstrating that there is a tremendous opportunity to bring HSR to the Toronto-Windsor corridor.

As part of Ontario's transportation system, HSR can connect communities, generate economic growth and opportunity, and support the Province of Ontario in its desire for *Moving Ontario Forward*. Recommendations for the implementation of HSR in Southwestern Ontario are included throughout the report, as well as key considerations for the Province to support decision-making.

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Chapter 1

Travel in the Toronto-Windsor Corridor

This section describes the range of transportation and travel options available in the Toronto-Windsor corridor, with a focus on the evolution of freight and passenger rail services. Historically, the majority of rail lines in the corridor were owned by freight companies, which necessitated the sharing of tracks and initially constrained the development of passenger rail service. Recently, more focus has been placed on improving passenger rail service, including infrastructure investments through Moving Ontario Forward to support increased track capacity and electrification, which will support GO Regional Express Rail (RER) and provide faster, more frequent passenger service. Further work will be required to coordinate all intercity passenger rail services, including GO RER, VIA Rail, and HSR. Work is also underway to rationalize (align and accommodate) freight and passenger rail services. Together these commitments will set the stage not only for improved rail service in the Greater Toronto and Hamilton Area, but also for HSR service in the Toronto-Windsor corridor.

Rail Services

Track Ownership and Mixed Freight/Passenger Services – An Overview

The relationship between the owner of a rail corridor and companies paying to use the corridor often entails negotiations over use and service. In North America, the vast majority of rail lines are owned by freight companies that also operate their businesses on those lines.

When freight companies own rail lines, they give priority to freight trains over passenger trains. Freight trains can be as long as three kilometres and for freight businesses to succeed, these trains need to be kept moving. The movement of goods is itself key to the success of the economy and by its nature requires flexibility in its scheduling. When various services share track, capacity challenges and operational constraints are created for all of them, including for train schedules and the speeds trains can achieve.

In Southwestern Ontario, passenger rail services, including VIA Rail and GO Transit, have traditionally had to negotiate and share track space with freight companies, and specific passenger train paths are agreed to between the freight companies and GO Transit. Each additional GO Transit service that Metrolinx wants to introduce first requires negotiation with the freight companies.

Many of Southwestern Ontario's rail lines were built or bought in the nineteenth and early twentieth centuries by the Canadian National Railway (CN) and the Canadian Pacific Railway (CP), still the two main private freight companies operating lines in the Windsor-Toronto corridor today.

Starting with the introduction of the *National Transportation Act* in 1987, and continuing with the adoption of the *Canada Transportation Act* in 1996, both CN and CP closed unprofitable lines and sold others to freight operators (shortline railways) or passenger operators.

GO Transit, which is now a division of Metrolinx, purchased a number of the lines or sections of track to provide almost exclusive commuter services in the Greater Toronto and Hamilton Area (GTHA), including portions of the Kitchener GO line; some freight access rights continue to be in place on the corridors, although access is restricted to outside of peak passenger hours. The exception was a 14-kilometre stretch of track between Georgetown and Bramalea, which still forms part of CN's main freight line and is the only non-Metrolinx-owned section of track between Toronto and Kitchener-Waterloo. Metrolinx now owns 80% of the GO Train corridor network, which it has progressively purchased from the freight rail companies.

The Evolution of GO Train Service to Kitchener

GO Train service has increased over time to meet demand, and work is ongoing to continually improve service. Current efforts are focused on building infrastructure and on electrification, both of which will enable GO RER service and future HSR service. Of particular note for HSR is the evolution of, and plans for, the Kitchener line.

GO Trains were introduced by the Province in 1967, connecting Pickering, Toronto and Oakville along the north shore of Lake Ontario. In 1974, a new service was implemented between Toronto's Union Station and Georgetown, which today forms part of the Kitchener line. More trains have been added over time in response to increasing ridership.

Initially, GO Trains operating on what is now known as the Kitchener line terminated at Georgetown. In December 2011, service was expanded west to Guelph and Kitchener, with two peak trains departing eastbound from Kitchener to Toronto on weekday mornings and returning from Toronto in the afternoon, with travel times of approximately 125 minutes. This service level remained more or less the same until 2016.

In September 2016, GO extended two morning and two afternoon peak train trips that had been running between Georgetown and Union Station to now also serve Acton, Guelph, and Kitchener. This doubled the number of weekday train trips between Kitchener and Toronto. GO also introduced a new express bus service running all day between Kitchener and the Bramalea GO station, timed to allow bus passengers to transfer to trains.

Moving Ontario Forward, GO RER and Electrification

In spring 2014, the Province announced its *Moving Ontario Forward* plan, committing $29 billion over 10 years to build an integrated transportation network across the province. This commitment was increased to $31.5 billion in the 2015 budget. *Moving Ontario Forward* ultimately falls within the largest infrastructure investment plan in Ontario's history: a total of $130 billion over ten years for critical infrastructure. As part of this plan, on April 17, 2015, the Province and Metrolinx announced commitments for Ontario's first RER network. The concept of regional express rail originated in Europe as a system to link suburban commuters to the downtown core.

The program includes implementing electric trains that run all day and in both directions within the most heavily travelled sections of the Metrolinx network, including a portion of the corridor from Toronto to Kitchener-Waterloo. Under this plan, core segments of the GO network will feature all-day service with faster trip times operating at expected maximum speeds of 160 km/h based on the number of station stops on each corridor. The track alignment design on the Kitchener corridor is assumed to accommodate possible speeds of up to 200 km/h, although faster speeds are assumed not to be precluded. The envisioned electrified GO RER services would offer frequent, all-day stopping services, either terminating at or passing through Union Station.

Under the 2015 GO RER budget commitment, the government allocated funding for the first stages of electrification of the Kitchener line as far as Bramalea, with planned service every 15 minutes. This commitment was expanded in 2016 to include all-day, electrified service to Kitchener.

Considerations and Implications

A main challenge facing HSR in the Toronto-to-Windsor corridor is the number of current freight and commuter passenger operators that share infrastructure, including VIA Rail semi-express services connecting cities with limited stops and GO Train stopping services serving multiple stations. With the expansion of GO RER on the Kitchener corridor, these challenges can be expected to become more significant.

Because the Province has indicated that the Toronto-to-Kitchener-Waterloo corridor should be served by a combination of HSR and GO RER service, a reference point for this study will be how these two concepts can best serve the travelling public and taxpayers in general. In the absence of a coordinated approach, there is a risk that current commitments and plans could result in three publicly-funded services (HSR, GO RER, and VIA Rail) all competing for passengers on the same corridor. The Special Advisor's recommended approach seeks to mitigate this risk and provide the best overall connectivity for the travelling public through a service plan coordinated between federal and provincial services.

Union Station in Toronto was originally designed to accommodate long-distance passenger trains and relatively low passenger volumes; increased train services through this hub will require re-consideration of existing infrastructure. Although significant improvements have been made in recent years to accommodate an increasing number of passengers and to better integrate local, regional, and long-distance services, the long-term capacity required to accommodate future GO RER and HSR passengers will also need to be considered.

GO RER and ultimately HSR services will require a significant increase in the capacity and efficiency of the Kitchener corridor and will only be possible if the majority of freight traffic bypasses it or is removed, allowing it to become a predominantly passenger corridor. The government's preferred option is to build a freight bypass in return for Metrolinx assuming ownership of the portion of the Kitchener line currently owned by CN. This proposed solution has been termed "rail rationalization."

On June 14, 2016, the Province announced an agreement-in-principle with CN that began technical analysis and planning for the construction of a new freight line. When built, the bypass will separate the majority of freight and passenger services, allowing CN to shift its traffic between Georgetown and Bramalea to the new freight line, as there is insufficient space in the corridor to provide for both freight and passenger services. Once it is complete, Metrolinx will own the entire Kitchener corridor and have sufficient flexibility to meet its GO RER commitments. HSR will also be able to successfully operate on the corridor once the majority of freight traffic is removed.

VIA Rail

Ontario's plans for HSR will need to consider VIA Rail's intercity services in Southwestern Ontario. In comparison with an HSR service, average travel times on the current VIA Rail system are lengthy, at 95 minutes from Toronto to Kitchener, 153 minutes to London, and 255 minutes to Windsor.

In 1977, the federal government formed VIA Rail, Canada's national passenger rail corporation. In the 1980s and 1990s, following budget cuts and declining ridership, VIA Rail's services were gradually withdrawn from many communities across Southwestern Ontario. Today trains operate on two lines in the Toronto-Windsor corridor: the former CN North Main Line through Guelph, Kitchener, Stratford, St. Marys and London; and the CN South Main Line through Brantford and Woodstock to London, which then continues to Windsor. VIA Rail also offers one train trip per day both ways between Toronto and Sarnia. Additional trips to Sarnia are offered by an intercommunity bus connection provided by Robert Q Airbus from the London VIA Rail station.

Since 2014, VIA Rail has indicated its intention to acquire dedicated tracks to offer electrified "High Frequency Rail" (HFR) service in the Quebec-Windsor corridor, though details for HFR are not yet known. It has indicated that it hopes to attract private investment for the necessary infrastructure investments. Recent announcements include its intention to build new track in Eastern Ontario via Peterborough as part of its plan to acquire dedicated tracks.

The 2016 federal budget committed $3.3 million in funding for Transport Canada to further study the HFR proposal, and also committed $7.7 million for VIA Rail to proceed with pre-procurement and technical studies for fleet renewal and safety upgrades. At the time of writing this report, the federal government had not yet confirmed its long-term plans for VIA Rail in Ontario; however, it has publicly expressed interest in HFR and the potential to increase train frequencies in the Toronto-Ottawa-Montreal corridor.

Bus Travel

The bus industry has played a crucial role in delivering transportation options for Ontario residents for more than a century. Ontario's economic regulatory regime was established in the 1920s to ensure that intercommunity bus operators served both large urban centres and small, rural and remote communities across the province. These operators were almost exclusively private, and were required to subsidize their unprofitable routes or services with their profitable routes. This is no longer the case, and there have been reductions and discontinuances of unprofitable scheduled service routes for Ontario's small, rural and northern communities in recent years as companies have started to require that their individual business lines be independently profitable.

Currently the private bus company Greyhound has operating licences for intercommunity bus services between Toronto and Windsor, which is one of their high-volume corridors. Greyhound also offers a number of daily bus trips to and from cities within the corridor. As of November 2016, these included

- Toronto to Kitchener-Waterloo (21 trips)
- Kitchener-Waterloo to Toronto (18 trips)
- Toronto to London, and London to Toronto (12 trips each way)
- Toronto to Windsor, and Windsor to Toronto (4 trips each way)

With the exception of Pearson Airport, Greyhound serves all the station stops proposed for HSR as well as a number of smaller communities along the route. Larger cities in the corridor usually have more than one Greyhound bus stop.

In 2016, the Province consulted with stakeholders and the public on intercommunity bus modernization, discussing whether to maintain the current approach to regulating buses in the province, or to pursue de-regulation. At the time of writing, no consensus has been reached among stakeholders on a preferred approach; however, the Government continues to work with bus operators, communities and other key stakeholders to establish a regime that is both fair to operators and better serves Ontario's communities and the travelling public.

Within the GTHA and Kitchener, GO Transit also operates an extensive bus route network. It has multiple bus stops within cities and serves a number of smaller communities in the Toronto-

Kitchener corridor, offering transportation options to an interregional market that cannot be served by GO Train services.

Air Travel

The proposal for HSR in Southwestern Ontario includes a stop at Pearson Airport, Canada's largest and busiest airport. It is currently connected to Toronto's Union Station via rail and served by the UP Express, but lacks rail connections to other Ontario cities.

Operated by the Greater Toronto Airports Authority (GTAA), Pearson Airport is a hub for approximately 443,000 flights a year, with 41 million passengers using the airport in 2015; the numbers are projected to reach 65 million to 70 million by 2043.[1] While Pearson serves a number of regional airports, its main role is as a hub for long-haul domestic and international flights. It is the second-busiest international airport in North America after New York's John F. Kennedy International Airport.

Currently, Pearson Airport is mostly accessed by car; however, the proximity of the Kitchener GO line to the airport facilitated the construction of the UP Express service between Terminal 1 and Union Station. Service began in 2015, offering trips to and from Union Station and Pearson every 15 minutes, with a journey time of approximately 25 minutes. The airport is also served by a number of Toronto Transit Commission bus routes, including an express bus service that connects to the subway system at Kipling Station.

According to the GTAA, only 8% of air passengers in Ontario take public transit to Pearson Airport, a significantly lower percentage compared to other world airports, as detailed in Table 1.1.[2]

Table 1.1: Public Transit Travel to Airports: An International Comparison

International Airport	Percentage of Public Transit Use by Air Travellers
Frankfurt Airport, Germany	33%
London Heathrow Airport, U.K.	36%
Amsterdam Schiphol Airport, The Netherlands	39%
Kai Tek International Airport, Hong Kong	63%
Shanghai Pudong International Airport, China	51%

Source: Greater Toronto Airports Authority/Urban Strategies Inc.

GTAA information indicates that approximately two million people per year travel from London and Kitchener-Waterloo to Pearson Airport. There is no direct rail service to the airport along the Windsor-London-Kitchener corridor. People in these communities have to rely either on driving,

limited bus and private shuttle services, or on local regional airports, some of which offer air travel options to Pearson Airport.

Current air travel patterns from Windsor, London, and Kitchener to Toronto are relatively low, comprising less than 1% of travel in the corridor. By comparison, the automobile serves approximately 93% of trips in the corridor and bus serves 5%.[3]

HSR service in the Toronto-Windsor corridor is expected to replace short-haul flights in the corridor, effectively freeing up capacity and runway space for bigger, more profitable long-distance flights. This has been the case for HSR between major European cities such as Paris to London and Frankfurt to Cologne, where rail has a dominant market share.[4]

The GTAA has recently released reports on its development strategy for Pearson Airport, which envisions transforming the airport into a multimodal transportation hub that would connect air, rail, bus, and rapid transit systems.[5] An HSR station at Pearson Airport would complement the GTAA's strategy to create a truly multimodal hub for Ontario.

Automobile Travel

The automobile is the Toronto-Windsor corridor's most frequently used mode of transportation. Highway 401 is one of the country's busiest automobile and truck routes, connecting Canada's busiest land border crossing, the Windsor-Detroit Gateway, to the Quebec border, and passing through Toronto. The 401 is a main artery for the movement of goods and commuters in the province's road system. Private automobiles account for approximately 93% of mode share in the Toronto-Windsor corridor.[6] In the GTHA alone, the number of car trips is increasing at a faster rate than that of the population: between 1986 and 2011 the number of trips made by automobile in the region grew 71%; in comparison, the population increase for the same period was 62%.[7]

In 2016, MTO announced the expansion of the current six-lane Highway 401 west of Toronto. Contrary to its original intent of reducing traffic congestion, evidence has shown that highway expansion actually leads to an increase in car use and associated traffic congestion and carbon emissions.

Another fact that cannot be ignored is that Ontario's highways are subject to winter weather conditions that can impede traffic flow. Rail travel in winter conditions tends to be more reliable.

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Chapter 2

Connecting Communities

Among the most important factors to consider when implementing an HSR service is who the end users will be and how the service will benefit their communities. During the course of his appointment, the Special Advisor met with municipal and provincial stakeholders and Indigenous communities within the Toronto-Windsor corridor to discuss the opportunities and challenges associated with HSR. Enthusiasm for and interest in the project is high overall; however, this community engagement has highlighted a number of important considerations that must be reviewed when implementing HSR.

Community Engagement

A key component of the Special Advisor's mandate was to engage with First Nations and Métis communities as well as public- and private-sector stakeholders. Over the course of his appointment Mr. Collenette held municipal engagement sessions in each of the four main station-area communities (Toronto, Kitchener-Waterloo, London, and Windsor) and engagement sessions with Indigenous communities in the corridor. Informal and one-on-one meetings were also held with stakeholders throughout the Special Advisor's term. Throughout the past year, many individuals, organizations and communities approached the Special Advisor to meet on the HSR file. While everyone received a response, the limited time frame for concluding work on the study meant that it was impossible to accept every request to meet. However, as plans for HSR move forward, there will be further engagement opportunities for interested parties.

This chapter summarizes key feedback and provides recommendations for government based on what was heard at the engagement sessions.

Engagement Sessions – Public and Private Sectors

The engagement sessions were designed to explore four key areas:

- Opportunities associated with HSR.
- Key considerations.
- Related projects that the Ministry should be made aware of.
- Future engagement as the project progresses.

Stakeholders and Indigenous communities were invited to attend sessions in Toronto, Kitchener-Waterloo, London and Windsor in February 2016. Each session included a presentation on the HSR project by the Special Advisor and MTO officials followed by breakout table discussions.

The engagement sessions were well-attended, with Kitchener-Waterloo and London having the highest numbers of participants. Attendees included elected officials and/or staff representatives across all levels of government as well as people representing chambers of commerce, boards of trade, academic institutions and key regional industry groups.

The following themes emerged consistently across all four engagement sessions:

Economic Development Opportunities

Every community expressed a view that HSR has the potential to be transformative—spurring economic growth, increasing labour mobility, attracting talent, addressing traffic congestion and increasing the quality of life for all of the communities along the proposed corridor.

Toronto attendees identified the connection of communities further west to the airport as a key economic factor. Although Pearson Airport already has a downtown link via the UP Express, the airport and surrounding commercial and industrial areas, sometimes termed "employment lands," remain relatively disconnected from other regional transit projects and lack broader connections to Southwestern Ontario. Participants noted that it was likely that a direct airport connection to HSR would increase ridership for the service through connecting key employment hubs such as Kitchener-Waterloo to Pearson Airport.

As the sessions moved further west, interest in the economic development opportunities associated with HSR increased. At the engagement session in Kitchener there was general agreement that one key challenge that area businesses face is attracting talent, particularly in the high-tech industry. An HSR connection has the potential to make living in the Kitchener-Waterloo region more appealing for residents commuting to Toronto, and would also increase the attractiveness of "reverse commuting," giving employees working in Kitchener-Waterloo the option of living in Toronto. Representatives from the tech industry indicated that highly skilled prospective employees, particularly those who are younger, tend to prefer to live in larger city centres such as Toronto's, and that the reverse commute would make it easier for them to do so.

Participants in London also discussed the potential of HSR to create talent attraction opportunities for the city, similar to those described above for Kitchener-Waterloo. They indicated that although thousands of students attend the University of Western Ontario or one of the city's colleges, fewer than desired settle in London once they graduate. According to participants, one reason for this could be a lack of job opportunities commensurate with the graduates' knowledge and skills.

Participants at the session indicated that talent is often lost to Toronto or Kitchener-Waterloo, although this talent loss is difficult to quantify.

Some participants in London also believed that HSR service could create the opportunity for London to become a hub for HSR rolling-stock maintenance since the region already has a long history of building heavy-rail locomotives. Some also believed a case could be made for the HSR maintenance and operations centres to be located in London because it is situated at the mid-point of the corridor.

At the Windsor session, HSR was viewed as potentially transformational from the perspective of reviving the manufacturing industry and providing new employment opportunities. HSR's potential to resume cross-border connections with the United States via the existing tunnel also generated considerable enthusiasm. This point was echoed in a discussion with representatives from Michigan's Department of Transportation, the Council of the Great Lakes Region, and Amtrak, the American passenger rail and bus operator.

Many people at various sessions also noted that HSR could make train travel an enjoyable experience for commuters, optimizing productivity levels by making the trains efficient and work-friendly spaces, with access to Wi-Fi, designated quiet cars and quality refreshment services. HSR riders would enjoy their journeys, welcoming trips as opportunities for reading, reflection, and work, in contrast to the "lost time" experience of long car commutes.

Coordination and Integration of Transportation and Transit Services

The second key theme that emerged from the engagement sessions was the need to coordinate services in the corridor and to integrate HSR with local and regional transit systems.

At each session it was noted that rationalizing existing services such as VIA Rail, GO RER, and the UP Express, which run within the same corridor as the proposed HSR system, would be critical to its success. Stakeholders suggested that MTO work closely with the municipal and federal governments to achieve the right balance for optimal service in the corridor.

Stakeholders also highlighted the need to ensure that HSR would not displace existing services such as VIA Rail's services to communities not on the HSR line such as Woodstock, Ingersoll, Stratford and St. Marys. A system-wide approach in developing better connectivity and mobility options in Southwestern Ontario was suggested to ensure that existing rail and bus services would be able to connect passengers to a future HSR network. Participants firmly believed that investing in services for smaller communities in the near term would build ridership and increase mobility options in advance of HSR implementation.

On a related note, stakeholders emphasized that integration of local and regional transit strategies was essential to ensure coordination of transportation priorities and so that services would operate

as one user-friendly system. The topic of "first-mile/last-mile" connections was discussed extensively at the engagement sessions. Table 2.1 summarizes local projects underway that were discussed at the sessions and which projects MTO should take into consideration when coordinating with HSR.

Table 2.1: Projects and Services Discussed at the Special Advisor's Engagement Sessions

Toronto	KW	London	Windsor
• UP Express • GO Regional Express Rail • SmartTrack • Mississauga Transitway • Hurontario-Main LRT (Brampton) • Eglinton Crosstown • Finch West LRT	• Waterloo ION LRT/Bus Rapid Transit (BRT) • King/Victoria multimodal transportation hub • GO Transit	• Shift Rapid Transit project • City of London's corridor protection strategy	• Planning and track upgrade activities across the border in the United States

The various local projects listed in Table 2.1, all in different stages of development, are positive contributions to the HSR planning process and will contribute to the success of HSR. As Kitchener-Waterloo builds its new multimodal hub, for example, regular community engagement may also help with HSR integration plans.

It was also beneficial to learn that some communities have already started planning for HSR or are receptive to beginning planning for HSR integration. Municipal stakeholders in London mentioned that their corridor-protection plans are forward-looking and that HSR is already being considered, including what a downtown HSR station might look like, as they upgrade existing CN lines and grade separations. The Special Advisor also met with the Mayor of Guelph and senior city staff who expressed interest in supporting planning efforts to bring HSR to Guelph.

Future Engagement

In all the sessions participants emphasized the need for the continued engagement of stakeholders on the project. There was a specific interest from participants discussing the business case for HSR, in particular implementation timelines, budget, and the target market for the service.

MTO officials explained that the HSR project is in its early stages, and that more information will be made available as the EA process advances. This is a formalized process outlined in legislation that that government must follow and it includes requirements for Indigenous engagement and public and stakeholder consultation.

Other Considerations

Fares

Participants emphasized that both HSR's target market and how much it will cost users must be made very clear during the planning and technical stages of the project. If business travellers are target users, a potential pricing approach would be to offer tiered fares with business class seats at one price, as well as other more affordable options. The Special Advisor was encouraged to consider other pricing approaches, such as student and senior prices, or offering discounts for bulk ticket purchases or for passes. In Europe, for example, HSR fares can vary significantly depending on how many tickets are purchased at a time or how far in advance they are purchased, and discounts are generally provided for trips that are paid for in advance. Fare integration with intercommunity buses, VIA Rail and GO Transit was noted as a desirable aspect of HSR.

Service Levels

Participants discussing service levels had various opinions, often dependent on their location. In Kitchener-Waterloo, for example, many stakeholders felt that a shorter commute time to Toronto was one of the most desired factors. In communities such as London and Windsor, although speed was important, so was the provision of predictable and regular service, particularly at peak times in the morning and evening.

Emerging Technologies

A number of stakeholders encouraged the Special Advisor and MTO to consider the impacts and implications that emerging technologies would have on future transportation services. It was suggested that Autonomous Vehicles (AVs) might provide excellent opportunities for first-mile/last-mile connections and for smaller communities to connect with HSR, and that alternative rail technologies merited further consideration. Hyperloop, an emerging technology now being tested around the world where people are transported in pods at immense speeds through pneumatic tubes on a cushion of air, was also raised.

Business Case Results

Finally, a number of stakeholders recommended that more detailed information be shared at future engagement sessions about the project and about the business case for HSR in the corridor. They would like to see more detail on potential station locations, timing, and the costs and benefits, including a Benefit-Cost Ratio (BCR), if possible, to demonstrate evidence-based decision-making for the project.

Recommended Approach – Public and Private Sectors

Overall, stakeholders in the Toronto-Windsor corridor are enthusiastic about the potential opportunities that HSR can bring to their communities, with economic development opportunities being the primary area of interest. Stakeholders believe that HSR will extend Toronto's and Kitchener-Waterloo's "commute sheds," making both commuting to work and business-related day-trips to and from these major employment hubs easier. They believe HSR will also spur jobs and economic growth in London and Windsor.

Stakeholders also indicated that it will be important for the Province to ensure that services are integrated and that first-mile/last-mile connections are made, creating a comprehensive transportation network for Southwestern Ontario with HSR as the foundation. Where possible, work already underway in the communities on transit projects, mobility hubs, or other infrastructure investments must be taken into account and integrated with HSR. Shorter-term investments to bolster mobility options in advance of HSR implementation could be made in municipal transit and intercommunity services, particularly in smaller communities in the corridor. Stakeholders' expectations are high for future engagement on HSR to include more information about the business case.

Based on the feedback from the engagement sessions during the Special Advisor's term, it is recommended that the Province undertake the following as the HSR project advances:

Recommendation 1: Integration with Local Transit Services
The Province should continue to work closely with municipal stakeholders in the corridor to identify opportunities to integrate local transit and existing and planned services with future HSR stations and ensure that first-mile/last-mile connections are made.

Recommendation 2: Regional Transportation Infrastructure
The Province should encourage and support investment in regional transportation infrastructure in the near term to increase transportation options in smaller communities, which will help build ridership in the corridor and establish a system-wide approach to mobility in Southwestern Ontario.

Recommendation 3: Share Detailed Business Case Results

The Province should share detailed business case results for HSR as the project develops, emphasizing collaboration, transparency and information-sharing, to ensure that communities along the corridor are informed about and engaged in the project.

Recommendation 4: Continued Engagement with Stakeholders

The Province should continue to engage with stakeholders, including but not limited to municipalities and land owners in the corridor, on the planning, development, and implementation of HSR, including throughout the Environmental Assessment process.

Engagement with Indigenous Communities

There are a number of First Nations and Métis communities in the proposed HSR study area, and the Special Advisor emphasized the need to engage with Indigenous communities as early as possible in the project-planning phase.

Letters introducing the Special Advisor and the proposed HSR project were sent to all First Nations communities in the study area, as well as to the Métis Nation of Ontario. The Special Advisor offered to meet with community leaders to provide more information and to have discussions about the communities' interests and concerns.

The objectives for the meetings with Indigenous communities were similar to the municipal engagement sessions, including

- Providing communities with a high-level overview of the proposed HSR project.
- Seeking feedback on how best to engage with First Nations communities in the corridor.
- Understanding the key challenges and opportunities presented by HSR from the perspective of First Nations.

The following section summarizes feedback from the Indigenous communities that met with the Special Advisor and/or MTO officials.

Ongoing Engagement with Indigenous Communities

One theme that emerged in each of the meetings with Indigenous communities was the need for ongoing, regular engagement throughout the duration of the HSR project with communities in the study area. Community leaders stressed the importance of collaboration between their communities and the Province, to ensure that the views and interests of Indigenous peoples are adequately incorporated at each stage in the project.

Communities requested that long-term engagement plans for the HSR project be defined and developed in partnership with their communities; each has differing needs, interests and preferred approaches. For example, the Aamjiwnaang, Chippewas of the Thames, Walpole Island, and Kettle and Stoney Point First Nations indicated a preference to be engaged as a group to allow for a unified regional voice. Other communities may prefer to be engaged one-on-one.

All communities emphasized the importance of ongoing engagement leading up to and throughout the EA process, particularly as more project details become available.

Economic Development Opportunities and Partnerships

Communities meeting the Special Advisor and MTO officials were interested in the economic development benefits of the project, identifying employment, procurement opportunities, ongoing revenue generation, business arrangements, and partnerships as potential economic opportunities. They noted that the proposed project could bring substantial benefits to Indigenous communities and businesses through activities related to

- Construction
- Operations
- Maintenance
- Consulting services (e.g., for feasibility or EA studies).

Some communities recommended that the Province consider how to ensure that communities are prepared before the project begins so that they can take advantage of economic development opportunities that arise from the project—for example, identifying what specialized skills and education will be required for various components of the project (construction, maintenance, operations) and determining what the Province can do to help ensure Indigenous peoples and businesses have the capacity, expertise, and skills required to take advantage of these opportunities.

The concept of equity partnership and a desire to be shareholders in the HSR project was also raised by some communities. There are no models for such an arrangement to do with rail infrastructure in the Province; however, equity arrangements between the private sector and First Nations have been successful for other types of infrastructure, such as energy utilities, and equity partnership models for

HSR could be explored. Above all, Indigenous communities want to be considered true economic partners as HSR moves forward.

Environmental Protection and Respect for Culturally Sensitive Lands

The protection of the natural environment and respect for culturally sensitive lands must be a priority throughout the implementation of HSR. Overall, assuming that HSR would be an electrified service, the communities expressed the view that the project would be a positive one for the environment, particularly because it would reduce greenhouse gas (GHG) emissions by taking cars off the road; however, a number of important considerations for the HSR corridor were raised by the communities, including but not limited to concerns about

- Protecting wildlife, including the provision of wildlife overpasses/underpasses on the HSR corridor.
- Minimizing impacts of rail corridors on the environment such as the loss of Carolinian grassland, woodlands, or the spread of invasive species, such as phragmites, an invasive species of grass that crowds out native vegetation and can spread along transportation corridors.
- Soil contamination and leaching risks posed by construction materials.
- Noise and vibration impacts from fast and frequent train movements.
- Protecting water systems such as the Grand River, Thames River Watershed, and others.

Communities encouraged the Province to recognize that Indigenous peoples are experts on the environment and have a deep knowledge and understanding of local species of plants and animals. Their services could be retained to support the EA process for environmental monitoring or to offer traditional knowledge.

On a case-by-case basis at provincial construction projects the Province and Indigenous communities often arrange for environmental or archaeological field monitors when necessary. For example, after the Highway 407 East project revealed thousands of Indigenous artifacts from a former Huron-Wendat settlement, Indigenous field monitors visited the site for inspections, as shown in Figure 2.1.

Figure 2.1: Indigenous Field Monitors on an Archaeology Site in the Highway 407 East Corridor

Source: Ministry of Transportation

Of primary concern to communities is the protection of lands used for cultural purposes such as for ceremonies or for gathering medicinal plants, as well as potential impacts on archaeological resources such as traditional First Nations' settlements and burial sites, and this concern must be considered when planning any new infrastructure for HSR, including tracks or new stations.

Education and Awareness

Communities viewed the HSR project as providing an excellent opportunity to advance education and build awareness of Indigenous culture, history and traditions in Southwestern Ontario, a way to build trust and understanding and to educate Ontarians and all HSR users about First Nations and Métis history. It was suggested that Indigenous communities could engage directly with the public in a number of ways throughout the project, including during the EA process, to raise awareness about their traditional territories, histories, and cultures.

Participants suggested that if HSR is built the Province could procure Indigenous artists and historians to create art and cultural installations for HSR stations. This has been a successful endeavour in other MTO projects. The Right Honourable Herb Gray Parkway, for example, features artwork produced by local Indigenous artists (see Figure 2.2), and the hiking trail running parallel to the highway includes educational plaques that detail Indigenous history and traditions for path users to read and interact with. As a second example, the artifacts from the former Huron-Wendat settlement on the 407 East site mentioned above went on public display during Doors Open Whitby in 2014 (see Figure 2.3).

Figure 2.2: Sculpture of a Turtle Designed by Walpole Island First Nation Artist Teresa Altiman Featured on the Herb Gray Parkway Trail

Source: Ministry of Transportation

Figure 2.3: Indigenous Stone and Bone Artifacts Found on the 407 East Site

Source: Ministry of Transportation

Capacity Funding

Participants raised lack of capacity as a potential barrier to successful engagement on the HSR project, noting that many Indigenous communities do not have the human resources, financial capacity or technical expertise to meaningfully participate in government-led engagement processes. Communities in the HSR study area identified the need for the Province to provide capacity funding to facilitate their meaningful participation in the HSR project; communities often request capacity funding so they can hire their own technical experts to review project information such as EA studies or engineering reports, and since many communities are small, they may also require capacity

funding to hire administrative staff to deal with the hundreds of requests received each year from government that seek feedback on various policies, initiatives and projects.

Recommended Approach – Indigenous Engagement

Overall, the HSR project is viewed as a positive opportunity with the potential to generate economic development and environmental benefits; however, Indigenous communities want to ensure that there will be real benefits and shared prosperity for their communities.

Given the important considerations that were raised by Indigenous communities during early engagement, it is advised that the Province adopt the following recommendations as the HSR project advances.

Recommendation 5: Continued Engagement with Indigenous Communities
The Province should continue to engage with Indigenous communities on the planning, development, and implementation of HSR, including throughout the Environmental Assessment process, and work with communities to determine preferred approaches to engagement.

Recommendation 6: Opportunities for Indigenous Communities – Economic Benefits
The Province should consider opportunities for Indigenous communities to share in the economic benefits associated with HSR, including generating future opportunities related to procurement and other economic partnership arrangements.

Recommendation 7: Protection of the Environment and Lands of Cultural and Archaeological Importance
The Province should commit to protecting the natural environment, culturally sensitive lands and archaeological sites throughout the Toronto-Windsor corridor, recognizing that Indigenous communities are experts in these areas of knowledge.

Recommendation 8: Showcasing of Indigenous Art and Culture

The Province should provide opportunities to showcase Indigenous culture, history and traditions throughout the HSR project, including showcasing Indigenous art and culture at future HSR stations, and consider Indigenous traditional naming opportunities for HSR-related infrastructure.

Recommendation 9: Indigenous Capacity Funding

The Province should consider providing capacity funding to Indigenous communities in the study area to facilitate engagement on the HSR project.

Chapter 3

The Business Case for High Speed Rail

HSR in Southwestern Ontario would operate between Toronto's Union Station and Pearson Airport, Guelph, and Kitchener-Waterloo on a corridor shared with commuter services, including GO RER. West of Kitchener, HSR would operate on new, dedicated track to London, Chatham, and Windsor. This mix of services would allow rail to capture a significant mode share in the corridor and serve a wide range of markets from commuter to leisure to business. This chapter contains the Special Advisor's recommendations for station locations, alignment, speed, and implementation.

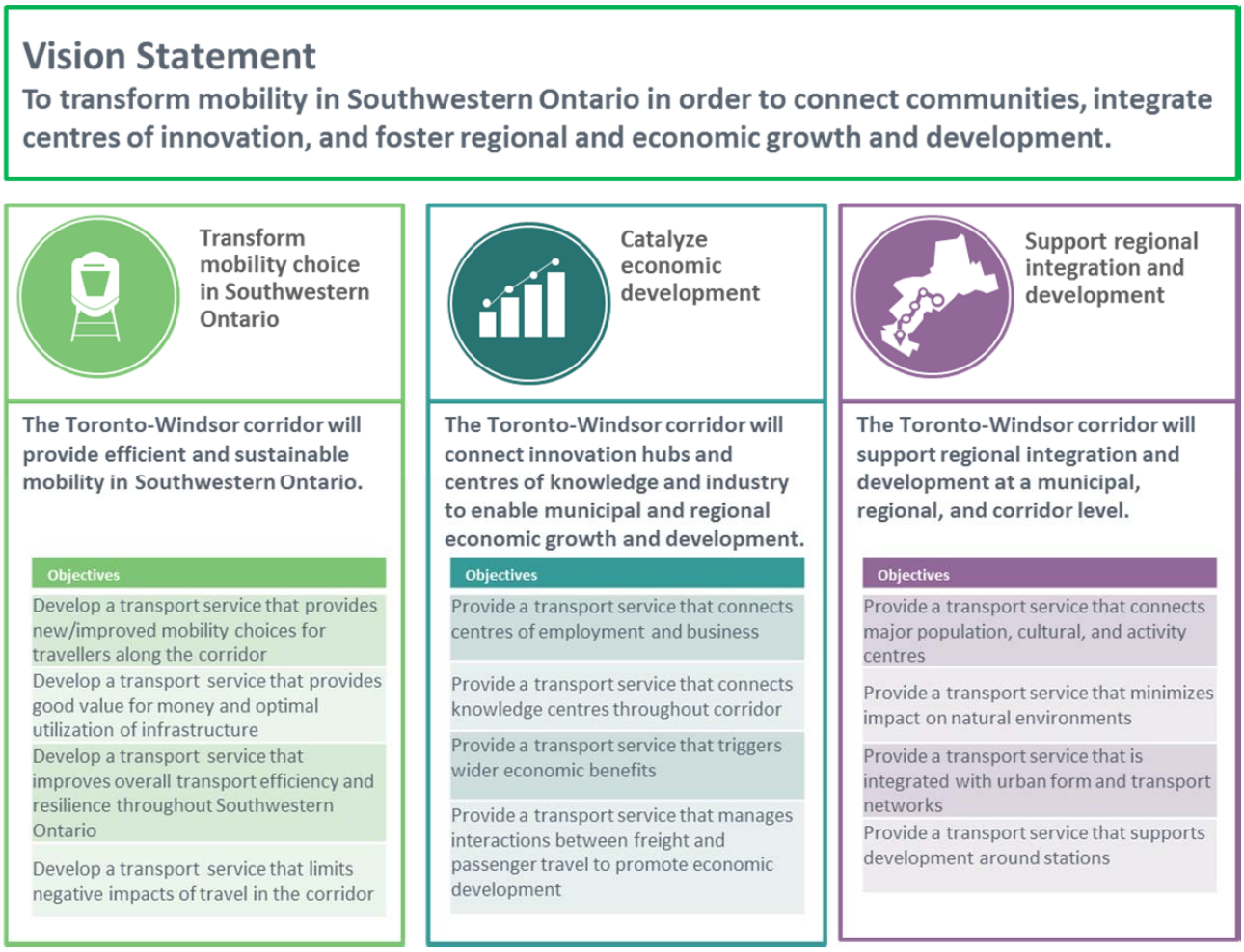
HSR will be a new and unprecedented transportation infrastructure initiative for Ontario. The Special Advisor clearly found that HSR has the potential to transform travel in the Toronto-Windsor corridor and help the Province in achieving its transportation, economic development, and environmental goals, a finding that was supported by the business case analysis.

Vision for HSR

The vision for HSR in the Toronto-Windsor corridor, shown in Figure 3.1, was developed to guide the assessment of various implementation options and delivery of the HSR system. Ultimately, the vision underpins the Special Advisor's recommendations regarding stations, alignment, speed, phasing, and implementation considerations, which are detailed below.

It encapsulates three foundational principles: to transform mobility choice in Southwestern Ontario; to catalyze economic development; and to support regional integration and development. A series of objectives expands upon each principle.

Figure 3.1: Vision for HSR in the Toronto-Windsor Corridor



Graphic Produced by Steer Davies Gleave

The Foundational Principles in Detail

The objectives articulated under each of the three foundational principles reflect the challenges and opportunities in the corridor. Each principle is described in more detail below.

Transform Mobility Choice in Southwestern Ontario

Based on input from communities in the Toronto-Windsor corridor and an assessment of transportation trends, economic profiles and the government's objectives for transportation in the corridor, it is clear that a change from the overwhelming reliance on automobile use is required. The automobile's dominance along the corridor can be understood from two perspectives:

- There is a lack of reliable, competitive travel options.
- Rail as a means of travel is less attractive than it once was.

Existing rail services do not provide adequate trip frequencies or travel times to effectively compete with the automobile, even despite highway congestion and unpredictable travel times that automobile users often face. Although the Province's GO RER program on the Kitchener corridor can be expected to expand travellers' reliance on and expectations of the regional rail market, the Toronto-Windsor corridor still lacks an intercity rail alternative.

For HSR to be successful it must provide a fast, frequent and comfortable travel option that will be the best alternative to existing modes. The provision of such a service will create new travel markets between cities within and adjacent to the HSR network. Additionally, it will shape mode share in the corridor by providing a convenient alternative to automobile use. HSR will also provide options for rural residents to access larger centres on the network.

HSR should be implemented with careful consideration of its fiscal impacts and long-term sustainability. It should be implemented based on a sound business case, provide value for money, and build on and complement existing and planned rail infrastructure and services.

Catalyze Economic Development

HSR will be a transformative investment in transportation infrastructure for Ontario, which in turn will trigger economic growth and development. Communities along the corridor have highlighted HSR as being critical to the economic potential of the corridor and its long-term prosperity.

In particular, London and the Region of Waterloo have advocated strongly for frequent and fast rail services to support the growth of their high-tech industries. In North America, the Toronto-London portion of the Innovation SuperCorridor is one of the top regions in terms of the rate of technology start-ups and growth in technology employment. Currently this corridor lacks the required frequent, efficient transportation linkages to support Ontario's position as a leader in the knowledge economy.

HSR will improve travel speeds and frequency of service to foster substantially stronger economic integration between cities throughout Southwestern Ontario.

Support Regional Integration and Development

HSR should be delivered as part of an integrated solution for transportation in the corridor. This means ensuring that regional transportation, urban development and economic plans consider the possibility of HSR and protect for its development and operations.

Stations on the network should be developed within urban cores in such ways as to maximize the economic, social and environmental benefits of HSR. The Province should work closely with

communities to ensure the presence of adequate first-mile/last-mile linkages and plans for leveraging the potentially wider economic benefits of the service.

HSR will support provincial policies that manage growth and development by linking existing urban areas and encouraging their growth and revitalization, which will in turn mitigate urban sprawl.

Directly supporting the urban structure of the *Growth Plan for the Greater Golden Horseshoe (2006),* and connecting communities without adding pressure on the Greenbelt, HSR is well aligned with the Provincial Policy Statement, which guides municipalities across Ontario in planning where and how to grow. HSR directly supports transit-oriented development, for example, a key principle of these plans.

By linking cities, encouraging the continued protection of the Greenbelt, and making living in Guelph, Kitchener-Waterloo, London, Chatham or Windsor more viable options for Ontarians who need to commute or travel to the GTHA for business and leisure, HSR will support where and how the Province wants to grow.

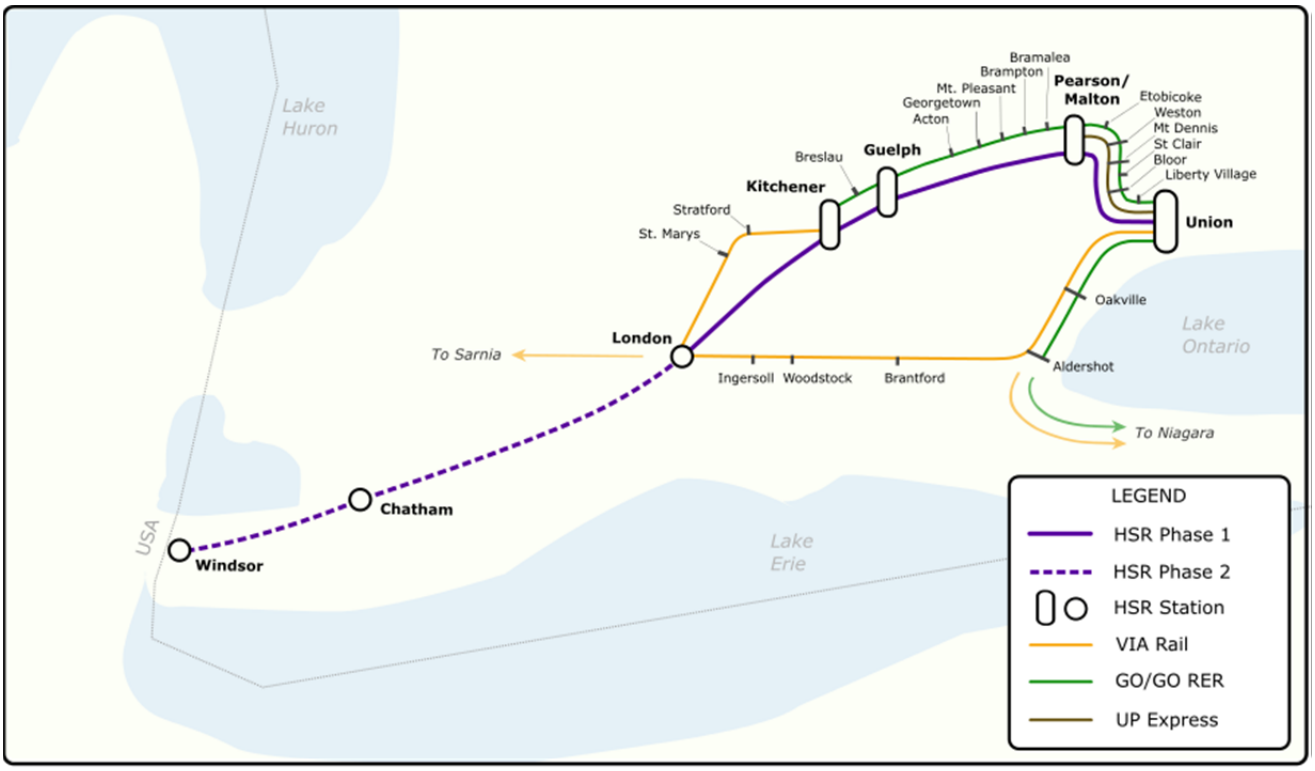
Stations, Alignment, and Speed

This section provides details on the business case for HSR, including key station locations, the preferred alignment for the service, and how fast the trains should travel to provide the optimal service to attract ridership. To assess the viability of HSR service, the Special Advisor directed Steer Davies Gleave (SDG), an internationally respected transportation consultancy, to conduct a detailed business case analysis of two comparative HSR scenarios: a dedicated HSR system operating at top speeds of over 300 km/h (Scenario A), and an HSR system operating on a combination of mixed conventional and dedicated railway at top speeds of 250 km/h (Scenario B).

Stations and Alignment

As mandated by the Province, the Special Advisor pursued an analysis of HSR stops at Union Station, Pearson Airport, Kitchener-Waterloo, London, and Windsor. Following community engagement in the corridor, cross-jurisdictional research, and the business case analysis it became apparent that a case can also be made for recommending HSR stops in Guelph and Chatham. This would offer a seven-stop HSR system connecting economic hubs, increasing regional interconnectivity and spanning nearly 400 kilometres across Southwestern Ontario. Figure 3.2 illustrates the Special Advisor's recommended HSR stations and alignment, which are consistent with Scenario B, as well as other passenger rail services in the corridor following the implementation of HSR.

Figure 3.2: Proposed Future Southwestern Ontario Passenger Rail Network



Source: MTO

It is proposed that HSR be implemented in two phases. Phase 1 would connect Toronto to London and Phase 2 would extend HSR to Windsor. In addition to offering a prudent approach to HSR implementation, phasing major construction projects is also a best practice that has been applied in comparable jurisdictions. The benefits of a phased approach include spreading capital costs out over time and allowing revenue and ridership generation to begin in earlier phases.

Recommendation 10: Phased Implementation

The Province should proceed with a phased approach to implementing HSR to maximize benefits and reduce costs.

- **Phase 1** would be implemented from Toronto to London with a target operational date of 2025.
  - This phase would build on GO RER investments between Toronto and Kitchener-Waterloo.
- **Phase 2** would be implemented from London to Windsor with a target operation date of 2031, as demand for HSR develops.

The following section details the Special Advisor's station recommendations for the Government's consideration, and includes considerations for associated infrastructure requirements and rationale. Through the EA process, the stations and alignment would be finalized following engagement and consultation with Indigenous communities, land owners, and municipalities in the Toronto-Windsor corridor to address issues and seek input from all affected parties. Throughout the HSR project, measures should be taken to protect environmentally and culturally sensitive lands, agricultural land, and areas of architectural significance.

Recommended Stations and Alignment

The Special Advisor recommends that the Toronto-Windsor corridor include the following HSR stations: Toronto Union Station, Pearson Airport, Guelph, Kitchener-Waterloo, London, Chatham and Windsor.

Toronto: Union Station

A Union Station stop, as the eastern terminus of the HSR network, is essential to the integration of HSR with existing services and to connect Southwestern Ontario with Toronto for business and leisure travel purposes. Union Station is Canada's largest passenger railway station and a key transportation hub, connecting local Toronto Transit Commission (TTC) services to regional bus and GO train services, the UP Express and VIA Rail.

The station building is currently owned by the City of Toronto; the Province, through Metrolinx, owns the train shed, rail corridor and platforms. The station is currently undergoing significant upgrades to increase capacity, improve safety and modernize the train concourse and platforms.

In 2012, Metrolinx released its *Union Station 2031 Demands and Opportunities Study*, which indicated that Union Station was serving over 240,000 users per day, including GO Rail, TTC and VIA Rail passengers. The study found that, based on trends in population growth in GO catchment areas and employment growth in GO destination areas, Union Station could expect to experience at least a doubling of daily passenger boarding over the next 20 years. This analysis did not include projections for HSR passengers both boarding and disembarking, which would add significant demands on station capacity. Despite the upgrades now underway at Union Station, additional work will need to be undertaken to address capacity issues and accommodate the growth of GO RER services, which will double from the current 29 trains in the peak hour to more than 50 in 2024.

As demand for rail services is expected to continue growing beyond 2024, further expansion is needed to support this future increase. The expansion should also be designed to accommodate HSR trains, which could represent almost 10% of the service in the peak hour. One option that has been discussed to add capacity is to build a new four-track, two-platform concourse under the western approach tracks to the station around Simcoe Street.

Recommendation 11: Union Station

The Province should work to ensure that

- Station capacity is addressed to accommodate future growth in ridership that will occur due to use by HSR, GO RER and VIA Rail services.
- Further consideration is given to developing a new concourse and platforms west of the existing station, building them under the approach tracks.
- A minimum of two level-boarding HSR platforms are constructed.

Moving west from Union Station, HSR trains would proceed along the Kitchener corridor toward Pearson Airport, sharing track with other rail services.

Pearson Airport

Internationally, HSR stations at airports often provide intercity connections that let air passengers access a wide and integrated network of various modes of transportation within a particular region. HSR stations at airports are typically either

- Direct connections within the airport and integrated within a multimodal airport hub; or
- Indirect connections, where the HSR station is connected to the airport by another mode of transportation such as a bus, LRT or subway.

The Netherlands' *Amsterdam Airport* Schiphol is one example of a direct connection, with an HSR station beneath the airport's terminal complex. This station is also a stop for a number of other transportation modes, creating a multimodal hub that provides integrated local, regional, and international service connections.

Newark Liberty International Airport in New Jersey, one of three international airports serving the New York City area, is an example of an indirect connection. Passengers can use Newark's AirTrain monorail service to access the airport, but to do so requires one or more connections to and from services such as New Jersey Transit and Amtrak rather than a direct, seamless link.

In the short term, it is recommended that Pearson Airport be served by an expanded Malton GO Station, offering an indirect connection to the airport from the HSR line. Access to the airport would be via an enhanced "people-mover" system connecting the approximately three kilometres between Terminals 1 and 3 and Malton Station. A Pearson Airport/Malton HSR stop would connect HSR to GO RER services, as well as to local Mississauga Transit services. HSR would enhance service from Union Station to the airport and would expand access to the airport for cities to the west (Guelph, Kitchener-Waterloo, London, Chatham and Windsor).

In the long term, it is recommended that the benefits of direct HSR access to the airport be explored, including increased ridership. Furthermore, the GTAA is currently planning for airport expansion and the development of a multimodal hub at Pearson Airport. Any planning work the Province undertakes for an HSR station directly at Pearson Airport should be aligned with the GTAA's work, to achieve efficiencies and ensure effective implementation.

HSR's infrastructure between Union Station and the airport station at Malton GO would require joint operation on tracks shared with GO RER services and UP Express. This could be addressed through track upgrades, the construction of passing tracks and/or a service priority agreement to enable HSR to overtake slower services in the corridor as necessary. The exact details of these upgrades will be defined with further analysis and design in the next stage of project development.

Recommendation 12: Pearson Airport

It is recommended that the Province

- Expand Malton GO Station as necessary to accommodate an HSR stop.
- Work with the Greater Toronto Airports Authority (GTAA) to provide a people-mover system linking HSR at Malton Station to the airport terminals.
- Coordinate the infrastructure requirements for GO RER and UP Express with those for HSR through this segment of the corridor.
- Work with the GTAA to provide direct access for HSR as air passenger volumes increase and to support its plans for the future Pearson Airport multimodal hub, most likely by 2031.

Guelph

The next stop westward on the HSR line, in Guelph, would bring HSR into the historic downtown train station at the intersection of Carden and Wyndham Streets. There are plans to expand the current station into a multimodal terminal to be used by VIA Rail, GO RER, and local Guelph Transit services. Accommodating HSR would require station and track expansion, including the construction of two level-boarding platforms, as well as a third passing track in the middle of the existing tracks to allow for the interoperation of GO RER and HSR services. This accommodation was encouraged by the Mayor of Guelph and city officials in discussions with the Special Advisor.

The route westwards from Guelph Station is aligned in the middle of Kent Street and is flanked by century homes of architectural significance. This severely limits train speeds through the area, although improvements are possible if some of the four level crossings before Guelph Junction are rationalized (for example through the implementation of grade separations or closures). The infrastructure requirements for GO RER will also need to be coordinated with those for HSR through this stretch of the corridor.

Recommendation 13: Guelph

It is recommended that the Province

- Work closely with the City of Guelph to deliver on infrastructure requirements to accommodate GO RER and an HSR stop at the historic Guelph Station.
- Ensure that all necessary measures are undertaken to protect the historically significant architecture in the station precinct.
- Coordinate the infrastructure requirements for GO RER with those for HSR through this stretch of the corridor.

Kitchener-Waterloo

Apart from the need to rationalize some of the crossings at Guelph Junction, the route westward toward Kitchener-Waterloo is straight and can accommodate the construction of double tracks.

The City of Kitchener has plans underway to build a new multimodal station slightly to the west of the current VIA Rail station. HSR would connect to local services such as Waterloo ION LRT and Grand River Transit buses.

Recommendation 14: Kitchener-Waterloo

It is recommended that the Province

- Work closely with the Cities of Kitchener and Waterloo to ensure that planning for the new multimodal station accommodates HSR.
- Coordinate the infrastructure requirements for GO RER with those for HSR to Kitchener-Waterloo.
- Work to ensure that station upgrades do not preclude future HSR service.

London

It is recommended that the Kitchener-London segment of the HSR corridor be constructed as a new, dedicated HSR line. A feasible option is to build the tracks adjacent to the existing hydro corridor to the point where they would interface with CN, and from there continue adjacent to the CN South Main line corridor into London. The hydro right-of-way is currently protected for future hydro expansion; however, there is an opportunity to build new HSR tracks beside the corridor. It would be prudent to perform various HSR engineering studies to ensure the proper functioning of HSR infrastructure and public safety.

The introduction of HSR would offer the opportunity to rebuild the existing London Station as a multimodal transportation terminal, in cooperation with the City of London and VIA Rail.

The new HSR station in London would be built by expanding the existing VIA Rail station, located on York Street in the city centre. The new station would enable connections to London's planned bus rapid transit (BRT) system, Shift, and is close to the existing Greyhound bus terminal.

Recommendation 15: London

It is recommended that the Province

- Build a new, dedicated HSR line between Kitchener-Waterloo and London adjacent to the existing Hydro One corridor.
- Work closely with Hydro One throughout the duration of the project.
- Work with VIA Rail and the City of London to expand the existing VIA Rail station to accommodate HSR and ensure seamless connection with the future Shift BRT service.
- Work with CN on requirements for the new HSR line to run adjacent to the CN South Main line into London.

Chatham

Service from London to Chatham would require a new, grade-separated, single, bi-directional, electrified track running adjacent to the existing CN Rail corridor to Chatham.

The existing VIA Rail Station in Chatham would be refurbished and a second platform built to accommodate the new HSR service and to allow for the development of a multimodal hub in Chatham, connecting HSR to Chatham-Kent's local bus and taxi services as well as to intercommunity buses.

Recommendation 16: Chatham

It is recommended that the Province

- Work with CN to explore options to build a new electrified track, adjacent to the existing CN corridor.
- Work with VIA Rail and the Municipality of Chatham-Kent to explore options to expand Chatham Station to accommodate HSR.

Windsor

Westward from Chatham, HSR service would continue to Windsor, veering off the CN/VIA Rail right-of-way and connecting with the CP corridor into Windsor. The service could eventually connect with Amtrak tracks in Detroit via the existing CP tunnel.

A new HSR station would also be constructed in Windsor, ideally located adjacent to the CP corridor at a point close to downtown. As with all HSR stations, coordination between HSR and local transit in Windsor to ensure first-mile/last-mile connections is essential.

Recommendation 17: Windsor
It is recommended that the Province ▪ Work with CP to explore the implementation of a new track and passing tracks along the existing CP Windsor corridor. ▪ Work with CP and the City of Windsor to identify options for the building of a new HSR station that will provide access to downtown Windsor. ▪ Work with CP, Amtrak and the State of Michigan on plans for future expansion of the HSR service to the U.S. via Detroit through the existing rail tunnel under the Detroit River.

Speed

Once the station stops have been determined, the next important aspect of the system to be considered is optimal speeds for HSR service. As discussed in Chapter 1, the speeds, distances, number of stops and costs of HSR systems around the world vary; the types of HSR systems that countries pursue essentially depend on regional transportation contexts and policy priorities.

The Special Advisor's recommendation on optimal speed was supported by the analysis of two scenarios and their corresponding benefit-cost ratios (BCRs), as described in this section.

The introduction to this report provided a brief description of dedicated, mixed conventional and fully mixed HSR systems. The distinctions are important since each system type has characteristics that are relevant to the question of speed. For example, the Japanese HSR system, with trains operating at speeds of over 300 km/h, has a number of key factors that contribute to its success, including dedicated track, a potential market of millions of daily passengers and long distances (generally between 400 kilometres and 600 kilometres) between relatively few stops.

HSR systems in Germany and the United States, which reach speeds of between 200 km/h and 300 km/h and operate on a mix of dedicated, mixed conventional, and fully mixed railway, provide a

frequent, fast alternative to both automobile and air travel and are aimed at encouraging regional integration. In many cases stops serve relatively small communities and are not very far apart; the larger number of stops and the mix of dedicated and conventional rail tracks do not typically permit the same "bullet" speeds experienced in other systems.

The Toronto-Windsor HSR corridor exhibits similar characteristics to the German and American systems described above. Distances between station stops are relatively short and HSR would interoperate with other conventional passenger rail services, particularly on the Toronto-London segment. These factors would constrain the ability of HSR trains to achieve or maintain very high speeds (for example in excess of 250 km/h).

Analysis: Preferred Speed and Alignments

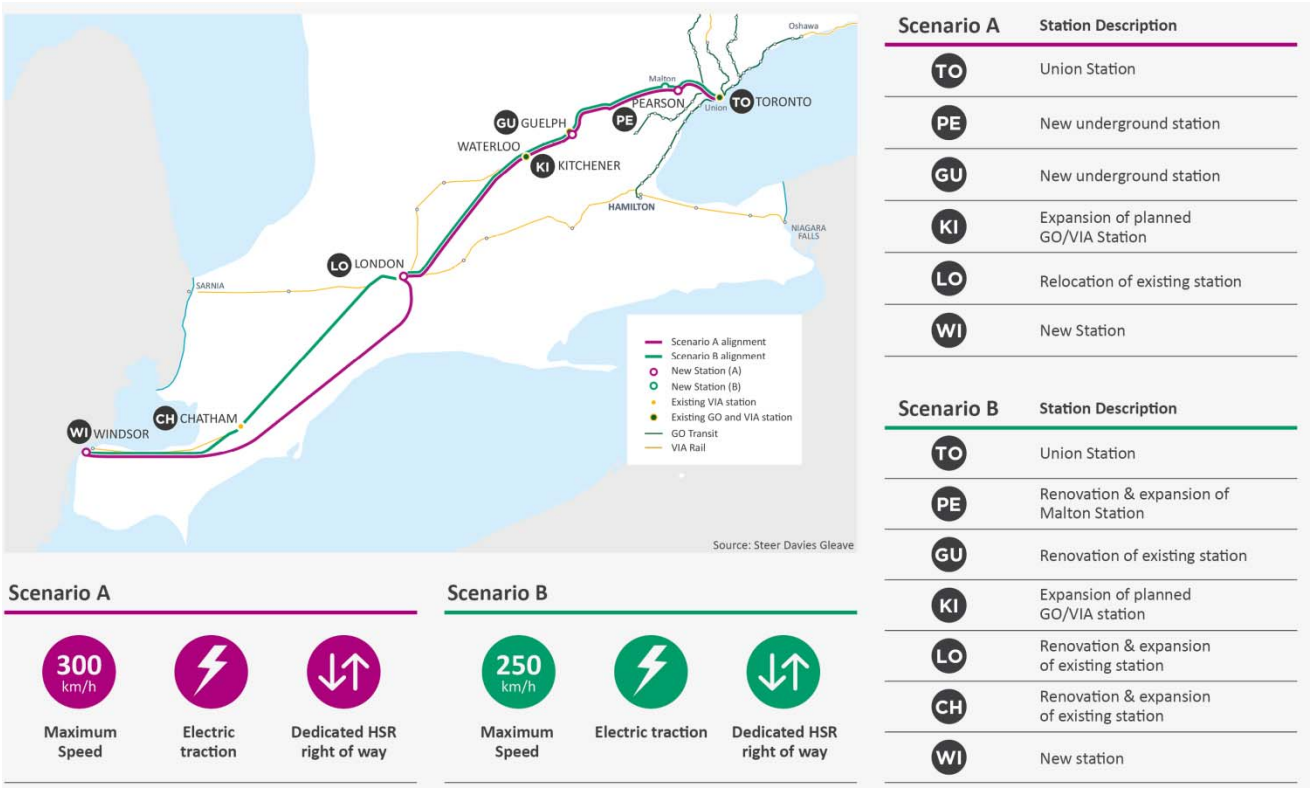
In determining the preferred speed of an HSR system between Toronto and Windsor, two representative scenarios were analyzed based on the recommended station stops and an assessment of the financial and economic impacts.

- **Scenario A:** Electrified HSR service operating primarily on a dedicated right-of-way and capable of achieving a top speed of 300 km/h.

- **Scenario B:** Electrified HSR service capable of achieving a top speed of 250 km/h.

Figures 3.3 and 3.4 illustrate the alignments, stations, travel times and distances for each of the two scenarios. Figure 3.3 provides an overview of the HSR alignments for Scenarios A and B and describes the station stops. Figure 3.4 illustrates the alignment and travel times between station stops for both scenarios and total travel times between Toronto and Windsor.

Figure 3.3: HSR Scenario A and Scenario B Alignments and Station Stops



Source: Steer Davies Gleave

Figure 3.4: HSR Scenario A and Scenario B Travel Times, Distances and Alignment Description

Scenario A	Travel time on segment (min)	Distance (km)	Description
TO ▶ PE	14	22.8	Use of existing rail alignment along the Union Station Rail Corridor (USRC) and Kitchener Line until Humber River. Tunnel from Humber River to Pearson Airport to allow for underground rail access
PE ▶ GU	18	53.9	Tunnel through to western Brampton, return to existing Kitchener Line until Rockwood, access Guelph in greenfield alignment with tunnel into Guelph under College Ave alongside the University of Guelph
GU ▶ KI	9	21.8	Use of Greenfield alignment and Guelph subdivision to access downtown station in Kitchener Waterloo
KI ▶ LO	25	87.1	Guelph subdivision to western limits of Kitchener, greenfield alignment alongside hydro corridor to allow high speed travel to eastern limits of London, trench alongside CN Dundas line into London
LO ▶ WI	49	190.7	CN Talbot line exiting London, onto former Canadian Southern Line to the west and through a greenfield curve to new track along the CP Windsor line at Tilbury with a connection to downtown Windsor
Total	115	376.3	

Scenario B	Travel time on segment (min)	Distance (km)	Description
TO ▶ PE	16	27.8	Use of existing rail alignment along the URSC and Kitchener Line leading to Malton Station Shared operations along alignment
PE ▶ GU	23	49.9	Use of upgraded Kitchener Line right of way
GU ▶ KI	9	18.1	Use of upgraded Kitchener Line right of way
KI ▶ LO	25	88.3	Guelph subdivision to western limits of Kitchener, greenfield alignment alongside hydro corridor to allow high speed travel to eastern limits of London, trench alongside CN Dundas line into London
LO ▶ CH	29	105.6	Development adjacent to existing CN line with connection in Chatham
CH ▶ WI	22	75.6	New track along the CP Windsor line with a connection to downtown Windsor
Total	124	365.3	

Source: Steer Davies Gleave

Scenario A (300 km/h)

In Scenario A, the 300 km/h HSR would take 115 minutes to travel between Toronto and Windsor. Due to its higher train speeds, Scenario A would require the development of dedicated HSR infrastructure for a greater portion of the alignment and would be a significant capital undertaking, including the construction of a new rail tunnel from Pearson Airport to just past Brampton, a tunnel under the University of Guelph, and a newly-built corridor between Kitchener and London, as well as between London and Windsor. The distances between HSR stations in the Toronto-Windsor corridor and relatively low population densities limits the ability of a 300 km/h service to achieve its top speed for sufficient time to maximize benefits through travel time savings and increased ridership. A summary of the costs and benefits of Scenario A is provided in Tables 3.1, 3.2 and 3.3.

Scenario B (250 km/h)

In Scenario B, the 250 km/h HSR would offer similar travel times to those in Scenario A. Scenario B is envisioned to operate primarily on the existing rail alignment between Toronto and Kitchener-Waterloo. Westward from Kitchener-Waterloo, HSR would run on a newly-built, dedicated corridor from Kitchener to Windsor.

It is important to note that the interoperation with GO RER between Union Station and Kitchener in Scenario B would require the integration of service timetables and capacity as well as speed improvements on the corridor. Interoperation may also reduce the potential ridership market for HSR and limit the range of fares that HSR could charge due to the availability of GO RER services. Key considerations related to the interplay between HSR and GO RER are discussed in the next section.

Scenario Costs and Benefits

To assess the viability of the two HSR scenarios, an in-depth analysis of the costs of implementing HSR and the benefits that it would bring to the corridor is summarized below.

The analysis concluded that Scenario B could be undertaken at a significantly lower cost relative to Scenario A, would yield similar economic benefits, and would provide similar journey times and passenger demand.

The analysis generated BCRs for each scenario. The BCR is an economic tool that compares the net benefits of HSR (detailed in Chapter 4) against the net costs of the project. As a value-for-money indicator, the BCR is a critical benchmark for evaluating large infrastructure projects.

BCRs greater than one indicate that the project will yield economic benefits above its costs. BCRs less than one indicate that a project's costs outweigh its total net benefits.

Scenario Capital Costs

HSR capital costs comprise expenditures related to construction and delivery (including building or upgrading railway tracks, electrification, building stations, signalling systems and other civil engineering requirements), and expenditures related to non-capital requirements such as design, project oversight and environmental mitigation.

Due to the complexity and scale of an HSR system, international best practice is to fully assess the project in terms of economic impact and cost. The capital costs for Scenarios A and B were therefore estimated with three different ways of evaluating the service. All costs are estimated in 2021 dollars:

1. **Base direct capital costs:** These costs summarize the total gross costs of procuring and operating an HSR system and form the basis for the other two cost calculations noted below. Base costs are not adjusted over time and represent the cost of implementing the entire system within one year. This category of costs is used to illustrate the total dollar value of procuring HSR at a specific time.

2. **Economic costs estimated in inflation-adjusted ("real") dollars:** These costs are adjusted over the 60-year lifecycle of HSR construction and operations based on assumptions about growth rates for economic variables, for example growth in revenues, population and/or the cost of buying goods and services. Economic costs are used to assess the net economic benefits of HSR and to estimate the BCR, and are expressed in terms of present value.

3. **Financial costs estimated in non-adjusted ("nominal") dollars:** These financial costs are intended to compare revenues and costs of HSR over the lifecycle of the project. These costs are increased over time based on an assumed 3% rate of inflation, as the intent is to conduct an equivalent assessment of the extent to which HSR revenues can cover operating and capital costs at the time they are incurred.

Table 3.1 provides a summary of the base direct capital costs for HSR in the Toronto-Windsor corridor. These costs do not include a contingency for cost overruns or uncertainties that may affect project delivery. They reflect only the direct costs of procuring HSR infrastructure and vehicles.

Table 3.1: Summary of Scenario A and Scenario B Base Direct Capital Costs (Without Contingency)

Base costs in million $2021	Scenario A	Scenario B
Toronto-London	$15,090	$4,110
London-Windsor	$4,370	$3,390
Total: Toronto-Windsor	$19,460	$7,500

Source: Steer Davies Gleave

Scenario B is anticipated to cost over $4 billion for the Toronto-London segment of the corridor and approximately $3.4 billion for London-Windsor. In contrast, Scenario A entails significant costs due to tunnelling, with capital costs of $15 billion for Toronto-London and $4.4 billion for London-Windsor.

Given the early stages of HSR analysis and study, and in consideration of potential uncertainties and risks to project delivery (e.g., unanticipated future infrastructure costs), the analysis included a 66%

contingency (also termed an "uplift") to these base direct capital costs, in addition to other soft costs.*

The 66% uplift is based on international best practices and guidance from the American Association of Cost Engineering (AACE)[1] and the United Kingdom Treasury Board Green Book for projects that are similar in scope to HSR.[2] It is important to note that this uplift is significantly higher than other rail projects in Ontario such as GO RER, which assumes a 50% contingency for its cost estimates.[3] This demonstrates that HSR costing has been undertaken on a conservative basis that is appropriate for this stage of the project.

Building on the base direct capital costs in Table 3.1, capital costs that include the 66% contingency are shown in Tables 3.2 and 3.3 and are listed by the three cost categories defined previously. As noted above, the base direct, economic and financial costs differ only because the growth assumptions used to calculate them are different. For example, since financial costs are increased by an assumed annual inflation rate of 3% throughout the project lifecycle, these estimates are higher than the adjusted economic costs and the base direct capital costs, which are incurred in their entirety within one year.

Table 3.2: Summary of Scenario A Uplifted Capital Costs (Including Contingency)

Capital costs in million $2021	Toronto-London	London-Windsor	Toronto-Windsor
Base	$43,580	$12,970	$56,550
Economic	$41,610	$10,630	$52,240
Financial	$45,250	$12,020	$57,270

Source: Steer Davies Gleave

Table 3.3: Summary of Scenario B Uplifted Capital Costs (Including Contingency)

Capital costs in million $2021	Toronto-London	London-Windsor	Toronto-Windsor
Base	$10,870	$10,070	$20,940
Economic	$10,600	$8,940	$19,540
Financial	$11,480	$9,760	$21,240

Source: Steer Davies Gleave

* Soft costs include assumptions for as-yet unknown expenditures such as environmental mitigation, HSR project staffing and overhead, training and project preparation costs (for example, detailed design, consultation, etc.). These assumptions are further detailed in the appended business case.

It is important to note that if the above HSR figures were estimated using the GO RER contingency assumptions based on the GO RER initial business case, the capital cost estimates for HSR would be lower, as illustrated in Table 3.4, below.

Table 3.4: Estimate of Scenario B Capital Costs Using GO RER Assumptions (Including 50% Contingency in $2014)

Capital costs in million $2014 based on GO RER assumptions	Toronto-London	London-Windsor	Toronto-Windsor
Base	$8,000	$7,400	$15,400

Source: Steer Davies Gleave

As the EA process proceeds and more information about the corridor and procurement approach for HSR is obtained (for example, in terms of governance and financing), it is anticipated that the contingency will be reduced and that costs estimates will be refined accordingly.

A key conclusion from the capital cost assessment is that Scenario B represents the lowest capital costs across all categories of cost estimation.

For the purposes of this report and subsequent chapters, the economic cost estimates including the contingency are used since they allow for a comparative assessment of HSR costs and benefits. The economic costs are compared with economic benefits to yield the BCR, which provides a clear benchmark of the value for money of undertaking HSR.

As illustrated in Table 3.5, the analysis demonstrates a positive business case for Scenario B only in the segment between Toronto and London (BCR of 1.02), since its BCR of greater than one indicates that the economic benefits of HSR between Toronto and London outweigh the costs of delivering the service; the BCR for the entire corridor, however, is less than one.

In contrast, the business case analysis reveals that Scenario A, with a BCR of 0.36 between Toronto and London and a BCR of 0.17 between London and Windsor, is not a viable option; although it provides similar benefits to Scenario B, it also presents significantly higher costs.

Table 3.5: Summary of BCRs for Scenario A and Scenario B

Economic BCR	Scenario A	Scenario B
Toronto-Windsor	0.32	0.70
Toronto-London	0.36	1.02
London-Windsor	0.17	0.24

Source: Steer Davies Gleave

Travel demand, population densities and distances between cities along the Toronto-Windsor corridor do not support the additional cost associated with a dedicated 300 km/h HSR system. A pragmatic approach, whereby existing provincial infrastructure investments on the corridor can be leveraged to improve travel times and service frequencies, is required.

In summary, the assessment of costs and the BCRs demonstrate that Scenario B (a seven-stop, 250 km/h HSR service in the Toronto-Windsor corridor) yields better value for money.

Recommendation 18: Speed
The Province should implement electrified 250 km/h HSR technology for the Toronto-Windsor corridor. ▪ This would offer a distinct intercity service that meets the UIC definition for HSR. ▪ To reduce infrastructure costs, the Province could investigate the procurement of HSR trains with tilting capability, which can allow trains to achieve higher speeds on less optimal alignments, such as curves.

The following section and Chapter 4 examine considerations for implementing HSR and the economic benefits that the service will bring to the corridor.

Implementing High Speed Rail

This section provides details on HSR capital works and service planning and makes recommendations with respect to integration of HSR capital planning with GO RER and coordinating service planning with other passenger rail and intercommunity bus services.

Preparatory Work – HSR and GO RER Integrated Capital and Service Planning

As discussed in the previous section, HSR will be operating on a shared corridor with GO RER between Toronto and Kitchener-Waterloo, so the interplay between the two services on the Kitchener corridor is a critical consideration underlying the success of HSR in Ontario. The Province will need to ensure that both initiatives are aligned, in particular by ensuring that current planning and procurements for GO RER take account of and enable HSR.

Building on its 2014 commitment for GO RER to Kitchener-Waterloo, the Province has tasked Metrolinx with providing all-day two-way service along the corridor. Several planning and procurement studies are currently underway, including freight rationalization, electrification and station upgrades. Specifically, the Province's commitment to GO RER includes

- Fifteen-minute service between Union Station and Bramalea.
- All-day two-way service to Kitchener-Waterloo. This service is expected to serve all stops between Kitchener-Waterloo and Bramalea and then run directly as an express to Union Station.
- Additional peak-period service to Georgetown and Mount Pleasant.
- New GO station stops at Breslau, St. Clair, Mount Dennis and Liberty Village.
- Enhanced Train Control (ETC) (Request for Quote issued in June 2016).

Capital works and service planning are two key aspects of the Province's GO RER plans that, if undertaken strategically and with a long-term vision, could accelerate HSR delivery and increase the viability of expanded rail services on the Kitchener corridor. Measures to ensure that GO RER capital works protect for HSR and that service planning is integrated for all rail services are discussed in further detail below.

GO RER Capital Works

It will be critical for MTO to work in close partnership with Metrolinx to ensure an alignment of service planning and capital cost assumptions for GO RER and HSR. The following recommendations, based on the HSR business case, are essential for enabling HSR on the Kitchener corridor.

Recommendation 19: Accommodating HSR in GO RER Work

The Province should ensure that GO RER commitments, planning and capital works accommodate future HSR on the Kitchener corridor.

- The development of GO RER with a view to its interoperability with HSR on the Kitchener corridor will support the Province in advancing both commitments.
- The Province should
    - Ensure that electrification and railway on the Kitchener corridor is built to accommodate speeds of 250km/h.
    - Protect the Kitchener corridor and stations for future capacity expansion wherever feasible.
    - Ensure level boarding platforms are not precluded at the designated HSR/GO RER station stops.
    - Prioritize the implementation of Enhanced Train Control (ETC) and ensure that signalling systems and other technologies do not preclude HSR operations.

Service Planning

Service planning refers to the number and frequency of trains operating along a corridor within a given period. In the case of international HSR systems, trains generally run every hour; however, on certain busy international corridors there can be as many as 10 trains an hour. Service planning is based on ridership demand and the capacity available on railway corridors.

To assess ridership for HSR on the Toronto-Windsor corridor, annual demand for the service was extrapolated based on traveller preferences for time savings, fares, proximity and ability to access HSR stations, and other socio-economic variables.

The business case has forecast total HSR ridership of up to 10.6 million by 2041.

The following frequency of services is the initial recommendation to minimize costs, optimize benefits, and to meet the projected ridership demands. Detailed train service demand modelling is required to confirm the recommendation and this will take place during the EA process.

Recommendation 20: Union-Kitchener Service Frequency

Based on ridership demand and corridor capacity, it is recommended that during peak periods the Province provide, in both directions, a frequency of 3 HSR trains and 1 GO RER train between Union Station and Kitchener.

- The Province should also provide the following service levels during off-peak periods:
    - 2 HSR trains per hour.
    - 1 GO RER train per hour.

HSR will become an essential part of the region's transportation network. As in most countries with high speed intercity services, the new service must become only one part of an integrated public transportation system. To ensure an appropriate level and mix of intercity and commuter services, it is recommended that the Province optimize its own rail services and coordinate with VIA Rail, Metrolinx, and other services that operate in the corridor, such as intercommunity bus services.

Recommendation 21: Integrated Provincial Services

The Province should align provincial mandates to optimize rail services by directing Metrolinx and MTO to collaborate on the development of an Integrated Rail Strategy for the Toronto-Kitchener corridor, which would

- Clarify the mandates of GO RER, UP Express and HSR on the corridor.
- Assess ridership and service frequencies.
- Recommend how the Province might optimize GO RER, UP Express and HSR ridership to maximize the benefit to Ontarians.

Recommendation 22: Coordination with VIA Rail Services

The Province should coordinate the integration of Southwestern Ontario passenger services with VIA Rail.

- MTO should engage VIA Rail with the objective of rationalizing VIA Rail and HSR service patterns in the Toronto-Windsor corridor.
    - On the Toronto-Kitchener corridor, HSR would replace VIA Rail service.
    - VIA Rail would continue operations from Union Station to London on the CN South Main line (not on the Kitchener corridor), serving a number of communities, including Oakville, Aldershot, Brantford, Woodstock, and Ingersoll.
    - Between Kitchener and London, VIA Rail would continue to operate on the CN North Main line via St. Marys and Stratford.
    - Between London and Windsor, VIA Rail would continue providing existing services until HSR is introduced in this segment of the corridor.
    - To ensure an integrated system, VIA Rail and HSR would enter into a codeshare agreement (i.e., a business arrangement where two operators share services) that would allow passengers to seamlessly use the two services with the same ticket.

In addition to aligning HSR with other rail service providers, the Province will also need to consider opportunities to coordinate with private bus companies. The Province's intercommunity bus consultations in summer 2016 showed that private bus companies have become increasingly concerned that subsidized public transit operators like GO Transit and VIA Rail are being given an unfair advantage. It is reasonable to assume that these concerns will only be amplified with the development of HSR.

The business case demonstrates that HSR will have an impact on bus travel in the Toronto to Windsor corridor as former or potential bus customers switch to HSR. HSR implementation, however,

also has the potential to be used as a catalyst to develop a strategy and partnership with the bus industry to encourage feeder services to HSR stations and in the process, facilitate a re-opening of abandoned routes to smaller communities. This could provide a means for the bus industry to benefit from, rather than be adversely affected by, the transportation modal split that HSR will precipitate.

Recommendation 23: Intercommunity Bus
As work on the intercommunity bus modernization initiative advances, the Province should work closely with the bus industry and other stakeholders to develop a partnership strategy with HSR for mutual benefit.

REFERENCES

[1] AACE Inc. (2003). *AACE International Recommended Practice No. 17R-97 Cost Estimate Classification System*. https://www.nsf.gov/about/contracting/rfqs/support_ant/docs/facility_manuals/palmer_mcm_and_southpole/costestimatingsystemaace-208a.pdf.

[2] HM Treasury (2013). *Green Book Supplementary Guidance: Optimism bias*. https://www.gov.uk/government/publications/green-book-supplementary-guidance-optimism-bias.

[3] Metrolinx. *GO Regional Express Rail Initial Business Case*. http://www.metrolinx.com/en/regionalplanning/projectevaluation/benefitscases/GO_RER_Initial_Business_Case_EN.pdf.

Chapter 4

The Benefits of High Speed Rail

HSR will have a transformative impact on Ontario's economy and deliver benefits by motivating a significant mode shift away from the automobile, reducing travel times and providing better connectivity along the Toronto-Windsor corridor; all of these will support the Province's goals for addressing climate change. HSR will also generate benefits by connecting economic clusters, increasing employment catchment areas, and encouraging competition and knowledge-sharing.

This chapter details some of the benefits that will be realized both quantitatively and qualitatively as a result of HSR in the Toronto-Windsor corridor. It is structured to reflect the three key themes (foundational principles) highlighted in the vision for HSR as described in Chapter 3: Transform Mobility; Catalyze Economic Development; and Support Regional Integration and Development. Figure 4.1 illustrates the benefits described in this chapter within the context of the three themes.

The BCRs shown in Table 3.4 of Chapter 3 include a range of benefits that fit under the first two key themes and include, for example, GHG reductions as a result of HSR, benefits of reduced road congestion and passenger travel time savings, and cost savings through a reduction in personal automobile ownership, all over a 60-year time frame.

The third key theme is covered in the second half of the chapter, which describes what are commonly referred to as wider economic benefits, or WEBs. There is a growing practice worldwide of including WEBs in BCR calculations for transportation projects. WEBs are the additional benefits that transportation projects such as HSR can deliver to regions as a result of increased connectivity and mobility options, which generate what is referred to as "expanded benefits." With the inclusion of WEBs in the BCR calculation for HSR between Toronto and London, the expanded BCR increases from 1.02 to 1.09.

It is estimated that HSR would generate over $20 billion in economic value over a 60-year period. Approximately $17 billion of these benefits will be realized in the Toronto-London segment of the corridor, with the remaining $3 billion realized in the London-Windsor segment.

Figure 4.1: The Benefits of HSR

Source: Steer Davies Gleave

Transform Mobility

Based on projections consistent with the Province's *Growth Plan for the Greater Golden Horseshoe (2006)*, over 10 million travellers annually are forecast to use HSR in the Toronto-Windsor corridor by 2041. As a comparison, in 2015, VIA Rail carried approximately 920,000 passengers in the Toronto-Windsor corridor and 3.6 million passengers in the entire Quebec City-Windsor corridor.[1]

As the business case demonstrates, HSR will alter transportation patterns in the Toronto-Windsor corridor and encourage a shift away from automobile use. A comparison between forecast mode shares in 2041 under a business-as-usual (BAU) scenario and with HSR implemented demonstrates that if the BAU scenario prevails, automobile use in the corridor would reach 95%. With the implementation of HSR, automobile use is forecast to be 86%. In 2041, HSR could therefore take an estimated 5.7 million cars off of the highway network between Toronto and Windsor.

Travel Time Savings

A key benefit of HSR would be reliability and travel time savings. HSR is anticipated to offer savings of between 40% and 60% over current travel times, as highlighted in Table 4.1.

Table 4.1: Comparison of Travel Times: HSR and Other Modes

	Travel time (minutes)							
Segment	A	B	UPX	GO	GO RER	VIA Rail	Air	Auto
TO ▶ PE	14	16	25					23
TO ▶ GU	32	39		99		69		67
TO ▶ KI	41	48		123	72	95		74
TO ▶ LO	66	73				130	42	120
TO ▶ CH		102				200		172
TO ▶ WI	115	124				254	68	221
GU ▶ KI	9	9		24		26		7
KI ▶ LO	25	25				118		46
LO ▶ WI	49	51						101
Resulting HSR Ridership (2041)	11,662,300	10,621,700						

Source: Steer Davies Gleave

These travel-time reductions represent an unprecedented level of efficiency for passenger travel in this corridor, especially when viewed in combination with the productivity and environmental benefits. The business case has estimated that travel time savings from HSR would yield over $7 billion in economic benefits over a 60-year period.

Savings from Automobile Use

HSR will provide an alternative to the automobile and consequently could reduce the need or desire for automobile ownership or use. This would yield significant economic benefits including reductions

in costs related to automobile ownership (purchase costs, insurance) and operations (fuel, maintenance etc.).

The reduction in automobile use would also result in a reduction in expenditures related to highway maintenance and expansion along the corridor (i.e., if personal automobile use decreases, this would result in less wear on highway infrastructure). In combination, these reductions are estimated to yield approximately $9 billion in benefits over a 60-year period.

Congestion Reduction and Safety Benefits

According to the business case, automobile use in the Toronto-Windsor corridor is primarily single occupancy with an average of 1.2 occupants per car.

HSR's travel time savings would encourage automobile users to switch to HSR, which would increase the overall efficiency of passenger travel on the Toronto-Windsor corridor and free up road capacity for other productive uses including the movement of goods. The business case estimates that the Province would realize approximately $3.7 billion in economic benefits over a 60-year period through a reduction in congestion and associated improvements to transportation safety (i.e., due to a reduced number of vehicles on the road) directly attributable to HSR.

Environmental Benefits

HSR would unlock significant environmental and economic benefits. Over a 60-year period, HSR would lead to reduced emissions and save over 7 million tonnes of CO_2 from entering the atmosphere.

Although this represents a relatively small percentage of overall Ontario emissions, a 250 km/h electrified HSR service has a carbon reduction factor of over 20. This suggests that for every tonne of CO_2 that the HSR system would create due to electricity supply requirements, it would remove over 20 tonnes of CO_2 emissions from the road network due the changes in travel demand driven by the HSR service.

Travel by HSR produces one-third of the carbon emissions of car travel and one-fourth of the emissions of an equivalent trip by air.[2] In the long term, this would contribute to the Province's goals to transition to a low-carbon economy and reduce GHG emissions, particularly in the transportation sector.

In addition to the reduction of GHG emissions, HSR generally also presents other environmental benefits. Studies indicate that HSR systems demonstrate high levels of land-use efficiency in

comparison with the land required for highway operations; for example, a two-track HSR railway can carry 13% more passengers per hour than a six-lane highway and requires 40% less land.[3]

Catalyze Economic Development

Talent Mobility and Attraction

HSR could shape travel in the Toronto-Windsor corridor by expanding the commute shed* and reducing commute times between Toronto and Kitchener-Waterloo to an average of 48 minutes. This will enable greater mobility for all categories of travellers from business to leisure and allow more Ontarians to live and work in different communities.

Compared to driving, which can take up to two hours between Toronto and Kitchener-Waterloo during peak times, this is a significant time-saving benefit. It is also worth considering that the time spent commuting by rail can be considered productive time, since high speed internet and mobile connectivity options would enable HSR commuters to do work or other tasks they would otherwise be unable to accomplish if they were driving.

Similarly, Kitchener-Waterloo and London would be brought well within the 45-minute commute shed range at 25 minutes. This means that the total two-way daily commute time between the two cities would be less than one hour, representing a significant opportunity for talent mobility between two growing communities that have strong industrial foundations and world-class universities.

In addition to reducing travel times and enabling the expansion of commute sheds, HSR would connect knowledge centres throughout the corridor. The benefits of this are difficult to quantify, but connecting key centres of learning has been undertaken elsewhere in the world. For example, in the U.K., the London-Cambridge high-tech corridor rail service connects world-class educational institutions with the country's largest city and financial centre.

In the Toronto-Windsor corridor, many knowledge and corporate centres, including those highlighted in Table 4.2, would be linked by HSR connections.

By connecting these knowledge centres, HSR could support innovation and collaboration between industries and academic institutions, or create more opportunities for university/college partnership programs or the expansion of satellite campuses.

* For the purposes of this report, "commute shed" is defined as a geographic area within which people can travel in a specified time.

Table 4.2: Selection of Knowledge Centres in the Toronto-Windsor Corridor

Urban Centre	Knowledge Centre
Downtown Toronto	• University of Toronto • Ryerson University • Ontario College of Art and Design (OCAD University) • MaRS Discovery District/Healthcare District • Financial District • Humber College • George Brown College • Seneca College • Various universities with downtown campuses
Pearson Airport	• Adjacent airport corporate centre
Guelph	• University of Guelph
Region of Waterloo	• Wilfrid Laurier University • University of Waterloo • Conestoga College • Start-up and high-tech hub
London	• University of Western Ontario • Fanshawe College
Windsor	• University of Windsor • St. Clair College

Source: Steer Davies Gleave. Note that this list of knowledge centres and institutions in the corridor is representative and not necessarily exhaustive.

In a recent speech, the Premier's Business Advisor, Ed Clark, gave sound advice: "Create the right environment and companies will come to where the supply of talent and ideas are located." Modern, fast, efficient transportation links, including HSR, are an essential part of creating such an environment, one that will foster innovation, investment and productivity.

Global connectivity is so important to commerce today that access is crucial not just to Toronto as the region's major business centre but to other cities in North America and around the world as well. Efficient and reliable transportation links from Pearson, Canada's largest airport, to businesses within the Greater Toronto Area are essential.

Throughout the Special Advisor's engagement with Indigenous communities and with stakeholders, particularly those representing the business sector in the corridor, a key theme was repeated: talent mobility among Southwestern Ontario municipalities is the single-largest challenge for growing

companies. For example, representatives of the technology business community in Kitchener-Waterloo believe that when a company grows beyond 300 employees it often "hits a wall" where talent attraction and retention becomes challenging. Many young professionals tend to prefer to live in larger urban centres such as downtown Toronto. Without access to the talent pool of high-tech professionals in the Toronto area, companies find it more difficult to expand their operations.

Beyond Kitchener-Waterloo, similar challenges are faced by companies in the London area. At a roundtable held in London by the Mowat Centre in 2015 with information communications technology executives, the main concern expressed was over the barriers posed by a skills shortage—executives worry that they only have partial success in attracting top talent to London although the city has access to top university and college graduates and attractive features such as more affordable housing. But they compete with, and often lose out to, what they perceive to be more desirable city centres. The connection of economic hubs through a fast, reliable HSR service will expand the overall commute shed and enable greater mobility.

Wider Economic Benefits (WEBs)

As described earlier in the chapter, the expanded BCR for HSR includes the measurement of WEBs. According to the business case, the literature on WEBs typically divides benefits into three categories:

- Agglomeration benefits.
- Imperfect competition.
- Labour supply improvements.

The primary benefits related to HSR are associated with agglomeration.

Agglomeration benefits, or "cluster benefits," are generated when firms and people locate near one another in cities and industrial clusters and encourage knowledge-sharing, competition, and innovation.[4] HSR can be considered to bring firms and people closer together through reduced travel times.

These benefits would positively impact the following industries in the Toronto-Windsor corridor:

- Manufacturing (light and heavy manufacturing).
- Construction (residential, commercial, and industrial construction).
- Consumer services (sales, retail, tourism, transportation).
- Producer services (insurance, finance, research and development, and knowledge-based industries).

As shown in Table 4.3, WEBs would generate an additional $1.3 billion in economic benefits for the corridor over a 60-year period, which in addition to the base benefits brings the total value generated in the corridor to $21.55 billion. The business case demonstrates that producer services are expected to generate the majority of benefits due to the density of knowledge in this sector between Kitchener-Waterloo, Guelph, and Toronto in particular.

Additionally, WEBs that have been calculated for Kitchener-Waterloo to London are anticipated to see the most growth over the 60-year period, largely due to the population and employment growth forecast for the region.

Table 4.3: Value Generated Through WEBs

Sector	Value
NPV 60-year (million $2021)	$1,300
Manufacturing (million $2021)	$260
Construction (million $2021)	$80
Consumer services (million $2021)	$100
Producer services (million $2021)	$860

Source: Steer Davies Gleave

Overall, although the WEBs generate fewer benefits compared to the base benefits, it is important to understand that HSR systems generate more than just travel-related benefits. Measuring agglomeration benefits in particular quantifies some of these WEBs, while other benefits are qualitative.

Support Regional Integration and Development

As demonstrated throughout the business case, HSR will provide a fast, efficient connection between urban centres and knowledge centres in the corridor. In addition to transforming mobility and catalyzing economic development, HSR will also contribute to regional integration and development.

According to the business case, the population catchment for HSR by 2041 will be 13.5 million people, providing a significant number of Ontarians access to a service that connects them to jobs, universities, and cultural centres when and if they need it. This shift in regional integration benefits can be expanded by investing in first-mile/last-mile connections to HSR and expanding the feeder system for buses and rail, and by encouraging mixed-use development and intensification in and around HSR stations.

From a land-use perspective, HSR will support provincial policies such as the *Growth Plan for the Greater Golden Horseshoe (2006),* by helping the Province to grow where it has designated for intensification without adding pressure to the Greenbelt. It will be necessary to encourage this by intensifying development around HSR stations and encouraging municipalities to pursue transit-oriented development.

Furthermore, regional integration is closely linked to economic growth, which is more likely to occur in places that have better transportation connections. This includes local transit and first-mile/last-mile linkages, but it also includes HSR and its ability to increase market access and connect communities within a larger region.

Some argue that HSR has a tendency to exacerbate sprawl by allowing more people to commute to the hub city, which just increases challenges faced by regional centres that were supposed to benefit from quicker connectivity. For example, there has been some doubt in the U.K. that the planned HS2 between London and Birmingham will turn Birmingham, the U.K.'s second-largest city, into a bedroom community rather than an independent commercial hub. However, an assessment of the German ICE model has shown that an HSR connection in smaller communities can actually directly contribute to strong economic growth.

Limburg and Montabaur, two small German towns with populations of approximately 34,000 and 13,000, are 20 kilometres apart along the German ICE track that runs from Cologne to Frankfurt, two major hub cities with populations of around 1 million and 700,000 respectively.

In partnership with other levels of government, local planning authorities in both Limburg and Montabaur were able to negotiate an HSR stop when the ICE line was being planned and to provide land for development. The HSR station at Montabaur was built outside the city centre, a short distance from a highway connecting Cologne and Frankfurt. Commuters were attracted by low residential land values and proactive zoning of private land. Development in the area surrounding the station started occurring as the station and HSR line were being developed and accelerated after operations began.

The station also spurred the development of business and retail centres. Since the station opened, approximately 50 enterprises with 1,000 jobs have located in Montabaur. A study of the spatial impacts of HSR found that the Montabaur's GDP and employment grew by 2.7% more than other comparable communities, and concluded that HSR had a tangible and permanent impact on the town's growth.[5]

The key lesson from this example is that the implementation of any HSR system should be coupled with an alignment of regional transportation and of economic and urban planning policies. In cases where HSR has generated economic benefits, it has been coupled with efforts to connect stations to transit linkages and other first-mile/last-mile connections.

Recommendation 24: Encouraging Density

It is recommended the Province develop and/or encourage, as appropriate, regional development initiatives, tax incentives and/or grants to mitigate any urban sprawl HSR might create, and encourage transit-oriented development in station areas.

- Since growth and development policies are implemented at the municipal level, the Province should work closely with municipalities to achieve this objective.

Chapter 5

Governance

HSR will establish a new form of transportation in Ontario, distinct from any other mode of travel. It is essential for the Government to establish the right governance structure to ensure that HSR is delivered to meet the Province's objectives. This section reviews international experience and sets out a recommended governance framework for HSR planning and operations in Ontario.

The function of governance is to ensure that an organization or partnership fulfils its overall purpose, achieves its intended outcomes and operates in an effective, efficient and ethical manner.[6]

Appropriate governance supported by relevant legislation will ensure that HSR is subject to proper oversight, is effectively and efficiently delivered, and meets the Province's objectives.

Significant organizational capacity will be required to oversee the delivery of HSR. Due to their scale and complexity, international HSR projects are generally delivered and managed by public corporations with significant autonomy over business operations. As Ontario does not yet have governance and delivery systems in place for HSR, it is recommended that the Province create a new legislated entity to manage the implementation and operation of the service.

Aligning the mandates of provincial agencies, including this new HSR entity and Metrolinx, and ensuring that their roles and responsibilities are each clearly delineated will be critical, particularly with respect to the operation of services in the Kitchener corridor.

Current Passenger Rail Governance Systems in Ontario

Passenger rail services in Ontario are delivered by the publicly-owned corporations Metrolinx (provincial) and VIA Rail (federal). Reviewing the governance systems for each of these corporations provides context for considering potential models for HSR governance.

Metrolinx

Originally established in 2006 as the Greater Toronto Transportation Authority (GTTA) under the *GTTA Act*, Metrolinx is a Crown agency with authority now established through the *Metrolinx Act*.

The act defines the agency's mandate and outlines responsibilities, reporting relationships and scope of operations. Metrolinx is overseen by a board appointed by order-in-council (OIC) by the Minister of Transportation and operates under the oversight of MTO.

A legislated mandate provides clear direction to both Metrolinx and MTO on their respective roles and responsibilities. This direction is further specified in a five-year Memorandum of Understanding (MOU) that governs the relationship.

The agency is responsible for providing leadership in the coordination, planning, financing and development of an integrated, multimodal transportation network in the GTHA. It also plays a lead role in the procurement of vehicles for local transit systems, equipment, technologies, facilities, and related supplies and services on behalf of Ontario municipalities.

While Metrolinx was originally established as a regional transit planning organization, in 2009 the province merged it with GO Transit. This provided Metrolinx with a significant transit operations role and brought provincially-operated bus and rail services under one umbrella.

Metrolinx currently oversees two rail services: GO Trains, which provide commuter services, and the UP Express, a dedicated rail link to Pearson Airport that also carries some commuters. Through the implementation of GO RER, Metrolinx is overseeing a significant expansion in its rail network with the eventual goal of offering frequent services along all of its rail corridors.

With the exception of a 14-kilometre stretch between Bramalea and Georgetown, Metrolinx owns the track between Toronto's Union Station and Kitchener on the Kitchener corridor, and has the authority to charge track access fees and regulate the operations of rail services running on its tracks.

Key Features of the Metrolinx Model

As an integrated service provider, Metrolinx has the ability to align transit operations and provide an interconnected system. Through its operation of buses, trains, and its ownership of stations, railway, parking and ticketing services, Metrolinx provides commuters with an integrated solution that can cater to specific regional markets, and it can offer aligned service timetables, consistent service and predictable ticketing and fares. This system of operations is similar to European regional rail networks, especially those of France and Germany.

Metrolinx is provincially funded. Although rail services recoup a portion of their operational costs, all capital investments, rolling stock procurements and maintenance work is financed through annual and project-specific appropriations.

VIA Rail

VIA Rail was created in 1977 as a subsidiary of CN (then a Crown corporation) to provide intercity passenger service in Canada. VIA Rail's shares were soon purchased by the Government of Canada, and it was established as a parent Crown corporation under the *Financial Administration Act*. VIA Rail is incorporated under the *Canadian Business Corporations Act* of 1985 with the Government of Canada as the sole shareholder.

VIA Rail provides services across Canada, including through Ontario. Within the province it offers frequent intercity semi-express rail services from Toronto to Ottawa and beyond to Quebec, and limited semi-express service from Toronto to Southwestern Ontario. Close to 95% of VIA Rail's passenger volume and 75% of its annual national revenues are based on the Quebec City-to-Windsor corridor.[7]

Key Features of VIA Rail Governance

VIA Rail does not have enabling legislation. The corporation's governance, financing and mandate are determined by the federal cabinet and subject to change depending on government's financial priorities.

Similar to other Crown corporations, VIA Rail is at arm's-length to the federal government, with an independent board and Chief Executive Officer appointed by the Minister of Transport Canada. VIA Rail operates under a subsidy model. It receives an annual appropriation from the federal government and all net losses are covered through operating subsidies.

Unlike Metrolinx, VIA Rail does not have an MOU. Its operations are influenced by the *Canada Transportation Act* (CTA), which establishes the legislative framework for Canada's transportation sector; however, the CTA does not make specific provisions for passenger rail operations.

VIA Rail's strategic direction, which assumes a five-year timeframe, is detailed in its corporate plans, which are annually prepared and must be approved by Transport Canada.

Towards a Governance Model for HSR – International Experience

To inform recommendations for an appropriate approach to HSR governance in Ontario this study reviewed models used in Europe, the U.K., and Japan, which are each described in detail below. As a general observation, international experience provides three broad conclusions about the governance of HSR systems and similar large passenger rail operations:

1. **Dedicated governance:** HSR systems around the world are primarily delivered and operated by dedicated, publicly-owned corporations. These are structured as arm's-length bodies with clear legislative mandates and reporting relationships to their respective governments. The few privately-owned operations (e.g., HS1 in the U.K. and Japan Rail) operate under public oversight and regulation that sets clear requirements for service levels, fares, fees and maintenance.

2. **Separation of operations and infrastructure:** In Europe and Japan, legislation requires a separation of railway infrastructure and operations. These functions are delivered by distinct entities with the objective of allowing open access to railway networks, fostering competition

and ensuring that infrastructure is developed in a consistent manner. Indeed, this is the official policy of the European Union. The separation of railway operations and infrastructure in Ontario through regulation would require radical policy and legislative change in Ottawa that would force the freight railways to divest their infrastructure, with compensation. This is a very unlikely scenario and has never seriously been considered in Canada.

3. **Service delivery frameworks:** In all cases HSR systems operate as distinct services separate from commuter or conventional intercity railway services. HSR is marketed separately, generally operates on dedicated infrastructure, and its fares may be set based on market demand. This is in contrast to commuter and conventional intercity services, which aim to maximize passenger volumes, have regulated fares, and serve a greater number of stops.

HSR would be a new intercity passenger rail service in Ontario. A single-purpose entity tasked with implementing and operating the project would be able to effectively manage the various stages of the project from preliminary design and engineering to financing and operations.

A service-delivery framework would help clarify the roles and responsibilities of all passenger rail operators on the corridor, help manage service levels, and ensure that all services are complementary. This model would, in effect, mirror the regulated systems observed in Europe.

Assessing International Experience

With a few exceptions HSR systems around the world are owned and operated by national governments and funded by the public sector:

Europe: Germany, France, Spain (Publicly-Owned Infrastructure and Operations)

The French, German and Spanish model of delivery and operations is based on highly-integrated, publicly-owned railway corporations that operate at arm's-length but are publicly funded. These corporations also have oversight over all their countries' railway services including regional and intercity passenger operations.

As a result of European Union (EU) competition directives, European railway companies are required to separate infrastructure ownership from operations to foster competition and ensure that all rail providers have fair access to the railway network.

In France, the Federal Ministry of Transportation established the Société Nationale des Chemins de Fer Français (SNCF) as the primary organization to deliver rail services. SNCF Group consists of three state-owned corporations, including SNCF Réseau (network) and SNCF Mobilités (passenger and freight operations).[8]

SNCF Réseau (formerly incorporated as the separate Réseau Ferré de France [RFF]) manages French rail infrastructure, including expansion of the network, infrastructure maintenance, allocation of capacity, and establishment of track access fees. Over half of SNCF Réseau's revenue is derived from track access fees charged to SNCF Mobilités, which operates transit, commuter, regional, and HSR services and is fully funded by the French government.[9]

This dual structure has increased railway efficiency by fostering competition and simplifying management and reporting structures. Separating infrastructure from operations has ensured that all infrastructure works are undertaken consistently and based on clear standards and guidelines, maintenance schedules and procurement processes.

However, it has also led to challenges for government in ensuring a balance between the fees charged by SNCF Réseau to cover infrastructure maintenance and expansion costs and the fees paid by SNCF Mobilités to operate on the network. An increase in SNCF Réseau fees results in increases in SNCF Mobilités' operating costs and therefore lower net revenues; this necessitates a greater government subsidy or higher fares and/or lower service levels on unprofitable routes.

The German and Spanish systems operate under similar governance structures. The German railway network is overseen by Deutsche Bahn (DB), a highly-integrated, publicly-owned corporation. DB operates a wide range of services from freight rail to HSR to regional rail and bus.[10] The corporation's integrated nature allows it to spread costs across a broad range of markets and business units, which reduces its operating risk.

Europe: United Kingdom (Publicly-Owned Infrastructure, Private Operations)

The United Kingdom has one of Europe's oldest and largest intercity and commuter rail networks. Prior to 1993, the U.K.'s railways were owned, operated and controlled by a single public entity, British Rail. Policy reforms in 1993 and 2004 led to increasing privatization of railway operations; all intercity, regional, and passenger commuter services are currently operated as franchises by private companies.[11]

The U.K. has balanced private-sector ownership of rail operations with public-sector oversight and regulation over infrastructure, management, revenues and costs. Network Rail as a government agency owns and is responsible for maintaining and developing the railway network. The Department for Transport's Office of Rail and Road provides oversight over the entire system, setting track access charges, fares, and customer service standards, granting licences to train operators, and monitoring the railway system.[12]

The U.K.'s current railway governance system has led to a significant expansion in rail use, greater service efficiencies and higher levels of competition. At the same time, government subsidies have been reduced while fares have significantly increased. This expansion has also placed a number of

pressures on the rail network, necessitating greater public investment in building and upgrading railway infrastructure.

The scale and complexity of the U.K.'s commuter and HSR networks, which are governed separately, have meant greater government involvement in building HSR infrastructure, regulations and operations.

HS1 was the U.K.'s first experience with HSR. Initially envisioned as being delivered by a public-private consortium, the project's development was challenged by escalating costs, which led to increased delivery risks and consequent concerns from private-sector partners about the project's viability. To address these challenges, the government restructured the consortium and assumed a larger role in overseeing project delivery and funding.[13]

After completion, HS1 was operated by the government for ten years before its infrastructure and operations were tendered to a consortium of public-private interests. Currently, the Ontario Teachers' Pension Plan (OTPP) and Borealis own HS1's infrastructure and stations while SNCF, Caisse de dépôt et placement du Québec (CDPQ) and Hermes Infrastructure, a private equity fund, own the primary operator, Eurostar.[14] It is interesting to note that Canadian pension funds became long-term investors in HSR once it established viability in a given market.

Figure 5.1 illustrates the U.K.'s HSR network. HS1 operates from London and connects to France via the Channel Tunnel. HS2 is a planned expansion to the HSR network that will provide connections to northern England and Scotland through Birmingham.

Figure 5.1: U.K. High Speed Rail Network

Source: U.K. Department for Transport

The U.K.'s experience with HS1 has significantly influenced subsequent large rail infrastructure projects such as Crossrail and HS2. Overviews of their governance structures and key lessons are detailed in Tables 5.1 and 5.2.

Table 5.1: Case Study of Crossrail

Crossrail	
Project Overview[15]	Crossrail is Europe's largest infrastructure project, with a total cost of close to $30 billion. It covers 118 km of rail, including 42 km of tunnels, has 40 stations, and is being built by over 10,000 workers. The project is aimed at increasing transit capacity, providing faster connections across London, supporting revitalization of neighbourhoods and balancing growth. Once complete, Crossrail will increase London's transit capacity by 10% and bring an additional 1.5 million people to within 45 minutes of Central London. 95% of Crossrail procurement has been awarded to domestic firms, most of them small and medium-sized businesses.
Results	The first Crossrail trains will begin service in 2017 and the full network will be operational by 2019. The project is anticipated to be delivered on time and on budget.[16]
Governance Model	The U.K. National Audit Office has singled out Crossrail's governance model as a template for other large infrastructure projects.[17] Independent reviews of the project by KPMG and the U.K. government have also highlighted the critical role that governance has played in ensuring effective project delivery.[18] Key elements of Crossrail's governance: • Establishment of a new independent public corporation (Crossrail Limited) to oversee project delivery. • Clear agreements between all partners, including industry and public-sector sponsors (U.K. Department for Transport and Transport for London). • A checkpoint system which gradually allowed Crossrail Limited to assume an increasing level of decision-making authority. • Private-sector partnership to help finance station stops along the Crossrail network.
Key Lessons	1. Develop a clear business case that fully accounts for total project costs. 2. Create a new public or public-private corporation to oversee delivery. 3. Involve project beneficiaries (e.g., airports, businesses close to stations, municipalities) in supporting financing and delivery. 4. Ensure clear reporting relationships and mandates between the

	delivery agent and the government. 5. Create milestones or checkpoints in transitioning authority from the government to the delivery agent. 6. Dedicate a discrete function within the delivery agent to pursue the delivery of wider economic benefits.

Table 5.2: Case Study of HS2

High Speed Two Limited (HS2 Ltd.)	
Project Overview	HS2 is a $93 billion CDN project to build a new HSR service from London to Manchester and Leeds via Birmingham. The project has three phases, with Phase 1 planned to open in 2026.[19] Objectives for building HS2 include enabling economic growth by meeting existing and future rail demand, and improving connectivity between towns and cities. The U.K. Department for Transport is also seeking to increase investment and regeneration around station areas.[20] HS2 Ltd. is the company established to develop, build, and maintain this new HSR line.
Results	Construction is set to begin in December 2016. Results of HS2 Ltd.'s performance to date have been mixed: • In 2013, the U.K. National Audit Office reported on early HS2 project preparations, having reviewed its business case, program management, and estimated project costs; the report identified weaknesses in a number of areas. For example, it found that the HS2 business case lacked strategic context and did not adequately detail certain aspects, such as the scale of potential future capacity shortages on HS2's rail lines.[21] • In June 2016, the National Audit Office reported that steps had been taken to address weaknesses identified in 2013 and found that timelines projecting Phase 1 to open by 2026 were at risk due to legislative and other delays. As a result, the Department for Transport has advised HS2 Ltd. to review its project schedule without increasing costs.[22]
Governance Model	Key elements of HS2's governance:[23] • The establishment of a new independent public corporation, HS2 Ltd., as the project's delivery agent.

	• HS2 Ltd. is wholly owned by the Department for Transport. • The Department for Transport and HS2 Ltd. entered into a development agreement, similar to an MOU, which acts as the principal mechanism for managing the governance and operational relationship between them. • The Department for Transport acts as the project's funder and sponsor and HS2 Ltd. is the delivery agent, subject to periodic reviews, reporting annually to the department, and subject to progress reports from the National Audit Office.
Key Lessons	1. Create a new public corporation to oversee project delivery. 2. Ensure clear reporting relationships and mandates between the delivery agent and the funding sponsor through a mechanism such as a development agreement or MOU. 3. Establish periodic reviews to measure the corporate body's performance and efficiency. Appoint an independent government person or body to oversee these reviews, identify at-risk milestones and project weaknesses and track the governing body's performance in addressing them.

Japan Rail (privately-owned operations and infrastructure)

Japan has the oldest and one of the most extensive and integrated HSR networks in the world. The popular system accounts for a mode share of over 80% for all intercity trips of between 320 kilometres and 600 kilometres in length.[24]

Prior to 1987 the entire Japanese railway system was integrated under Japanese National Railways, a single, state-owned entity. Reforms in 1987 led to restructuring and privatization of the HSR network, which now comprises six single passenger railway entities roughly divided by region.[25]

The Japanese HSR network operates under a hybrid structure, whereby the government subsidizes services along low-volume and unprofitable routes but does not subsidize generally profitable lines on high-volume routes.

Railway reform also led to the creation of a dedicated entity, the Japan Railway Construction, Transport and Technology Agency (JRCTTA), to construct new HSR lines. JRCTTA owns the HSR infrastructure and leases it to the privatized HSR operators.[26]

Recommended Approach

Based on an assessment of the Toronto-Windsor corridor and best practices of large rail infrastructure projects around the world, it is evident that effective and timely delivery of such projects, especially HSR, is predicated on the presence of a clear governance structure.

HSR would be one of the largest infrastructure projects ever undertaken in Ontario. The Province would need to maintain an ongoing role in the project's delivery due to its scale and complexity, and to ensure the Province's objectives for HSR were achieved.

It is therefore recommended that the Province pursue the creation of a dedicated governance body.

Recommendation 25: HSR Governance

The Province should establish, at an early date, a new independent Crown corporation to oversee HSR (HSRCO).

- The corporation would be a legislated entity with authority over the operations of HSR and all railway assets owned by the Province beyond Kitchener to Windsor.
- HSRCO would be established in the near term as the EA process proceeds under MTO's direction and would be in place prior to the start of HSR construction.
- Its mandate would include:
    - Oversight of all aspects of the project from financing and delivery to operations.
    - Responsibility for ensuring value-for-money and wider benefits from HSR implementation and operations.
    - Coordination with VIA Rail and Metrolinx on service plans.
- HSR operations from Toronto's Union Station to Kitchener would be detailed in an MOU with Metrolinx.
- A provincially-appointed board of directors would oversee the corporation.

HSRCO

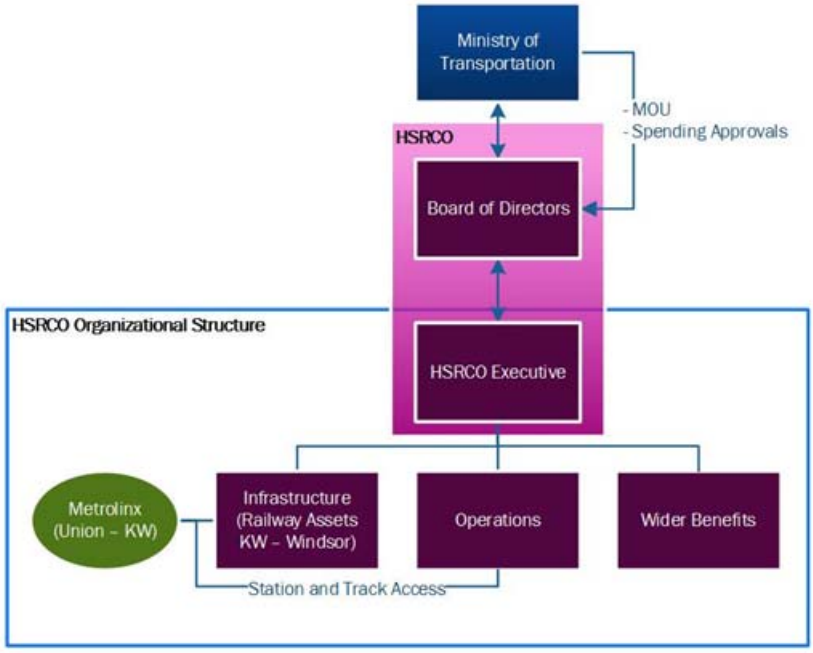
For the purposes of this report, the proposed Crown corporation to oversee HSR will be called "High Speed Rail Corporation" (HSRCO).

The Province should carefully consider the U.K.'s Crossrail and HS2 as potential models for the new HSRCO. Both projects have similar opportunities and challenges to those facing the implementation of HSR in Ontario.

Time frames for the new HSRCO are subject to government decision-making on HSR; however, as noted in the recommendation above, the entity should be in place to oversee the project's construction at an early stage in the project. MTO would continue to be responsible for the planning and analysis in support of the EA process before the establishment of HSRCO, and would lead robust consultation, studies and technical work.

A potential governance structure for HSRCO is illustrated in Figure 5.2 and described in the section below.

Figure 5.2: HSRCO Governance Structure



Legislated Entity

The new HSRCO would be created through legislation that would set the framework for the corporation's mandate, responsibilities, reporting requirements and organizational structure.

HSRCO Organizational Structure

The relationship between HSRCO and MTO would be governed by an MOU that reflects the terms established in the legislation and details the responsibilities and requirements for reporting to the Minister of Transportation.

HSRCO would report to the Minister through a provincially-appointed board and would work closely with MTO on all matters related to HSR's implementation and operations.

As mentioned earlier in the chapter, other jurisdictions often separate railway infrastructure and operations into distinct entities through legislation. HSRCO would not do this; however, there is value in managing the two in separate divisions within the same entity. This provides a clear mandate to the Infrastructure Division to have direct responsibility over construction, maintenance and capital financing of the assets while the Operations Division remains focused on running the service.

Additionally, Crossrail has had success with the implementation of a Wider Benefits division in their governance structure, which would also be an effective addition to the HSRCO structure. HSRCO would therefore comprise the following three primary divisions:

Infrastructure Division

Once a preferred financing and delivery model for HSR is determined, HSRCO would oversee all construction and infrastructure assets, including the stations and right-of-way between Kitchener and Windsor. This division would act as the dedicated HSR asset manager. Responsibilities could include overseeing or administering construction and maintenance of track, signals, communications and electrification systems. Should the private sector be engaged to finance and deliver the entire system or components of the system, the Infrastructure Division could oversee the key functions of such a contract.

Operations Division

The Operations Division would manage aspects of operations, including customer-focused services such as marketing, and ticket services, as well as non-customer facing services such as operating the trains, safety, inspection, and rolling-stock (train) management. Should the private sector be engaged to operate any or all of these services, the Operations Division could be responsible for managing the concession and ensuring that key performance indicators are met, as set out in agreements between HSRCO and the private sector proponent.

Wider Benefits Division

The establishment of a dedicated "wider benefits" function was a key recommendation from the U.K. government's evaluation of Crossrail. This division's purpose would be to ensure that HSR implementation and operations generate economic benefits and have transformative impacts. This could include pursuing land and station development opportunities, working with communities on creating linkages to HSR stations, and acting as the main HSR liaison division for local and Indigenous communities.

Engagement and Partnership

A key factor behind Crossrail's success was the strong financial support the U.K. government and Transport for London were able to elicit from the business community, which included securing financial contributions for future Crossrail stations and instituting a business levy to help pay for the infrastructure.

As detailed in Chapter 2, *Connecting Communities*, there is strong interest from stakeholders and partners along the Toronto-Windsor corridor for HSR. The Province should ensure that future work

on the project, and ultimately HSRCO, continues to build on this engagement and cultivates partnerships with the business community as the project develops.

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Chapter 6

Financing and Delivery

HSR will be built within the context of the Province's path to a balanced budget; therefore, consideration of value for money is paramount. Determining how best to finance and deliver a project of this scale requires an understanding of options that balance innovation in design, construction, and user experience with risk and cost to government.

Financing and Delivering Ontario's Largest Transportation Project

As is often the case for public transportation and other public goods, capital costs for HSR systems are generally not fully recoverable through fares and other operating revenues alone. Although around the world revenues typically cover operating and maintenance costs for HSR systems, reliable financing and funding is always required to deliver capital infrastructure. This chapter discusses financing and delivery options for HSR in Ontario and identifies some potential funding opportunities.

To achieve a successful HSR system a variety of elements must be considered, including but not limited to

- **Planning the HSR system**
  - A major transportation infrastructure project such as HSR requires significant study and planning, including the pre-design, engineering, and technical feasibility studies that ultimately inform the design characteristics of the preferred HSR system.
  - This work supports the future EA process.

- **Environmental assessment process, land permitting, and if required, land acquisition**
  - All transportation infrastructure projects in Ontario are subject to provincial EA requirements.
  - The EA process supports responsible environmental decision-making by ensuring that governments and other public bodies consider potential environmental effects before an infrastructure project begins.

- The process ensures Indigenous engagement and public consultation, including before and during a project.
- The environmental permits and other approvals that are required depend on the scope of the project being undertaken.

- **Determining a financing and delivery model based on a value for money analysis**
  - A VfM analysis is conducted on various financing and delivery models being considered for a particular infrastructure project to determine the most efficient and effective way to deliver a project while also ensuring the best value for taxpayer dollars spent.
  - Based on the specific project and consideration for factors such as budget, risk, innovation, and schedule, the model that delivers the best value for money might be traditional (100% public funds), or a mix of public and private funds structured through one of the various Alternative Financing and Procurement (AFP) models.

- **Design and construction**
  - Detailed concept design and construction of the HSR system involves the physical build-out of the infrastructure, which can include new, dedicated HSR lines or building the infrastructure needed to upgrade existing track and/or to accommodate higher speeds; this can also include the construction of new or expanded stations, if necessary.
  - The work generally consists of civil engineering, tunnelling if required, signalling, and electric power supply/distribution.
  - The high speed trains to run on the system—also termed the "rolling stock"—must also be designed, bought if required, tested and serviced on the system prior to the start of operations.

- **Operation and maintenance**
  - Once the HSR system is built, ongoing operation and maintenance are required over the lifecycle of the system.
  - Operations refer to both the operation of the infrastructure (signalling, train control, safety inspections), and the trains (day-to-day service, ticket sales, customer service).
  - Maintenance includes replacing and fixing track, repairing damage, and servicing and cleaning trains.

To deliver an HSR system, the above tasks must be undertaken either directly by government or procured through various types of contracts. In many cases the private sector is better equipped to deliver on components, such as the civil engineering and construction, for example, and the government may choose to award a contract to a private-sector company for such work through a competitive procurement process.

Risk

The inherent environmental, technical, operational, and financial risks associated with a project this large and complex are different than those associated with more typical industrial investments, due in part to the relatively high capital costs and long construction periods of such projects, and, in the case of rail transportation, to the relatively slow-rising revenues, where passenger volumes increase over time. Whereas the risk profile of some of the Province's construction projects, such as highways, is fairly well-understood, HSR would be unprecedented for Ontario and Canada. Some major risk factors for this project include

- **Environmental risks**, or those risks associated with environmentally sensitive lands, watersheds, plant and animal species, archaeology, or culturally sensitive lands.
- **Weather-related risks**, especially in winter (e.g., storms), causing delays or potential infrastructure issues such as subsidence.
- **Cost overrun risks** during construction, which can negatively impact on-time, on-budget delivery.
- **Lifecycle risk** related to potential maintenance and operational cost overruns, such as the inability to run trains on time due to poor maintenance.
- **Interface risk**, or the risk that components of the HSR system, including the track, rolling stock, operations, maintenance and other components, do not integrate or work together efficiently; interface risks can arise when a project is dependent on the interconnection or interaction of separate components being delivered by two or more suppliers.
- **Revenue risk**, resulting in revenues that are less than forecast, also referred to as **passenger risk**, since passenger demand drives revenues.

Identifying and allocating risk appropriately is integral to project success and an important input in any VfM analysis, which helps to determine any particular infrastructure project's optimal financing and delivery model.

The Models: How Are Major Transportation Projects Financed and Delivered?

When determining the most appropriate procurement model for HSR, analyzing which model will provide the best value for money and the preferred net fiscal impact over the project's lifecycle is one of the most important steps. Because the Province has never undertaken this type of project before, delivering a successful HSR system will require both expertise and innovation.

Various models for HSR financing and delivery exist internationally, from traditional 100% public-sector delivery to 100% private-sector delivery, but because rail infrastructure, similar to other public goods, is built to provide socio-economic benefits and not purely for monetary gains for investors, the latter model is extremely rare.[1]

The *Brightline* from Miami to Orlando, Florida, is one such example, the United States' first privately-owned and operated intercity passenger rail system. Currently being built by All Aboard Florida, a subsidiary of the Florida East Coast Industries corporation (a real estate, transportation and infrastructure company), the *Brightline* is unique for a few reasons: its business model is driven by a large, successful tourism industry and the system is being built on an existing right-of-way owned by Florida East Coast Industries, so environmental and land impacts are minimal.[2] But conditions like these are rare.

As this chapter will detail, HSR systems around the world are typically financed and delivered through some combination of public and private involvement and through various types of financing and delivery models.

Traditional

Historically, transit and other major infrastructure projects in Ontario have been delivered through traditional design, bid and build (DBB) models whereby the government puts out requests for bids. First, proponents bid on design, based on a predetermined scope of work. Next, they bid on constructing the resulting design from the first bid. Subsequent to the construction contracts, separate contracts can be issued for operations, maintenance, and rolling stock. This model has been most commonly applied for Ontario's linear transportation infrastructure such as highways.

DBB can result in several separate contracts that are typically overseen by the government. In a DBB, although the private sector remains involved in delivering components of the project and is paid by the government for work completed, it is not often involved in financing the project. Benefits of the traditional approach include the relatively simple procurement process and the government's ability to access lower capital costs.

Some disadvantages of the traditional approach to procurement include the potential of disconnects between a project's various components, since all of them are procured and delivered separately. If problems arise there is the potential for suppliers to refuse responsibility—an HSR system's poor maintenance, for example, could be blamed on poor construction or poor design. Under the DBB model, such "interface risk" is ultimately borne by government, as are lifecycle and operational risks. The risks of this approach are overcome by employing a *system and safety integrator* responsible for integrating the different designs and construction tasks.

The majority of HSR systems around the world have been procured using traditional models. This is partly to ensure that more detailed design is completed before the construction is tendered as the risks of price escalation when this is not done have been seen as unacceptably high. Design-build contracts offer the private-sector partner incentives for innovation (in construction methodology, for example) and are often combined with benefit-sharing to achieve better VfM.

Another variant of the traditional approach was used successfully by the federal government in the 1990s when it decided to confront the issue of modernization of antiquated airport infrastructure. Under the National Airports Policy, not-for-profit local airport authorities (LAAs) were established to take over management and operations of Canada's 29 major national airports on 60-year concessions, although the Government of Canada still owns the facilities. These LAAs faced the huge challenge of renovating and/or rebuilding airports that required vast sums of capital to do so. However, as bodies that are arm's-length from government, the LAAs have been able to borrow on open financial markets to finance their projects. Revenue streams to recover the money borrowed come from a variety of sources, including landing fees and commercial rents. Since the devolution of airports began in 1992, some $19 billion dollars of improvements have been financed privately, with no burden to the general taxpayer. The GTAA alone financed more than $4 billion in expenditures for terminals, roads and other infrastructure from domestic and international sources. Whether this model could be adapted to the building of HSR should be one of the subjects for further discussion.

Alternative Financing and Procurement Models

Public-private partnerships (P3s), also referred to in Ontario as AFP models, have recently been used to deliver major transit and infrastructure projects in the province. The AFP model aims to bring together private- and public-sector expertise in a structure that transfers some project risks (e.g., project cost increases, scheduling delays, etc.) from the public sector to the private sector. Under AFP, provincial ministries and/or project owners establish the scope and purpose of a project while design and construction work is financed and carried out by a private-sector consortium. Depending on the structure of the contract, the same consortium could also be responsible for the operation and/or maintenance of the asset.

The Province established IO in 2005 as a Crown agency responsible for financing and modernizing public infrastructure. One of IO's business lines, "Major Projects," manages the delivery of infrastructure projects primarily through the AFP model.

The Province uses a VfM assessment for AFP projects, comparing the total project costs for AFP to the costs of traditional procurements, to ensure that AFP offers the best value for government. If an AFP delivery model is chosen for a particular project IO often acts as the procurement and commercial lead, supporting contract development and evaluating the financial structure proposed by bid respondents.

Under the AFP model the private-sector consortium arranges for its own project financing. This can involve different types of private lenders, ranging from banks to life insurance companies. Since the consortium typically does not get paid until the construction is well underway and certified as meeting the project requirements, the lenders' interests are aligned with the government's interests in ensuring that construction is completed on schedule, within budget and with the proper level of quality.

To reduce a project's overall financing costs while ensuring appropriate risk transfer is maintained, IO recently modified its AFP model to provide construction progress payments (CPPs) during construction. Previously, the consortium received no payments until the project was constructed and certified as fit for use, at which point the consortium would receive a substantial completion payment (SCP) representing approximately 60%–85% of the consortium's total project budget.

CPPs are monthly payments made by the project sponsor (i.e., government) to the private consortium once the consortium has expended 50% of its construction costs. The CPPs and SCP are sized to maintain the incentives for on-time and on-budget performance. After substantial completion, regular (typically monthly) "availability" payments are provided to the consortium as long as the asset is maintained and available for its intended use.

These tools ensure that the government optimally balances risk transfer and financing costs, and that the private sector retains sufficient "skin in the game" to meet its obligations. AFP projects are characterized as having higher initial costs due to the higher costs of borrowing from private sources compared to the government's lower borrowing costs for construction financing, although the trade-off is that a portion of the construction and operating risks are transferred to the private sector under an AFP model.

In Europe, where HSR systems have been built for a number of years, traditional procurement approaches tend to be preferred. In the U.K., for example, although HS1 was originally envisioned as an AFP-type project, the government had to assume the delivery of the project due to lower-than-projected revenue forecasts. More recent rail projects in the U.K., such as HS2, have resumed using traditional financing and delivery models.

To support the Special Advisor in developing insight and recommendations around the appropriate delivery models for HSR, MTO engaged IO to undertake a market sounding. Between January and July 2016, IO and MTO officials met with stakeholders representing the financial sector, engineering and construction firms, and operators and equipment providers to discuss the potential opportunities associated with HSR in Southwestern Ontario as well as key considerations regarding financing and delivery.

Lessons from the Market Sounding: What We Heard

Overall, private-sector interest in an HSR system in Southwestern Ontario is high. All respondents indicated a strong interest in having a role in the project under the right conditions and were keen to be kept engaged as the project advances.

Private-sector participants in the market sounding were asked a series of questions related to their interest levels in the HSR project, the allocation of various types of risk, their preferred capital structures, where the private sector sees the role of government and, ultimately, what their preferred

delivery model would be for a project of this scale. Participants were not given any information pertaining to the business case for HSR (e.g., cost estimates or potential timelines), since at the time it was not available. Instead, participants were asked to express their general thoughts and opinions about what such a project might look like and how they would like to be involved. The following is an overview of what respondents said about HSR in general and about key project factors.

Cost to Government

Market respondents articulated clearly and unanimously that they saw no scenario where the private sector would finance and deliver a turnkey HSR solution funded solely by projected ridership. This response suggests that the market is also unlikely to accept a financing and delivery model that transfers significant revenue risk (i.e., passenger risk) to the private sector. It was emphasized that this reluctance flows from HSR systems not having an established revenue stream and existing traffic patterns.

However, transferring some portion of passenger risk to the private sector is not unprecedented. For example, as described in Case Study 1, Vancouver's Canada Line LRT system was able to transfer approximately 10% of its passenger risk to the private sector via an AFP contract.

Case Study 1: Canada Line LRT, Vancouver[3]

Key Lesson:	Government transferred most risks to the private sector (i.e., InTransitBC) through a 35-year Design-Build-Finance-Operate-Maintain (DBFOM) AFP contract.
Considerations:	• Most notably, the private sector assumed a portion of the line's passenger or revenue risk, since the contract stipulates that 10% of its revenue is dependent on achieving ridership forecasts. • Since it markets the system, sets fares, and controls bus service to support the line, the Greater Vancouver Transportation Authority retained some risks including the majority of ridership revenue. • This AFP was expected to generate $92 million (NPV) in savings to the government compared to a traditional procurement.

As HSR in Ontario would be a new system the market indicated that government would need to bear a significant portion of costs and revenue risk, at least for a certain period of time, until ridership and revenues are proven. Some respondents suggested that one approach to reducing cost to government is to have the government operate the HSR trains for five or ten years to build ridership and revenue levels. Once these levels are proven, the government could sell the operations as a concession to the private sector to recoup a share of project costs. This is the model used in the U.K. for HS1. Case Study 2 describes how the concession model was implemented for this project.

Case Study 2: High Speed One (HS1), U.K.[4]

Key Lesson	Government had to assume project delivery following lower-than-projected traffic outcomes for HS1; government was eventually able to recuperate some costs through an operating concession model after ridership and revenue levels were established.
Considerations	• Initial expectations were that construction of HS1 could be entirely financed by the private sector against expected revenues from Eurostar UK; traffic forecasts were overly optimistic and government had to intervene and assume project delivery. • Government brought project in-house in 1998 and established ridership and revenue streams, and in 2010 sold operating concession for track infrastructure to Borealis and Teachers' Infrastructure Group, recouping some project costs through track access charges.[5] These operators have little direct exposure to passenger risk. The sale of the operating concession is generally regarded as well-handled and achieving a higher-than-expected price for government.

Project Phasing

The market unanimously suggested that developing HSR in stages would reduce the overall risk premium paid by government. It was suggested that building HSR first from Toronto to London, and then extending the track to Windsor in a second phase would be a measured approach, and would generate a number of benefits including balancing costs over time and reducing ridership risk/revenue risk.

In this context, a few of the market sounding participants mentioned the example of California's high speed rail system, which is currently under construction and described below in Case Study 3. The project is experiencing a number of challenges including cost uncertainty, delays, and reduced public support, which sounding participants suggested might be attributed to building too much at one time, which has introduced integration risk.

Case Study 3: California HSR[6]

Key Lesson	Project size and various construction "packages" have created high integration risk and challenges to remaining on budget.
Considerations	• The California High Speed Rail Authority (CHRSA) is delivering its HSR system through a Design-Build model. • Because of its size the project is being delivered in phases, broken down into three construction packages per phase since the sections under construction are quite large: Phase 1, for example, covers the 840-km distance from Anaheim to San Francisco. • The total cost is expected to be approximately $64 billion USD.

Capital Structure

When private-sector respondents were asked about the size of project that the market could bear, many of them indicated that the maximum capital costs of a single contract to deliver HSR should be $5 billion, as a general estimate, and that if the project's capital costs were beyond $5 billion, the project would have to be broken down into smaller, more manageable contracts. Some projects with capital costs above $5 billion can be found, however. For example, an approximately $10 billion HSR project is being delivered in France under one AFP contract. Another influencing factor will be the number of other projects underway at the same time, since how much market capital is available for any one project depends on how much is already tied up in other projects.

If the project is over $5 billion, there could be benefits to breaking it up into various contracts, including potentially increasing market competition. When a single project is too large only one or two private-sector proponents may have the capacity to deliver it, thereby reducing cost competitiveness in the bidding process.

Role of Government

Every participant emphasized that to successfully deliver an HSR solution there is no role for "passive government." The project is not financeable without government involvement, largely due to the risks described earlier in the chapter. To protect its interest and to ensure value for money, government must actively ascertain and properly allocate risks under the appropriate funding model.

The private sector expects that EA processes and related engagement with stakeholders and Indigenous communities are part of government's role. They also indicated that government must reduce the risk of over-serving the corridor by managing the various "moving parts" including the coordination of VIA Rail, UP Express, GO RER, and ensuring that the majority of freight is successfully taken off the corridor. These were considered significant strategic decisions related to the delivery of HSR in Ontario and participants made clear that these are prerequisites for private-sector involvement in the project.

Delivery Model

Almost all respondents recommended that the government pursue an AFP model to finance and deliver HSR in Ontario. Most of those recommending such an approach indicated a strong preference for a DBFOM model. Others recommended a Design-Build-Finance-Maintain (DBFM) model, which is currently being used to deliver the Eglinton Crosstown LRT. Respondents indicated that including the "O" (Operate) component for HSR would generate a more integrated solution and a higher likelihood that the infrastructure would be operated smoothly once delivered.

This approach is not unprecedented in Canada. The country's first DBFOM model for a transit project, Vancouver's Canada Line LRT, was delivered under a 35-year contract and in October 2016 the DBFOM model was announced as the chosen approach for Ontario's Hurontario-Main LRT, connecting the lakeshore in Mississauga to Brampton.

Under a DBFOM model, every component of the HSR project would be delivered by one private-sector consortium (i.e., a group of companies with varied project-area expertise that agree to bid on a project as one entity). Private financing of the Design and Build components provides an incentive for on-time/on-budget construction of the asset; the integration of Design and Build transfers "constructability" risk; and the inclusion of Operate and Maintain reduces integration and lifecycle risks. Because the party that designs and builds the system will also operate and maintain the trains and infrastructure they have an incentive to deliver an efficient and high-quality system over the duration of the concession.

As with all AFPs, DBFOM contracts include the number of years the concession will be held by the private-sector consortium: the government retains ownership of the infrastructure and the private sector operates and maintains it for the number of years specified in the contract. For example, France's Tours-Bordeaux HSR line, which is considered a strong example of on-time, cost-effective delivery, is being financed and delivered, operated and maintained by LISEA, a consortium of companies, over a 50-year period as part of its DBFOM contract.[7] Highlights of this project are described in Case Study 4.

Case Study 4: Tours-Bordeaux HSR, France[8]

Key Lesson	The French Government transferred most risks to the private sector through a DBFOM model; the private sector is financing approximately 45% of the project. To date, the project is an international example of DBFOM achieving desired outcome on an HSR project.
Considerations	• This project represents the first time France has used this kind of AFP model: a single company essentially designs, finances, builds, runs and maintains a major railway line.

	• To date, the project is considered an excellent example of on-time, cost-effective infrastructure delivery in Europe; project complexity is relatively low, however, due to the absence of a need for tunnels and the largely greenfield construction. • The government ensured that the contract has reliability and availability targets with built-in penalties if they are not met and financial incentives for early delivery and performance.

As discussed earlier, real capital risk is best transferred to the private sector through AFP models, including DBFOMs. Payments to the private sector are structured to give consortia financial incentives to deliver on time and on budget.

Innovative Funding Tools

Although not a major focus of the market sounding, questions were also asked about other innovative ways that the government could reduce out-of-pocket costs for HSR. The following section outlines potential funding tools that warrant further consideration.

Land Value Capture

The general premise of land value capture (LVC) is that improved connectivity generated by new transit or transportation services increases land and development value around station areas. LVC tools seek to capture some of this increased value generated by a new transportation facility (i.e., station), to apply it toward funding the transportation project.[9]

One LVC tool that has gained media attention in recent years is tax increment financing (TIF), which forecasts increases in property values due to new transportation facilities (such as a new HSR station) and earmarks the forecasted property tax revenue increases to fund construction. In general, the market sounding respondents who commented on the application of LVC tools indicated that governments tend to overestimate the value that can be captured through such tools. It was also noted that the Province may be limited in its ability to capture such value, since the lands developed are generally owned by municipalities.

Overall, enthusiasm for these types of tools was relatively low; however, respondents did express interest in development opportunities that could be associated with HSR in Toronto, specifically at Union Station; if the Province were to pursue LVC tools in the future, any development or opportunities associated with Union Station and the surrounding area would certainly receive attention from the private sector. In September 2016 the City of Toronto proposed a Rail Deck Park over the western approach tracks to Union Station. If adopted, this future development would also have to be taken into consideration.

Station Retail and Parking

A number of respondents were interested in the potential for retail opportunities at HSR stations, suggesting that the Province could offer separate contracts for retail concourses, parking lots, air rights, and other ancillary businesses at HSR stations, for example, recouping costs by selling these rights to the private sector. Such place-making—that is, creating stations that themselves are "go-to" destinations—has been successful in other jurisdictions; in the U.K. HS1 retail and parking concessions account for approximately 10% of revenue.[10]

Opportunities connected to Union Station interested respondents the most but, as HSR ridership expands, key hubs such as Kitchener-Waterloo and London could also offer promising opportunities. Kitchener-Waterloo is currently developing a large multimodal hub for VIA Rail and GO services to connect to local feeder systems, such as the Waterloo ION LRT; London's VIA Rail station is located on prime downtown lands that are largely undeveloped.

Neither potential opportunities associated with joint development nor revenue tools such as business levies and development charges were discussed during the market sounding. These tools have been successfully applied in the U.K. and future market soundings and analysis for HSR should consider researching them in greater depth. Below is a brief analysis of both of these tools.

Business Levies

Levies are a type of tax typically collected within a certain geographic area. Levies create a mechanism to ensure that those who will benefit from the construction of certain infrastructure (such as local residents or businesses) contribute to its cost. For example, in the U.K., London's business community was highly supportive of the construction of the London Crossrail system, which will provide a crucial east-west link across the city and connect London Heathrow Airport to Canary Wharf, a major financial centre in the city's east end. (See Case Study 5.)

A property impact study commissioned by Crossrail in 2012 concluded that property values around Crossrail stations would increase as a result of the project, with commercial office values around Crossrail stations in central London increasing by 10% over the next decade. Residential capital values immediately adjacent to the stations are projected to increase by 25% in Central London above an already rising baseline projection, and by 20% in the suburbs.[11] Acknowledging the future Crossrail's role in this "land value uplift," London's business community let Transport for London and the Greater London Authority implement a Crossrail Business Rate Supplement and a Community Infrastructure Levy to help pay for Crossrail.

Although these types of tools are sometimes criticized as disincentives for business and development, when the private sector recognizes the benefits of a project there is the potential for their involvement.

Case Study 5: London Crossrail, U.K.[12]

Key Lesson	International example of a unique/alternative approach to working with the business community to fund and deliver a major transit project.
Considerations	• The Crossrail commuter rail project has gained an international reputation for its application of joint development; the cost of the project has been largely shared between the government, Transport for London (TfL) and the business community. • TfL and the Greater London Authority (GLA) are contributing over $11 billion, which includes levies paid by businesses that will benefit from the service, through the Crossrail Business Rate Supplement (BRS) and the Community Infrastructure Levy (CIL). • London businesses will contribute through a variety of mechanisms including joint development and the BRS, which alone will yield $6.8 billion.

Joint Development

Similarly, the London Crossrail project has had success with ventures such as "joint property development," a term that in cases of railway station development applies when a private partner obtains the right to develop part of the site—either around or above the station—and in exchange participates in building the station, either by contributing financially or in kind, usually by constructing the station).[13]

Currently Crossrail Ltd. has joint ventures in place for six of its station sites, including at Canary Wharf, which includes plans for 9,000 square meters of retail space and a rooftop park. In exchange for agreeing to contribute $250 million towards the design and construction of the station and bearing the risk of any cost overruns, Canary Wharf Group plc obtained the rights to build a four-storey shopping centre above the station.[14]

This development-based land value capture tool requires a clear and strong business case and extensive engagement with the private sector. Further analysis to determine the applicability of joint property development for HSR stations in Southwestern Ontario would be worth pursuing.

Recommended Approach

The HSR project is still in early phases of planning. Although it is important to begin to consider financing and delivery models that could be applied to HSR, design and cost certainty cannot be known or understood until completion of the pre-design, assessment of the technical planning work

and initiation of the EA process. Conducting a full VfM analysis on optional models for HSR before these key project phases are completed is challenging.

It is evident from the market sounding results that private-sector interest is high and that the market generally feels some form of AFP is both a reasonable and preferred way to finance and deliver the HSR project in Ontario, particularly a DBFOM model with a large private-sector consortium delivering it, potentially in packages of $5 billion.

Based on an assessment of international jurisdictions and feedback received during the market sounding, it is also evident that traditional models are a viable option. These are generally applied in markets where government knowledge of and experience with HSR is extensive (i.e., the U.K., Germany). However, not all European countries are continuing to pursue traditional models of delivery. As noted earlier, France, a country with an extensive history of HSR infrastructure delivery, has chosen to pursue a DBFOM approach for its new Tours-Bordeaux HSR line.

Given these considerations and others outlined throughout the chapter, the recommended approach at this point for the financing and delivery of HSR is as follows:

Recommendation 26: Financing and Delivery Models

The Province should conclude at a principles level that an AFP model (potentially DBFOM) is a viable option to finance and deliver HSR while ensuring that a full VfM analysis is conducted on AFP versus traditional models during the EA process.

Recommendation 27: Private-Sector Engagement

The Province should continue to engage key private-sector partners throughout the HSR project, including by potentially engaging in a follow-up market sounding during the environmental assessment process and once more project details become available. This should include re-engaging former participants as well as potentially broadening to other private-sector interests.

Recommendation 28: Federal Financing Experience

The federal experience with private-sector airport financing under the National Airports Policy should be examined to ascertain whether aspects of this model could be applied to HSR.

Recommendation 29: Innovative Funding Tools

The Province should consider innovative funding tools to help pay for HSR and/or stations, such as business levies, land value capture tools, and joint development.

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Chapter 7

Implementation of High Speed Rail – Next Steps

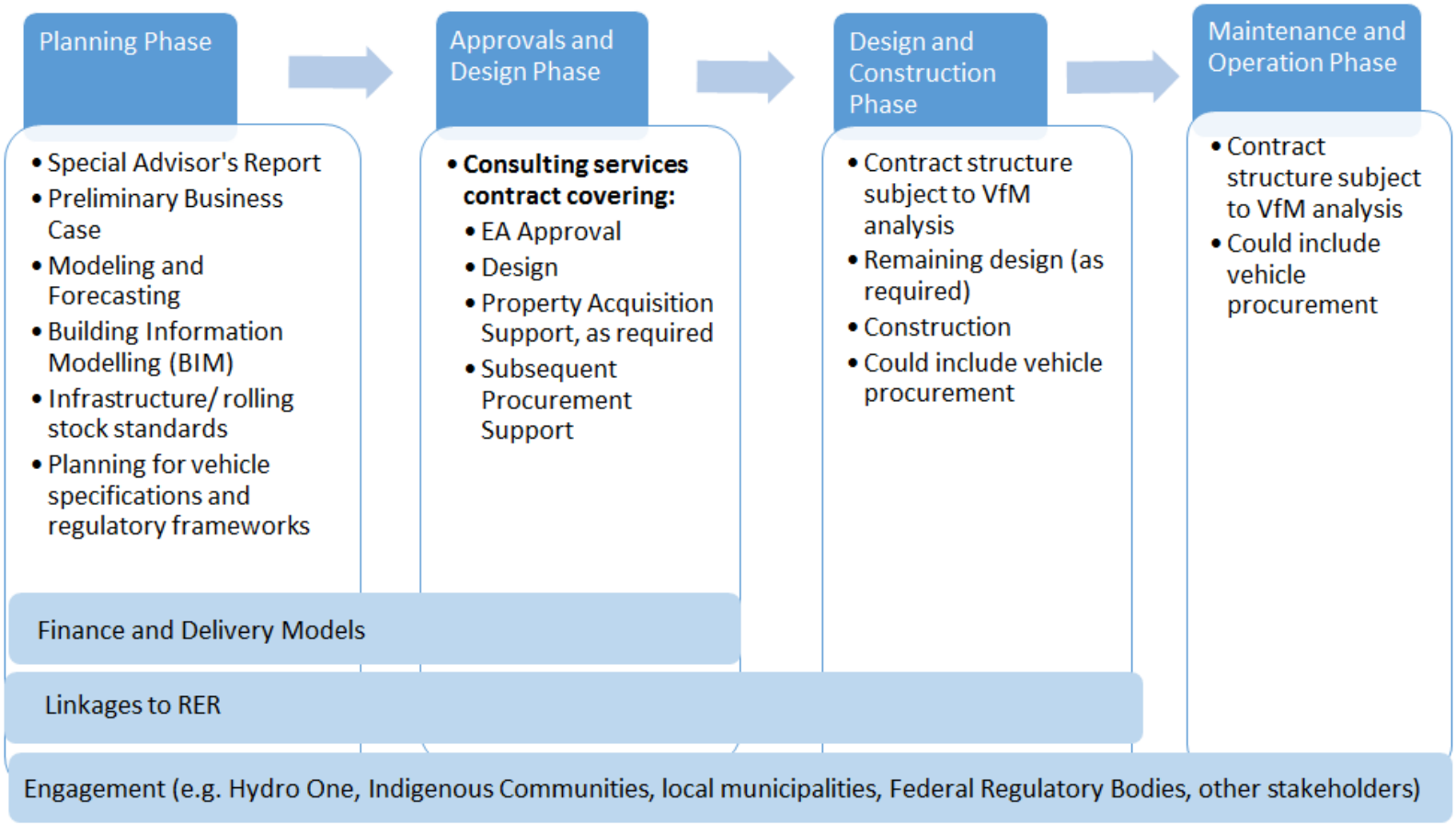
The Special Advisor has provided numerous recommendations for the implementation of HSR in the Toronto-Windsor corridor. This chapter contains recommended next steps to reach an operational target of 2025 for HSR.

In parallel to the work the Special Advisor has conducted over the course of the past year, MTO has continued to advance the planning work for HSR in the Toronto-Windsor corridor. This has included supporting the Special Advisor with the development of the preliminary business case, as well as undertaking modelling and forecasting work and early preparations for the EA process. In September 2016, the Minister's mandate letter indicated that MTO is to issue the Request for Proposal (RFP) for the EA process for HSR in 2017.

As mentioned earlier in the report, the provincial EA process for transportation projects is the TPAP. Additionally, due to the recommended speed of 250 km/h, HSR from Toronto to Windsor will also require the completion of a federal EA, the CEAA. These processes require several precursor studies to inform their scope.

To support the further advancement of HSR, the Province should undertake a number of key next steps. These include the phases of Planning, Approvals and Design, Design and Construction, and Maintenance and Operation. In addition, the Province should pursue the analysis of financing and delivery models and linkages to GO RER planning and extensive external engagement in parallel with the above phases. (See Figure 7.1.)

Figure 7.1: Next Steps for HSR



Planning Phase

This report and the preliminary business case are the first initiatives to be completed in the Planning phase of HSR. A modelling and forecasting study is also underway that will analyze the modal splits within the corridor in more detail and be used to verify some of the assumptions that were used in the preliminary business case. The completion of the modelling and forecasting study is anticipated in late summer 2017.

In addition, to effectively inform the work required under the Approvals and Design stage, it is recommended that the Province undertake preliminary investigations into appropriate Building Information Modelling (BIM), HSR infrastructure and rolling stock standards, procurement strategies, vehicle specifications and regulatory frameworks under the current planning phase. This work would complete the preparatory planning studies.

The completion of the Planning Phase will provide the Province with a key decision point for the rollout of this ambitious project.

Parallel Work (Finance and Delivery Models, Linkages to RER, Stakeholder Engagement)

As illustrated in Figure 7.1, there are also three requirements that will continue through more than one of the phases. These include

- A detailed study of the appropriate financing and delivery models.
- The integration with and linkages to GO RER.
- Engagement with Indigenous communities, municipalities, and key stakeholders (e.g., Hydro One, CN, CP and regulatory bodies of the Government of Canada).

Finance and Delivery

As detailed in Chapter 6, further study of appropriate financing and delivery models is required in conjunction with IO to determine the best configuration of project contract(s) to ensure VfM and efficient execution. It is expected that a number of competitive procurement packages will be needed for the project. The overarching delivery strategy will be to seek to maximize economies of scale, capture innovation from the private sector and minimize interface risks. Over the project's lifetime it is equally important to have a clear focus on minimizing the project's lifecycle costs and allowing for expansion of the HSR network and service pattern.

Linkages to GO RER

As described in Chapter 3, HSR will share tracks with GO RER between Toronto and Kitchener; therefore, coordination with GO RER service delivery and infrastructure provision is key to the

efficient rollout of HSR. A working group should be established to ensure that planning assumptions are aligned between the two projects, infrastructure rationalization opportunities are realized, construction is coordinated and service is optimized. As planning progresses and more opportunities for efficient delivery are recognized, the business cases for both HSR and the Kitchener corridor portion of GO RER will require revision.

Engagement

Hydro One

Engagement with key power-supply stakeholders is also critical; it should be undertaken as a next step and should continue through to the Operations and Maintenance phase.

Hydro One will be the supplier of electric power (i.e., traction power) for the electrified HSR system; therefore, MTO must perform various electrical/induction studies in coordination with Hydro One to ensure proper functioning of the infrastructure and public safety. Indeed, connection to Ontario's power grid is a rigorous process governed by the Independent Electricity System Operator (IESO).

Also, the existing hydro right-of-way between Kitchener and London is protected for future hydro expansion; however, the HSR train between these two cities could run adjacent to but outside of the current hydro corridor. It is recommended that MTO work closely with Hydro One throughout the duration of the project.

Federal Bodies

Federal bodies will have a role to play in the EA process and potentially with the operational aspects of HSR. Average operational train speeds of over 200 k/hr require a federal CEAA approval process. While it is understood that the provincial TPAP can run in parallel with the CEAA process (indeed, CEAA documentation is often included as an appendix to the environmental project report developed for the TPAP), internal discussions are required prior to consultation with the CEAA. This will ensure both authorities have been briefed on the current developments and are comfortable with the agreed approach.

While operations on this section of the corridor are contained within Ontario, it is possible that in the long term development of the corridor could expand into Quebec and the United States, given proposals currently under consideration by VIA Rail for HFR between Toronto-Ottawa-Montreal, and Amtrak's plans for some form of HSR in the Detroit-Chicago corridor. Since this project represents the first HSR undertaking in Canada, a briefing should be conducted at an early date with Transport Canada to discuss the appropriate regulatory scheme for HSR and what cooperation is required with VIA Rail, which owns some stations on the HSR line and a small portion of the required track west of Chatham Station.

Indigenous Communities, Municipalities, and other Stakeholders

As detailed in Chapter 2, engagement with Indigenous communities, municipalities and stakeholders is critical to the success of the HSR project. Recommendations described in Chapter 2 should be put into action in the near term.

Furthermore, the stakeholders, municipalities, and Indigenous communities that met with the Special Advisor throughout his term will be engaged again and expanded upon. Indeed, as the project progresses it will be essential for MTO to continue engaging with these groups, as well as many others, such as additional Indigenous communities, environmental groups, and others.

Canada's two national railway companies will also need to be engaged extensively. CN and CP are key stakeholders since there would be interface with the CN and CP corridors west of London. It is likely that agreements with these companies for some sections of the HSR corridor will be required.

Approvals and Design Phase

Following the completion of the Planning phase, the next major step required is the procurement of services for the Approvals and Design phase, which include EA approvals, engineering design, property acquisition support, as required, and subsequent procurement support. EA approvals will include the TPAP and CEAA processes outlined above as well as identifying other environmental impacts and obtaining the requisite approvals (like potential amendments to existing TPAPs in the Kitchener Corridor or EAs required for any upgrades to Hydro One's supply networks).

The extent of design work required will depend on the configuration of contracts for the next procurement phase, subject to the VfM analysis discussed above. At a minimum, design work should include a Reference Concept Design (RCD) as a basis for environmental impact assessment as well as a proof of concept for subsequent design stages. It is recommended that the Province consider the inclusion of exercisable options to complete design work for the whole corridor as well as to design direct access to Pearson Airport. The options would be aimed at future capacity and speed improvements that could be implemented in phases.

Design, Construction, Operations and Maintenance Phases

The Design and Construction and Maintenance and Operation phases will be pursued in the future. Design and Construction should generally start by 2022 to ensure HSR is operational by 2025. Maintenance and Operations will commence following operations.

Recommendations

Based on the phases described above it is recommended that the Province pursue the following recommendations as next steps to implement HSR in Ontario.

Recommendation 30: EA Funding and Procurement Approvals

The Province should continue to seek funding and procurement approvals required to obtain consultant services for the EA and associated design work in 2017.

Recommendation 31: MTO-Metrolinx Working Group

The Province should establish a formal working group with representatives from MTO and Metrolinx to ensure alignment between planning for HSR and GO RER.

Recommendation 32: Hydro and Electricity-Grid Stakeholders

The Province should develop a plan to ensure timely engagement with key hydro and electricity-grid stakeholders. To support this, it should retain a technical consultant to identify proposed connection points, facilitate technical coordination with Hydro One, and provide advice regarding a potential ministerial agreement.

Recommendation 33: Studies to Inform Environmental Assessment Scope

The Province should proceed with the required studies as soon as possible to inform the consultant scope for the Environmental Assessment in 2017.

- Ensure that the procurement protects for interoperability with systems and technologies used elsewhere (e.g., the United States), recognizing the longer-term potential for an international service.

Recommendation 34: Provincial-Federal Environmental Assessments

To support the environmental assessment process, after internal provincial discussions between MTO, MOECC, and others as appropriate, the Province should arrange a discussion with the Canadian Environmental Assessment Agency to ensure all parties are aware of the details of Ontario's HSR plans.

Recommendation 35: Coordination with Transport Canada

The Province should establish a formal working group with Transport Canada to discuss the appropriate regulatory scheme for HSR and seek advice regarding requirements for potential future connections to the United States.

Recommendation 36: Coordination with National Freight Rail Companies

The Province should arrange briefings with the national freight rail companies to discuss Ontario's HSR plans and seek their input.

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Chapter 2: Connecting Communities		
1	The Province should continue to work closely with municipal stakeholders in the corridor to identify opportunities to integrate local transit and existing and planned services with future HSR stations and ensure that first-mile/last-mile connections are made.	21
2	The Province should encourage and support investment in regional transportation infrastructure in the near term to increase transportation options in smaller communities, which will help build ridership in the corridor and establish a system-wide approach to mobility in Southwestern Ontario.	21
3	The Province should share detailed business case results for HSR as the project develops, emphasizing collaboration, transparency and information-sharing, to ensure that communities along the corridor are informed about and engaged in the project.	22
4	The Province should continue to engage with stakeholders, including but not limited to municipalities and land owners in the corridor, on the planning, development, and implementation of HSR, including throughout the Environmental Assessment process.	22
5	The Province should continue to engage with Indigenous communities on the planning, development, and implementation of HSR, including throughout the Environmental Assessment process, and work with communities to determine preferred approaches to engagement.	27
6	The Province should consider opportunities for Indigenous communities to share in the economic benefits associated with HSR, including generating future opportunities related to procurement and other economic partnership arrangements.	27
7	The Province should commit to protecting the natural environment, culturally sensitive lands and archaeological sites throughout the Toronto-Windsor corridor, recognizing that Indigenous communities are experts in these areas of knowledge.	27

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8	The Province should provide opportunities to showcase Indigenous culture, history and traditions throughout the HSR project, including showcasing Indigenous art and culture at future HSR stations, and consider Indigenous traditional naming opportunities for HSR-related infrastructure.	28
9	The Province should consider providing capacity funding to Indigenous communities in the study area to facilitate engagement on the HSR project.	28
Chapter 3: The Business Case for High Speed Rail		
10	The Province should proceed with a phased approach to implementing HSR to maximize benefits and reduce costs. ▪ Phase 1 would be implemented from Toronto to London with a target operational date of 2025. o This phase would build on GO RER investments between Toronto and Kitchener-Waterloo. ▪ Phase 2 would be implemented from London to Windsor with a target operation date of 2031, as demand for HSR develops.	33
11	*Union Station* The Province should work to ensure that ▪ Station capacity is addressed to accommodate future growth in ridership that will occur due to use by HSR, GO RER and VIA Rail services. ▪ Further consideration is given to developing a new concourse and platforms west of the existing station, building them under the approach tracks. ▪ A minimum of two level-boarding HSR platforms are constructed.	35

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12	*Pearson Airport* It is recommended that the Province ▪ Expand Malton GO Station as necessary to accommodate an HSR stop. ▪ Work with the Greater Toronto Airports Authority (GTAA) to provide a people-mover system linking HSR at Malton Station to the airport terminals. ▪ Coordinate the infrastructure requirements for GO RER and UP Express with those for HSR through this segment of the corridor. ▪ Work with the GTAA to provide direct access for HSR as air passenger volumes increase and to support its plans for the future Pearson Airport multimodal hub, most likely by 2031.	36
13	*Guelph* It is recommended that the Province ▪ Work closely with the City of Guelph to deliver on infrastructure requirements to accommodate GO RER and an HSR stop at the historic Guelph Station. ▪ Ensure that all necessary measures are undertaken to protect the historically significant architecture in the station precinct. ▪ Coordinate the infrastructure requirements for GO RER with those for HSR through this stretch of the corridor.	37
14	*Kitchener-Waterloo* It is recommended that the Province ▪ Work closely with the Cities of Kitchener and Waterloo to ensure that planning for the new multimodal station accommodates HSR. ▪ Coordinate the infrastructure requirements for GO RER with those for HSR to Kitchener-Waterloo. ▪ Work to ensure that station upgrades do not preclude future HSR service.	37

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15	*London* It is recommended that the Province ▪ Build a new, dedicated HSR line between Kitchener-Waterloo and London adjacent to the existing Hydro One corridor. ▪ Work closely with Hydro One throughout the duration of the project. ▪ Work with VIA Rail and the City of London to expand the existing VIA Rail station to accommodate HSR and ensure seamless connection with the future Shift BRT service. ▪ Work with CN on requirements for the new HSR line to run adjacent to the CN South Main line into London.	38
16	*Chatham* It is recommended that the Province ▪ Work with CN to explore options to build a new electrified track, adjacent to the existing CN corridor. ▪ Work with VIA Rail and the Municipality of Chatham-Kent to explore options to expand Chatham Station to accommodate HSR.	38
17	*Windsor* It is recommended that the Province ▪ Work with CP to explore the implementation of a new track and passing tracks along the existing CP Windsor corridor. ▪ Work with CP and the City of Windsor to identify options for the building of a new HSR station that will provide access to downtown Windsor. ▪ Work with CP, Amtrak and the State of Michigan on plans for future expansion of the HSR service to the U.S. via Detroit through the existing rail tunnel under the Detroit River.	39

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18	The Province should implement electrified 250 km/h HSR technology for the Toronto-Windsor corridor. ▪ This would offer a distinct intercity service that meets the UIC definition for HSR. ▪ To reduce infrastructure costs, the Province could investigate the procurement of HSR trains with tilting capability, which can allow trains to achieve higher speeds on less optimal alignments, such as curves.	47
19	The Province should ensure that GO RER commitments, planning and capital works accommodate future HSR on the Kitchener corridor. ▪ The development of GO RER with a view to its interoperability with HSR on the Kitchener corridor will support the Province in advancing both commitments. ▪ The Province should o Ensure that electrification and railway on the Kitchener corridor is built to accommodate speeds of 250km/h. o Protect the Kitchener corridor and stations for future capacity expansion wherever feasible. o Ensure level boarding platforms are not precluded at the designated HSR/GO RER station stops. o Prioritize the implementation of Enhanced Train Control (ETC) and ensure that signalling systems and other technologies do not preclude HSR operations.	48
20	Based on ridership demand and corridor capacity, it is recommended that during peak periods the Province provide, in both directions, a frequency of 3 HSR trains and 1 GO RER train between Union Station and Kitchener. ▪ The Province should also provide the following service levels during off-peak periods: o 2 HSR trains per hour. o 1 GO RER train per hour.	49

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21	The Province should align provincial mandates to optimize rail services by directing Metrolinx and MTO to collaborate on the development of an Integrated Rail Strategy for the Toronto-Kitchener corridor, which would ▪ Clarify the mandates of GO RER, UP Express and HSR on the corridor. ▪ Assess ridership and service frequencies. ▪ Recommend how the Province might optimize GO RER, UP Express and HSR ridership to maximize the benefit to Ontarians.	50
22	The Province should coordinate the integration of Southwestern Ontario passenger services with VIA Rail. ▪ MTO should engage VIA Rail with the objective of rationalizing VIA Rail and HSR service patterns in the Toronto-Windsor corridor. o On the Toronto-Kitchener corridor, HSR would replace VIA Rail service. o VIA Rail would continue operations from Union Station to London on the CN South Main line (not on the Kitchener corridor), serving a number of communities, including Oakville, Aldershot, Brantford, Woodstock, and Ingersoll. o Between Kitchener and London, VIA Rail would continue to operate on the CN North Main line via St. Marys and Stratford. o Between London and Windsor, VIA Rail would continue providing existing services until HSR is introduced in this segment of the corridor. o To ensure an integrated system, VIA Rail and HSR would enter into a codeshare agreement (i.e., a business arrangement where two operators share services) that would allow users to seamlessly use the two services with the same ticket.	50
23	As work on the intercommunity bus modernization initiative advances, the Province should work closely with the bus industry and other stakeholders to develop a partnership strategy with HSR for mutual benefit.	51

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	Chapter 4: Benefits of HSR	
24	It is recommended the Province develop and/or encourage, as appropriate, regional development initiatives, tax incentives and/or grants to mitigate any urban sprawl HSR might create, and encourage transit-oriented development in station areas. ▪ Since growth and development policies are implemented at the municipal level the Province should work closely with municipalities to achieve this objective.	61
	Chapter 5: Governance	
25	The Province should establish, at an early date, a new independent Crown corporation to oversee HSR (HSRCO): ▪ The corporation would be a legislated entity with authority over the operations of HSR and all railway assets owned by the Province beyond Kitchener to Windsor. ▪ HSRCO would be established in the near term as the EA process proceeds under MTO's direction and would be in place prior to the start of HSR construction. ▪ Its mandate would include o Oversight of all aspects of the project from financing and delivery to operations. o Responsibility for ensuring value for money and wider benefits from HSR implementation and operations. o Coordination with VIA Rail and Metrolinx on service plans. ▪ HSR operations from Toronto's Union Station to Kitchener would be detailed in an MOU with Metrolinx. ▪ A provincially-appointed board of directors would oversee the corporation.	72

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Chapter 6: Financing and Delivery		
26	The Province should conclude at a principles level that an AFP model (potentially DBFOM) is a viable option to finance and deliver HSR while ensuring that a full VfM analysis is conducted on AFP versus traditional models during the environmental assessment process.	90
27	The Province should continue to engage key private-sector partners throughout the HSR project, including by potentially engaging in a follow-up market sounding during the environmental assessment process and again once more project details become available. This should include re-engaging former participants as well as potentially broadening to other private-sector interests.	90
28	The federal experience with private-sector airport financing under the National Airports Policy should be examined to ascertain whether aspects of this model could be applied to HSR.	91
29	The Province should consider innovative funding tools to help pay for HSR and/or stations, such as business levies, land value capture tools, and joint development.	91
Chapter 7: Next Steps		
30	The Province should continue to seek funding and procurement approvals required to obtain consultant services for the EA and associated design work in 2017.	98
31	The Province should establish a formal working group with representatives from MTO and Metrolinx to ensure alignment between planning for HSR and GO RER.	98
32	The Province should develop a plan to ensure timely engagement with key hydro and electricity-grid stakeholders. To support this, it should retain a technical consultant to identify proposed connection points, facilitate technical coordination with Hydro One, and provide advice regarding a potential ministerial agreement.	98

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33	The Province should proceed with the required studies as soon as possible to inform the consultant scope for the environmental assessment in 2017. ▪ Ensure that the procurement protects for interoperability with systems and technologies being used elsewhere (e.g., the United States), recognizing the longer-term potential for an international service.	98
34	To support the environmental assessment process, after internal provincial discussions between MTO, MOECC, and others as appropriate, the Province should arrange a discussion with the Canadian Environmental Assessment Agency to ensure all parties are aware of the details of Ontario's HSR plans.	99
35	The Province should establish a formal working group with Transport Canada to discuss the appropriate regulatory scheme for HSR and seek advice regarding requirements for potential future connections to the United States.	99
36	The Province should arrange briefings with the national freight rail companies to discuss Ontario's HSR plans and seek their input.	99

Glossary

Alternative Financing and Procurement (AFP): AFP is the name by which public-private partnerships (or P3s) are known in Ontario. P3s represent a long-term, performance-based approach to the procurement and delivery of public infrastructure where the private sector assumes a share of the risks in financing, design, construction, operations and maintenance.

Benefit-Cost Ratio (BCR): A measure of the value for money of a project expressed as a ratio of the total benefits divided by the total costs associated with a project.

Building Information Model (BIM): A digital model of a proposed project as well as the terrain (landscape) in which it will be built. These accurate virtual models support project design, allowing better analysis, integration and control than manual processes. When completed, the model contains precise geometry and data needed to support construction activities. After construction, the model can be updated and used to digitally monitor how well the infrastructure is working once it is operational, and can help determine when and where maintenance is needed.

Bus Rapid Transit (BRT): A system of dedicated bus lanes, often separated from the roadway by curbs or barriers, which combines features of a rail system (such as stations, payment on the platform instead of on the vehicle, and all-door boarding) with the flexibility of a bus system.

Codeshare: business arrangement where two operators share services along a route or corridor.

Commute Shed: A geographic area from which workers commute into an employment zone or neighbourhood, assuming maximum travel time or distances.

Design-Build-Finance-Operate-Maintain (DBFOM) Model: The private partner designs, builds and finances a public asset (e.g., a hospital, highway, or transit system), provides facility management services and operates the asset under a long-term agreement.

Design-Build-Finance-Maintain (DBFM) Model: The private partner designs, builds and finances a public asset (e.g., a hospital, highway, or transit system) and provides maintenance services under a long-term agreement.

Diesel Multiple Unit (DMU): The generic term for a diesel-powered train where a separate locomotive is not required because the traction system is contained under various cars in the train.

Employment Lands: Privately- and publicly-owned properties that are used or designated for commercial, industrial, or institutional purposes. Commercial includes both office and retail uses.

Environmental Assessment: A process used to predict and mitigate the adverse environmental effects of a project before it is started. It is a planning tool that provides decision-makers with the

information they need to ensure all approved projects support a healthy, sustainable environment for present and future generations.

Feeder Services: Local transit services that pick up and deliver passengers to a rail transit station or express bus stop, transfer point, or terminal.

First-mile/Last-mile: First-mile/last-mile refers to how a person connects to and from public transportation services, using a wide range of travel modes.

Greenhouse Gases (GHGs): Gases that trap heat in the atmosphere, including carbon dioxide, methane, nitrous oxide and fluorinated gases, and which are emitted primarily as a result of burning carbon-based fuels.

High Speed Rail (HSR): Systems that operate at speeds on the order of 200 km/h on upgraded, existing corridors and at speeds equal to or greater than 250 km/h on new corridors.

Interoperation: Technical compatibility of infrastructure, rolling stock, signalling and other subsystems of the rail system, as well as less complex procedures for the authorization of rolling stock to ensure that various types of rail vehicles can safely use the same rail corridor.

Land Value Capture: A way to fund infrastructure improvements by calculating the increased property values that a new transportation project will create and establishing a levy or tax on land or development to reflect this higher value. This is intended to "capture" the increase in property values that will be generated by improved access to transportation, which, like waterfront views or other valued features, can increase property values.

Level-Access Platforms: A platform that is at approximately the same level as the rail or train car floor.

Level Boarding: Refers to interior train floors that are level with station platforms so that a passenger does not have to climb steps to board the train.

Light Rail Transit (LRT), sometimes also defined as **"light rapid transit":** A metropolitan electrical railway system characterized by its ability to operate single cars or short trains along exclusive rights-of-way at ground level, on aerial structures, in subways or, occasionally, in streets and to board and discharge passengers at track- or car-floor level.

Modal Split: The proportion of total person-trips using each of the various different modes of transportation, generally expressed as a percentage.

Multimodal Transportation Hub: A place where passengers and/or cargo move between vehicles or between transport modes, which all serve a common location. Public transport hubs can include train stations, rapid transit stations, bus and tram stations or stops, airports and ferry slips.

Net Present Value (NPV): The sum of the present values (i.e., costs subtracted from benefits) of all aspects of a project (design, construction, maintenance and financing) throughout its lifecycle as expressed in today's dollars.

Over-Serviced/Over-Served: Multiple transit services travelling the same route and visiting the same stops with similar frequency, leading to more services than are needed by travellers.

Reference Concept Design (RCD): A functional design used in the Alternative Financing and Procurement (AFP) model, which is intended to provide proof of concept and is often used as a basis of design for subsequent design stages. The RCD typically represents approximately 30% of the total design.

Rolling Stock: Any vehicles that operate on a railway track, including train cars and engines.

Stopping Services: Train service that makes stops at local stations between the main stations on the line, as opposed to an express service.

Substantial Completion Payment: A payment made upon completion of one of the more significant milestones in a construction project, affecting the rights and responsibilities of the owner and contractor. At substantial completion, the owner of the asset under construction can assume beneficial occupation (i.e., is able to use the infrastructure).

System and Safety Integrator: A person or persons whose function is to coordinate the design, construction and operation of various rail systems (electrification, signalling, and communications) to ensure safe and reliable operations.

Tilting Train Technology: One of a number of techniques that allows trains to manoeuvre curves safely and more comfortably at higher speeds than the curve may have been designed for.

Traditional Procurement Model: The funding and delivery of infrastructure and services by the public sector using a design-bid-build model.

Transit Project Assessment Process (TPAP): An EA process specifically tailored to transit projects in Ontario. A TPAP sets defined consultation and review guidelines for transit projects and does not require the study of alternative routes or designs.

Transit-Oriented Development: A planning approach that calls for high-density, mixed-use business/residential neighbourhood centres to be clustered around transit stations and corridors. Transit-oriented development is focused within an 800-metre radius of transit stops, with the highest intensity and mix of land uses concentrated within 400 metres of or adjacent to the station. A transit-supportive approach to land-use planning, urban design and transit operations may include transit-oriented development as well as a variety of other strategies that make transit viable and improve

the quality of the transit-using experience. These strategies may be implemented near transit stops or stations or at on broader scale, as appropriate.

Value for Money (VfM): Describes the quantitative and/or qualitative benefit to the public expected from a particular procurement method. Quantitative value is achieved through lower cost of a particular procurement method, whereas qualitative value is achieved when a procurement method better supports the goal of the project without costing more.

Wider Economic Benefits (WEBs): The wider benefits to the economy from an increase in accessibility provided by a transport investment, typically quantified due to their impact on agglomeration.